

**10 MWe Solar Thermal
Central Receiver Pilot Plant
Solar Facilities Design Integration**

**PSS FINAL DESIGN CALCULATIONS
BOOK 17 OF 26--THERMAL OIL PIPING
CONSTRUCTION PACKAGE 9 (RADL ITEM 7-9)**

September 1980

DISCLAIMER

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**STEARNS-ROGER ENGINEERING CORP
4500 CHERRY DRIVE
P.O. BOX 5888
DENVER, CO 80217**

**PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC-03-79SF10499**

PREFACE

This document is provided by McDonnell Douglas Astronautics Company (MDAC) in accordance with Department of Energy Contract Number DE-AC03-79SF10499, Reports and Deliverables List (RADL Item 7-8). The report was prepared by Stearns-Roger Engineering Corporation under MDAC Subcontract Number 78012035.

The Plant Support Subsystem Final Design Calculations (RADL Item 7-8) are arranged in a twenty-six book volume as shown on the master Table of Contents.

Book 17 of this document is provided in support of the Mechanical Equipment Installation, Construction Package No. 9 and includes isometric drawings, weight, thermal, seismic, and stress analyses, for the thermal oil piping design.

Questions concerning this report should be directed to R.J. Perkins at (714) 896-3073.

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BOOK 4 - RECEIVER TOWER
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PACKAGE 5A (RADL ITEM 7-21)

Note: This document includes design calculation for the receiver tower steel (Construction Package 5A) which was previously submitted by MDAC letter A3-228-EP-RJP-46, dated 16 January 1980, and therefore, is not included in this submittal. Please transfer your copy to your RADL ITEM 7-8 file, marking it as BOOK 4 of 25.

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 DESIGN CALCULATIONS (RADL ITEM 7-8)

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Note: This document was previously submitted by MDAC Letter A3-228-EP-RJP-262, dated 7 March 1980 and therefore is not included in this submittal. Please transfer your copy to your RADL ITEM 7-8 file, marking it as BOOK 25 of 25.

BOOK-26-MDAC GENERAL ANALYSIS AND
BACKGROUND DATA

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- 2 Receiver Subsystem Calculations
- 3 Thermal Storage Subsystems Calculations
- 4 Analysis of Plant Cost Reduction Options
- 5 Collector Field Design and Plant Power Calculations
- 6 Miscellaneous Plant Calculations

LINE T0-4 TSS OIL CHARGING FEED

Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

**10MWe SOLAR PILOT PLANT
C-21700**

TSS OIL CHARGING SYSTEM FEED

PIPING SYSTEM

8"-TO-4-BBA

CONDITIONS ANALYZED / ANAL. I.D. NO.

THERMAL T-21700-TO-4-A-3

DEAD WEIGHT W-21700-TO-4-A-3

PRESSURE P-21700-TO-4-A-0

SEISMIC X-TO-4-A-3

CODE REFERENCE: **ANSI B31.1-1973**
W/ APPENDA B.
(SUMMER 1979)

ANALYST G.H. MAY

DATE 7-14-80

TO-4

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
EE16.01.2
PAGE 1 OF 1
ISSUED 8-31-73
REVISED 4-15-74

APPROVALS
Des. Sect: _____
Sect. Supv. _____
Div. _____

PIPING ANALYSIS RESULTS

Date JULY 7, 1980

TO: T.E. OLSON
FROM: G.H. MAY, Piping Engineering Group
Client DOE Project SOLAR I Job No. C-21700
Pipe Line Analyzed TSS OIL - CHARGING SYSTEM FEED 18" TO-4-BBA
Reference Dwg. P13-14 B

This piping has been analyzed for the THERMAL, DEAD WEIGHT, PRESSURE & 1/2 SAFE SHUTDOWN EARTHQUAKE loading condition and is found to be:

- Satisfactory, as is.
- Satisfactory, with comments noted.
- Unsatisfactory - See Comments.

COMMENT 1) ALL PIPE STRESSES ARE LESS THAN THE ALLOWABLES.
2) ANCHOR LOADS ARE SIMILAR TO THOSE PREVIOUSLY SUBMITTED EXCEPT THAT SEISMIC LOADS ARE NOW INCLUDED.
3) THIS IS A FINAL ANALYSIS WHICH INCLUDES VALVE AND SUPPORT LOCATION REVISIONS.

RECOMMENDATION 1) SUBMIT THE FORCES & MOMENTS TO ROCKETDYNE.
2) USE THE REFERENCED ROUTING.

ATTACHS: PIPE STRESS SUMMARY REPORT, SUMMARY OF FORCES & MOMENTS

G.H. May
Signature

Copies to: Sender
Analysis Folder - Job File
Piping Engrg. Supervisor TCT
K.E. NOBLE

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		EE16.01.8
APPROVALS						PIPE STRESS SUMMARY REPORT ANSI B31.1 - 1973 EDITION	PAGE <u>1</u> OF <u>1</u>
Des. Sect. <u>HY</u>							ISSUED 5/27/75 REVISED
Sect. Supv. <u>[Signature]</u>							
Dw. _____							

10MWE SOLAR PILOT PLANT
Job Name
TSS OIL - CHARGING SYSTEM FEED 18" TO 4-BBA
System/Pipe Line Name

C-21700
Job No.
TO-4
Analysis No.

1. Loading Conditions Analyzed

Pressure X
Weight X
Thermal Expansion X
Sustained Mech. Loads _____
Occasional Loads X

Analysis Ident. Code
P-TO-4-A-0
W-TO-4-A-3
T-TO-4-A-3
X-TO-4-A-3

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} \leq 1.0 S_h$ 4615 psi \leq 15000 psi

Material: - ASTM A106 GR.B

PRES = 115 PSIG \Rightarrow SLP = 685 psi
Temp = 525°F @ PT. 45 (DUMM LEG)

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{0.75 iM_B}{z} \leq K S_h$ 16891 psi \leq 18000 psi

Material: - ASTM A106 GR.B

Temp = 525°F @ PT. 45 (ON PIPE)

Eq. (13) $S_E = \frac{iM_C}{z} \leq S_A$ 8570 psi \leq 22500 psi

Material: - ASTM A106 GR.B

Temp = 525°F @ PT. 65F

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{iM_C}{z} \leq (S_h + S_A)$ 9494 psi \leq 37500 psi

Material: - ASTM A106 GR.B

Temp = 525°F @ PT. 65F

3. Stress Evaluation (Local or Special)

Loading	Analysis Ident. Code	Calculated Stress (psi)	Allowable Stress (psi)
_____	_____	_____	_____
_____	_____	_____	_____

REMARKS:

- ALL PIPE STRESSES ARE LESS THAN THE ALLOWABLES.
- OCCASIONAL LOAD IS 1/2 SAFE SHUTDOWN EARTHQUAKE.

[Signature] 7-7-80
Prepared By Date
[Signature] 7-7-80
Approved By Date

CUSTOMER: DOE
 PROJECT: SOLARI
 JOB NO: C-21700
 BY: G.H. MAY DATE: JULY 7, 1980
 REF. DWGS: P13-14 B
 ANALYSIS CODE: T/WIX-TO-4-A-3/3/3

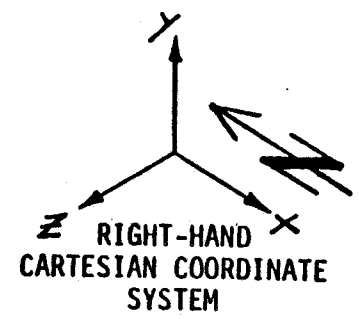
SUMMARY OF FORCES & MOMENTS
 ON SYSTEM TERMINAL EQUIPMENT
 (SYSTEM)

TSS OIL - CHARGING SYSTEM FEED
8-TO-4-BBA

DIVISION USAGE				
MM	P	PP	SH	FI
X				SP
APPROVALS				
Des. Sect. <i>[Signature]</i> Sect. Supv. <i>[Signature]</i> Div. Mgr. <i>[Signature]</i>				

Stearns-Roger
 INCORPORATED
 ENGINEERING STANDARD

SUMMARY OF FORCES & MOMENTS
 PER. ANSI B31.1-1973 PWR. PIPING CODE

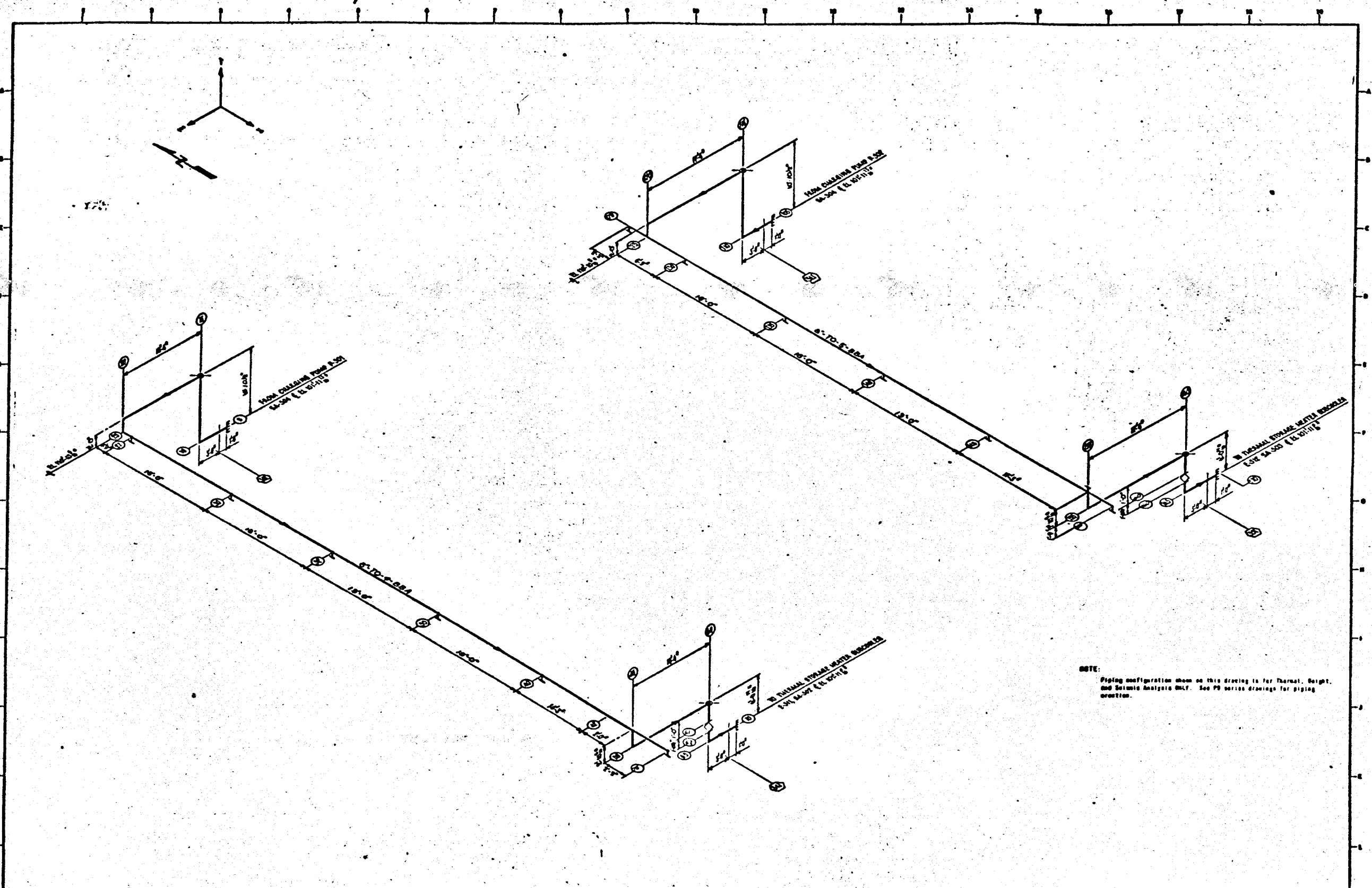


THE REPORTED REACTIONS BASED ON A THERMAL
 EXPANSION ANALYSIS FROM ...70.°F TO 525.°F
 USING E_c. THE COLD MOD. OF ELASTICITY, AND
0.% COLD SPRING.

EQUIPMENT CONNECTIONS	LOC. NO.	FORCES (LBS)				MOMENTS (FT.-LBS)			
		X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
FROM CHRG. PUMP (THERMAL)	5	-386	-47	-6	389	817	-5250	2638	5932
P-301, 10" EAST } WEIGHT	5	-4	-97	0	97	-20	-52	8	56
INTERFACE (301) } SEISMIC	5	892	259	955	1332	4250	8335	6403	11337
TO T.S. HTR. SUBCOOLER (THERMAL)	70	386	-42	6	388	924	5784	-1481	6041
E-311, 1'0" EAST } WEIGHT	70	4	98	0	98	-603	85	154	628
INTERFACE (341) } SEISMIC	70	1121	247	842	1423	1735	12040	5139	13205

ISSUED 2/28/74
 REVISED 4/18/78
 PAGE 1 OF 1

STANDARD NUMBER
 EE 16.01.7



NOTE:
Piping configuration shown on this drawing is for Thermal, Weight, and Static Analysis ONLY. See PD series drawings for piping location.

REV	REVISIONS	DATE	BY	CHKD	APP'D	REFERENCE DRAWING	PERM RECORD	DATE	BY	CHKD	APP'D
0	UPDATE PER ANALYSIS DOCUMENTATION					S. B. PERRYMAN/ALP/12/86 J. R. SCOTT/1/2/87 M. T. BAKER/3/10/87 R. J. WILSON/2/28/87					

DEPARTMENT OF ENERGY
 SAN FRANCISCO OPERATIONS OFFICE
 SOLAR TSM MEGAWATT PROJECT OFFICE
 9550 PLAKE DRIVE, SUITE 310
 S. MONTE, CALIFORNIA 94731
10 MW SOLAR PILOT PLANT - BAGOZIT, CALIFORNIA

SOLAR FACILITIES DESIGN INTEGRATOR

ANALYSIS ISOMETRIC
TSS OIL - CHARGING SYSTEM FEED

ANALYSIS ISOMETRIC (P13-19)

BRANCH CONNECTION SYMBOLS	PIPE SUPPORT SYMBOLS	ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN.			ANCHOR &/OR TERM. POINTS	COORDINATE		
			X	Y	Z		X	Y	Z
UNREINFORCED PIPE-PIPE INTERSECTION	CONSTANT SUPPORT	5	0.0	0.0	0.0	5 } TO-04	0'-0"	0'-0"	0'-0"
REINFORCED PIPE-PIPE INTERSECTION	VARIABLE SPRING SUPPORT	70	↓	↓	↓	70 }	92'-0"	-0'-0 1/2"	0'-0"
ASA TEE	RIGID ROD OR STRUT	105	↓	↓	↓	105 } TO-05	0'-0"	0'-0"	0'-0"
WELDOLET	HYDRAULIC SNUBBER	170	↓	↓	↓	170 }	79'-0"	-0'-0 1/2"	0'-0"
SWEEPOLET	RIGID GUIDE								
	ANCHOR								

MODELING SYMBOLS	PIPING SYMBOLS
POINT OF INTEREST	ELBOW
DATA POINT NO.	BEND
MASS POINT OR CENTER OF GRAVITY	VALVES (ASSUMED RIGID)
INTERFACE POINT	REDUCER OR INCREASER
	EQUIPMENT NOZZLE

ANALYZED CONDITIONS			VALVES & SPECIAL COMPONENTS			
OPERATING TEMP (°F)	DESIGN PRESSURE (PSIG)	CASE	VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS
525°	115	TO-4, TO-5	VTO-5-13	243	FINAL	Remove Nozzles 4245 1/2
			VTO-4-12	243		

NOTES:

- 1) DIMENSIONS ARE IN FEET AND INCHES UNLESS NOTED OTHERWISE.
- 2) ALL ELBOWS ARE ASA LONG RADIUS UNLESS NOTED OTHERWISE.
- 3) PIPE ANALYZED FROM COLD TO HOT.
- 4) THERMAL ANALYSIS TEMPERATURE RANGE IS FROM 70° F. TO OPERATING TEMPERATURE UNLESS NOTED OTHERWISE.
- 5) SCALE: NONE
- 6) THIS DATA AND ATTACHED DRAWINGS USED FOR ANALYSIS PURPOSES ONLY.

DATA POINTS		PIPE MATERIAL	LINE SPEC.	PIPE SIZE (IN.)		WEIGHT LBS./LINEAR FT.			INS. THK.
FROM	TO			O.D.	W.T.	PIPE	FLUID	INSULATION	
5	70	A106 Gr B	BBA	8.625	.322	28.55	19.7 @ 575°F 18.4 @ 77°F	10.6	3 1/2"
105	170	↓	↓	↓	↓	↓	↓	↓	↓
45	75	↓	↓	4.5	.237	10.8	N/A	0	0
175/150	175/180	↓	↓	↓	↓	↓	↓	↓	↓

NO.	REFERENCES	NO.	ANALYSIS CODES	NO.	REVISIONS	DATE	BY	CH'D	APP'D
	P13-14		T/W-TO-4-A-3 1/3						
			T/W-TO-5-A-3 1/3						
			X-TO-4-A-3						
			X-TO-5-A-1						

PIPING ANALYSIS DATA (P13-14)

Stearns-Roger
INCORPORATED

10MW SOLAR PILOT PLANT - DAGGETT, CALIF.
TSS OIL - CHARGING SYSTEM FEED
FOR ISOMETRIC P13-14 REV. A

DRAWN: KEM	DATE: 1-14-80	ANAL. BY GJM	DATE: 1-23-80
CHECKED: KEM	DATE: 1-29-80	APP'D. BY GJM	DATE: 1-24-80
JOB NO. C-21700		SYSTEM NO. TO-04, 05	
SHEET 1 OF 1			


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FOREWORD

THE FOLLOWING REPORT WAS GENERATED BY THE DYNAPLEX PIPING ANALYSIS PROGRAM. THE PROGRAM ACCOMMODATES THE WIDEST RANGE OF PRACTICAL SITUATIONS ENCOUNTERED IN MODERN PIPING SYSTEMS INCLUDING DYNAMIC AS WELL AS THERMAL, WEIGHT AND PRESSURE EFFECTS.

FOR FURTHER INFORMATION OR PROMPT ASSISTANCE IN USING THE DYNAPLEX PROGRAM, PLEASE CONTACT YOUR LOCAL COMPUTER CENTER REPRESENTATIVE OR:

ENGINEERING SERVICES MANAGER
AUTON COMPUTING CORPORATION
1 METRO PLAZA
505 THORNALL STREET
EDISON, N.J. 08817

THE STRESS FORMULATION OF
ANSI B31.1 - 1977
INCLUDING THE LATEST MANDATORY UPDATES
HAS BEEN APPLIED IN THIS ANALYSIS

THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

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*
* STEARNS - ROGER CORP
* -----
*
* DOE 10MW SOLAR PILOT PLANT - C-21700
*
* TSS OIL CHARGING(T/W-TD-4-A-3/3)
*
*
* 7/ 1/80
*
*
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*****

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DYNALFLX

STEARNS - ROGER CORP

PAGE 1

PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
 JOB - TSS OIL CHARGING(T/W-10-4-A-3/3)

DATE 7/ 1/80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP, 7/ 1/80, PROJ. DOE 10M W SOLAR PILOT PLANT - C-21700, JORTSS OIL CH ARGING(T/W-10-4-A-3/ 3)	1
2	GEN								APPLY B31.1-1973	2
3			5	10			4=0	L	MAT=LCS, OD=8.625, WT=.322, UNIF=25.3, TEMP=525.	3
4				15		10=10-1/2		L		4
5				20			15=6	L		5
6				25		-2=0		L		6
7				27	1=9					7
8				30	18=0					8
9				32	18=0					9
10				35	19=0					10
11				40	19=0					11
12				42	14=3					12
13				45	2=0				SIF=2.44	13
14				50		-2=10-5/16		L		14
15				60			-19=6	L		15
16				61		-1=0				16
17				62		-1=7-1/2			RIGID, WEIGHT=243.	17
18				65		-3=4-3/16		L		18
19				70			-4=0			19
20			45	75	2=9				OD=4.50, WT=.237, TEMP=70., UNIF=0.0	20
21	ANC	5								21
22	ANC	70								22
23	RAD	27				RIGID				23
24	RAD	30				RIGID				24
25	RAD	32				RIGID				25
26	RAD	35				RIGID				26
27	RAD	40				RIGID				27
28	RAD	75				RIGID				28
29	HGP								LOC(15F, 60N), USE TABLE 1	29

INPUT DATA - (CARD IMAGES)

:1 :4 :7 :10 :13 :25 :37 :49 :60 :
: : : : : : : : : :
LINE :TYP:LOC:FRM:TD : DELTA X : DELTA Y : DELTA Z : RADIUS : ADDITIONAL DATA : LINE
NUMBER : :NO.: : : : : : : : : : : : NUMBER

30 :CCC: 70: 1 :92-0 :0-0-1/2 :0-0 : : : : : : : : 30

DYNAFLEX

STEARNS - ROGER CORP

PAGE 3

PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
 JOB - TSS GIL CHARGING(T/W-YG-4-A-373)

DATE 7/ 1/80

 *
 * EDITED PIPING SYSTEM DESCRIPTION *

 *

EXPLANATORY NOTES

 IN THE EDITED PIPING SYSTEM DESCRIPTION:

- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
- (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
- (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCULATIONS IS ASSUMED TO BE .25 INCHES.
- (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
- (5) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS ON RIGID RESTRAINTS (RAD,ROT) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR,MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (RAD,RAF) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASM) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
- (6) A POINT IDENTIFIED AS A TENTATIVE HANGER LOCATION IS ASSUMED TO BE FREE TO MOVE IN THE VERTICAL DIRECTION FOR THE INITIAL THERMAL LOADING CASE AND FULLY RESTRAINED IN THE VERTICAL DIRECTION FOR THE INITIAL WEIGHT LOADING CASE.
- (7) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
- (8) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

GENERAL DATA

COORDINATES OF ALL POINTS OF THE SYSTEM ARE WITH RESPECT TO POINT 5, WHICH IS THE ORIGIN

HANGER DESIGN DATA:
THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION = .10 INCHES.
VARIABLE SPRING HANGERS SELECTED FROM TABLE #12

MATERIALS USED (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)

LCS - LOW CARBON STEEL
YOUNGS MODULUS AT AMBIENT TEMPERATURE = 27,900,000. PSI
POISSONS RATIO = .30
DENSITY = 490. POUNDS PER CUBIC FOOT

LOADING CONDITIONS ANALYZED

FREE THERMAL
RESTRAINED WEIGHT

DIST. LOADS
(LBS PER FT)

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE WALL		TEMP (DEG) (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z				DIAMETER (IN)	THICK (IN)		MATL (LCS)	PRESS (PSI)	WT. UNIF
ANCHR		5	0.00	0.00	0.00								
	STRAIGHT					3.00			8.625	.322	LCS 525.	28.6	25.3
	(
	(* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 525. DEGREES FAHRENHEIT IS 3.86 INCHES PER 100 FEET												
	(* A UNIFORM DISTRIBUTED LOAD OF 25.30 PLF IS ACTING IN THE -Y DIRECTION.												
	(
	>- 10N		0.00	0.00	3.00								
	(
	BEND	10N	0.00	.29	3.71	1.00	1.57	90.000					
	(
	>- 10F		0.00	1.00	4.00								
	(						8.8A						
	>- 15N		0.00	9.88	4.00								
	(
	BEND	15N	0.00	10.58	4.29	1.00	1.57	90.000					

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 5

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							MAIL (PSI)	PIPE FT. UNIF
BEND	-(	15M	0.00	10.58	4.29	1.00	1.57	90.000	6.625	.322	LCS: 525.	24.6	25.3
	)	>= 15F	0.00	10.88	5.00								
	(	* TENTATIVE HANGER AT POINT 15F - SEE NOTE (9) ABOVE.											
	(	HANGER LENGTH NOT SPECIFIED.											
STRAIGHT	-(						13.50						
	)	>= 20N	0.00	10.88	18.50								
BEND	-(	20M	0.00	10.58	19.21	1.00	1.57	90.000					
	)	>= 20F	0.00	9.87	19.50								
	(	* POINT 20F IS EQUIVALENT TO POINT 25N											
BEND	-(	25M	.29	9.17	19.50	1.00	1.57	90.000					
	)	>= 25F	1.00	8.88	19.50								
STRAIGHT	-(						.75						
	)	>= 27	1.75	8.88	19.50								
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 27											
	(	IN DIRECTION Y											
STRAIGHT	-(						18.00						
	)	>= 30	19.75	8.88	19.50								
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 30											
	(	IN DIRECTION Y											
STRAIGHT	-(						18.00						
	)	>= 32	37.75	8.88	19.50								

* NOTES PERTAINING TO POINT 32 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
		>- 32	37.75	8.88	19.50			8.625	.322	LCS	525.	28.6	25.3
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 32											
		(IN DIRECTION Y											
STRAIGHT	-					19.00							
		>- 35	56.75	8.88	19.50								
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 35											
		(IN DIRECTION Y											
STRAIGHT	-					19.00							
		>- 40	75.75	8.88	19.50								
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 40											
		(IN DIRECTION Y											
STRAIGHT	-					14.25							
		>- 42	90.00	8.88	19.50								
STRAIGHT	-					2.00							
		(* STRESS INTENSIFICATION SPECIFIED AT POINT 45											
		(STRESS INTENSIFICATION FACTOR = 2.44											
BR PT		>- 45	92.00	8.88	19.50								
STRAIGHT	-					1.86							
		>- 50N	92.00	7.02	19.50								
BEND	-	50M	92.00	6.31	19.21	1.00	1.57	90.000					
		>- 50F	92.00	6.02	18.50								
STRAIGHT	-					13.50							
		>- 60N	92.00	6.02	5.00								

* NOTES PERTAINING TO POINT 604 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 7

POINT TYPE	ELEMENT DESIGNATION NO.	POINT LOC.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
	>= 60N		92.00	6.02	5.00			8.625	.322	LCS	525.	28.6	25.3
	(
	(	* TENTATIVE HANGER AT POINT 60N - SEE NOTE (9) ABOVE.											
	(	HANGER LENGTH NOT SPECIFIED.											
	(
	(
	BEND -	60H	92.00	5.72	4.29	1.00	1.57	90.000					
	(
	>= 61		92.00	5.02	4.00								
	(
	(	* POINT 61 IS EQUIVALENT TO POINT 60F											
	(
	RIGID -					1.71			N/A	N/A		N/A	N/A
	(
	(	* WEIGHT OF ELEMENT = 243. POUNDS											
	(
	STRAIGHT -	62	92.00	3.31	4.00		2.35						
	(
	>= 65N		92.00	.96	4.00								
	(
	BEND -	65H	92.00	.25	3.71	1.00	1.57	90.000					
	(
	>= 65F		92.00	-.04	3.00								
	(
	STRAIGHT -						3.00						
	(
	ANCHR	-- 70	92.00	-.04	0.00								
	(
	(	* CONTROL COORDINATES OF POINT 70, IN FEET :											
	(	X = 92.00, Y = -.04, Z = 0.00											
	(	RESULTANT DIFFERENCE IS ZERO											
	(
	BR PT	-- 45	92.00	8.88	19.50								

* NOTES PERTAINING TO POINT 45 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAHETER (IN)	WALL THICK (IN)	TEMP (DEG) (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
BR PT	-- 45		92.00	8.88	19.50			8.625	.322	LCS	525	28.6	25.3
	(STRAIGHT - (					2.75		4.500	.237		70	10.8	0.0
	(* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 70. DEGREES FAHRENHEIT IS 0.00 INCHES PER 100 FEET												
	(* A UNIFORM DISTRIBUTED LOAD OF .00 PLF IS ACTING IN THE -Y DIRECTION.												
TERM	-- 75		94.75	8.88	19.50								
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 75 IN DIRECTION Y												

DYNAFLEX

LOADING - REFERENCE THERMAL

PAGE 9

 *
 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

 *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
5	-386.	-47.	-6.	389.	817.	-5250.	2638.	5932.
70	386.	-42.	6.	388.	924.	5784.	-1481.	6041.
RESTRAINTS:								
27	0.	-2.	0.	2.	0.	0.	0.	0.
30	0.	60.	0.	60.	0.	0.	0.	0.
32	0.	-5.	0.	5.	0.	0.	0.	0.
35	0.	-37.	0.	37.	0.	0.	0.	0.
40	0.	167.	0.	167.	0.	0.	0.	0.
75	0.	-93.	0.	93.	0.	0.	0.	0.

DYNAFLEX

LOADING = @FREE@ THERMAL

PAGE 10

*
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
* ----- *
*

THE MAXIMUM STRESS OF 8570. OCCURS AT POINT 65F

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

DYNAFLEX

LOADING - FREEZ THERMAL

PAGE 11

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	STR - (	5	6.	389.	2638.	817.	5250.	1.00	1.00	16.81	4235.
	)	10N	6.	389.	2638.	675.	4092.	2.44	2.44	16.81	8558.
	BEND - (	10M	37.	387.	915.	644.	4486.	2.44	2.44	16.81	8050.
	)	10F	47.	386.	3706.	634.	2252.	2.44	2.44	16.81	7631.
	STR - (	15N	47.	386.	3706.	685.	1173.	2.44	2.44	16.81	6872.
	)	15M	37.	387.	3563.	676.	1518.	2.44	2.44	16.81	6845.
	BEND - (	15F	6.	389.	1559.	644.	3320.	2.44	2.44	16.81	6484.
	)	20N	6.	389.	1559.	7.	1890.	2.44	2.44	16.81	4266.
	BEND - (	20M	29.	388.	2552.	28.	507.	2.44	2.44	16.81	4530.
	)	20F	47.	386.	2276.	46.	1173.	2.44	2.44	16.81	4459.
	BEND - (	25M	240.	306.	1644.	886.	1573.	2.44	2.44	16.81	4251.
	)	25F	386.	48.	52.	740.	2270.	2.44	2.44	16.81	4158.
	STR - (	27	386.	48.	52.	704.	2266.	1.00	1.00	16.81	1695.
	)	30	386.	12.	52.	178.	2162.	1.00	1.00	16.81	1549.
	STR - (	32	386.	12.	52.	13.	2057.	1.00	1.00	16.81	1469.
	)	35	386.	8.	52.	118.	1947.	1.00	1.00	16.81	1393.
	STR - (	40	386.	32.	52.	486.	1837.	1.00	1.00	16.81	1357.
	)	42	386.	135.	52.	1435.	1754.	1.00	1.00	16.81	1616.
	STR - (	45	386.	135.	52.	1705.	1743.	2.44	2.44	16.81	4247.
	)	50N	42.	386.	1743.	63.	1242.	2.44	2.44	16.81	4569.
	BEND - (50M	26.	387.	467.	79.	1838.	2.44	2.44	16.81	3304.

DYNAFLEX

LOADING - FREE THERMAL

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND	(	50M	26.	387.	467.	79.	1838.	2.44	2.44	16.81	3304.
)										
STR	(	50F	6.	388.	856.	111.	1357.	2.44	2.44	16.81	2800.
)										
BEND	(	60N	6.	388.	856.	679.	3854.	2.44	2.44	16.81	6974.
)										
BEND	(	60M	26.	387.	3444.	710.	2392.	2.44	2.44	16.81	7404.
)										
RIGID	(	61	42.	386.	4240.	727.	471.	2.44	2.44	16.81	7534.
)										
STR	(	62	42.	386.	4240.	189.	736.	1.00	1.00	16.81	3075.
)										
	(	65N	42.	386.	4240.	750.	1095.	2.44	2.44	16.81	7735. *
)										
BEND	(	65M	26.	387.	2110.	767.	4046.	2.44	2.44	16.81	8055. *
)										
STR	(	65F	6.	388.	1481.	798.	4626.	2.44	2.44	16.81	8570. **
)										
ANCHR	--	70	6.	388.	1481.	924.	5784.	1.00	1.00	16.81	4313.
BR PT	--	45	0.	93.	0.	255.	0.	2.44	2.44	3.21	2327.
										8.50	879.
TERM	--	75	0.	93.	0.	0.	0.	1.00	1.00	3.21	0.
										8.50	

REVISE 4" DUMMY LEG TO 6" STD. WT. PIPE

G.H. MAY 7/7/80

DYNAFLEX

LOADING - FREE THERMAL

PAGE 13

 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		5	-386.	-47.	-6.	817.	-5250.	2638.
	STRAIGHT - (	>- 10N	-386.	-47.	-6.	675.	-4092.	2638.
	BEND - (	10N	-386.	-47.	-6.	644.	-3819.	2525.
	STRAIGHT - (	>- 10F	-386.	-47.	-6.	634.	-3706.	2252.
	BEND - (	>- 15N	-386.	-47.	-6.	685.	-3706.	-1173.
	BEND - (	15N	-386.	-47.	-6.	676.	-3593.	-1446.
	STRAIGHT - (	>- 15F	-386.	-47.	-6.	644.	-3320.	-1559.
	BEND - (	>- 20N	-386.	-47.	-6.	7.	1890.	-1559.
	BEND - (	20N	-386.	-47.	-6.	-28.	2163.	-1446.
	STRAIGHT - (	>- 20F	-386.	-47.	-6.	-46.	2276.	-1173.
	BEND - (	25N	-386.	-47.	-6.	-50.	2275.	-886.
	STRAIGHT - (	>- 25F	-386.	-47.	-6.	-52.	2270.	-740.
	STRAIGHT - (	>- 27	-386.	-47.	-6.	-52.	2266.	-704.
	STRAIGHT - (	>- 30	-386.	11.	-6.	-52.	2162.	178.
	STRAIGHT - (	>- 32	-386.	11.	-6.	-52.	2057.	-13.
	STRAIGHT - (	>- 35	-386.	6.	-6.	-52.	1947.	-118.
	STRAIGHT - (	>- 40	-386.	-32.	-6.	-52.	1837.	488.
	STRAIGHT - (	>- 42	-386.	135.	-6.	-52.	1754.	-1435.

DYNAFLEX

LOADING - ZFREE THERMAL

PAGE 14

INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>- 42	-386.	135.	-6.	-52.	1754.	-1435.
BRANCH PT.	STRAIGHT - (	-- 45	-386.	135.	-6.	-52.	1743.	-1705.
BRANCH PT.	STRAIGHT - (	-- 45	-386.	42.	-6.	-52.	1743.	-1960.
		>- 50N	-386.	42.	-6.	-63.	1743.	-1242.
	BEND - (	50M	-386.	42.	-6.	-79.	1630.	-970.
	STRAIGHT - (	>- 50F	-386.	42.	-6.	-111.	1357.	-856.
		>- 60N	-386.	42.	-6.	-679.	-3854.	-856.
	BEND - (	60M	-386.	42.	-6.	-710.	-4127.	-743.
		>- 61	-386.	42.	-6.	-727.	-4240.	-471.
	RIGID - (	>- 62	-386.	42.	-6.	-736.	-4240.	189.
23	STRAIGHT - (	>- 65N	-386.	42.	-6.	-750.	-4240.	1095.
	BEND - (	65M	-386.	42.	-6.	-767.	-4353.	1368.
	STRAIGHT - (	>- 65F	-386.	42.	-6.	-798.	-4626.	1481.
ANCHOR	STRAIGHT - (	-- 70	-386.	42.	-6.	-924.	-5784.	1481.
BRANCH PT.	STRAIGHT - (	-- 45	0.	93.	0.	0.	-0.	255.
TERMINAL	STRAIGHT - (	-- 75	0.	93.	0.	0.	0.	0.

DYNAFLEX

LOADING - FREE THERMAL

PAGE 15

 * DISPLACEMENTS AND ROTATIONS *

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		5	-.000	-.000	-.000	.000	-.000	.000
	STRAIGHT - (
	>	10N	-.019	-.003	.116	.009	-.057	.042
	(
	BEND - (	10M	-.039	.006	.144	.025	-.153	.086
	(
	>	10F	-.068	.031	.160	.040	-.197	.157
	(
	STRAIGHT - (
	>	15N	-.398	.374	.256	.064	-.371	.177
	(
	BEND - (	15M	-.447	.397	.278	.080	-.391	.173
	(
	>	15F	-.520	.395	.310	.095	-.451	.183
	(
	STRAIGHT - (
	>	20N	-1.919	.092	.832	.113	-.490	.071
	(
	BEND - (	20M	-1.984	.064	.852	.113	-.459	.073
	(
	>	20F	-2.002	.030	.847	.112	-.450	.060
	(
	BEND - (	25M	-1.984	.005	.856	.123	-.433	.036
	(
	>	25F	-1.955	-.003	.909	.139	-.388	.017
	(
	STRAIGHT - (
	>	27	-1.526	-.000	.969	.138	-.381	.015
	(
	STRAIGHT - (
	>	30	-1.231	.000	2.095	.134	-.216	-.004
	(
	STRAIGHT - (
	>	32	-.537	-.000	2.623	.129	-.063	.002
	(
	STRAIGHT - (
	>	35	.196	-.000	2.563	.123	.092	-.005
	(
	STRAIGHT - (
	>	40	.929	.000	1.902	.118	.239	.011
	(
	STRAIGHT - (
	>	42	1.479	.021	1.032	.114	.543	-.016
	(
	STRAIGHT - (
BRANCH PT.		45	1.556	.011	.885	.114	.357	-.029
BRANCH PT.		45	1.556	.011	.885	.114	.357	-.029

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DYNAFLEX

LOADING - FREE THERMAL

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.		-- 45	1.556	.011	.885	.114	.357	-.029
	STRAIGHT - (	>- 50N	1.542	-.061	.841	.113	.375	-.041
	BEND - (	( 50M	1.510	-.081	.813	.111	.394	-.074
		>- 50F	1.444	-.076	.779	.109	.430	-.091
	STRAIGHT - (	>- 60N	.257	.210	.258	.087	.361	-.152
	BEND - (	( 60M	.201	.210	.226	.071	.286	-.133
		>- 61	.166	.187	.206	.054	.258	-.119
	RIGID - (	>- 62	.123	.121	.186	.054	.256	-.119
	STRAIGHT - (	>- 65N	.066	.030	.162	.047	.204	-.113
25	BEND - (	( 65M	.041	.005	.145	.029	.163	-.062
		>- 65F	.021	-.003	.116	.011	.064	-.024
	STRAIGHT - (
ANCHOR		-- 70	.000	-.000	.000	.000	.000	-.000
BRANCH PT.		-- 45	1.556	.011	.885	.114	.357	-.029
TERMINAL	STRAIGHT - (	-- 75	1.556	-.000	.680	.114	.357	-.015

LOADING - RESTRAINING WEIGHT (+ORIF)

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
5	-4.	-97.	-0.	97.	-20.	-52.	8.	56.
70	4.	97.	0.	98.	-603.	85.	154.	628.
RESTRAINTS:								
15F	0.	-1150.	0.	1150.	0.	0.	0.	0.
27	0.	-942.	0.	942.	0.	0.	0.	0.
30	0.	-1014.	0.	1014.	0.	0.	0.	0.
32	0.	-1002.	0.	1002.	0.	0.	0.	0.
35	0.	-963.	0.	963.	0.	0.	0.	0.
40	0.	-1254.	0.	1254.	0.	0.	0.	0.
60N	0.	-1306.	0.	1306.	0.	0.	0.	0.
75	0.	-665.	0.	665.	0.	0.	0.	0.

 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF ^{4,615} 12,221. OCCURS AT POINT 45

REVISE 4" DUMMY LEG TO
 6" STD. WT. PIPE

G.H. MAY 7-7-80

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

DYNAFLEX

LOADING = PRESTRAINED WEIGHT

(+UNIF)

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESILANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 5	0.	97.	8.	20.	52.	1.00	1.00	16.81	40.
	STR = (
		>= 10N	0.	65.	8.	67.	40.	2.44	2.44	16.81	103.
		(
	BEND = (	10M	76.	76.	21.	7.	31.	2.44	2.44	16.81	50.
		(
		>= 10F	150.	4.	36.	29.	4.	2.44	2.44	16.81	60.
	STR = (
		>= 15N	628.	4.	36.	32.	33.	2.44	2.44	16.81	76.
		(
	BEND = (	15M	474.	474.	50.	224.	1.	2.44	2.44	16.81	300.
		(
		>= 15F	0.	713.	37.	714.	32.	2.44	2.44	16.81	935.
	STR = (
		>= 20N	0.	290.	37.	283.	24.	2.44	2.44	16.81	374.
		(
	BEND = (	20M	235.	235.	44.	65.	6.	2.44	2.44	16.81	102.
		(
		>= 20F	374.	4.	28.	33.	37.	2.44	2.44	16.81	74.
		(
	BEND = (	25M	298.	292.	6.	148.	45.	2.44	2.44	16.81	202.
		(
		>= 25F	4.	459.	36.	457.	27.	2.44	2.44	16.81	599.
	STR = (
		>= 27	4.	499.	36.	816.	27.	1.00	1.00	16.81	584.
	STR = (
		>= 30	4.	487.	36.	1588.	21.	1.00	1.00	16.81	1134.
	STR = (
		>= 32	4.	519.	36.	1557.	14.	1.00	1.00	16.81	1112.
	STR = (
		>= 35	4.	458.	36.	1429.	8.	1.00	1.00	16.81	1020.
	STR = (
		>= 40	4.	566.	36.	2460.	1.	1.00	1.00	16.81	1756.
	STR = (
		>= 42	4.	80.	36.	1867.	4.	1.00	1.00	16.81	1353.
	STR = (
BR PT		-- 45	4.	188.	36.	1598.	5.	2.44	2.44	16.81	2089.
		(
BR PT		-- 45	448.	4.	5.	191.	36.	2.44	2.44	16.81	254.
	STR = (
		>= 50N	347.	4.	5.	36.	185.	2.44	2.44	16.81	243.
		(
	BEND = (50M	216.	216.	132.	129.	123.	2.44	2.44	16.81	289.

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DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND	(	50M	216.	216.	132.	129.	123.	2.44	2.44	16.81	249.
	>	50F	0.	263.	179.	329.	9.	2.44	2.44	16.81	489.
STR	(	60N	0.	942.	179.	1033.	64.	2.44	2.44	16.81	1372.
BEND	(	60M	566.	565.	173.	452.	78.	2.44	2.44	16.81	640.
	>	61	757.	4.	68.	223.	175.	2.44	2.44	16.81	380.
RIGID	(	62	471.	4.	68.	168.	223.	1.00	1.00	16.81	205.
STR	(	65N	344.	4.	68.	224.	158.	2.44	2.44	16.81	369.
BEND	(	65M	214.	213.	159.	131.	61.	2.44	2.44	16.81	281.
	>	65F	0.	260.	154.	66.	72.	2.44	2.44	16.81	239.
STR	(	70	0.	98.	154.	603.	85.	1.00	1.00	16.81	449.
ANCHR	--	45	0.	636.	0.	1789.	0.	2.44	2.44	3.21	12221. **
UR PT	STR	(								8.50	4615
TERM	--	75	0.	665.	0.	0.	0.	1.00	1.00	3.21	0.
										8.50	

REVISE 4" DUMMY LEG TO 6" STD. WT. PIPE

G.H. MAY 7/7/80

 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		-- 5	-4.	-97.	-0.	-20.	-52.	8.
	STRAIGHT - (	>- 10N	-4.	65.	-0.	+67.	-40.	8.
	BEND - (	10M	-4.	107.	-0.	-7.	-37.	7.
	STRAIGHT - (	>- 10F	-4.	150.	-0.	29.	+36.	4.
	BEND - (	>- 15N	-4.	628.	-0.	32.	-36.	-33.
31	BEND - (	15M	-4.	670.	-0.	224.	-35.	-36.
	STRAIGHT - (	>- 15F	-4.	713.	-0.	714.	-32.	-37.
	BEND - (	>- 20N	-4.	290.	-0.	-283.	24.	-37.
	BEND - (	20M	-4.	332.	-0.	-65.	26.	-36.
	STRAIGHT - (	>- 20F	-4.	374.	-0.	37.	28.	-33.
	BEND - (	25M	-4.	417.	-0.	36.	28.	-148.
	STRAIGHT - (	>- 25F	-4.	459.	-0.	36.	27.	-457.
	STRAIGHT - (	>- 27	-4.	499.	-0.	36.	27.	-816.
	STRAIGHT - (	>- 30	-4.	-487.	-0.	36.	21.	-1588.
	STRAIGHT - (	>- 32	-4.	-519.	-0.	36.	14.	-1557.
	STRAIGHT - (	>- 35	-4.	-458.	-0.	36.	8.	-1429.
	STRAIGHT - (>- 40	-4.	566.	-0.	36.	1.	-2460.
	STRAIGHT - (>- 42	-4.	80.	-0.	36.	-4.	1867.

DYNAFLEX

LOADING = RESTRAINED WEIGHT (+UNIF)

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		> 42	-4.	80.	-0.	36.	-4.	1867.
BRANCH PT.	STRAIGHT - (	-- 45	-4.	188.	-0.	36.	-5.	1598.
BRANCH PT.	STRAIGHT - (	-- 45	-4.	-448.	-0.	36.	-5.	-191.
		> 50N	-4.	-347.	-0.	36.	-5.	-183.
	BEND - (	50M	-4.	-305.	-0.	129.	-6.	-180.
		> 50F	-4.	-263.	-0.	329.	-9.	-179.
	STRAIGHT - (	> 60N	-4.	-842.	-0.	-1033.	-64.	-179.
	BEND - (	60M	-4.	-800.	-0.	-452.	-67.	-178.
		> 61	-4.	-757.	-0.	-223.	-68.	-175.
	RIGID - (	> 62	-4.	-471.	-0.	-223.	-68.	-168.
3	STRAIGHT - (	> 65N	-4.	-344.	-0.	-224.	-68.	-158.
	BEND - (	65M	-4.	-302.	-0.	-131.	-69.	-155.
		> 65F	-4.	-260.	-0.	66.	-72.	-154.
ANCHOR	STRAIGHT - (	-- 70	-4.	-98.	-0.	603.	-45.	-154.
BRANCH PT.		-- 45	-0.	636.	0.	-0.	-0.	1789.
TERMINAL	STRAIGHT - (	-- 75	-0.	665.	0.	-0.	0.	0.

 * DISPLACEMENTS AND ROTATIONS *

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 5	-.000	-.000	-.000	-.000	-.000	.000
	STRAIGHT - (	>-- 10N	-.000	.000	-.000	-.001	-.001	.000
	(
	BEND - (	10M	-.000	.001	-.000	-.002	-.001	.000
	(
	STRAIGHT - (	>-- 10F	-.001	.001	-.000	-.002	-.002	.001
	(
	STRAIGHT - (	>-- 15N	-.002	.001	-.002	-.000	-.003	.000
	(
	BEND - (	15M	-.002	.001	-.002	.002	-.003	-.000
	(
	STRAIGHT - (	>-- 15F	-.002	-.000	-.002	.013	-.004	-.000
	(
	STRAIGHT - (	>-- 20N	-.014	-.002	-.002	-.021	-.004	-.003
	(
	BEND - (	20M	-.015	.002	-.001	-.025	-.004	-.003
	(
	STRAIGHT - (	>-- 20F	-.016	.003	.003	-.025	-.004	-.004
	(
	BEND - (	25M	-.016	.003	.007	-.024	-.003	-.005
	(
	STRAIGHT - (	>-- 25F	-.017	.002	.009	-.023	-.003	-.012
	(
	STRAIGHT - (	>-- 27	-.017	-.000	.009	-.023	-.003	-.014
	(
	STRAIGHT - (	>-- 30	-.017	-.000	.015	-.020	-.001	.005
	(
	STRAIGHT - (	>-- 32	-.017	-.000	.016	-.016	.001	-.004
	(
	STRAIGHT - (	>-- 35	-.017	-.000	.012	-.013	.001	.006
	(
	STRAIGHT - (	>-- 40	-.017	-.000	.006	-.009	.002	-.019
	(
	STRAIGHT - (	>-- 42	-.017	-.068	.001	-.006	.002	.016
	(
BRANCH PT.		-- 45	-.017	-.058	.000	-.006	.002	.031
BRANCH PT.		-- 45	-.017	-.058	.000	-.006	.002	.031

DYNAFLEX

LOADING - UNRESTRAINED WEIGHT (+LNIF)

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.	STRAIGHT - (	45	-.017	-.058	.000	-.006	.002	.031
	>-	50N	-.005	-.058	.002	-.005	.001	.029
	BEND - (	50M	-.001	-.058	.003	-.004	.003	.026
	>-	50F	-.000	-.058	.003	.001	.004	.024
	STRAIGHT - (	60N	-.008	-.000	.003	.027	.002	.012
	>-	60M	-.007	.002	.002	.010	.001	.011
	BEND - (	61	-.006	.003	.001	.003	.002	.008
	>-	62	-.004	.003	.000	.003	.002	.007
	RIGID - (	65N	-.000	.003	-.001	.001	.001	.006
	>-	65M	.000	.003	-.000	-.004	.001	.003
	BEND - (	65F	.000	.002	.000	-.005	.001	.002
	>-	70	.000	.000	.000	-.000	.000	.000
ANCHOR	STRAIGHT - (	45	-.017	-.058	.000	-.006	.002	.031
BRANCH PT.	>-	75	-.017	-.000	-.001	-.006	.002	.132
TERMINAL	STRAIGHT - (

HANGER DESIGN DATA
-----EXPLANATORY NOTES:

- (1) ALL MOVEMENTS SHOWN BELOW REFER TO THE INITIAL EXPANSION LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE NOT BEEN VERTICALLY RESTRAINED AND ALL WEIGHT EFFECTS HAVE BEEN SUPPRESSED.
- (2) THE WEIGHT FRACTIONS SHOWN BELOW REFER TO THE WEIGHT LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE BEEN RIGIDLY RESTRAINED IN THE VERTICAL DIRECTION AND ALL THERMAL EFFECTS INCLUDING IMPOSED ANCHOR MOVEMENTS HAVE BEEN SUPPRESSED.
- (3) IN THE FOLLOWING TABLE VSH DENOTES A VARIABLE SPRING HANGER AND CSH DENOTES A CONSTANT SUPPORT HANGER.
- (4) THE SUPPORT LOADS IN THE INSTALLED CONDITION HAVE BEEN CALCULATED TO PRODUCE THE CORRECT WEIGHT BALANCE IN THE OPERATING CONDITION.
- (5) IF THE FREE VERTICAL MOVEMENT EXCEEDS THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION OF .10 IN , A VARIABLE SPRING IS SELECTED. IF A VARIABLE SPRING HANGER CANNOT BE FOUND WHICH SATISFIES BOTH THE LOAD VARIATION CRITERION SELECTED BY THE USER AND THE WORKING RANGE OF THE SPRINGS LISTED IN SPRING TABLE (1) OF THE USER'S MANUAL, A CONSTANT SUPPORT HANGER IS RECOMMENDED.
- (6)
- (7) THE NOMINAL ROD DIAMETER FOR RIGID HANGERS IS TAKEN FROM ANSI H31.1 - 1977 TABLE 121.2.2(A), (CARRYING CAPACITIES OF THREADED ASTM A 107 HOT ROLLED CARBON STEEL) ASSUMING A ROD TEMPERATURE OF 650 DEGREES FAHRENHEIT. A MINIMUM 1/2 IN. DIAMETER ROD WILL BE SELECTED FOR ALL PIPE WHICH IS NOMINALLY 2-1/2 IN. OD OR LARGER.
- (8) THE SO-CALLED &THEORETICAL& SPRING INSTALLATION LOAD SHOWN BELOW PRESUPPOSES THAT THE HANGER LOCATION IS RESTRAINED AGAINST VERTICAL MOVEMENT WHILE THE SPRING IS SET TO THE COLD LOAD.

DYNALFX

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HANGER DESIGN DATA TABLE

HANGER LOC. NO.	SUPPORT LOAD (POUNDS)	FREE VERTICAL MOVEMENT (INCHES)	HORIZONTAL MOVEMENT (INCHES)		TYPE	PRELIMINARY HANGER SELECTION SPECIFICATION	SWING	
			Y	Z			LENGTH (FEET)	ANGLE (DEG)
15F	1150.	.39	.52	.31	VSH	1 - SHORT RANGE SPRING, SPRING RATE = 520 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1355 LBS SPRING LOAD IN THE OPERATING CONDITION = 1150 LBS	N/A	N/A
60N	1306.	.21	.26	.26	VSH	1 - SHORT RANGE SPRING, SPRING RATE = 520 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1415 LBS SPRING LOAD IN THE OPERATING CONDITION = 1306 LBS	N/A	N/A

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DYNAPLEX

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 * STATIC SOLUTION ACCURACY CHECKS *

EACH BASIC STATIC SOLUTION COMPRISING EACH LOAD OR LOADING COMBINATION
 SPECIFIED IN THIS RUN HAS BEEN SUBJECTED TO EQUILIBRIUM AND
 COMPATABILITY CHECKS FOR ALL POINTS IN THE SYSTEM:

LOADING - FREE THERMAL

STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

LOADING - RESTRAINED WEIGHT (+UNIF)

STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

DYNAFLEX

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FOREWORD

THE FOLLOWING REPORT WAS GENERATED BY THE DYNAFLEX PIPING ANALYSIS PROGRAM. THE PROGRAM ACCOMMODATES THE WIDEST RANGE OF PRACTICAL SITUATIONS ENCOUNTERED IN MODERN PIPING SYSTEMS INCLUDING DYNAMIC AS WELL AS THERMAL, WEIGHT AND PRESSURE EFFECTS.

FOR FURTHER INFORMATION OR PROMPT ASSISTANCE IN USING THE DYNAFLEX PROGRAM, PLEASE CONTACT YOUR LOCAL COMPUTER CENTER REPRESENTATIVE OR:

ENGINEERING SERVICES MANAGER
AITON COMPUTING CORPORATION
1 METRO PLAZA
505 THORNTON STREET
EDISON, N.J. 08817

THE STRESS FORMULATION OF
ANSI B31.1 - 1977
INCLUDING THE LATEST MANDATORY UPDATES
HAS BEEN APPLIED IN THIS ANALYSIS

THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

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*
*          STEARNS - ROGER CORP
*          -----
*
*          DOF 10MW SOLAR PILOT PLANT - C-21700
*
*          TSS OIL CHARGING(X-10-4-A-3)
*
*
*          77 3780
*
*
*****

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INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC	FRM	TD	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
									:9./,531,33./,125),	
									:SPEC 2(FRE/6,.1/.009,	
									:.25/.055,3.5/.638,	
									:9./,531,33./,125),	
									:SHOCK 1(Y/1,0SPEC 1),	
									:SHOCK 2(Z/1,0 SPEC 1),	
									:SHOCK 3(Y/1,SPEC2),	
									:SHOCK 4(X/1,SPEC1),	
									:Y/1,SPEC2,Z/1,SPEC1),	
									:LOG,1,92	
31	DMO								:LUMP POINTS(AUTOMATIC)	31
									:MAX SPACING=5-0	
									:EXCLUDE ALL H NODES)	
									:MODE CUTOFF=50,	
32	OUT								:SHOCK 1,SHOCK 2,	32
									:SHOCK 3,SHOCK 4	

DYNAFLEX

STEARNS - ROGER CORP

PAGE 3

PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
JOB - TSS OIL CHARGING(X-10-4-A-3)

DATE 7/ 3/80

*
* EDITED PIPING SYSTEM DESCRIPTION *

*

EXPLANATORY NOTES

IN THE EDITED PIPING SYSTEM DESCRIPTION:

- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
- (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
- (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCULATIONS IS ASSUMED TO BE .25 INCHES.
- (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
- (8) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS ON RIGID RESTRAINTS (RAD,RAK) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR,MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (RAD,RAK) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASM) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
- (14) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
- (15) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

DYNAPLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 4

GENERAL DATA

COORDINATES OF ALL POINTS OF THE SYSTEM ARE WITH RESPECT TO POINT 5, WHICH IS THE ORIGIN

MATERIALS USED (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)

LCS - LOW CARBON STEEL
 YOUNGS MODULUS AT AMBIENT TEMPERATURE = 27,900,000. PSI
 POISSONS RATIO = .30
 DENSITY = 490. POUNDS PER CUBIC FOOT

SHOCK AND SPECTRUM DATA

MODE CUTOFF SET AT 50

FREQUENCY CUTOFF SET AT 33.00 CPS

SPECTRUM 1		SPECTRUM 2	
(LOGARITHMIC INTERPOLATION)		(LOGARITHMIC INTERPOLATION)	
FREQUENCY	G	FREQUENCY	G
----CPS	-----	----CPS	-----
.10	.01	.10	.01
.25	.08	.25	.06
2.50	.64	3.50	.64
9.00	.53	9.00	.53
33.00	.13	33.00	.13

SHOCK SPECIFICATIONS

SHOCK 1 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING
 THE CLOSELY SPACED FREQUENCY (CSF) METHOD.
 CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND
 THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 5

SHOCK 2 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 3 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 4 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION AND
100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION AND
100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

LOADING CONDITIONS ANALYZED

- SHOCK 1
- SHOCK 2
- SHOCK 3
- SHOCK 4

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
ANCHR		-- 5	0.00	0.00	0.00								

* NOTES PERTAINING TO POINT 5 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MATL (FAHR)	DIST. LOADS (LBS PER FT)		
			X	Y	Z							PRESS (PSI)	WT, UNIF	
ANCHR		5	0.00	0.00	0.00									
	STRAIGHT	-(					3.00		8.625	.322	LCS	525.	28.6	25.3
		(	* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 525. DEGREES FAHRENHEIT IS 3.86 INCHES PER 100 FEET											
		(	* A UNIFORM DISTRIBUTED LOAD OF 25.30 PLF IS ACTING IN THE -Y DIRECTION.											
		>-	10N	0.00	0.00	3.00								
	BEND	-(	10M	0.00	.29	3.71	1.00	1.57	90.000					
		>-	10F	0.00	1.00	4.00								
	STRAIGHT	-(					4.44							
	STRAIGHT	-(	>- 10F.1	0.00	5.44	4.00								
		>-	15N	0.00	9.88	4.00								
45	BEND	-(	15M	0.00	10.58	4.29	1.00	1.57	90.000					
		>-	15F	0.00	10.88	5.00								
	STRAIGHT	-(					4.50							
	STRAIGHT	-(	>- 15F.1	0.00	10.88	9.50								
		>-	15F.2	0.00	10.88	14.00								
	STRAIGHT	-(					4.50							
		>-	20N	0.00	10.88	18.50								
	BEND	-(	20M	0.00	10.58	19.21	1.00	1.57	90.000					
		>-	20F	0.00	9.87	19.50								
		(	* POINT 20F IS EQUIVALENT TO POINT 25N											
		(
		(
	BEND	-(	25M	.29	9.17	19.50	1.00	1.57	90.000					
		>-	25F	1.00	8.88	19.50								
	STRAIGHT	-(					.75							
		>-	27	1.75	8.88	19.50								

* NOTES PERTAINING TO POINT 27 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MAYL (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	WT. UNIF
		>- 27	1.75	8.88	19.50				8.625	.322	LCS: 525.	26.6	25.38
		(
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 27											
		(IN DIRECTION Y											
		(
	STRAIGHT	(				4.50							
		(
		>- 27.1	6.25	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 27.2	10.75	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 27.3	15.25	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 30	19.75	8.88	19.50								
		(
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 30											
		(IN DIRECTION Y											
		(
		(
	STRAIGHT	(				4.50							
		(
48		>- 30.1	24.25	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 30.2	28.75	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 30.3	33.25	8.88	19.50								
	STRAIGHT	(				4.50							
		(
		>- 32	37.75	8.88	19.50								
		(
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 32											
		(IN DIRECTION Y											
		(
		(
	STRAIGHT	(				4.75							
		(
		>- 32.1	42.50	8.88	19.50								
	STRAIGHT	(				4.75							
		(
		>- 32.2	47.25	8.88	19.50								
	STRAIGHT	(				4.75							
		(
		>- 32.3	52.00	8.88	19.50								
	STRAIGHT	(				4.75							
		(
		>- 35	56.75	8.88	19.50								

* NOTES PERTAINING TO POINT 35 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 9

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (OEG) (FAHR)	DIST. LOADS (LBS PER FT)		
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF	
		>- 50F.2	92.00	6.02	9.50				8.625	.322	LCS	525.	28.6	25.3
STRAIGHT	-	(					4.50							
		>- 60N	92.00	6.02	5.00									
BEND	-	(				1.00	1.57	90.000						
		(
		>- 61	92.00	5.02	4.00									
		(
		(* POINT	61 IS EQUIVALENT TO POINT 60F											
RIGID	-	(					1.71		N/A	N/A		N/A	N/A	
		(
		(* WEIGHT OF ELEMENT =	243. POUNDS											
		(
STRAIGHT	-	>- 62	92.00	3.31	4.00		2.35							
		(
BEND	-	>- 65N	92.00	.96	4.00									
		(				1.00	1.57	90.000						
STRAIGHT	-	>- 65F	92.00	-.04	3.00		3.00							
ANCHR	--	70	92.00	-.04	0.00									
		(
		(* CONTROL COORDINATES OF POINT 70, IN FEET :	X = 92.00, Y = -.04, Z = 0.00											
		(	RESULTANT DIFFERENCE IS ZERO											
		(
BR PT	--	45	92.00	8.88	19.50									
		(
STRAIGHT	-	(					2.75		4.500	.237		70.	10.8	0.0
		(
		(* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 70.	DEGREES FAHRENHEIT IS 0.00 INCHES PER 100 FEET											
		(
		(* A UNIFORM DISTRIBUTED LOAD OF .00 PLF IS ACTING	IN THE -Y DIRECTION.											
		(
TERM	--	75	94.75	8.88	19.50									

* NOTES PERTAINING TO POINT 75 APPEAR ON THE FOLLOWING PAGE

 * LUMPED DYNAMIC MODEL *

 *

EXPLANATORY NOTES:

- (1) THE MASS OF THE SYSTEM IS LUMPED AT THE POINTS SHOWN BELOW. FRACTIONAL LOCATION NUMBERS, IF ANY, RESULT FROM ADDITIONAL MASS POINTS LOCATED BY THE PROGRAM BASED ON THE MAXIMUM LUMP SPACING CRITERION GIVEN IN THE INPUT DATA.
- (2) THE MASS AT A POINT IS A COMBINATION OF DISTRIBUTED MASS LUMPED IN A LINEAR FASHION PLUS ANY ADDITIONAL CONCENTRATED MASS INPUT BY THE USER (SHOWN IN PARENTHESES).
- (3) ROTATIONAL DEGREES OF FREEDOM ARE NOT INCLUDED IN THE MODEL UNLESS SPECIFICALLY ADDED BY THE USER. ALL THREE DISPLACEMENT DEGREES OF FREEDOM ARE AUTOMATICALLY DELETED AT ANCHORS. THE DEGREE OF FREEDOM ASSOCIATED WITH A RIGID RESTRAINT OR SNUBBER ORIENTED IN THE X, Y OR Z DIRECTION IS ALSO DELETED.

NO.	LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
		WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
						X	Y	Z
	5	81.				0.	0.	0.
	10N	123.	X	Y	Z	0.	0.	0.
	10F	162.	X	Y	Z	0.	0.	0.
	10F.1	239.	X	Y	Z	0.	0.	0.
	15N	162.	X	Y	Z	0.	0.	0.
	15F	164.	X	Y	Z	0.	0.	0.
	15F.1	242.	X	Y	Z	0.	0.	0.
	15F.2	242.	X	Y	Z	0.	0.	0.
	20N	164.	X	Y	Z	0.	0.	0.
	20F	85.	X	Y	Z	0.	0.	0.
	25F	63.	X	Y	Z	0.	0.	0.
	27	141.	X		Z	0.	0.	0.
	27.1	242.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

PAGE 12

LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
		X	Y	Z	X	Y	Z
27.2	242.	X	Y	Z	0.	0.	0.
27.3	242.	X	Y	Z	0.	0.	0.
30	242.	X		Z	0.	0.	0.
30.1	242.	X	Y	Z	0.	0.	0.
30.2	242.	X	Y	Z	0.	0.	0.
30.3	242.	X	Y	Z	0.	0.	0.
32	249.	X		Z	0.	0.	0.
32.1	256.	X	Y	Z	0.	0.	0.
32.2	256.	X	Y	Z	0.	0.	0.
51 32.3	256.	X	Y	Z	0.	0.	0.
35	256.	X		Z	0.	0.	0.
35.1	256.	X	Y	Z	0.	0.	0.
35.2	256.	X	Y	Z	0.	0.	0.
35.3	256.	X	Y	Z	0.	0.	0.
40	256.	X		Z	0.	0.	0.
40.1	256.	X	Y	Z	0.	0.	0.
40.2	256.	X	Y	Z	0.	0.	0.
42	182.	X	Y	Z	0.	0.	0.
45	119.	X	Y	Z	0.	0.	0.
50N	92.	X	Y	Z	0.	0.	0.
50F	164.	X	Y	Z	0.	0.	0.
50F.1	242.	X	Y	Z	0.	0.	0.
50F.2	242.	X	Y	Z	0.	0.	0.

LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
					X	Y	Z
60N	164.	X	Y	Z	0.	0.	0.
61	185.	X	Y	Z	0.	0.	0.
62	206.	X	Y	Z	0.	0.	0.
65N	106.	X	Y	Z	0.	0.	0.
65F	123.	X	Y	Z	0.	0.	0.
70	81.				0.	0.	0.
75	15.	X		Z	0.	0.	0.

NUMBER OF DYNAMIC DEGREES OF FREEDOM = 117, TOTAL MASS OF SYSTEM = 8294. POUNDS

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 * FREQUENCIES, PERIODS OF VIBRATION AND MASS PARTICIPATION FACTORS *
 * ----- *
 * *****

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS		
			X	Y	Z
1	.80740	1.23854	.61029480	.01800087	3.28388313
2	.76440	1.03691	4.06008650	.00961417	.45882373
3	2.19609	.45536	.76970669	.05269876	.66993037
4	3.29091	.30387	.46145269	.18444802	2.13481580
5	4.88363	.20477	.45137495	.12945252	.93175166
6	5.57850	.17926	.63728390	.18494594	.96522910
7	6.58653	.15183	.39788003	.39352351	1.26640456
8	9.15886	.10918	.59978605	.19755262	.07503005
9	10.37719	.09637	.91025765	.24218479	.03159162
10	11.53051	.08673	.01909361	1.33821108	.27777815
11	13.77757	.07258	.05317680	.37462195	.02546877
12	14.12365	.07080	.11087611	.34783446	.15747513
13	16.46532	.06073	.06062673	.92035633	.11886202
14	17.14517	.05833	.04509092	.56627328	.21883503
15	19.94338	.05014	.01906907	1.35385292	.11660275
16	20.45555	.04889	.13760091	.72421631	.13941303
17	22.31005	.04482	.01577064	.40859035	.12172859
18	23.83773	.04195	.13590472	.75997011	.07049075
19	25.91248	.03859	.25303065	.57055981	.06254190
20	27.00577	.03703	.04391666	2.38077840	.02319998
21	27.76397	.03602	.08606283	.34716101	.14412797
22	29.89918	.03345	.05079240	.71461321	.06165209
23	31.54850	.03170	.08465011	.18266714	.20524358

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NOTE:

 SECTION 3.7.2 OF THE U.S. NUCLEAR REGULATORY COMMISSION STANDARD REVIEW PLAN DATED JUNE, 1975
 STATES THAT AN ADEQUATE NUMBER OF DEGREES OF FREEDOM IN DYNAMIC MODELING MAY BE TAKEN EQUAL
 TO TWICE THE NUMBER OF MODES WITH FREQUENCIES LESS THAN 33 CPS.

FOR THIS ANALYSIS THE RATIO OF DYNAMIC DEGREES OF FREEDOM TO FREQUENCIES LESS THAN 33 CPS = 5.09

THE COLD ELASTIC MODULUS WAS USED IN CALCULATING THE NATURAL FREQUENCIES OF THE SYSTEM
 IN THIS ANALYSIS.

DYNAFLEX

MODE ORTHOGONALITY CHECK

ON DIAGONAL TERMS: MAX. = 1.00000 MIN. = 1.00000

OFF DIAGONAL TERMS: MAX. = 7.50943 X 10⁻¹⁴ MIN. = -2.29957 X 10⁻¹³

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE FITTED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
5	710.	77.	330.	787.	1499.	7957.	5036.	9535.
70	1064.	102.	332.	1119.	674.	11950.	4640.	12837.
RESTRAINTS:								
27	0.	151.	0.	151.	0.	0.	0.	0.
30	0.	147.	0.	147.	0.	0.	0.	0.
32	0.	61.	0.	61.	0.	0.	0.	0.
35	0.	99.	0.	99.	0.	0.	0.	0.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

PAGE 17

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
40	0.	365.	0.	365.	0.	0.	0.	0.
75	0.	238.	0.	238.	0.	0.	0.	0.

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 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 * ----- *
 * *

THE MAXIMUM STRESS OF 13,041. OCCURS AT POINT 65F

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)		SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE			OUT-OF PLANE
ANCHR	STR - (	5	330.	714.	5036.	1499.	7957.	1.00	1.00	16.81	6807.
	> -	10N	330.	714.	5036.	1724.	5869.	2.44	2.44	16.81	10346.
BEND	- (	10M	287.	732.	1041.	1681.	7155.	2.44	2.44	16.81	9693.
	> -	10F	77.	783.	5181.	1470.	4327.	2.44	2.44	16.81	9020.
STR	- (	10F.1	79.	780.	5181.	1189.	60.	1.00	1.00	16.81	3795.
	> -	15N	82.	740.	5181.	1373.	1906.	2.44	2.44	16.81	7428.
BEND	- (	15M	264.	696.	5194.	1555.	1888.	2.44	2.44	16.81	7497.
	> -	15F	292.	685.	2586.	1583.	4514.	2.44	2.44	16.81	7100.
STR	- (	15F.1	243.	639.	2586.	1206.	1652.	1.00	1.00	16.81	2354.
	> -	15F.2	243.	639.	2586.	809.	1568.	1.00	1.00	16.81	2235.
BEND	- (	20N	205.	551.	2586.	419.	4073.	2.44	2.44	16.81	6324.
	> -	20M	98.	580.	4838.	306.	1520.	2.44	2.44	16.81	6634.
BEND	- (	20F	96.	557.	4608.	2058.	151.	2.44	2.44	16.81	6592.
	> -	25M	371.	426.	3298.	1706.	3213.	2.44	2.44	16.81	6411.
	> -	25F	520.	220.	100.	1563.	4597.	2.44	2.44	16.81	6341.
STR	- (	27	465.	212.	100.	1567.	4593.	1.00	1.00	16.81	3465.
	> -	27.1	399.	189.	100.	1073.	4647.	1.00	1.00	16.81	3405.
STR	- (	27.2	399.	189.	100.	576.	4745.	1.00	1.00	16.81	3413.
	> -	27.3	334.	166.	100.	75.	4795.	1.00	1.00	16.81	3424.
STR	- (	30	271.	153.	100.	437.	4732.	1.00	1.00	16.81	3393.
	> -	30.1	210.	113.	100.	285.	4528.	1.00	1.00	16.81	3239.
STR	- (	30.2	153.	131.	100.	134.	4177.	1.00	1.00	16.81	2984.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

PAGE 20

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MOIULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
STR -(	> 30.2	153.	131.	100.	154.	4177.	1.00	1.00	16.81	2984.
STR -(	> 30.3	110.	154.	100.	40.	3691.	1.00	1.00	16.81	2636.
STR -(	> 32	98.	180.	100.	185.	3094.	1.00	1.00	16.81	2214.
STR -(	> 32.1	129.	205.	100.	67.	2418.	1.00	1.00	16.81	1728.
STR -(	> 32.2	183.	225.	100.	75.	1859.	1.00	1.00	16.81	1330.
STR -(	> 32.3	313.	233.	100.	189.	1699.	1.00	1.00	16.81	1222.
STR -(	> 35	381.	240.	100.	312.	2053.	1.00	1.00	16.81	1484.
STR -(	> 35.1	450.	238.	100.	42.	2700.	1.00	1.00	16.81	1929.
STR -(	> 35.2	450.	238.	100.	382.	3451.	1.00	1.00	16.81	2480.
STR -(	> 35.3	519.	234.	100.	725.	4225.	1.00	1.00	16.81	3061.
STR -(	> 40	589.	230.	100.	1066.	4990.	1.00	1.00	16.81	3643.
STR -(	> 40.1	659.	367.	100.	329.	5741.	1.00	1.00	16.81	4106.
STR -(	> 40.2	800.	378.	100.	1717.	6504.	1.00	1.00	16.81	4803.
STR -(	> 42	800.	378.	100.	3099.	7314.	1.00	1.00	16.81	5671.
BR PT	-- 45	850.	382.	100.	3679.	7679.	2.44	2.44	16.81	11125.
UR PT	-- 45	116.	922.	7678.	4288.	100.	2.44	2.44	16.81	11490.
STR -(	> 50N	115.	947.	7678.	498.	2651.	2.44	2.44	16.81	10626.
BEND -(	50M	259.	918.	3868.	647.	6637.	2.44	2.44	16.81	10066.
STR -(	> 50F	257.	919.	1754.	649.	6774.	2.44	2.44	16.81	9176.
STR -(	> 50F.1	264.	960.	1754.	299.	2585.	1.00	1.00	16.81	2241.
STR -(	> 50F.2	294.	1033.	1754.	476.	2238.	1.00	1.00	16.81	2058.
STR -(> 60N	306.	1044.	1754.	879.	6728.	2.44	2.44	16.81	9150.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
		>- 60N	306.	1044.	1754.	879.	6728.	2.44	2.44	16.81	9150.
	BEND - (	60M	287.	1050.	6287.	856.	4259.	2.44	2.44	16.81	9978.
		>- 61	104.	1083.	7755.	668.	729.	2.44	2.44	16.81	10207.
	RIGID - (	62	102.	1111.	7755.	1099.	125.	1.00	1.00	16.81	5592.
	STR - (	>- 65N	102.	1114.	7755.	657.	3579.	2.44	2.44	16.81	11185.
	BEND - (	65M	299.	1078.	2767.	866.	8720.	2.44	2.44	16.81	11999. *
		>- 65F	332.	1068.	4640.	903.	8798.	2.44	2.44	16.81	13041. **
	STR - (	ANCHR -- 70	332.	1068.	4640.	674.	11950.	1.00	1.00	16.81	9164.
		BR PT -- 45	4.	238.	0.	656.	6.	2.44	2.44	3.21 8.50	4479. 1691.
	STR - (TERM -- 75	4.	238.	0.	0.	0.	1.00	1.00	3.21 8.50	0.

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REVISE 4" Ø DUMMY LEG TO 6" STD. WT. PIPE

G.H. MNY 7-7-80

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

PAGE 22

 * DISPLACEMENTS AND ROTATIONS *

 *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		5	.000	.000	.000	.000	.000	.000
	STRAIGHT -	(	(.0)	(.0)	(.0)			
	>=	10N	.028	.006	.000	.020	.005	.000
	(	(	(1.2)	(3.2)	(.0)			
	BEND -	10M	.059	.012	.003	.060	.227	.151
	(	(	(2.7)	(5.0)	(.9)			
	>=	10F	.107	.016	.015	.098	.296	.275
	STRAIGHT -	(	(7.4)	(6.2)	(4.4)			
	>=	10F.1	.390	.016	.114	.111	.418	.325
	STRAIGHT -	(	(52.1)	(6.2)	(32.4)			
	>=	15N	.694	.016	.214	.099	.539	.318
	(	(	(102.7)	(6.2)	(59.9)			
61	BEND -	15M	.773	.021	.227	.064	.565	.306
	(	(	(109.9)	(7.1)	(63.1)			
	>=	15F	.880	.028	.230	.027	.645	.316
	STRAIGHT -	(	(110.6)	(8.4)	(63.9)			
	>=	15F.1	1.514	.041	.230	.006	.700	.255
	STRAIGHT -	(	(96.0)	(11.0)	(63.9)			
	>=	15F.2	2.177	.034	.230	.018	.703	.193
	STRAIGHT -	(	(92.4)	(9.6)	(63.9)			
	>=	20N	2.820	.021	.230	.029	.656	.133
	(	(	(104.7)	(6.2)	(63.9)			
	BEND -	20M	2.903	.020	.232	.037	.592	.138
	(	(	(107.1)	(5.7)	(64.2)			
	>=	20F	2.919	.019	.238	.041	.574	.120
	(	(	(107.6)	(5.6)	(64.7)			
	BEND -	25M	2.905	.014	.253	.053	.542	.076
	(	(	(107.1)	(4.2)	(64.6)			
	>=	25F	2.901	.006	.289	.073	.460	.038
	STRAIGHT -	(	(107.0)	(1.9)	(63.5)			
	>=	27	2.901	.000	.335	.073	.407	.033

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

PAGE 23

DISPLACEMENTS AND ROTATIONS (CONTINUED)

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>-	27	2.901	.000	.335	.073	.447	.033
	STRAIGHT - (		(107.0)	(.0)	(62.5)			
	>-	27.1	2.902	.019	.668	.070	.372	.009
	STRAIGHT - (		(107.1)	(8.2)	(69.3)			
	>-	27.2	2.902	.020	.969	.068	.295	.006
	STRAIGHT - (		(107.1)	(10.6)	(85.0)			
	>-	27.3	2.902	.011	1.201	.066	.219	.012
	STRAIGHT - (		(107.1)	(6.8)	(92.9)			
	>-	30	2.902	.000	1.360	.064	.153	.009
	STRAIGHT - (		(107.1)	(.0)	(89.9)			
	>-	30.1	2.902	.005	1.445	.062	.112	.002
	STRAIGHT - (		(107.1)	(6.0)	(83.8)			
	>-	30.2	2.902	.005	1.462	.061	.119	.002
	STRAIGHT - (		(107.1)	(8.4)	(82.6)			
	>-	30.3	2.902	.002	1.419	.059	.158	.003
	STRAIGHT - (		(107.1)	(5.6)	(82.3)			
	>-	32	2.902	.000	1.328	.057	.202	.001
	STRAIGHT - (		(107.1)	(.0)	(74.1)			
	>-	32.1	2.902	.001	1.197	.055	.241	.002
	STRAIGHT - (		(107.1)	(6.3)	(59.0)			
2	>-	32.2	2.902	.003	1.053	.053	.265	.002
	STRAIGHT - (		(107.1)	(8.9)	(54.1)			
	>-	32.3	2.902	.003	.921	.051	.273	.001
	STRAIGHT - (		(107.1)	(5.5)	(65.1)			
	>-	35	2.902	.000	.826	.049	.263	.006
	STRAIGHT - (		(107.1)	(.0)	(74.0)			
	>-	35.1	2.902	.008	.779	.048	.238	.008
	STRAIGHT - (		(107.0)	(4.6)	(73.2)			
	>-	35.2	2.901	.015	.767	.046	.201	.004
	STRAIGHT - (		(107.0)	(7.1)	(70.8)			
	>-	35.3	2.901	.014	.758	.045	.157	.006
	STRAIGHT - (		(107.0)	(4.8)	(76.1)			
	>-	40	2.901	.000	.717	.043	.131	.024
	STRAIGHT - (		(107.0)	(.0)	(82.1)			
	>-	40.1	2.901	.030	.614	.042	.159	.031
	STRAIGHT - (		(107.0)	(4.9)	(77.7)			
	>-	40.2	2.901	.053	.427	.041	.240	.011
	STRAIGHT - (		(107.0)	(8.3)	(62.4)			
	>-	42	2.901	.044	.143	.040	.352	.036
	STRAIGHT - (		(107.0)	(8.5)	(49.3)			
BRANCH PT.	--	45	2.901	.024	.075	.039	.406	.063
			(107.0)	(8.5)	(49.5)			
BRANCH PT.	--	45	2.901	.024	.075	.039	.406	.063
	STRAIGHT - ((107.0)	(8.5)	(49.5)			
	>-	50N	2.870	.024	.063	.037	.475	.090

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>= 50N		2.870	.024	.063	.037	.475	.090
	(		(105.9)	(8.5)	(52.0)			
	BEND -(	50M	2.820	.022	.060	.024	.543	.183
	(		(104.1)	(9.5)	(54.2)			
	>= 50F		2.716	.020	.060	.011	.689	.241
	STRAIGHT -(		(100.5)	(12.2)	(55.2)			
	>= 50F.1		2.022	.019	.059	.007	.770	.283
	STRAIGHT -(		(92.0)	(24.4)	(55.2)			
	>= 50F.2		1.288	.020	.059	.004	.772	.324
	STRAIGHT -(		(107.1)	(25.7)	(55.2)			
	>= 60N		.592	.014	.059	.013	.691	.366
	(		(121.9)	(14.9)	(55.1)			
	BEND -(	60M	.478	.010	.058	.033	.559	.334
	(		(117.5)	(11.3)	(53.4)			
	>= 61		.398	.008	.051	.051	.508	.309
	PIGID -(		(103.4)	(9.0)	(47.4)			
	>= 62		.288	.008	.033	.052	.506	.309
	STRAIGHT -(		(68.7)	(9.0)	(30.4)			
	>= 65N		.140	.008	.008	.049	.409	.286
	(		(22.5)	(9.0)	(7.3)			
2	BEND -(	65M	.084	.006	.002	.031	.323	.159
	(		(10.6)	(6.9)	(1.5)			
	>= 65F		.043	.003	.000	.010	.127	.074
	STRAIGHT -(		(5.4)	(3.9)	(.0)			
ANCHOR	-- 70		.000	.000	.000	.000	.000	.000
	(		(.0)	(.0)	(.0)			
BRANCH PT.	-- 45		2.901	.024	.075	.039	.406	.063
	STRAIGHT -(		(107.0)	(8.5)	(49.5)			
TERMINAL	-- 75		2.901	.000	.277	.039	.406	.032

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
5	538.	218.	894.	1066.	3952.	2480.	3942.	6108.	
70	351.	202.	762.	863.	1545.	1463.	2198.	3059.	
RESTRAINTS:									
27	0.	305.	0.	305.	0.	0.	0.	0.	
30	0.	96.	0.	96.	0.	0.	0.	0.	
32	0.	30.	0.	30.	0.	0.	0.	0.	
35	0.	40.	0.	40.	0.	0.	0.	0.	

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
40	0.	128.	0.	128.	0.	0.	0.	0.
75	0.	181.	0.	181.	0.	0.	0.	0.

 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 9193. OCCURS AT POINT 20F

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		5	894.	581.	3942.	3952.	2480.	1.00	1.00	16.81	4361.
	STR - (
	>	10N	894.	581.	3942.	4604.	1110.	2.44	2.44	16.81	8046.
	(
	BEND - (	10M	787.	719.	2528.	4397.	2960.	2.44	2.44	16.81	7767.
	(
	>	10F	220.	1043.	867.	3930.	3404.	2.44	2.44	16.81	6883.
	STR - (
	>	10F.1	224.	1038.	867.	1034.	109.	1.00	1.00	16.81	967.
	STR - (
	>	15N	237.	918.	867.	3727.	1297.	2.44	2.44	16.81	5276.
	(
	BEND - (	15M	714.	624.	1424.	4204.	1165.	2.44	2.44	16.81	5992.
	(
	>	15F	774.	547.	1789.	4263.	824.	2.44	2.44	16.81	6132.
	STR - (
	>	15F.1	710.	540.	1789.	3165.	2390.	1.00	1.00	16.81	3106.
	STR - (
	>	15F.2	626.	544.	1789.	2000.	4397.	1.00	1.00	16.81	3677.
	STR - (
	>	20N	529.	549.	1789.	856.	6446.	2.44	2.44	16.81	8807.
	(
	BEND - (	20M	275.	711.	5935.	555.	3657.	2.44	2.44	16.81	9131.
	(
	>	20F	281.	709.	6903.	161.	1374.	2.44	2.44	16.81	9193.
	(
	BEND - (	25M	303.	689.	4938.	1091.	4630.	2.44	2.44	16.81	8953.
	(
	>	25F	469.	590.	407.	987.	6430.	2.44	2.44	16.81	8510.
	STR - (
	>	27	461.	508.	407.	1020.	6076.	1.00	1.00	16.81	4408.
	STR - (
	>	27.1	452.	498.	407.	721.	3992.	1.00	1.00	16.81	2911.
	STR - (
	>	27.2	443.	481.	407.	407.	2139.	1.00	1.00	16.81	1581.
	STR - (
	>	27.3	443.	481.	407.	76.	1537.	1.00	1.00	16.81	1136.
	STR - (
	>	30	434.	450.	407.	283.	2811.	1.00	1.00	16.81	2038.
	STR - (
	>	30.1	425.	399.	407.	203.	4338.	1.00	1.00	16.81	3114.
	STR - (
	>	30.2	417.	343.	407.	126.	5671.	1.00	1.00	16.81	4060.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR -(	>- 30.2	417.	343.	407.	126.	5671.	1.00	1.00	16.81	4060.
	STR -(	>- 30.3	401.	224.	407.	55.	6705.	1.00	1.00	16.81	4795.
	STR -(	>- 32	401.	224.	407.	87.	7392.	1.00	1.00	16.81	5285.
	STR -(	>- 32.1	393.	188.	407.	69.	7730.	1.00	1.00	16.81	5526.
	STR -(	>- 32.2	386.	195.	407.	90.	7695.	1.00	1.00	16.81	5502.
	STR -(	>- 32.3	371.	274.	407.	99.	7352.	1.00	1.00	16.81	5257.
	STR -(	>- 35	371.	274.	407.	121.	6777.	1.00	1.00	16.81	4848.
	STR -(	>- 35.1	365.	301.	407.	61.	6031.	1.00	1.00	16.81	4315.
8	STR -(	>- 35.2	359.	317.	407.	185.	5121.	1.00	1.00	16.81	3670.
	STR -(	>- 35.3	353.	341.	407.	300.	4032.	1.00	1.00	16.81	2901.
	STR -(	>- 40	348.	384.	407.	413.	2831.	1.00	1.00	16.81	2063.
	STR -(	>- 40.1	339.	511.	407.	96.	2117.	1.00	1.00	16.81	1541.
	STR -(	>- 40.2	335.	554.	407.	548.	3094.	1.00	1.00	16.81	2262.
	STR -(	>- 42	332.	572.	407.	985.	5188.	1.00	1.00	16.81	3781.
BR PT		-- 45	332.	572.	407.	1164.	6199.	2.44	2.44	16.81	8257.
BR PT	STR -(	-- 45	246.	664.	6200.	878.	407.	2.44	2.44	16.81	8198.
		>- 50N	243.	671.	6200.	726.	350.	2.44	2.44	16.81	8163.
BEND		(50M	577.	421.	4358.	1066.	4284.	2.44	2.44	16.81	8100.
		(50F	584.	410.	291.	1076.	5876.	2.44	2.44	16.81	7810.
	STR -(	>- 50F.1	635.	402.	291.	428.	4441.	1.00	1.00	16.81	3192.
	STR -(	>- 50F.2	674.	400.	291.	1154.	3046.	1.00	1.00	16.81	2334.
	STR -(>- 60N	704.	402.	291.	2062.	1809.	2.44	2.44	16.81	3601.

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
		>- 60N	704.	402.	291.	2062.	1809.	2.44	2.44	16.81	3601.
	BEND - (	60M	643.	493.	1402.	1998.	943.	2.44	2.44	16.81	3416.
		>- 61	211.	783.	1600.	1560.	505.	2.44	2.44	16.81	2991.
	RIGID - (	62	204.	936.	1600.	1048.	305.	1.00	1.00	16.81	1383.
	STR - (	>- 65N	203.	839.	1600.	1479.	1851.	2.44	2.44	16.81	3733.
	BEND - (	65M	671.	542.	2309.	1964.	1207.	2.44	2.44	16.81	4260.
		>- 65F	762.	405.	2198.	2058.	1445.	2.44	2.44	16.81	4360.
	STR - (	70	762.	405.	2198.	1545.	1463.	1.00	1.00	16.81	2184.
	ANCHR	-- 45	1.	181.	0.	497.	14.	2.44	2.44	3.21	3399.
	BR PT STR - (75	1.	181.	0.	0.	0.	1.00	1.00	8.50	1284.
	TERM									3.21	0.
										8.50	

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REVISE 4"Ø DUMMY LEG TO 6" STD. WT. PIPE
G.H. MAY 7-80

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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 *
 * DISPLACEMENTS AND ROTATIONS *
 *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		5	.000	.000	.000	.000	.000	.000
	STRAIGHT - (		(.0)	(.0)	(.0)			
	>= 10N		.008	.016	.000	.052	.021	.063
	(		(.7)	(6.8)	(.0)			
	BEND - (	10M	.018	.031	.008	.161	.060	.095
	(		(2.6)	(12.1)	(2.7)			
	>= 10F		.042	.043	.040	.261	.084	.169
	STRAIGHT - (		(10.6)	(16.0)	(13.6)			
	>= 10F.1		.221	.043	.305	.296	.097	.209
	STRAIGHT - (		(83.7)	(16.0)	(103.8)			
	>= 15N		.418	.043	.571	.262	.113	.207
	(		(166.7)	(16.0)	(193.5)			
70	BEND - (	15M	.452	.056	.603	.168	.110	.180
	(		(178.0)	(19.8)	(204.4)			
	>= 15F		.473	.073	.612	.068	.112	.166
	STRAIGHT - (		(177.9)	(25.2)	(207.1)			
	>= 15F.1		.540	.102	.612	.003	.108	.126
	STRAIGHT - (		(133.7)	(35.9)	(207.2)			
	>= 15F.2		.582	.077	.612	.048	.100	.089
	STRAIGHT - (		(81.1)	(29.3)	(207.2)			
	>= 20N		.570	.021	.612	.074	.144	.059
	(		(30.1)	(12.6)	(207.2)			
	BEND - (	20M	.553	.013	.617	.089	.245	.072
	(		(22.9)	(10.2)	(208.6)			
	>= 20F		.535	.013	.631	.096	.284	.076
	(		(19.7)	(9.4)	(212.1)			
	BEND - (	25M	.529	.009	.653	.127	.333	.049
	(		(20.2)	(7.2)	(213.0)			
	>= 25F		.527	.004	.689	.160	.459	.025
	STRAIGHT - ((20.6)	(3.2)	(207.7)			
	>= 27		.527	.000	.731	.158	.477	.022

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		> 27	.527 (20.6)	.000 (.0)	.731 (200.0)	.156	.477	.022
	STRAIGHT - (	> 27.1	.527 (20.7)	.013 (13.6)	1.102 (155.7)	.149	.567	.006
	STRAIGHT - (	> 27.2	.527 (20.7)	.014 (16.8)	1.605 (125.0)	.139	.617	.004
	STRAIGHT - (	> 27.3	.527 (20.7)	.007 (10.3)	2.164 (118.1)	.130	.630	.008
	STRAIGHT - (	> 30	.527 (20.7)	.000 (.0)	2.730 (128.7)	.120	.607	.006
	STRAIGHT - (	> 30.1	.528 (20.7)	.004 (8.6)	3.265 (143.2)	.111	.552	.002
	STRAIGHT - (	> 30.2	.528 (20.7)	.004 (12.2)	3.738 (156.7)	.102	.470	.001
	STRAIGHT - (	> 30.3	.528 (20.7)	.002 (8.7)	4.124 (168.9)	.092	.368	.002
	STRAIGHT - (	> 32	.528 (20.8)	.000 (.0)	4.404 (177.2)	.083	.257	.002
	STRAIGHT - (	> 32.1	.528 (20.8)	.002 (10.6)	4.571 (176.1)	.074	.153	.002
71	STRAIGHT - (	> 32.2	.528 (20.8)	.003 (15.8)	4.597 (162.1)	.064	.142	.001
	STRAIGHT - (	> 32.3	.528 (20.8)	.002 (11.2)	4.483 (141.6)	.055	.235	.002
	STRAIGHT - (	> 35	.528 (20.8)	.000 (.0)	4.234 (131.9)	.047	.347	.003
	STRAIGHT - (	> 35.1	.528 (20.8)	.004 (12.1)	3.862 (145.0)	.039	.453	.004
	STRAIGHT - (	> 35.2	.528 (20.8)	.007 (18.2)	3.383 (168.4)	.033	.541	.002
	STRAIGHT - (	> 35.3	.528 (20.8)	.006 (13.4)	2.821 (181.9)	.029	.608	.003
	STRAIGHT - (	> 40	.528 (20.8)	.000 (.0)	2.200 (174.9)	.029	.647	.010
	STRAIGHT - (	> 40.1	.528 (20.8)	.012 (17.6)	1.554 (149.5)	.032	.653	.013
	STRAIGHT - (	> 40.2	.528 (20.8)	.023 (29.6)	.920 (119.9)	.038	.621	.007
	STRAIGHT - (	> 42	.528 (20.8)	.024 (28.7)	.347 (110.1)	.045	.545	.008
BRANCH PT.	STRAIGHT - (	-- 45	.528 (20.8)	.019 (24.3)	.155 (115.0)	.049	.500	.017
BRANCH PT.	STRAIGHT - (	-- 45	.528 (20.8)	.019 (24.3)	.155 (115.0)	.049	.500	.017
	STRAIGHT - (	> 50H	.531	.019	.140	.047	.441	.021

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>- 50N	.531	.019	.140	.047	.441	.021
	(		(21.1)	(24.3)	(116.3)			
	BEND -	50M	.511	.017	.136	.027	.396	.060
	(		(21.5)	(24.4)	(117.8)			
	>- 50F		.470	.017	.135	.013	.285	.096
	STRAIGHT -		(22.0)	(25.5)	(118.8)			
	>- 50F.1		.275	.030	.135	.015	.201	.094
	STRAIGHT -		(29.6)	(39.6)	(118.8)			
	>- 50F.2		.156	.040	.135	.005	.143	.092
	STRAIGHT -		(33.1)	(44.9)	(118.7)			
	>- 60N		.113	.031	.135	.026	.107	.091
	(		(31.8)	(29.8)	(118.6)			
	BEND -	60M	.107	.024	.131	.074	.077	.095
	(		(29.8)	(22.7)	(115.2)			
	>- 61		.092	.018	.117	.117	.068	.095
	RIGID -		(25.9)	(17.9)	(102.3)			
	>- 62		.059	.018	.075	.117	.068	.095
	STRAIGHT -		(17.0)	(17.9)	(65.7)			
	>- 65N		.019	.018	.017	.111	.051	.081
	(		(5.5)	(17.9)	(15.5)			
72	BEND -	65M	.010	.013	.003	.070	.042	.047
	(		(2.5)	(13.3)	(3.2)			
	>- 65F		.005	.006	.000	.022	.017	.035
	STRAIGHT -		(1.2)	(7.2)	(.1)			
ANCHOR	-- 70		.000	.000	.000	.000	.000	.000
	(		(.0)	(.0)	(.0)			
BRANCH PT.	-- 45		.528	.019	.155	.049	.500	.017
	STRAIGHT -		(20.8)	(24.3)	(115.0)			
TERMINAL	-- 75		.528	.000	.209	.049	.500	.041

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *
 * *****

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LDC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
5	46.	116.	67.	142.	445.	82.	306.	546.	
73	52.	98.	134.	173.	411.	169.	204.	489.	
RESTRAINTS:									
27	0.	82.	0.	82.	0.	0.	0.	0.	
30	0.	127.	0.	127.	0.	0.	0.	0.	
32	0.	142.	0.	142.	0.	0.	0.	0.	
35	0.	115.	0.	115.	0.	0.	0.	0.	

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
40	0.	124.	0.	124.	0.	0.	0.	0.
75	0.	180.	0.	180.	0.	0.	0.	0.

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 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 3379. OCCURS AT POINT 45

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	STR - (	5	67.	125.	306.	445.	82.	1.00	1.00	16.81	390.
	>-	10N	67.	119.	306.	314.	70.	2.44	2.44	16.81	580.
BEND	- (	10M	107.	86.	276.	313.	142.	2.44	2.44	16.81	575.
	>-	10F	110.	81.	113.	278.	264.	2.44	2.44	16.81	522.
	STR - (
	>-	10F.1	84.	65.	113.	114.	53.	1.00	1.00	16.81	121.
	STR - (
	>-	15N	75.	57.	113.	278.	72.	2.44	2.44	16.81	403.
BEND	- (	15M	74.	58.	60.	300.	119.	2.44	2.44	16.81	429.
	>-	15F	51.	80.	69.	291.	119.	2.44	2.44	16.81	420.
	STR - (
	>-	15F.1	44.	73.	69.	310.	176.	1.00	1.00	16.81	259.
	STR - (
78											
	>-	15F.2	38.	34.	69.	300.	197.	1.00	1.00	16.81	261.
	STR - (
	>-	20N	48.	86.	69.	102.	201.	2.44	2.44	16.81	307.
BEND	- (	20M	51.	85.	153.	72.	173.	2.44	2.44	16.81	316.
	>-	20F	63.	75.	230.	43.	83.	2.44	2.44	16.81	324.
BEND	- (	25M	58.	87.	158.	112.	159.	2.44	2.44	16.81	327.
	>-	25F	60.	83.	31.	143.	206.	2.44	2.44	16.81	330.
	STR - (
	>-	27	60.	83.	31.	174.	193.	1.00	1.00	16.81	187.
	STR - (
	>-	27.1	59.	72.	31.	249.	194.	1.00	1.00	16.81	226.
	STR - (
	>-	27.2	58.	41.	31.	289.	253.	1.00	1.00	16.81	275.
	STR - (
	>-	27.3	56.	81.	31.	153.	279.	1.00	1.00	16.81	228.
	STR - (
	>-	30	56.	81.	31.	283.	302.	1.00	1.00	16.81	296.
	STR - (
	>-	30.1	54.	84.	31.	173.	308.	1.00	1.00	16.81	253.
	STR - (
	>-	30.2	53.	53.	31.	290.	291.	1.00	1.00	16.81	294.

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR - (	>= 30.2	53.	53.	31.	290.	291.	1.00	1.00	16.81	294.
	STR - (	>= 30.3	50.	87.	31.	201.	286.	1.00	1.00	16.81	251.
	STR - (	>= 32	50.	87.	31.	321.	312.	1.00	1.00	16.81	320.
	STR - (	>= 32.1	49.	93.	31.	166.	337.	1.00	1.00	16.81	269.
	STR - (	>= 32.2	49.	59.	31.	360.	309.	1.00	1.00	16.81	339.
	STR - (	>= 32.3	49.	47.	31.	306.	244.	1.00	1.00	16.81	280.
	STR - (	>= 35	50.	102.	31.	273.	220.	1.00	1.00	16.81	251.
	STR - (	>= 35.1	50.	102.	31.	263.	252.	1.00	1.00	16.81	261.
	STR - (	>= 35.2	50.	68.	31.	482.	311.	1.00	1.00	16.81	410.
77	STR - (	>= 35.3	50.	47.	31.	447.	356.	1.00	1.00	16.81	408.
	STR - (	>= 40	51.	77.	31.	350.	340.	1.00	1.00	16.81	349.
	STR - (	>= 40.1	51.	130.	31.	328.	263.	1.00	1.00	16.81	301.
	STR - (	>= 40.2	52.	86.	31.	650.	169.	1.00	1.00	16.81	480.
	STR - (	>= 42	52.	85.	31.	603.	141.	1.00	1.00	16.81	443.
BR PT	--	45	52.	85.	31.	481.	182.	2.44	2.44	16.81	673.
BR PT	--	45	94.	82.	184.	106.	31.	2.44	2.44	16.81	280.
	STR - (	>= 50N	75.	81.	184.	99.		2.44	2.44	16.81	293.
BEND	- (	50M	70.	90.	147.	148.	141.	2.44	2.44	16.81	329.
	STR - (	>= 50F	66.	89.	105.	187.	172.	2.44	2.44	16.81	359.
	STR - (	>= 50F.1	79.	44.	105.	322.	188.	1.00	1.00	16.81	276.
	STR - (	>= 50F.2	79.	44.	105.	296.	152.	1.00	1.00	16.81	249.
	STR - (>= 60N	108.	86.	105.	356.	95.	2.44	2.44	16.81	500.

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
		>= 60N	108.	86.	105.	356.	95.	2.44	2.44	16.81	500.
	BEND	(60M	121.	66.	101.	360.	87.	2.44	2.44	16.81	501.
	RIGID	(>= 61	80.	112.	90.	301.	85.	2.44	2.44	16.81	425.
	STR	(>= 62	91.	142.	90.	74.	105.	1.00	1.00	16.81	112.
	BEND	(>= 65N	94.	143.	90.	231.	157.	2.44	2.44	16.81	383.
	BEND	(>= 65M	140.	100.	179.	313.	103.	2.44	2.44	16.81	490.
	STR	(>= 65F	134.	108.	204.	335.	71.	2.44	2.44	16.81	520.
	ANCHR	-- 70	134.	111.	204.	411.	169.	1.00	1.00	16.81	349.
	BR PT	-- 45	0.	180.	0.	495.	10.	2.44	2.44	3.21 8.50	3379. ** 1276.
	TERM	-- 75	0.	180.	0.	0.	0.	1.00	1.00	3.21 8.50	0.

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REVISE 4" Ø DUMMY LEG TO 6" STD. WT. PIPE

G.H. MAY 7-7-80

 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR	--	5	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
	>-	10N	.000	.001	.000	.004	.000	.005
	(		(3.0)	(21.4)	(.1)			
	BEND -(	10M	.001	.003	.001	.011	.001	.007
	(		(4.5)	(28.9)	(3.0)			
	>-	10F	.002	.003	.003	.018	.002	.012
	STRAIGHT -(		(8.5)	(31.1)	(7.6)			
	>-	10F.1	.014	.003	.021	.020	.002	.015
	STRAIGHT -(		(40.6)	(31.5)	(22.3)			
	>-	15N	.029	.003	.039	.018	.005	.015
	(		(58.2)	(31.8)	(31.1)			
	BEND -(	15M	.030	.004	.041	.012	.006	.014
	(		(55.5)	(32.1)	(30.2)			
	>-	15F	.030	.005	.041	.006	.008	.013
	STRAIGHT -(		(46.8)	(36.7)	(28.9)			
	>-	15F.1	.023	.009	.041	.003	.010	.012
	STRAIGHT -(		(51.3)	(62.3)	(28.9)			
	>-	15F.2	.015	.008	.041	.004	.011	.012
	STRAIGHT -(		(67.3)	(84.6)	(28.9)			
	>-	20N	.007	.004	.041	.007	.010	.011
	(		(38.2)	(38.8)	(28.8)			
	BEND -(	20M	.006	.003	.042	.008	.010	.011
	(		(28.9)	(31.6)	(26.2)			
	>-	20F	.006	.003	.042	.009	.010	.010
	(		(15.8)	(29.1)	(26.1)			
	BEND -(	25M	.006	.002	.043	.009	.010	.008
	((5.5)	(24.2)	(33.9)			
	>-	25F	.006	.001	.042	.009	.013	.007
	STRAIGHT -((5.1)	(12.4)	(38.9)			
	>-	27	.006	.000	.040	.009	.013	.007

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>= 27	.006 (5.1)	.000 (.0)	.040 (38.8)	.009	.013	.007
	STRAIGHT - (	>= 27.1	.006 (5.0)	.005 (68.3)	.032 (45.0)	.009	.014	.004
		>= 27.2	.006 (5.0)	.007 (87.3)	.027 (46.7)	.008	.014	.001
	STRAIGHT - (	>= 27.3	.006 (4.9)	.004 (47.8)	.024 (37.0)	.008	.013	.004
		>= 30	.006 (4.8)	.000 (.0)	.025 (39.8)	.008	.012	.005
	STRAIGHT - (	>= 30.1	.006 (4.9)	.004 (69.5)	.028 (44.3)	.007	.011	.004
		>= 30.2	.006 (5.0)	.007 (107.7)	.030 (39.3)	.007	.011	.001
	STRAIGHT - (	>= 30.3	.006 (5.1)	.005 (64.8)	.032 (36.0)	.007	.010	.004
		>= 32	.006 (5.2)	.000 (.0)	.032 (38.6)	.007	.009	.006
	STRAIGHT - (	>= 32.1	.006 (5.3)	.006 (57.0)	.031 (45.6)	.007	.009	.006
8		>= 32.2	.006 (5.4)	.010 (103.6)	.027 (42.5)	.007	.011	.001
	STRAIGHT - (	>= 32.3	.006 (5.5)	.007 (73.6)	.023 (35.5)	.008	.013	.005
		>= 35	.006 (5.6)	.000 (.0)	.023 (39.9)	.008	.014	.009
	STRAIGHT - (	>= 35.1	.006 (5.7)	.009 (65.8)	.028 (39.9)	.008	.012	.008
		>= 35.2	.006 (5.7)	.014 (104.0)	.033 (38.0)	.009	.009	.002
	STRAIGHT - (	>= 35.3	.006 (5.8)	.011 (76.0)	.036 (43.9)	.009	.007	.008
		>= 40	.006 (5.8)	.000 (.0)	.034 (43.3)	.010	.008	.014
	STRAIGHT - (	>= 40.1	.006 (5.8)	.015 (80.4)	.029 (36.6)	.010	.011	.013
		>= 40.2	.006 (5.8)	.024 (128.9)	.023 (45.7)	.011	.013	.005
	STRAIGHT - (	>= 42	.006 (5.8)	.022 (119.7)	.020 (62.9)	.011	.012	.008
		BRANCH PT. -- 45	.006 (5.8)	.018 (100.2)	.021 (73.4)	.012	.011	.012
	BRANCH PT. -- 45		.006 (5.8)	.018 (100.2)	.021 (73.4)	.012	.011	.012
	STRAIGHT - (>= 50N	.007	.018	.021	.011	.010	.012

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>-	50N	.007 (27.7)	.018 (100.3)	.021 (38.8)	.011	.010	.012
	BEND -(	50M	.008 (39.4)	.018 (98.8)	.021 (39.4)	.009	.009	.011
	>-	50F	.009 (46.1)	.018 (96.1)	.022 (41.0)	.007	.007	.010
	STRAIGHT -(	50F.1	.009 (58.1)	.016 (95.7)	.022 (41.0)	.006	.005	.009
	>-	50F.2	.010 (40.0)	.012 (72.3)	.022 (41.0)	.008	.005	.008
	STRAIGHT -(	60N	.010 (46.7)	.005 (23.8)	.022 (41.0)	.009	.004	.007
	BEND -(	60M	.010 (50.0)	.004 (18.5)	.021 (40.5)	.013	.003	.008
	>-	61	.009 (45.2)	.003 (17.4)	.019 (36.7)	.019	.004	.009
	RIGID -(	62	.006 (28.3)	.003 (17.4)	.012 (23.6)	.019	.003	.009
	STRAIGHT -(	65N	.002 (7.0)	.003 (17.3)	.003 (5.8)	.018	.003	.008
81	BEND -(	65M	.001 (3.8)	.003 (16.2)	.001 (1.7)	.012	.003	.005
	>-	65F	.001 (2.2)	.001 (12.2)	.000 (.1)	.004	.001	.003
	STRAIGHT -(	70	.000 (.0)	.000 (.0)	.000 (.0)	.000	.000	.000
ANCHOR	--	70	.000 (.0)	.000 (.0)	.000 (.0)	.000	.000	.000
BRANCH PT.	--	45	.006 (5.8)	.018 (100.2)	.021 (73.4)	.012	.011	.012
TERMINAL	STRAIGHT -(	75	.006 (5.8)	.000 (.0)	.024 (73.4)	.012	.012	.040

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
5	892.	259.	955.	1332.	4250.	8335.	6403.	11337.	
8	1121.	247.	842.	1423.	1735.	12040.	5139.	13205.	
RESTRAINTS:									
27	0.	350.	0.	350.	0.	0.	0.	0.	
30	0.	216.	0.	216.	0.	0.	0.	0.	
32	0.	157.	0.	157.	0.	0.	0.	0.	
35	0.	157.	0.	157.	0.	0.	0.	0.	

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM
ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
40	0.	406.	0.	406.	0.	0.	0.	0.
75	0.	349.	0.	349.	0.	0.	0.	0.

 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 14,117, OCCURS AT POINT 45

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS STF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNALLEX

LOADING - SHOCK LOADING NO. 4

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	STR - (	5	955.	929.	6403.	4250.	8335.	1.00	1.00	16.81	8094.
	>-	10N	955.	928.	6403.	4926.	5973.	2.44	2.44	16.81	13119.
	BEND - (	10M	844.	1030.	2748.	4811.	7744.	2.44	2.44	16.81	12434.
	>-	10F	257.	1306.	5254.	4205.	5512.	2.44	2.44	16.81	11358.
	STR - (	10F.1	258.	1301.	5254.	1580.	135.	1.00	1.00	16.81	3918.
	>-	15N	262.	1181.	5254.	3982.	2306.	2.44	2.44	16.81	9120.
	BEND - (	15M	764.	937.	5387.	4492.	2222.	2.44	2.44	16.81	9607.
	>-	15F	829.	881.	3145.	4557.	4590.	2.44	2.44	16.81	9391.
	STR - (	15F.1	673.	840.	3145.	3401.	2911.	1.00	1.00	16.81	3906.
	>-	15F.2	673.	840.	3145.	2178.	4672.	1.00	1.00	16.81	4311.
	STR - (	20N	570.	783.	3145.	958.	7628.	2.44	2.44	16.81	10846.
	BEND - (	20M	296.	922.	7658.	639.	3964.	2.44	2.44	16.81	11291.
	>-	20F	305.	896.	8303.	2476.	225.	2.44	2.44	16.81	11317.
	BEND - (	25M	483.	815.	5940.	2028.	5638.	2.44	2.44	16.81	11016.
	>-	25F	703.	635.	421.	1854.	7906.	2.44	2.44	16.81	10618.
	STR - (	27	657.	555.	421.	1878.	7619.	1.00	1.00	16.81	5610.
	>-	27.1	606.	534.	421.	1517.	6129.	1.00	1.00	16.81	4486.
	STR - (	27.2	558.	512.	421.	762.	5211.	1.00	1.00	16.81	3772.
	>-	27.3	558.	512.	421.	187.	5043.	1.00	1.00	16.81	3615.
	STR - (	30	515.	483.	421.	593.	5512.	1.00	1.00	16.81	3969.
	>-	30.1	477.	423.	421.	390.	6278.	1.00	1.00	16.81	4500.
	STR - (	30.2	447.	371.	421.	343.	7050.	1.00	1.00	16.81	5048.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)		SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE			OUT-OF PLANE
	STR - (	>- 30.2	447.	371.	421.	343.	7050.	1.00	1.00	16.81	5048.
	STR - (	>- 30.3	416.	300.	421.	212.	7659.	1.00	1.00	16.81	5478.
	STR - (	>- 32	416.	300.	421.	381.	8020.	1.00	1.00	16.81	5739.
	STR - (	>- 32.1	417.	293.	421.	191.	8106.	1.00	1.00	16.81	5796.
	STR - (	>- 32.2	430.	303.	421.	379.	7923.	1.00	1.00	16.81	5670.
	STR - (	>- 32.3	488.	368.	421.	373.	7549.	1.00	1.00	16.81	5404.
	STR - (	>- 35	488.	368.	421.	432.	7085.	1.00	1.00	16.81	5076.
	STR - (	>- 35.1	530.	399.	421.	273.	6612.	1.00	1.00	16.81	4734.
	STR - (	>- 35.2	578.	402.	421.	642.	6183.	1.00	1.00	16.81	4448.
8	STR - (	>- 35.3	630.	416.	421.	903.	5851.	1.00	1.00	16.81	4237.
	STR - (	>- 40	686.	454.	421.	1196.	5747.	1.00	1.00	16.81	4201.
	STR - (	>- 40.1	745.	598.	421.	474.	6125.	1.00	1.00	16.81	4396.
	STR - (	>- 40.2	868.	673.	421.	1916.	7205.	1.00	1.00	16.81	5331.
	STR - (	>- 42	914.	693.	421.	3307.	8969.	1.00	1.00	16.81	6831.
BR PT		-- 45	914.	693.	421.	3889.	9871.	2.44	2.44	16.81	13871.
BR PT	STR - (	-- 45	288.	1139.	9870.	4378.	421.	2.44	2.44	16.81	14117.
		>- 50N	280.	1164.	9870.	886.	2675.	2.44	2.44	16.81	13403.
BEND	(	50M	636.	1014.	5829.	1255.	7901.	2.44	2.44	16.81	12925.
	(	>- 50F	642.	1010.	1781.	1271.	8969.	2.44	2.44	16.81	12055.
	STR - (	>- 50F.1	661.	1044.	1781.	613.	5142.	1.00	1.00	16.81	3910.
	STR - (	>- 50F.2	742.	1111.	1781.	1293.	3793.	1.00	1.00	16.81	3122.
	STR - (>- 60N	775.	1122.	1781.	2289.	6967.	2.44	2.44	16.81	9846.

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	>- 60N	775.	1122.	1781.	2269.	6967.	2.44	2.44	16.81	9846.
BEND - (	60M	715.	1162.	6442.	2203.	4363.	2.44	2.44	16.81	10559.
	>- 61	248.	1341.	7918.	1723.	891.	2.44	2.44	16.81	10645.
RIGID - (	62	246.	1397.	7918.	1520.	346.	1.00	1.00	16.81	5762.
STR - (	>- 65N	246.	1401.	7918.	1635.	4032.	2.44	2.44	16.81	11798.
BEND - (	65M	748.	1210.	3609.	2169.	8804.	2.44	2.44	16.81	12743.
	>- 65F	842.	1147.	5139.	2272.	8916.	2.44	2.44	16.81	13760.
STR - (	ANCHR -- 70	842.	1148.	5139.	1735.	12040.	1.00	1.00	16.81	9427.
BR PT	STR - (-- 45	4.	349.	0.	960.	18.	2.44	2.44	3.21	6560.
TERM	-- 75	4.	349.	0.	0.	0.	1.00	1.00	3.21	2477.
									8.50	0.

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REVISE 4" DUMMY LEG TO 6" STD. WT. PIPE

G.H. MAY

7-7-80

 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR	--	5	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
	>-	10N	.030	.017	.000	.056	.087	.102
	(		(3.3)	(22.7)	(.1)			
	BEND -(	10M	.061	.033	.008	.172	.235	.179
	(		(5.9)	(31.7)	(4.2)			
	>-	10F	.115	.046	.043	.279	.308	.323
	STRAIGHT -(		(15.5)	(35.5)	(16.2)			
	>-	10F.1	.449	.046	.327	.317	.429	.386
	STRAIGHT -(		(106.6)	(35.9)	(111.0)			
	>-	15N	.810	.046	.611	.281	.551	.380
	(		(204.3)	(36.1)	(204.9)			
	BEND -(	15M	.896	.060	.646	.180	.575	.355
	(		(216.5)	(38.4)	(216.1)			
	>-	15F	1.000	.078	.655	.073	.654	.357
	STRAIGHT -(		(214.6)	(44.9)	(218.7)			
	>-	15F.1	1.608	.110	.655	.007	.708	.285
	STRAIGHT -(		(172.4)	(90.5)	(218.8)			
	>-	15F.2	2.254	.085	.655	.052	.710	.213
	STRAIGHT -(		(140.1)	(90.0)	(218.8)			
	>-	20N	2.877	.029	.655	.079	.672	.146
	(		(115.4)	(41.3)	(218.8)			
	BEND -(	20M	2.955	.024	.661	.097	.641	.156
	(		(113.3)	(33.8)	(219.9)			
	>-	20F	2.968	.023	.675	.105	.641	.142
	(		(110.5)	(31.0)	(223.2)			
	BEND -(	25M	2.953	.017	.702	.138	.637	.091
	(		(109.2)	(25.6)	(225.1)			
	>-	25F	2.949	.007	.748	.176	.650	.046
	STRAIGHT -(		(109.1)	(13.0)	(220.6)			
	>-	27	2.949	.000	.805	.174	.655	.041

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>-	27	2.949	.000	.805	.174	.655	.041
	STRAIGHT - (		(109.1)	(.0)	(213.1)			
	>-	27.1	2.949	.024	1.289	.165	.678	.012
	STRAIGHT - (		(109.1)	(76.1)	(176.3)			
	>-	27.2	2.949	.025	1.875	.155	.684	.007
	STRAIGHT - (		(109.1)	(89.5)	(158.2)			
	>-	27.3	2.949	.014	2.475	.146	.667	.015
	STRAIGHT - (		(109.2)	(49.4)	(154.8)			
	>-	30	2.949	.000	3.050	.137	.626	.012
	STRAIGHT - (		(109.2)	(.0)	(162.0)			
	>-	30.1	2.949	.007	3.570	.128	.563	.005
	STRAIGHT - (		(109.2)	(70.3)	(171.7)			
	>-	30.2	2.949	.009	4.014	.118	.485	.002
	STRAIGHT - (		(109.2)	(108.7)	(181.4)			
	>-	30.3	2.949	.006	4.362	.110	.401	.006
	STRAIGHT - (		(109.2)	(65.6)	(191.3)			
	>-	32	2.949	.000	4.600	.101	.327	.006
	STRAIGHT - (		(109.2)	(.0)	(195.9)			
	>-	32.1	2.949	.006	4.725	.092	.285	.006
	STRAIGHT - (		(109.2)	(58.3)	(191.3)			
	>-	32.2	2.949	.011	4.716	.084	.301	.002
	STRAIGHT - (		(109.2)	(105.2)	(176.1)			
	>-	32.3	2.949	.008	4.576	.076	.360	.006
	STRAIGHT - (		(109.2)	(74.6)	(159.9)			
	>-	35	2.949	.000	4.314	.069	.436	.011
	STRAIGHT - (		(109.2)	(.0)	(156.4)			
	>-	35.1	2.949	.013	3.940	.062	.512	.012
	STRAIGHT - (		(109.2)	(67.0)	(167.2)			
	>-	35.2	2.949	.022	3.469	.057	.577	.005
	STRAIGHT - (		(109.2)	(105.8)	(186.6)			
	>-	35.3	2.949	.019	2.921	.054	.628	.010
	STRAIGHT - (		(109.2)	(77.3)	(202.0)			
	>-	40	2.949	.000	2.314	.053	.660	.029
	STRAIGHT - (		(109.2)	(.0)	(198.0)			
	>-	40.1	2.949	.035	1.671	.054	.672	.036
	STRAIGHT - (		(109.2)	(82.5)	(172.4)			
	>-	40.2	2.949	.063	1.015	.057	.666	.014
	STRAIGHT - (		(109.2)	(132.5)	(142.7)			
	>-	42	2.948	.054	.376	.061	.649	.037
	STRAIGHT - (		(109.2)	(123.3)	(136.0)			
BRANCH PT.	--	45	2.948	.035	.173	.063	.644	.067
			(109.2)	(103.5)	(145.2)			
BRANCH PT.	--	45	2.948	.035	.173	.063	.644	.067
	STRAIGHT - (		(109.2)	(103.5)	(145.2)			
	>-	500	2.919	.035	.155	.061	.648	.093

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

PAGE 51

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	Y AXIS	Y AXIS	Z AXIS
		>- 50N	2.919	.035	.155	.061	.608	.093
	(		(111.5)	(103.5)	(133.2)			
	BEND - (	50M	2.466	.033	.150	.038	.672	.193
	(		(113.4)	(102.3)	(135.6)			
		>- 50F	2.756	.032	.149	.019	.746	.260
	STRAIGHT - (		(112.7)	(100.1)	(137.3)			
		>- 50F.1	2.040	.039	.149	.018	.796	.298
	STRAIGHT - (		(112.8)	(106.4)	(137.2)			
		>- 50F.2	1.227	.046	.149	.010	.785	.337
	STRAIGHT - (		(119.0)	(80.9)	(137.2)			
		>- 60M	.602	.034	.149	.031	.699	.377
	(		(134.3)	(41.0)	(137.0)			
	BEND - (	60M	.490	.026	.145	.082	.564	.347
	(		(131.1)	(31.4)	(133.3)			
		>- 61	.409	.020	.129	.129	.512	.323
	RIGID - (		(115.7)	(26.5)	(118.6)			
		>- 62	.294	.020	.082	.129	.510	.323
	STRAIGHT - (		(76.2)	(26.5)	(76.2)			
8		>- 65N	.141	.020	.019	.123	.412	.298
	(		(24.2)	(26.4)	(18.1)			
	BEND - (	65M	.084	.014	.004	.078	.326	.166
	(		(11.5)	(22.0)	(3.9)			
		>- 65F	.043	.007	.000	.024	.128	.082
	STRAIGHT - (		(6.0)	(14.7)	(.1)			
ANCHOR	--	70	.000	.000	.000	.000	.000	.000
			(.0)	(.0)	(.0)			
BRANCH PT.	--	45	2.948	.035	.173	.063	.644	.067
	STRAIGHT - (		(109.2)	(103.5)	(145.2)			
TERMINAL	--	75	2.948	.000	.347	.063	.645	.066

DYNAFLEX

STEARNS - ROGER CORP

PAGE 52

PROJECT ONE 10MW SOLAR PILOT PLANT - C-21700
 JOB TSS OIL CHARGING(X-TC-4-A-5)
 DATE 7/ 3/80

 *
 * STRESS SUMMARY *
 * ----- *
 *

EXPLANATORY NOTES:

- (1) EQUATION NUMBERS REFER TO ARTICLE 104.8 OF THE ANSI B31.1-1977 PIPING CODE.
- (7) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.
- (9) THE COLD MODULUS WAS USED IN ANALYZING THE OCCASIONAL LOADS.

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 53

STRESSES ARE IN PSI

LOC. NO.	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
5	6807	4361	390	8094
10N	10346	8046	580	13119
10M	9693	7767	575	12434
10F	9020	6883	522	11358
10F.1	3795	967	121	3918
15N	7428	5276	403	9120
15M	7497	5992	429	9607
15F	7100	6132	420	9391
15F.1	2354	3106	259	3906
15F.2	2235	3677	261	4311
20N	6324	8807	307	10846
20M	6634	9131	316	11291
20F	6592	9193	324	11317
25N	6411	8953	327	11016
25F	6341	8510	330	10618
27	3465	4408	187	5610
27.1	3405	2911	226	4486
27.2	3413	1581	275	3772
27.3	3424	1136	228	3615
30	3393	2038	296	3969
30.1	3239	3114	253	4500

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 54

STRESSES ARE IN PSI

LOC. NO.	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
30.2	2984	4060	294	5048
30.3	2636	4795	251	5478
32	2214	5245	320	5739
32.1	1724	5526	269	5796
32.2	1330	5502	339	5670
32.3	1222	5257	280	5404
35	1484	4848	251	5076
35.1	1929	4315	261	4734
35.2	2480	3670	410	4448
35.3	3061	2901	408	4237
40	3643	2063	349	4201
40.1	4106	1541	301	4396
40.2	4803	2262	480	5331
42	5671	3781	443	6831
45	11125	8257	673	13871
45	11490	8198	280	14117
50N	10626	8163	293	13403
50M	10066	8100	329	12925
50F	9176	7810	359	12055
50F.1	2241	3192	276	3910
50F.2	2058	2334	249	3122

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 55

STRESSES ARE IN PSI

F_Q (12) F_Q (12) E_Q (12) E_Q (12)

SHOCK 1 SHOCK 2 SHOCK 3 SHOCK 4

LOC. NO.	-----	-----	-----	-----
60N	9150	3601	500	9846
60M	9978	3416	501	10559
61	10207	2991	425	10645
62	5592	1783	112	5762
65N	11185	3733	383	11798
65M	11999	4260	490	12743
65F	13041	4360	520	13760
70	9164	2184	349	9427
45	4479	3399	3379	6560
75	0	0	0	0

10

↑
DYNAFLEXTABLE OF CONTENTS

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Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

10MWe SOLAR PILOT PLANT
C-21700

TSS OIL CHARGING SYSTEM FEED

PIPING SYSTEM

8" - TO-5 - BBA

97

CONDITIONS ANALYZED / ANAL. I.D. NO.

THERMAL T-21700-TO-5-A-3

DEAD WEIGHT W-21700-TO-5-A-3

PRESSURE P-21700-TO-5-A-0

SEISMIC X-21700-TO-5-A-1

CODE REFERENCE: ANSI B31.1-1973
W/ APPENDA B.
(SUMMER 1979)

ANALYST G.H. MAY DATE 7-14-80

TRANSMITTAL

TO-5

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER

EE16.01.2

PAGE 1 OF 1

APPROVALS

Des. Sect: _____

Sect. Supv. _____

Div. _____

PIPING ANALYSIS RESULTS

ISSUED 8-31-73
REVISED 4-15-74

Date JULY 8, 1980

TO: T.E. OLSON

FROM: G.H. MAY, Piping Engineering Group

Client DOE Project SOLAR I Job No. C-21700

Pipe Line Analyzed TSS OIL - CHARGING SYSTEM FEED 18"-TO-5 -BBA

Reference Dwg. PI3-14 A

This piping has been analyzed for the THERMAL, DEAD WEIGHT, PRESSURE & 1/2 SAFE SHUTDOWN EARTHQUAKE loading condition and is found to be:

- Satisfactory, as is.
- Satisfactory, with comments noted.
- Unsatisfactory - See Comments.

COMMENT 1) ALL PIPE STRESSES ARE SATISFACTORY.

2) ALL ANCHOR LOADS ARE SIMILAR TO PREVIOUS TRANSMITTALS EXCEPT SEISMIC LOADS ARE NOW INCLUDED.

3) THESE ANALYSES ARE FINAL.

RECOMMENDATION 1) SUBMIT THE ANCHOR LOADS TO ROCKWELL.

2) USE THE REFERENCED ROUTING.

ATTACHS: PIPE STRESS SUMMARY REPORT, SUMMARY OF FORCES & MOMENTS

G.H. May
Signature

Copies to: Sender
Analysis Folder - Job File
Piping Engrg. Supervisor TCT
K.E. NOBLE

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		EE16.01.8
APPROVALS						PIPE STRESS SUMMARY REPORT ANSI B31.1 - 1973 EDITION	PAGE <u>1</u> OF <u>1</u>
Des. Sect. <u>JV Seal</u>							ISSUED 5/27/75 REVISED
Sect. Supv. <u>J. H. Seal</u>							
Div. _____							

10MWE SOLAR PILOT PLANT - SOLAR I
Job Name
TSS OIL - CHARGING SYSTEM FEED
System/Pipe Line Name 8"-T0-5-BBA

C-21700
Job No.
T0-5
Analysis No.

1. Loading Conditions Analyzed

Pressure X
Weight X
Thermal Expansion X
Sustained Mech. Loads _____
Occasional Loads X

Analysis Ident. Code
P-T0-5-A-0
W-T0-5-A-3
T-T0-5-A-3
X-T0-5-A-1

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} \leq 1.0 S_h$ 3555 psi \leq 15000 psi

Material: - ASTM A106 GR.B Temp = 525°F @ Pt. 150 (DUMMY LEG)
PRESS = 115 PSIG \Rightarrow SLP = 685 PSI

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{0.75 iM_B}{z} \leq K S_h$ 15184 psi \leq 18000 psi

Material: - ASTM A106 GR.B Temp = 525°F @ Pt. 150

Eq. (13) $S_E = \frac{iM_C}{z} \leq S_A$ 6769 psi \leq 22500 psi

Material: - Temp = 525°F @ Pt. 165F

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{iM_C}{z} \leq (S_h + S_A)$ 7743 psi \leq 37500 psi

Material: - ASTM A106 GR.B Temp = 525°F @ Pt. 165F

3. Stress Evaluation (Local or Special)

Loading	Analysis Ident. Code	Calculated Stress (psi)	Allowable Stress (psi)
_____	_____	_____	_____
_____	_____	_____	_____

REMARKS:

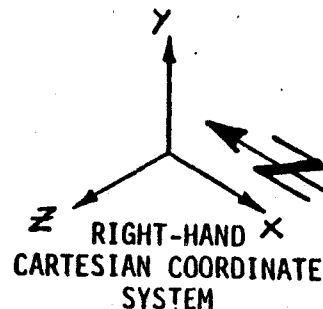
- 1) ALL PIPE STRESSES ARE LESS THAN THE ALLOWABLES.
- 2) OCCASIONAL LOAD IS 1/2 SAFE SHUTDOWN EARTHQUAKE.

J. H. Seal 7-8-80
Prepared By Date
J. H. Seal 7-8-80
Approved By Date

CUSTOMER: DOE
 PROJECT: SOLARI
 JOB NO: C-21700
 BY: GMM DATE: 7-7-80
 REF. DWGS: P13-14 B
 ANALYSIS CODE: T/W/X -T0-5-A-3/3/1

SUMMARY OF FORCES & MOMENTS
 ON SYSTEM TERMINAL EQUIPMENT
 (SYSTEM)

TSS OIL-CHARGING SYSTEM FEED
8"-T0-5-BBA



THE REPORTED REACTIONS BASED ON A THERMAL
 EXPANSION ANALYSIS FROM ...70°F TO 525°F
 USING E_c , THE COLD MOD. OF ELASTICITY, AND
0...% COLD SPRING.

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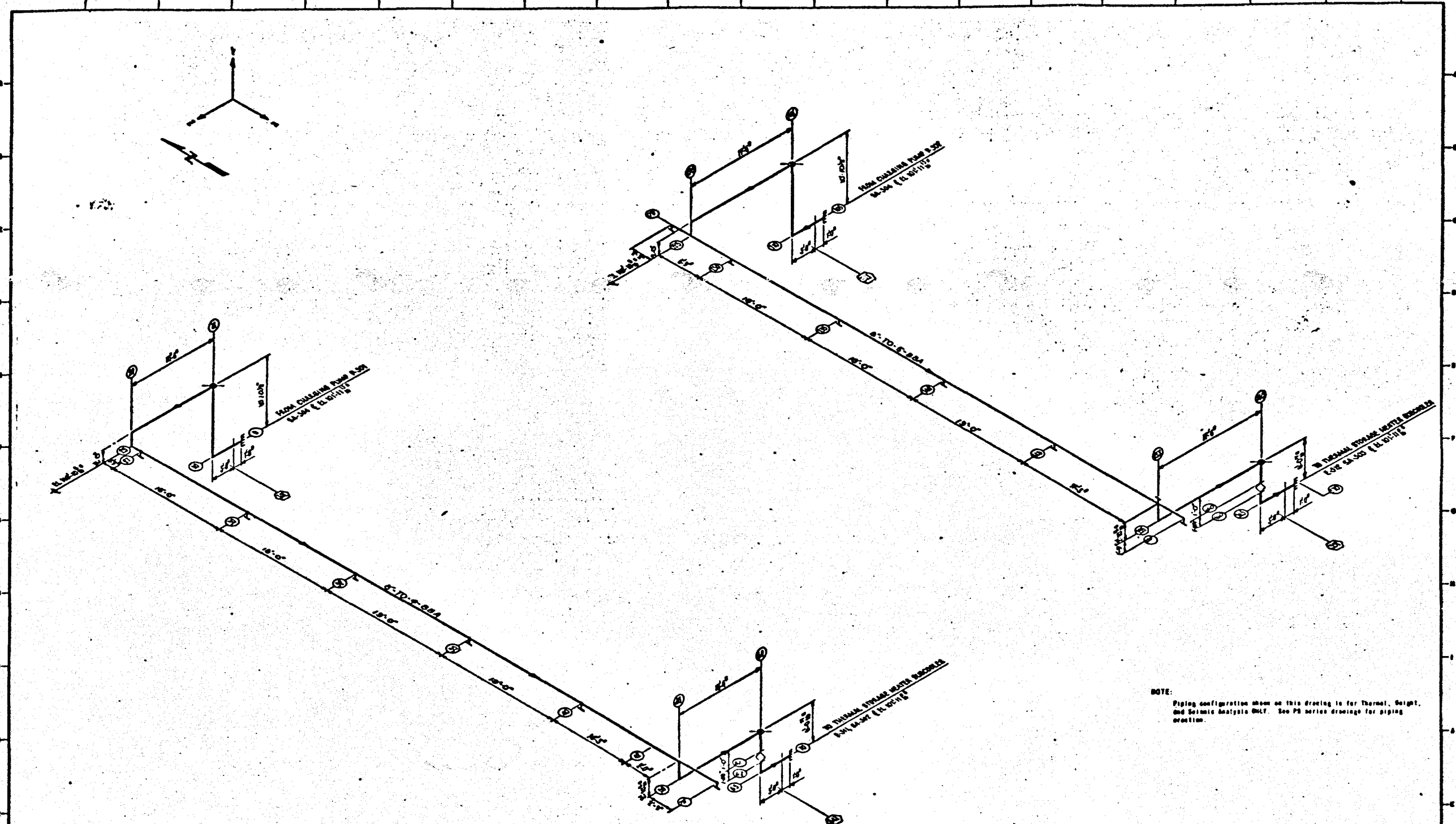
EQUIPMENT CONNECTIONS	LOC. NO.	FORCES (LBS)				MOMENTS (FT.-LBS)			
		X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
FROM CHARGING PUMP (THERMAL)	105	-283	-33	-7	285	656	-3982	1787	4414
P-302, 10" EAST } WEIGHT	105	-4	21	-1	21	-392	-45	42	397
INTERFACE (31) } SEISMIC	105	924	236	937	1337	4486	8376	6197	11344
T0 T.S. HRA. SUBMERG (THERMAL)	170	283	-35	7	285	813	4505	-1119	4713
E-312, 10" EAST } WEIGHT	170	4	92	1	92	-584	101	192	623
INTERFACE (33) } SEISMIC	170	989	254	946	1392	2099	11167	4566	12246

DIVISION USAGE
 MM P PP SH FI SP
 X
 APPROVALS
 Des. Sect. [Signature]
 Sect. Supv. [Signature]
 DWG. [Signature]

PER. ANSI B31.1-1973 PWR. PIPING CODE
 SUMMARY OF FORCES & MOMENTS

Stearns-Roger
 INCORPORATED
 ENGINEERING STANDARD

STANDARD NUMBER
 EE 16.01.7
 PAGE 1 OF 1
 ISSUED 2/28/74
 REVISED 4/18/78



NOTE:
 Piping configuration shown on this drawing is for Thermal, Geopt,
 and Seismic Analysis Only. See PD series drawings for piping
 erection.

REVISIONS				REFERENCE DRAWINGS				PIPING RECORD				BDR 10-5-79				SOLAR FACILITIES DESIGN INTEGRATOR			
1	UPDATE FOR ANALYSIS DOCUMENTATION	0	1/25/81	257	S-R PLAN/SECTION HALF INCHES														
				258	S-R SECTION - NEW 20\"/>														

DEPARTMENT OF ENERGY
 SAN FRANCISCO OPERATIONS OFFICE
 SOLAR THERMAL MEGAWATT PROJECT OFFICE
 9550 PLAIN DRIVE, SUITE 710
 EL MONTE, CALIFORNIA 91731
 10 MW SOLAR PILOT PLANT - BAQOTTI, CALIFORNIA

ANALYSIS ISOMETRIC
TSS 01L - CHARGING SYSTEM FEED

ANALYSIS ISOMETRIC (P13-14) N0P3005132018

BRANCH CONNECTION SYMBOLS		PIPE SUPPORT SYMBOLS		ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN.			ANCHOR &/OR TERM. POINTS	COORDINATE														
					X	Y	Z		X	Y	Z												
	UNREINFORCED PIPE-PIPE INTERSECTION		CONSTANT SUPPORT	5	0.0	0.0	0.0	5 } TO-04	0'-0"	0'-0"	0'-0"												
	REINFORCED PIPE-PIPE INTERSECTION		VARIABLE SPRING SUPPORT	70				70 }	92'-0"	-0'-0 1/2"	0'-0"												
	ASA TEE		RIGID ROD OR STRUT	105				105 } TO-05	0'-0"	0'-0"	0'-0"												
	WELDOLET		HYDRAULIC SNUBBER	170				170 }	79'-0"	-0'-0 1/2"	0'-0"												
	SWEEPOLET		RIGID GUIDE																				
			ANCHOR																				
MODELING SYMBOLS		PIPING SYMBOLS		ANALYZED CONDITIONS				VALVES & SPECIAL COMPONENTS															
	POINT OF INTEREST		ELBOW	OPERATING TEMP (°F)	DESIGN PRESSURE (PSIG)	CASE	VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS													
	DATA POINT NO.		BEND	525°	115	TO-4, TO-5	VTO-5-13	243	FINAL	Reverse No. 525 4-5 1/2													
	MASS POINT OR CENTER OF GRAVITY		VALVES (ASSUMED RIGID)				VTO-4-12	243															
	INTERFACE POINT		REDUCER OR INCREASER																				
			EQUIPMENT NOZZLE																				
NOTES:				DATA POINTS				PIPE		LINE		PIPE SIZE (IN.)		WEIGHT LBS./LINEAR FT.		INS.							
1) DIMENSIONS ARE IN FEET AND INCHES UNLESS NOTED OTHERWISE.				FROM		TO		MATERIAL		SPEC.		O.D.		W.T.		PIPE		FLUID		INSULATION		THK.	
2) ALL ELBOWS ARE ASA LONG RADIUS UNLESS NOTED OTHERWISE.				5		70		A106 Gr B		BBA		8.025		.322		28.55		14.7 @ 575°F		10.6		3/2"	
3) PIPE ANALYZED FROM COLD TO HOT.				105		170																	
4) THERMAL ANALYSIS TEMPERATURE RANGE IS FROM 70° F. TO OPERATING TEMPERATURE UNLESS NOTED OTHERWISE.				45		75						4.5		.237		10.8		N/A		0		0	
5) SCALE: NONE				175/150		175/180																	
6) THIS DATA AND ATTACHED DRAWINGS USED FOR ANALYSIS PURPOSES ONLY.																							
				REVISIONS				DATE		BY		CH'D		APP'D		PIPING ANALYSIS DATA (PI3-14) Stearns-Roger <small>INCORPORATED</small> 10MW SOLAR PILOT PLANT - DAGGETT, CALIF. TSS OIL - CHARGING SYSTEM FEED FOR ISOMETRIC PI3-14 REV. A DRAWN: KEM DATE: 1-14-80 ANAL. BY GJM DATE: 1-23-80 CHECKED: KSR DATE: 1-24-80 APP'D BY JHM DATE: 1-24-80 JOB NO. C-21700 SYSTEM NO. TO-04, 05 SHEET 1 OF 1							
NO.				REFERENCES				NO.				ANALYSIS CODES											
				PI3-14								T/W-TO-4-A-3/3											
												T/W-TO-5-A-3/3											
												X-TO-4-A-3											
												X-TO-5-A-1											

THERMAL

DYNAFLEX

STEARNS - ROGER CORP

PAGE 1

PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
JOB - TSS OIL CHARGING(T/W-10-5-A-3/3)

DATE 7/ 1/80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYPE	LOC	FR	NO	10	13	25	37	49	60	LINE NUMBER
1	HED									STEARNS - ROGER CORP,	1
										7/ 1/80, PROJ, DOE 10M	
										W SOLAR PILOT PLANT -	
										C-21700, JOB TSS OIL C	
										HARGING(T/W-10-5-A-3/3)	
2	GEN									APPLY 831.1-1973	2
3				105	110			4-0		L MAT=LCS, OD=8.625,	3
										WT=, 322, UNIF=25.3,	
										TEMP=525,	
4					115		10-10-1/2			L	4
5					120			17-6		L	5
6					125		-2-0				6
										SIF=2.44	
7					130	16-9					7
8					135	18-0					8
9					140	18-0					9
10					145	19-0					10
11					150	17-3				SIF=2.44	11
12					155		-2-10-5/16			L	12
13					160			17-6		L	13
14					161		-1-0				14
15					162		-1-8-1/2			RIGID, WEIGHT=243,	15
16					165		-3-4-3/16			L	16
17					170			4-0			17
18				125	175	-2-3				OD=4.50, WT=.237,	18
										TEMP=70., UNIF=0.0	
19				150	180	1-9					19
20	ANC	105									20
21	ANC	170									21
22	RAD	130					RIGID				22
23	RAD	135					RIGID				23
24	RAD	140					RIGID				24
25	RAD	145					RIGID				25
26	RAD	175					RIGID				26
27	RAD	180					RIGID				27
28	CCC	170			79-0		-0-0-1/2	0-0			28
29	HGR									LDC(115F, 160N),	29
										USE TABLE 1	

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DYNAFLEX

STEARNS - ROGER CORP

PAGE 2

PROJECT - ONE 10MW SOLAR PILOT PLANT - C-21700
JOB - TSS OIL CHANGING(T/W-TU-5-A-3/3)

DATE 7/ 1/80

*
* EDITED PIPING SYSTEM DESCRIPTION *

*

EXPLANATORY NOTES

IN THE EDITED PIPING SYSTEM DESCRIPTION:

- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
- (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
- (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCULATIONS IS ASSUMED TO BE .25 INCHES.
- (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
- (A) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS OR RIGID RESTRAINTS (RAD,RAR) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR,MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (RAD,RAR) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASH) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
- (9) A POINT IDENTIFIED AS A TENTATIVE HANGER LOCATION IS ASSUMED TO BE FREE TO MOVE IN THE VERTICAL DIRECTION FOR THE INITIAL THERMAL LOADING CASE AND FULLY RESTRAINED IN THE VERTICAL DIRECTION FOR THE INITIAL WEIGHT LOADING CASE.
- (14) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
- (15) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 4

POINT TYPE	ELEMENT DESIGNATION	POINT LJC NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MAYL (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
	BEND	(115H	0.00	10.58	4.29	1.00	1.57	90.000	8.625	.322	LCS: 525.	28.6	25.3
		(>-115F	0.00	10.88	5.00								
		(* TENTATIVE HANGER AT POINT 115F - SEE NOTE (9) ABOVE, (HANGER LENGTH NOT SPECIFIED.											
	STRAIGHT	(					15.50						
		(>-120N	0.00	10.88	20.50								
	BEND	(120N	0.00	10.58	21.21	1.00	1.57	90.000					
		(>-120F	0.00	9.88	21.50								
	STRAIGHT	(					1.00						
100		(* STRESS INTENSIFICATION SPECIFIED AT POINT 125 (STRESS INTENSIFICATION FACTOR = 2.44											
BR PT		(>-125	0.00	8.88	21.50								
	STRAIGHT	(					6.75						
		(>-130	6.75	8.88	21.50								
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 130 (IN DIRECTION Y											
	STRAIGHT	(					18.00						
		(>-135	24.75	8.88	21.50								
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 135 (IN DIRECTION Y											
	STRAIGHT	(					18.00						
		(>-140	42.75	8.88	21.50								

* NOTES PERTAINING TO POINT 140 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 5

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
		>-140	42.75	8.88	21.50			8.625	.322	LCS	525	28.6	25.3
		(
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 140											
		(IN DIRECTION Y											
		(
	STRAIGHT	-(				19.00							
		(
		>-145	61.75	8.88	21.50								
		(
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 145											
		(IN DIRECTION Y											
		(
	STRAIGHT	-(				17.25							
		(
		(* STRESS INTENSIFICATION SPECIFIED AT POINT 150											
		(STRESS INTENSIFICATION FACTOR = 2.44											
		(
		(
BR PT		>-150	79.00	8.88	21.50								
	STRAIGHT	-(				1.86							
		(
		>-155N	79.00	7.02	21.50								
		(
	BEND	-(	155N	79.00	6.31	21.21	1.00	1.57	90.000				
		(
		>-155F	79.00	6.02	20.50								
		(
	STRAIGHT	-(				15.50							
		(
		>-160N	79.00	6.02	5.00								
		(
		(* TENTATIVE HANGER AT POINT 160N - SEE NOTE (9) ABOVE.											
		(HANGER LENGTH NOT SPECIFIED.											
		(
		(
		(
		BEND	-(	160N	79.00	5.72	4.29	1.00	1.57	90.000			
		(
		>-161	79.00	5.02	4.00								

* NOTES PERTAINING TO POINT 161 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 7

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT)	
			X	Y	Z								WT.	UNIF
BR PT		--150	79.00	8.88	21.50				4.500	.237	LCS	70.	10.8	0
	STRAIGHT - (						1.75							
TFRM		--180	80.75	8.88	21.50									
* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 180 IN DIRECTION Y														

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DYNAFLEX

LOADING - @FREE@ THERMAL

PAGE 8

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LIC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
105	-283.	-33.	-7.	285.	656.	-3982.	1787.	4414.
170	283.	-35.	7.	285.	813.	4505.	-1119.	4713.
RESTRAINTS:								
130	0.	101.	0.	101.	0.	0.	0.	0.
135	0.	2.	0.	2.	0.	0.	0.	0.
140	0.	-30.	0.	30.	0.	0.	0.	0.
145	0.	122.	0.	122.	0.	0.	0.	0.
175	0.	-64.	0.	64.	0.	0.	0.	0.
180	0.	-62.	0.	62.	0.	0.	0.	0.

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*****
*
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
*-----*
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THE MAXIMUM STRESS OF 6769. OCCURS AT POINT 165F

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIP IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (14) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 105	7.	285.	1787.	656.	3982.	1.00	1.00	16.81	3151.
	STR = (
		>- 110N	7.	285.	1787.	556.	3133.	2.44	2.44	16.81	6354.
	(
	BEND = (	110H	28.	284.	869.	534.	3279.	2.44	2.44	16.81	5978.
	(
		>- 110F	33.	283.	2850.	529.	1504.	2.44	2.44	16.81	5685.
	STR = (
		>- 115N	33.	283.	2850.	588.	1008.	2.44	2.44	16.81	5361.
	(
	BEND = (	115H	28.	284.	2811.	583.	1102.	2.44	2.44	16.81	5354.
	(
		>- 115F	7.	285.	1291.	561.	2567.	2.44	2.44	16.81	5097.
	STR = (
		>- 120N	7.	285.	1291.	45.	1821.	2.44	2.44	16.81	3888.
	(
	BEND = (	120H	19.	285.	2284.	19.	575.	2.44	2.44	16.81	4100.
	(
		>- 120F	33.	283.	2104.	5.	1008.	2.44	2.44	16.81	4062.
	STR = (
		-- 125	33.	283.	2104.	725.	2.	2.44	2.44	16.81	3877.
BR PT											
	STR = (
		-- 125	283.	98.	2.	581.	2104.	2.44	2.44	16.81	3803.
BR PT											
	STR = (
		>- 130	283.	98.	2.	77.	2060.	1.00	1.00	16.81	1471.
	STR = (
		>- 135	283.	9.	2.	5.	1941.	1.00	1.00	16.81	1385.
	STR = (
		>- 140	283.	26.	2.	97.	1822.	1.00	1.00	16.81	1302.
	STR = (
		>- 145	283.	97.	2.	374.	1696.	1.00	1.00	16.81	1240.
	STR = (
		-- 150	283.	97.	2.	1297.	1582.	2.44	2.44	16.81	3563.
BR PT											
	STR = (
		-- 150	35.	283.	1582.	1405.	2.	2.44	2.44	16.81	3685.
BR PT											
	STR = (
		>- 155N	35.	283.	1582.	14.	879.	2.44	2.44	16.81	3150.
	(
	BEND = (	155H	20.	285.	580.	29.	1540.	2.44	2.44	16.81	2865.
	(
		>- 155F	7.	285.	595.	56.	1299.	2.44	2.44	16.81	2489.
	STR = (
		>- 160N	7.	285.	595.	598.	3089.	2.44	2.44	16.81	5576.

DYNAFLEX

LOADING - FREE THERMAL

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	>- 160N	7.	285.	595.	598.	3089.	2.44	2.44	16.81	5576.
	(
BEND	- (160M	20.	285.	2688.	625.	1464.	2.44	2.44	16.81	5897.
	(
	>- 161	35.	283.	3372.	640.	312.	2.44	2.44	16.81	6001.
RIGID	- (
	>- 162	35.	283.	3372.	171.	651.	1.00	1.00	16.81	2455.
STR	- (
	>- 165N	35.	283.	3372.	667.	836.	2.44	2.44	16.81	6159. *
	(
BEND	- (165M	20.	285.	1710.	682.	3176.	2.44	2.44	16.81	6392. *
	(
	>- 165F	7.	285.	1119.	708.	3656.	2.44	2.44	16.81	6769. **
STR	- (
ANCHR	-- 170	7.	285.	1119.	813.	4505.	1.00	1.00	16.81	3364.
	(
BR PT	-- 125	0.	64.	0.	144.	0.	2.44	2.44	3.21	1314.
	STR - (								8.50	496
TERM	-- 175	0.	64.	0.	0.	0.	1.00	1.00	3.21	0.
	(								8.50	
BR PT	-- 150	0.	62.	0.	108.	0.	2.44	2.44	3.21	986.
	STR - (								8.50	372
TERM	-- 180	0.	62.	0.	0.	0.	1.00	1.00	3.21	0.
	(								8.50	

REVISE 4" Ø DUMMY LEG TO 6" STD. WT. PIPE

GHMAY
7-8-80

 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		-- 105	-283.	-33.	-7.	656.	-3982.	1787.
	STRAIGHT - (	>- 110N	-283.	-33.	-7.	556.	-3133.	1787.
	BEND - (	( 110M	-283.	-33.	-7.	534.	-2933.	1704.
		>- 110F	-283.	-33.	-7.	529.	-2850.	1504.
	STRAIGHT - (	>- 115N	-283.	-33.	-7.	588.	-2850.	-1008.
117	BEND - (	( 115M	-283.	-33.	-7.	583.	-2767.	-1208.
		>- 115F	-283.	-33.	-7.	561.	-2567.	-1291.
	STRAIGHT - (	>- 120N	-283.	-33.	-7.	45.	1821.	-1291.
	BEND - (	( 120M	-283.	-33.	-7.	19.	2021.	-1208.
		>- 120F	-283.	-33.	-7.	5.	2104.	-1008.
BRANCH PT.	STRAIGHT - (	-- 125	-283.	-33.	-7.	-2.	2104.	-725.
BRANCH PT.		-- 125	-283.	-97.	-7.	-2.	2104.	-581.
	STRAIGHT - (	>- 130	-283.	-97.	-7.	-2.	2060.	77.
	STRAIGHT - (	>- 135	-283.	6.	-7.	-2.	1941.	5.
	STRAIGHT - (	>- 140	-283.	-25.	-7.	-2.	1822.	-97.
	STRAIGHT - (	>- 145	-283.	97.	-7.	-2.	1696.	374.
BRANCH PT.	STRAIGHT - (-- 150	-283.	97.	-7.	-2.	1582.	-1297.
BRANCH PT.		-- 150	-283.	35.	-7.	-2.	1582.	-1405.

DYNAFLEX

LOADING - 0FRFF0 THERMAL

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
BRANCH PT.		-- 150	-283.	35.	-7.	-2.	1582.	-1405.
	STRAIGHT - (	>- 155N	-283.	35.	-7.	-14.	1582.	-879.
	BEND - (	155M	-283.	35.	-7.	-29.	1499.	-678.
	STRAIGHT - (	>- 155F	-283.	35.	-7.	-56.	1299.	-595.
		>- 160N	-283.	35.	-7.	-598.	-3089.	-595.
	BEND - (	160M	-283.	35.	-7.	-625.	-3289.	-512.
		>- 161	-283.	35.	-7.	-640.	-3372.	-312.
	RIGID - (	>- 162	-283.	35.	-7.	-651.	-3372.	171.
	STRAIGHT - (	>- 165N	-283.	35.	-7.	-667.	-3372.	836.
	BEND - (	165M	-283.	35.	-7.	-682.	-3455.	1036.
		>- 165F	-283.	35.	-7.	-708.	-3656.	1119.
ANCHOR	STRAIGHT - (	-- 170	-283.	35.	-7.	-813.	-4505.	1119.
BRANCH PT.		-- 175	-0.	64.	0.	-0.	-0.	-144.
TERMINAL	STRAIGHT - (	-- 175	-0.	64.	0.	-0.	-0.	-0.
BRANCH PT.		-- 180	0.	62.	0.	0.	-0.	108.
TERMINAL	STRAIGHT - (	-- 180	0.	62.	0.	0.	0.	0.

DYNAFLEX

LOADING - REFER THERMAL

PAGE 14

 * DISPLACEMENTS AND ROTATIONS *

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	-.000	-.000	-.000	.000	-.000	.000
	STRAIGHT -(	>- 110N	-.014	-.002	.116	.007	-.044	.028
		(
	BEND -(	110M	-.029	.007	.144	.020	-.115	.060
		(
	STRAIGHT -(	>- 110F	-.050	.033	.159	.033	-.148	.110
		(
	BEND -(	>- 115N	-.278	.375	.239	.053	-.282	.119
		(
	BEND -(	115M	-.313	.399	.259	.067	-.296	.115
		(
	STRAIGHT -(	>- 115F	-.367	.399	.290	.080	-.342	.122
		(
119	STRAIGHT -(	>- 120N	-1.592	.098	.889	.099	-.366	.015
		(
	BEND -(	120M	-1.643	.072	.910	.100	-.335	.018
		(
	STRAIGHT -(	>- 120F	-1.661	.039	.906	.100	-.326	.009
BRANCH PT.		-- 125	-1.660	.000	.885	.100	-.315	.005
BRANCH PT.		-- 125	-1.660	.000	.885	.100	-.315	.005
	STRAIGHT -(	>- 130	-1.399	.000	1.290	.100	-.257	-.002
	STRAIGHT -(	>- 135	-.704	.000	1.981	.100	-.111	.001
	STRAIGHT -(	>- 140	-.010	-.000	2.134	.100	.028	-.002
	STRAIGHT -(	>- 145	.723	.000	1.750	.100	.164	.008
BRANCH PT.		-- 150	1.389	.008	.947	.100	.279	-.024
BRANCH PT.		-- 150	1.389	.008	.947	.100	.279	-.024
	STRAIGHT -(>- 155N	1.378	-.064	.909	.100	.295	-.033
		(
	BEND -(155M	1.352	-.085	.882	.099	.311	-.058

DYNAFLEX

LOADING - FREE THERMAL

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	REND - (	155H	1.352	-.085	.882	.099	.311	-.058
	>- 155F		1.300	-.082	.849	.098	.343	-.072
	STRAIGHT - (
	>- 160H		.201	.212	.251	.077	.287	-.121
	REND - (	160H	.157	.211	.219	.063	.226	-.105
	>- 161		.129	.188	.200	.048	.203	-.093
	RIGID - (
	>- 162		.096	.122	.143	.048	.202	-.093
	STRAIGHT - (
	>- 165N		.051	.031	.161	.042	.160	-.088
	REND - (	165H	.032	.006	.144	.026	.128	-.048
	>- 165F		.016	-.003	.116	.009	.050	-.018
	STRAIGHT - (
ANCHOR	-- 170		.000	-.000	.000	.000	.000	-.000
BRANCH PT.	-- 125		-1.660	.000	.885	.100	-.315	.005
TERMINAL	STRAIGHT - (
	-- 175		-1.660	-.000	.737	.100	-.315	-.002
BRANCH PT.	-- 150		1.349	.008	.947	.100	.279	-.024
TERMINAL	STRAIGHT - (
	-- 180		1.349	-.000	.845	.100	.279	-.020

DYNAFLX

LOADING - RESTRAINED WEIGHT (+UNIF)

PAGE 16

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
105	-4.	21.	-1.	21.	-392.	-45.	42.	397.
170	4.	92.	1.	92.	-584.	101.	192.	623.
RESTRAINTS:								
121 115F	0.	-1331.	0.	1331.	0.	0.	0.	0.
130	0.	-991.	0.	991.	0.	0.	0.	0.
135	0.	-979.	0.	979.	0.	0.	0.	0.
140	0.	-941.	0.	941.	0.	0.	0.	0.
145	0.	-1225.	0.	1225.	0.	0.	0.	0.
160N	0.	-1343.	0.	1343.	0.	0.	0.	0.
175	0.	-352.	0.	352.	0.	0.	0.	0.
180	0.	-797.	0.	797.	0.	0.	0.	0.

DYNAFLFX

LOADING = UNRESTRAINED WEIGHT (+GRAV)

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 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 *

THE MAXIMUM STRESS OF 9415. OCCURS AT POINT 150

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIP IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	-- 105	1.	21.	42.	392.	45.	1.00	1.00	16.81	283.
STR - (	>- 110N	1.	183.	42.	87.	33.	2.44	2.44	16.81	133.
BEND - (	110M	159.	160.	7.	57.	50.	2.44	2.44	16.81	99.
STR - (	>- 110F	267.	4.	29.	127.	38.	2.44	2.44	16.81	177.
STR - (	>- 115N	745.	4.	29.	133.	1.	2.44	2.44	16.81	178.
BEND - (	115M	556.	558.	21.	360.	18.	2.44	2.44	16.81	472.
STR - (	>- 115F	1.	830.	3.	933.	25.	2.44	2.44	16.81	1219.
STR - (	>- 120N	1.	335.	3.	353.	39.	2.44	2.44	16.81	464.
BEND - (	120M	267.	266.	31.	102.	28.	2.44	2.44	16.81	144.
STR - (	>- 120F	419.	4.	43.	12.	1.	2.44	2.44	16.81	58.
BR PT	-- 125	473.	4.	43.	5.	11.	2.44	2.44	16.81	58.
BR PT	-- 125	4.	145.	11.	771.	43.	2.44	2.44	16.81	1008.
STR - (	>- 130	4.	482.	11.	1436.	38.	1.00	1.00	16.81	1026.
STR - (	>- 135	4.	492.	11.	1482.	26.	1.00	1.00	16.81	1058.
STR - (	>- 140	4.	463.	11.	1362.	13.	1.00	1.00	16.81	973.
STR - (	>- 145	4.	561.	11.	2293.	0.	1.00	1.00	16.81	1637.
BR PT	-- 150	4.	265.	11.	1150.	12.	2.44	2.44	16.81	1502.
BR PT	-- 150	513.	4.	12.	228.	11.	2.44	2.44	16.81	299.
STR - (	>- 155N	413.	4.	12.	10.	221.	2.44	2.44	16.81	289.
BEND - (	155M	262.	261.	164.	122.	144.	2.44	2.44	16.81	527.
STR - (>- 155F	1.	328.	217.	368.	17.	2.44	2.44	16.81	558.
STR - (>- 160N	1.	836.	217.	1019.	80.	2.44	2.44	16.81	1365.

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DYNAFLEX

LOADING - RESTRAINED WEIGHT (UNIF)

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	>- 160N	1.	836.	217.	1019.	80.	2.44	2.44	16.81	1365.
BEND - (	160M	561.	560.	211.	443.	94.	2.44	2.44	16.81	652.
RIGID - (	>- 161	751.	4.	84.	215.	213.	2.44	2.44	16.81	410.
STR - (	>- 162	465.	4.	84.	206.	216.	1.00	1.00	16.81	221.
	>- 165N	338.	4.	84.	218.	196.	2.44	2.44	16.81	398.
BEND - (	165M	210.	209.	197.	128.	76.	2.44	2.44	16.81	322.
STR - (	>- 165F	1.	254.	192.	66.	89.	2.44	2.44	16.81	289.
ANCHR	-- 170	1.	92.	192.	584.	101.	1.00	1.00	16.81	445.
BR PT	-- 125	0.	328.	0.	765.	0.	2.44	2.44	3.21 8.50	5228. 1977.
124 TERM	-- 175	0.	352.	0.	0.	0.	1.00	1.00	3.21 8.50	0.
BR PT	-- 150	0.	778.	0.	1378.	0.	2.44	2.44	3.21 8.50	9415. 3593.
TERM	-- 180	0.	797.	0.	0.	0.	1.00	1.00	3.21 8.50	0.

REVISE 4" DUMMY LEGS TO 6" STD. WT. PIPE

G.H. MAY 7-8-80

DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

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 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		-- 105	-4.	21.	-1.	-392.	-45.	42.
	STRAIGHT - (	>= 110N	-4.	183.	-1.	-87.	-33.	42.
	BEND - (	110M	-4.	225.	-1.	57.	-30.	41.
		>= 110F	-4.	267.	-1.	127.	-29.	38.
125	STRAIGHT - (	>= 115N	-4.	745.	-1.	133.	-29.	1.
	BEND - (	115M	-4.	788.	-1.	360.	-28.	-2.
		>= 115F	-4.	830.	-1.	933.	-25.	-3.
	STRAIGHT - (	>= 120N	-4.	335.	-1.	-353.	39.	-3.
	BEND - (	120M	-4.	377.	-1.	-102.	42.	-2.
		>= 120F	-4.	419.	-1.	12.	43.	1.
BRANCH PT.		-- 125	-4.	473.	-1.	11.	43.	5.
BRANCH PT.		-- 125	-4.	145.	-1.	11.	43.	771.
	STRAIGHT - (	>= 130	-4.	-492.	-1.	11.	38.	-1436.
	STRAIGHT - (	>= 135	-4.	-492.	-1.	11.	26.	-1492.
	STRAIGHT - (	>= 140	-4.	-463.	-1.	11.	13.	-1362.
	STRAIGHT - (	>= 145	-4.	561.	-1.	11.	-0.	-2293.
BRANCH PT.		-- 150	-4.	265.	-1.	11.	-12.	1150.
BRANCH PT.		-- 150	-4.	-513.	-1.	11.	-12.	-228.

DYNAFLEX

LOADING = RESTRAINED WEIGHT (40MIF)

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
BRANCH PT.		-- 150	-4.	-513.	-1.	11.	-12.	-228.
	STRAIGHT - (	>- 155N	-4.	-413.	-1.	10.	-12.	-221.
		PEND - (155M	-4.	-370.	-1.	122.	-14.	-218.
	STRAIGHT - (	>- 155F	-4.	-328.	-1.	368.	-17.	-217.
		>- 160N	-4.	-836.	-1.	-1019.	-80.	-217.
	HEND - (	160M	-4.	-793.	-1.	-443.	-83.	-216.
		>- 161	-4.	-751.	-1.	-215.	-84.	-213.
	RIGID - (	>- 162	-4.	-465.	-1.	-216.	-84.	-206.
	STRAIGHT - (	>- 165N	-4.	-338.	-1.	-218.	-84.	-196.
		HEND - (165M	-4.	-296.	-1.	-128.	-86.	-193.
		>- 165F	-4.	-254.	-1.	66.	-89.	-192.
ANCHOR	STRAIGHT - (	-- 170	-4.	-92.	-1.	584.	-101.	-192.
BRANCH PT.		-- 125	-0.	328.	0.	-0.	0.	-765.
TERMINAL	STRAIGHT - (-- 175	-0.	352.	0.	-0.	-0.	-0.
BRANCH PT.		-- 150	-0.	778.	-0.	-0.	0.	1378.
TERMINAL	STRAIGHT - (-- 180	-0.	797.	-0.	-0.	-0.	-0.

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 * DISPLACEMENTS AND ROTATIONS *

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	-.000	.000	-.000	-.000	-.000	.000
	STRAIGHT - (	>- 110N	-.000	.001	-.000	-.003	-.000	.001
		(
	BEND - (	110H	-.000	.002	-.000	-.004	-.001	.001
		(
	STRAIGHT - (	>- 110F	-.001	.002	-.001	-.001	-.002	.002
		(
	STRAIGHT - (	>- 115N	-.006	.002	.001	.003	-.003	.003
		(
	BEND - (	115H	-.006	.002	.002	.008	-.003	.003
		(
	STRAIGHT - (	>- 115F	-.007	-.000	.003	.023	-.004	.003
		(
127	STRAIGHT - (	>- 120N	-.020	-.017	.003	-.027	-.003	.003
		(
	BEND - (	120H	-.020	-.012	.005	-.032	-.003	.003
		(
	STRAIGHT - (	>- 120F	-.020	-.010	.009	-.033	-.002	.003
BRANCH PT.		-- 125	-.019	-.010	.016	-.033	-.002	.003
BRANCH PT.	STRAIGHT - (	>- 130	-.019	-.000	.018	-.032	-.001	-.000
		(
	STRAIGHT - (	>- 135	-.019	-.000	.018	-.031	.001	-.000
		(
	STRAIGHT - (	>- 140	-.019	-.000	.010	-.030	.003	.002
		(
	STRAIGHT - (	>- 145	-.019	-.000	-.002	-.029	.003	-.014
BRANCH PT.		-- 150	-.019	-.028	-.014	-.028	.003	.040
BRANCH PT.	STRAIGHT - (	>- 155N	-.004	-.028	-.003	-.028	.003	.038
		(
	BEND - (155H	.001	-.029	.001	-.027	.004	.034

DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND -(	155M	.001	-.029	.001	-.027	.004	.034
	>-	155F	.002	-.033	.003	-.021	.005	.032
	STRAIGHT -(
	>-	160N	-.010	-.000	.003	.027	.002	.014
	BEND -(	160M	-.009	.002	.002	.010	.002	.013
	>-	161	-.008	.003	.001	.003	.002	.009
	RIGID -(
	>-	162	-.004	.003	.000	.003	.002	.009
	STRAIGHT -(
	>-	165N	-.000	.003	-.001	.001	.001	.007
	BEND -(	165M	.000	.003	-.000	-.004	.002	.004
	>-	165F	.000	.002	.000	-.004	.001	.003
	STRAIGHT -(
ANCHOR	--	170	.000	.000	.000	-.000	.000	.000
BRANCH PT.	STRAIGHT -(	125	-.019	-.010	.016	-.033	-.002	.003
TERMINAL	--	175	-.019	-.000	.015	-.033	-.002	-.032
BRANCH PT.	STRAIGHT -(	150	-.019	-.028	-.014	-.028	.003	.040
TERMINAL	--	180	-.019	-.000	-.015	-.028	.003	.089

HANGER DESIGN DATA

EXPLANATORY NOTES:

- (1) ALL MOVEMENTS SHOWN BELOW REFER TO THE INITIAL EXPANSION LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE NOT BEEN VERTICALLY RESTRAINED AND ALL WEIGHT EFFECTS HAVE BEEN SUPPRESSED.
- (2) THE WEIGHT REACTIONS SHOWN BELOW REFER TO THE WEIGHT LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE BEEN RIGIDLY RESTRAINED IN THE VERTICAL DIRECTION AND ALL THERMAL EFFECTS INCLUDING IMPOSED ANCHOR MOVEMENTS HAVE BEEN SUPPRESSED.
- (3) IN THE FOLLOWING TABLE VSH DENOTES A VARIABLE SPRING HANGER AND CSH DENOTES A CONSTANT SUPPORT HANGER.
- (4) THE SUPPORT LOADS IN THE INSTALLED CONDITION HAVE BEEN CALCULATED TO PRODUCE THE CORRECT WEIGHT BALANCE IN THE OPERATING CONDITION.
- (5) IF THE FREE VERTICAL MOVEMENT EXCEEDS THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION OF .10 IN , A VARIABLE SPRING IS SELECTED. IF A VARIABLE SPRING HANGER CANNOT BE FOUND WHICH SATISFIES BOTH THE LOAD VARIATION CRITERION SELECTED BY THE USER AND THE WORKING RANGE OF THE SPRINGS LISTED IN SPRING TABLE (1) OF THE USER'S MANUAL, A CONSTANT SUPPORT HANGER IS RECOMMENDED.
- (6) THE NOMINAL ROD DIAMETER FOR RIGID HANGERS IS TAKEN FROM ANSI B31.1 - 1977 TABLE 121.2.2(A), (CARRYING CAPACITIES OF THREADED ASTM A 107 HOT ROLLED CARBON STEEL) ASSUMING A ROD TEMPERATURE OF 650 DEGREES FAHRENHEIT. A MINIMUM 1/2 IN. DIAMETER ROD WILL BE SELECTED FOR ALL PIPE WHICH IS NOMINALLY 2-1/2 IN. OD OR LARGER.
- (7) THE SO-CALLED @THEORETICAL@ SPRING INSTALLATION LOAD SHOWN BELOW PRESUPPOSES THAT THE HANGER LOCATION IS RESTRAINED AGAINST VERTICAL MOVEMENT WHILE THE SPRING IS SET TO THE COLD LOAD.

HANGER DESIGN DATA TABLE

HANGER LOC. NO.	SUPPORT LOAD (POUNDS)	FREE VERTICAL MOVEMENT (INCHES)	HORIZONTAL MOVEMENT (INCHES)		TYPE	PRELIMINARY HANGER SELECTION SPECIFICATION	SWING	
			X	Z			LENGTH (FEET)	ANGLE (DEG)
115F	1331.	.40	.37	.29	VSH	1 - SHORT RANGE SPRING, SPRING RATE = 520 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1532 LBS SPRING LOAD IN THE OPERATING CONDITION = 1331 LBS	N/A	N/A
160H	1343.	.21	.20	.25	VSH	1 - SHORT RANGE SPRING, SPRING RATE = 520 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1453 LBS SPRING LOAD IN THE OPERATING CONDITION = 1343 LBS	N/A	N/A

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DYNAFLEX

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 *
 * STATIC SOLUTION ACCURACY CHECKS *
 *

EACH BASIC STATIC SOLUTION COMPRISING EACH LOAD OR LOADING COMBINATION
 SPECIFIED IN THIS RUN HAS BEEN SUBJECTED TO EQUILIBRIUM AND
 COMPATIBILITY CHECKS FOR ALL POINTS IN THE SYSTEM:

LOADING = @FREE@ THERMAL

 STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

LOADING = @RESTRAINED@ WEIGHT (+UNIF)

 STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

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DYNAFLEX

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FOREWORD

THE FOLLOWING REPORT WAS GENERATED BY THE DYNAFLEX PIPING ANALYSIS PROGRAM. THE PROGRAM ACCOMMODATES THE WIDEST RANGE OF PRACTICAL SITUATIONS ENCOUNTERED IN MODERN PIPING SYSTEMS INCLUDING DYNAMIC AS WELL AS THERMAL, WEIGHT AND PRESSURE EFFECTS.

FOR FURTHER INFORMATION OR PROMPT ASSISTANCE IN USING THE DYNAFLEX PROGRAM, PLEASE CONTACT YOUR LOCAL COMPUTER CENTER REPRESENTATIVE OR:

ENGINEERING SERVICES MANAGER
ADTOM COMPUTING CORPORATION
1 METRO PLAZA
505 THORNALL STREET
EDISON, N.J. 08817

THE STRESS FORMULATION OF
ANSI B31.1 - 1977
INCLUDING THE LATEST MANDATORY UPDATES
HAS BEEN APPLIED IN THIS ANALYSIS

THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

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*****
*
*
* STEARNS - ROGER CORP
* -----
*
* DUE 10MW SOLAR PILOT PLANT - C-21700
*
* TSS OIL CHARGING(X-TO-5-A-1)
*
*
* 77 5/80
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*
*
*****

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PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
JOB - TSS OIL CHARGING(X-TO-5-A-1)

DATE 7/ 3/80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP, 7/ 3/80, PROJ.DOE 10M W SOLAR PILOT PLANT - C-21700, JOBTSS OIL C HARGING(X-TO-5-A-1)	1
2	GEN								APPLY B31.1-1973	2
3			105	110			4-0	L	MAT=LCS, DD=8.625, WT=.322, UNIF=25.3, TEMP=525.	3
4				115		10-10-1/2		L		4
5				120			17-6	L		5
6				125		-2-0			SIF=2.44	6
7				130	6-9					7
8				135	18-0					8
9				140	18-0					9
10				145	19-0					10
11				150	17-3				SIF=2.44	11
12				155		-2-10-5/16		L		12
13				160			-17-6	L		13
14				161		-1-0				14
15				162		-1-3-1/2			RIGID, WEIGHT=243.	15
16				165		-3-4-3/16		L		16
17				170			-4-0			17
18			125	175	-2-3				DD=4.50, WT=.237, TEMP=70., UNIF=0.0	18
19			150	180	1-9					19
20	ANC	105								20
21	ANC	170								21
22	RAD	130				RIGID				22
23	RAD	135				RIGID				23
24	RAD	140				RIGID				24
25	RAD	145				RIGID				25
26	RAD	175				RIGID				26
27	RAD	180				RIGID				27
28	CCC	170		79-0		-0-0-1/2	0-0			28
29	DYL								SPEC 1(FRE7G,.17.013, .25/.082,2.5/.634, .97.531,33.7.125),	29

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INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
30	DMO								:SPEC 2(FRF/G,.17.009, :.25/.055,3.5/.638, :9./531,33./125), :SHOCK 1(X/1.0SPEC 1), :SHOCK 2(Z/1.0 SPEC 1), :SHOCK 3(Y/1.SPEC2), :SHOCK 4(X/1.SPEC1, :Y/1.SPEC2,Z/1.SPEC1), :LOG,1.92 :LUMP POINTS(AUTOMATIC :PAX SPACING=5-0 :EXCLUDE ALL M NODES) :MODE CUTOFF=50, :FREQUENCY CUTOFF=33 :SHOCK 1,SHOCK 2, :SHOCK 3,SHOCK 4	30
31	OUT									31

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STEAMNS - ROGER CORP

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PROJECT - DOE 10MW SOLAR PILOT PLANT - C-21700
JOB - TSS OIL CHARGING(X-TU-5-A-1)

DATE 7/ 3/80

*
* EDITED PIPING SYSTEM DESCRIPTION *

*

EXPLANATORY NOTES

IN THE EDITED PIPING SYSTEM DESCRIPTION:

- 138
- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
 - (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
 - (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCULATIONS IS ASSUMED TO BE .25 INCHES.
 - (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
 - (8) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS ON RIGID RESTRAINTS (RAD,RAR) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR,MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (RAD,RAR) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASM) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
 - (14) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
 - (15) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 4

GENERAL DATA

COORDINATES OF ALL POINTS OF THE SYSTEM ARE WITH RESPECT TO POINT 105, WHICH IS THE ORIGIN

MATERIALS USED (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)

LCS - LOW CARBON STEEL

YOUNGS MODULUS AT AMBIENT TEMPERATURE = 27,900,000. PSI

POISSONS RATIO = .30

DENSITY = 490. POUNDS PER CUBIC FOOT

SHOCK AND SPECTRUM DATA

MODE CUTOFF SET AT 50

FREQUENCY CUTOFF SET AT 33.00 CPS

SPECTRUM 1

(LOGARITHMIC INTERPOLATION)

SPECTRUM 2

(LOGARITHMIC INTERPOLATION)

FREQUENCY	G
---CPS---	-----
.10	.01
.25	.08
2.50	.64
9.00	.53
33.00	.13

FREQUENCY	G
---CPS---	-----
.10	.01
.25	.06
3.50	.64
9.00	.53
33.00	.13

SHOCK SPECIFICATIONS

SHOCK 1 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD.

CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

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DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 5

SHOCK 2 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD.

CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 3 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD.

CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 4 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION AND

100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION AND

100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD.

CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

LOADING CONDITIONS ANALYZED

- SHOCK 1
- SHOCK 2
- SHOCK 3
- SHOCK 4

POINT TYPE	ELEMENT DESIGNATION NO.	POINT LOC.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE WALL		TEMP		DIST. LOADS (LBS PER FT)	
			X	Y	Z				DIAMETER (IN)	THICK (IN)	MATL (FAHR)	PRESS (PSI)	WT.	UNIF
ANCHR		--105	0.00	0.00	0.00				:	:	:	:	:	:

* NOTES PERTAINING TO POINT 105 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

DIST. LOADS
(LBS PER FT)

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	WT. UNIF
								8.625	.322	100	525	28.6	25.3
BR PT		>-125	0.00	8.88	21.50								
	STRAIGHT - (					3.38							
		>-125.1	3.38	8.88	21.50								
	STRAIGHT - (					3.38							
		>-130	6.75	8.88	21.50								
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 130											
	(	IN DIRECTION Y											
	STRAIGHT - (					4.50							
		>-130.1	11.25	8.88	21.50								
	STRAIGHT - (					4.50							
		>-130.2	15.75	8.88	21.50								
	STRAIGHT - (					4.50							
		>-130.3	20.25	8.88	21.50								
	STRAIGHT - (					4.50							
		>-135	24.75	8.88	21.50								
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 135											
	(	IN DIRECTION Y											
	STRAIGHT - (					4.50							
		>-135.1	29.25	8.88	21.50								
	STRAIGHT - (					4.50							
		>-135.2	33.75	8.88	21.50								
	STRAIGHT - (					4.50							
		>-135.3	38.25	8.88	21.50								
	STRAIGHT - (					4.50							
		>-140	42.75	8.88	21.50								
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 140											
	(	IN DIRECTION Y											
	STRAIGHT - (					4.75							
		>-140.1	47.50	8.88	21.50								
	STRAIGHT - (4.75							
		>-140.2	52.25	8.88	21.50								
	STRAIGHT - (4.75							
		>-140.3	57.00	8.88	21.50								

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE WALL		TEMP (DEG)	DISY. LOADS (LBS PER FT)		
			X	Y	Z				DIAMETER (IN)	WALL THICK (IN)		MATL	PRESS (PSI)	WT.	UNIF
		>-140.3	57.00	8.88	21.50				8.625	.322	LCS	525.	28.6	25.3
	STRAIGHT	-					4.75							
		>-145	61.75	8.88	21.50									
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 145 IN DIRECTION Y												
	STRAIGHT	-					4.31							
		* STRESS INTENSIFICATION SPECIFIED AT POINT 150 STRESS INTENSIFICATION FACTOR = 2.44												
		>-145.1	66.06	8.88	21.50									
	STRAIGHT	-					4.31							
		>-145.2	70.38	8.88	21.50									
	STRAIGHT	-					4.31							
		>-145.3	74.69	8.88	21.50									
	STRAIGHT	-					4.31							
BR PT		>-150	79.00	8.88	21.50									
	STRAIGHT	-					1.86							
		>-155N	79.00	7.02	21.50									
141	BEND	-	155N	79.00	6.31	21.21	1.00	1.57	90.000					
		>-155F	79.00	6.02	20.50									
	STRAIGHT	-					3.88							
		>-155F.1	79.00	6.02	16.63									
	STRAIGHT	-					3.88							
		>-155F.2	79.00	6.02	12.75									
	STRAIGHT	-					3.88							
		>-155F.3	79.00	6.02	8.87									
	STRAIGHT	-					3.88							
		>-160N	79.00	6.02	5.00									
	BEND	-	160N	79.00	5.72	4.29	1.00	1.57	90.000					
		>-161	79.00	5.02	4.00									

* NOTES PERTAINING TO POINT 161 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
		>-161	79.00	5.02	4.00			8.625	.322	LCS	525.	29.6	25.3
		(* POINT 161 IS EQUIVALENT TO POINT 160F											
	RIGID	- (				1.71		N/A	N/A			N/A	N/A
		(* WEIGHT OF ELEMENT = 243. POUNDS											
		>-162	79.00	3.31	4.00								
	STRAIGHT	- (					2.35						
		>-165N	79.00	.96	4.00								
	BEND	- (165M	79.00	.25	3.71	1.00	1.57	90.000					
		>-165F	79.00	-.04	3.00								
	STRAIGHT	- (					3.00						
	ANCHR	--170	79.00	-.04	0.00								
		* CONTROL COORDINATES OF POINT 170, IN FEET :											
		X = 79.00, Y = -.04, Z = 0.00											
		RESULTANT DIFFERENCE IS ZERO											
		BR PT --125	0.00	8.88	21.50								
	STRAIGHT	- (					2.25	4.500	.237		70.	10.8	0.0
		(* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 70.											
		(DEGREES FAHRENHEIT IS 0.00 INCHES PER 100 FEET											
		(* A UNIFORM DISTRIBUTED LOAD OF .00 PLF IS ACTING											
		(IN THE -Y DIRECTION.											
		TERM --175	-2.25	8.88	21.50								
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 175											
		IN DIRECTION Y											
		BR PT --150	79.00	8.88	21.50								

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MATERIAL	DIST. LOADS (LBS PER FT)		
			X	Y	Z							WT.	UP IF	
HR PT		--150	79.00	8.88	21.50				4.500	.237	LCS	70.	10.8	0
	STRAIGHT - (						1.75							
TERM		--180	80.75	8.88	21.50									
	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 180 IN DIRECTION Y													

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DYNAFLEX

PAGE 11

 * LUMPED DYNAMIC MODEL *

 *

EXPLANATORY NOTES:

- (1) THE MASS OF THE SYSTEM IS LUMPED AT THE POINTS SHOWN BELOW. FRACTIONAL LOCATION NUMBERS, IF ANY, RESULT FROM ADDITIONAL MASS POINTS LOCATED BY THE PROGRAM BASED ON THE MAXIMUM LUMP SPACING CRITERION GIVEN IN THE INPUT DATA.
- (2) THE MASS AT A POINT IS A COMBINATION OF DISTRIBUTED MASS LUMPED IN A LINEAR FASHION PLUS ANY ADDITIONAL CONCENTRATED MASS INPUT BY THE USER (SHOWN IN PARENTHESES).
- (3) ROTATIONAL DEGREES OF FREEDOM ARE NOT INCLUDED IN THE MODEL UNLESS SPECIFICALLY ADDED BY THE USER. ALL THREE DISPLACEMENT DEGREES OF FREEDOM ARE AUTOMATICALLY DELETED AT ANCHORS. THE DEGREE OF FREEDOM ASSOCIATED WITH A RIGID RESTRAINT OR SNUBBER ORIENTED IN THE X, Y OR Z DIRECTION IS ALSO DELETED.

LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
					X	Y	Z
105	81.						
110N	127.	X	Y	Z	0.	0.	0.
110F	162.	X	Y	Z	0.	0.	0.
110F.1	239.	X	Y	Z	0.	0.	0.
115N	162.	X	Y	Z	0.	0.	0.
115F	147.	X	Y	Z	0.	0.	0.
115F.1	209.	X	Y	Z	0.	0.	0.
115F.2	209.	X	Y	Z	0.	0.	0.
115F.3	209.	X	Y	Z	0.	0.	0.
120N	147.	X	Y	Z	0.	0.	0.
120F	69.	X	Y	Z	0.	0.	0.
125	130.	X	Y	Z	0.	0.	0.
125.1	182.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

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LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION		MOMENT OF INERTIA (LB - IN X IN)			
		X	Y	Z	X	Y	Z
130	212.	X		Z	0.	0.	0.
130.1	242.	X	Y	Z	0.	0.	0.
130.2	242.	X	Y	Z	0.	0.	0.
130.3	242.	X	Y	Z	0.	0.	0.
135	242.	X		Z	0.	0.	0.
135.1	242.	X	Y	Z	0.	0.	0.
135.2	242.	X	Y	Z	0.	0.	0.
135.3	242.	X	Y	Z	0.	0.	0.
140	249.	X		Z	0.	0.	0.
140.1	256.	X	Y	Z	0.	0.	0.
140.2	256.	X	Y	Z	0.	0.	0.
140.3	256.	X	Y	Z	0.	0.	0.
145	244.	X		Z	0.	0.	0.
145.1	232.	X	Y	Z	0.	0.	0.
145.2	232.	X	Y	Z	0.	0.	0.
145.3	232.	X	Y	Z	0.	0.	0.
150	176.	X	Y	Z	0.	0.	0.
155N	92.	X	Y	Z	0.	0.	0.
155F	147.	X	Y	Z	0.	0.	0.
155F.1	209.	X	Y	Z	0.	0.	0.
155F.2	209.	X	Y	Z	0.	0.	0.
155F.3	209.	X	Y	Z	0.	0.	0.
160N	147.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

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LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
					X	Y	Z
161	185.	X	Y	Z	0.	0.	0.
162	206.	X	Y	Z	0.	0.	0.
165N	106.	X	Y	Z	0.	0.	0.
165F	123.	X	Y	Z	0.	0.	0.
170	81.				0.	0.	0.
175	12.	X		Z	0.	0.	0.
180	9.	X		Z	0.	0.	0.

NUMBER OF DYNAMIC DEGREES OF FREEDOM = 117, TOTAL MASS OF SYSTEM = 7846. POUNDS

 * FREQUENCIES, PERIODS OF VIBRATION AND MASS PARTICIPATION FACTORS *

MASS PARTICIPATION FACTORS

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS		
			X	Y	Z
1	.95136	1.05113	3.97087610	.00187664	.28459377
2	1.06383	.94000	.28689243	.03662330	3.20668334
3	2.49116	.40142	.34830572	.12763847	1.09971707
4	3.73143	.26799	.63557245	.20438930	1.87377365
5	5.22683	.19132	.75407632	.17158769	1.07660999
6	5.78879	.17275	.30547076	.29869040	1.26009884
7	7.71827	.12956	.57132522	.30470316	.52598430
8	9.30726	.10744	1.02285355	.13500014	.11471685
9	11.87861	.08418	.16469898	.97905279	.21152927
10	12.64458	.07909	.04539385	.83199852	.12951040
11	15.18552	.06585	.03301920	.02500425	.03853239
12	15.63494	.06396	.08802007	1.71752282	.37356947
13	16.79564	.05954	.02630380	.94560415	.05584490
14	19.16495	.05218	.04672865	.15887429	.18540591
15	20.79447	.04809	.09292391	.40985531	.00867823
16	22.36769	.04471	.23602194	.11755378	.07005878
17	23.77205	.04207	.20876923	.33524746	.00262566
18	25.80189	.03876	.13999168	1.17521588	.14250416
19	26.97288	.03707	.06940904	2.01060171	.03915556
20	29.26532	.03417	.01509949	.40455282	.13894241
21	31.44762	.03180	.04048847	.49618125	.13714687

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NOTE:

SECTION 3.7.2 OF THE U.S. NUCLEAR REGULATORY COMMISSION STANDARD REVIEW PLAN DATED JUNE, 1975 STATES THAT AN ADEQUATE NUMBER OF DEGREES OF FREEDOM IN DYNAMIC MODELING MAY BE TAKEN EQUAL TO TWICE THE NUMBER OF MODES WITH FREQUENCIES LESS THAN 33 CPS.

FOR THIS ANALYSIS THE RATIO OF DYNAMIC DEGREES OF FREEDOM TO FREQUENCIES LESS THAN 33 CPS = 5.57

THE OLD ELASTIC MODULUS WAS USED IN CALCULATING THE NATURAL FREQUENCIES OF THE SYSTEM IN THIS ANALYSIS.

DYNAFLEX

MODE ORTHOGONALITY CHECK

ON DIAGONAL TERMS: MAX. = 1.00000 MIN. = 1.00000

OFF DIAGONAL TERMS: MAX. = 8.63626 X 10⁻¹⁴ MIN. = -1.12287 X 10⁻¹³

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
105	810.	57.	293.	863.	1411.	8287.	5346.	9962.	
170	878.	64.	294.	928.	712.	10921.	3756.	11571.	
RESTRAINTS:									
130	0.	299.	0.	299.	0.	0.	0.	0.	
135	0.	42.	0.	42.	0.	0.	0.	0.	
140	0.	82.	0.	82.	0.	0.	0.	0.	
145	0.	289.	0.	289.	0.	0.	0.	0.	

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
175	0.	246.	0.	246.	0.	0.	0.	0.
180	0.	208.	0.	208.	0.	0.	0.	0.

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 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 * ----- *
 * *****

THE MAXIMUM STRESS OF 12,006. OCCURS AT POINT 165F

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELFM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	STR - (	-- 105	293.	812.	5346.	1411.	8287.	1.00	1.00	16.81	7112.
	>- 110N		293.	811.	5346.	1580.	5899.	2.44	2.44	16.81	10598.
BEND	- (	110M	248.	826.	973.	1534.	7328.	2.44	2.44	16.81	9858.
	>- 110F		58.	861.	5113.	1343.	4537.	2.44	2.44	16.81	9096.
	STR - (	-- 110F.1	61.	841.	5113.	960.	67.	1.00	1.00	16.81	3714.
	>- 115N		62.	822.	5113.	1199.	2573.	2.44	2.44	16.81	7635.
BEND	- (	115M	231.	791.	5645.	1368.	1330.	2.44	2.44	16.81	7781.
	>- 115F		266.	780.	3350.	1403.	4347.	2.44	2.44	16.81	7397.
	STR - (	-- 115F.1	238.	738.	3350.	1162.	1481.	1.00	1.00	16.81	2743.
	>- 115F.2		238.	738.	3350.	910.	1560.	1.00	1.00	16.81	2717.
	STR - (	-- 115F.3	218.	657.	3350.	654.	4192.	1.00	1.00	16.81	3859.
	>- 120N		214.	617.	3350.	422.	6696.	2.44	2.44	16.81	9792.
BEND	- (	120M	124.	641.	7268.	326.	2836.	2.44	2.44	16.81	10196.
	>- 120F		75.	649.	7304.	166.	2756.	2.44	2.44	16.81	10196.
BR PT	STR - (	-- 125	76.	630.	7304.	2192.	73.	2.44	2.44	16.81	9964.
BR PT	STR - (	-- 125	552.	351.	73.	1651.	7305.	2.44	2.44	16.81	9785.
	>- 125.1		501.	351.	73.	708.	6670.	1.00	1.00	16.81	4769.
	STR - (	-- 130	441.	213.	73.	239.	6046.	1.00	1.00	16.81	4320.
	>- 130.1		441.	213.	73.	150.	5222.	1.00	1.00	16.81	3730.
	STR - (	-- 130.2	372.	212.	73.	63.	4386.	1.00	1.00	16.81	5132.
	>- 130.3		305.	216.	73.	35.	3525.	1.00	1.00	16.81	2517.
	STR - (-- 135	238.	223.	73.	124.	2647.	1.00	1.00	16.81	1893.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL: STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR -(	>- 135	238.	223.	73.	124.	2647.	1.00	1.00	16.81	1893.
	STR -(	>- 135.1	175.	229.	73.	31.	1801.	1.00	1.00	16.81	1267.
	STR -(	>- 135.2	117.	229.	73.	71.	1135.	1.00	1.00	16.81	813.
	STR -(	>- 135.3	83.	226.	73.	163.	1067.	1.00	1.00	16.81	772.
	STR -(	>- 140	98.	221.	73.	257.	1639.	1.00	1.00	16.81	1185.
	STR -(	>- 140.1	150.	220.	73.	35.	2441.	1.00	1.00	16.81	1744.
	STR -(	>- 140.2	215.	206.	73.	319.	3249.	1.00	1.00	16.81	2331.
	STR -(	>- 140.3	285.	185.	73.	604.	3987.	1.00	1.00	16.81	2879.
	STR -(	>- 145	356.	162.	73.	887.	4616.	1.00	1.00	16.81	3356.
153	STR -(	>- 145.1	424.	267.	73.	105.	5090.	1.00	1.00	16.81	3635.
	STR -(	>- 145.2	490.	268.	73.	1091.	5497.	1.00	1.00	16.81	4001.
	STR -(	>- 145.3	556.	273.	73.	2073.	5875.	1.00	1.00	16.81	4448.
BR PT		-- 150	622.	280.	73.	3051.	6271.	2.44	2.44	16.81	9112.
BR PT	STR -(	-- 150	85.	697.	6271.	3390.	73.	2.44	2.44	16.81	9313.
		>- 155N	84.	723.	6271.	323.	2158.	2.44	2.44	16.81	8670.
BEND -(		>- 155M	180.	705.	3147.	427.	5452.	2.44	2.44	16.81	8239.
		>- 155F	180.	705.	1486.	431.	5575.	2.44	2.44	16.81	7555.
	STR -(	>- 155F.1	205.	784.	1486.	262.	2751.	1.00	1.00	16.81	2240.
	STR -(	>- 155F.2	224.	813.	1486.	361.	660.	1.00	1.00	16.81	1189.
	STR -(	>- 155F.3	245.	835.	1486.	570.	3493.	1.00	1.00	16.81	2740.
	BEND -(	>- 160N	261.	847.	1486.	787.	6673.	2.44	2.44	16.81	8985.
		>- 160M	226.	857.	5990.	750.	4286.	2.44	2.44	16.81	9668.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND	(	160M	226.	957.	5990.	750.	4286.	2.44	2.44	16.81	9668.
)										
RIGID	(	>- 161	66.	884.	7505.	583.	647.	2.44	2.44	16.81	9865.
)										
STR	(	>- 162	64.	921.	7505.	833.	110.	1.00	1.00	16.81	5391.
)										
	(	>- 165M	64.	925.	7505.	581.	2880.	2.44	2.44	16.81	10524.
)										
BEND	(	165M	243.	895.	3138.	774.	7905.	2.44	2.44	16.81	11152.
)										
	(	>- 165F	294.	879.	3756.	829.	8351.	2.44	2.44	16.81	12006.
)										
ANCHR	--	170	294.	880.	3756.	712.	10921.	1.00	1.00	16.81	8261.
BR PT	--	125	3.	246.	0.	553.	5.	2.44	2.44	3.21	3781.
	STR	(								8.50	1428.
TERM	--	175	3.	246.	0.	0.	0.	1.00	1.00	3.21	0.
										8.50	
BR PT	--	150	3.	208.	0.	364.	2.	2.44	2.44	3.21	2485.
	STR	(								8.50	938.
TERM	--	180	3.	208.	0.	0.	0.	1.00	1.00	3.21	0.
										8.50	

REVISE 4" ϕ DUMMY LEGS TO 6" STD. WT. PIPE

G.H. MAY 7-8-80

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DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	.000	.000	.000	.000	.000	.000
	STRAIGHT - (		(.0)	(.0)	(.0)			
	>= 110N		.029	.006	.000	.018	.087	.085
	BEND - (	110M	.060	.011	.003	.055	.231	.159
	(		(3.1)	(3.7)	(.8)			
	>= 110F		.110	.015	.014	.089	.301	.287
	STRAIGHT - (		(8.6)	(4.8)	(3.9)			
	>= 110F.1		.405	.015	.105	.102	.421	.336
	STRAIGHT - (		(57.2)	(4.8)	(29.1)			
	>= 115N		.717	.015	.197	.092	.541	.322
	BEND - (	115M	.705	.019	.208	.061	.562	.295
	(		(118.6)	(5.8)	(57.0)			
	>= 115F		.901	.026	.212	.028	.634	.298
	STRAIGHT - (		(119.5)	(7.4)	(57.8)			
	>= 115F.1		1.433	.040	.212	.008	.679	.230
	STRAIGHT - (		(106.9)	(11.8)	(57.8)			
	>= 115F.2		1.986	.040	.212	.008	.679	.161
	STRAIGHT - (		(98.5)	(12.5)	(57.8)			
	>= 115F.3		2.521	.028	.212	.021	.635	.093
	STRAIGHT - (		(98.0)	(9.5)	(57.8)			
	>= 120N		3.004	.007	.212	.029	.550	.028
	BEND - (	120M	(107.8)	(4.0)	(57.8)			
	(		3.074	.003	.214	.037	.434	.042
	>= 120F		(110.2)	(3.1)	(58.0)			
	STRAIGHT - (		3.094	.002	.219	.042	.398	.025
	>= 125		(111.1)	(2.8)	(58.3)			
BRANCH PT.		-- 125	3.090	.002	.228	.042	.360	.015
			(111.0)	(2.8)	(58.9)			
BRANCH PT.		-- 125	3.090	.002	.228	.042	.360	.015

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

PAGE 23

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.		-- 125	3.090 (111.0)	.002 (2.8)	.228 (58.9)	.042	.360	.015
	STRAIGHT - (	>- 125.1	3.090 (111.0)	.003 (2.5)	.164 (45.5)	.041	.267	.002
	STRAIGHT - (	>- 130	3.090 (111.0)	.000 (.0)	.263 (47.2)	.040	.184	.004
	STRAIGHT - (	>- 130.1	3.090 (111.0)	.002 (4.6)	.371 (62.3)	.039	.094	.001
	STRAIGHT - (	>- 130.2	3.090 (111.0)	.002 (6.5)	.410 (70.5)	.038	.061	.001
	STRAIGHT - (	>- 130.3	3.090 (111.0)	.001 (3.9)	.391 (65.9)	.036	.102	.001
	STRAIGHT - (	>- 135	3.090 (111.0)	.000 (.0)	.341 (55.7)	.035	.148	.001
	STRAIGHT - (	>- 135.1	3.090 (111.0)	.001 (3.9)	.310 (53.7)	.034	.182	.002
	STRAIGHT - (	>- 135.2	3.090 (111.0)	.002 (6.4)	.351 (60.7)	.033	.200	.001
	STRAIGHT - (	>- 135.3	3.090 (111.0)	.003 (4.6)	.462 (64.1)	.032	.201	.001
	STRAIGHT - (	>- 140	3.090 (111.0)	.000 (.0)	.600 (59.1)	.031	.185	.005
155	STRAIGHT - (	>- 140.1	3.090 (111.0)	.006 (4.8)	.737 (52.7)	.030	.152	.007
	STRAIGHT - (	>- 140.2	3.090 (111.0)	.012 (7.3)	.839 (59.0)	.029	.104	.004
	STRAIGHT - (	>- 140.3	3.090 (111.0)	.012 (5.3)	.886 (73.9)	.028	.055	.005
	STRAIGHT - (	>- 145	3.090 (110.9)	.000 (.0)	.861 (62.7)	.027	.077	.020
	STRAIGHT - (	>- 145.1	3.090 (110.9)	.023 (5.8)	.765 (80.1)	.027	.152	.027
	STRAIGHT - (	>- 145.2	3.090 (110.9)	.043 (9.8)	.591 (69.2)	.026	.240	.016
	STRAIGHT - (	>- 145.3	3.090 (110.9)	.047 (9.2)	.333 (56.0)	.026	.337	.012
BRANCH PT.		-- 150	3.090 (110.9)	.018 (4.5)	.061 (50.5)	.026	.441	.057
BRANCH PT.		-- 150	3.090 (110.9)	.018 (4.5)	.061 (50.5)	.026	.441	.057
	STRAIGHT - (	>- 155N	3.063 (109.9)	.018 (4.5)	.056 (53.0)	.024	.502	.078
	BEND - (155M	3.014 (108.1)	.017 (5.4)	.055 (54.9)	.017	.559	.154
		>- 155F	2.911	.016	.054	.011	.684	.202

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	STRAIGHT -	>= 155F	2.911 (104.4)	.016 (8.1)	.054 (55.8)	.011	.684	.202
	STRAIGHT -	>= 155F.1	2.326 (99.4)	.015 (20.6)	.054 (55.8)	.009	.748	.232
	STRAIGHT -	>= 155F.2	1.708 (118.6)	.019 (27.0)	.054 (55.7)	.006	.767	.263
	STRAIGHT -	>= 155F.3	1.094 (138.6)	.019 (25.1)	.054 (55.7)	.004	.737	.293
	BEND -	>= 160N	.525 (146.5)	.013 (14.9)	.054 (55.7)	.013	.657	.323
	BEND -	160M	.419 (139.7)	.010 (11.1)	.053 (54.0)	.031	.526	.290
	RIGID -	>= 161	.348 (122.5)	.008 (8.8)	.047 (47.8)	.047	.476	.264
	RIGID -	>= 162	.254 (81.6)	.008 (8.8)	.030 (30.7)	.047	.473	.264
	STRAIGHT -	>= 165N	.127 (27.1)	.008 (8.8)	.007 (7.3)	.045	.380	.246
	BEND -	165M	.077 (12.8)	.006 (6.6)	.001 (1.5)	.029	.301	.136
157	STRAIGHT -	>= 165F	.039 (6.5)	.003 (3.7)	.000 (.0)	.009	.118	.060
ANCHOR		-- 170	.000 (.0)	.000 (.0)	.000 (.0)	.000	.000	.000
BRANCH PT.	STRAIGHT -	-- 125	3.090 (111.0)	.002 (2.8)	.228 (58.9)	.042	.360	.015
TERMINAL		-- 175	3.090 (111.0)	.000 (.0)	.371 (72.7)	.042	.360	.011
BRANCH PT.	STRAIGHT -	-- 150	3.090 (110.9)	.018 (4.5)	.061 (50.5)	.026	.441	.057
TERMINAL		-- 180	3.090	.000	.194	.026	.441	.045

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
105	445.	181.	887.	1008.	4229.	1213.	3113.	5389.	
158 170	453.	211.	889.	1020.	1911.	2324.	2586.	3967.	
RESTRAINTS:									
130	0.	173.	0.	173.	0.	0.	0.	0.	
135	0.	17.	0.	17.	0.	0.	0.	0.	
140	0.	37.	0.	37.	0.	0.	0.	0.	
145	0.	139.	0.	139.	0.	0.	0.	0.	

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM
ON THE ANCHORS AND RESTRAINTS.

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
175	0.	194.	0.	194.	0.	0.	0.	0.
180	0.	184.	0.	184.	0.	0.	0.	0.

 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 9257. OCCURS AT POINT 150

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELFM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 105	887.	479.	3113.	4229.	1213.	1.00	1.00	16.81	3847.
	STR -(
		>- 110N	887.	479.	3113.	4763.	533.	2.44	2.44	16.81	7463.
	BEND -(
		>- 110M	755.	668.	2512.	4631.	1763.	2.44	2.44	16.81	7254.
	STR -(
		>- 110F	182.	992.	821.	4056.	2670.	2.44	2.44	16.81	6431.
	STR -(
		>- 110F.1	186.	987.	821.	726.	184.	1.00	1.00	16.81	793.
	STR -(
		>- 115N	194.	880.	621.	3626.	1077.	2.44	2.44	16.81	5054.
	BEND -(
		>- 115M	703.	563.	614.	4136.	1482.	2.44	2.44	16.81	5793.
	STR -(
		>- 115F	804.	407.	1435.	4235.	1101.	2.44	2.44	16.81	6013.
	STR -(
		>- 115F.1	764.	388.	1435.	3472.	2237.	1.00	1.00	16.81	3122.
	STR -(
		>- 115F.2	712.	387.	1435.	2671.	3360.	1.00	1.00	16.81	3231.
	STR -(
		>- 115F.3	669.	401.	1435.	1845.	4503.	1.00	1.00	16.81	3622.
	STR -(
		>- 120N	617.	416.	1435.	1071.	5696.	2.44	2.44	16.81	7796.
	BEND -(
		>- 120M	337.	663.	5047.	775.	3385.	2.44	2.44	16.81	7999.
	STR -(
		>- 120F	235.	706.	6013.	322.	1236.	2.44	2.44	16.81	8027.
BR PT		-- 125	236.	700.	6013.	1108.	360.	2.44	2.44	16.81	8002.
	STR -(
		>- 125.1	344.	622.	360.	927.	6012.	2.44	2.44	16.81	7961.
	STR -(
		>- 130	345.	606.	360.	194.	2454.	1.00	1.00	16.81	1776.
	STR -(
		>- 130.1	345.	554.	360.	140.	1650.	1.00	1.00	16.81	1210.
	STR -(
		>- 130.2	347.	501.	360.	87.	3128.	1.00	1.00	16.81	2249.
	STR -(
		>- 130.3	348.	429.	360.	36.	4787.	1.00	1.00	16.81	3427.
	STR -(
		>- 135	350.	348.	360.	49.	6118.	1.00	1.00	16.81	4375.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE			
	STR -(	>- 135	350.	348.	360.	49.	6118.	1.00	1.00	16.81		4375.
	STR -(	>- 135.1	353.	276.	360.	45.	7032.	1.00	1.00	16.81		5027.
	STR -(	>- 135.2	355.	232.	360.	70.	7526.	1.00	1.00	16.81		5379.
	STR -(	>- 135.3	358.	227.	360.	93.	7635.	1.00	1.00	16.81		5457.
	STR -(	>- 140	362.	248.	360.	117.	7406.	1.00	1.00	16.81		5294.
	STR -(	>- 140.1	366.	279.	360.	42.	6839.	1.00	1.00	16.81		4889.
	STR -(	>- 140.2	370.	313.	360.	178.	5956.	1.00	1.00	16.81		4262.
	STR -(	>- 140.3	374.	357.	360.	308.	4769.	1.00	1.00	16.81		3422.
	STR -(	>- 145	379.	415.	360.	437.	3353.	1.00	1.00	16.81		2427.
	STR -(	>- 145.1	384.	492.	360.	60.	2263.	1.00	1.00	16.81		1636.
	STR -(	>- 145.2	394.	608.	360.	522.	2619.	1.00	1.00	16.81		1924.
	STR -(	>- 145.3	399.	648.	360.	987.	4490.	1.00	1.00	16.81		3292.
BR PT		-- 150	399.	648.	360.	1445.	6927.	2.44	2.44	16.81		9257. **
BR PT	STR -(	-- 150	258.	773.	6927.	1279.	360.	2.44	2.44	16.81		9215. **
		>- 155N	257.	784.	6927.	948.	539.	2.44	2.44	16.81		9156. **
BEND -(		155M	647.	511.	4648.	1344.	4983.	2.44	2.44	16.81		9069. **
	STR -(	>- 155F	670.	480.	178.	1370.	6524.	2.44	2.44	16.81		8707. **
	STR -(	>- 155F.1	721.	485.	178.	590.	4948.	1.00	1.00	16.81		3560.
	STR -(	>- 155F.2	721.	485.	178.	821.	3347.	1.00	1.00	16.81		2463.
	STR -(	>- 155F.3	796.	490.	178.	1614.	1732.	1.00	1.00	16.81		1695.
	STR -(	>- 160N	826.	493.	178.	2428.	495.	2.44	2.44	16.81		3244.
REND -(		160M	735.	621.	471.	2333.	386.	2.44	2.44	16.81		3149.

LOADING - SHOCK LOADING NO. 2

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE	LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				SIF	SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
		AXIAL	RESISTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF-PLANE BENDING	OUT-OF-PLANE BENDING			
BEND - (	160M	735.	621.	471.	2333.	386.	2.44	2.44	16.81		3149.
RIGID - (	161	220.	936.	679.	1811.	330.	2.44	2.44	16.81		2562.
STR - (	162	213.	994.	679.	1077.	342.	1.00	1.00	16.81		941.
BEND - (	165M	212.	967.	679.	1739.	2134.	2.44	2.44	16.81		3702.
RIGID - (	165M	766.	674.	1375.	2312.	2174.	2.44	2.44	16.81		4517.
STR - (	165F	849.	500.	2586.	2440.	1039.	2.44	2.44	16.81		4836.
ANCHR	170	889.	500.	2586.	1911.	2324.	1.00	1.00	16.81		2832.	
HR PT	125	1.	194.	0.	436.	14.	2.44	2.44	3.21		2982.	
TERM	175	1.	194.	0.	0.	0.	1.00	1.00	8.50		1126.	
HR PT	150	0.	184.	0.	322.	5.	2.44	2.44	3.21		2198.	
TERM	180	0.	184.	0.	0.	0.	1.00	1.00	8.50		830.	

REVISE 4" P DUMMY LEGS TO 6" STD. WTY. PIPE

G. H. MAY 7-8-80

 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	.000	.000	.000	.000	.000	.000
	STRAIGHT - (		(.0)	(.0)	(.0)			
	>- 110N		.003	.017	.000	.055	.008	.050
	(		(1.3)	(6.3)	(.0)			
	BEND - (	110M	.009	.033	.008	.167	.023	.070
	(		(4.1)	(10.5)	(2.2)			
	>- 110F		.024	.045	.041	.270	.036	.123
	STRAIGHT - (		(13.9)	(13.4)	(10.8)			
	>- 110F.1		.156	.045	.316	.308	.034	.154
	STRAIGHT - (		(100.4)	(13.5)	(31.7)			
	>- 115N		.301	.045	.594	.276	.042	.151
	(		(196.7)	(13.5)	(152.5)			
164	BEND - (	115M	.321	.059	.629	.184	.047	.124
	(		(209.7)	(16.5)	(161.2)			
	>- 115F		.325	.078	.638	.085	.067	.109
	STRAIGHT - (		(210.1)	(21.2)	(163.4)			
	>- 115F.1		.291	.121	.638	.024	.088	.083
	STRAIGHT - (		(172.1)	(35.3)	(163.5)			
	>- 115F.2		.246	.119	.638	.025	.124	.059
	STRAIGHT - (		(124.4)	(38.7)	(163.5)			
	>- 115F.3		.207	.084	.638	.060	.177	.044
	STRAIGHT - (		(70.0)	(29.7)	(163.5)			
	>- 120N		.247	.025	.638	.082	.250	.046
	(		(19.2)	(11.3)	(163.5)			
	BEND - (	120M	.271	.011	.644	.103	.351	.026
	(		(15.7)	(7.5)	(164.5)			
	>- 120F		.286	.005	.660	.114	.388	.012
	STRAIGHT - (		(16.8)	(5.9)	(166.8)			
BRANCH PT.		-- 125	.286	.005	.683	.114	.419	.008
	(		(17.8)	(5.9)	(169.9)			
BRANCH PT.		-- 125	.286	.005	.683	.114	.419	.008

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.		-- 125	.286	.005	.683	.114	.419	.008
	STRAIGHT - (		(17.8)	(5.9)	(169.9)			
	>- 125.1		.286	.003	.922	.108	.487	.004
	STRAIGHT - (		(17.8)	(3.8)	(140.9)			
	>- 130		.286	.000	1.234	.102	.528	.004
	STRAIGHT - (		(17.8)	(.0)	(123.9)			
	>- 130.1		.286	.003	1.706	.094	.545	.001
	STRAIGHT - (		(17.8)	(4.4)	(131.5)			
	>- 130.2		.286	.003	2.188	.087	.522	.001
	STRAIGHT - (		(17.9)	(6.1)	(160.7)			
	>- 130.3		.286	.002	2.637	.079	.464	.002
	STRAIGHT - (		(17.9)	(3.9)	(188.8)			
	>- 135		.286	.000	3.019	.072	.379	.002
	STRAIGHT - (		(17.9)	(.0)	(204.5)			
	>- 135.1		.286	.001	3.307	.066	.279	.001
	STRAIGHT - (		(17.9)	(4.6)	(205.1)			
	>- 135.2		.286	.002	3.484	.059	.184	.000
	STRAIGHT - (		(17.9)	(7.7)	(194.4)			
	>- 135.3		.286	.002	3.539	.054	.143	.001
	STRAIGHT - (		(17.9)	(6.0)	(180.5)			
	>- 140		.286	.000	3.470	.049	.200	.003
	STRAIGHT - (		(18.0)	(.0)	(173.0)			
	>- 140.1		.286	.004	3.267	.045	.302	.004
	STRAIGHT - (		(18.0)	(8.2)	(176.9)			
	>- 140.2		.286	.007	2.942	.043	.403	.002
	STRAIGHT - (		(18.0)	(12.6)	(188.3)			
	>- 140.3		.286	.006	2.514	.043	.486	.003
	STRAIGHT - (		(18.0)	(9.6)	(197.0)			
	>- 145		.286	.000	2.011	.045	.541	.010
	STRAIGHT - (		(18.0)	(.0)	(194.5)			
	>- 145.1		.286	.011	1.517	.048	.561	.014
	STRAIGHT - (		(18.0)	(10.8)	(179.5)			
	>- 145.2		.285	.022	1.020	.052	.545	.009
	STRAIGHT - (		(18.0)	(17.6)	(154.9)			
	>- 145.3		.285	.025	.556	.057	.490	.005
	STRAIGHT - (		(18.0)	(16.7)	(130.4)			
BRANCH PT.		-- 150	.285	.012	.185	.063	.392	.026
	STRAIGHT - (		(18.0)	(8.0)	(120.1)			
BRANCH PT.		-- 150	.285	.012	.185	.063	.392	.026
	STRAIGHT - (		(18.0)	(8.0)	(120.1)			
	>- 155N		.277	.012	.166	.060	.325	.033
	(		(18.2)	(8.0)	(120.1)			
	BEND - (	155M	.280	.010	.141	.035	.271	.083
	((19.6)	(9.2)	(121.4)			
	>- 155F		.290	.009	.160	.019	.142	.126

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	STRAIGHT	>- 155F	.290 (21.9)	.009 (12.9)	.160 (122.5)	.019	.142	.126
	STRAIGHT	>- 155F.1	.318 (34.2)	.025 (34.5)	.160 (122.4)	.023	.069	.128
	STRAIGHT	>- 155F.2	.302 (42.1)	.042 (48.2)	.160 (122.4)	.018	.060	.131
	STRAIGHT	>- 155F.3	.252 (43.9)	.050 (48.0)	.160 (122.3)	.006	.082	.133
	BEND	>- 160N	.185 (41.4)	.037 (30.9)	.160 (122.2)	.033	.090	.136
	BEND	(160M	.164 (38.7)	.029 (23.4)	.155 (118.6)	.089	.083	.135
	RIGID	>- 161	.140 (33.6)	.022 (18.3)	.138 (105.3)	.138	.079	.130
	STRAIGHT	>- 162	.043 (22.3)	.022 (18.3)	.089 (67.6)	.139	.079	.129
	BEND	>- 165N	.033 (7.4)	.022 (18.3)	.021 (15.9)	.132	.071	.114
	BEND	(165M	.016 (3.5)	.016 (13.6)	.004 (3.3)	.084	.053	.065
188	STRAIGHT	>- 165F	.008 (1.7)	.008 (7.3)	.000 (.1)	.027	.020	.041
ANCHOR		-- 170	.000 (.0)	.000 (.0)	.000 (.0)	.000	.000	.000
BRANCH PT.	STRAIGHT	-- 125	.286 (17.8)	.005 (5.9)	.683 (169.9)	.114	.419	.008
TERMINAL		-- 175	.286 (17.8)	.000 (.0)	.580 (192.8)	.114	.419	.016
BRANCH PT.	STRAIGHT	-- 150	.285 (18.0)	.012 (8.0)	.185 (120.1)	.063	.392	.026
TERMINAL		-- 180	.285	.000	.120	.063	.392	.034

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
105	51.	140.	71.	165.	505.	99.	363.	630.
170	53.	125.	133.	191.	497.	171.	222.	570.
RESTRAINTS:								
130	0.	76.	0.	76.	0.	0.	0.	0.
135	0.	119.	0.	119.	0.	0.	0.	0.
140	0.	119.	0.	119.	0.	0.	0.	0.
145	0.	105.	0.	105.	0.	0.	0.	0.

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
175	0.	81.	0.	81.	0.	0.	0.	0.
180	0.	140.	0.	140.	0.	0.	0.	0.

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 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 * ----- *
 * *

637. 110N
 THE MAXIMUM STRESS OF 1672. OCCURS AT POINT 150

REVISE 4" D DUMMY LEGS TO 6" STD. WT. PIPE
 G.H.MAY
 7-8-80

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS STF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 105	71.	149.	363.	505.	99.	1.00	1.00	16.81	450.
	STR -(
		>- 110N	71.	144.	363.	319.	66.	2.44	2.44	16.81	637.
	BEND -(	110M	128.	96.	314.	320.	181.	2.44	2.44	16.81	631.
		>- 110F	134.	88.	114.	287.	312.	2.44	2.44	16.81	573.
	STR -(
		>- 110F.1	125.	87.	114.	93.	73.	1.00	1.00	16.81	117.
		>- 115N	104.	59.	114.	307.	77.	2.44	2.44	16.81	440.
	BEND -(	115M	98.	69.	43.	323.	145.	2.44	2.44	16.81	465.
		>- 115F	53.	107.	100.	298.	131.	2.44	2.44	16.81	445.
	STR -(
		>- 115F.1	49.	97.	100.	346.	162.	1.00	1.00	16.81	282.
		>- 115F.2	48.	56.	100.	469.	183.	1.00	1.00	16.81	366.
170	STR -(
		>- 115F.3	54.	43.	100.	393.	221.	1.00	1.00	16.81	329.
	STR -(
		>- 120M	74.	97.	100.	175.	292.	2.44	2.44	16.81	463.
	BEND -(	120M	86.	86.	219.	139.	243.	2.44	2.44	16.81	463.
		>- 120F	90.	82.	316.	89.	126.	2.44	2.44	16.81	459.
	STR -(
BR PT		-- 125	94.	85.	316.	156.	31.	2.44	2.44	16.81	462.
	STR -(
		>- 125.1	35.	89.	31.	140.	205.	1.00	1.00	16.81	178.
	STR -(
		>- 130	33.	82.	31.	165.	313.	1.00	1.00	16.81	253.
	STR -(
		>- 130.1	32.	73.	31.	132.	444.	1.00	1.00	16.81	332.
	STR -(
		>- 130.2	31.	48.	31.	218.	426.	1.00	1.00	16.81	342.
	STR -(
		>- 130.3	30.	70.	31.	168.	360.	1.00	1.00	16.81	284.
	STR -(
		>- 135	30.	86.	31.	259.	417.	1.00	1.00	16.81	351.

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELFM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)		SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE			OUT-OF PLANE
	STR -(	>- 135	30.	86.	31.	259.	417.	1.00	1.00	16.81	351.
	STR -(	>- 135.1	29.	93.	31.	155.	493.	1.00	1.00	16.81	370.
	STR -(	>- 135.2	29.	55.	31.	315.	433.	1.00	1.00	16.81	383.
	STR -(	>- 135.3	29.	70.	31.	239.	290.	1.00	1.00	16.81	269.
	STR -(	>- 140	30.	101.	31.	274.	323.	1.00	1.00	16.81	303.
	STR -(	>- 140.1	31.	95.	31.	203.	447.	1.00	1.00	16.81	351.
	STR -(	>- 140.2	33.	64.	31.	378.	445.	1.00	1.00	16.81	418.
	STR -(	>- 140.3	34.	65.	31.	336.	381.	1.00	1.00	16.81	363.
	STR -(	>- 145	36.	89.	31.	261.	403.	1.00	1.00	16.81	344.
171	STR -(	>- 145.1	38.	110.	31.	249.	445.	1.00	1.00	16.81	365.
	STR -(	>- 145.2	40.	75.	31.	488.	389.	1.00	1.00	16.81	446.
	STR -(	>- 145.3	42.	59.	31.	488.	208.	1.00	1.00	16.81	380.
	BR PT	-- 150	45.	104.	31.	263.	234.	2.44	2.44	16.81	461.
	STR -(	-- 150	84.	114.	234.	90.	31.	2.44	2.44	16.81	330.
	(	>- 155N	78.	114.	234.	171.	59.	2.44	2.44	16.81	387.
	BEND -(	155M	81.	107.	185.	247.	162.	2.44	2.44	16.81	454.
	(	>- 155F	105.	89.	82.	286.	211.	2.44	2.44	16.81	476.
	STR -(	>- 155F.1	95.	40.	82.	434.	210.	1.00	1.00	16.81	349.
	STR -(	>- 155F.2	95.	40.	82.	470.	199.	1.00	1.00	16.81	369.
	STR -(	>- 155F.3	98.	64.	82.	352.	139.	1.00	1.00	16.81	276.
	BEND -(	160N	114.	108.	82.	346.	102.	2.44	2.44	16.81	484.
	(	160M	138.	76.	97.	354.	84.	2.44	2.44	16.81	492.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND - (	160M	138.	76.	97.	354.	84.	2.44	2.44	16.81	492.
RIGID >-	161	103.	119.	100.	294.	62.	2.44	2.44	16.81	413.
STR - (	>- 162	118.	142.	100.	75.	92.	1.00	1.00	16.81	111.
	>- 165N	122.	143.	100.	243.	174.	2.44	2.44	16.81	412.
BEND - (	165M	156.	109.	198.	325.	111.	2.44	2.44	16.81	517.
STR - (	>- 165F	133.	133.	222.	353.	73.	2.44	2.44	16.81	553.
ANCHR	-- 170	133.	136.	222.	497.	171.	1.00	1.00	16.81	407.
BR PT	-- 175	0.	81.	0.	182.	4.	2.44	2.44	3.21 8.50	1242. 469.
TERM	-- 175	0.	81.	0.	0.	0.	1.00	1.00	3.21 8.50	0.
BR PT	-- 180	0.	140.	0.	245.	4.	2.44	2.44	3.21 8.50	1672. 631.
TERM	-- 180	0.	140.	0.	0.	0.	1.00	1.00	3.21 8.50	0.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	.000	.000	.000	.000	.000	.000
	STRAIGHT - (		(.0)	(.0)	(.0)			
	>- 110N		.000	.002	.000	.004	.000	.006
	(		(.9)	(20.6)	(.1)			
	BEND - (	110M	.001	.003	.001	.011	.001	.008
	(		(1.4)	(27.8)	(2.9)			
	>- 110F		.002	.003	.003	.018	.003	.014
	STRAIGHT - (		(3.4)	(29.8)	(7.2)			
	>- 110F.1		.017	.003	.021	.020	.002	.018
	STRAIGHT - (		(24.4)	(30.2)	(23.2)			
	>- 115N		.034	.003	.039	.018	.004	.018
	(		(46.1)	(30.5)	(35.2)			
173	BEND - (	115M	.036	.004	.042	.013	.005	.015
	(		(48.2)	(31.1)	(34.7)			
	>- 115F		.037	.006	.042	.009	.008	.014
	STRAIGHT - (		(46.6)	(36.5)	(33.8)			
	>- 115F.1		.030	.012	.042	.007	.010	.012
	STRAIGHT - (		(30.0)	(88.8)	(33.8)			
	>- 115F.2		.022	.014	.042	.002	.012	.010
	STRAIGHT - (		(29.9)	(117.5)	(33.7)			
	>- 115F.3		.013	.012	.042	.007	.012	.008
	STRAIGHT - (		(23.3)	(99.4)	(33.7)			
	>- 120N		.004	.005	.042	.010	.013	.007
	(		(9.7)	(49.2)	(33.6)			
	BEND - (	120M	.003	.003	.042	.013	.014	.005
	(		(6.5)	(40.7)	(31.0)			
	>- 120F		.003	.003	.043	.015	.015	.002
	STRAIGHT - (		(5.1)	(37.4)	(29.1)			
BRANCH PT.		-- 125	.003	.003	.044	.015	.016	.001
	((5.6)	(37.4)	(42.9)			
BRANCH PT.		-- 125	.003	.003	.044	.015	.016	.001

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.		-- 125	.003 (5.6)	.003 (37.4)	.044 (42.9)	.015	.016	.001
	STRAIGHT - (	>- 125.1	.003 (5.7)	.002 (29.2)	.040 (43.6)	.015	.017	.002
	STRAIGHT - (	>- 130	.003 (5.7)	.000 (.0)	.038 (66.6)	.015	.017	.003
	STRAIGHT - (	>- 130.1	.003 (5.7)	.003 (57.4)	.039 (80.2)	.015	.015	.003
	STRAIGHT - (	>- 130.2	.003 (5.7)	.005 (76.7)	.041 (65.9)	.016	.014	.001
	STRAIGHT - (	>- 130.3	.003 (5.7)	.004 (42.6)	.042 (41.0)	.016	.014	.003
	STRAIGHT - (	>- 135	.003 (5.7)	.000 (.0)	.043 (53.8)	.016	.013	.005
	STRAIGHT - (	>- 135.1	.003 (5.7)	.005 (65.6)	.042 (78.6)	.016	.012	.005
	STRAIGHT - (	>- 135.2	.003 (5.6)	.007 (106.8)	.038 (69.5)	.017	.015	.001
	STRAIGHT - (	>- 135.3	.003 (5.6)	.006 (69.3)	.035 (36.5)	.017	.017	.004
174	STRAIGHT - (	>- 140	.003 (5.6)	.000 (.0)	.035 (52.9)	.018	.017	.007
	STRAIGHT - (	>- 140.1	.003 (5.5)	.007 (55.9)	.039 (76.0)	.018	.015	.006
	STRAIGHT - (	>- 140.2	.003 (5.4)	.011 (90.4)	.043 (65.7)	.019	.013	.001
	STRAIGHT - (	>- 140.3	.003 (5.3)	.008 (67.3)	.045 (47.5)	.019	.013	.006
	STRAIGHT - (	>- 145	.003 (5.2)	.000 (.0)	.044 (55.7)	.020	.012	.010
	STRAIGHT - (	>- 145.1	.003 (5.2)	.009 (60.8)	.041 (71.9)	.020	.011	.009
	STRAIGHT - (	>- 145.2	.003 (5.1)	.016 (104.6)	.035 (79.0)	.021	.013	.003
	STRAIGHT - (	>- 145.3	.003 (5.0)	.015 (99.5)	.028 (75.6)	.021	.015	.005
BRANCH PT.		-- 150	.003 (4.9)	.006 (44.2)	.024 (82.8)	.022	.013	.012
BRANCH PT.		-- 150	.003 (4.9)	.006 (44.2)	.024 (82.8)	.022	.013	.012
	STRAIGHT - (	>- 155N	.005 (29.2)	.007 (44.2)	.022 (37.8)	.021	.011	.012
	BEND - (	155M	.007 (40.3)	.007 (47.8)	.023 (39.8)	.017	.010	.011
		>- 155F	.008	.009	.023	.012	.007	.010

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
105	924.	236.	937.	1337.	4486.	8376.	6197.	11344.	
170	989.	254.	946.	1392.	2099.	11167.	4566.	12246.	
RESTRAINTS:									
130	0.	354.	0.	354.	0.	0.	0.	0.	
135	0.	127.	0.	127.	0.	0.	0.	0.	
140	0.	149.	0.	149.	0.	0.	0.	0.	
145	0.	338.	0.	338.	0.	0.	0.	0.	

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
175	0.	323.	0.	323.	0.	0.	0.	0.
180	0.	311.	0.	311.	0.	0.	0.	0.

 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 13,106, OCCURS AT POINT 150

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	-- 105	937.	954.	6197.	4486.	8376.	1.00	1.00	16.81	8098.
STR -(
	>- 110N	937.	953.	6197.	5029.	5924.	2.44	2.44	16.81	12977. *
BEND -(	110M	805.	1067.	2712.	4889.	7539.	2.44	2.44	16.81	12255. *
STR -(
	>- 110F	234.	1316.	5179.	4283.	5273.	2.44	2.44	16.81	11154. *
STR -(
	>- 110F.1	229.	1261.	5179.	1207.	209.	1.00	1.00	16.81	3800. *
STR -(
	>- 115N	229.	1205.	5179.	3831.	2790.	2.44	2.44	16.81	9167. *
BEND -(	115M	747.	973.	5679.	4369.	1997.	2.44	2.44	16.81	9712. *
STR -(
	>- 115F	848.	886.	3645.	4471.	4486.	2.44	2.44	16.81	9543. *
STR -(
	>- 115F.1	806.	863.	3645.	3678.	2688.	1.00	1.00	16.81	4165. *
STR -(
178	>- 115F.2	753.	835.	3645.	2860.	3709.	1.00	1.00	16.81	4237. *
STR -(
	>- 115F.3	674.	781.	3645.	1997.	6156.	1.00	1.00	16.81	5303. *
STR -(
	>- 120N	657.	751.	3645.	1164.	8796.	2.44	2.44	16.81	12525. *
BEND -(	120M	369.	927.	8851.	852.	4423.	2.44	2.44	16.81	12967. *
STR -(
	>- 120F	263.	462.	9467.	373.	3023.	2.44	2.44	16.81	12985. *
STR -(
BR PT	-- 125	265.	946.	9467.	2461.	369.	2.44	2.44	16.81	12788. *
STR -(
BR PT	-- 125	652.	720.	369.	1904.	9466.	2.44	2.44	16.81	12624. *
STR -(
	>- 125.1	652.	720.	369.	818.	7848.	1.00	1.00	16.81	5639. *
STR -(
	>- 130	561.	600.	369.	349.	6533.	1.00	1.00	16.81	4678. *
STR -(
	>- 130.1	561.	600.	369.	244.	5494.	1.00	1.00	16.81	3935. *
STR -(
	>- 130.2	510.	547.	369.	243.	5404.	1.00	1.00	16.81	3871. *
STR -(
	>- 130.3	464.	485.	369.	175.	5956.	1.00	1.00	16.81	4262. *
STR -(
	>- 135	425.	422.	369.	291.	6679.	1.00	1.00	16.81	4780. *

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
STR - (	>- 135	425.	422.	369.	291.	6679.	1.00	1.00	16.81	4780.
STR - (	>- 135.1	395.	370.	369.	164.	7275.	1.00	1.00	16.81	5202.
STR - (	>- 135.2	376.	331.	369.	331.	7623.	1.00	1.00	16.81	5454.
STR - (	>- 135.3	369.	328.	369.	304.	7714.	1.00	1.00	16.81	5518.
STR - (	>- 140	376.	347.	369.	393.	7592.	1.00	1.00	16.81	5434.
STR - (	>- 140.1	396.	368.	369.	210.	7275.	1.00	1.00	16.81	5202.
STR - (	>- 140.2	429.	380.	369.	526.	6800.	1.00	1.00	16.81	4876.
STR - (	>- 140.3	471.	407.	369.	758.	6228.	1.00	1.00	16.81	4487.
STR - (	>- 145	521.	454.	369.	1023.	5719.	1.00	1.00	16.81	4156.
STR - (	>- 145.1	573.	571.	369.	277.	5588.	1.00	1.00	16.81	4003.
STR - (	>- 145.2	627.	620.	369.	1304.	6101.	1.00	1.00	16.81	4462.
STR - (	>- 145.3	740.	713.	369.	2347.	7397.	1.00	1.00	16.81	5547.
BR PT	-- 150	740.	713.	369.	3386.	9347.	2.44	2.44	16.81	12997. **
BR PT	-- 150	284.	1047.	9347.	3624.	369.	2.44	2.44	16.81	13106. ***
STR - (	>- 155N	281.	1072.	9347.	1015.	2225.	2.44	2.44	16.81	12615. **
BEND - (	155M	677.	877.	5616.	1432.	7388.	2.44	2.44	16.81	12261. **
STR - (	>- 155F	702.	858.	1499.	1465.	8584.	2.44	2.44	16.81	11538.
STR - (	>- 155F.1	755.	923.	1499.	778.	5665.	1.00	1.00	16.81	4220.
STR - (	>- 155F.2	795.	950.	1499.	1013.	3417.	1.00	1.00	16.81	2760.
STR - (	>- 155F.3	840.	974.	1499.	1748.	3902.	1.00	1.00	16.81	3234.
BEND - (	160M	874.	986.	1499.	2576.	6692.	2.44	2.44	16.81	9565.
BEND - (160M	781.	1061.	6010.	2476.	4304.	2.44	2.44	16.81	10179.

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FILEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND	(	160M	781.	1061.	6010.	2476.	4304.	2.44	2.44	16.81	10179.
)										
RIGID	(	>- 161	252.	1293.	7536.	1925.	729.	2.44	2.44	16.81	10201.
)										
STR	(	>- 162	252.	1363.	7536.	1364.	371.	1.00	1.00	16.81	5474.
)										
	(	>- 165N	252.	1368.	7536.	1850.	3589.	2.44	2.44	16.81	11164.
)										
BEND	(	165M	818.	1125.	3432.	2460.	8200.	2.44	2.44	16.81	12043.
)										
	(	>- 165F	945.	1020.	4566.	2601.	8416.	2.44	2.44	16.81	12955.
)										
A'ICHR	(	-- 170	946.	1021.	4566.	2099.	11167.	1.00	1.00	16.81	8742.
)										
BR PT	(	-- 125	4.	324.	0.	728.	15.	2.44	2.44	5.21	4973.
	)									8.50	1878.
TERM	(	-- 175	4.	324.	0.	0.	0.	1.00	1.00	5.21	0.
	)									8.50	
BR PT	(	-- 150	3.	311.	0.	544.	7.	2.44	2.44	5.21	3715.
	)									8.50	1403.
TERM	(-- 180	3.	311.	0.	0.	0.	1.00	1.00	5.21	0.
)									8.50	

REVISE 4" ϕ DUMMY LEGS TO 6" ϕ STD. WT. PIPE

G. H. MAY 7-8-80

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 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 105	.000	.000	.000	.000	.000	.000
	STRAIGHT - (		(.0)	(.0)	(.0)			
	>- 110N		.030	.018	.000	.058	.047	.099
	(		(2.0)	(21.7)	(.1)			
	BEND - (	110M	.061	.035	.009	.176	.232	.174
	(		(5.3)	(30.0)	(3.7)			
	>- 110F		.113	.048	.043	.285	.303	.312
	STRAIGHT - (		(16.7)	(33.1)	(13.5)			
	>- 110F.1		.435	.048	.334	.325	.422	.370
	STRAIGHT - (		(118.1)	(33.4)	(89.7)			
	>- 115N		.778	.048	.627	.292	.543	.356
	(		(230.5)	(33.7)	(165.5)			
	BEND - (	115M	.858	.062	.664	.195	.564	.320
	(		(245.7)	(35.7)	(174.5)			
	>- 115F		.958	.082	.673	.090	.638	.318
	STRAIGHT - (		(246.2)	(42.9)	(176.6)			
	>- 115F.1		1.463	.125	.673	.026	.645	.244
	STRAIGHT - (		(205.4)	(96.3)	(176.6)			
	>- 115F.2		2.001	.127	.674	.026	.690	.172
	STRAIGHT - (		(161.5)	(124.3)	(176.7)			
	>- 115F.3		2.529	.089	.674	.064	.660	.103
	STRAIGHT - (		(122.7)	(104.1)	(176.7)			
	>- 120N		3.014	.026	.674	.088	.605	.054
	(		(110.0)	(50.7)	(176.6)			
	BEND - (	120M	3.086	.012	.680	.110	.559	.049
	(		(111.5)	(41.5)	(177.2)			
	>- 120F		3.107	.006	.697	.122	.556	.028
	STRAIGHT - (		(112.4)	(38.0)	(179.1)			
BRANCH PT.		-- 125	3.103	.006	.722	.122	.553	.017
			(112.5)	(38.0)	(184.9)			
BRANCH PT.		-- 125	3.103	.006	.722	.122	.553	.017

DYNAPLEY

LOADING - SHOCK LOADING NO. 4

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.	--	125	3.103	.006	.722	.122	.553	.017
	STRAIGHT -(		(112.5)	(34.0)	(184.9)			
	>-	125.1	3.103	.005	.937	.116	.555	.005
	STRAIGHT -(		(112.5)	(29.6)	(154.3)			
	>-	130	3.103	.000	1.262	.111	.560	.007
	STRAIGHT -(		(112.5)	(.0)	(148.4)			
	>-	130.1	3.103	.005	1.746	.103	.554	.004
	STRAIGHT -(		(112.5)	(57.7)	(166.1)			
	>-	130.2	3.103	.006	2.227	.096	.525	.002
	STRAIGHT -(		(112.5)	(77.2)	(187.4)			
	>-	130.3	3.103	.004	2.667	.089	.475	.004
	STRAIGHT -(		(112.6)	(43.0)	(204.2)			
	>-	135	3.103	.000	3.038	.082	.407	.005
	STRAIGHT -(		(112.6)	(.0)	(218.7)			
	>-	135.1	3.103	.005	3.322	.076	.334	.005
	STRAIGHT -(		(112.6)	(65.9)	(226.1)			
	>-	135.2	3.104	.008	3.502	.070	.272	.002
	STRAIGHT -(		(112.6)	(107.2)	(215.2)			
	>-	135.3	3.104	.006	3.569	.065	.247	.005
	STRAIGHT -(		(112.6)	(69.7)	(195.0)			
	>-	140	3.103	.000	3.522	.061	.273	.009
	STRAIGHT -(		(112.6)	(.0)	(190.3)			
	>-	140.1	3.103	.010	3.350	.057	.339	.010
	STRAIGHT -(		(112.5)	(56.7)	(199.6)			
	>-	140.2	3.103	.018	3.060	.055	.416	.004
	STRAIGHT -(		(112.5)	(91.6)	(206.0)			
	>-	140.3	3.103	.016	2.666	.055	.489	.008
	STRAIGHT -(		(112.5)	(68.2)	(215.7)			
	>-	145	3.103	.000	2.188	.056	.547	.024
	STRAIGHT -(		(112.5)	(.0)	(218.6)			
	>-	145.1	3.103	.027	1.700	.058	.581	.031
	STRAIGHT -(		(112.5)	(62.0)	(209.3)			
	>-	145.2	3.103	.051	1.179	.062	.596	.019
	STRAIGHT -(		(112.5)	(106.6)	(187.2)			
	>-	145.3	3.103	.055	.649	.066	.595	.014
	STRAIGHT -(		(112.5)	(101.3)	(160.8)			
BRANCH PT.	--	150	3.103	.022	.196	.071	.590	.064
	STRAIGHT -(		(112.5)	(45.2)	(154.4)			
BRANCH PT.	--	150	3.103	.022	.196	.071	.590	.064
	STRAIGHT -(		(112.5)	(45.2)	(154.4)			
	>-	155N	3.075	.022	.176	.068	.598	.085
	(		(115.2)	(45.2)	(136.6)			
	BEND -(	155M	3.027	.021	.171	.043	.622	.175
	((117.0)	(49.0)	(139.1)			
	>-	155F	2.925	.020	.171	.025	.698	.238

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	Y AXIS	Y AXIS	Z AXIS
		>- 155F	2.925	.020	.171	.025	.698	.238
	STRAIGHT - (		(115.5)	(57.3)	(141.0)			
		>- 155F.1	2.348	.033	.171	.026	.752	.266
	STRAIGHT - (		(116.5)	(101.5)	(141.0)			
		>- 155F.2	1.734	.049	.171	.020	.769	.294
	STRAIGHT - (		(135.9)	(120.4)	(141.0)			
		>- 155F.3	1.122	.055	.170	.011	.742	.322
	STRAIGHT - (		(145.2)	(96.2)	(140.9)			
		>- 160H	.557	.040	.170	.037	.663	.351
	(		(160.4)	(40.1)	(140.8)			
	BEND - (	160H	.450	.031	.166	.095	.533	.320
	(		(150.7)	(31.4)	(136.7)			
		>- 161	.375	.024	.147	.147	.482	.294
	RIGID - (		(136.0)	(28.4)	(121.4)			
		>- 162	.270	.024	.094	.148	.480	.294
	STRAIGHT - (		(89.5)	(28.4)	(77.8)			
		>- 165N	.131	.024	.022	.141	.387	.271
	(		(29.1)	(28.3)	(18.4)			
184	BEND - (	165H	.078	.017	.004	.089	.306	.151
	(		(13.8)	(24.1)	(4.0)			
		>- 165F	.040	.009	.000	.029	.120	.073
	STRAIGHT - (		(7.1)	(16.6)	(.2)			
ANCHOR	--	170	.000	.000	.000	.000	.000	.000
			(.0)	(.0)	(.0)			
BRANCH PT.		-- 125	3.103	.006	.722	.122	.553	.017
	STRAIGHT - (		(112.5)	(38.0)	(184.9)			
TERMINAL		-- 175	3.103	.000	.690	.122	.553	.021
			(112.5)	(.0)	(215.0)			
BRANCH PT.		-- 150	3.103	.022	.196	.071	.590	.064
	STRAIGHT - ((112.5)	(45.2)	(154.4)			
TERMINAL		-- 180	3.103	.000	.229	.071	.590	.060

DYNAFLEX

STEARNS - ROGER CORP

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PROJECT DOE 10MW SOLAR PILOT PLANT - C-21700
 JOB TSS OIL CHARGING(X-TU-5-A-1)
 DATE 7/ 3/80

 *
 * STRESS SUMMARY *

 *

EXPLANATORY NOTES:

- (1) EQUATION NUMBERS REFER TO ARTICLE 104.8 OF THE ANSI B31.1-1977 PIPING CODE.
- (7) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.
- (9) THE COLD MODULUS WAS USED IN ANALYZING THE OCCASIONAL LOADS.

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DYNAFLEX

STRESS SUMMARY (CONTINUED)

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STRESSES ARE IN PSI

LOC. NO.	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
105	7112	3847	450	8098
110N	10598	7463	637	12977
110M	9858	7254	631	12255
110F	9096	6431	573	11154
110F.1	3714	793	117	3800
115N	7635	5054	440	9167
115M	7781	5793	465	9712
115F	7397	6013	445	9543
115F.1	2743	3122	282	4165
115F.2	2717	3231	366	4237
115F.3	3859	3622	329	5303
120N	9792	7796	463	12525
120M	10196	7999	463	12967
120F	10196	8027	459	12985
125	9964	8002	462	12788
125	9785	7961	487	12624
125.1	4789	2973	178	5639
130	4320	1776	253	4678
130.1	3730	1210	332	3935
130.2	3132	2249	342	3871
130.3	2517	3427	284	4262

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 54

STRESSES ARE IN PSI

EQ (12) EQ (12) EQ (12) EQ (12)

SHOCK 1 SHOCK 2 SHOCK 3 SHOCK 4

LOC.
NO.

135	1893	4375	351	4780
135.1	1287	5027	370	5202
135.2	813	5379	383	5454
135.3	772	5457	269	5518
140	1185	5294	303	5434
140.1	1744	4889	351	5202
140.2	2331	4262	418	4876
140.3	2879	3422	363	4487
145	3356	2827	344	4156
145.1	3635	1636	365	4003
145.2	4001	1924	446	4462
145.3	4448	3292	380	5547
150	9112	9257	461	12997
150	9313	9215	330	13106
155N	8670	9156	387	12615
155M	8239	9069	454	12261
155F	7555	8707	476	11538
155F.1	2240	3560	349	4220
155F.2	1189	2463	369	2760
155F.3	2740	1695	276	3234
160N	8985	3244	484	9565

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 55

STRESSES ARE IN PSI

EQ (12) EQ (12) EQ (12) EQ (12)

SHOCK 1 SHOCK 2 SHOCK 3 SHOCK 4

LOC.
NO.

160M	9668	3149	492	10179
161	9865	2562	413	10201
162	5391	941	111	5474
165N	10524	3702	412	11164
165M	11152	4517	517	12043
165F	12006	4836	553	12955
170	8261	2832	407	8742
125	3781	2982	1242	4973
175	0	0	0	0
150	2485	2198	1672	3715
180	0	0	0	0

DYNAFLEX

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STRESS SUMMARY 52

Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

10MWe SOLAR PILOT PLANT
C-21700

TSS OIL - EXTRACTION SYSTEM FEED

PIPING SYSTEM

8" - TO-12 - BBA

191

CONDITIONS ANALYZED / ANAL. I.D. NO.

THERMAL T-21700-TO-12-A-4

DEAD WEIGHT W-21700-TO-12-A-4

PRESSURE P-21700-TO-12-A-0

SEISMIC X-21700-TO-12-A-1

CODE REFERENCE: ANSI B31.1-1973
W/ APPENDIX B.
(SUMMER 1979)

ANALYST G.H. MAY DATE 7-14-80

T0-12

DIVISION USAGE					
MM	P	PP	SH	FI	SP

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER
EE16.01.2
PAGE 1 OF 1
ISSUED 8-31-73
REVISED 4-15-74

APPROVALS
Des. Sect: _____
Sect. Supv. _____
Div. _____

PIPING ANALYSIS RESULTS

Date JULY 7, 1980

TO: T.E. OLSON
FROM: G.H. MAY, Piping Engineering Group
Client DOE Project SOLAR I Job No. C-21700
Pipe Line Analyzed TSS-OIL - EXTRACTION SYSTEM FEED / 8" - T0-12-BBA
Reference Dwg. P13-15 A

This piping has been analyzed for the THERMAL, DEAD WEIGHT, PRESSURE & 1/2 SAFE SHUTDOWN EARTHQUAKE loading condition and is found to be:

- Satisfactory, as is.
- Satisfactory, with comments noted.
- Unsatisfactory - See Comments.

COMMENT (1) ALL PIPE STRESSES ARE SATISFACTORY.
(2) EQUIPMENT LOADS HAVE NOT BEEN REVISED SIGNIFICANTLY EXCEPT THAT SEISMIC LOADS ARE NOW INCLUDED.
(3) THIS ANALYSIS IS FINAL. IT INCLUDES VALVES AND SUPPORT ARRANGEMENTS WHICH ARE FINAL.

RECOMMENDATION (1) SUBMIT THESE FINAL LOADS TO ROCKETDYNE
(2) USE THE REFERENCED ROUTING.

ATTACHS: PIPE STRESS SUMMARY REPORT, SUMMARY OF FORCES & MOMENTS

G.H. May
Signature

Copies to: Sender
Analysis Folder - Job File
Piping Engrg. Supervisor TCT
K.E. NOBLE

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER
MM	P	PP	SH	FI	SP		EE16.01.8
APPROVALS						PIPE STRESS SUMMARY REPORT ANSI B31.1 - 1973 EDITION	PAGE <u>1</u> OF <u>1</u>
Des. Sect. <u>HY 2nd</u>							ISSUED 5/27/75 REVISED
Sect. Supv. <u>J. G. ...</u>							
Div. _____							

10 MWE SOLAR PILOT PLANT - SOLAR I
Job Name

TSS OIL - EXTRACTION SYSTEM FEED
System/Pipe Line Name 8"-T0-12-BBA

C-21700
Job No.

T0-12
Analysis No.

1. Loading Conditions Analyzed

Pressure X
Weight X
Thermal Expansion X
Sustained Mech. Loads _____
Occasional Loads X

Analysis Ident. Code

P-T0-12-A-0
W-T0-12-A-4
T-T0-12-A-4
X-T0-12-A-1

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} \leq 1.0 S_h$ 4909 psi \leq 15000 psi

Material: - ASTM A106 GR.B Temp = 580°F @ Pt. 344

PRESS = 115 PSIG \Rightarrow SLP = 685 PSI

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{0.75 iM_B}{z} \leq K S_h$ 16222 psi \leq 18000 psi

Material: - ASTM A106 GR.B Temp = 580°F @ Pt. 310N

Eq. (13) $S_E = \frac{iM_C}{z} \leq S_A$ 10524 psi \leq 22500 psi

Material: - ASTM A106 GR.B Temp = 580°F @ Pt. 310N

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75 iM_A}{z} + \frac{iM_C}{z} \leq (S_h + S_A)$ 11506 psi \leq 37500 psi

Material: - ASTM A106 GR.B Temp = 580°F @ Pt. 310N

3. Stress Evaluation (Local or Special)

Loading	Analysis Ident. Code	Calculated Stress (psi)	Allowable Stress (psi)
_____	_____	_____	_____
_____	_____	_____	_____

REMARKS:

- ALL PIPE STRESSES ARE LESS THAN THE ALLOWABLES.
- OCCASIONAL LOADS IS A 1/2 SAFE SHUTDOWN EARTHQUAKE W/ HORIB. ACCEL. = 125g @ 33cps

J. G. ... 7-7-80
Prepared By Date

J. G. ... 7-7-80
Approved By Date

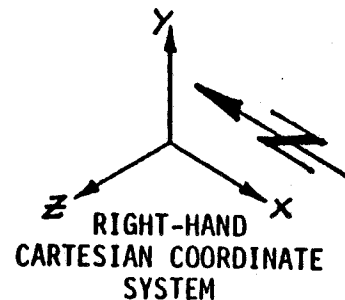
CUSTOMER: DOE
 PROJECT: SOLAR I
 JOB NO: C-21700
 BY: G.H. MAY DATE: JULY 7, 1980
 REF. DWGS: P13-15 A
 ANALYSIS CODE: T/W/X - TO-12-A-4/4/1

SUMMARY OF FORCES & MOMENTS
 ON SYSTEM TERMINAL EQUIPMENT
 (SYSTEM)

TSS OIL - EXTRACTION SYSTEM FEED
 8" TO -12-BBA

DIVISION USAGE
 MM P PE SH FI SP
 X
 APPROVALS
 Des. Sec. [Signature]
 Sect. Supv. [Signature]
 Div. [Signature]

THE REPORTED REACTIONS BASED ON A THERMAL EXPANSION ANALYSIS FROM ...70°F TO 580°F USING E_c , THE COLD MOD. OF ELASTICITY, AND0...% COLD SPRING.



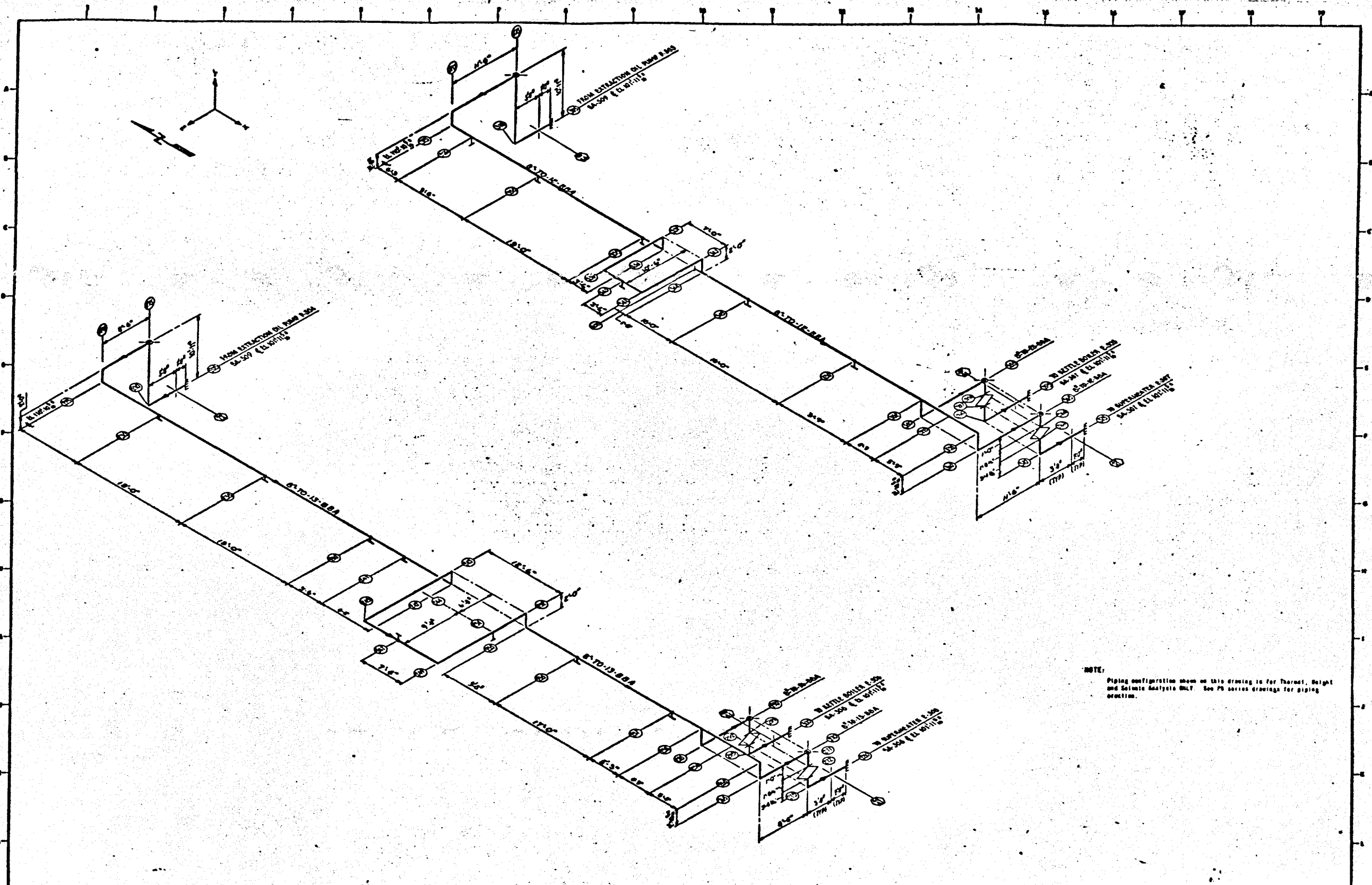
SUMMARY OF FORCES & MOMENTS
 PER. ANSI B31.1-1973 PWR. PIPING CODE

Stearns-Roger
 INCORPORATED
 ENGINEERING STANDARD

STANDARD NUMBER
 EE 16.01.7


PAGE 1 OF 1
 ISSUED 2/28/74
 REVISED 4/18/78

EQUIPMENT CONNECTIONS	FORCES (LBS)					MOMENTS (FT.-LBS)			
	LOC. NO.	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
FROM EXHA. OIL (THERMAL	305	-550	-154	-63	574	1345	-6337	3712	7466
PUMP P-303 } WEIGHT	305	7	38	0	38	-444	89	198	494
10" EAST (49 IA) SEISMIC	305	1233	366	961	1605	3787	9412	8782	13418
TO SUPERHEATER (THERMAL	375	421	-339	-561	779	1263	4433	-2027	5035
E-307, 20" EAST } WEIGHT	375	-16	-87	-4	88	-130	-220	-145	294
INTERFACE (49 IA) SEISMIC	375	924	432	1209	1581	1692	8946	4511	10160
TO KETTLE BOILER (THERMAL	395	129	133	624	651	2253	1903	-403	2977
E-305, 20" EAST } WEIGHT	395	9	-219	4	219	347	60	-27	353
INTERFACE (49 BI) SEISMIC	395	1224	590	1406	1955	1331	10599	5190	11876



NOTE:
Piping configuration shown on this drawing is for Thermal, Weight
and Seismic Analysis ONLY. See P-3 series drawings for piping
section.

REVISIONS				REFERENCE DRAWINGS				PIPING SYMBOLS				BDR 0-8-79				SOLAR FACILITIES DESIGN INTEGRATOR			
1	REVISED FOR ANALYSIS OCCUPATION	12/1/84	100	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED	155 OIL - EXTRACTION SYSTEM FEED		
2																			
3																			
4																			
5																			
6																			


DEPARTMENT OF ENERGY SOLAR TEN MEGAWATT PROJECT OFFICE
 8550 PLAZA DRIVE, SUITE 310
 SAN FRANCISCO, CALIFORNIA 94128
 10 MW SOLAR PHOTO PLANT - DAGUERRE, CALIFORNIA

TITLE
 ANALYSIS ISOMETRIC
 155 OIL - EXTRACTION SYSTEM FEED

ANALYSIS ISOMETRIC (P13-15)

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BRANCH CONNECTION SYMBOLS	PIPE SUPPORT SYMBOLS	ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN.			ANCHOR &/OR TERM. POINTS	COORDINATE		
			X	Y	Z		X	Y	Z
UNREINFORCED PIPE-PIPE INTERSECTION	CONSTANT SUPPORT	205	0.0	0.0	0.0	205	0'-0"	0'-0"	0'-0"
REINFORCED PIPE-PIPE INTERSECTION	VARIABLE SPRING SUPPORT	280				280	117'-6"	0'-0"	-1'-0"
A S A TEE	RIGID ROD OR STRUT	300				300	117'-0"	0'-0"	-1'-0"
WELDOLET	HYDRAULIC SNUBBER	305				305	0'-0"	0'-0"	0'-0"
SWEEPOLET	RIGID GUIDE	375				375	95'-6"	0'-0"	-1'-0"
	ANCHOR	395				395	85'-0"	0'-0"	-1'-0"

MODELING SYMBOLS	PIPING SYMBOLS
POINT OF INTEREST	ELBOW
DATA POINT NO.	BEND
MASS POINT OR CENTER OF GRAVITY	VALVES (ASSUMED RIGID)
INTERFACE POINT	REDUCER OR INCREASER
	EQUIPMENT NOZZLE

ANALYZED CONDITIONS			VALVES & SPECIAL COMPONENTS			
OPERATING TEMP (°F)	DESIGN PRESSURE (PSIG)	CASE	VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS
580	115	A	V-TO-12-16	243	FINAL	Rockwell - Nordstrom 4245 1/2
			V-TO-13-17			
			V-TO-25-14			
			V-TO-26-15			

NOTES:

- 1) DIMENSIONS ARE IN FEET AND INCHES UNLESS NOTED OTHERWISE.
- 2) ALL ELBOWS ARE A S A LONG RADIUS UNLESS NOTED OTHERWISE.
- 3) PIPE ANALYZED FROM COLD TO HOT.
- 4) THERMAL ANALYSIS TEMPERATURE RANGE IS FROM 70° F. TO OPERATING TEMPERATURE UNLESS NOTED OTHERWISE.
- 5) SCALE: NONE
- 6) THIS DATA AND ATTACHED DRAWINGS USED FOR ANALYSIS PURPOSES ONLY.

DATA POINTS		PIPE MATERIAL	LINE SPEC.	PIPE SIZE (IN.)		WEIGHT LBS./LINEAR FT.			INS. THK.
FROM	TO			O.D.	W.T.	PIPE	FLUID	INSULATION	
205	280	A106 Gr B	BBA	8.625	.322	28.55	14.7 @ 525°F 18.9 @ 22°F	10.7	3 1/2"
258	300								
305	375								
352	395								
344	405			45	.237	10.8	NA	NA	0

NO.	REFERENCES	NO.	ANALYSIS CODES	NO.	REVISIONS	DATE	BY	CH'D	APP'D
	P13-15		T/W-TO-12-A-9/4						
			T/W-TO-13-A-9/4						
			X-TO-12-A-1						
			X-TO-13-A-1						

PIPING ANALYSIS DATA (P13-15)

Stearns-Roger
INCORPORATED

10MWE SOLAR PILOT PLANT - DAGGET, CALIF.
TSS OIL-EXTRACTION SYSTEM FEED
FOR ISOMETRIC P13-15 REV. A

DRAWN: <i>KFN</i>	DATE: 1-14-80	ANAL. BY: <i>GMM</i>	DATE: 1-23-80
CHECKED: <i>KFN</i>	DATE: 1-24-80	APP'D. BY: <i>[Signature]</i>	DATE: 1-27-80
JOB NO. C-21700	SYSTEM NO. TO-12, 13	SHEET 1 OF 1	

THERMAL

DYNAFLEX

STEARNS - ROGER CORP

PAGE 1

PROJECT - ONE 10MW SOLAR PILOT PLANT C-21700
 JOB - TSS OIL EXTR(T/W-TD-12-A-4/4)

DATE 7/ 3/80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC	PKM	TD	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HEU								STEARNS - ROGER CORP	1
									7/ 3/80, PROJ, ONE 10M	
									W SOLAR PILOT PLANT	
									C-21700, JORTSS OIL EX	
									TR(T/W-TD-12-A-4/4)	
2	GEN								APPLY R31, I=1973	2
3			305	310			4-0	L	MAT=LCS, OU=8.625,	3
									WT=.322, UNIF=25.4,	
									TEMP=580.	
4				315		10-11		L		4
5				320			11-6	L		5
6				325		2-0		L		6
7				326	6-3					7
8				330	9-6					8
9				335	19-0					9
10				336	3-6			L		10
11				337		2-0		L		11
12				339			10-6	L		12
13				340	3-6					13
14				341	3-6			L		14
15				343			10-6	L		15
16				344		2-0			SIF=2.44	16
17				345	1A-0					17
18				350	1A-0					18
19				352	3-9				WLT	19
20				353	4-9					20
21				355	5-9			L		21
22				360		2-10-5/16		L		22
23				365			11-6	L		23
24				366		1-0				24
25				367		1-8-1/2			RIGID, WEIGHT=243.	25
26				370		3-4-3/16		L		26
27				375			5-0			27
28			352	380		2-10-5/16		L		28
29				385			11-6	L		29
30				386		1-0				30
31				387		1-8-1/2			RIGID, WEIGHT=243.	31
32				390		3-4-3/16		L		32

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INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYPE	LOC	FRM	TD	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
33	:	:	:	395	:	:	-5-0	:	:	33
34	:	:	344	405	-1-0	:	:	:	DD=4.50, WT=.237, TEMP=70., UNIF=0.0	34
35	ANC	305	:	:	:	:	:	:	:	35
36	ANC	375	:	:	:	:	:	:	:	36
37	ANC	395	:	:	:	:	:	:	:	37
38	RAD	326	:	:	:	RIGID	:	:	:	38
39	RAD	330	:	:	:	RIGID	:	:	:	39
40	PAD	335	:	:	:	RIGID	:	:	:	40
41	RAD	340	:	:	:	RIGID	:	:	:	41
42	RAD	345	:	:	:	RIGID	:	:	:	42
43	RAD	350	:	:	:	RIGID	:	:	:	43
44	RAD	353	:	:	:	RIGID	:	:	:	44
45	RAD	405	:	:	:	RIGID	:	:	:	45
46	HGR	:	:	:	:	:	:	:	LOC(315F, 365N, 385N), USE TABLE J	46
47	CCC	375	:	95-6	0-0	-1-0	:	:	:	47
48	CCC	395	:	85-0	0-0	-1-0	:	:	:	48

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DYNALLEX

STEARNS - ROGER CORP

PAGE 3

PROJECT - DOE 10MW SOLAR PILOT PLANT C-21700
JOB - TSS OIL EXTR(T/W-TD-12-A-474)

DATE 7/ 3/80

* EDITED PIPING SYSTEM DESCRIPTION *

*

EXPLANATORY NOTES

IN THE EDITED PIPING SYSTEM DESCRIPTION:

- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
- (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
- (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCULATIONS IS ASSIEMD TO BE .25 INCHES.
- (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
- (8) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS ON RIGID RESTRAINTS (RAD,RAR) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR,MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (HAD,RAR) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASM) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
- (9) A POINT IDENTIFIED AS A TENTATIVE HANGER LOCATION IS ASSUMED TO BE FREE TO MOVE IN THE VERTICAL DIRECTION FOR THE INITIAL THERMAL LOADING CASE AND FULLY RESTRAINED IN THE VERTICAL DIRECTION FOR THE INITIAL WEIGHT LOADING CASE.
- (14) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
- (15) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

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DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

GENERAL DATA

COORDINATES OF ALL POINTS OF THE SYSTEM ARE WITH RESPECT TO POINT 305, WHICH IS THE ORIGIN

HANGER DESIGN DATA:
THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION = .10 INCHES.
VARIABLE SPRING HANGERS SELECTED FROM TABLE #12

MATERIALS USED (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)

LCS = LOW CARBON STEEL
YOUNG'S MODULUS AT AMBIENT TEMPERATURE = 27,900,000. PSI
POISSONS RATIO = .30
DENSITY = 490. POUNDS PER CUBIC FOOT

LOADING CONDITIONS ANALYZED

REFR THERMAL
REFRESTRAINED WEIGHT

DIST. LOADS
(LBS PER FT)

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) (FAHR)	DIST. LOADS (LBS PER FT)		
			X	Y	Z							PRESS (PSI)	WT. UNIF	
ANCHR		--305	0.00	0.00	0.00									
	STRAIGHT						3.00		8.625	.322	LCS: 580.		28.6	25.4
	* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 580. DEGREES FAHRENHEIT IS 4.40 INCHES PER 100 FEET													
	* A UNIFORM DISTRIBUTED LOAD OF 25.40 PLF IS ACTING IN THE -Y DIRECTION.													
		>-310N	0.00	0.00	3.00									
	BEND	- (310M	0.00	.29	3.71	1.00	1.57	90.000						
		>-310F	0.00	1.00	4.00									
	STRAIGHT	- (8.92							
		>-315M	0.00	9.92	4.00									
	BEND	- (315M	0.00	10.62	4.29	1.00	1.57	90.000						

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
BEND	=	315M	0.00	10.62	4.29	1.00	1.57	90.000	8.625	.322	LCS: 580.	28.6	25.4
	(
	>	315F	0.00	10.92	5.00								
	(
	(	* TENTATIVE HANGER AT POINT 315F - SEE NOTE (9) ABOVE.											
	(	HANGER LENGTH NOT SPECIFIED.											
	(
STRAIGHT	=						9.50						
	(
	>	320N	0.00	10.92	14.50								
	(
BEND	=	320M	0.00	10.62	15.21	1.00	1.57	90.000					
	(
	>	320F	0.00	9.92	15.50								
	(
	(	* POINT 320F IS EQUIVALENT TO POINT 325N											
	(
BEND	=	325M	.29	9.21	15.50	1.00	1.57	90.000					
	(
	>	325F	1.00	8.92	15.50								
STRAIGHT	=						5.25						
	(
	>	326	6.25	8.92	15.50								
	(
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 326											
	(	IN DIRECTION Y											
	(
STRAIGHT	=						9.50						
	(
	>	330	15.75	8.92	15.50								
	(
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330											
	(	IN DIRECTION Y											
	(
STRAIGHT	=						19.00						
	(
	>	335	34.75	8.92	15.50								

* NOTES PERTAINING TO POINT 335 APPEAR ON THE FOLLOWING PAGE

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	WT. UNIF
		>-335	34.75	8.92	15.50			8.625	.322	LCS: 590.	28.6	25.4	
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 335									
		(	IN DIRECTION Y									
		(
	STRAIGHT	-				2.50							
		(
		>-336N	37.25	8.92	15.50								
		(
	BEND	-	336M	37.96	9.21	15.50	1.00	1.57	90.000				
		(
		>-336F	38.25	9.92	15.50								
		(
		(	* POINT 336F IS EQUIVALENT TO POINT 337N									
		(
		(
	BEND	-	337M	38.25	10.62	15.79	1.00	1.57	90.000				
		(
		>-337F	38.25	10.92	16.50								
	STRAIGHT	-				8.50							
		(
		>-339N	38.25	10.92	25.00								
		(
	BEND	-	339M	38.54	10.92	25.71	1.00	1.57	90.000				
		(
		>-339F	39.25	10.92	26.00								
	STRAIGHT	-				2.50							
		(
		>-340	41.75	10.92	26.00								
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 340									
		(	IN DIRECTION Y									
		(
	STRAIGHT	-				2.50							
		(
		>-341N	44.25	10.92	26.00								
		(
	BEND	-	341M	44.96	10.92	25.71	1.00	1.57	90.000				
		(
		>-341F	45.25	10.92	25.00								
	STRAIGHT	-				8.50							
		(
		>-343N	45.25	10.92	16.50								
		(
	BEND	-	343M	45.25	10.62	15.79	1.00	1.57	90.000				

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG FARR)	DIST. LOADS (LBS PER FT)	
			Y	X	Z							PRESS (PSI)	PIPE WT. UNIF
		>-370F	95.50	0.00	3.00			8.625	.322	LCS: 5FC:		28.6	25.4
STRAIGHT - (ANCHR		--375	95.50	0.00	-1.00		4.00						
		* CONTROL COORDINATES OF POINT 375, IN FEET :											
		X = 95.50, Y = 0.00, Z = -1.00											
		RESULTANT DIFFERENCE IS ZERO											
BR PY		--352	85.00	8.92	15.50								
		* WELDING TEE AT POINT 352											
STRAIGHT - (							1.86						
		>-380N	85.00	7.06	15.50								
BEND - (		380M	85.00	6.35	15.21	1.00	1.57	90.000					
		>-380F	85.00	6.06	14.50								
208 STRAIGHT - (		>-385N	85.00	6.06	5.00		9.50						
		* TENTATIVE HANGER AT POINT 385N - SEE NOTE (9) ABOVE.											
		HANGER LENGTH NOT SPECIFIED.											
BEND - (		385M	85.00	5.76	4.29	1.00	1.57	90.000					
		>-386	85.00	5.06	4.00								
		* POINT 386 IS EQUIVALENT TO POINT 385F											
RIGID - (							1.71		N/A	N/A		N/A	N/A
		* WEIGHT OF ELEMENT = 243. POUNDS											
		>-387	85.00	3.35	4.00								
STRAIGHT - (		>-390N	85.00	1.00	4.00		2.35						
BEND - (		390M	85.00	.29	3.71	1.00	1.57	90.000					

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
305	-550.	-154.	-63.	574.	1345.	-6337.	3712.	7466.
375	421.	-339.	-561.	779.	1263.	4433.	-2027.	5035.
210 395	129.	133.	624.	651.	2253.	1903.	-403.	2977.
RESTRAINTS:								
326	0.	150.	0.	150.	0.	0.	0.	0.
330	0.	-45.	0.	45.	0.	0.	0.	0.
335	0.	66.	0.	66.	0.	0.	0.	0.
340	0.	-88.	0.	88.	0.	0.	0.	0.
345	0.	-57.	0.	57.	0.	0.	0.	0.
350	0.	-10.	0.	10.	0.	0.	0.	0.
353	0.	224.	0.	224.	0.	0.	0.	0.
405	0.	119.	0.	119.	0.	0.	0.	0.

 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 10,524. OCCURS AT POINT 310N

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, FITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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DYNAFLEX

LOADING = FREE THERMAL

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	STR	= 305	63.	571.	3712.	1345.	6337.	1.00	1.00	16.81	5330.
		>= 310N	63.	571.	3712.	884.	4689.	2.44	2.44	16.81	10524. **
	BEND	= 310H	153.	553.	530.	794.	5551.	2.44	2.44	16.81	9807. **
		>= 310F	154.	553.	4139.	793.	3162.	2.44	2.44	16.81	9173.
	STR	= 315N	154.	553.	4139.	1353.	1738.	2.44	2.44	16.81	8163.
	BEND	= 315H	153.	553.	4317.	1353.	1309.	2.44	2.44	16.81	8199.
		>= 315F	63.	571.	2287.	1262.	3590.	2.44	2.44	16.81	7730.
	STR	= 320N	63.	571.	2287.	197.	1631.	2.44	2.44	16.81	4903.
	BEND	= 320H	64.	570.	2932.	325.	76.	2.44	2.44	16.81	5137.
		>= 320F	154.	553.	2180.	1738.	414.	2.44	2.44	16.81	4908.
	BEND	= 325H	280.	501.	1653.	1304.	1205.	2.44	2.44	16.81	4468.
		>= 325F	550.	166.	477.	1035.	2118.	2.44	2.44	16.81	4186.
	STR	= 326	550.	166.	477.	228.	1788.	1.00	1.00	16.81	1331.
		>= 330	550.	63.	477.	197.	1191.	1.00	1.00	16.81	927.
	STR	= 335	550.	65.	477.	731.	2.	1.00	1.00	16.81	611.
		>= 336N	550.	65.	477.	665.	159.	2.44	2.44	16.81	1452.
	BEND	= 336H	376.	406.	468.	491.	180.	2.44	2.44	16.81	1222.
		>= 336F	18.	553.	222.	98.	414.	2.44	2.44	16.81	835.
	BEND	= 337H	32.	553.	249.	364.	163.	2.44	2.44	16.81	819.
		>= 337F	63.	550.	452.	333.	328.	2.44	2.44	16.81	1132.
	STR	= 339N	63.	550.	452.	4999.	179.	2.44	2.44	16.81	8744.
	BEND	= 339H	433.	345.	441.	5369.	206.	2.44	2.44	16.81	9385.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	EXPANSION STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BEND	(	339M	433.	345.	441.	5365.	206.	2.44	2.44	16.81	9385.
	>	339F	550.	65.	160.	5485.	470.	2.44	2.44	16.81	9589.
STR	(
	>	340	550.	65.	160.	516.	5328.	1.00	1.00	16.81	3823.
STR	(
	>	341N	550.	94.	160.	5171.	341.	2.44	2.44	16.81	9027.
BEND	(	341M	344.	439.	108.	4966.	305.	2.44	2.44	16.81	8664.
	>	341F	63.	554.	272.	4559.	91.	2.44	2.44	16.81	7953.
STR	(
	>	343N	63.	554.	272.	502.	112.	2.44	2.44	16.81	1012.
BEND	(	343M	94.	550.	432.	533.	276.	2.44	2.44	16.81	1287.
	>	343F	70.	553.	662.	509.	278.	2.44	2.44	16.81	1531.
STR	(
BR PT	--	344	70.	553.	662.	827.	446.	2.44	2.44	16.81	2002.
BR PT	--	344	550.	80.	446.	708.	662.	2.44	2.44	16.81	1858.
STR	(
	>	345	550.	63.	446.	180.	1792.	1.00	1.00	16.81	1325.
STR	(
	>	350	550.	63.	446.	39.	2923.	1.00	1.00	16.81	2111.
STR	(
BR PT	--	352	550.	65.	446.	26.	3158.	1.84	1.84	16.81	4197.
BR PT	--	352	421.	573.	673.	772.	3380.	1.84	1.84	16.81	4647.
STR	(
	>	353	421.	655.	673.	224.	716.	1.00	1.00	16.81	719.
STR	(
	>	355N	421.	655.	673.	1386.	1949.	2.44	2.44	16.81	4325.
BEND	(	355M	537.	564.	2018.	1502.	1299.	2.44	2.44	16.81	4929.
	>	355F	339.	701.	2510.	1304.	112.	2.44	2.44	16.81	4927.
STR	(
	>	360N	339.	701.	2510.	370.	942.	2.44	2.44	16.81	4711.
BEND	(360M	636.	449.	1232.	667.	2143.	2.44	2.44	16.81	4458.
	>	360F	561.	540.	521.	542.	2089.	2.44	2.44	16.81	3887.

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DYNAFLEX

LOADING - FREE THERMAL

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	EXPANSION STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF-PLANE		
	STR	>- 360F	561.	540.	521.	592.	2089.	2.44	2.44	16.81	3887.
		>- 365N	561.	540.	521.	2627.	1908.	2.44	2.44	16.81	5726.
	BEND	(365M	636.	449.	1641.	2703.	1278.	2.44	2.44	16.81	6113.
	RIGID	>- 366	339.	701.	2329.	2405.	101.	2.44	2.44	16.81	5832.
	STR	>- 367	339.	701.	2329.	618.	1447.	1.00	1.00	16.81	2007.
		>- 370N	339.	701.	2329.	130.	1607.	2.44	2.44	16.81	4931.
	BEND	(370M	636.	449.	388.	168.	3080.	2.44	2.44	16.81	5413.
	STR	>- 370F	561.	540.	2027.	93.	2750.	2.44	2.44	16.81	5950.
ANCHR		-- 375	561.	540.	2027.	1263.	4433.	1.00	1.00	16.81	3595.
BR PT	STR	-- 352	133.	637.	222.	746.	1119.	1.84	1.84	16.81	1793.
214		>- 380N	133.	637.	222.	41.	506.	2.44	2.44	16.81	965.
	BEND	(380M	535.	370.	163.	443.	424.	2.44	2.44	16.81	1105.
	STR	>- 380F	624.	185.	377.	532.	93.	2.44	2.44	16.81	1147.
		>- 385N	624.	185.	377.	729.	1130.	2.44	2.44	16.81	2432.
	BEND	(385M	535.	370.	1104.	640.	624.	2.44	2.44	16.81	2473.
	RIGID	>- 386	133.	637.	1259.	238.	249.	2.44	2.44	16.81	2273.
	STR	>- 387	133.	637.	1259.	29.	828.	1.00	1.00	16.81	1076.
		>- 390N	133.	637.	1259.	2293.	274.	2.44	2.44	16.81	4579.
	BEND	(390M	535.	370.	659.	2695.	1175.	2.44	2.44	16.81	5246.
	STR	>- 390F	624.	185.	403.	2784.	1388.	2.44	2.44	16.81	5461.
ANCHR		-- 395	624.	185.	403.	2253.	1903.	1.00	1.00	16.81	2125.
BR PT		-- 344	0.	119.	0.	119.	0.	2.44	2.44	3.21	1084.

DYNAFLEX

LOADING - FREE THERMAL

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT FLEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
BR PT	-- 344	0.	119.	0.	119.	0.	2.44	2.44	3.21	1084.
STR - C										
TERM	-- 405	0.	119.	0.	0.	0.	1.00	1.00	3.21	0.

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DYNAPLEX

LOADING - ~~FREE~~ THERMAL

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 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		-- 305	-550.	-154.	-63.	1345.	-6337.	3712.
	STRAIGHT - (	>= 310N	-550.	-154.	-63.	884.	-4689.	3712.
	BEND - (	310M	-550.	-154.	-63.	794.	-4300.	3551.
		>= 310F	-550.	-154.	-63.	793.	-4139.	3162.
	STRAIGHT - (	>= 315N	-550.	-154.	-63.	1353.	-4139.	-1738.
216	BEND - (	315M	-550.	-154.	-63.	1353.	-3978.	-2126.
		>= 315F	-550.	-154.	-63.	1262.	-3590.	-2287.
	STRAIGHT - (	>= 320N	-550.	-154.	-63.	-197.	1631.	-2287.
	BEND - (	320M	-550.	-154.	-63.	-325.	2020.	-2126.
		>= 320F	-550.	-154.	-63.	-414.	2180.	-1738.
	BEND - (	325M	-550.	-154.	-63.	-458.	2162.	-1304.
		>= 325F	-550.	-154.	-63.	-477.	2118.	-1035.
	STRAIGHT - (	>= 326	-550.	-154.	-63.	-477.	1748.	-228.
	STRAIGHT - (	>= 330	-550.	-3.	-63.	-477.	1191.	-197.
	STRAIGHT - (	>= 335	-550.	18.	-63.	-477.	-2.	711.
	STRAIGHT - (	>= 336N	-550.	18.	-63.	-477.	-159.	665.
	BEND - (336M	-550.	18.	-63.	-458.	-204.	491.
		>= 336F	-550.	18.	-63.	-414.	-222.	98.

DYNAFLEX

LOADING - FREE THERMAL

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>- 336F	-550.	18.	-63.	-414.	-222.	98.
	BEND - (	337M	-550.	18.	-63.	-364.	-61.	-291.
		>- 337F	-550.	18.	-63.	-333.	328.	-452.
	STRAIGHT - (	339N	-550.	18.	-63.	-179.	4999.	-452.
	BEND - (	339M	-550.	18.	-63.	-166.	5369.	-457.
		>- 339F	-550.	18.	-63.	-160.	5485.	-470.
	STRAIGHT - (	340	-550.	18.	-63.	-160.	5328.	-516.
		>- 341N	-550.	-70.	-63.	-160.	5171.	-341.
	BEND - (	341M	-550.	-70.	-63.	-140.	4966.	-292.
217		>- 341F	-550.	-70.	-63.	-91.	4559.	-272.
	STRAIGHT - (	343N	-550.	-70.	-63.	502.	-112.	-272.
	BEND - (	343M	-550.	-70.	-63.	533.	-501.	-111.
		>- 343F	-550.	-70.	-63.	509.	-662.	278.
	STRAIGHT - (	344	-550.	-70.	-63.	446.	-662.	827.
BRANCH PT.		-- 344	-550.	-70.	-63.	446.	-662.	827.
BRANCH PT.	STRAIGHT - (	344	-550.	49.	-63.	446.	-662.	708.
		>- 345	-550.	-8.	-63.	446.	-1792.	-180.
	STRAIGHT - (	350	-550.	-8.	-63.	446.	-2923.	-39.
	STRAIGHT - (	352	-550.	-17.	-63.	446.	-3158.	26.
BRANCH PT.		-- 352	-550.	-17.	-63.	446.	-3158.	26.
BRANCH PT.	STRAIGHT - (	352	-421.	115.	561.	-673.	-3380.	772.
		>- 353	-421.	339.	561.	-673.	-716.	224.
	STRAIGHT - (	355N	-421.	339.	561.	-673.	1949.	-1386.
	BEND - (	355M	-421.	339.	561.	-509.	2345.	-1502.
		>- 355F	-421.	339.	561.	-112.	2510.	-1304.

DYNAFLEX

LOADING - @FREE@ THERMAL

PAGE 19

INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>- 355F	-421.	339.	561.	-112.	2510.	-1304.
	STRAIGHT - (	>- 360N	-421.	339.	561.	370.	2510.	-942.
		(360M	-421.	339.	561.	667.	2386.	-645.
		>- 360F	-421.	339.	561.	592.	2089.	-521.
	STRAIGHT - (	>- 365N	-421.	339.	561.	-2627.	-1908.	-521.
		(365M	-421.	339.	561.	-2703.	-2206.	-398.
		>- 366	-421.	339.	561.	-2405.	-2329.	-101.
	RIGID - (	>- 367	-421.	339.	561.	-1447.	-2329.	618.
		(370N	-421.	339.	561.	-130.	-2329.	1607.
218		(370M	-421.	339.	561.	168.	-2452.	1904.
		>- 370F	-421.	339.	561.	93.	-2750.	2027.
	STRAIGHT - (	-- 375	-421.	339.	561.	-1263.	-4433.	2027.
ANCHOR		-- 352	-129.	-133.	-624.	1119.	222.	-746.
BRANCH PT.	STRAIGHT - (	>- 380N	-129.	-133.	-624.	-41.	222.	-506.
		(380M	-129.	-133.	-624.	-443.	184.	-415.
		>- 380F	-129.	-133.	-624.	-532.	93.	-377.
	STRAIGHT - (	>- 385N	-129.	-133.	-624.	729.	-1130.	-377.
		(385M	-129.	-133.	-624.	640.	-1221.	-340.
		>- 386	-129.	-133.	-624.	238.	-1259.	-249.
	RIGID - (	>- 387	-129.	-133.	-624.	-428.	-1259.	-29.
		(390N	-129.	-133.	-624.	-2293.	-1259.	274.
		(390M	-129.	-133.	-624.	-2695.	-1297.	365.
		>- 390F	-129.	-133.	-624.	-2784.	-1388.	403.

DYNAFLEX

LOADING - 2°F/FEET THERMAL

PAGE 20

INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>= 390F	-129.	-133.	-624.	-2784.	-1388.	403.
ANCHOR	STRAIGHT - (-- 395	-129.	-133.	-624.	-2253.	-1903.	403.
BRANCH PT.		-- 344	0.	-119.	0.	0.	0.	119.
TERMINAL	STRAIGHT - (-- 405	0.	-119.	0.	0.	-0.	-0.

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DYNAFLEX

LOADING = GRAVITY THERMAL

PAGE 21

 * DISPLACEMENTS AND ROTATIONS *

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 30S	-.000	-.000	-.000	.000	-.000	.000
	STRAIGHT - (	>- 310N	-.023	-.005	.132	.014	-.067	.059
	BEND - (	310M	-.046	.005	.165	.033	-.180	.114
	STRAIGHT - (	>- 310F	-.084	.033	.184	.052	-.234	.208
	BEND - (	>- 315N	-.525	.426	.314	.091	-.429	.234
	BEND - (	315M	-.585	.450	.342	.123	-.448	.220
	STRAIGHT - (	>- 315F	-.669	.442	.382	.154	-.511	.227
	BEND - (	>- 320N	-1.758	.106	.800	.175	-.548	.112
	BEND - (	320M	-1.830	.067	.820	.168	-.526	.106
	BEND - (	>- 320F	-1.848	.076	.809	.160	-.522	.081
	BEND - (	325M	-1.826	-.002	.817	.164	-.508	.045
	STRAIGHT - (	>- 325F	-1.793	-.010	.879	.174	-.468	.018
	STRAIGHT - (	>- 326	-1.562	.000	1.370	.161	-.426	.004
	STRAIGHT - (	>- 330	-1.144	-.000	2.156	.137	-.368	.004
	STRAIGHT - (	>- 335	-.309	.000	3.498	.089	-.322	.016
	BEND - (	>- 336N	-.199	.010	3.667	.082	-.323	.023
	BEND - (	336M	-.170	.028	3.720	.080	-.324	.037
	BEND - (>- 336F	-.163	.061	3.751	.072	-.323	.040
	BEND - (337M	-.190	.088	3.774	.063	-.323	.043
	BEND - (>- 337F	-.240	.092	3.809	.055	-.318	.040

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DYNAFLEX

LOADING - REFERENCE THERMAL

PAGE 22

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>- 337F	-.240	.092	3.809	.055	-.318	.040
	STRAIGHT - (	>- 339N	-.749	.003	4.183	.046	-.225	.020
	BEND - (	339M	-.761	-.003	4.223	.046	-.103	.017
		>- 339F	-.733	-.003	4.241	.047	.026	.009
	STRAIGHT - (	>- 340	-.623	-.000	4.213	.045	.081	.004
	STRAIGHT - (	>- 341N	-.513	.001	4.157	.043	.135	-.000
	BEND - (	341M	-.495	.003	4.115	.040	.255	-.008
		>- 341F	-.529	.008	4.066	.036	.367	-.011
	STRAIGHT - (	>- 343N	-1.277	.075	3.692	.043	.444	-.023
221	BEND - (	343M	-1.344	.069	3.658	.055	.439	-.022
		>- 343F	-1.374	.041	3.636	.068	.435	-.017
	STRAIGHT - (	-- 344	-1.377	-.003	3.621	.070	.431	-.015
BRANCH PT.		-- 344	-1.377	-.003	3.621	.070	.431	-.015
	STRAIGHT - (	>- 345	-.545	-.000	2.139	.112	.341	.005
	STRAIGHT - (	>- 350	.206	-.000	1.153	.155	.168	-.003
BRANCH PT.	STRAIGHT - (	-- 352	.371	-.003	1.039	.164	.122	-.003
BRANCH PT.		-- 352	.371	-.003	1.039	.164	.122	-.003
	STRAIGHT - (	>- 353	.580	.000	.943	.147	.082	.006
	STRAIGHT - (	>- 355N	.789	.004	.860	.130	.094	-.005
	BEND - (	355M	.818	-.012	.835	.139	.133	-.040
		>- 355F	.822	-.046	.805	.148	.149	-.073
	STRAIGHT - (	>- 360N	.809	-.084	.779	.148	.161	-.077
	BEND - (	360M	.785	-.106	.743	.161	.184	-.108

DYNAFLEX

LOADING - FREE THERMAL

PAGE 23

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND - (	360M	.785	-.106	.743	.161	.184	-.108
	>-	360F	.746	-.094	.702	.177	.233	-.127
	STRAIGHT - (
	>-	365N	.253	.240	.284	.137	.236	-.153
	BEND - (	365M	.212	.243	.247	.073	.198	-.144
	>-	366	.180	.215	.229	.013	.182	-.135
	RIGID - (
	>-	367	.132	.140	.224	.012	.182	-.134
	STRAIGHT - (
	>-	370N	.068	.037	.221	.005	.153	-.124
	BEND - (	370M	.044	.006	.207	.006	.123	-.074
	>-	370F	.027	-.006	.176	.010	.059	-.043
	STRAIGHT - (
ANCHOR	--	375	.000	-.000	-.000	.000	.000	-.000
BRANCH PT.	--	352	.371	-.003	1.039	.164	.122	-.003
	STRAIGHT - (
	>-	380N	.369	-.084	.974	.168	.124	-.008
	BEND - (	380M	.359	-.105	.936	.161	.128	-.019
	>-	380F	.338	-.095	.895	.149	.133	-.023
	STRAIGHT - (
	>-	385N	.085	.197	.477	.153	.113	-.042
	BEND - (	385M	.067	.208	.436	.170	.092	-.037
	>-	386	.057	.188	.397	.181	.084	-.035
	RIGID - (
	>-	387	.044	.112	.352	.181	.084	-.035
	STRAIGHT - (
	>-	390N	.027	.009	.246	.166	.068	-.034
	BEND - (	390M	.019	-.014	.212	.106	.056	-.020
	>-	390F	.012	-.016	.176	.041	.027	-.009
	STRAIGHT - (
ANCHOR	--	395	.000	.000	.000	.000	.000	-.000
BRANCH PT.	--	344	-1.377	-.003	3.621	.070	.431	-.015

DYNAFLEX

LOADING - FREE THERMAL

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.	STRAIGHT - (	-- 344	-1.377	-.003	3.621	.070	.431	-.015
TERMINAL		-- 405	-1.377	.000	3.712	.070	.431	-.012



DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UKIF)

PAGE 25

 *
 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *
 *

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)				
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT	
ANCHORS:									
305	7.	38.	0.	38.	-440.	89.	198.	490.	
375	-16.	-87.	-4.	88.	-130.	-220.	-145.	294.	
395	9.	-219.	4.	219.	347.	60.	-27.	353.	
RESTRAINTS:									
315F	0.	-1229.	0.	1229.	0.	0.	0.	0.	
326	0.	-995.	0.	995.	0.	0.	0.	0.	
330	0.	-588.	0.	588.	0.	0.	0.	0.	
335	0.	-1067.	0.	1067.	0.	0.	0.	0.	
340	0.	-894.	0.	894.	0.	0.	0.	0.	
345	0.	-1210.	0.	1210.	0.	0.	0.	0.	
350	0.	-653.	0.	653.	0.	0.	0.	0.	
353	0.	-1211.	0.	1211.	0.	0.	0.	0.	
365N	0.	-1084.	0.	1084.	0.	0.	0.	0.	

DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

PAGE 26

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
385N	0.	-890.	0.	890.	0.	0.	0.	0.
405	0.	-724.	0.	724.	0.	0.	0.	0.

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DYNAFLEX

LOADING - UNRESTRAINED WEIGHT (4UNIT)

PAGE 27

 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

THE MAXIMUM STRESS OF 4909. OCCURS AT POINT 344

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 305	0.	38.	198.	444.	89.	1.00	1.00	16.81	353.
	STR -(	>- 310N	0.	200.	198.	87.	70.	2.44	2.44	16.81	297.
	BEND -(	310M	171.	171.	188.	68.	95.	2.44	2.44	16.81	289.
	STR -(	>- 310F	285.	7.	63.	143.	205.	2.44	2.44	16.81	337.
	BEND -(	>- 315N	766.	7.	63.	141.	263.	2.44	2.44	16.81	398.
	BEND -(	315M	572.	571.	233.	373.	146.	2.44	2.44	16.81	605.
	STR -(	>- 315F	0.	851.	269.	961.	57.	2.44	2.44	16.81	1305.
	BEND -(	>- 320N	0.	135.	269.	192.	5.	2.44	2.44	16.81	432.
	BEND -(	320M	125.	126.	196.	83.	182.	2.44	2.44	16.81	366.
	BEND -(	>- 320F	220.	7.	12.	26.	263.	2.44	2.44	16.81	345.
	BEND -(	325M	181.	190.	10.	186.	27.	2.44	2.44	16.81	245.
	STR -(	>- 325F	7.	305.	26.	17.	11.	2.44	2.44	16.81	44.
	STR -(	>- 326	7.	407.	26.	2361.	10.	1.00	1.00	16.81	1685.
	STR -(	>- 330	7.	482.	26.	931.	8.	1.00	1.00	16.81	665.
	STR -(	>- 335	7.	544.	26.	1524.	3.	1.00	1.00	16.81	1088.
	BEND -(	>- 336N	7.	389.	26.	384.	2.	2.44	2.44	16.81	502.
	BEND -(	336M	240.	249.	20.	121.	17.	2.44	2.44	16.81	162.
	BEND -(	>- 336F	304.	7.	2.	26.	20.	2.44	2.44	16.81	43.
	BEND -(	337M	185.	185.	13.	107.	8.	2.44	2.44	16.81	141.
	STR -(	>- 337F	0.	219.	13.	276.	8.	2.44	2.44	16.81	361.
	BEND -(>- 339N	0.	240.	13.	64.	187.	2.44	2.44	16.81	259.
	BEND -(339M	5.	282.	67.	68.	62.	2.44	2.44	16.81	149.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELFM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MOULDS (IN (3))	LONGITUDINAL STRESS PSI		
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		:	:	
	BEND	(	339M	5.	282.	67.	68.	62.	2.44	2.44	16.81	:	149.
		(:		
		>	339F	7.	325.	83.	70.	307.	2.44	2.44	16.81	:	425.
	STR	(:		
		>	340	7.	434.	83.	1287.	69.	1.00	1.00	16.81	:	922.
	STR	(:		
		>	341N	7.	299.	83.	69.	371.	2.44	2.44	16.81	:	505.
		(:		
	BEND	(	341M	4.	257.	238.	66.	8.	2.44	2.44	16.81	:	323.
		(:		
		>	341F	0.	214.	103.	62.	328.	2.44	2.44	16.81	:	457.
	STR	(:		
		>	343N	0.	245.	103.	199.	6.	2.44	2.44	16.81	:	293.
		(:		
	BEND	(	343M	203.	203.	75.	12.	73.	2.44	2.44	16.81	:	138.
		(:		
		>	343F	329.	7.	0.	76.	110.	2.44	2.44	16.81	:	174.
	STR	(:		
228	BR PT	--	344	383.	7.	0.	116.	76.	2.44	2.44	16.81	:	181.
											:		
	BR PT	--	344	7.	330.	76.	603.	0.	2.44	2.44	16.81	:	793.
	STR	(:		
		>	345	7.	568.	76.	2206.	5.	1.00	1.00	16.81	:	1576.
	STR	(:		
		>	350	7.	404.	76.	728.	10.	1.00	1.00	16.81	:	323.
	STR	(:		
	BR PT	--	352	7.	47.	76.	173.	11.	1.84	1.84	16.81	:	187.
											:		
	BR PT	--	352	16.	341.	93.	118.	81.	1.84	1.84	16.81	:	168.
	STR	(:		
		>	353	16.	613.	93.	2346.	62.	1.00	1.00	16.81	:	1677.
	STR	(:		
		>	355N	16.	357.	93.	41.	43.	2.44	2.44	16.81	:	144.
		(:		
	BEND	(	355M	234.	211.	95.	193.	38.	2.44	2.44	16.81	:	285.
		(:		
		>	355F	272.	16.	39.	270.	97.	2.44	2.44	16.81	:	377.
	STR	(:		
		>	360N	226.	16.	39.	100.	256.	2.44	2.44	16.81	:	363.
		(:		
	BEND	(	360M	127.	133.	149.	161.	197.	2.44	2.44	16.81	:	385.
		(:		
		>	360F	4.	142.	240.	276.	23.	2.44	2.44	16.81	:	479.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
STR - (	>- 360F	4.	142.	240.	276.	23.	2.44	2.44	16.81	479.
	>- 365N	4.	712.	240.	820.	126.	2.44	2.44	16.81	1127.
BEND - (	365M	471.	477.	264.	329.	70.	2.44	2.44	16.81	558.
RIGID - (	>- 366	627.	16.	142.	134.	225.	2.44	2.44	16.81	389.
STR - (	>- 367	341.	16.	142.	198.	128.	1.00	1.00	16.81	196.
	>- 370N	214.	16.	142.	118.	161.	2.44	2.44	16.81	320.
BEND - (	370M	118.	125.	210.	61.	2.	2.44	2.44	16.81	285.
STR - (	>- 370F	4.	130.	145.	46.	157.	2.44	2.44	16.81	286.
ANCHR	-- 375	4.	88.	145.	130.	220.	1.00	1.00	16.81	210.
STR PT	-- 382	388.	10.	91.	55.	169.	1.84	1.84	16.81	197.
	>- 380N	287.	10.	91.	176.	38.	2.44	2.44	16.81	263.
BEND - (	380M	176.	171.	41.	103.	85.	2.44	2.44	16.81	182.
STR - (	>- 380F	4.	203.	29.	54.	82.	2.44	2.44	16.81	134.
	>- 385N	4.	580.	29.	457.	5.	2.44	2.44	16.81	599.
BEND - (	385M	383.	378.	26.	63.	10.	2.44	2.44	16.81	90.
RIGID - (	>- 386	495.	10.	14.	88.	19.	2.44	2.44	16.81	119.
STR - (	>- 387	209.	10.	14.	4.	81.	1.00	1.00	16.81	59.
	>- 390N	82.	10.	14.	73.	18.	2.44	2.44	16.81	99.
BEND - (	390M	31.	27.	5.	86.	29.	2.44	2.44	16.81	118.
STR - (	>- 390F	4.	10.	27.	97.	23.	2.44	2.44	16.81	135.
ANCHR	-- 395	4.	219.	27.	347.	60.	1.00	1.00	16.81	252.
BR PT	-- 344	0.	713.	0.	719.	0.	2.44	2.44	3.21	4909. **

LOADING - 2 RESTRAINED WEIGHT (2R1F)

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT FLEM TYPE	LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)		STF	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	SHEAR	RESULTANT	TORSION	IN-PLANE BENDING	OUT-OF- PLANE BENDING			
BR PT	344	0.	713.	0.	719.	0.	2.44	2.44	3.21	4909. **
TERM	405	0.	724.	0.	0.	0.	1.00	1.00	3.21	0.

 * INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES *

EXPLANATORY NOTES

THE FORCES AND MOMENTS AT ANY POINT SHOWN BELOW REPRESENT THE ACTION OF THE FAR END OF THE BRANCH ACTING ON THE NEAR END OF THE BRANCH.

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
ANCHOR		-- 305	7.	38.	0.	-444.	49.	198.
	STRAIGHT - (	>> 310N	7.	200.	0.	-87.	70.	198.
	BEND - (	310M	7.	242.	0.	68.	65.	200.
		>> 310F	7.	285.	0.	143.	63.	205.
	STRAIGHT - (	>- 315N	7.	766.	0.	141.	63.	263.
	BEND - (	315M	7.	808.	0.	373.	61.	268.
		>- 315F	7.	851.	0.	961.	57.	269.
	STRAIGHT - (	>- 320N	7.	135.	0.	-192.	-5.	269.
	BEND - (	320M	7.	177.	0.	-83.	-10.	268.
		>- 320F	7.	220.	0.	-26.	-12.	263.
	BEND - (	325M	7.	262.	0.	-26.	-12.	186.
		>- 325F	7.	305.	0.	-26.	-11.	-17.
	STRAIGHT - (	>- 326	7.	-407.	0.	-26.	-10.	-2361.
	STRAIGHT - (	>- 330	7.	-482.	0.	-26.	-8.	-931.
	STRAIGHT - (	>- 335	7.	544.	0.	-26.	-3.	-1524.
	STRAIGHT - (	>- 334N	7.	-389.	0.	-26.	-2.	-384.
	BEND - (336M	7.	-346.	0.	-26.	-2.	-121.
		>- 336F	7.	-304.	0.	-26.	-2.	-20.

DYNAFLEX

LOADING - UNRESTRAINED WEIGHT (+UNIF)

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>= 336F	7.	-304.	0.	-26.	-2.	-20.
	BEND - (	337H	7.	-261.	0.	-107.	-4.	-15.
		>= 337F	7.	-219.	0.	-276.	-8.	-13.
	STRAIGHT - (	339N	7.	240.	0.	-187.	-64.	-13.
		>= 339N	7.	240.	0.	-187.	-64.	-13.
	BEND - (	339H	7.	282.	0.	-4.	-68.	-92.
		>= 339F	7.	325.	0.	83.	-70.	-307.
	STRAIGHT - (	340	7.	-434.	0.	83.	-69.	-1287.
		>= 341N	7.	-299.	0.	83.	-69.	-371.
		>= 341N	7.	-299.	0.	83.	-69.	-371.
	BEND - (	341H	7.	-257.	0.	163.	-66.	-174.
		>= 341F	7.	-214.	0.	328.	-62.	-103.
	STRAIGHT - (	343N	7.	245.	0.	199.	-6.	-103.
		>= 343N	7.	245.	0.	199.	-6.	-103.
	BEND - (	343H	7.	287.	0.	12.	-2.	-105.
		>= 343F	7.	329.	0.	-76.	0.	-110.
	STRAIGHT - (	344	7.	383.	0.	-76.	0.	-116.
BRANCH PT.		-- 344	7.	383.	0.	-76.	0.	-116.
		>= 344	7.	-330.	0.	-76.	0.	603.
BRANCH PT.	STRAIGHT - (	345	7.	-568.	0.	-76.	5.	-2206.
		>= 345	7.	-568.	0.	-76.	5.	-2206.
	STRAIGHT - (	350	7.	404.	0.	-76.	10.	-728.
		>= 350	7.	404.	0.	-76.	10.	-728.
BRANCH PT.	STRAIGHT - (	352	7.	-47.	0.	-76.	11.	-173.
		-- 352	7.	-47.	0.	-76.	11.	-173.
BRANCH PT.		-- 352	16.	341.	4.	93.	-81.	-118.
	STRAIGHT - (	353	16.	-613.	4.	93.	-62.	-2346.
		>= 353	16.	-613.	4.	93.	-62.	-2346.
	STRAIGHT - (	355N	16.	-357.	4.	93.	-43.	-41.
		>= 355N	16.	-357.	4.	93.	-43.	-41.
	BEND - (	355M	16.	-315.	4.	94.	-40.	193.
		>= 355M	16.	-315.	4.	94.	-40.	193.
		>= 355F	16.	-272.	4.	97.	-39.	270.

DYNAFLEX

LOADING - RESTRAINED WEIGHT (+UNIF)

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		>= 355F	16.	-272.	4.	97.	-39.	270.
	STRAIGHT - (	>= 360M	16.	-226.	4.	100.	-39.	256.
	BEND - (	360M	16.	-183.	4.	161.	-34.	245.
		>= 360F	16.	-141.	4.	276.	-23.	240.
	STRAIGHT - (	>= 365N	16.	-712.	4.	-420.	126.	240.
	BEND - (	365M	16.	-670.	4.	-329.	137.	236.
		>= 366	16.	-627.	4.	-134.	142.	225.
	RIGID - (	>= 367	16.	-341.	4.	-128.	142.	198.
	STRAIGHT - (	>= 370N	16.	-214.	4.	-118.	142.	161.
	BEND - (	370M	16.	-172.	4.	-61.	146.	150.
		>= 370F	16.	-129.	4.	46.	157.	145.
	STRAIGHT - (	-- 375	16.	87.	4.	130.	220.	145.
ANCHOR		-- 352	-9.	-388.	-4.	-169.	91.	-55.
	STRAIGHT - (	>= 380N	-9.	-287.	-4.	-176.	91.	-38.
	BEND - (	380M	-9.	-245.	-4.	-103.	89.	-31.
		>= 380F	-9.	-203.	-4.	54.	82.	-29.
	STRAIGHT - (	>= 385N	-9.	-580.	-4.	-457.	-5.	-29.
	BEND - (	385M	-9.	-538.	-4.	-63.	-11.	-26.
		>= 386	-9.	-495.	-4.	88.	-14.	-19.
	RIGID - (	>= 387	-9.	-209.	-4.	81.	-14.	-4.
	STRAIGHT - (	>= 390N	-9.	-82.	-4.	73.	-14.	18.
	BEND - (390M	-9.	-40.	-4.	88.	-17.	24.
		>= 390F	-9.	3.	-4.	97.	-23.	27.

DYNAFLEX

LOADING = RESTRAINED WEIGHT (+UKIF)

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INTERNAL FORCES AND MOMENTS ORIENTED TO X Y AND Z AXES (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)		
			X	Y	Z	X	Y	Z
		> 390F	-9.	3.	-4.	97.	-23.	27.
ANCHOR	STRAIGHT -(	-- 395	-9.	219.	-4.	-347.	-60.	27.
BRANCH PT.		-- 344	0.	713.	-0.	0.	-0.	-719.
TERMINAL	STRAIGHT -(	-- 405	0.	724.	-0.	0.	0.	-0.

 * DISPLACEMENTS AND ROTATIONS *

 *

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR	STRAIGHT -(	305	.000	.000	.000	-.000	.000	.000
	>-	310N	.000	.001	.000	-.004	.001	.003
	(
	BEND -(	310M	.000	.002	-.000	-.004	.001	.004
	(
	>-	310F	-.001	.002	-.001	-.001	.000	.004
	STRAIGHT -(
	>-	315N	-.023	.003	.002	.004	.003	.016
	(
	BEND -(	315M	-.026	.002	.003	.009	.002	.021
	(
	>-	315F	-.027	-.000	.004	.024	.002	.023
	STRAIGHT -(
	>-	320N	-.022	-.056	.004	.024	.003	.037
	(
	BEND -(	320M	-.019	-.059	.002	.020	.004	.039
	(
	>-	320F	-.013	-.060	-.001	.019	.006	.044
	(
	BEND -(	325M	-.006	-.057	-.004	.019	.006	.049
	(
	>-	325F	-.003	-.049	-.006	.018	.005	.052
	STRAIGHT -(
	>-	326	-.003	-.000	-.011	.018	.005	.029
	STRAIGHT -(
	>-	330	-.003	-.000	-.021	.016	.005	-.019
	STRAIGHT -(
	>-	335	-.003	-.000	-.038	.014	.004	.011
	STRAIGHT -(
	>-	336N	-.003	.003	-.040	.013	.004	.002
	(
	BEND -(	336M	-.003	.002	-.040	.013	.004	-.004
	(
	>-	336F	-.002	.002	-.038	.013	.004	-.005
	(
	BEND -(337M	-.001	.001	-.036	.011	.005	-.005
	(
	>-	337F	.000	-.000	-.036	.007	.004	-.005

DYNAFLEX

LOADING - UNRESTRAINED WEIGHT (+UP/F)

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>= 337F	.000	-.000	-.036	.007	.004	-.005
	STRAIGHT - (	>= 339N	.007	.005	-.036	-.012	.003	-.006
	BEND - (	339M	.008	.007	-.036	-.014	.002	-.006
		>= 339F	.008	.007	-.036	-.013	.000	-.010
	STRAIGHT - (	>= 340	.008	-.000	-.036	-.012	-.001	-.018
	STRAIGHT - (	>= 341N	.008	-.012	-.035	-.010	-.001	-.026
	BEND - (	341M	.008	-.017	-.035	-.011	-.003	-.031
		>= 341F	.009	-.021	-.035	-.007	-.004	-.031
	STRAIGHT - (	>= 343N	.018	-.014	-.035	.014	-.006	-.035
	BEND - (	343M	.016	-.012	-.036	.016	-.005	-.036
237		>= 343F	.011	-.011	-.038	.015	-.004	-.038
BRANCH PT.	STRAIGHT - (	-- 344	.003	-.011	-.041	.015	-.004	-.039
BRANCH PT.		-- 344	.003	-.011	-.041	.015	-.004	-.039
	STRAIGHT - (	>= 345	.003	-.000	-.024	.007	-.004	.010
	STRAIGHT - (	>= 350	.003	-.000	-.009	.000	-.004	.009
BRANCH PT.	STRAIGHT - (	-- 352	.003	.004	-.006	-.001	-.004	.003
BRANCH PT.		-- 352	.003	.004	-.006	-.001	-.004	.003
	STRAIGHT - (	>= 353	.003	-.000	-.002	.001	-.005	-.019
	STRAIGHT - (	>= 355N	.003	-.034	.003	.003	-.006	-.040
	BEND - (	355M	.001	-.040	.004	.004	-.006	-.038
		>= 355F	-.004	-.042	.004	.005	-.006	-.032
	STRAIGHT - (	>= 360N	-.010	-.042	.003	.006	-.006	-.031
	BEND - (360M	-.014	-.042	.002	.009	-.008	-.026

DYNAFLEX

LOADING = UNRESTRAINED WEIGHT (KUNIF)

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND -(	360M	-.014	-.042	.002	.009	-.008	-.026
)							
	>- 360F		-.014	-.040	.001	.014	-.010	-.024
	STRAIGHT -(
	>- 365N		.005	-.000	.001	.019	-.008	-.012
	(
	BEND -(	365M	.005	.002	.001	.006	-.007	-.011
	(
	>- 366		.004	.002	.000	.001	-.007	-.007
	RIGID -(
	>- 367		.002	.002	-.000	.001	-.007	-.007
	STRAIGHT -(
	>- 370N		-.002	.002	-.000	-.000	-.005	-.006
	(
	BEND -(	370M	-.002	.002	-.000	-.002	-.005	-.003
	(
	>- 370F		-.001	.001	-.000	-.003	-.003	-.003
	STRAIGHT -(
ANCHOR	-- 375		-.000	-.000	-.000	-.000	-.000	-.000
BRANCH PT.	-- 352		.003	.004	-.006	-.001	-.004	.003
	STRAIGHT -(
	>- 380N		.004	.004	-.006	-.003	-.003	.003
	(
	BEND -(	380M	.005	.004	-.005	-.006	-.002	.001
	(
	>- 380F		.005	.002	-.004	-.007	.000	.001
	STRAIGHT -(
	>- 385N		.003	-.000	-.004	.001	.002	-.001
	(
	BEND -(	385M	.002	-.000	-.004	-.005	.002	-.001
	(
	>- 386		.002	-.001	-.004	-.004	.002	-.001
	RIGID -(
	>- 387		.002	-.001	-.002	-.004	.002	-.001
	STRAIGHT -(
	>- 390N		.001	-.001	-.000	-.003	.001	-.001
	(
	BEND -(	390M	.001	-.001	-.000	-.001	.001	-.001
	(
	>- 390F		.000	-.001	.000	.001	.001	-.001
	STRAIGHT -(
ANCHOR	-- 395		.000	-.000	.000	.000	.000	-.000
BRANCH PT.	-- 344		.003	-.011	-.041	.015	-.004	-.039

DYNAFLEX

LOADING = RESTRAINER WEIGHT (+UNIF)

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
BRANCH PT.	STRAIGHT - (	-- 344	.003	-.011	-.041	.015	-.004	-.039
TERMINAL		-- 405	.003	-.000	-.042	.015	-.004	-.053

HANGER DESIGN DATA
-----EXPLANATORY NOTES:

- (1) ALL MOVEMENTS SHOWN BELOW REFER TO THE INITIAL EXPANSION LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE NOT BEEN VERTICALLY RESTRAINED AND ALL WEIGHT EFFECTS HAVE BEEN SUPPRESSED.
- (2) THE WEIGHT REACTIONS SHOWN BELOW REFER TO THE WEIGHT LOADING CASE WHEREIN TENTATIVE HANGER LOCATIONS HAVE BEEN RIGIDLY RESTRAINED IN THE VERTICAL DIRECTION AND ALL THERMAL EFFECTS INCLUDING IMPOSED ANCHOR MOVEMENTS HAVE BEEN SUPPRESSED.
- (3) IN THE FOLLOWING TABLE VSH DENOTES A VARIABLE SPRING HANGER AND CSH DENOTES A CONSTANT SUPPORT HANGER.
- (4) THE SUPPORT LOADS IN THE INSTALLED CONDITION HAVE BEEN CALCULATED TO PRODUCE THE CORRECT WEIGHT BALANCE IN THE OPERATING CONDITION.
- (5) IF THE FREE VERTICAL MOVEMENT EXCEEDS THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION OF .10 IN , A VARIABLE SPRING IS SELECTED. IF A VARIABLE SPRING HANGER CANNOT BE FOUND WHICH SATISFIES BOTH THE LOAD VARIATION CRITERION SELECTED BY THE USER AND THE WORKING RANGE OF THE SPRINGS LISTED IN SPRING TABLE (I) OF THE USER'S MANUAL, A CONSTANT SUPPORT HANGER IS RECOMMENDED.
- (6) THE NOMINAL ROD DIAMETER FOR RIGID HANGERS IS TAKEN FROM ANSI B31.1 - 1977 TABLE 121.2.2(A), (CARRYING CAPACITIES OF THREADED ASTM A 107 HOT ROLLED CARBON STEEL) ASSUMING A ROD TEMPERATURE OF 650 DEGREES FAHRENHEIT. A MINIMUM 1/2 IN. DIAMETER ROD WILL BE SELECTED FOR ALL PIPE WHICH IS NOMINALLY 2-1/2 IN. OD OR LARGER.
- (8) THE SO-CALLED @THEORETICAL@ SPRING INSTALLATION LOAD SHOWN BELOW PRESUPPOSES THAT THE HANGER LOCATION IS RESTRAINED AGAINST VERTICAL MOVEMENT WHILE THE SPRING IS SET TO THE COLD LOAD.

HANGER DESIGN DATA TABLE

HANGER LOC. NO.	SUPPORT LOAD (POUNDS)	FREE VERTICAL MOVEMENT (INCHES)	HORIZONTAL MOVEMENT (INCHES)		TYPE	PRELIMINARY HANGER SELECTION SPECIFICATION	SWING	
			X	Y			LENGTH (FEET)	ANGLE (DEG)
315F	1229.	.44	-.67	.38	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 520 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1458 LBS SPRING LOAD IN THE OPERATING CONDITION = 1229 LBS	N/A	N/A
365N	1084.	.24	.25	.28	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 400 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1180 LBS SPRING LOAD IN THE OPERATING CONDITION = 1084 LBS	N/A	N/A
385N	890.	.20	.08	.48	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 400 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 969 LBS SPRING LOAD IN THE OPERATING CONDITION = 890 LBS	N/A	N/A

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DYNAFLEX

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 *
 * STATIC SOLUTION ACCURACY CHECKS *
 *

EACH BASIC STATIC SOLUTION COMPRISING EACH LOAD OR LOADING COMBINATION
 SPECIFIED IN THIS RUN HAS BEEN SUBJECTED TO EQUILIBRIUM AND
 COMPATIBILITY CHECKS FOR ALL POINTS IN THE SYSTEM:

LOADING = @FREE@ THERMAL

 STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

LOADING = @RESTRAINED@ WEIGHT (+UNIF)

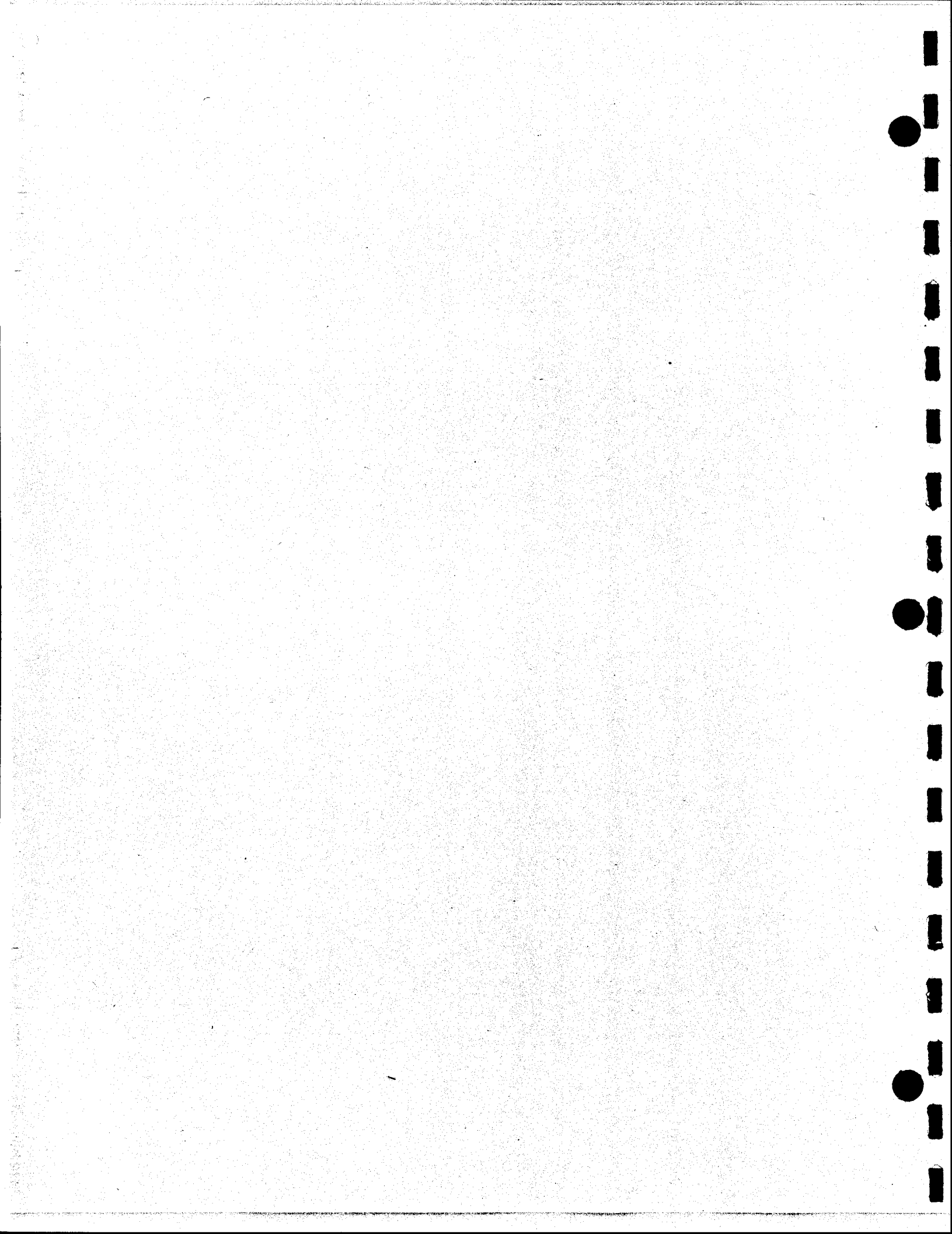
 STATIC EQUILIBRIUM AND COMPATIBILITY HAVE BEEN SATISFIED FOR THIS
 BASIC STATIC SOLUTION AT ALL POINTS IN THE SYSTEM.

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DYNALOX

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STEARNs - ROGER CORP

PROJECT - DOE 10MW SOLAR PILOT PLANT C-21700
 JOB - YSS OIL EXTR(X-TU-12-A-1)

DATE 7 / 7 / 80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYPE	LOC	FRONT	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	1	1	1	1	1	1	1	STEARNs - ROGER CORP, : 7 / 7 / 80, PROJ, DOE 10MW	1
2	1	1	1	1	1	1	1	W SOLAR PILOT PLANT : C-21700, YSS OIL EXTR	2
3	1	1	1	1	1	1	1	TR(X-TU-12-A-1) : APPLY R31, 1-1973	3
4	1	1	1	1	1	1	1	MAT=LCS, 00#8.625, : PTS.322, UNIF#25.4,	4
5	1	1	1	1	1	1	1	TEMP=580. :	5
6	1	1	1	1	1	1	1		6
7	1	1	1	1	1	1	1		7
8	1	1	1	1	1	1	1		8
9	1	1	1	1	1	1	1		9
10	1	1	1	1	1	1	1		10
11	1	1	1	1	1	1	1		11
12	1	1	1	1	1	1	1		12
13	1	1	1	1	1	1	1		13
14	1	1	1	1	1	1	1		14
15	1	1	1	1	1	1	1		15
16	1	1	1	1	1	1	1	SIF#2.44	16
17	1	1	1	1	1	1	1		17
18	1	1	1	1	1	1	1		18
19	1	1	1	1	1	1	1	MULT	19
20	1	1	1	1	1	1	1		20
21	1	1	1	1	1	1	1		21
22	1	1	1	1	1	1	1		22
23	1	1	1	1	1	1	1		23
24	1	1	1	1	1	1	1		24
25	1	1	1	1	1	1	1	RIGID, WEIGHT#243.	25
26	1	1	1	1	1	1	1		26
27	1	1	1	1	1	1	1		27
28	1	1	1	1	1	1	1		28
29	1	1	1	1	1	1	1		29
30	1	1	1	1	1	1	1		30
31	1	1	1	1	1	1	1	RIGID, WEIGHT#243.	31
32	1	1	1	1	1	1	1		32

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYPE	LOC	FRMT	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
33	:	:	:	:	195		-5-0			33
34	:	:	344	405	-1-0				ROD=4.50,WT=.237, TEMP=70.,UNIF=0.0	34
35	:	ANC	305	:	:	:	:	:		35
36	:	ANC	375	:	:	:	:	:		36
37	:	ANC	395	:	:	:	:	:		37
38	:	RAD	326	:	:	:	:	:		38
39	:	RAD	330	:	:	:	:	:	RIGID	39
40	:	RAD	335	:	:	:	:	:	RIGID	40
41	:	RAD	340	:	:	:	:	:	RIGID	41
42	:	RAD	345	:	:	:	:	:	RIGID	42
43	:	RAD	350	:	:	:	:	:	RIGID	43
44	:	RAD	355	:	:	:	:	:	RIGID	44
45	:	RAD	405	:	:	:	:	:	RIGID	45
46	:	CCC	375	:	95-6		-1-0			46
47	:	CCC	395	:	85-0		-1-0			47
48	:	DYL	:	:	:	:	:	:	SPEC 1(FRE76.,1/.013, .25/.082,2.5/.638, 197.531,33.7,125), SPEC 2(FRE/G,1/.009, .25/.055,2.5/.638, 197.531,33.7,125), SHOCK 1(X71.0SPEC 1), SHOCK 2(Z71.0 SPEC 1), SHOCK 3(Y71.SPEC2), SHOCK 4(X71.SPEC1, Y71.SPEC2,Z71.SPEC1), LOG,1.92	48
49	:	DHT	:	:	:	:	:	:	LUMP POTENTIAL(AUTOMATIC, MAX SPACING=5-0, EXCLUDE ALL N NODS), MODE CUTOFF=60, FREQUENCY CUTOFF=33, SHOCK 1,SHOCK 2, SHOCK 3,SHOCK 4	49
50	:	OUT	:	:	:	:	:	:		50

PROJECT - DOE 10MW SOLAR PILOT PLANT C-21700
JOB - TSS OIL EXTR(X-TU-12-A-1)

DATE 7/ 7/80

*
* EDITED PIPING SYSTEM DESCRIPTION *

*

EXPLANATORY NOTES

IN THE EDITED PIPING SYSTEM DESCRIPTION:

- (1) POINT LOCATION NUMBER SUFFIXES N, M AND F IDENTIFY THE NEAR POINT, THE MID POINT AND THE FAR POINT RESPECTIVELY OF A PIPING ELEMENT IN THE DIRECTION IN WHICH THE LINE IS TRAVERSED. FRACTIONAL NODE NUMBERS APPEARING IN THE FOLLOWING REPORTS IDENTIFY THOSE NODES AT WHICH THE PROGRAM HAS INTRODUCED EVENLY SPACED LUMP POINTS AND ARE DETERMINED FROM THE MAXIMUM LUMP SPACING CRITERIA ENTERED BY THE USER. IF FRACTIONAL NODE NUMBERS ARE ASSIGNED TO MORE THAN ONE ELEMENT ORIGINATING AT THE SAME BRANCH POINT, A LETTER WILL PRECEDE THE FRACTIONAL PORTION OF THE NUMBER TO UNIQUELY IDENTIFY EACH POINT (E.G. 2.A1). LETTERS ARE ASSIGNED TO ELEMENTS ALPHABETICALLY IN THE ORDER OF THEIR APPEARANCE IN THE INPUT DATA.
- (2) AMBIENT TEMPERATURE IS ASSUMED TO BE 70 DEGREES FAHRENHEIT.
- (3) THE MAXIMUM ALLOWABLE DIFFERENCE IN LOOP CLOSURE CALCATIONS IS ASSUMED TO BE .25 INCHES.
- (4) THE MAXIMUM ALLOWABLE DIFFERENCE BETWEEN THE CALCULATED AND INPUT COORDINATES OF USER DESIGNATED CHECK POINTS IS ASSUMED TO BE .25 INCHES.
- (8) IN ORDER TO MAKE IT POSSIBLE IN CERTAIN SITUATIONS TO PERFORM INDEPENDENT WEIGHT AND THERMAL ANALYSES IN THE SAME RUN AND APPLY THE CODE STRESS CALCULATIONS CORRECTLY, THE PROGRAM MAKES CERTAIN ASSUMPTIONS. IF THE INPUT DATA SPECIFIES IMPOSED MOVEMENTS ON ANCHORS (ANC) OR DISPLACEMENTS OR ROTATIONS ON RIGID RESTRAINTS (RAD, RAR) THESE ARE ASSUMED BY THE PROGRAM TO BE THERMAL EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE THERMAL. ALTERNATELY, IF THE INPUT DATA SPECIFIES FORCES AND MOMENTS (FOR, MOM) OR IMPOSED DISPLACEMENTS OR ROTATIONS ON FLEXIBLE RESTRAINTS (RAD, RAR) THESE ARE ASSUMED TO BE WEIGHT EFFECTS AND INCLUDED ONLY IN THOSE LOADING CASES WHICH INCLUDE WEIGHT. IF THESE ASSUMPTIONS ARE INVALID FOR A PARTICULAR SITUATION, THE USER CAN ACCURATELY MODEL THE MOST GENERAL SITUATION BY USING THE AUXILIARY SUPPORT MOVEMENTS (ASM) AND THE AUXILIARY CONCENTRATED LOADS (ACL) FEATURE OF THE PROGRAM AS AN ALTERNATE METHOD OF SPECIFYING THESE EFFECTS.
- (14) STRESS INTENSIFICATION FACTORS SPECIFIED AT THE TANGENT INTERSECTION POINT OF A BEND OR MITER WILL BE APPLIED TO THE NEAR, MID AND FAR POINTS OF THE BEND OR MITER.
- (15) THE TABLE OF CONTENTS APPEARS AT THE END OF THIS REPORT.

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 4

GENERAL DATA

COORDINATES OF ALL POINTS OF THE SYSTEM ARE WITH RESPECT TO POINT 305, WHICH IS THE ORIGIN

MATERIALS USED (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)

LC3 - LOW CARBON STEEL
 YOUNGS MODULUS AT AMBIENT TEMPERATURE = 27,900,000. PSI
 POISSONS RATIO = .30
 DENSITY = 490. POUNDS PER CUBIC FOOT

SHOCK AND SPECTRUM DATA

MODE CUTOFF SET AT 60

FREQUENCY CUTOFF SET AT 33.00 CPS

SPECTRUM 1		SPECTRUM 2	
(LOGARITHMIC INTERPOLATION)		(LOGARITHMIC INTERPOLATION)	
FREQUENCY	G	FREQUENCY	G
----CPS----	-----	----CPS----	-----
.10	.01	.10	.01
.25	.08	.25	.06
2.50	.64	2.50	.64
9.00	.53	9.00	.53
33.00	.13	33.00	.13

SHOCK SPECIFICATIONS

SHOCK 1 CONSISTS OF :
 100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD.
 CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY BRSS.

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

PAGE 5

SHOCK 2 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 3 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

SHOCK 4 CONSISTS OF :

100.00 PERCENT OF SPECTRUM 1 IN THE X DIRECTION AND
100.00 PERCENT OF SPECTRUM 2 IN THE Y DIRECTION AND
100.00 PERCENT OF SPECTRUM 1 IN THE Z DIRECTION.

THE GLOBAL COMPONENTS OF THIS SHOCK ARE ASSUMED TO ACT INDEPENDENTLY

THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE ARE COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. CLOSELY SPACED MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

LOADING CONDITIONS ANALYZED

- SHOCK 1
- SHOCK 2
- SHOCK 3
- SHOCK 4

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MATEL	DIST. LOADS (LBS PER FT)	
			X	Y	Z							(FAHR)	(PSI)	WT. UNIF
ANCHR		--305	0.00	0.00	0.00								

* NOTES PERTAINING TO POINT 305 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION NO.	POINT LOC. NO.	COORDINATES (FY)			RADIUS (FY)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE WALL			TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z				DIAMETER (IN)	THICK (IN)	MATL		PRESS (PSI)	WT.	UNIF
		>-326	6.25	8.92	15.50				8.625	.322	LCS	580	28.6	25.4
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 326											
		(	IN DIRECTION Y											
	STRAIGHT	-					4.75							
		(
	STRAIGHT	-	>-326.1	11.00	8.92	15.50								
		(					4.75							
		(	>-330	15.75	8.92	15.50								
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330											
		(	IN DIRECTION Y											
	STRAIGHT	-					4.75							
		(
	STRAIGHT	-	>-330.1	20.50	8.92	15.50								
		(					4.75							
	STRAIGHT	-	>-330.2	25.25	8.92	15.50								
		(					4.75							
	STRAIGHT	-	>-330.3	30.00	8.92	15.50								
		(					4.75							
	STRAIGHT	-	>-335	34.75	8.92	15.50								
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 335											
		(	IN DIRECTION Y											
	STRAIGHT	-					2.50							
		(
		(	>-336N	37.25	8.92	15.50								
	BEND	-	336M	37.96	9.21	15.50	1.00	1.57	90.000					
		(
		(	>-336F	38.25	9.92	15.50								
		(
		(* POINT 336F IS EQUIVALENT TO POINT 337N											
		(
	BEND	-	337M	38.25	10.62	15.79	1.00	1.57	90.000					
		(
		(>-337F	38.25	10.92	16.50								

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
								8.625	.322	LCS	580	28.6	25.4
	STRAIGHT	>-337F	38.25	10.92	16.50		4.25						
		>-337F.1	38.25	10.92	20.75		4.25						
	STRAIGHT	>-339H	38.25	10.92	25.00								
	BEND	(339H	38.54	10.92	25.71	1.00	1.57	90.000					
		>-339F	39.25	10.92	26.00		2.50						
	STRAIGHT	>-340	41.75	10.92	26.00								
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 340 IN DIRECTION Y											
	STRAIGHT						2.50						
		>-341N	44.25	10.92	26.00								
	BEND	(341H	44.96	10.92	25.71	1.00	1.57	90.000					
		>-341F	45.25	10.92	25.00		4.25						
	STRAIGHT	>-341F.1	45.25	10.92	20.75		4.25						
		>-343N	45.25	10.92	16.50								
	BEND	(343H	45.25	10.62	15.79	1.00	1.57	90.000					
		>-343F	45.25	9.92	15.50								
	STRAIGHT						1.00						
		(* STRESS INTENSIFICATION SPECIFIED AT POINT 344 STRESS INTENSIFICATION FACTOR = 2.44											
HR PT		>-344	45.25	8.92	15.50								

* NOTES PERTAINING TO POINT 344 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE WALL		TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z				DIAMETER (IN)	THICK (IN)		MAIL (PSI)	WT.	UNIF
BR PT		>-344	45.25	8.92	15.50				8.625	.322	LCS: 580.	28.6	25.4
	STRAIGHT - (						4.50						
		>-344.1	49.75	8.92	15.50								
	STRAIGHT - (						4.50						
		>-344.2	54.25	8.92	15.50								
	STRAIGHT - (						4.50						
		>-344.3	58.75	8.92	15.50								
	STRAIGHT - (						4.50						
		>-345	63.25	8.92	15.50								
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 345 IN DIRECTION Y											
	STRAIGHT - (						4.50						
		>-345.1	67.75	8.92	15.50								
	STRAIGHT - (						4.50						
		>-345.2	72.25	8.92	15.50								
	STRAIGHT - (						4.50						
		>-345.3	76.75	8.92	15.50								
	STRAIGHT - (						4.50						
		>-350	81.25	8.92	15.50								
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 350 IN DIRECTION Y											
	STRAIGHT - (						3.75						
BR PT		>-352	85.00	8.92	15.50								
		* WELDING TEE AT POINT 352											
	STRAIGHT - (						4.75						
		>-353	89.75	8.92	15.50								

* NOTES PERTAINING TO POINT 353 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (FAHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z							PRESS (PSI)	PIPE WT. UNIF
		>-353	89.75	8.92	15.50			8.625	.322	LC9 580	29.6	25.4	
		(
		(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 353									
		(	IN DIRECTION Y									
		(
	STRAIGHT	-				4.75							
		>-355N	94.50	8.92	15.50								
		(
	BEND	-	355M	95.21	8.62	15.50	1.00	1.57	90.000				
		(
	STRAIGHT	-	>-355F	95.50	7.92	15.50		.86					
		(
		>-360N	95.50	7.06	15.50								
		(
	BEND	-	360M	95.50	6.35	15.21	1.00	1.57	90.000				
		(
	STRAIGHT	-	>-360F	95.50	6.06	14.50		4.75					
		(
	STRAIGHT	-	>-360F.1	95.50	6.06	9.75		4.75					
		(
		>-365N	95.50	6.06	5.00								
		(
	BEND	-	365M	95.50	5.76	4.29	1.00	1.57	90.000				
		(
		>-366	95.50	5.06	4.00								
		(
		(	* POINT 366 IS EQUIVALENT TO POINT 365F									
		(
	RIGID	-				1.71		N/A	N/A		N/A	N/A	
		(
		(	* HEIGHT OF ELEMENT = 243. POUNDS									
		(
	STRAIGHT	-	>-367	95.50	3.45	4.00		2.35					
		(
		>-370N	95.50	1.00	4.00								
		(
	BEND	-	370M	95.50	.29	3.71	1.00	1.57	90.000				
		(
	STRAIGHT	-	>-370F	95.50	0.00	3.00		4.00					
		(
	ANCHR	-	--375	95.50	0.00	-1.00							

* NOTES PERTAINING TO POINT 375 APPEAR ON THE FOLLOWING PAGE

DIST. LOADS
(LBS PER FT)

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	TEMP (DEG) MAYL (FAHR)	PRESS PIPE	
			X	Y	Z							(PSI)	WT. UNIF
ANCHR	--375		95.50	0.00	-1.00				8.625	.322	LC9: 540.	28.6	25.4
* CONTROL COORDINATES OF POINT 375, IN FEET :													
X = 95.50, Y = 0.00, Z = -1.00													
RESULTANT DIFFERENCE IS ZERO													
BR PT	--352		85.00	8.92	15.50								
* WELDING TEE AT POINT 352													
STRAIGHT	-					1.86							
		>=380N	85.00	7.06	15.50								
BEND	-	380M	85.00	6.35	15.21	1.00	1.57	90.000					
		>=380F	85.00	6.06	14.50								
STRAIGHT	-	>=380F.1	85.00	6.06	9.75		4.75						
STRAIGHT	-	>=385N	85.00	6.06	5.00		4.75						
BEND	-	385M	85.00	5.76	4.29	1.00	1.57	90.000					
		>=386	85.00	5.06	4.00								
* POINT 386 IS EQUIVALENT TO POINT 385F													
RIGID	-					1.71			N/A	N/A		N/A	N/A
* WEIGHT OF ELEMENT = 243. POUNDS													
STRAIGHT	-	>=387	85.00	3.35	4.00		2.35						
		>=390N	85.00	1.00	4.00								
BEND	-	390M	85.00	.29	3.71	1.00	1.57	90.000					
		>=390F	85.00	0.00	3.00		4.00						
STRAIGHT	-												
ANCHR	--395		85.00	0.00	-1.00								

* NOTES PERTAINING TO POINT 395 APPEAR ON THE FOLLOWING PAGE

DYNAFLEX

EDITED PIPING SYSTEM DESCRIPTION (CONTINUED)

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT)			RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	LCS	TEMP (FHR)	DIST. LOADS (LBS PER FT)	
			X	Y	Z								PRESS (PSI)	WT. UNIF
ANCHR		--395	85.00	0.00	-1.00				8.625	.322		580.	28.6	25.4
			* CONTROL COORDINATES OF POINT 395, IN FEET :											
			X = 85.00, Y = 0.00, Z = -1.00											
			RESULTANT DIFFERENCE IS ZERO											
BR PT		--344	45.25	8.92	15.50									
	STRAIGHT					1.00			4.500	.237		70.	10.8	0.0
			* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 70. DEGREES FAHRENHEIT IS 0.00 INCHES PER 100 FEET											
			* A UNIFORM DISTRIBUTED LOAD OF .00 PLF IS ACTING IN THE +Y DIRECTION.											
TERM		--405	44.25	8.92	15.50									
			* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 405 IN DIRECTION Y											

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 *
 * LUMPED DYNAMIC MODEL *
 * ----- *
 *

EXPLANATORY NOTES:

- (1) THE MASS OF THE SYSTEM IS LUMPED AT THE POINTS SHOWN BELOW. FRACTIONAL LOCATION NUMBERS, IF ANY, RESULT FROM ADDITIONAL MASS POINTS LOCATED BY THE PROGRAM BASED ON THE MAXIMUM LUMP SPACING CRITERION GIVEN IN THE INPUT DATA.
- (2) THE MASS AT A POINT IS A COMBINATION OF DISTRIBUTED MASS LUMPED IN A LINEAR FASHION PLUS ANY ADDITIONAL CONCENTRATED MASS INPUT BY THE USER (SHOWN IN PARENTHESES).
- (3) ROTATIONAL DEGREES OF FREEDOM ARE NOT INCLUDED IN THE MODEL UNLESS SPECIFICALLY ADDED BY THE USER. ALL THREE DISPLACEMENT DEGREES OF FREEDOM ARE AUTOMATICALLY DELETED AT ANCHORS. THE DEGREE OF FREEDOM ASSOCIATED WITH A RIGID RESTRAINT OR SHUBBER ORIENTED IN THE X, Y OR Z DIRECTION IS ALSO DELETED.

DISPLACEMENT FREEDOM

ROTATIONAL FREEDOM

LOC. NO.	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
					X	Y	Z
305	81.				0.	0.	0.
310N	123.	X	Y	Z	0.	0.	0.
310F	163.	X	Y	Z	0.	0.	0.
310F.1	241.	X	Y	Z	0.	0.	0.
315N	163.	X	Y	Z	0.	0.	0.
315F	171.	X	Y	Z	0.	0.	0.
315F.1	256.	X	Y	Z	0.	0.	0.
320N	171.	X	Y	Z	0.	0.	0.
320F	85.	X	Y	Z	0.	0.	0.
325F	113.	X	Y	Z	0.	0.	0.
325F.1	142.	X	Y	Z	0.	0.	0.
326	199.	X		Z	0.	0.	0.
326.1	256.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

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LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION		MOMENT OF INERTIA (LB - IN X IN)			
		X	Y	Z	X	Y	Z
330	256.	X		Z	0.	0.	0.
330.1	256.	X	Y	Z	0.	0.	0.
330.2	256.	X	Y	Z	0.	0.	0.
330.3	256.	X	Y	Z	0.	0.	0.
335	196.	X		Z	0.	0.	0.
336N	110.	X	Y	Z	0.	0.	0.
336F	85.	X	Y	Z	0.	0.	0.
337F	157.	X	Y	Z	0.	0.	0.
337F.1	229.	X	Y	Z	0.	0.	0.
339N	157.	X	Y	Z	0.	0.	0.
339F	110.	X	Y	Z	0.	0.	0.
340	135.	X		Z	0.	0.	0.
341N	110.	X	Y	Z	0.	0.	0.
341F	157.	X	Y	Z	0.	0.	0.
341F.1	229.	X	Y	Z	0.	0.	0.
343N	157.	X	Y	Z	0.	0.	0.
343F	69.	X	Y	Z	0.	0.	0.
344	154.	X	Y	Z	0.	0.	0.
344.1	243.	X	Y	Z	0.	0.	0.
344.2	243.	X	Y	Z	0.	0.	0.
344.3	243.	X	Y	Z	0.	0.	0.
345	243.	X		Z	0.	0.	0.
345.1	243.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

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LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
		X	Y	Z	X	Y	Z
345.2	243.	X	Y	Z	0.	0.	0.
345.3	243.	X	Y	Z	0.	0.	0.
350	223.	X		Z	0.	0.	0.
352	280.	X	Y	Z	0.	0.	0.
353	256.	X		Z	0.	0.	0.
355N	171.	X	Y	Z	0.	0.	0.
355F	66.	X	Y	Z	0.	0.	0.
360N	66.	X	Y	Z	0.	0.	0.
360F	171.	X	Y	Z	0.	0.	0.
360F.1	256.	X	Y	Z	0.	0.	0.
365N	171.	X	Y	Z	0.	0.	0.
366	186.	X	Y	Z	0.	0.	0.
367	207.	X	Y	Z	0.	0.	0.
370N	106.	X	Y	Z	0.	0.	0.
370F	150.	X	Y	Z	0.	0.	0.
375	108.				0.	0.	0.
380N	93.	X	Y	Z	0.	0.	0.
380F	171.	X	Y	Z	0.	0.	0.
380F.1	256.	X	Y	Z	0.	0.	0.
385N	171.	X	Y	Z	0.	0.	0.
386	186.	X	Y	Z	0.	0.	0.
387	207.	X	Y	Z	0.	0.	0.
390N	106.	X	Y	Z	0.	0.	0.

DYNAFLEX

LUMPED DYNAMIC MODEL (CONTINUED)

PAGE 16

LOC. NO.	DISPLACEMENT FREEDOM			ROTATIONAL FREEDOM			
	WEIGHT (POUNDS)	DIRECTION			MOMENT OF INERTIA (LB - IN X IN)		
		X	Y	Z	X	Y	Z
390F	150.	X	Y	Z	0.	0.	0.
395	108.				0.	0.	0.
405	5.	X		Z	0.	0.	0.

NUMBER OF DYNAMIC DEGREES OF FREEDOM = 169, TOTAL MASS OF SYSTEM = 10,811. POUNDS

 * FREQUENCIES, PERIODS OF VIBRATION AND MASS PARTICIPATION FACTORS *

 *

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS		
			X	Y	Z
1	.69941	1.42977	.06914971	.00261905	3.51328306
2	1.35510	.73796	4.60541389	.00408909	.14268382
3	2.13830	.46766	1.09496626	.06005318	.79780044
4	2.29276	.43616	.48321769	.00839986	.53590809
5	3.30343	.30272	.25634576	.15983896	1.97992524
6	4.82790	.20713	.21977936	.00252968	1.18745058
7	5.59529	.17872	.70293889	.27465049	.95781469
8	6.70574	.14913	.32876876	.47619250	2.24746082
9	7.51825	.13301	.39745551	.10004409	.09213541
10	8.93307	.11194	.39817126	.22348810	.05716326
11	10.04218	.09956	.28772566	.13478182	.04930733
12	10.93631	.09104	.15826833	.13272615	.00023493
13	11.41923	.08757	.22095535	.08271012	.02787072
14	12.37819	.08079	1.22141684	.20470181	.01349058
15	13.16172	.07598	.16707319	1.40119799	.11147876
16	13.83638	.07227	.04088603	.69669577	.36324980
17	15.07239	.06635	.03907861	.70685084	.01872522
18	15.28671	.06542	.06651988	.46186478	.06719464
19	15.51822	.06444	.01181893	1.06648796	.10992861
20	15.84303	.06312	.03866422	.61587000	.14244466
21	18.69263	.05350	.01705107	1.38686829	.18827290
22	22.45057	.04454	.04208824	.00902689	.03888803
23	23.73343	.04213	.01658996	1.41541154	.08486023
24	25.67516	.03895	.00942036	1.70551163	.29850293
25	26.01457	.03844	.02670232	.38108551	.12834656
26	27.96334	.03576	.03688055	1.30743945	.03948054
27	28.33971	.03529	.01531060	.79331959	.06040696
28	29.30828	.03412	.00233213	1.53193849	.02438404
29	31.61620	.03163	.08739987	.03242068	.01725992

NOTE:

SECTION 3.7.2 OF THE U.S. NUCLEAR REGULATORY COMMISSION STANDARD REVIEW PLAN DATED JUNE, 1975 STATES THAT AN ADEQUATE NUMBER OF DEGREES OF FREEDOM IN DYNAMIC MODELING MAY BE TAKEN EQUAL TO TWICE THE NUMBER OF MODES WITH FREQUENCIES LESS THAN 33 CPS.

FOR THIS ANALYSIS THE RATIO OF DYNAMIC DEGREES OF FREEDOM TO FREQUENCIES LESS THAN 33 CPS = 5.83

MODE ORTHOGONALITY CHECK

ON DIAGONAL TERMS: MAX. = 1.00000 MIN. = 1.00000

OFF DIAGONAL TERMS: MAX. = 1.89502 X 10⁻¹³ MIN. = -1.94517 X 10⁻¹³

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
305	1071.	132.	368.	1140.	1529.	9177.	7627.	12030.
375	896.	361.	872.	1302.	633.	8769.	4332.	9801.
395	1124.	305.	795.	1410.	739.	10219.	4631.	11244.
RESTRAINTS:								
326	0.	328.	0.	328.	0.	0.	0.	0.
330	0.	323.	0.	323.	0.	0.	0.	0.
335	0.	72.	0.	72.	0.	0.	0.	0.

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
340	0.	39.	0.	39.	0.	0.	0.	0.
345	0.	105.	0.	105.	0.	0.	0.	0.
350	0.	576.	0.	576.	0.	0.	0.	0.
353	0.	472.	0.	472.	0.	0.	0.	0.
405	0.	43.	0.	43.	0.	0.	0.	0.

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 *
 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 * ----- *
 *

THE MAXIMUM STRESS OF 12,889. OCCURS AT POINT 310N

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT FLEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL: STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR	-- 305	368.	1079.	7627.	1529.	9177.	1.00	1.00	16.81	8588.
STR -(
	>- 310N	368.	1078.	7627.	1870.	5981.	2.44	2.44	16.81	12889. **
BEND -(	310M	350.	1084.	1645.	1847.	8846.	2.44	2.44	16.81	11994. *
	>- 310F	133.	1132.	4922.	1623.	6557.	2.44	2.44	16.81	10913.
STR -(
	>- 310F.1	136.	1097.	4922.	1807.	200.	1.00	1.00	16.81	3746.
STR -(
	>- 315N	137.	1061.	4922.	1595.	2840.	2.44	2.44	16.81	7707.
BEND -(	315M	327.	1019.	5774.	1787.	862.	2.44	2.44	16.81	7972.
	>- 315F	330.	1018.	3848.	1789.	3919.	2.44	2.44	16.81	7542.
STR -(
	>- 315F.1	308.	981.	3848.	1154.	913.	1.00	1.00	16.81	2941.
STR -(
	>- 320N	259.	819.	3848.	566.	4960.	2.44	2.44	16.81	8230.
BEND -(	320M	102.	853.	6456.	440.	1385.	2.44	2.44	16.81	8640.
	>- 320F	148.	805.	5761.	3048.	319.	2.44	2.44	16.81	8520.
BEND -(	325M	512.	640.	4278.	2503.	3847.	2.44	2.44	16.81	8192.
	>- 325F	765.	291.	331.	2259.	5709.	2.44	2.44	16.81	8029.
STR -(
	>- 325F.1	646.	266.	331.	2199.	5641.	1.00	1.00	16.81	4329.
STR -(
	>- 326	553.	336.	331.	2185.	5603.	1.00	1.00	16.81	4300.
STR -(
	>- 326.1	439.	317.	331.	864.	5508.	1.00	1.00	16.81	3987.
STR -(
	>- 330	439.	317.	331.	476.	5329.	1.00	1.00	16.81	3827.
STR -(
	>- 330.1	333.	142.	331.	267.	4952.	1.00	1.00	16.81	3548.
STR -(
	>- 330.2	247.	165.	331.	128.	4326.	1.00	1.00	16.81	3099.
STR -(
	>- 330.3	207.	206.	331.	235.	3472.	1.00	1.00	16.81	2496.
STR -(
	>- 335	297.	254.	331.	434.	2471.	1.00	1.00	16.81	1806.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR	>= 335	297.	254.	331.	434.	2471.	1.00	1.00	16.81	1806.
		>= 336N	337.	259.	331.	394.	1957.	2.44	2.44	16.81	2642.
	BEND	(336M	227.	359.	1246.	291.	1372.	2.44	2.44	16.81	2449.
		>= 336F	35.	424.	1785.	132.	266.	2.44	2.44	16.81	2363.
	BEND	(337M	204.	404.	1352.	346.	1084.	2.44	2.44	16.81	2308.
	STR	>= 337F	258.	373.	362.	382.	1476.	2.44	2.44	16.81	2046.
	STR	>= 337F.1	271.	506.	362.	291.	830.	1.00	1.00	16.81	679.
		>= 339N	278.	544.	362.	2684.	244.	2.44	2.44	16.81	3551.
	BEND	(339M	231.	547.	289.	3132.	327.	2.44	2.44	16.81	4129.
	STR	>= 339F	543.	280.	239.	3448.	383.	2.44	2.44	16.81	4541.
	STR	>= 340	607.	281.	239.	439.	4011.	1.00	1.00	16.81	2886.
		>= 341N	638.	272.	239.	4571.	522.	2.44	2.44	16.81	6015.
	BEND	(341M	609.	300.	449.	4540.	379.	2.44	2.44	16.81	5977.
	STR	>= 341F	268.	439.	558.	4156.	213.	2.44	2.44	16.81	5483.
	STR	>= 341F.1	254.	686.	558.	175.	1537.	1.00	1.00	16.81	1174.
		>= 343N	224.	792.	558.	301.	2626.	2.44	2.44	16.81	3527.
	BEND	(343M	184.	402.	2363.	287.	2050.	2.44	2.44	16.81	4100.
	STR	>= 343F	50.	822.	3321.	140.	288.	2.44	2.44	16.81	4356.
BR PT		-- 344	50.	438.	3321.	1063.	140.	2.44	2.44	16.81	4559.
BR PT	STR	-- 344	851.	222.	140.	1038.	3321.	2.44	2.44	16.81	4549.
	STR	>= 344.1	918.	210.	140.	709.	2749.	1.00	1.00	16.81	2029.
	STR	>= 344.2	918.	210.	140.	375.	2283.	1.00	1.00	16.81	1655.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR - (	>- 344.2	918.	210.	140.	375.	2283.	1.00	1.00	16.81	1655.
	STR - (	>- 344.3	988.	203.	140.	44.	1910.	1.00	1.00	16.81	1368.
	STR - (	>- 345	1060.	203.	140.	326.	1653.	1.00	1.00	16.81	1207.
	STR - (	>- 345.1	1133.	198.	140.	209.	1615.	1.00	1.00	16.81	1167.
	STR - (	>- 345.2	1206.	212.	140.	102.	1925.	1.00	1.00	16.81	1380.
	STR - (	>- 345.3	1279.	225.	140.	87.	2548.	1.00	1.00	16.81	1423.
	STR - (	>- 350	1352.	234.	140.	192.	3234.	1.00	1.00	16.81	2315.
BR PT		-- 352	1419.	599.	140.	1892.	3957.	1.84	1.84	16.81	4330.
BR PT	STR - (	-- 352	575.	1174.	1110.	2898.	3806.	1.84	1.84	16.81	4846.
	STR - (	>- 353	654.	914.	1110.	1048.	713.	1.00	1.00	16.81	1203.
	STR - (	>- 355N	707.	916.	1110.	2712.	4229.	2.44	2.44	16.81	6718.
	BEND - (	355M	755.	878.	4020.	2761.	2800.	2.44	2.44	16.81	7343.
	STR - (	>- 355F	364.	1099.	5069.	2369.	274.	2.44	2.44	16.81	7314.
	BEND - (	360N	364.	1127.	5069.	457.	1748.	2.44	2.44	16.81	7026.
	BEND - (	360M	853.	822.	2577.	946.	4288.	2.44	2.44	16.81	6648.
	STR - (	>- 360F	844.	832.	1013.	938.	4322.	2.44	2.44	16.81	5924.
	STR - (	>- 360F.1	856.	918.	1013.	807.	576.	1.00	1.00	16.81	1012.
	BEND - (	365N	862.	934.	1013.	2524.	3463.	2.44	2.44	16.81	5750.
	BEND - (	365M	865.	931.	3404.	2527.	2358.	2.44	2.44	16.81	6334.
	RIGID - (	>- 366	362.	1218.	4321.	2024.	199.	2.44	2.44	16.81	8236.
	STR - (	>- 367	361.	1246.	4321.	1354.	542.	1.00	1.00	16.81	3256.
		>- 370N	361.	1249.	4321.	1506.	3439.	2.44	2.44	16.81	7474.

DYNAPLEX

LOADING - SHOCK LOADING NO. 1

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
		>- 370N	361.	1249.	4321.	1506.	3439.	2.44	2.44	16.81	7474.
	BEND	(370M	870.	966.	506.	2018.	6107.	2.44	2.44	16.81	8424.
		>- 370F	872.	964.	4332.	2020.	5205.	2.44	2.44	16.81	9228.
	STR	(-- 375	872.	966.	4332.	633.	8769.	1.00	1.00	16.81	6997.
	ANCHR										
		>- 380N	311.	1205.	7270.	4757.	1184.	1.84	1.84	16.81	8652.
	BR PT	(STR									
		>- 380M	311.	1229.	7270.	309.	3027.	2.44	2.44	16.81	10291.
	BEND	(380M	758.	1016.	3306.	717.	6595.	2.44	2.44	16.81	9678.
		>- 380F	763.	1013.	2074.	717.	6307.	2.44	2.44	16.81	8719.
	STR	(-- 380F.1	768.	1061.	2074.	780.	1554.	1.00	1.00	16.81	1932.
	STR	(-- 385N	784.	1126.	2074.	2242.	3569.	2.44	2.44	16.81	6134.
	BEND	(385M	772.	1134.	4293.	2229.	1850.	2.44	2.44	16.81	8762.
		>- 386	308.	1337.	4647.	1765.	996.	2.44	2.44	16.81	8620.
	RIGID	(-- 387	305.	1371.	4647.	892.	416.	1.00	1.00	16.81	3391.
	STR	(-- 390N	305.	1375.	4647.	1452.	3511.	2.44	2.44	16.81	7837.
	BEND	(390M	778.	1174.	712.	1925.	6541.	2.44	2.44	16.81	8951.
		>- 390F	795.	1162.	4631.	1943.	3753.	2.44	2.44	16.81	9972.
	STR	(-- 395	795.	1165.	4631.	759.	10219.	1.00	1.00	16.81	8027.
	ANCHR										
		>- 344	2.	43.	0.	43.	1.	2.44	2.44	3.21	294.
	BR PT	(STR									
	TERM	(-- 405	2.	43.	0.	0.	0.	1.00	1.00	3.21	0.

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 305	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
	>- 310N		.032	.006	.000	.021	.093	.121
	(		(2.4)	(1.7)	(.0)			
	BEND -(	310M	.067	.012	.003	.065	.251	.212
	(		(5.1)	(3.3)	(.8)			
	>- 310F		.130	.017	.016	.106	.334	.382
	STRAIGHT -(		(10.9)	(4.5)	(4.1)			
	>- 310F.1		.531	.017	.125	.121	.450	.458
	STRAIGHT -(		(61.1)	(4.5)	(31.8)			
	>- 315N		.962	.017	.234	.107	.566	.449
	(		(118.1)	(4.5)	(59.3)			
	BEND -(	315M	1.061	.022	.247	.070	.582	.415
	(		(127.2)	(5.8)	(62.6)			
	>- 315F		1.176	.029	.251	.038	.645	.413
	STRAIGHT -(		(131.4)	(7.7)	(63.5)			
	>- 315F.1		1.840	.053	.251	.032	.676	.317
	STRAIGHT -(		(149.2)	(16.6)	(63.5)			
	>- 320N		2.492	.073	.251	.036	.623	.220
	(		(187.0)	(24.8)	(63.5)			
	BEND -(	320M	2.565	.076	.252	.039	.543	.224
	(		(191.9)	(26.1)	(63.6)			
	>- 320F		2.566	.077	.257	.041	.521	.192
	(		(191.9)	(26.6)	(63.8)			
	BEND -(	325M	2.543	.068	.270	.063	.480	.127
	(		(190.1)	(24.8)	(63.7)			
	>- 325F		2.536	.054	.298	.092	.371	.073
	STRAIGHT -(		(189.6)	(20.9)	(63.4)			
	>- 325F.1		2.536	.021	.431	.087	.313	.049
	STRAIGHT -(		(189.6)	(8.9)	(67.6)			
	>- 326		2.536	.000	.569	.083	.255	.026

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>= 326	2.536	.000	.569	.083	.255	.026
	STRAIGHT - (		(189.6)	(.0)	(78.3)			
		>= 326.1	2.536	.000	.760	.075	.150	.004
	STRAIGHT - (		(189.6)	(4.6)	(101.3)			
		>= 330	2.537	.000	.855	.067	.050	.008
	STRAIGHT - (		(189.6)	(.0)	(116.2)			
		>= 330.1	2.537	.004	.851	.059	.062	.002
	STRAIGHT - (		(189.6)	(7.2)	(116.5)			
		>= 330.2	2.537	.005	.755	.051	.147	.003
	STRAIGHT - (		(189.6)	(11.5)	(101.8)			
		>= 330.3	2.537	.004	.579	.043	.219	.003
	STRAIGHT - (		(189.6)	(9.1)	(77.3)			
		>= 335	2.537	.000	.346	.036	.275	.007
	STRAIGHT - (		(189.6)	(.0)	(54.1)			
		>= 336N	2.537	.005	.217	.032	.296	.011
		(	(189.6)	(6.5)	(48.0)			
	BEND - (	336M	2.536	.007	.182	.032	.331	.019
		(	(189.5)	(8.7)	(46.9)			
		>= 336F	2.535	.008	.165	.034	.343	.023
		(	(189.3)	(9.8)	(45.8)			
	BEND - (	337M	2.514	.007	.162	.027	.354	.032
		(	(147.3)	(9.0)	(45.2)			
		>= 337F	2.466	.005	.161	.019	.381	.039
	STRAIGHT - (		(182.8)	(7.5)	(45.0)			
		>= 337F.1	2.186	.015	.161	.014	.392	.034
	STRAIGHT - (		(163.5)	(17.3)	(45.0)			
		>= 339N	1.949	.025	.161	.010	.377	.033
		(	(164.4)	(32.5)	(45.0)			
	BEND - (	339M	1.919	.024	.146	.007	.337	.034
		(	(166.2)	(31.5)	(42.2)			
		>= 339F	1.910	.019	.120	.008	.295	.036
	STRAIGHT - (		(167.1)	(25.3)	(34.9)			
		>= 340	1.909	.000	.163	.008	.275	.036
	STRAIGHT - (		(167.1)	(.0)	(26.5)			
		>= 341N	1.909	.019	.253	.009	.252	.037
		(	(167.1)	(25.2)	(42.8)			
	BEND - (	341M	1.908	.024	.282	.007	.213	.040
		(	(165.6)	(31.6)	(50.0)			
		>= 341F	1.894	.026	.291	.010	.211	.041
	STRAIGHT - (		(161.3)	(32.9)	(52.5)			
		>= 341F.1	1.761	.016	.291	.012	.216	.049
	STRAIGHT - (		(136.3)	(21.4)	(52.5)			
		>= 343N	1.645	.005	.291	.013	.191	.058
		((129.2)	(6.7)	(52.5)			
	BEND - (343M	1.628	.004	.292	.015	.139	.043

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND - (	343M	1.628	.004	.292	.015	.139	.043
	(		(128.7)	(4.4)	(52.8)			
	>-	343F	1.619	.004	.294	.017	.118	.023
	STRAIGHT - (		(128.4)	(3.5)	(53.7)			
BRANCH PT.	--	344	1.615	.004	.298	.017	.104	.021
	(		(128.1)	(3.5)	(55.0)			
BRANCH PT.	--	344	1.615	.004	.298	.017	.104	.021
	STRAIGHT - (		(128.1)	(3.5)	(55.0)			
	>-	344.1	1.615	.016	.352	.014	.065	.005
	STRAIGHT - (		(128.1)	(13.4)	(63.9)			
	>-	344.2	1.614	.015	.394	.011	.054	.005
	STRAIGHT - (		(128.1)	(14.3)	(74.2)			
	>-	344.3	1.614	.008	.416	.008	.063	.009
	STRAIGHT - (		(128.1)	(8.2)	(80.1)			
	>-	345	1.614	.000	.418	.007	.062	.006
	STRAIGHT - (		(128.1)	(.0)	(78.4)			
	>-	345.1	1.614	.003	.401	.006	.072	.002
	STRAIGHT - (		(128.1)	(5.2)	(70.3)			
	>-	345.2	1.613	.003	.366	.005	.078	.002
	STRAIGHT - (		(128.0)	(6.4)	(60.0)			
	>-	345.3	1.613	.002	.311	.008	.086	.002
	STRAIGHT - (		(128.0)	(4.3)	(51.9)			
	>-	350	1.613	.000	.231	.011	.107	.002
	STRAIGHT - (		(128.0)	(.0)	(45.1)			
BRANCH PT.	--	352	1.613	.003	.136	.014	.140	.014
	(		(127.9)	(3.8)	(38.5)			
BRANCH PT.	--	352	1.613	.003	.136	.014	.140	.014
	STRAIGHT - (		(127.9)	(3.8)	(38.5)			
	>-	353	1.612	.000	.029	.026	.104	.006
	STRAIGHT - (		(127.9)	(.0)	(29.3)			
	>-	355N	1.612	.012	.099	.052	.145	.032
	(		(127.9)	(18.8)	(39.0)			
	BEND - (	355M	1.608	.021	.124	.031	.229	.097
	(		(127.4)	(22.3)	(41.8)			
	>-	355F	1.588	.027	.136	.012	.263	.158
	STRAIGHT - (		(125.8)	(23.7)	(43.5)			
	>-	360N	1.559	.027	.134	.012	.286	.165
	(		(123.4)	(23.7)	(44.6)			
	BEND - (	360M	1.512	.028	.133	.007	.333	.226
	(		(119.7)	(24.3)	(45.7)			
	>-	360F	1.440	.025	.134	.030	.431	.263
	STRAIGHT - (		(113.9)	(25.3)	(46.1)			
	>-	360F.1	.981	.013	.134	.031	.478	.288
	STRAIGHT - ((95.1)	(25.1)	(46.1)			
	>-	365N	.512	.028	.133	.006	.450	.313

DYNAFLEX

LOADING - SHOCK LOADING NO. 1

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>- 365N		.512	.028	.133	.006	.450	.313
	(	(109.5)		(15.9)	(46.1)			
	BEND -(	365M	.432	.024	.131	.062	.340	.296
	(	(107.7)		(13.0)	(44.8)			
	>- 366		.367	.019	.117	.117	.351	.279
	(	(96.6)		(11.1)	(39.8)			
	RIGID -(
	>- 367		.267	.019	.075	.117	.350	.279
	(	(67.0)		(11.1)	(25.8)			
	STRAIGHT -(
	>- 370N		.134	.019	.017	.112	.296	.256
	(	(27.1)		(11.1)	(6.4)			
	BEND -(	370M	.086	.014	.004	.070	.238	.154
	(	(16.4)		(9.3)	(1.5)			
	>- 370F		.053	.007	.000	.021	.114	.092
	(	(10.8)		(6.4)	(.0)			
	STRAIGHT -(
ANCHOR	-- 375		.000	.000	.000	.000	.000	.000
	(	(.0)		(.0)	(.0)			
BRANCH PT.	-- 352		1.613	.003	.136	.014	.140	.014
	(	(127.9)		(3.8)	(38.5)			
	STRAIGHT -(
	>- 380N		1.601	.003	.132	.015	.206	.043
	(	(127.1)		(3.8)	(38.3)			
	BEND -(	380M	1.573	.003	.131	.006	.277	.141
	(	(124.8)		(4.0)	(38.7)			
	>- 380F		1.510	.005	.131	.018	.423	.200
	(	(119.4)		(4.8)	(39.1)			
	STRAIGHT -(
	>- 380F.1		1.043	.025	.131	.017	.499	.252
	(	(110.0)		(10.7)	(39.1)			
	STRAIGHT -(
	>- 385N		.548	.030	.131	.012	.479	.304
	(	(148.5)		(11.1)	(39.1)			
	BEND -(	385M	.463	.024	.128	.066	.412	.294
	(	(147.6)		(9.3)	(38.2)			
	>- 386		.396	.019	.114	.114	.396	.293
	(	(132.6)		(7.9)	(34.1)			
	RIGID -(
	>- 387		.291	.019	.073	.114	.385	.293
	(	(91.5)		(7.9)	(22.1)			
	STRAIGHT -(
	>- 390N		.150	.019	.017	.109	.327	.272
	(	(38.9)		(7.9)	(5.4)			
	BEND -(	390M	.098	.014	.003	.068	.265	.165
	(	(21.2)		(6.3)	(1.2)			
	>- 390F		.061	.007	.000	.022	.130	.098
	(	(14.0)		(4.1)	(.0)			
	STRAIGHT -(
ANCHOR	-- 395		.000	.000	.000	.000	.000	.000
	(	(.0)		(.0)	(.0)			
BRANCH PT.	-- 344		1.615	.004	.298	.017	.104	.021
	(	(128.1)		(3.5)	(55.0)			
	STRAIGHT -(
TERMINAL	-- 405		1.615	.000	.287	.017	.104	.020

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
305	608.	320.	885.	1121.	3438.	2089.	4345.	5921.
375	220.	199.	822.	874.	1464.	1763.	1247.	2609.
395	483.	482.	1155.	1341.	915.	2808.	2338.	3766.
RESTRAINTS:								
326	0.	592.	0.	592.	0.	0.	0.	0.
330	0.	246.	0.	246.	0.	0.	0.	0.
335	0.	79.	0.	79.	0.	0.	0.	0.

FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
340	0.	49.	0.	49.	0.	0.	0.	0.
345	0.	59.	0.	59.	0.	0.	0.	0.
350	0.	712.	0.	712.	0.	0.	0.	0.
353	0.	683.	0.	683.	0.	0.	0.	0.
405	0.	46.	0.	46.	0.	0.	0.	0.

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 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

 *

THE MAXIMUM STRESS OF 10,944. OCCURS AT POINT 352

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 305	885.	688.	4345.	3438.	2089.	1.00	1.00	16.81	4227.
	STR -(	>- 310N	885.	688.	4345.	4385.	705.	2.44	2.44	16.81	8113.
	BEND -(	310M	852.	729.	3208.	4351.	2776.	2.44	2.44	16.81	7936.
		>- 310F	322.	1074.	831.	3819.	3737.	2.44	2.44	16.81	7061.
	STR -(	>- 310F.1	333.	1020.	831.	1046.	113.	1.00	1.00	16.81	957.
		>- 315N	334.	962.	831.	3791.	1672.	2.44	2.44	16.81	5518.
	BEND -(	315M	777.	660.	1192.	4230.	1954.	2.44	2.44	16.81	6280.
		>- 315F	762.	677.	2254.	4214.	1235.	2.44	2.44	16.81	6446.
	STR -(	>- 315F.1	694.	676.	2254.	2575.	3826.	1.00	1.00	16.81	3665.
		>- 320N	556.	686.	2254.	877.	6523.	2.44	2.44	16.81	9084.
	BEND -(	320M	207.	859.	6359.	499.	3450.	2.44	2.44	16.81	9089.
		>- 320F	373.	801.	7093.	308.	1700.	2.44	2.44	16.81	9333.
	BEND -(	325M	344.	802.	5321.	1258.	4521.	2.44	2.44	16.81	9263.
		>- 325F	576.	655.	711.	980.	6637.	2.44	2.44	16.81	8809.
	STR -(	>- 325F.1	575.	639.	711.	1088.	5508.	1.00	1.00	16.81	4040.
		>- 326	575.	622.	711.	1830.	4453.	1.00	1.00	16.81	3474.
	STR -(	>- 326.1	575.	516.	711.	730.	2765.	1.00	1.00	16.81	2115.
		>- 330	579.	494.	711.	350.	1948.	1.00	1.00	16.81	1501.
	STR -(	>- 330.1	596.	392.	711.	230.	2627.	1.00	1.00	16.81	1949.
		>- 330.2	608.	356.	711.	249.	3930.	1.00	1.00	16.81	2857.
	STR -(	>- 330.3	608.	356.	711.	379.	5253.	1.00	1.00	16.81	3794.
		>- 335	636.	262.	711.	547.	6398.	1.00	1.00	16.81	4612.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		PSI	
		>- 335	636.	262.	711.	547.	6398.	1.00	1.00	16.81	4612.	
	STR -(
		>- 336N	643.	234.	711.	522.	6893.	2.44	2.44	16.81	9074.	
	BEND -(	336M	451.	515.	5368.	343.	4564.	2.44	2.44	16.81	9211.	
		>- 336F	51.	483.	7066.	217.	588.	2.44	2.44	16.81	9262.	
	BEND -(	337M	152.	667.	5300.	540.	4443.	2.44	2.44	16.81	9058.	
		>- 337F	208.	651.	806.	507.	6446.	2.44	2.44	16.81	8508.	
	STR -(
		>- 337F.1	177.	661.	806.	358.	3860.	1.00	1.00	16.81	2827.	
	STR -(
		>- 339N	172.	637.	806.	1918.	292.	2.44	2.44	16.81	2743.	
	BEND -(	339M	429.	484.	714.	1836.	479.	2.44	2.44	16.81	2646.	
		>- 339F	635.	178.	292.	1862.	820.	2.44	2.44	16.81	2684.	
	STR -(
		>- 340	623.	192.	292.	866.	1980.	1.00	1.00	16.81	1557.	
	STR -(
		>- 341N	605.	208.	292.	2119.	966.	2.44	2.44	16.81	3065.	
	BEND -(	341M	515.	359.	623.	2134.	825.	2.44	2.44	16.81	3096.	
		>- 341F	202.	607.	1007.	2138.	298.	2.44	2.44	16.81	3110.	
	STR -(
		>- 341F.1	215.	602.	1007.	385.	3547.	1.00	1.00	16.81	2646.	
	STR -(
		>- 343N	289.	585.	1007.	553.	5884.	2.44	2.44	16.81	7828.	
	BEND -(	343M	233.	609.	4995.	506.	3894.	2.44	2.44	16.81	8296.	
		>- 343F	55.	650.	6442.	340.	469.	2.44	2.44	16.81	8445.	
	STR -(
	BR PT	-- 344	56.	655.	6442.	299.	188.	2.44	2.44	16.81	8428.	
		-- 344	572.	348.	188.	322.	6440.	2.44	2.44	16.81	8427.	
	STR -(
		>- 344.1	572.	348.	188.	237.	5228.	1.00	1.00	16.81	3739.	
	STR -(
		>- 344.2	563.	392.	188.	158.	3946.	1.00	1.00	16.81	2823.	

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE			
	STR -(	>- 344.2	563.	392.	188.	158.	3946.	1.00	1.00	16.81	2823.
	STR -(	>- 344.3	556.	419.	188.	110.	2832.	1.00	1.00	16.81	2027.
	STR -(	>- 345	554.	439.	188.	179.	2394.	1.00	1.00	16.81	1719.
	STR -(	>- 345.1	553.	502.	188.	95.	3116.	1.00	1.00	16.81	2230.
	STR -(	>- 345.2	553.	542.	188.	211.	4658.	1.00	1.00	16.81	3332.
	STR -(	>- 345.3	554.	577.	188.	362.	6645.	1.00	1.00	16.81	4753.
	STR -(	>- 350	558.	901.	188.	520.	8879.	1.00	1.00	16.81	6351.
BR PT		-- 352	558.	901.	188.	2019.	10904.	1.84	1.84	16.81	10944. **	
BR PT	STR -(	-- 352	140.	592.	767.	603.	6048.	1.84	1.84	16.81	6045.
	STR -(	>- 353	149.	572.	767.	1978.	3955.	1.00	1.00	16.81	3204.
	(	>- 355N	159.	574.	767.	633.	1944.	2.44	2.44	16.81	2851.
	BEND -(	355M	218.	555.	892.	529.	1567.	2.44	2.44	16.81	2454.
	(	>- 355F	324.	500.	1590.	440.	339.	2.44	2.44	16.81	2200.
	STR -(	>- 360N	308.	525.	1590.	282.	338.	2.44	2.44	16.81	2155.
	(BEND -(360M	546.	270.	1055.	489.	1158.	2.44	2.44	16.81	2143.
	(	>- 360F	497.	351.	261.	435.	1426.	2.44	2.44	16.81	1976.
	STR -(	>- 360F.1	628.	320.	261.	1017.	637.	1.00	1.00	16.81	876.
	STR -(	>- 365N	695.	311.	261.	2175.	573.	2.44	2.44	16.81	2956.
	(BEND -(365M	655.	388.	601.	2133.	416.	2.44	2.44	16.81	2944.
	(	>- 366	232.	725.	739.	1712.	276.	2.44	2.44	16.81	2461.
	RIGID -(	>- 367	208.	844.	739.	588.	422.	1.00	1.00	16.81	722.
	STR -(>- 370N	203.	851.	739.	1512.	1033.	2.44	2.44	16.81	2578.	

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE			
		>- 370N	203.	851.	739.	1512.	1033.	2.44	2.44	16.81	2578.	
	BEND	(370M	715.	504.	563.	2036.	1313.	2.44	2.44	16.81	3248.	
		>- 370F	822.	299.	1247.	2145.	929.	2.44	2.44	16.81	3459.	
	STR	(375	822.	297.	1247.	1464.	1763.	1.00	1.00	16.81	1863.	
	ANCHR	-- 352	504.	1118.	4932.	1774.	886.	1.84	1.84	16.81	5246.	
	BR PT	STR	(380N	504.	1127.	4932.	1057.	988.	2.44	2.44	16.81	6712.
		BEND	(380M	1087.	585.	2960.	1642.	3855.	2.44	2.44	16.81	6699.
		>- 380F	1039.	667.	575.	1593.	4499.	2.44	2.44	16.81	6277.	
		STR	(380F.1	1086.	677.	575.	863.	2444.	1.00	1.00	16.81	1895.
		>- 385N	1110.	679.	575.	3193.	664.	2.44	2.44	16.81	4324.	
		BEND	(385M	1133.	680.	700.	3215.	401.	2.44	2.44	16.81	4328.
		>- 386	492.	1204.	721.	2575.	188.	2.44	2.44	16.81	3501.	
		RIGID	(387	485.	1249.	721.	742.	644.	1.00	1.00	16.81	870.
		STR	(390N	483.	1251.	721.	2069.	1858.	2.44	2.44	16.81	3751.
		BEND	(390M	1155.	683.	1366.	2745.	1910.	2.44	2.44	16.81	4717.
		>- 390F	1155.	682.	2338.	2746.	1030.	2.44	2.44	16.81	4897.	
		STR	(395	1155.	682.	2338.	915.	2808.	1.00	1.00	16.81	2689.
		ANCHR	-- 344	1.	46.	0.	46.	2.	2.44	2.44	3.21	314.
		BR PT	STR	(405	1.	46.	0.	0.	1.00	1.00	3.21	0.
		TERM	-- 405	1.	46.	0.	0.	0.	1.00	1.00	3.21	0.

 *
 * DISPLACEMENTS AND ROTATIONS *

 *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 305	.000	.000	.000	.000	.000	.000
	STRAIGHT -(	(.0)	(.0)	(.0)				
	>- 310N	.006	.014	.000	.048	.015	.069	
	(	(.8)	(5.6)	(.0)				
	BEND -(	310M	.015	.029	.007	.152	.044	.101
	(	(2.0)	(10.8)	(2.7)				
	>- 310F	.039	.040	.038	.249	.065	.178	
	STRAIGHT -(	(7.4)	(14.8)	(13.6)				
	>- 310F.1	.229	.040	.293	.283	.065	.221	
	STRAIGHT -(	(61.1)	(14.8)	(105.0)				
	>- 315N	.437	.040	.546	.247	.070	.216	
	(	(122.5)	(14.8)	(196.1)				
	BEND -(	315M	.469	.051	.577	.152	.067	.177
	(	(130.4)	(18.9)	(207.0)				
	>- 315F	.480	.066	.584	.053	.076	.156	
	STRAIGHT -(	(129.2)	(24.5)	(209.8)				
	>- 315F.1	.467	.083	.584	.020	.102	.104	
	STRAIGHT -(	(89.9)	(36.4)	(209.8)				
	>- 320N	.409	.057	.584	.050	.180	.060	
	(	(62.5)	(36.1)	(209.9)				
	BEND -(	320M	.387	.052	.588	.065	.292	.077
	(	(61.3)	(36.0)	(210.8)				
	>- 320F	.368	.050	.598	.070	.332	.081	
	(	(61.0)	(36.0)	(213.2)				
	BEND -(	325M	.363	.047	.619	.096	.382	.057
	(	(61.4)	(33.6)	(213.7)				
	>- 325F	.362	.080	.659	.128	.511	.044	
	STRAIGHT -(	(61.9)	(28.3)	(209.6)				
	>- 325F.1	.362	.017	.864	.118	.575	.037	
	STRAIGHT -((61.9)	(11.9)	(191.5)				
	>- 326	.362	.000	1.140	.109	.627	.022	

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>= 326	.362	.000	1.140	.109	.627	.022
	STRAIGHT -(	(61.9)	(.0)	(176.4)				
		>= 326.1	.362	.007	1.743	.093	.689	.003
	STRAIGHT -(	(61.9)	(5.4)	(155.7)				
		>= 330	.362	.000	2.411	.077	.712	.000
	STRAIGHT -(	(61.8)	(.0)	(140.2)				
		>= 330.1	.362	.006	3.094	.063	.699	.005
	STRAIGHT -(	(61.8)	(8.1)	(126.9)				
		>= 330.2	.362	.009	3.750	.051	.652	.003
	STRAIGHT -(	(61.8)	(13.4)	(118.4)				
		>= 330.3	.362	.008	4.347	.044	.576	.004
	STRAIGHT -(	(61.8)	(10.6)	(120.6)				
		>= 335	.362	.000	4.856	.043	.477	.013
	STRAIGHT -(	(61.8)	(.0)	(132.7)				
		>= 336N	.362	.008	5.081	.045	.418	.018
	(	(61.8)	(7.2)	(139.7)				
	BEND -(	336M	.362	.011	5.130	.034	.311	.028
	(	(61.5)	(9.3)	(140.6)				
		>= 336F	.363	.013	5.141	.050	.277	.031
	(	(60.6)	(10.1)	(140.3)				
	BEND -(	337M	.348	.011	5.135	.038	.249	.065
	(	(57.3)	(9.9)	(140.1)				
		>= 337F	.319	.007	5.134	.028	.217	.100
	STRAIGHT -(	(50.3)	(9.6)	(140.0)				
		>= 337F.1	.286	.018	5.134	.022	.235	.083
	STRAIGHT -(	(59.4)	(12.1)	(140.0)				
		>= 339N	.459	.035	5.134	.017	.254	.067
	(	(132.2)	(17.2)	(140.0)				
	BEND -(	339M	.495	.033	5.128	.017	.267	.063
	(	(145.4)	(16.5)	(136.7)				
		>= 339F	.511	.026	5.112	.020	.276	.052
	STRAIGHT -(	(151.0)	(13.1)	(129.5)				
		>= 340	.511	.000	5.052	.018	.278	.046
	STRAIGHT -(	(151.0)	(.0)	(116.3)				
		>= 341N	.511	.023	4.989	.016	.275	.041
	(	(151.0)	(13.1)	(121.6)				
	BEND -(	341M	.495	.028	4.971	.009	.264	.034
	(	(145.6)	(16.6)	(126.8)				
		>= 341F	.457	.029	4.962	.009	.257	.034
	STRAIGHT -(	(133.5)	(17.3)	(129.4)				
		>= 341F.1	.243	.020	4.962	.013	.270	.046
	STRAIGHT -(	(69.9)	(10.3)	(129.4)				
		>= 343N	.270	.006	4.962	.019	.319	.063
	((54.3)	(3.2)	(129.4)				
	BEND -(343M	.298	.003	4.961	.029	.408	.033

DYNAFLEX

LOADING - SHOCK LOADING NO. 2

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND = (	343M	.298	.003	4.961	.029	.408	.033
	(		(55.2)	(3.0)	(129.4)			
	>=	343F	.314	.002	4.957	.038	.045	.008
BRANCH PT.	STRAIGHT = (	344	(55.7)	(3.3)	(129.2)			
	--	344	.315	.002	4.950	.039	.475	.007
BRANCH PT.	STRAIGHT = (	344	(56.4)	(3.3)	(128.6)			
	--	344	.315	.002	4.950	.039	.475	.007
	STRAIGHT = (		(56.4)	(3.3)	(128.6)			
	>=	344.1	.315	.006	4.472	.039	.570	.002
	STRAIGHT = (		(56.4)	(14.1)	(113.3)			
	>=	344.2	.315	.006	3.912	.040	.641	.002
	STRAIGHT = (		(56.5)	(17.1)	(119.4)			
	>=	344.3	.315	.003	3.295	.042	.685	.003
	STRAIGHT = (		(56.5)	(11.1)	(146.0)			
	>=	345	.315	.000	2.650	.044	.696	.004
	STRAIGHT = (		(56.5)	(.0)	(168.0)			
	>=	345.1	.315	.004	2.006	.046	.675	.004
	STRAIGHT = (		(56.5)	(10.1)	(159.3)			
	>=	345.2	.314	.007	1.398	.048	.617	.002
	STRAIGHT = (		(56.5)	(14.2)	(148.6)			
	>=	345.3	.314	.007	.863	.051	.519	.003
	STRAIGHT = (		(56.5)	(9.9)	(119.5)			
	>=	350	.314	.000	.441	.054	.380	.011
BRANCH PT.	STRAIGHT = (	352	(56.5)	(.0)	(110.4)			
	--	352	.314	.008	.212	.057	.230	.003
BRANCH PT.	STRAIGHT = (	352	(56.5)	(0.2)	(128.6)			
	--	352	.314	.008	.212	.057	.230	.003
	STRAIGHT = (		(56.5)	(8.2)	(128.6)			
	>=	353	.314	.000	.103	.039	.135	.022
	STRAIGHT = (		(56.5)	(.0)	(168.5)			
	>=	355N	.314	.036	.143	.021	.082	.045
	(		(56.5)	(50.6)	(207.2)			
	BEND = (	355M	.312	.043	.150	.011	.056	.054
	(		(59.7)	(59.9)	(211.6)			
	>=	355F	.306	.046	.151	.018	.051	.060
	STRAIGHT = (		(54.5)	(63.7)	(212.4)			
	>=	360N	.297	.046	.149	.018	.051	.061
	(		(54.7)	(63.7)	(211.6)			
	BEND = (	360M	.287	.046	.147	.013	.055	.071
	(		(55.1)	(63.6)	(211.9)			
	>=	360F	.275	.046	.147	.012	.072	.080
	STRAIGHT = (		(53.3)	(64.6)	(212.6)			
	>=	360F.1	.200	.051	.147	.007	.084	.081
	STRAIGHT = (		(40.0)	(74.5)	(212.5)			
	>=	365N	.119	.039	.147	.030	.083	.081

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	>- 365N		.119	.039	.147	.030	.083	.081
	(		(36.7)	(58.4)	(212.3)			
	BEND -(	365M	.103	.031	.143	.081	.072	.079
	(		(34.8)	(47.3)	(206.8)			
	>- 366		.088	.025	.127	.127	.066	.073
	RIGID -(		(29.9)	(38.8)	(184.1)			
	>- 367		.062	.025	.082	.127	.066	.073
	STRAIGHT -(		(19.1)	(38.8)	(118.6)			
	>- 370N		.028	.025	.019	.122	.057	.064
	(		(6.4)	(38.9)	(28.4)			
	BEND -(	370M	.017	.019	.004	.079	.046	.040
	(		(4.1)	(30.5)	(6.0)			
	>- 370F		.010	.011	.000	.029	.022	.026
	STRAIGHT -(		(2.7)	(18.8)	(.2)			
ANCHOR	-- 375		.000	.000	.000	.000	.000	.000
	(		(.0)	(.0)	(.0)			
BRANCH PT.	-- 352		.314	.008	.212	.057	.230	.003
	STRAIGHT -(		(56.5)	(8.2)	(128.6)			
	>- 380N		.311	.008	.190	.056	.182	.012
	(		(56.5)	(8.1)	(125.3)			
	BEND -(	380M	.311	.006	.184	.025	.145	.058
	(		(56.7)	(8.3)	(125.5)			
	>- 380F		.309	.004	.184	.020	.079	.092
	STRAIGHT -(		(57.1)	(8.0)	(126.3)			
	>- 380F.1		.264	.030	.183	.026	.080	.105
	STRAIGHT -(		(56.6)	(24.4)	(126.2)			
	>- 385N		.189	.040	.183	.014	.089	.119
	(		(51.2)	(32.2)	(126.1)			
	BEND -(	385M	.170	.033	.179	.091	.085	.122
	(		(47.9)	(27.7)	(123.4)			
	>- 386		.147	.026	.160	.160	.083	.126
	RIGID -(		(41.9)	(23.4)	(110.3)			
	>- 387		.102	.026	.103	.160	.083	.126
	STRAIGHT -(		(28.9)	(23.4)	(71.1)			
	>- 390N		.043	.026	.024	.153	.076	.113
	(		(11.5)	(23.4)	(16.9)			
	BEND -(	390M	.026	.019	.005	.096	.060	.071
	(		(6.7)	(18.9)	(3.6)			
	>- 390F		.015	.010	.000	.029	.031	.050
	STRAIGHT -(		(4.1)	(12.5)	(.2)			
ANCHOR	-- 395		.000	.000	.000	.000	.000	.000
	(		(.0)	(.0)	(.0)			
BRANCH PT.	-- 344		.315	.002	4.950	.039	.475	.007
	STRAIGHT -(		(56.4)	(3.3)	(128.6)			
TERMINAL	-- 405		.315	.000	5.045	.039	.475	.007

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
305	48.	116.	68.	143.	431.	101.	287.	527.
375	33.	130.	156.	205.	566.	143.	144.	601.
395	40.	153.	102.	188.	620.	160.	133.	657.
RESTRAINTS:								
326	0.	254.	0.	254.	0.	0.	0.	0.
330	0.	135.	0.	135.	0.	0.	0.	0.
335	0.	95.	0.	95.	0.	0.	0.	0.

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM
ON THE ANCHORS AND RESTRAINTS.

FORCES (POUNDS)

MOMENTS (FOOT-POUNDS)

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
340	0.	51.	0.	51.	0.	0.	0.	0.
345	0.	111.	0.	111.	0.	0.	0.	0.
350	0.	144.	0.	144.	0.	0.	0.	0.
353	0.	217.	0.	217.	0.	0.	0.	0.
405	0.	86.	0.	86.	0.	0.	0.	0.

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LOADING = SHOCK LOADING NO. 3

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*
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

*

THE MAXIMUM STRESS OF 644. OCCURS AT POINT 326

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
ANCHR		-- 305	68.	126.	287.	431.	101.	1.00	1.00	16.81	376.
	STR = (	>- 310N	68.	119.	287.	304.	88.	2.44	2.44	16.81	557.
	BEND = (	310M	107.	86.	271.	305.	122.	2.44	2.44	16.81	556.
		>- 310F	109.	83.	126.	273.	244.	2.44	2.44	16.81	506.
	STR = (	>- 310F.1	95.	82.	126.	117.	96.	1.00	1.00	16.81	141.
		>- 315N	67.	55.	126.	311.	148.	2.44	2.44	16.81	479.
	BEND = (	315M	77.	40.	102.	331.	170.	2.44	2.44	16.81	503.
		>- 315F	53.	69.	151.	311.	134.	2.44	2.44	16.81	485.
	STR = (	>- 315F.1	51.	61.	151.	206.	117.	1.00	1.00	16.81	200.
		>- 320N	68.	84.	151.	121.	145.	2.44	2.44	16.81	315.
	BEND = (	320M	79.	69.	135.	84.	163.	2.44	2.44	16.81	298.
		>- 320F	79.	74.	159.	40.	148.	2.44	2.44	16.81	288.
	BEND = (	325M	72.	117.	113.	122.	90.	2.44	2.44	16.81	247.
		>- 325F	31.	134.	45.	95.	109.	2.44	2.44	16.81	197.
	STR = (	>- 325F.1	31.	183.	45.	407.	152.	1.00	1.00	16.81	312.
	STR = (	>- 326	31.	94.	45.	855.	285.	1.00	1.00	16.81	644. **
		>- 326.1	31.	94.	45.	510.	408.	1.00	1.00	16.81	467.
	STR = (	>- 330	32.	109.	45.	319.	338.	1.00	1.00	16.81	333.
		>- 330.1	34.	118.	45.	222.	286.	1.00	1.00	16.81	260.
	STR = (	>- 330.2	37.	78.	45.	459.	376.	1.00	1.00	16.81	425.
		>- 330.3	40.	45.	45.	401.	360.	1.00	1.00	16.81	386.
	STR = (	>- 335	46.	112.	45.	234.	254.	1.00	1.00	16.81	249.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	FLEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)		SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS (PSI)	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE			OUT-OF PLANE
	STR - (	>= 335	46.	112.	45.	234.	254.	1.00	1.00	16.81	249.
		>= 336N	48.	96.	45.	106.	291.	2.44	2.44	16.81	409.
	BEND - (	336M	51.	94.	224.	125.	222.	2.44	2.44	16.81	443.
		>= 336F	55.	72.	324.	46.	139.	2.44	2.44	16.81	465.
	BEND - (	337M	62.	66.	253.	71.	227.	2.44	2.44	16.81	453.
	STR - (	>= 337F	56.	72.	147.	81.	289.	2.44	2.44	16.81	437.
	STR - (	>= 337F.1	44.	46.	147.	139.	156.	1.00	1.00	16.81	182.
		>= 339N	35.	57.	147.	125.	86.	2.44	2.44	16.81	276.
	BEND - (	339M	35.	57.	122.	127.	89.	2.44	2.44	16.81	258.
	STR - (	>= 339F	31.	59.	83.	115.	105.	2.44	2.44	16.81	231.
	STR - (	>= 340	28.	51.	83.	94.	101.	1.00	1.00	16.81	115.
		>= 341N	30.	46.	83.	155.	119.	2.44	2.44	16.81	277.
	BEND - (	341M	43.	35.	103.	169.	135.	2.44	2.44	16.81	313.
	STR - (	>= 341F	36.	41.	133.	165.	91.	2.44	2.44	16.81	301.
	STR - (	>= 341F.1	46.	42.	133.	106.	152.	1.00	1.00	16.81	162.
		>= 343N	56.	42.	133.	108.	246.	2.44	2.44	16.81	391.
	BEND - (	343M	47.	52.	222.	101.	212.	2.44	2.44	16.81	422.
	STR - (	>= 343F	22.	66.	271.	75.	133.	2.44	2.44	16.81	406.
BR PT		= 344	22.	70.	271.	138.	56.	2.44	2.44	16.81	404.
BR PT		= 344	35.	101.	56.	103.	271.	2.44	2.44	16.81	386.
	STR - (	>= 344.1	32.	52.	56.	329.	209.	1.00	1.00	16.81	281.
	STR - (>= 344.2	32.	52.	56.	412.	316.	1.00	1.00	16.81	373.

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		:	:
	STR - (	>- 344.2	32.	52.	56.	412.	316.	1.00	1.00	16.81	:	373.
	STR - (	>- 344.3	30.	63.	56.	223.	319.	1.00	1.00	16.81	:	281.
	STR - (	>- 345	28.	102.	56.	263.	287.	1.00	1.00	16.81	:	281.
	STR - (	>- 345.1	26.	80.	56.	271.	295.	1.00	1.00	16.81	:	288.
	STR - (	>- 345.2	25.	53.	56.	307.	302.	1.00	1.00	16.81	:	310.
	STR - (	>- 345.3	25.	61.	56.	131.	240.	1.00	1.00	16.81	:	199.
	STR - (	>- 350	25.	119.	56.	274.	174.	1.00	1.00	16.81	:	235.
HR PT		-- 352	25.	119.	56.	264.	326.	1.84	1.84	16.81	:	418.
HR PT	STR - (	-- 352	24.	112.	87.	254.	256.	1.84	1.84	16.81	:	366.
	STR - (	>- 353	26.	127.	87.	623.	207.	1.00	1.00	16.81	:	473.
	(	>- 355N	27.	112.	87.	60.	103.	2.44	2.44	16.81	:	192.
	BEND - (	355M	54.	102.	120.	33.	58.	2.44	2.44	16.81	:	179.
	(	>- 355F	90.	72.	111.	61.	82.	2.44	2.44	16.81	:	197.
	STR - (	>- 360N	65.	79.	111.	122.	76.	2.44	2.44	16.81	:	237.
	BEND - (	360M	84.	58.	96.	165.	108.	2.44	2.44	16.81	:	287.
	(	>- 360F	76.	69.	91.	182.	110.	2.44	2.44	16.81	:	303.
	STR - (	>- 360F.1	99.	65.	91.	247.	76.	1.00	1.00	16.81	:	195.
	(	>- 365N	118.	68.	91.	406.	95.	2.44	2.44	16.81	:	558.
	BEND - (	365M	123.	58.	114.	405.	67.	2.44	2.44	16.81	:	556.
	(	>- 366	66.	119.	99.	338.	80.	2.44	2.44	16.81	:	471.
	RIGID - (>- 367	102.	157.	99.	78.	118.	1.00	1.00	16.81	:	123.
	STR - (>- 370N	114.	159.	99.	275.	119.	2.44	2.44	16.81	:	412.

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DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
		>= 370N	114.	159.	99.	275.	119.	2.44	2.44	16.81	412.
		(
	BEND	= (370M	162.	110.	153.	366.	62.	2.44	2.44	16.81	525.
		(
		>= 370F	156.	119.	144.	381.	86.	2.44	2.44	16.81	544.
		(
	STR	= (
	ANCHR	-- 375	156.	134.	144.	566.	143.	1.00	1.00	16.81	429.
		(
	BR PT	-- 352	40.	119.	162.	52.	125.	1.84	1.84	16.81	208.
		(
		>= 380N	39.	114.	162.	127.	47.	2.44	2.44	16.81	275.
		(
	BEND	= (380M	90.	81.	112.	193.	122.	2.44	2.44	16.81	332.
		(
		>= 380F	112.	44.	55.	219.	147.	2.44	2.44	16.81	351.
		(
	STR	= (
		>= 380F.1	81.	49.	55.	225.	93.	1.00	1.00	16.81	178.
		(
	STR	= (
		>= 385N	83.	63.	55.	270.	69.	2.44	2.44	16.81	371.
		(
	BEND	= (385M	96.	41.	33.	266.	76.	2.44	2.44	16.81	364.
		(
		>= 386	61.	85.	63.	222.	42.	2.44	2.44	16.81	307.
		(
	RIGID	= (
		>= 387	116.	108.	63.	23.	92.	1.00	1.00	16.81	82.
		(
		>= 390N	133.	109.	63.	193.	95.	2.44	2.44	16.81	293.
		(
	BEND	= (390M	138.	103.	111.	239.	76.	2.44	2.44	16.81	359.
		(
		>= 390F	102.	139.	133.	238.	46.	2.44	2.44	16.81	361.
		(
	STR	= (
	ANCHR	-- 395	102.	158.	133.	624.	160.	1.00	1.00	16.81	469.
		(
	BR PT	-- 388	0.	86.	0.	86.	1.	2.44	2.44	3.21	590.
		(
	STR	= (
	TERM	-- 405	0.	86.	0.	0.	0.	1.00	1.00	3.21	0.

 * DISPLACEMENTS AND ROTATIONS *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

DISPLACEMENTS (INCHES)

ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 305	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
	>- 310N		.000	.001	.000	.004	.001	.005
	(		(1.8)	(28.2)	(.0)			
	BEND -(	310M	.001	.002	.001	.011	.001	.006
	(		(3.1)	(38.3)	(4.1)			
	>- 310F		.002	.003	.003	.017	.002	.011
	STRAIGHT -(		(6.0)	(41.3)	(10.3)			
	>- 310F.1		.013	.003	.020	.019	.004	.013
	STRAIGHT -(		(30.3)	(41.8)	(27.8)			
	>- 315N		.026	.003	.038	.017	.006	.014
	(		(49.6)	(42.1)	(37.6)			
	BEND -(	315M	.027	.004	.040	.012	.008	.013
	(		(49.9)	(41.4)	(38.3)			
	>- 315F		.027	.005	.040	.011	.011	.012
	STRAIGHT -(		(46.1)	(42.0)	(38.2)			
	>- 315F.1		.019	.014	.040	.010	.013	.013
	STRAIGHT -(		(24.0)	(89.9)	(38.2)			
	>- 320N		.015	.022	.040	.009	.013	.015
	(		(40.6)	(151.0)	(38.1)			
	BEND -(	320M	.015	.024	.040	.009	.013	.016
	(		(38.3)	(159.7)	(36.5)			
	>- 320F		.014	.024	.041	.010	.013	.018
	(		(24.3)	(163.3)	(33.9)			
	BEND -(	325M	.014	.023	.041	.010	.014	.020
	(		(9.0)	(155.5)	(34.0)			
	>- 325F		.014	.020	.041	.010	.014	.021
	STRAIGHT -(		(8.5)	(134.9)	(34.1)			
	>- 325F.1		.014	.009	.038	.010	.014	.019
	STRAIGHT -((8.5)	(59.2)	(45.1)			
	>- 326		.014	.000	.037	.010	.013	.012

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>- 326	.014	.000	.037	.010	.013	.012
	STRAIGHT - (	(8.5)	(8.5)	(.0)	(67.3)			
		>- 326.1	.014	.005	.035	.009	.011	.001
	STRAIGHT - (	(8.5)	(8.5)	(33.8)	(80.7)			
		>- 330	.014	.000	.033	.008	.011	.007
	STRAIGHT - (	(8.5)	(8.5)	(.0)	(52.4)			
		>- 330.1	.014	.008	.029	.008	.012	.008
	STRAIGHT - (	(8.4)	(8.4)	(72.9)	(36.8)			
		>- 330.2	.014	.013	.026	.008	.012	.002
	STRAIGHT - (	(8.4)	(8.4)	(109.9)	(72.1)			
		>- 330.3	.014	.010	.022	.008	.012	.007
	STRAIGHT - (	(8.3)	(8.3)	(78.3)	(74.2)			
		>- 335	.014	.000	.020	.008	.013	.012
	STRAIGHT - (	(8.2)	(8.2)	(.0)	(31.6)			
		>- 336N	.014	.006	.020	.008	.012	.012
		(	(8.1)	(61.7)	(29.3)			
	BEND - (	336M	.014	.008	.020	.007	.012	.011
		(	(7.5)	(81.4)	(32.4)			
		>- 336F	.014	.009	.020	.007	.012	.011
		(	(24.5)	(89.5)	(34.5)			
	BEND - (	337M	.013	.009	.020	.006	.013	.010
		(	(43.2)	(88.9)	(35.8)			
		>- 337F	.011	.008	.020	.006	.017	.011
	STRAIGHT - (	(49.4)	(49.4)	(88.0)	(35.9)			
		>- 337F.1	.010	.008	.020	.006	.019	.010
	STRAIGHT - (	(34.3)	(34.3)	(79.5)	(36.0)			
		>- 339N	.027	.008	.020	.006	.020	.010
		(	(27.0)	(56.5)	(36.0)			
	BEND - (	339M	.030	.007	.019	.004	.020	.010
		(	(29.4)	(52.1)	(34.9)			
		>- 339F	.031	.006	.016	.004	.019	.011
	STRAIGHT - (	(30.2)	(30.2)	(41.2)	(31.3)			
		>- 340	.031	.000	.011	.004	.019	.011
	STRAIGHT - (	(30.2)	(30.2)	(.0)	(21.8)			
		>- 341N	.031	.006	.012	.003	.018	.010
		(	(30.2)	(39.2)	(31.1)			
	BEND - (	341M	.030	.007	.013	.003	.016	.009
		(	(29.5)	(48.0)	(35.5)			
		>- 341F	.028	.007	.014	.004	.014	.008
	STRAIGHT - (	(27.6)	(27.6)	(48.6)	(36.7)			
		>- 341F.1	.018	.004	.014	.004	.012	.007
	STRAIGHT - (	(24.0)	(24.0)	(34.6)	(36.7)			
		>- 343N	.013	.002	.014	.004	.010	.008
		((29.1)	(21.8)	(35.6)			
	BEND - (343M	.012	.002	.014	.005	.009	.007

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND -(	343M	.012 (26.9)	.002 (21.0)	.014 (34.7)	.005	.009	.007
	>-	343F	.012 (17.0)	.002 (20.9)	.014 (31.9)	.006	.009	.008
BRANCH PT.	STRAIGHT -(	344	.012 (6.1)	.002 (20.9)	.014 (35.7)	.006	.009	.008
BRANCH PT.	STRAIGHT -(	344	.012 (6.1)	.002 (20.9)	.014 (35.7)	.006	.009	.008
	>-	344.1	.012 (6.1)	.009 (90.0)	.016 (53.9)	.007	.010	.006
	STRAIGHT -(	344.2	.012 (6.2)	.011 (107.1)	.020 (77.2)	.007	.008	.002
	>-	344.3	.012 (6.2)	.007 (65.6)	.023 (59.2)	.007	.006	.007
	STRAIGHT -(	345	.012 (6.2)	.000 (.0)	.024 (54.7)	.008	.007	.007
	>-	345.1	.012 (6.2)	.006 (66.5)	.022 (59.9)	.009	.007	.004
	STRAIGHT -(	345.2	.012 (6.2)	.007 (97.0)	.019 (66.8)	.009	.008	.001
	>-	345.3	.012 (6.2)	.004 (61.3)	.014 (73.9)	.010	.010	.005
	STRAIGHT -(	350	.012 (6.2)	.000 (.0)	.013 (59.6)	.011	.010	.004
BRANCH PT.	STRAIGHT -(	352	.012 (6.1)	.002 (18.2)	.016 (63.8)	.012	.008	.001
BRANCH PT.	STRAIGHT -(	352	.012 (6.1)	.002 (18.2)	.016 (63.8)	.012	.008	.001
	>-	353	.012 (6.1)	.000 (.0)	.021 (92.5)	.012	.007	.007
	STRAIGHT -(	355N	.012 (6.1)	.011 (77.6)	.025 (85.1)	.011	.007	.013
	BEND -(	355M	.012 (7.0)	.013 (92.2)	.026 (74.0)	.011	.006	.013
	>-	355F	.012 (19.1)	.014 (98.2)	.026 (57.4)	.010	.006	.013
	STRAIGHT -(	360N	.012 (35.8)	.014 (98.2)	.026 (51.6)	.010	.006	.012
	BEND -(	360M	.012 (48.4)	.013 (97.2)	.026 (57.8)	.007	.006	.011
	>-	360F	.012 (50.3)	.013 (94.2)	.026 (60.7)	.006	.006	.010
	STRAIGHT -(	360F.1	.008 (23.3)	.011 (64.4)	.026 (60.8)	.006	.006	.008
	STRAIGHT -(365N	.008	.008	.026	.007	.006	.007

DYNAFLEX

LOADING - SHOCK LOADING NO. 3

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>- 365N	.008	.008	.026	.007	.006	.007
		(34.0)		(53.0)	(60.8)			
	BEND - (	365M	.008	.006	.025	.014	.004	.007
		(35.6)		(55.6)	(59.1)			
		>- 366	.007	.005	.023	.022	.004	.007
	RIGID - (		(31.5)	(56.7)	(52.5)			
		>- 367	.004	.005	.015	.022	.004	.007
	STRAIGHT - (		(19.5)	(56.7)	(33.3)			
		>- 370N	.002	.005	.003	.022	.003	.006
		(8.4)		(56.5)	(9.7)			
	BEND - (	370M	.001	.005	.001	.014	.003	.004
		(6.9)		(54.5)	(3.7)			
		>- 370F	.001	.003	.000	.007	.002	.003
	STRAIGHT - (		(5.0)	(44.9)	(.1)			
ANCHOR		-- 375	.000	.000	.000	.000	.000	.000
		(.0)		(.0)	(.0)			
BRANCH PT.		-- 352	.012	.002	.016	.012	.008	.001
	STRAIGHT - (		(6.1)	(18.2)	(63.8)			
		>- 380N	.012	.002	.015	.012	.006	.001
		(9.0)		(18.2)	(44.3)			
	BEND - (	380M	.012	.002	.016	.009	.006	.002
		(10.5)		(20.0)	(58.3)			
		>- 380F	.012	.003	.016	.005	.004	.003
	STRAIGHT - (		(11.3)	(26.9)	(62.6)			
		>- 380F.1	.010	.005	.016	.003	.004	.004
	STRAIGHT - (		(18.3)	(52.3)	(62.8)			
		>- 385N	.009	.006	.016	.003	.004	.005
		(31.7)		(63.7)	(62.9)			
	BEND - (	385M	.008	.005	.016	.008	.003	.005
		(32.2)		(65.9)	(60.5)			
		>- 386	.007	.005	.014	.014	.003	.006
	RIGID - (		(29.2)	(66.9)	(53.0)			
		>- 387	.005	.005	.009	.014	.003	.006
	STRAIGHT - (		(20.4)	(66.9)	(33.3)			
		>- 390N	.002	.005	.002	.013	.003	.006
		(8.5)		(66.6)	(10.6)			
	BEND - (	390M	.001	.004	.001	.010	.002	.004
		(5.4)		(64.4)	(4.3)			
		>- 390F	.001	.003	.000	.006	.001	.003
	STRAIGHT - (		(3.8)	(53.0)	(.2)			
ANCHOR		-- 395	.000	.000	.000	.000	.000	.000
		(.0)		(.0)	(.0)			
BRANCH PT.		-- 344	.012	.002	.014	.006	.009	.008
	STRAIGHT - (		(6.1)	(20.9)	(35.7)			
TERMINAL		-- 405	.012	.000	.014	.006	.009	.010

GENERAL NOTES FOR THIS LOADING:

- (1) THE SPECIFICATIONS FOR THE SHOCK LOAD INCLUDING SPECTRUM INTERPOLATION RULES APPEAR IN THE EDITED PIPING SYSTEM DESCRIPTION.
- (2) THE GLOBAL COMPONENTS OF THE SHOCK HAVE BEEN ASSUMED TO ACT INDEPENDENTLY
- (3) THE ABSOLUTE VALUE OF THE RESPONSE QUANTITIES ASSOCIATED WITH EACH FUNDAMENTAL MODE HAVE BEEN COMBINED USING THE CLOSELY SPACED FREQUENCY (CSF) METHOD. MODES WITHIN 10 PERCENT OF EACH OTHER ARE DIRECTLY SUMMED AND THEN COMBINED WITH THE REMAINING MODAL QUANTITIES BY SRSS.

 * FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS *

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
ANCHORS:								
305	1233.	366.	961.	1605.	3787.	9412.	8782.	13418.
375	924.	432.	1209.	1581.	1692.	8946.	4511.	10160.
395	1224.	590.	1406.	1955.	1331.	10599.	5190.	11876.
RESTRAINTS:								
326	0.	723.	0.	723.	0.	0.	0.	0.
330	0.	428.	0.	428.	0.	0.	0.	0.
335	0.	143.	0.	143.	0.	0.	0.	0.

DYNAPLEX

LOADING - SHOCK LOADING NO. 4

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FORCES AND MOMENTS ON ANCHORS AND RESTRAINTS (CONTINUED)

EXPLANATORY NOTES

THE FORCES AND MOMENTS SHOWN BELOW ARE THE ACTIONS OF THE PIPING SYSTEM ON THE ANCHORS AND RESTRAINTS.

LOC. NO.	FORCES (POUNDS)				MOMENTS (FOOT-POUNDS)			
	X	Y	Z	RESULTANT	X	Y	Z	RESULTANT
RESTRAINTS (CONTINUED) -								
340	0.	80.	0.	80.	0.	0.	0.	0.
345	0.	164.	0.	164.	0.	0.	0.	0.
350	0.	927.	0.	927.	0.	0.	0.	0.
353	0.	858.	0.	858.	0.	0.	0.	0.
405	0.	107.	0.	107.	0.	0.	0.	0.

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 * INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *
 * ----- *
 * *

THE MAXIMUM STRESS OF 15,240. OCCURS AT POINT 310N

EXPLANATORY NOTES:

- (1) THE FORCES AND MOMENTS SHOWN BELOW ARE WITH REFERENCE TO THE ELEMENT LOCAL AXES.
- (2) THE STRESSES SHOWN BELOW ARE CALCULATED IN ACCORDANCE WITH THE ANSI B31.1 - 1977 PIPING CODE (INCLUDING ALL MANDATORY UPDATES)
- (3) A (**) FOLLOWING A STRESS VALUE INDICATES THE MAXIMUM STRESS FOR THIS LOADING CONDITION.
- (4) A (*) FOLLOWING A STRESS VALUE INDICATES A STRESS WITHIN 10 PER CENT OF THE MAXIMUM.
- (5) THE COLD MODULUS HAS BEEN USED IN THIS ANALYSIS.
- (6) THE STRESS INTENSIFICATION FACTORS (ABBREVIATED AS SIF IN THE TABLE HEADING BELOW) ARE AUTOMATICALLY CALCULATED AND APPLIED AT BENDS, ELBOWS, MITERS AND ADMISSIBLE TYPES OF TEES (AS SPECIFICALLY IDENTIFIED IN THE INPUT DESCRIPTION OF THE PIPING SYSTEM). USER ENTERED STRESS INTENSIFICATION FACTORS TAKE PRECEDENCE OVER INTERNALLY CALCULATED VALUES.
- (16) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS, THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE	LOC. NO.	FORCES (POUNDS)			MOMENTS (FOOT-POUNDS)			SIF			SECTION MODULUS (IN ³)	LONGITUDINAL STRESS
		AXIAL	SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF-PLANE	PLANE	PLANE			PSI
ANCHR	305	961.	1286.	8782.	3787.	9412.	1.00	1.00	16.81	9579.		
STR - (	>= 310N	961.	1285.	8782.	4777.	6023.	2.44	2.44	16.81	15240. **	
BEND - (	310M	927.	1309.	3616.	4737.	9272.	2.44	2.44	16.81	14392. *	
STR - (	>= 310F	365.	1562.	4993.	4159.	7551.	2.44	2.44	16.81	13008.	
STR - (	>= 310F.1	368.	1499.	4993.	2091.	249.	1.00	1.00	16.81	3859.	
BEND - (	>= 315N	371.	1433.	4993.	4125.	3299.	2.44	2.44	16.81	9490.	
STR - (	>= 315M	847.	1215.	5896.	4604.	2142.	2.44	2.44	16.81	10160.	
STR - (	>= 315F	832.	1225.	4462.	4589.	4112.	2.44	2.44	16.81	9933.	
STR - (	>= 315F.1	761.	1193.	4462.	2829.	3935.	1.00	1.00	16.81	4703.	
BEND - (	>= 320N	617.	1072.	4462.	1050.	8196.	2.44	2.44	16.81	12262.	
STR - (	>= 320M	244.	1212.	9063.	670.	3721.	2.44	2.44	16.81	12622.	
BEND - (	>= 320F	421.	1128.	9170.	3493.	445.	2.44	2.44	16.81	12789.	
STR - (	>= 325M	620.	1032.	6828.	2804.	5936.	2.44	2.44	16.81	12368.	
STR - (	>= 325F	954.	729.	785.	2464.	8755.	2.44	2.44	16.81	11921.	
STR - (	>= 325F.1	916.	714.	785.	2486.	7886.	1.00	1.00	16.81	5929.	
STR - (	>= 326	865.	700.	785.	2976.	7163.	1.00	1.00	16.81	5563.	
STR - (	>= 326.1	798.	623.	785.	1271.	6177.	1.00	1.00	16.81	4537.	
STR - (	>= 330	727.	597.	785.	671.	5684.	1.00	1.00	16.81	4124.	
STR - (	>= 330.1	646.	437.	785.	417.	5613.	1.00	1.00	16.81	4057.	
STR - (	>= 330.2	644.	414.	785.	538.	5857.	1.00	1.00	16.81	4236.	
STR - (	>= 330.3	644.	414.	785.	600.	6307.	1.00	1.00	16.81	4558.	
STR - (	>= 335	703.	382.	785.	737.	6863.	1.00	1.00	16.81	4939.	

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)		SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS (PSI)	
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE			OUT-OF PLANE
	STR - (	>- 335	703.	382.	785.	737.	6863.	1.00	1.00	16.81	4959.
		>- 336N	728.	362.	785.	663.	7171.	2.44	2.44	16.81	9459.
	BEND - (	336M	507.	635.	5516.	467.	4771.	2.44	2.44	16.81	9542.
		>- 336F	97.	807.	7295.	290.	647.	2.44	2.44	16.81	9570.
	BEND - (	337M	262.	783.	5475.	645.	4579.	2.44	2.44	16.81	9358.
		>- 337F	336.	754.	896.	639.	6619.	2.44	2.44	16.81	8761.
	STR - (	>- 337F.1	316.	828.	896.	482.	3951.	1.00	1.00	16.81	2913.
		>- 338N	328.	840.	896.	3301.	390.	2.44	2.44	16.81	4496.
	BEND - (	339H	488.	733.	760.	3632.	586.	2.44	2.44	16.81	4911.
		>- 339F	836.	337.	387.	3920.	911.	2.44	2.44	16.81	5280.
	STR - (	>- 340	846.	349.	387.	976.	4475.	1.00	1.00	16.81	3281.
		>- 341N	880.	345.	387.	5041.	1104.	2.44	2.44	16.81	6757.
	BEND - (	341M	799.	469.	774.	5019.	918.	2.44	2.44	16.81	6739.
		>- 341F	338.	883.	1159.	4677.	377.	2.44	2.44	16.81	6310.
	STR - (	>- 341F.1	335.	913.	1159.	436.	3868.	1.00	1.00	16.81	2899.
		>- 343N	369.	986.	1159.	639.	6448.	2.44	2.44	16.81	8595.
	BEND - (	343M	301.	1009.	5330.	581.	4406.	2.44	2.44	16.81	9263.
		>- 343F	78.	1050.	7252.	375.	566.	2.44	2.44	16.81	9511.
	STR - (	-- 344	78.	1066.	7252.	1113.	241.	2.44	2.44	16.81	9591.
	BR PT	-- 344	1026.	425.	241.	1091.	7251.	2.44	2.44	16.81	9584.
	STR - (	>- 344.1	1026.	425.	241.	817.	5910.	1.00	1.00	16.81	4263.
	STR - (	>- 344.2	1077.	447.	241.	579.	4570.	1.00	1.00	16.81	3293.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN ³)	LONGITUDINAL STRESS PSI
			AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	STR = (	>- 344.2	1077.	447.	241.	579.	4570.	1.00	1.00	16.81	3293.
	STR = (	>- 344.3	1134.	470.	241.	253.	3431.	1.00	1.00	16.81	2462.
	STR = (	>- 345	1197.	494.	241.	456.	2924.	1.00	1.00	16.81	2120.
	STR = (	>- 345.1	1327.	547.	241.	355.	3522.	1.00	1.00	16.81	2533.
	STR = (	>- 345.2	1394.	590.	241.	387.	5050.	1.00	1.00	16.81	3620.
	STR = (	>- 345.3	1461.	630.	241.	395.	7121.	1.00	1.00	16.81	5094.
	STR = (	>- 350	1525.	1088.	241.	619.	9451.	1.00	1.00	16.81	6764.
BR PT		-- 352	1525.	1088.	241.	2779.	11605.	1.84	1.84	16.81	11777.
BR PT	STR = (	-- 352	592.	1319.	1352.	2971.	7150.	1.84	1.84	16.81	7756.
	STR = (	>- 353	671.	1085.	1352.	2323.	4024.	1.00	1.00	16.81	3455.
	(	>- 355N	726.	1087.	1352.	2786.	4656.	2.44	2.44	16.81	7301.
	BEND = (	>- 355M	788.	1043.	4120.	2811.	3209.	2.44	2.44	16.81	7744.
	(	>- 355F	496.	1209.	5313.	2410.	444.	2.44	2.44	16.81	7640.
	STR = (	>- 360N	482.	1246.	5313.	551.	1782.	2.44	2.44	16.81	7553.
	(	>- 360M	1016.	867.	2787.	1078.	4442.	2.44	2.44	16.81	6991.
	(	>- 360F	982.	906.	1051.	1050.	4552.	2.44	2.44	16.81	6252.
	STR = (	>- 360F.1	1066.	975.	1051.	1322.	862.	1.00	1.00	16.81	1353.
	(	>- 365N	1113.	986.	1051.	3356.	3512.	2.44	2.44	16.81	6489.
	BEND = (	>- 365M	1092.	1010.	3458.	3331.	2396.	2.44	2.44	16.81	7007.
	(	>- 366	435.	1422.	4385.	2672.	350.	2.44	2.44	16.81	6720.
	RIGID = (	>- 367	429.	1513.	4385.	1463.	677.	1.00	1.00	16.81	3337.
	STR = (>- 370N	429.	1520.	4385.	2151.	3593.	2.44	2.44	16.81	7917.

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT ELEM TYPE TYPE	LOC. NO.	FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE		
	>= 370N	429.	1520.	4385.	2151.	3593.	2.44	2.44	16.81	7917.
BEND	(370M	1138.	1095.	773.	2890.	6247.	2.44	2.44	16.81	9044.
	>= 370F	1209.	1017.	4511.	2971.	5288.	2.44	2.44	16.81	9870.
ANCHR	(375	1209.	1020.	4511.	1692.	8946.	1.00	1.00	16.81	7253.
BR PT	-- 352	594.	1648.	8787.	5077.	1484.	1.84	1.84	16.81	10120.
	>= 380N	594.	1672.	8787.	1108.	3184.	2.44	2.44	16.81	12289.
BEND	(380M	1329.	1176.	4439.	1802.	7640.	2.44	2.44	16.81	11775.
	>= 380F	1294.	1214.	2153.	1760.	7749.	2.44	2.44	16.81	10749.
	>= 380F.1	1309.	1257.	2153.	1185.	2898.	1.00	1.00	16.81	2712.
	>= 385N	1361.	1316.	2153.	3911.	3631.	2.44	2.44	16.81	7514.
BEND	(385M	1374.	1303.	4349.	3921.	1894.	2.44	2.44	16.81	8036.
	>= 386	584.	1801.	4703.	3130.	1015.	2.44	2.44	16.81	7495.
RIGID	(387	585.	1858.	4703.	1161.	772.	1.00	1.00	16.81	3502.
	>= 390N	587.	1862.	4703.	2535.	3973.	2.44	2.44	16.81	8694.
BEND	(390M	1399.	1362.	1544.	3362.	6815.	2.44	2.44	16.81	10125.
	>= 390F	1406.	1355.	5190.	3373.	5844.	2.44	2.44	16.81	11115.
ANCHR	(395	1406.	1359.	5190.	1331.	10599.	1.00	1.00	16.81	8478.
BR PT	-- 344	2.	107.	0.	107.	2.	2.44	2.44	3.21	730.
TERM	(405	2.	107.	0.	0.	0.	1.00	1.00	3.21	0.

 *
 * DISPLACEMENTS AND ROTATIONS *

 *

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)
 DISPLACEMENTS (INCHES) ROTATIONS (DEGREES) ABOUT

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
ANCHOR	-- 305		.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
	>- 310N		.033	.016	.000	.052	.094	.140
	(		(3.1)	(28.8)	(.1)			
	BEND -(	310M	.069	.031	.008	.166	.255	.235
	(		(6.3)	(39.9)	(4.9)			
	>- 310F		.136	.044	.041	.271	.340	.422
	STRAIGHT -(		(14.5)	(44.1)	(17.6)			
	>- 310F.1		.578	.044	.319	.308	.454	.509
	STRAIGHT -(		(91.6)	(44.5)	(113.2)			
	>- 315N		1.057	.044	.596	.270	.570	.498
	(		(177.2)	(44.8)	(208.3)			
	BEND -(	315M	1.160	.056	.629	.168	.586	.451
	(		(188.9)	(45.8)	(219.7)			
	>- 315F		1.271	.072	.637	.066	.650	.442
	STRAIGHT -(		(190.0)	(49.2)	(222.5)			
	>- 315F.1		1.898	.100	.637	.039	.684	.333
	STRAIGHT -(		(175.8)	(98.4)	(222.5)			
	>- 320N		2.526	.095	.637	.062	.648	.229
	(		(201.3)	(157.3)	(222.5)			
	BEND -(	320M	2.594	.095	.641	.077	.617	.237
	(		(205.1)	(165.8)	(223.1)			
	>- 320F		2.592	.095	.652	.082	.618	.209
	(		(202.8)	(169.4)	(225.1)			
	BEND -(	325M	2.568	.086	.676	.116	.614	.141
	(		(200.0)	(161.0)	(225.6)			
	>- 325F		2.562	.070	.724	.158	.631	.088
	STRAIGHT -(		(199.6)	(139.4)	(221.6)			
	>- 325F.1		2.562	.028	.966	.147	.655	.064
	STRAIGHT -((199.6)	(61.0)	(208.0)			
	>- 326		2.562	.000	1.274	.137	.677	.036

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>= 326	2.562	.000	1.274	.137	.677	.036
	STRAIGHT -(	(199.6)	(199.6)	(.0)	(204.4)			
		>= 326.1	2.562	.012	1.901	.120	.705	.005
	STRAIGHT -(	(199.6)	(199.6)	(34.5)	(202.6)			
		>= 330	2.562	.000	2.559	.102	.714	.014
	STRAIGHT -(	(199.6)	(199.6)	(.0)	(189.5)			
		>= 330.1	2.562	.011	3.209	.087	.701	.009
	STRAIGHT -(	(199.6)	(199.6)	(73.7)	(176.2)			
		>= 330.2	2.562	.017	3.826	.073	.669	.004
	STRAIGHT -(	(199.6)	(199.6)	(111.3)	(172.0)			
		>= 330.3	2.562	.013	4.386	.062	.616	.009
	STRAIGHT -(	(199.6)	(199.6)	(79.5)	(161.3)			
		>= 335	2.562	.000	4.868	.056	.551	.019
	STRAIGHT -(	(199.6)	(199.6)	(.0)	(146.7)			
		>= 336N	2.562	.011	5.085	.056	.513	.024
	(	(199.6)	(199.6)	(62.5)	(150.6)			
	BEND -(	336M	2.562	.016	5.134	.047	.454	.036
	(	(199.4)	(199.4)	(82.7)	(151.7)			
		>= 336F	2.561	.018	5.143	.060	.442	.040
	(	(200.3)	(200.3)	(90.6)	(151.5)			
	BEND -(	337M	2.538	.016	5.138	.047	.433	.073
	(	(200.6)	(200.6)	(89.9)	(151.5)			
		>= 337F	2.487	.012	5.136	.034	.439	.108
	STRAIGHT -(	(195.9)	(195.9)	(88.9)	(151.4)			
		>= 337F.1	2.205	.024	5.136	.027	.458	.090
	STRAIGHT -(	(177.3)	(177.3)	(82.3)	(151.4)			
		>= 339N	2.002	.043	5.136	.021	.455	.075
	(	(212.6)	(212.6)	(67.3)	(151.4)			
	BEND -(	339M	1.982	.041	5.131	.019	.430	.073
	(	(222.8)	(222.8)	(63.1)	(147.2)			
		>= 339F	1.977	.032	5.114	.022	.404	.064
	STRAIGHT -(	(227.2)	(227.2)	(50.1)	(137.7)			
		>= 340	1.977	.000	5.054	.020	.391	.060
	STRAIGHT -(	(227.2)	(227.2)	(.0)	(121.2)			
		>= 341N	1.977	.030	4.996	.018	.373	.056
	(	(227.2)	(227.2)	(48.4)	(132.6)			
	BEND -(	341M	1.971	.038	4.979	.012	.339	.053
	(	(222.5)	(222.5)	(59.8)	(140.9)			
		>= 341F	1.948	.039	4.971	.014	.333	.054
	STRAIGHT -(	(211.2)	(211.2)	(61.2)	(144.4)			
		>= 341F.1	1.778	.026	4.971	.018	.346	.067
	STRAIGHT -(	(155.0)	(155.0)	(42.0)	(144.4)			
		>= 343N	1.667	.008	4.971	.023	.372	.086
	((143.1)	(143.1)	(23.0)	(144.3)			
	BEND -(343M	1.655	.005	4.970	.033	.431	.055

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
	BEND -(	343M	1.655	.005	4.970	.033	.431	.055
	(		(142.6)	(21.6)	(144.0)			
	>-	343F	1.650	.005	4.966	.042	.461	.026
BRANCH PT.	STRAIGHT -(		(141.0)	(21.5)	(143.5)			
	--	344	1.645	.005	4.959	.043	.486	.023
	(		(140.1)	(21.4)	(144.4)			
BRANCH PT.	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	--	344	1.645	.005	4.959	.043	.486	.023
	>-	344.1	1.645	.019	4.485	.042	.573	.008
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	344.2	1.645	.020	3.932	.042	.644	.006
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	344.3	1.645	.011	3.321	.043	.688	.012
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	345	1.644	.000	2.682	.045	.699	.011
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	345.1	1.644	.008	2.046	.047	.678	.006
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	345.2	1.644	.011	1.445	.050	.622	.003
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	345.3	1.644	.008	.917	.053	.527	.006
	STRAIGHT -(		(140.1)	(21.4)	(144.4)			
	>-	350	1.643	.000	.498	.057	.395	.012
	STRAIGHT -(		(140.0)	(21.4)	(144.4)			
BRANCH PT.	--	352	1.643	.009	.252	.060	.269	.014
	(		(140.0)	(21.4)	(144.4)			
BRANCH PT.	STRAIGHT -(		(140.0)	(21.4)	(144.4)			
	--	352	1.643	.009	.252	.060	.269	.014
	>-	353	1.643	.000	.109	.048	.171	.023
	STRAIGHT -(		(140.0)	(21.4)	(144.4)			
	>-	355N	1.643	.039	.176	.057	.166	.057
	(		(140.0)	(21.4)	(144.4)			
	BEND -(	355M	1.638	.049	.196	.035	.236	.112
	(		(139.3)	(112.2)	(228.1)			
	>-	355F	1.618	.056	.205	.024	.268	.169
	STRAIGHT -(		(138.4)	(119.4)	(224.3)			
	>-	360N	1.587	.056	.202	.024	.290	.176
	(		(139.7)	(119.4)	(222.3)			
	BEND -(	360M	1.539	.055	.200	.017	.337	.237
	(		(140.3)	(118.7)	(224.3)			
	>-	360F	1.466	.054	.201	.032	.437	.275
	STRAIGHT -(		(135.4)	(117.0)	(225.9)			
	>-	360F.1	1.001	.054	.201	.032	.486	.299
	STRAIGHT -((105.7)	(101.6)	(225.8)			
	>-	365N	.526	.049	.200	.031	.458	.324

DYNAFLEX

LOADING - SHOCK LOADING NO. 4

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES)			ROTATIONS (DEGREES) ABOUT		
			X	Y	Z	X AXIS	Y AXIS	Z AXIS
		>- 365N	.526	.049	.200	.031	.458	.324
	BEND -(	365M	(120.4)	(80.5)	(225.6)			
		(	.404	.040	.196	.103	.387	.307
		(	(118.6)	(74.1)	(219.7)			
		>- 366	.377	.032	.174	.174	.357	.289
	RIGID -(		(105.9)	(69.6)	(195.5)			
		>- 367	.274	.032	.112	.174	.356	.289
	STRAIGHT -(		(72.4)	(69.6)	(125.9)			
		>- 370N	.137	.032	.026	.167	.302	.265
		(	(29.1)	(69.4)	(30.7)			
	BEND -(	370M	.088	.024	.005	.107	.242	.159
		(	(18.2)	(63.1)	(7.2)			
		>- 370F	.054	.014	.000	.037	.116	.096
	STRAIGHT -(		(12.2)	(49.1)	(.3)			
ANCHOR		-- 375	.000	.000	.000	.000	.000	.000
		(	(.0)	(.0)	(.0)			
BRANCH PT.		-- 352	1.643	.009	.252	.060	.269	.014
	STRAIGHT -(		(140.0)	(20.3)	(178.7)			
		>- 380N	1.631	.009	.232	.060	.275	.045
		(	(139.4)	(20.3)	(138.3)			
	BEND -(	380M	1.603	.007	.226	.027	.313	.153
		(	(137.5)	(22.0)	(143.7)			
		>- 380F	1.541	.007	.226	.027	.431	.220
	STRAIGHT -(		(132.9)	(28.5)	(176.3)			
		>- 380F.1	1.076	.039	.226	.031	.505	.273
	STRAIGHT -(		(125.1)	(58.8)	(176.3)			
		>- 385N	.579	.050	.226	.018	.487	.327
		(	(160.2)	(72.3)	(176.3)			
	BEND -(	385M	.894	.041	.221	.112	.420	.318
		(	(158.5)	(72.1)	(142.6)			
		>- 386	.422	.032	.197	.197	.395	.319
	RIGID -(		(142.1)	(71.3)	(127.0)			
		>- 387	.308	.032	.126	.197	.394	.319
	STRAIGHT -(		(98.1)	(71.3)	(81.6)			
		>- 390N	.156	.032	.029	.189	.336	.295
		(	(38.6)	(71.1)	(20.6)			
	BEND -(	390M	.102	.024	.006	.118	.272	.179
		(	(22.8)	(67.4)	(5.7)			
		>- 390F	.063	.013	.000	.037	.134	.110
	STRAIGHT -(		(15.1)	(54.6)	(.2)			
ANCHOR		-- 395	.000	.000	.000	.000	.000	.000
		(	(.0)	(.0)	(.0)			
BRANCH PT.		-- 344	1.645	.005	4.959	.043	.486	.023
	STRAIGHT -((140.1)	(21.4)	(144.4)			
TERMINAL		-- 405	1.645	.000	5.054	.043	.486	.024

DYNAFLEX

STEARNS - ROGER CORP

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PROJECT DOE 10MW SOLAR PILOT PLANT C-21700
JOB TSS OIL EXTR(X-10-12-A-1)
DATE 7/ 7/80

*
* STRESS SUMMARY *
* ----- *
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EXPLANATORY NOTES:

- (1) EQUATION NUMBERS REFER TO ARTICLE 104.8 OF THE ANSI B31.1-1977 PIPING CODE.
- (7) THE EXACT SECTION MODULUS IS USED IN THE STRESS CALCULATIONS UNLESS THE SPECIFIC PIPING CODE OR THE USER EXPLICITLY REQUESTS OTHERWISE. IN THIS ANALYSIS THE SO-CALLED EFFECTIVE MODULUS IS USED FOR THE BRANCH LEG AT REDUCED OUTLET CONNECTIONS. THESE ARE IDENTIFIED WITH AN ASTERISK. THE EXACT SECTION MODULUS IS USED FOR ALL OTHER POINTS.
- (9) THE COLD MODULUS WAS USED IN ANALYZING THE OCCASIONAL LOADS.

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 64

STRESSES ARE IN PSI				
	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
LOC. NO.				
305	8588	4227	376	9579
310N	12889	8113	557	15240
310M	11994	7936	556	14392
310F	10913	7061	506	13008
310F.1	3746	957	141	3869
315N	7707	5518	479	9490
315M	7972	6280	503	10160
315F	7542	6446	485	9933
315F.1	2941	3665	200	4703
320N	8230	9084	315	12262
320M	8640	9469	298	12822
320F	8520	9533	288	12789
325M	8192	9263	247	12368
325F	8029	8809	197	11921
325F.1	4329	4040	312	5929
326	4300	3474	644	5565
326.1	3987	2113	467	4537
330	3827	1501	333	4124
330.1	3548	1949	260	4057
330.2	3099	2857	425	4236
330.3	2496	3794	386	4558

DYNAFLEX

STRESS SUMMARY (CONTINUED)

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LOC. NO.	STRESSES ARE IN PSI			
	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
335	1806	4612	249	4959
336N	2642	9074	409	9459
336M	2449	9211	443	9542
336F	2363	9262	465	9570
337M	2308	9058	453	9358
337F	2046	8508	437	8761
337F.1	679	2827	182	2913
339N	3551	2743	276	4496
339M	4129	2646	258	4911
339F	4541	2684	231	5280
340	2886	1557	115	3281
341N	6015	3065	277	6757
341M	5977	3096	313	6739
341F	5483	3110	301	6310
341F.1	1174	2646	162	2899
343N	3527	7828	391	8595
343M	4100	8296	422	9263
343F	4356	8445	406	9511
344	4559	8428	404	9591
344	4549	8427	386	9584
344.1	2029	3739	281	4263

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 66

LOC. NO.	STRESSES ARE IN PSI			
	EQ (12)	EQ (12)	EQ (12)	EQ (12)
	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
344.2	1655	2823	373	3293
344.3	1368	2027	281	2462
345	1207	1719	281	2120
345.1	1167	2230	288	2533
345.2	1380	3332	310	3620
345.3	1823	4753	199	5094
350	2315	6351	235	6764
352	4330	10944	418	11777
352	4846	6045	366	7756
353	1203	3204	473	3455
355N	6718	2851	192	7301
355M	7343	2454	179	7744
355F	7314	2200	197	7640
360N	7026	2155	237	7353
360M	6648	2143	287	6991
360F	5924	1976	303	6252
360F.1	1012	876	195	1353
365N	5750	2956	558	6489
365M	6334	2944	556	7007
366	6236	2461	471	6720
367	3256	722	123	3337

DYNAFLEX

STRESS SUMMARY (CONTINUED)

PAGE 67

STRESSES ARE IN PSI

EQ (12) EQ (12) EQ (12) EQ (12)

SHOCK 1 SHOCK 2 SHOCK 3 SHOCK 4

LOC.
NO.

LOC. NO.	SHOCK 1	SHOCK 2	SHOCK 3	SHOCK 4
370N	7474	2578	412	7917
370M	8424	3248	525	9044
370F	9228	3459	544	9870
375	6997	1863	429	7253
352	8652	5246	208	10120
380N	10291	6712	275	12289
380M	9678	6699	332	11775
380F	8719	6277	351	10749
380F.1	1932	1895	178	2712
385N	6134	4324	371	7514
385M	4762	4328	364	8036
386	6620	3501	307	7495
387	3391	870	82	3502
390N	7837	3751	293	8694
390M	8951	4717	359	10125
390F	9972	4897	361	11115
395	8027	2689	469	8478
344	294	314	590	730
405	0	0	0	0

DYNAFLEX

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Department of Energy
San Francisco Operations Office
1333 Broadway
Oakland, California 94612

Reply To: DOE Solar One Project Office
P.O. Box 366
Daggett, CA 92327

OCT 11 1984

Mr. Robert L. Gervais
Solar One Project Office
McDonnell Douglas Astronautics Corp.
P.O. Box 366
Daggett, CA 92327

Subject: Contractor Clearance of Contract DE-AC03-79SF10499
Solar One Reports for DOE/TIC Inclusion.

Dear Bob:

Enclosed are copies of covers and title pages of eight reports prepared by McDonnell Douglas Astronautics Corporation for the Solar One Project under the above referenced contract. In preparation for delivery of these documents to DOE/TIC, I have prepared a SAN form 70 "Request for Patent Clearance" and a DOE form RA-426 "Recommendations for Announcement and Distribution of Documents" for each document.

Please have the appropriate MDAC personnel complete and sign these forms. As agreed, SAN form 70 should be forwarded to SAN/OPC by your office with copies of the completed SAN form 70 and the transmittal letter being sent to me. The completed DOE form RA-426 should be sent directly back to me.

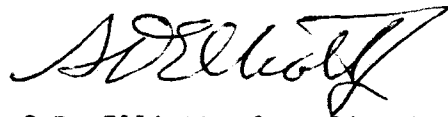
The documents covered by this letter are:

<u>Primary Document No.</u>	<u>Secondary No.</u>	<u>Brief Title</u>
DOE/SF/10499-T100	STMPD 185	PSS Final Design Calculations (Book 10 of 26)
DOE/SF/10499-T101	STMPD 186	PSS Final Design Calculations (Book 11 of 26)
DOE/SF/10499-T102	STMPD 187	PSS Final Design Calculations (Book 12 of 26)
DOE/SF/10499-T103	STMPD 188	PSS Final Design Calculations (Book 13 of 26)
DOE/SF/10499-T104	STMPD 189	PSS Final Design Calculations (Book 14 of 26)

DOE/SF/10499-T105	STMPO 190	PSS Final Design Calculations (Book 15 of 26)
DOE/SF/10499-T106	STMPO 191	PSS Final Design Calculations (Book 16 of 26)
DOE/SF/10499-T107	STMPO 192	PSS Final Design Calculations (Book 17 of 26)

If you should have any questions or concerns please do not hesitate to contact me by telephone at, (619) 254-2672.

Sincerely,



S.D. Elliott, Jr., Director
DOE Solar One Project Office

SDE/aks
Project File: CCC009.RNO(SA3:)

Encl: Eight Document Covers W/forms 70 and RA-426

cc: Roger Gaither, SAN/OPC
W.D. Matheny, DOE/TIC
Mike Lopez, DOE/SAN (FGS)
Mary Soderstrum, B&McD



DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

CONTRACTOR REQUEST FOR PATENT CLEARANCE
FOR RELEASE OF UNCLASSIFIED DOCUMENT

Prime Contract No. DE-AC03-79SF10499
Subcontract No. (N/A)
Report No. (STMP0 192) DOE/SF/10499-T107
Date of Report September 1980
Name & Phone No. of DOE Technical Representative S.D. Elliott, Jr. (619) 254-2672

TO: Roger S. Gaither, Asst. Chief for Prosecution
Office of Patent Counsel/Livermore Office
P.O. Box 808, L-376
Livermore, California 94550

FROM: McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

- Document Title: Plant Support Subsystem Final Design Calculations
(Book 17 of 26)
- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
 Copy of Oral Presentation, Other (please specify): _____
(Routine)
- In order to meet a publication schedule or submission deadline, patent clearance by _____
would be desired.

SENDER IS TO CHECK BOX #4 OR #5 BELOW.

4. I have reviewed (or have had reviewed by technically knowledgeable personnel) this document for possible inventive subject matter (Subject Inventions) and that no inventions or discoveries (Subject Inventions) are deemed to be disclosed in this document except as stated below:
- Attention should be directed to pages _____ of this document.
 - This document describes matter relating to an invention:
 - Contractor Invention Docket No. _____
 - A disclosure of the invention was submitted to DOE on _____ (date)
 - A disclosure of the invention will be submitted shortly _____ (approximate date)
 - A waiver of DOE's patent rights to the contractor:

has been granted, has been applied for; or will be applied for _____ (date)
5. This document is being submitted, but no review has been made of this document for possible inventive subject matter.
Provide copy of clearance to: Solar One Project Office
P.O. Box 366, Daggett, CA 92327
6. Remarks:

Reviewing/Submitting Official: Name (Print/Type) _____
Title _____
Signature _____ Date _____

TO: INITIATOR OF REQUEST
FROM: ASSISTANT CHIEF FOR PROSECUTION
Office of Patent Counsel/Livermore Office

- No patent objection to above-identified release.
 Please defer release until advised by this office.

Signed _____ Date Mailed _____

DOE AND MAJOR CONTRACTOR RECOMMENDATIONS FOR
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See Instructions on Reverse Side

1. DOE Report No. DOE/SF/10499-T107 (STMPO 192)	2. Contract No. DE-AC03-79SF10499	3. Subject Category No. UC-62, 62c, 62d
4. Title Plant Support Subsystem Final Design Calculations (Book 17 of 26)		
5. Type of Document ("x" one) <input checked="" type="checkbox"/> a. Scientific and technical report <input type="checkbox"/> b. Conference paper: Title of conference _____ <div style="text-align: right; margin-top: 5px;">Date of conference _____</div> Exact location of conference _____ Sponsoring organization _____ <input type="checkbox"/> c. Other (specify planning, educational, impact, market, social, economic, thesis, translations, journal article manuscript, etc.) _____		
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DOE/SF/10499-T107
SIMPO 192

SAN/0499-50
MDC G8502

10 MWe Solar Thermal
Central Receiver Pilot Plant

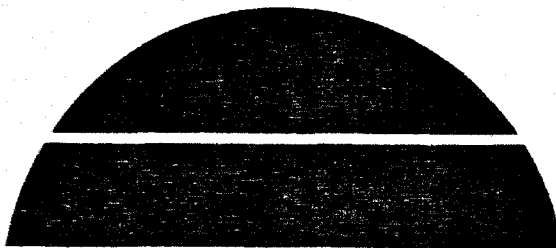
SOLAR FACILITIES DESIGN INTEGRATION

PSS FINAL DESIGN CALCULATIONS
BOOK 17 OF 26--THERMAL OIL PIPING
CONSTRUCTION PACKAGE 9 (RADL ITEM 7-8)

September 1980

WORK PERFORMED UNDER CONTRACT
DE-AC03-78SF10499

STEARNS-ROGER ENGINEERING CORP
4500 CHERRY CREEK DRIVE
P.O. BOX 5888
DENVER, CO 80217



U.S. Department of Energy

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Solar Energy

**10 MWe Solar Thermal
Central Receiver Pilot Plant
Solar Facilities Design Integration**

**PSS FINAL DESIGN CALCULATIONS
BOOK 17 OF 26--THERMAL OIL PIPING
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September 1980

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**STEARNS-ROGER ENGINEERING CORP
4500 CHERRY DRIVE
P.O. BOX 5888
DENVER, CO 80217**

**PREPARED FOR THE
U.S. DEPARTMENT OF ENERGY
SOLAR ENERGY
UNDER CONTRACT DE-AC-03-79SF10499**

U.S. DEPARTMENT OF ENERGY

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1. DOE Report No. <u>DOE/SF/10499-T107 (STPO 192)</u>	2. Contract No. <u>DE-AC03-79SF10499</u>	3. Subject Category No. <u>UC-62, 62c, 62d</u>
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S.D. Elliott, Jr., Director, DOE Solar One Project Office
Organization
P.O. Box 366, Daggett, CA 92327 (619) 254-2672
Signature _____ Date _____



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Office of Patent Counsel/Livermore Office
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Livermore, California 94550

FROM: McDonnell Douglas Corporation
3855 Lakewood Blvd.
Long Beach, CA 90846

Prime Contract No. DE-AC03-79SF10499
Subcontract No. (N/A)
Report No. (STMP0 192) DOE/SF/10499-T107
Date of Report September 1980
Name & Phone No. of DOE Technical Representative S.D. Elliott, Jr. (619) 254-2672

- Document Title: Plant Support Subsystem Final Design Calculations
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- Type of Document: Technical Report, Conference Paper, Journal Article, Abstract or Summary,
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Reviewing/Submitting Official: Name (Print/Type) John P. Scholl
Title Asst. Chief Patent Counsel, MDC (MS 122-23)
Signature [Signature] Date 8 NOV 84

TO: INITIATOR OF REQUEST
FROM: ASSISTANT CHIEF FOR PROSECUTION
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