SAN/0499-50
MDC G8502

DOE/SF/10499-T105
STMPO 190

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

PSS FINAL DESIGN CALCULATIONS
BOOK 15 OF 26--MAIN STEAM PIPING
CONSTRUCTION PACKAGE 9 (RADL 7-8)

September 1980

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 15 of this document is provided in support of the Mechanical Equipment Installation, Construction Package No. 9 and includes isometric drawings, weight, seismic, thermal and stress analysis for the main steam piping design.

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

MASTER TABLE OF CONTENTS FOR PSS FINAL DESIGN CALCULATIONS (RADL ITEM 7-8)

MASTER TABLE OF CONTENTS FOR PSS FINAL
DESIGN CALCULATIONS (RADL ITEM 7-8)

Note: This document includes design calculation for the reciever 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.

MASTER TABLE OF CONTENTS FOR PSS FINAL DESIGN CALCULATIONS (RADL ITEM 7-8)

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MASTER TABLE OF CONTENTS FOR PSS FINAL DESIGN CALCULATIONS (RADL ITEM 7-8)

LINE MS-3 MAIN STEAM - DESUPER HEATER BRANCH

Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

10MWe SOLAR PILOT PLANT

C-21700

MAIN STEAM DESUPERHEATER BRANCH

PIPING SYSTEM

6"-MS-3-QEB

CONDITIONS ANALYZED/ANAL. I.D. NO.

THERMAL	T-21700-MS-3-A-3
DEAD WEIGHT	W-21700-MS-3-A-3
PRESSURE	P-21700-MS-3-A-0
SEISMIC	X-21700-MS-3-A-1

CODE REFERENCE: ANSI B31.1-1973
W/ ADDENDA C.
(SUMMER 1979)

ANALYST G.H. MAY DATE 7-25-80

TRANSMITTAL

T/W/X-MS-3-A-3/3/1

DIVISION USAGE						Stearns-Roger INCORPORATED ENGINEERING STANDARD	STANDARD NUMBER EE16.01.2
MM	P	PP	SH	FI	SP		

APPROVALS
Des. Sect.
Sect. Supv.
Div.

PIPING ANALYSIS RESULTS

PAGE 1 OF 1
ISSUED 8-31-73
REVISED 4-15-74

Date FEB. 28, 1980

TO: T.E. OLSON

FROM: G. H. MAY, Piping Engineering Group

Client DOE Project SOLAR I Job No. C-21700

Pipe Line Analyzed MAIN STEAM DESUPERHEATER BRANCH / 6"-MS-3-QEB

Reference Dwg. PB-2 A

This piping has been analyzed for the THERMAL, DEAD WEIGHT & PRESSURE & OPERATIONAL BASIS EARTHQUAKE loading condition and is found to be:

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

COMMENT (1) ALL PIPE STRESSES ARE SATISFACTORY.
(2) ALL FORCES AND MOMENTS ARE REASONABLE AND SHOULD BE ACCEPTED.

RECOMMENDATION (1) USE THE REFERENCED ROUTING.
(2) SUBMIT THE FORCES AND MOMENTS ON THE DESUPERHEATER TO ROCKETDYNE FOR THEIR APPROVAL.

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					
MM	P	PP	SH	FI	SP

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER EE16.01.8

PAGE 1 OF 1

APPROVALS
Des. Sect. [signature]
Sect. Supv. [signature]
Div. ______

PIPE STRESS SUMMARY REPORT

ANSI B31.1 - 1973 EDITION

ISSUED 5/27/75
REVISED

10MWe SOLAR PILOT PLANT -DOE — C-21700
Job Name — Job No.

MAIN STEAM DESUPERHEATER BRANCH 16"-MS-3-QEB — MS-3
System/Pipe Line Name — Analysis No.

1. Loading Conditions Analyzed — Analysis Ident. Code

		Analysis Ident. Code
Pressure	X	P-MS-3-A-0
Weight	X	W-MS-3-A-3
Thermal Expansion	X	T-MS-3-A-3
Sustained Mech. Loads		
Occasional Loads	X	X-MS-3-A-1

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} \leq 1.0\ S_h$ — 3357 psi ≤ 10360 psi

PRESS = 1565 PSIG ⇒ S_{LP} = 1885 PSI

Material: - ASTM A335 P22 — Temp = 960°F @ PT. 370

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{0.75\ iM_B}{Z} \leq KS_h$ — 9374 psi ≤ 12430 psi

Material: - ASTM A335 P22 — Temp = 960°F @ PT. 400

Eq. (13) $S_E = \frac{iM_C}{Z} \leq S_A$ — 7550 psi ≤ 19200 psi

Material: - ASTM A335 P22 — Temp = 960°F @ PT. 360M

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{iM_C}{Z} \leq (S_h + S_A)$ — 9560 psi ≤ 29560 psi

Material: - ASTM A335 P22 — Temp = 960°F @ PT. 360M

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) EQ.12 INCLUDES STRESSES FROM AN OPERATIONAL BASIS EARTHQUAKE BASED ON GROUND RESPONSE SPECTRUM.

Prepared By: [signature] — Date: 2-28-80

Approved By: [signature] — Date: 2-28-80

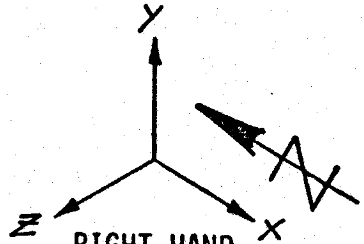
CUSTOMER: DOE
PROJECT: 10 MWe SOLAR PILOT PLANT
JOB NO: C-21700
BY: GHM DATE: FEB. 28, 1980
REF. DWGS: P13-2 A
ANALYSIS CODE: T/W/X-MS-3-A-3/3/1

SUMMARY OF FORCES & MOMENTS ON SYSTEM TERMINAL EQUIPMENT

(SYSTEM)

MAIN STEAM DESUPERHEATER BRANCH
6"-MS-3-QEB

THE REPORTED REACTIONS BASED ON A THERMAL EXPANSION ANALYSIS FROM ...70°F TO 960°F USING E_c, THE COLD MOD. OF ELASTICITY, AND ....0...% COLD SPRING.



RIGHT-HAND CARTESIAN COORDINATE SYSTEM

EQUIPMENT CONNECTIONS		LOC. NO.	FORCES (LBS) X	FORCES (LBS) Y	FORCES (LBS) Z	FORCES (LBS) RESULTANT	MOMENTS (FT.-LBS) X	MOMENTS (FT.-LBS) Y	MOMENTS (FT.-LBS) Z	MOMENTS (FT.-LBS) RESULTANT
DESUPERHEATER	THERMAL	400	-745	-399	-542	1004	1456	-6319	7248	9726
DS-301 STEAM INLET	WEIGHT	400	-4	321	-3	321	-1148	-47	-119	1156
1'0" EAST 1I	SEISMIC	400	901	345	1243	1574	6493	10402	7713	14487

DIVISION USAGE

MM	P	PP	SH	FI	SP
X					

APPROVALS
Dec. Sec.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

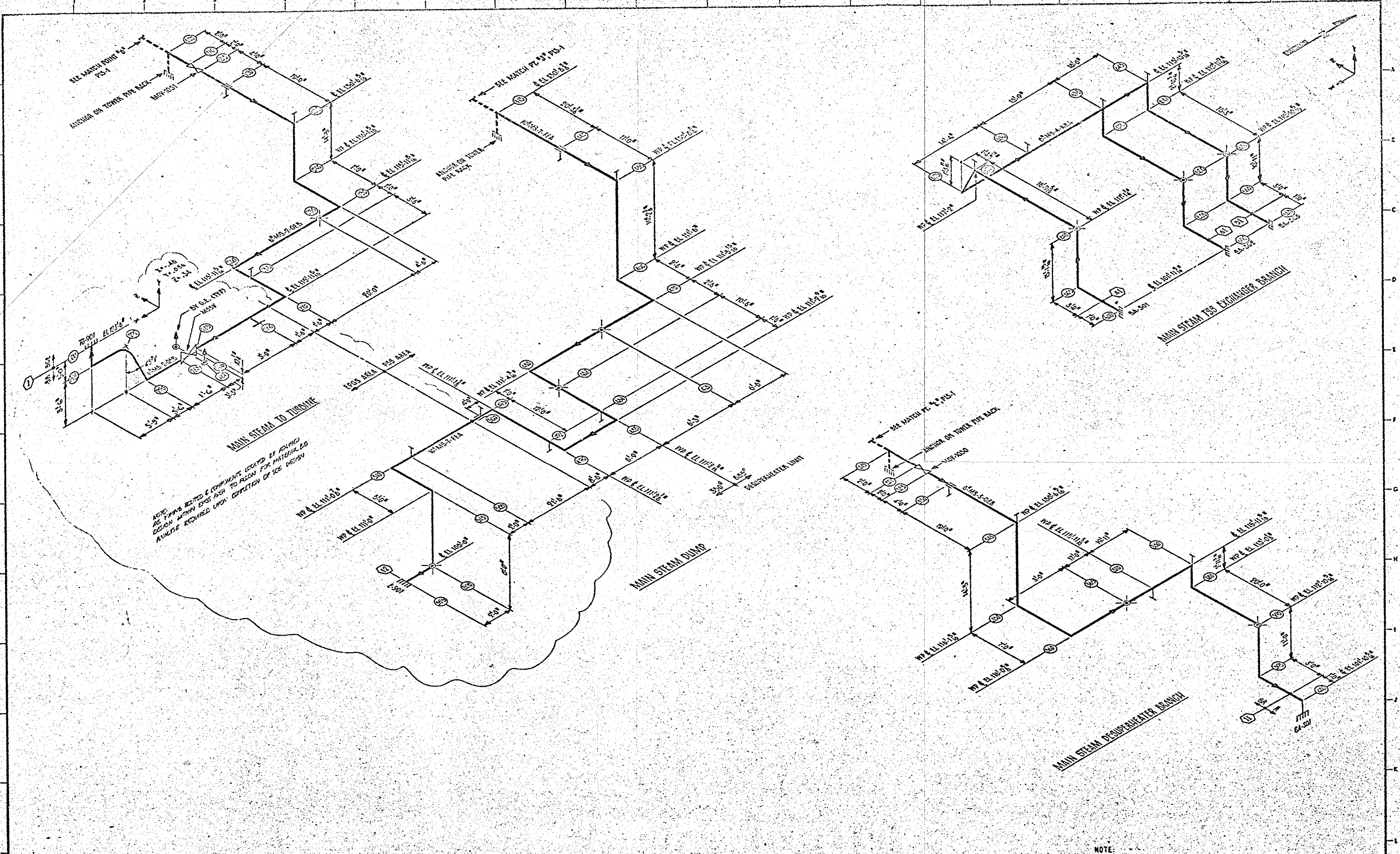
SUMMARY OF FORCES & MOMENTS
PER. ANSI B31.1-1973 PWR. PIPING CODE

STANDARD NUMBER
EE 16.01.7

PAGE 1 OF 1

ISSUED 2/28/74
REVISED 4/18/78

ISOMETRIC



NOTE:

Piping configuration shown on this drawing is for Thermal, Weight and Seismic Analysis ONLY. See P9 series drawings for piping erection.

NO	REVISIONS	DATE	BY	CK'D	APP'D
B	UPDATED PER LATEST ANALYSIS DOCUMENTS	7/19/80			

DOC. NO.	REFERENCE DRAWINGS
P9-5	R.S TOWER PIPING-PLANS
P9-7	YARD PIPING NORTH HALF 110'-0" LEVEL-PLAN
P9-8	YARD PIPING SOUTH HALF 110'-0" LEVEL-PLAN
P9-9	YARD PIPING NORTH HALF 115'-0" LEVEL-PLAN
P9-10	YARD PIPING SOUTH HALF 115'-0" LEVEL-PLAN
SK7351-M22A	TURBINE PIPING LAYOUT (PRELIM)

PRINT RECORD

DRAWN	T.D.H.	12-1-79
CHECKED		
MECH. CH.		3-24-80
ELECT. CH.	TEO	5/28/80
STRUCT. CH.	DPO	1/25/80
PIPING CH.	TEO	3/21/80
APPROVED		
APPROVED		

S.R. ORDER NO. C-21700
C.R. DWG NO. XL-22934
SHEET NO. P13-2
REV. B

SOLAR FACILITIES DESIGN INTEGRATOR

McDONNELL DOUGLAS — Rockwell International Rocketdyne Division

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

TITLE
ANALYSIS ISOMETRIC
MAIN STEAM - PSS, TSS & EPGS

SCALE NONE
DATE 5-9-80
SHEET NO. 1 OF 1

ANALYSIS ISOMETRIC (P13-2) 7

DRAWING NO. 40P2005131921
REV. B

Form 22079

BRANCH CONNECTION SYMBOLS

- UNREINFORCED PIPE—PIPE INTERSECTION
- REINFORCED PIPE—PIPE INTERSECTION
- A S A TEE
- WELDOLET
- SWEEPOLET

PIPE SUPPORT SYMBOLS

- CONSTANT SUPPORT
- VARIABLE SPRING SUPPORT
- RIGID ROD OR STRUT
- HYDRAULIC SNUBBER
- RIGID GUIDE
- ANCHOR

MODELING SYMBOLS

- POINT OF INTEREST
- DATA POINT NO.
- MASS POINT OR CENTER OF GRAVITY
- INTERFACE POINT

PIPING SYMBOLS

- ELBOW
- BEND
- VALVES (ASSUMED RIGID)
- REDUCER OR INCREASER
- EQUIPMENT NOZZLE

ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN. X	Y	Z	ANCHOR &/OR TERM. POINTS	COORDINATE X	Y	Z
205	0.0	0.0	0.0	205 } MS-2	0'-0"	0'-0"	0'-0"
300	-.46	.056	.35	300	48'-0½"	-6'-10 5/16"	-38'-6"
315	0.0	0.0	0.0	315 } MS-3	0'-0"	0'-0"	0'-0"
400				400	-39-11"	-28'-4 3/16"	-58'-0"
415				415 } MS-4	0'-0"	0'-0"	0'-0"
525				525	53'-6"	-25'-2⅜"	-39'-9⅛"
600				600	0'-0"	0'-0"	0'-0"
665				665 } MS-5	-46'-1"	-5'-0½"	-0'-2"
690				690	-28'-1"	0'-0½"	-0'-2"

ANALYZED CONDITIONS

OPERATING TEMP (°F)	DESIGN PRESSURE (P S I G)	CASE
960	1565	MS-2
960	1565	MS-3
885	100	MS-4 / PT 415-485
350	100	MS-4 / PT 485-525
650	1385	MS-5

VALVES & SPECIAL COMPONENTS

VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS
MSSV	3000	EST	GE Prelim Turbine Info
MOV-1031	1315	EST	Powell 125023 WE
MOV-1030	1315	EST	" " "

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 FROM	TO	PIPE MATERIAL	LINE SPEC.	PIPE SIZE (IN.) O.D.	W.T.	WEIGHT LBS./LINEAR FT. PIPE	FLUID	INSULATION	INS. THK.
205 / 315	300 / 400	A335 P22	QEB	6.625	.864	54.3	3.1	15.2	5
415	484	↓ P11	FEA	10.75	.365	41.3	34.1	20.6	5
600	665 / 690	A106 Gr B	KBA	8.625	.500	43.4	19.8	11.1	3½
484	525	A335 P11	FEA	10.75	.365	41.3	34.1	8.7	3½

NO.	REFERENCES	NO.	ANALYSIS CODES
			T/W/X-MS-2-A-4/5/3
			T/W/X-MS-3-A-3/3/1
			T/W/X-MS-4-A-5/3/1
			T/W/X-MS-5-A-2/3/1

NO.	REVISIONS	DATE	BY	CH'D	APP'D

PIPING ANALYSIS DATA

Stearns-Roger INCORPORATED (P13-2)

10 MWE SOLAR PILOT PLANT - DAGGET, CALIF.
MAIN STEAM - PSS TSS & EPGS
FOR ISOMETRIC P13-2

DRAWN: KEN	DATE: 2-15-80	ANAL. BY GHM	DATE: 2-28-80
CHECKED: KE Fisher	DATE: 3-3-80	APP'D. BY GHM	DATE: 3-19-80
JOB NO. C-21700	SYSTEM NO. MS-2,3,4 & 5 9	SHEET 1 OF 1	

THERMAL

DYNAFLEX

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
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.

STEARNS - ROGER CORP

10MW SOLAR PILOT PLANT - C-21700

MS VALVE TO THER STOR (T/W-MS-3-A-3/73)

2/25/80

DYNAFLEX (MOD204F-UCC)

LAST UPDATE - 12/25/79

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - PS VALVE TO THER STOR (T/W-HS-3-A-3/3)

DATE 2/25/80

INPUT DATA - (CARD IMAGES)

12

LINE NUMBER	:1 TYP	:4 LOC NO.	:7 FRM	:10 TO	:13 DELTA X	:25 DELTA Y	:37 DELTA Z	:49 RADIUS	:60 ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP,	1
									2/25/80,PROJ.10MW SO	
									LAR PILOT PLANT - C-2	
									1700,JOBPS VALVE TO T	
									HER STOR (T/W-HS-3-A-	
									3/3)	
2	GEN								APPLY B31.1-1973,EXA	2
3			315	320			-2-0		MAT=LCM,OD=6.625,	3
									WT=.864,UNIF=15.2,	
									TEMP=960.	
4				325			-2-0		RIGID,WEIGHT=1315.	4
5				330			-4-0			5
6				345			-19-0	L		6
7				350		-14-5		L		7
8				360			-7-0	L		8
9				365	-3-0					9
10				370	-17-0					10
11				380	-19-11			L		11
12				385		-2-11-3/16		L		12
13				390			-20-0	L		13
14				395		-11-0		L		14
15				400			-4-0			15
16	ANC	315								16
17	ANC	400								17
18	RAD	330			RIGID					18
19	RAD	330				RIGID				19
20	RAD	345	[illegible]			RIGID				20
21	RAD	370				RIGID				21
22	RAD	380	[illegible]			RIGID				22
23	HGR								LOC(365,390N),	23
									USE TABLE 1	
24	CCC	400			-39-11	-28-4-3/16	-58-0			24

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS VALVE TO THER STOR (1/2-MS-3-A-3/3)

DATE 2/25/80

* 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 LOOP POINTS AND ARE DETERMINED FROM THE MAXIMUM LOOP 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.

13

(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.

(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.

(15) 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 315, WHICH IS THE ORIGIN

HANGER DESIGN DATA:

THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION = .10 INCHES.
VARIABLE SPRING HANGERS SELECTED FROM TABLE @1@

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

LCM - LOW CHROME MOLY STEEL
YOUNGS MODULUS AT AMBIENT TEMPERATURE = 29,900,000. PSI
POISSONS RATIO = .30
DENSITY = 500. POUNDS PER CUBIC FOOT

LOADING CONDITIONS ANALYZED

@FREE@ THERMAL
@RESTRAINED@ WEIGHT

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
ANCHR		--315	0.00	0.00	0.00										
	STRAIGHT -(						2.00		6.625	.864	LCM	960.		54.3	15.2
14	(* THERMAL EXPANSION OF LCM BETWEEN AMBIENT AND 960. DEGREES FAHRENHEIT IS 8.46 INCHES PER 100 FEET														
	(* A UNIFORM DISTRIBUTED LOAD OF 15.20 PLF IS ACTING IN THE -Y DIRECTION.														
		>-320	0.00	0.00	-2.00										
	RIGID -(						2.00		N/A	N/A			N/A	N/A	
	(* WEIGHT OF ELEMENT = 1315. POUNDS														
		>-325	0.00	0.00	-4.00										
	STRAIGHT -(						4.00								
		>-330	0.00	0.00	-8.00										

* NOTES PERTAINING TO POINT 330 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									6.625	.864	LCM	960.		54.3	15.2
		>-330	0.00	0.00	-8.00										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330 IN DIRECTION X													
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330 IN DIRECTION Y													
	STRAIGHT						18.25								
		>-345N	0.00	0.00	-26.25										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 345N IN DIRECTION Y													
	BEND	345M	0.00	-.22	-26.78	.75	1.18	90.000							
		>-345F	0.00	-.75	-27.00										
	STRAIGHT						12.92								
		>-350N	0.00	-13.67	-27.00										
	BEND	350M	0.00	-14.20	-27.22	.75	1.18	90.000							
		>-350F	0.00	-14.42	-27.75										
	STRAIGHT						5.50								
		>-360N	0.00	-14.42	-33.25										
	BEND	360M	-.22	-14.42	-33.78	.75	1.18	90.000							
		>-360F	-.75	-14.42	-34.00										
	STRAIGHT						2.25								
		>-365	-3.00	-14.42	-34.00										
		* TENTATIVE HANGER AT POINT 365 - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.													
	STRAIGHT						17.00								
		>-370	-20.00	-14.42	-34.00										

* NOTES PERTAINING TO POINT 370 APPEAR ON THE FOLLOWING PAGE

15

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									6.625	.664	LCM	960.		54.3	15.2
		>-370	-20.00	-14.42	-34.00										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 370 IN DIRECTION Y													
	STRAIGHT						19.17								
		>-380N	-39.17	-14.42	-34.00										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 380N IN DIRECTION Y													
	BEND	380M	-39.70	-14.64	-34.00	.75	1.18	90.000							
		>-380F	-39.92	-15.17	-34.00										
	STRAIGHT						1.43								
		>-385N	-39.92	-16.60	-34.00										
	BEND	385M	-39.92	-17.13	-34.22	.75	1.18	90.000							
		>-385F	-39.92	-17.35	-34.75										
	STRAIGHT						18.50								
		>-390N	-39.92	-17.35	-53.25										
		* TENTATIVE HANGER AT POINT 390N - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.													
	BEND	390M	-39.92	-17.57	-53.78	.75	1.18	90.000							
		>-390F	-39.92	-18.10	-54.00										
	STRAIGHT						9.50								
		>-395N	-39.92	-27.60	-54.00										
	BEND	395M	-39.92	-28.13	-54.22	.75	1.18	90.000							
		>-395F	-39.92	-28.35	-54.75										
	STRAIGHT						3.25								
ANCHOR		--400	-39.92	-28.35	-58.00										

* NOTES PERTAINING TO POINT 400 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	COORDINATES (FT) Y	COORDINATES (FT) Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	DIST. LOADS (LBS PER FT) UNIF
									6.625	.864	LCM	960.		54.3	15.2
ANCHR		--400	-39.92	-28.35	-58.00										

* CONTROL COORDINATES OF POINT 400, IN FEET :
X = -39.92, Y = -28.35, Z = -58.00
RESULTANT DIFFERENCE IS ZERO

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	315	-1693.	-123.	542.	1782.	-307.	4240.	2693.	5033.
	400	-745.	-399.	-542.	1004.	1456.	-6319.	7248.	9726.
RESTRAINTS:									
	330	2439.	0.	0.	2439.	0.	0.	0.	0.
	330	0.	258.	0.	258.	0.	0.	0.	0.
18	345N	0.	568.	0.	568.	0.	0.	0.	0.
	370	0.	-868.	0.	868.	0.	0.	0.	0.
	380N	0.	565.	0.	565.	0.	0.	0.	0.

```
* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 7550. OCCURS AT POINT 360M

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.

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(15) 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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
ANCHP		-- 315	542.	1698.	2693.	307.	4240.	1.00	1.00	20.02	3016.
	STR -(										
		>- 320	542.	1698.	2693.	62.	854.	1.00	1.00	20.02	1694.
	RIGID -(										
		>- 325	542.	1698.	2693.	183.	2533.	1.00	1.00	20.02	2219.
	STR -(										
		>- 330	542.	1698.	2693.	674.	9307.	1.00	1.00	20.02	5820.
	STR -(										
		>- 345N	542.	754.	2693.	1797.	4296.	1.00	1.00	20.02	3224.
	(										
	BEND -(	345M	880.	754.	5106.	2051.	1528.	1.00	1.00	20.02	3422.
	(										
		>- 345F	703.	922.	4855.	1918.	2134.	1.00	1.00	20.02	3379.
	STR -(										
		>- 350N	703.	922.	4855.	7493.	5085.	1.00	1.00	20.02	6157.
	(										
	BEND -(	350M	880.	754.	2030.	5218.	9127.	1.00	1.00	20.02	6416.
	(										
		>- 350F	542.	1025.	8052.	4965.	5414.	1.00	1.00	20.02	6532.
	STR -(										
		>- 360N	542.	1025.	8052.	1098.	9513.	1.00	1.00	20.02	7498. *
	(										
20	BEND -(	360M	910.	717.	5072.	9790.	6098.	1.00	1.00	20.02	7550. **
	(										
		>- 360F	745.	888.	571.	9666.	7525.	1.00	1.00	20.02	7349. *
	STR -(										
		>- 365	745.	888.	571.	5944.	8446.	1.00	1.00	20.02	6198.
	STR -(										
		>- 370	745.	567.	571.	6007.	771.	1.00	1.00	20.02	3645.
	STR -(										
		>- 380N	745.	567.	571.	2837.	11163.	1.00	1.00	20.02	6911. *
	(										
	BEND -(	380M	809.	595.	7609.	2885.	8585.	1.00	1.00	20.02	7088. *
	(										
		>- 380F	399.	922.	11569.	2578.	978.	1.00	1.00	20.02	7127. *
	STR -(										
		>- 385N	399.	922.	11569.	1510.	1754.	1.00	1.00	20.02	7070. *
	(										
	BEND -(	385M	666.	752.	7277.	1954.	8853.	1.00	1.00	20.02	6967. *
	(										
		>- 385F	542.	246.	951.	1862.	11010.	1.00	1.00	20.02	6716.
	STR -(										
		>- 390N	542.	246.	951.	5524.	2779.	1.00	1.00	20.02	3749.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
		>- 390N	542.	846.	951.	5524.	2779.	1.00	1.00	20.02	3749.
	BEND -(	390M	666.	752.	2801.	5617.	1688.	1.00	1.00	20.02	3895.
		>- 390F	399.	922.	3336.	392.	5417.	1.00	1.00	20.02	3820.
	STR -(										
		>- 395N	399.	922.	3338.	6689.	266.	1.00	1.00	20.02	4482.
	BEND -(	395M	666.	752.	2533.	66.	7485.	1.00	1.00	20.02	4736.
		>- 395F	542.	846.	7248.	159.	3897.	1.00	1.00	20.02	4932.
	STR -(										
ANCHR		-- 400	542.	846.	7248.	1456.	6319.	1.00	1.00	20.02	5828.

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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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
ANCHOR		-- 315	-1693.	-123.	542.	-307.	4240.	2693.
	STRAIGHT -(							
		>- 320	-1693.	-123.	542.	-62.	854.	2693.
	RIGID -(							
		>- 325	-1693.	-123.	542.	183.	-2533.	2693.
	STRAIGHT -(							
		>- 330	-1693.	-123.	542.	674.	-9307.	2693.
	STRAIGHT -(							
		>- 345N	745.	135.	542.	-1797.	4296.	2693.
	BEND -(	345M	745.	703.	542.	-2051.	4691.	2530.
		>- 345F	745.	703.	542.	-1918.	4855.	2134.
	STRAIGHT -(							
		>- 350N	745.	703.	542.	5085.	4855.	-7493.
	BEND -(	350M	745.	703.	542.	5216.	5019.	-7889.
		>- 350F	745.	703.	542.	4965.	5414.	-8052.
	STRAIGHT -(							
		>- 360N	745.	703.	542.	1096.	9513.	-8052.
	BEND -(	360M	745.	703.	542.	726.	9790.	-7898.
		>- 360F	745.	703.	542.	571.	9666.	-7525.
	STRAIGHT -(							
		>- 365	745.	703.	542.	571.	8446.	-5944.
	STRAIGHT -(							
		>- 370	745.	-165.	542.	571.	-771.	6007.
	STRAIGHT -(							
		>- 380N	745.	-165.	542.	571.	-11163.	2837.
	BEND -(	380M	745.	399.	542.	690.	-11450.	2885.
		>- 380F	745.	399.	542.	978.	-11569.	2578.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	Y	Z	MOMENTS (FOOT-POUNDS) X	Y	Z
		>- 380F	745.	399.	542.	978.	-11569.	2578.
	STRAIGHT -(							
		>- 385N	745.	399.	542.	1754.	-11569.	1510.
	(							
	BEND -(	385M	745.	399.	542.	1954.	-11406.	1115.
	(							
		>- 385F	745.	399.	542.	1862.	-11010.	951.
	STRAIGHT -(							
		>- 390N	745.	399.	542.	-5524.	2779.	951.
	(							
	BEND -(	390M	745.	399.	542.	-5617.	3174.	788.
	(							
		>- 390F	745.	399.	542.	-5417.	3338.	392.
	STRAIGHT -(							
		>- 395N	745.	399.	542.	-266.	3338.	-6689.
	(							
	BEND -(	395M	745.	399.	542.	-66.	3502.	-7084.
	(							
		>- 395F	745.	399.	542.	-159.	3897.	-7248.
	STRAIGHT -(							
ANCHOR		-- 400	745.	399.	542.	-1456.	6319.	-7248.

DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 315	-.000	-.000	.000	-.000	.000	.000
	STRAIGHT -(							
		>- 320	-.006	-.000	-.169	-.002	.021	.029
	RIGID -(							
		>- 325	-.015	-.001	-.338	-.002	.021	.029
	STRAIGHT -(							
		>- 330	.000	.000	-.677	.006	-.077	.088
	STRAIGHT -(							
	(	>- 345N	.990	.000	-2.220	-.037	-.268	.353
	BEND -(	345M	1.035	-.023	-2.263	-.045	-.250	.361
	(	>- 345F	1.087	-.070	-2.276	-.054	-.235	.369
	STRAIGHT -(							
	(	>- 350N	2.007	-1.163	-2.159	.031	.104	.225
	BEND -(	350M	2.025	-1.205	-2.182	.053	.124	.191
24	(	>- 350F	2.018	-1.217	-2.230	.075	.148	.162
	STRAIGHT -(							
	(	>- 360N	1.759	-1.081	-2.695	.145	.319	-.077
	BEND -(	360M	1.703	-1.060	-2.724	.151	.361	-.105
	(	>- 360F	1.641	-1.039	-2.700	.156	.403	-.137
	STRAIGHT -(							
		>- 365	1.450	-.959	-2.489	.163	.488	-.200
	STRAIGHT -(							
		>- 370	.013	-.000	-.075	.216	.759	-.197
	STRAIGHT -(							
	(	>- 380N	-1.608	.000	2.295	.275	.283	.155
	BEND -(	380M	-1.645	-.036	2.311	.281	.237	.168
	(	>- 380F	-1.645	-.089	2.290	.289	.197	.180
	STRAIGHT -(							
	(	>- 385N	-1.569	-.210	2.202	.297	.108	.192
	BEND -(	385M	-1.571	-.241	2.150	.305	.068	.201

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	BEND -(	385M	-1.571	-.241	2.150	.305	.068	.201
	(>-	385F	-1.566	-.226	2.091	.313	.022	.209
	STRAIGHT -(>-	390N	-.692	.899	.527	.172	-.295	.304
	(BEND -(	390M	-.645	.899	.475	.148	-.283	.306
	(>-	390F	-.598	.860	.441	.124	-.272	.307
	STRAIGHT -(>-	395N	-.064	.057	.340	.012	-.101	.183
	(BEND -(	395M	-.041	.012	.320	.011	-.087	.153
	(>-	395F	-.026	-.005	.275	.011	-.069	.127
ANCHOR	STRAIGHT -(--	400	-.000	-.000	-.000	.000	-.000	.000

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WEIGHT

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
315	-12.	-886.	3.	886.	-845.	29.	29.	846.
400	-4.	321.	-3.	321.	-1148.	-47.	-119.	1156.
RESTRAINTS:								
330	16.	0.	0.	16.	0.	0.	0.	0.
330	0.	-1557.	0.	1557.	0.	0.	0.	0.
345R	0.	-1835.	0.	1835.	0.	0.	0.	0.
365	0.	-938.	0.	938.	0.	0.	0.	0.
370	0.	-1432.	0.	1432.	0.	0.	0.	0.
380A	0.	-1381.	0.	1381.	0.	0.	0.	0.
390R	0.	-2117.	0.	2117.	0.	0.	0.	0.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS

THE MAXIMUM STRESS OF 1472. OCCURS AT POINT 370

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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHP		-- 315	3.	886.	29.	845.	29.	1.00	1.00	20.02	507.
	STR -(										
		>- 320	3.	747.	29.	788.	6.	1.00	1.00	20.02	472.
	RIGID -(										
		>- 325	3.	599.	29.	936.	17.	1.00	1.00	20.02	561.
	STR -(										
		>- 330	3.	681.	29.	2014.	63.	1.00	1.00	20.02	1208.
	STR -(										
		>- 345N	3.	568.	29.	1169.	16.	1.00	1.00	20.02	701.
	(										
	BEND -(	345M	851.	855.	33.	517.	7.	1.00	1.00	20.02	311.
	(										
		>- 345F	1165.	5.	19.	26.	254.	1.00	1.00	20.02	153.
	STR -(										
		>- 350N	267.	5.	19.	31.	219.	1.00	1.00	20.02	133.
	(										
	BEND -(	350M	158.	162.	9.	165.	38.	1.00	1.00	20.02	102.
	(										
		>- 350F	3.	185.	34.	56.	23.	1.00	1.00	20.02	41.
	STR -(										
		>- 360N	3.	197.	34.	46.	87.	1.00	1.00	20.02	63.
	(										
29	BEND -(	360M	5.	238.	132.	48.	154.	1.00	1.00	20.02	125.
	(										
		>- 360F	4.	279.	257.	153.	48.	1.00	1.00	20.02	182.
	STR -(										
		>- 365	4.	503.	257.	956.	42.	1.00	1.00	20.02	594.
	STR -(										
		>- 370	4.	754.	257.	2403.	4.	1.00	1.00	20.02	1472. **
	STR -(										
		>- 380N	4.	803.	257.	760.	55.	1.00	1.00	20.02	482.
	(										
	BEND -(	380M	536.	542.	221.	343.	142.	1.00	1.00	20.02	259.
	(										
		>- 380F	721.	5.	57.	176.	255.	1.00	1.00	20.02	189.
	STR -(										
		>- 385N	622.	5.	57.	251.	170.	1.00	1.00	20.02	185.
	(										
	BEND -(	385M	409.	412.	79.	119.	158.	1.00	1.00	20.02	128.
	(										
		>- 385F	3.	540.	167.	178.	54.	1.00	1.00	20.02	150.
	STR -(										
		>- 390N	3.	746.	167.	1731.	27.	1.00	1.00	20.02	1042.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 390N	3.	746.	167.	1731.	27.	1.00	1.00	20.02	1042.
	BEND -(	390M	939.	942.	138.	1013.	97.	1.00	1.00	20.02	615.
		>- 390F	1289.	5.	30.	164.	723.	1.00	1.00	20.02	444.
	STR -(										
		>- 395N	629.	5.	30.	697.	122.	1.00	1.00	20.02	425.
	BEND -(	395M	414.	418.	107.	564.	63.	1.00	1.00	20.02	346.
		>- 395F	3.	547.	119.	263.	33.	1.00	1.00	20.02	174.
	STR -(										
ANCHR		-- 400	3.	321.	119.	1148.	47.	1.00	1.00	20.02	693.

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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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
ANCHOR	--	315	-12.	-886.	3.	-845.	29.	29.
	STRAIGHT -(							
	>-	320	-12.	-747.	3.	788.	6.	29.
	RIGID -(							
	>-	325	-12.	599.	3.	936.	-17.	29.
	STRAIGHT -(							
	>-	330	4.	-680.	3.	-2014.	-63.	29.
	STRAIGHT -(							
	>-	345N	4.	588.	3.	-1169.	16.	29.
	BEND -(	345M	4.	-1206.	3.	-517.	18.	28.
	>-	345F	4.	-1165.	3.	-254.	19.	26.
	STRAIGHT -(							
	>-	350N	4.	-267.	3.	-219.	19.	-31.
	BEND -(	350M	4.	-226.	3.	-165.	20.	-33.
	>-	350F	4.	-185.	3.	-56.	23.	-34.
	STRAIGHT -(							
	>-	360N	4.	197.	3.	-87.	46.	-34.
	BEND -(	360M	4.	238.	3.	-202.	48.	15.
	>-	360F	4.	279.	3.	-257.	48.	153.
	STRAIGHT -(							
	>-	365	4.	-503.	3.	-257.	42.	956.
	STRAIGHT -(							
	>-	370	4.	-754.	3.	-257.	-4.	2443.
	STRAIGHT -(							
	>-	380N	4.	-803.	3.	-257.	-55.	760.
	BEND -(	380M	4.	-762.	3.	-257.	-56.	343.
	>-	380F	4.	-721.	3.	-255.	-57.	176.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	Y	Z	MOMENTS (FOOT-POUNDS) X	Y	Z
		>- 380F	4.	-721.	3.	-255.	-57.	176.
	STRAIGHT -(							
		>- 385N	4.	-622.	3.	-251.	-57.	170.
	(							
	BEND -(	385M	4.	-581.	3.	-119.	-56.	168.
	(							
		>- 385F	4.	-540.	3.	178.	-54.	167.
	STRAIGHT -(							
		>- 390N	4.	746.	3.	-1731.	27.	167.
	(							
	BEND -(	390M	4.	-1330.	3.	-1013.	29.	166.
	(							
		>- 390F	4.	-1289.	3.	-723.	30.	164.
	STRAIGHT -(							
		>- 395N	4.	-629.	3.	-697.	30.	122.
	(							
	BEND -(	395M	4.	-588.	3.	-564.	31.	120.
	(							
		>- 395F	4.	-547.	3.	-263.	33.	119.
	STRAIGHT -(							
ANCHOR		-- 400	4.	-321.	3.	1148.	47.	119.

DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR	--	315	-.000	-.000	.000	-.000	.000	.000
	STRAIGHT -(							
	>-	320	-.000	-.001	.000	-.000	.000	.000
	RIGID -(							
	>-	325	-.000	-.001	.000	.000	.000	.000
	STRAIGHT -(							
	>-	330	.000	-.000	.000	-.007	-.001	.001
	STRAIGHT -(							
	>-	345N	.007	-.000	.000	.018	-.002	.004
	(							
	BEND -(	345M	.008	.002	-.001	.015	-.002	.004
	(							
	>-	345F	.008	.002	-.002	.013	-.002	.004
	STRAIGHT -(							
	>-	350N	.020	.002	-.020	.000	-.001	.004
	(							
	BEND -(	350M	.020	.002	-.020	-.000	-.001	.004
	(							
	>-	350F	.020	.002	-.020	-.001	-.001	.004
	STRAIGHT -(							
	>-	360N	.021	.002	-.020	.001	.000	.003
	(							
	BEND -(	360M	.021	.002	-.020	.001	.000	.003
	(							
	>-	360F	.021	.002	-.020	.000	.001	.003
	STRAIGHT -(							
	>-	365	.021	-.000	-.020	-.003	.001	.008
	STRAIGHT -(							
	>-	370	.021	-.000	-.013	-.027	.002	.010
	STRAIGHT -(							
	>-	380N	.021	-.000	-.007	-.053	-.000	-.032
	(							
	BEND -(	380M	.019	.003	-.005	-.054	-.000	-.030
	(							
	>-	380F	.016	.005	.001	-.055	-.000	-.029
	STRAIGHT -(							
	>-	385N	.008	.005	.018	-.057	-.001	-.028
	(							
	BEND -(	385M	.005	.002	.024	-.058	-.001	-.027

DYNAFLEX LOADING - @RESTRAINED@ WEIGHT (+UNIF)

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	BEND -(	385	.005	.002	.024	-.058	-.001	-.027
	(>-	385F	.003	-.004	.027	-.058	-.001	-.027
	STRAIGHT -(>-	390	.012	-.000	.027	.035	-.002	-.010
	(BEND -(	390	.012	.003	.026	.029	-.002	-.009
	(>-	390F	.011	.005	.023	.026	-.002	-.009
	STRAIGHT -(>-	395	.000	.005	-.001	-.002	-.001	-.003
	(BEND -(	395	-.000	.004	-.000	-.005	-.001	-.002
	(>-	395F	-.000	.004	-.000	-.007	-.001	-.002
ANCHOR	STRAIGHT -(--	400	-.000	.000	-.000	-.000	-.000	-.000

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.

35 (7) 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) X	HORIZONTAL MOVEMENT (INCHES) Z	PRELIMINARY HANGER SELECTION TYPE	PRELIMINARY HANGER SELECTION SPECIFICATION	SWING LENGTH (FEET)	SWING ANGLE (DEG)
365	938.	-.96	1.45	-2.49	VSH	1 - MIDDLE RANGE SPRING. SPRING RATE = 200 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 746 LBS SPRING LOAD IN THE OPERATING CONDITION = 938 LBS	N/A	N/A
300N	2117.	.90	-.69	.53	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 1200 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 3196 LBS SPRING LOAD IN THE OPERATING CONDITION = 2117 LBS	N/A	N/A

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* * * * * * * * * * * * * * * * * *
*                                 *
* STATIC SOLUTION ACCURACY CHECKS *
*                                 *
* * * * * * * * * * * * * * * * * *
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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.

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DYNAFLEX

TABLE OF CONTENTS

SEISMIC

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS VALVE TO THER STOR (X-MS-3-A-1)

DATE 2/26/80

INPUT DATA - (CARD IMAGES)

:1 :4 :7 :10 :13 :25 :37 :49 :60

LINE NUMBER	TYP	LOC NO.	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP, 2/26/80,PROJ.10MW SOLAR PILOT PLANT - C-21700,JOHMS VALVE TO THER STOR (X-MS-3-A-1)	1
2	GEN								APPLY B31.1-1973,EXA	2
3			315	320			-2-0		MAT=LCM,OD=6.625, WT=.864,UNIF=15.2, TEMP=960.	3
4				325			-2-0		RIGID,WEIGHT=1315.	4
5				330			-4-0			5
6				345			-19-0	L		6
7				350		-14-5		L		7
8				360			-7-0	L		8
9				365	-3-0					9
10				370	-17-0					10
11				380	-19-11			L		11
12				385		-2-11-3/16		L		12
13				390			-20-0	L		13
14				395		-11-0		L		14
15				400			-4-0			15
16	ANC	315								16
17	ANC	400								17
18	RAD	330			RIGID					18
19	RAD	330				RIGID				19
20	RAD	345	[illegible]			RIGID				20
21	RAD	370				RIGID				21
22	RAD	380	[illegible]			RIGID				22
23	CCC	400			-39-11	-23-4-3/16	-58-0			23
24	DYL								SPEC 1(FRE/G,.1/.013,.25/.082,2.5/.638,9./.531,33./.125),SPEC 2(FRE/G,.17.009,.25/.055,2.5/.638,9./.531,33./.125),SHOCK 1(X/1.0SPEC 1),SHOCK 2(Z/1.0 SPEC 1),SHOCK 3(Y/1.SPEC2),	24

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DYNA

DYNAFLEX

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
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

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

STEARNS - ROGER CORP

10MW SOLAR PILOT PLANT - C-21700

HS VALVE TO THER STOR (X-HS-3-A-1)

2/26/80

DYNAFLEX (MOD204F-UCC)

LAST UPDATE - 12/25/79

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP	LOC NO.	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
	:1	:4	:7	:10	:13	:25	:37	:49	:60	
									SHOCK 4(X/1.SPEC1,	
									Y/1.SPEC2,Z/1.SPEC1),	
									LOG,1.92	
25	GEO								LOOP POINTS(AUTOMATIC	25
									,MAX SPACING=5-0	
									,EXCLUDE ALL H NODES)	
									,MODE CUTOFF=20,	
									FREQUENCY CUTOFF=33	
26	OUT								SHOCK 1,SHOCK 2,	26
									SHOCK 3,SHOCK 4	

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS VALVE TO THER STOR (X-MS-3-A-1)

DATE 2/26/80

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* * * * * * * * * * * * * * * * * * *
*                                   *
* EDITED PIPING SYSTEM DESCRIPTION  *
* --------------------------------  *
*                                   *
* * * * * * * * * * * * * * * * * * *
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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.

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(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,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.

(6) 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 315, WHICH IS THE ORIGIN

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

LCM - LOW CHROME MOLY STEEL
YOUNGS MODULUS AT AMBIENT TEMPERATURE = 29,900,000. PSI
POISSONS RATIO = .30
DENSITY = 490. POUNDS PER CUBIC FOOT

SHOCK AND SPECTRUM DATA

MODE CUTOFF SET AT 20

FREQUENCY CUTOFF SET AT 33.00 CPS

SPECTRUM 1 (LOGARITHMIC INTERPOLATION) FREQUENCY CPS	G	SPECTRUM 2 (LOGARITHMIC INTERPOLATION) FREQUENCY CPS	G
.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

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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.

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

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
ANCHP		--315	0.00	0.00	0.00										
	STRAIGHT						2.00		6.625	.864	LCM	960.		54.3	15.2
	* THERMAL EXPANSION OF LCM BETWEEN AMBIENT AND 960. DEGREES FAHRENHEIT IS 3.46 INCHES PER 100 FEET														
	* A UNIFORM DISTRIBUTED LOAD OF 15.20 PLF IS ACTING IN THE -Y DIRECTION.														
		>-320	0.00	0.00	-2.00										

* NOTES PERTAINING TO POINT 320 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE. (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									6.625	.864	LCM	960.		54.3	15.2
		>-320	0.00	0.00	-2.00										
	RIGID -(						2.00		N/A	N/A			N/A	N/A	
	(* WEIGHT OF ELEMENT = 1315. POUNDS														
		>-325	0.00	0.00	-4.00										
	STRAIGHT -(						4.00								
		>-330	0.00	0.00	-8.00										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330 IN DIRECTION X														
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 330 IN DIRECTION Y														
	STRAIGHT -(						4.56								
		>-330.1	0.00	0.00	-12.56										
	STRAIGHT -(						4.56								
		>-330.2	0.00	0.00	-17.13										
	STRAIGHT -(						4.56								
		>-330.3	0.00	0.00	-21.69										
	STRAIGHT -(						4.56								
		>-345N	0.00	0.00	-26.25										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 345N IN DIRECTION Y														
	BEND -(	345B	0.00	-.22	-26.78	.75	1.18	90.000							
		>-345F	0.00	-.75	-27.00										
	STRAIGHT -(						4.31								
		>-345F.1	0.00	-5.06	-27.00										
	STRAIGHT -(						4.31								
		>-345F.2	0.00	-9.36	-27.00										
	STRAIGHT -(						4.31								
		>-350N	0.00	-13.67	-27.00										
	BEND -(	35[illegible]	0.00	[illegible]	-27.22	.75	1.18	90.000							

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                                                                                                                     DIST. LOADS
                                                                                                                     (LBS PER FT)
                        POINT       COORDINATES (FT)                                  OUTSIDE   WALL          TEMP   -----------
POINT  ELEMENT          LOC.   ----------------------   RADIUS  LENGTH    ANGLE   DIAMETER  THICK         (DEG)  PRESS PIPE
TYPE   DESIGNATION      NO.        X       Y       Z      (FT)    (FT)    (DEG)      (IN)     (IN)   MATL (FAHR) (PSI)  WT.   UNIF
-----  -----------  ------  ------- ------- -------   ------  ------    -----   --------  -----  ---- ------ -----  ----  ----
                                                                                : 6.625:   .864: LCM: 960.:      : 54.3: 15.2:
            BEND -(  350B       0.00  -14.20  -27.22      .75    1.18   90.000 :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     >-350F     0.00  -14.42  -27.75                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                2.75         :       :       :    :      :     :     :     :
                     >-350F.1   0.00  -14.42  -30.50                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                2.75         :       :       :    :      :     :     :     :
                     >-360N     0.00  -14.42  -33.25                            :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
            BEND -(  360B       -.22  -14.42  -33.78      .75    1.18   90.000 :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     >-360F     -.75  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                2.25         :       :       :    :      :     :     :     :
                     >-365     -3.00  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.25         :       :       :    :      :     :     :     :
                     >-365.1   -7.25  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.25         :       :       :    :      :     :     :     :
                     >-365.2  -11.50  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.25         :       :       :    :      :     :     :     :
                     >-365.3  -15.75  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.25         :       :       :    :      :     :     :     :
                     >-370    -20.00  -14.42  -34.00                            :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     ( * RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 370      :       :       :    :      :     :     :     :
46                   (    IN DIRECTION Y                                        :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.79         :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     >-370.1  -24.79  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.79         :       :       :    :      :     :     :     :
                     >-370.2  -29.58  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.79         :       :       :    :      :     :     :     :
                     >-370.3  -34.38  -14.42  -34.00                            :       :       :    :      :     :     :     :
        STRAIGHT -(                                                4.79         :       :       :    :      :     :     :     :
                     >-380N   -39.17  -14.42  -34.00                            :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     ( * RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 380N     :       :       :    :      :     :     :     :
                     (    IN DIRECTION Y                                        :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
            BEND -(  380B     -39.70  -14.64  -34.00      .75    1.18   90.000 :       :       :    :      :     :     :     :
                     (                                                          :       :       :    :      :     :     :     :
                     >-380F   -39.92  -15.17  -34.00                            :       :       :    :      :     :     :     :
```

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									6.625	.864	LCM	960.		54.3	15.2
		>-380F	-39.92	-15.17	-34.00										
	STRAIGHT -(						1.43								
		>-385N	-39.92	-16.60	-34.00										
	(														
	BEND -(	3850	-39.92	-17.13	-34.22	.75	1.18	90.000							
	(														
		>-385F	-39.92	-17.35	-34.75										
	STRAIGHT -(						4.63								
		>-385F.1	-39.92	-17.35	-39.33										
	STRAIGHT -(						4.63								
		>-385F.2	-39.92	-17.35	-44.00										
	STRAIGHT -(						4.63								
		>-385F.3	-39.92	-17.35	-48.63										
	STRAIGHT -(						4.63								
		>-390N	-39.92	-17.35	-53.25										
	(														
	BEND -(	3900	-39.92	-17.57	-53.78	.75	1.18	90.000							
	(														
		>-390F	-39.92	-18.10	-54.00										
	STRAIGHT -(						4.75								
		>-390F.1	-39.92	-22.85	-54.00										
	STRAIGHT -(						4.75								
		>-395N	-39.92	-27.60	-54.00										
47	(														
	BEND -(	3950	-39.92	-28.13	-54.22	.75	1.18	90.000							
	(														
		>-395F	-39.92	-28.35	-54.75										
	STRAIGHT -(						3.25								
ANCHR		--400	-39.92	-28.35	-58.00										

* CONTROL COORDINATES OF POINT 400, IN FEET :
X = -39.92, Y = -28.35, Z = -58.00
RESULTANT DIFFERENCE IS ZERO

```
* * * * * * * * * * * * * *
*                          *
*  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.

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	DISPLACEMENT FREEDOM				ROTATIONAL FREEDOM — MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION			X	Y	Z
315	69.				0.	0.	0.
320	742.	X	Y	Z	0.	0.	0.
325	812.	X	Y	Z	0.	0.	0.
330	298.			Z	0.	0.	0.
330.1	317.	X	Y	Z	0.	0.	0.
330.2	317.	X	Y	Z	0.	0.	0.
330.3	317.	X	Y	Z	0.	0.	0.
345N	199.	X		Z	0.	0.	0.
345F	191.	X	Y	Z	0.	0.	0.
345F.1	297.	X	Y	Z	0.	0.	0.
345F.2	2[illegible].	X	Y	Z	0.	0.	0.
350N	191.	X	Y	Z	0.	0.	0.
350F	156.	X	Y	Z	0.	0.	0.

	DISPLACEMENT FREEDOM				ROTATIONAL FREEDOM		
					MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION			X	Y	Z
350F.1	191.	X	Y	Z	0.	0.	0.
360H	136.	X	Y	Z	0.	0.	0.
360F	119.	X	Y	Z	0.	0.	0.
365	226.	X	Y	Z	0.	0.	0.
365.1	295.	X	Y	Z	0.	0.	0.
365.2	295.	X	Y	Z	0.	0.	0.
365.3	295.	X	Y	Z	0.	0.	0.
370	314.	X		Z	0.	0.	0.
370.1	333.	X	Y	Z	0.	0.	0.
370.2	333.	X	Y	Z	0.	0.	0.
370.3	333.	X	Y	Z	0.	0.	0.
380H	207.	X		Z	0.	0.	0.
380F	91.	Y	Y	Z	0.	0.	0.
385H	91.	X	Y	Z	0.	0.	0.
385F	202.	X	Y	Z	0.	0.	0.
385F.1	321.	X	Y	Z	0.	0.	0.
385F.2	321.	X	Y	Z	0.	0.	0.
385F.3	321.	X	Y	Z	0.	0.	0.
390H	202.	X	Y	Z	0.	0.	0.
390F	206.	X	Y	Z	0.	0.	0.
390F.1	330.	X	Y	Z	0.	0.	0.
395H	206.	X	Y	Z	0.	0.	0.
395F	154.	X	Y	Z	0.	0.	0.

	DISPLACEMENT FREEDOM		ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION	X	Y	Z
403	113.		0.	0.	0.

NUMBER OF DYNAMIC DEGREES OF FREEDOM = 100, TOTAL MASS OF SYSTEM = 9825. POUNDS

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

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS X	Y	Z
1	.88039	1.13585	3.81331626	.04724832	.64842915
2	1.87980	.53197	.98141578	.45430736	3.10306712
3	3.05422	.32742	.26667501	.04580247	1.70808241
4	3.91919	.25515	.94239791	.13011141	.42862710
5	4.16749	.23995	.75514653	.62167820	1.03757545
6	5.28776	.18912	1.03627413	.34984765	.15507050
7	7.74927	.12904	.03756246	1.41655161	.84478677
8	9.12371	.10960	.14267544	.41555116	.04905854
9	11.81366	.08465	.00269304	.25176260	.26694942
10	12.40673	.08060	.02949952	1.83648268	.41712082
11	14.99913	.06667	.20970328	.91435421	.18149968
12	16.32961	.06124	.17221260	.19809667	.04989137
13	17.77357	.05626	.46591277	.23382666	.02805239
14	18.19566	.05496	.27405085	.70991063	.00892138
15	20.65028	.04843	.22952225	1.21738988	.18950453
16	25.65496	.03898	.01869728	.22351457	.30336071
17	26.96611	.03708	.00470015	1.39896417	.07143881
18	31.88191	.03137	.40124551	.78789004	.37900367
19	32.58616	.03069	.49242111	.04008710	.25567220

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 = 5.26

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

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MODE ORTHOGONALITY CHECK

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

OFF DIAGONAL TERMS: MAX. = 1.84104×10^{-13} MIN. = -1.43525×10^{-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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
315	2205.	374.	410.	2273.	937.	5518.	3339.	6517.
400	786.	70.	348.	862.	2057.	10061.	6867.	12353.
RESTRAINTS:								
330	2934.	0.	0.	2934.	0.	0.	0.	0.
330	0.	788.	0.	788.	0.	0.	0.	0.
3450	0.	612.	0.	612.	0.	0.	0.	0.
370	0.	466.	0.	466.	0.	0.	0.	0.

FORCES AND MOMENTS IN 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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
580.	0.	159.	0.	159.	0.	0.	0.	0.

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

THE MAXIMUM STRESS OF 7624. OCCURS AT POINT 330

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.

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(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)

			FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF			
POINT TYPE	ELEM TYPE	LOC. NO.	AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 315	410.	2236.	3339.	937.	5518.	1.00	1.00	20.02	3906.
	STR -(										
		>- 320	410.	2236.	3339.	188.	1109.	1.00	1.00	20.02	2112.
	RIGID -(										
		>- 325	410.	2233.	3339.	560.	3298.	1.00	1.00	20.02	2833.
	STR -(										
		>- 330	410.	846.	3339.	2053.	12103.	1.00	1.00	20.02	7624. **
	STR -(										
		>- 330.1	410.	835.	3339.	167.	8778.	1.00	1.00	20.02	5629.
	STR -(										
		>- 330.2	410.	808.	3339.	1717.	5529.	1.00	1.00	20.02	4005.
	STR -(										
		>- 330.3	410.	772.	3339.	3569.	2515.	1.00	1.00	20.02	3294.
	STR -(										
		>- 345N	410.	691.	3339.	5401.	1252.	1.00	1.00	20.02	3879.
	(										
	BEND -(	345M	303.	743.	2869.	5231.	1937.	1.00	1.00	20.02	3759.
	(										
		>- 345F	289.	733.	1536.	2885.	4988.	1.00	1.00	20.02	3574.
	STR -(										
		>- 345F.1	289.	697.	1536.	528.	3329.	1.00	1.00	20.02	2220.
56	STR -(										
		>- 345F.2	289.	697.	1536.	2257.	1939.	1.00	1.00	20.02	2007.
	STR -(										
		>- 350N	289.	640.	1536.	4491.	1424.	1.00	1.00	20.02	2970.
	(										
	BEND -(	350M	264.	597.	2804.	1407.	4060.	1.00	1.00	20.02	3075.
	(										
		>- 350F	331.	563.	4649.	1309.	1699.	1.00	1.00	20.02	3177.
	STR -(										
		>- 350F.1	309.	537.	4649.	858.	2552.	1.00	1.00	20.02	3324.
	STR -(										
		>- 360N	261.	500.	4649.	980.	3529.	1.00	1.00	20.02	3642.
	(										
	BEND -(	360M	253.	490.	3951.	3739.	2907.	1.00	1.00	20.02	3696.
	(										
		>- 360F	345.	369.	1103.	4642.	3681.	1.00	1.00	20.02	3686.
	STR -(										
		>- 365	345.	369.	1103.	4032.	4187.	1.00	1.00	20.02	3545.
	STR -(										
		>- 365.1	297.	347.	1103.	2919.	4837.	1.00	1.00	20.02	3449.
	STR -(										
		>- 365.2	216.	320.	1103.	1696.	5400.	1.00	1.00	20.02	3493.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 365.2	215.	320.	1103.	1896.	5400.	1.00	1.00	20.02	3493.
	STR -(										
		>- 365.3	147.	295.	1103.	1228.	5791.	1.00	1.00	20.02	3608.
	STR -(										
		>- 370	178.	214.	1103.	1558.	5981.	1.00	1.00	20.02	3762.
	STR -(										
		>- 370.1	178.	214.	1103.	1205.	5984.	1.00	1.00	20.02	3717.
	STR -(										
		>- 370.2	244.	246.	1103.	1420.	5855.	1.00	1.00	20.02	3671.
	STR -(										
		>- 370.3	324.	271.	1103.	2029.	5720.	1.00	1.00	20.02	3697.
	STR -(										
		>- 380N	411.	280.	1103.	2792.	5671.	1.00	1.00	20.02	3845.
	(										
	BEND -(	380M	360.	374.	3546.	2714.	4559.	1.00	1.00	20.02	3824.
	(										
		>- 380F	104.	509.	5677.	2496.	1017.	1.00	1.00	20.02	3766.
	STR -(										
		>- 385N	103.	531.	5677.	1877.	898.	1.00	1.00	20.02	3623.
	(										
	BEND -(	385M	181.	532.	2957.	868.	4990.	1.00	1.00	20.02	3515.
	(										
		>- 385F	201.	525.	1565.	849.	5300.	1.00	1.00	20.02	3351.
	STR -(										
		>- 385F.1	204.	576.	1565.	910.	2789.	1.00	1.00	20.02	1993.
	STR -(										
		>- 385F.2	242.	675.	1565.	1114.	1016.	1.00	1.00	20.02	1302.
	STR -(										
		>- 385F.3	276.	710.	1565.	1327.	3463.	1.00	1.00	20.02	2412.
	STR -(										
		>- 390N	276.	710.	1565.	1520.	6599.	1.00	1.00	20.02	4165.
	(										
	BEND -(	390M	204.	752.	5816.	1477.	4085.	1.00	1.00	20.02	4351.
	(										
		>- 390F	70.	822.	7124.	1037.	1329.	1.00	1.00	20.02	4387.
	STR -(										
		>- 390F.1	70.	855.	7124.	2587.	259.	1.00	1.00	20.02	4544.
	STR -(										
		>- 395N	70.	855.	7124.	6280.	1871.	1.00	1.00	20.02	5800.
	(										
	BEND -(	395M	269.	916.	1800.	2050.	9724.	1.00	1.00	20.02	6052.
	(										
		>- 395F	348.	789.	6667.	2114.	7662.	1.00	1.00	20.02	6294.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 395F	348.	789.	6867.	2114.	7662.	1.00	1.00	20.02	6294.
	STR -(										
ANCHR		-- 400	348.	789.	6867.	2057.	10061.	1.00	1.00	20.02	7403. *

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	DISPLACEMENTS (INCHES) Y	DISPLACEMENTS (INCHES) Z	ROTATIONS (DEGREES) ABOUT X AXIS	ROTATIONS (DEGREES) ABOUT Y AXIS	ROTATIONS (DEGREES) ABOUT Z AXIS
ANCHOR		-- 315	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 320	.008	.001	.000	.005	.028	.036
	RIGID -(		(1.6)	(1.1)	(.0)			
		>- 325	.019	.003	.000	.005	.028	.036
	STRAIGHT -(		(3.9)	(2.6)	(.0)			
		>- 330	.000	.000	.000	.017	.101	.109
	STRAIGHT -(		(.0)	(.0)	(.1)			
		>- 330.1	.196	.029	.000	.038	.299	.191
	STRAIGHT -(		(34.0)	(18.6)	(.2)			
		>- 330.2	.552	.062	.000	.023	.434	.273
	STRAIGHT -(		(78.8)	(29.9)	(.3)			
		>- 330.3	1.007	.063	.000	.027	.509	.356
	STRAIGHT -(		(123.3)	(21.4)	(.3)			
59		>- 345D	1.506	.000	.000	.112	.525	.438
	(		(171.7)	(.0)	(.4)			
	BEND -(	345D	1.583	.014	.006	.135	.523	.449
	(		(174.8)	(3.1)	(1.6)			
		>- 345F	1.653	.020	.022	.157	.520	.461
	STRAIGHT -(		(176.6)	(4.5)	(5.0)			
		>- 345F.1	2.058	.020	.200	.231	.496	.490
	STRAIGHT -(		(119.0)	(4.5)	(33.9)			
		>- 345F.2	2.477	.020	.431	.276	.471	.473
	STRAIGHT -(		(105.8)	(4.6)	(56.5)			
		>- 350D	2.665	.020	.690	.294	.449	.414
	(		(111.4)	(4.6)	(89.8)			
	BEND -(	350D	2.528	.038	.722	.295	.444	.395
	(		(112.4)	(5.2)	(88.8)			
		>- 350F	2.994	.067	.736	.296	.438	.379
	STRAIGHT -(		(112.7)	(6.3)	(90.4)			
		>- 350F.1	3.238	.236	.736	.294	.418	.310

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	359F.1	3.238	.236	.736	.294	.416	.310
	STRAIGHT -(		(108.3)	(29.1)	(90.4)			
	>-	360A	3.466	.403	.736	.286	.384	.241
	(		(109.0)	(51.1)	(90.4)			
	BEND -(	360B	3.507	.425	.748	.283	.369	.227
	(		(110.5)	(54.0)	(89.2)			
	>-	360F	3.524	.416	.776	.280	.353	.209
	STRAIGHT -(		(111.2)	(54.2)	(86.4)			
	>-	365	3.524	.333	.896	.267	.316	.173
	STRAIGHT -(		(111.2)	(48.5)	(78.4)			
	>-	365.1	3.524	.212	1.161	.242	.238	.122
	STRAIGHT -(		(111.2)	(39.6)	(81.2)			
	>-	365.2	3.524	.121	1.247	.216	.151	.090
	STRAIGHT -(		(111.2)	(29.3)	(94.1)			
	>-	365.3	3.524	.051	1.317	.191	.070	.068
	STRAIGHT -(		(111.2)	(14.9)	(101.6)			
	>-	370	3.524	.000	1.301	.166	.083	.048
	STRAIGHT -(		(111.2)	(.0)	(97.6)			
	>-	370.1	3.524	.038	1.175	.138	.188	.030
	STRAIGHT -(		(111.2)	(14.7)	(80.5)			
	>-	370.2	3.524	.056	.933	.110	.300	.012
	STRAIGHT -(		(111.2)	(19.7)	(56.9)			
	>-	370.3	3.524	.048	.581	.083	.410	.027
	STRAIGHT -(		(111.2)	(13.2)	(39.0)			
	>-	380A	3.524	.000	.153	.057	.515	.072
	(		(111.2)	(.0)	(50.2)			
	BEND -(	380B	3.520	.009	.122	.052	.536	.083
	(		(111.2)	(2.4)	(53.4)			
	>-	380F	3.510	.013	.119	.048	.554	.094
	STRAIGHT -(		(111.1)	(3.6)	(56.4)			
	>-	385A	3.481	.013	.131	.043	.595	.106
	(		(111.6)	(3.6)	(62.1)			
	BEND -(	385B	3.441	.014	.135	.040	.613	.115
	(		(110.7)	(4.0)	(64.3)			
	>-	385F	3.366	.017	.137	.038	.635	.122
	STRAIGHT -(		(107.8)	(5.5)	(65.2)			
	>-	385F.1	2.716	.045	.137	.024	.706	.159
	STRAIGHT -(		(96.6)	(21.6)	(65.2)			
	>-	385F.2	2.022	.058	.137	.009	.727	.196
	STRAIGHT -(		(109.3)	(39.3)	(65.2)			
	>-	385F.3	1.335	.052	.137	.019	.692	.235
	STRAIGHT -(		(132.1)	(26.9)	(65.1)			
	>-	390A	.719	.023	.137	.044	.596	.273
	(		(153.1)	(11.1)	(65.1)			
	BEND -(	390B	[illegible]	.017	.134	.050	.568	.276

LOADING - SHOCK LOADING NO. 1

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) Y	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	BEND -(	3990	.604	.017	.134	.050	.568	.276
	(		(152.0)	(8.6)	(64.1)			
	>-	395F	.588	.015	.129	.056	.545	.278
	STRAIGHT -(		(145.0)	(7.4)	(61.3)			
	>-	395F.1	.313	.015	.065	.066	.362	.263
	STRAIGHT -(		(74.7)	(7.4)	(31.3)			
	>-	3951	.089	.015	.006	.046	.179	.175
	(		(16.9)	(7.4)	(3.1)			
	BEND -(	3959	.064	.013	.002	.037	.153	.146
	(		(12.5)	(6.5)	(.8)			
	>-	395F	.043	.010	.000	.028	.120	.121
	STRAIGHT -(		(9.3)	(4.8)	(.0)			
ANCHOR	--	400	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
315	745.	669.	1160.	1629.	2174.	1862.	951.	3016.
400	417.	264.	1177.	1277.	6038.	2598.	3334.	7371.
RESTRAINTS:								
330	1035.	0.	0.	1035.	0.	0.	0.	0.
331	0.	1829.	0.	1829.	0.	0.	0.	0.
345G	0.	872.	0.	872.	0.	0.	0.	0.
370	0.	705.	0.	705.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
3RON	0.	434.	0.	434.	0.	0.	0.	0.

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* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 7531. OCCURS AT POINT 345N

EXPLANATORY NOTES:
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(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.

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(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) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 315	1160.	1144.	951.	2174.	1862.	1.00	1.00	20.02	1807.
	STR -(	>- 320	1160.	1144.	951.	436.	373.	1.00	1.00	20.02	666.
	RIGID -(	>- 325	1160.	1140.	951.	1300.	1114.	1.00	1.00	20.02	1174.
	STR -(	>- 330	1160.	1140.	951.	4763.	4080.	1.00	1.00	20.02	3801.
	STR -(	>- 330.1	1160.	998.	951.	369.	2762.	1.00	1.00	20.02	1764.
	STR -(	>- 330.2	1160.	975.	951.	3987.	1548.	1.00	1.00	20.02	2626.
	STR -(	>- 330.3	1160.	975.	951.	8261.	908.	1.00	1.00	20.02	5013.
	STR -(	>- 345N	1160.	326.	951.	12453.	1408.	1.00	1.00	20.02	7531. **
	BEND -(	345M	906.	793.	1272.	12243.	1123.	1.00	1.00	20.02	7407. *
	(	>- 345F	250.	1178.	1530.	11648.	929.	1.00	1.00	20.02	7062. *
	STR -(	>- 345F.1	254.	1116.	1530.	1096.	6708.	1.00	1.00	20.02	4175.
	STR -(	>- 345F.2	257.	1061.	1530.	1581.	2156.	1.00	1.00	20.02	1846.
	STR -(	>- 350N	257.	1061.	1530.	2105.	2580.	1.00	1.00	20.02	2196.
	BEND -(	350M	729.	572.	1156.	2973.	2298.	1.00	1.00	20.02	2356.
	(	>- 350F	680.	291.	2187.	3060.	1539.	1.00	1.00	20.02	2435.
	STR -(	>- 350F.1	800.	289.	2187.	2596.	1553.	1.00	1.00	20.02	2237.
	STR -(	>- 360N	692.	285.	2187.	2168.	1620.	1.00	1.00	20.02	2085.
	BEND -(	360M	467.	504.	1050.	1536.	2794.	1.00	1.00	20.02	2011.
	(	>- 360F	122.	669.	2044.	1312.	2630.	1.00	1.00	20.02	1897.
	STR -(	>- 365	113.	618.	2044.	1541.	1021.	1.00	1.00	20.02	1652.
	STR -(	>- 365.1	97.	580.	2044.	836.	2430.	1.00	1.00	20.02	1968.
	STR -(	>- 365.2	82.	470.	2044.	1592.	3612.	1.00	1.00	20.02	2664.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	>-	365.2	82.	479.	2044.	1592.	3612.	1.00	1.00	20.02	2664.
	STR -(										
	>-	365.3	80.	435.	2044.	3078.	4218.	1.00	1.00	20.02	3360.
	STR -(										
	>-	370	83.	434.	2044.	4747.	4214.	1.00	1.00	20.02	3996.
	STR -(										
	>-	370.1	105.	384.	2044.	3520.	3527.	1.00	1.00	20.02	3151.
	STR -(										
	>-	370.2	127.	481.	2044.	1885.	2408.	1.00	1.00	20.02	2204.
	STR -(										
	>-	370.3	177.	673.	2044.	625.	2196.	1.00	1.00	20.02	1837.
	STR -(										
	>-	380N	193.	733.	2044.	1433.	4102.	1.00	1.00	20.02	2877.
	(										
	BEND -(	380M	352.	671.	4355.	1463.	2023.	1.00	1.00	20.02	3008.
	(										
	>-	380F	379.	677.	4503.	1410.	1780.	1.00	1.00	20.02	3022.
	STR -(										
	>-	385N	379.	677.	4503.	1174.	1594.	1.00	1.00	20.02	2948.
	(										
	BEND -(	385M	712.	354.	2433.	1613.	3890.	1.00	1.00	20.02	2914.
	(										
	>-	385F	668.	432.	1056.	1527.	4363.	1.00	1.00	20.02	2842.
	STR -(										
	>-	385F.1	718.	438.	1056.	1434.	3452.	1.00	1.00	20.02	2328.
	STR -(										
	>-	385F.2	885.	437.	1056.	2703.	2442.	1.00	1.00	20.02	2273.
	STR -(										
	>-	385F.3	899.	436.	1056.	4090.	1414.	1.00	1.00	20.02	2669.
	STR -(										
	>-	390N	997.	444.	1056.	5392.	1197.	1.00	1.00	20.02	3370.
	(										
	BEND -(	390M	995.	665.	1359.	5306.	870.	1.00	1.00	20.02	3323.
	(										
	>-	390F	290.	1119.	1333.	4805.	792.	1.00	1.00	20.02	3026.
	STR -(										
	>-	390F.1	273.	1265.	1333.	1067.	575.	1.00	1.00	20.02	1080.
	STR -(										
	>-	395N	267.	1249.	1333.	6110.	3023.	1.00	1.00	20.02	4163.
	(										
	BEND -(	395M	1016.	781.	1901.	6681.	2965.	1.00	1.00	20.02	4526.
	(										
	>-	395F	1177.	493.	3334.	6809.	1511.	1.00	1.00	20.02	4633.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 395F	1177.	493.	3334.	6809.	1511.	1.00	1.00	20.02	4633.
	STR -(										
ANCHR		-- 400	1177.	493.	3334.	6038.	2598.	1.00	1.00	20.02	4417.

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DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	DISPLACEMENTS (INCHES) Y	DISPLACEMENTS (INCHES) Z	ROTATIONS (DEGREES) ABOUT X AXIS	ROTATIONS (DEGREES) ABOUT Y AXIS	ROTATIONS (DEGREES) ABOUT Z AXIS
ANCHOR		-- 315	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 320	.003	.003	.000	.011	.009	.010
	RIGID -(		(.6)	(.7)	(.0)			
		>- 325	.006	.008	.000	.011	.009	.010
	STRAIGHT -(		(1.6)	(1.7)	(.0)			
		>- 330	.000	.000	.000	.040	.034	.031
	STRAIGHT -(		(.0)	(.0)	(.1)			
		>- 330.1	.066	.068	.000	.088	.099	.054
	STRAIGHT -(		(15.3)	(13.6)	(.2)			
		>- 330.2	.181	.143	.000	.054	.139	.078
	STRAIGHT -(		(41.2)	(26.2)	(.2)			
		>- 330.3	.324	.147	.001	.062	.157	.101
	STRAIGHT -(		(72.1)	(25.6)	(.3)			
68		>- 345N	.474	.000	.001	.259	.156	.125
	(		(104.9)	(.0)	(.4)			
	BEND -(	345M	.490	.032	.014	.312	.154	.128
	(		(106.7)	(5.5)	(2.6)			
		>- 345F	.494	.047	.052	.364	.152	.132
	STRAIGHT -(		(163.5)	(8.2)	(9.3)			
		>- 345F.1	.489	.047	.462	.528	.143	.145
	STRAIGHT -(		(68.1)	(8.2)	(79.4)			
		>- 345F.2	.511	.047	.980	.606	.140	.155
	STRAIGHT -(		(72.2)	(8.2)	(160.5)			
		>- 350N	.545	.047	1.532	.604	.147	.165
	(		(84.2)	(8.2)	(243.2)			
	BEND -(	350M	.552	.074	1.598	.594	.149	.167
	(		(83.6)	(11.9)	(253.2)			
		>- 350F	.559	.139	1.625	.582	.151	.170
	STRAIGHT -(		(79.5)	(22.6)	(257.3)			
		>- 350F.1	.566	.466	1.625	.552	.158	.184

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	350F.1	.586	.466	1.625	.552	.158	.184
	STRAIGHT -(		(51.0)	(85.8)	(257.3)			
	>-	360N	.620	.775	1.625	.525	.163	.203
	(		(34.4)	(152.3)	(257.3)			
	BEND -(	360M	.627	.824	1.624	.516	.165	.208
	(		(36.1)	(163.7)	(255.7)			
	>-	360F	.630	.824	1.620	.509	.167	.215
	STRAIGHT -(		(37.2)	(166.1)	(252.1)			
	>-	365	.630	.722	1.607	.484	.170	.226
	STRAIGHT -(		(37.2)	(153.9)	(238.6)			
	>-	365.1	.630	.517	1.585	.437	.169	.234
	STRAIGHT -(		(37.2)	(126.7)	(223.1)			
	>-	365.2	.630	.313	1.541	.390	.170	.220
	STRAIGHT -(		(37.2)	(90.2)	(218.7)			
	>-	365.3	.630	.133	1.459	.344	.185	.181
	STRAIGHT -(		(37.2)	(45.1)	(218.7)			
	>-	370	.630	.000	1.328	.297	.217	.112
	STRAIGHT -(		(37.2)	(.0)	(214.8)			
	>-	370.1	.630	.070	1.123	.245	.259	.033
	STRAIGHT -(		(37.2)	(39.2)	(198.9)			
	>-	370.2	.630	.074	.875	.193	.288	.020
	STRAIGHT -(		(37.2)	(54.8)	(172.8)			
	>-	370.3	.630	.041	.617	.142	.285	.042
	STRAIGHT -(		(37.2)	(39.6)	(145.0)			
	>-	380N	.630	.000	.408	.094	.241	.036
	(		(37.2)	(.0)	(130.3)			
	BEND -(	380M	.630	.004	.395	.089	.227	.033
	(		(37.1)	(5.3)	(130.5)			
	>-	380F	.629	.005	.396	.085	.216	.031
	STRAIGHT -(		(37.6)	(7.6)	(131.6)			
	>-	385N	.626	.005	.416	.079	.191	.030
	(		(42.4)	(7.6)	(135.9)			
	BEND -(	385M	.622	.008	.423	.079	.180	.030
	(		(45.3)	(7.9)	(138.0)			
	>-	385F	.615	.016	.427	.079	.169	.032
	STRAIGHT -(		(46.3)	(9.2)	(139.0)			
	>-	385F.1	.552	.089	.426	.069	.136	.047
	STRAIGHT -(		(61.4)	(43.2)	(139.0)			
	>-	385F.2	.472	.139	.426	.034	.129	.070
	STRAIGHT -(		(77.0)	(60.3)	(138.9)			
	>-	385F.3	.375	.141	.426	.034	.128	.095
	STRAIGHT -(		(86.0)	(52.9)	(138.9)			
	>-	390N	.291	.068	.426	.123	.115	.120
	(		(92.5)	(23.0)	(138.9)			
	BEND -(	390M	.276	.053	.420	.146	.110	.123

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	DISPLACEMENTS (INCHES) Y	DISPLACEMENTS (INCHES) Z	ROTATIONS (DEGREES) ABOUT X AXIS	ROTATIONS (DEGREES) ABOUT Y AXIS	ROTATIONS (DEGREES) ABOUT Z AXIS
	BEND -(	390D	.276	.053	.420	.146	.110	.123
	(		(91.3)	(18.0)	(136.8)			
	>-	390F	.259	.046	.402	.168	.106	.127
	STRAIGHT -(		(85.7)	(15.7)	(131.2)			
	>-	390F.1	.132	.046	.205	.209	.072	.124
	STRAIGHT -(		(44.7)	(15.7)	(67.3)			
	>-	395A	.026	.046	.020	.144	.039	.083
	(		(11.3)	(15.7)	(6.5)			
	BEND -(	395D	.016	.040	.005	.116	.034	.070
	(		(8.6)	(13.8)	(1.7)			
	>-	395F	.010	.029	.000	.087	.027	.059
	STRAIGHT -(		(6.4)	(10.2)	(.0)			
ANCHOR	--	400	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
315	126.	138.	281.	338.	343.	313.	252.	529.
400	146.	211.	196.	323.	1215.	489.	1107.	1715.
RESTRAINTS:								
330	182.	0.	0.	182.	0.	0.	0.	0.
330	0.	290.	0.	290.	0.	0.	0.	0.
345N	0.	312.	0.	312.	0.	0.	0.	0.
370	0.	262.	0.	262.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
3805	0.	199.	0.	199.	0.	0.	0.	0.

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* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 1139. OCCURS AT POINT 350N

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.

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(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) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 315	281.	187.	252.	303.	313.	1.00	1.00	20.02	317.
	STR -(	>- 320	281.	187.	252.	67.	61.	1.00	1.00	20.02	161.
	RIGID -(	>- 325	281.	181.	252.	208.	189.	1.00	1.00	20.02	226.
	STR -(	>- 330	281.	181.	252.	740.	680.	1.00	1.00	20.02	621.
	STR -(	>- 330.1	281.	155.	252.	84.	446.	1.00	1.00	20.02	311.
	STR -(	>- 330.2	281.	143.	252.	636.	291.	1.00	1.00	20.02	445.
	STR -(	>- 330.3	281.	143.	252.	1223.	257.	1.00	1.00	20.02	764.
	STR -(	>- 345N	281.	146.	252.	1802.	371.	1.00	1.00	20.02	1113. *
	BEND -(	345M	398.	133.	341.	1808.	233.	1.00	1.00	20.02	1111. *
	(	>- 345F	309.	284.	399.	1712.	237.	1.00	1.00	20.02	1063. *
	STR -(	>- 345F.1	315.	246.	399.	206.	1031.	1.00	1.00	20.02	674.
	STR -(	>- 345F.2	319.	196.	399.	322.	1267.	1.00	1.00	20.02	819.
	STR -(	>- 350N	319.	196.	399.	429.	1806.	1.00	1.00	20.02	1138. **
	BEND -(	350M	313.	195.	289.	1800.	434.	1.00	1.00	20.02	1123. *
	(	>- 350F	160.	333.	451.	1659.	367.	1.00	1.00	20.02	1054. *
	STR -(	>- 350F.1	128.	309.	451.	817.	344.	1.00	1.00	20.02	596.
	STR -(	>- 360N	128.	309.	451.	299.	584.	1.00	1.00	20.02	477.
	BEND -(	360M	140.	254.	292.	625.	461.	1.00	1.00	20.02	497.
	(	>- 360F	121.	261.	348.	612.	436.	1.00	1.00	20.02	496.
	STR -(	>- 365	100.	156.	348.	611.	502.	1.00	1.00	20.02	518.
	STR -(	>- 365.1	100.	158.	348.	909.	588.	1.00	1.00	20.02	682.
	STR -(	>- 365.2	83.	129.	348.	840.	834.	1.00	1.00	20.02	739.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 365.2	83.	129.	348.	840.	634.	1.00	1.00	20.02	739.
	STR -(										
		>- 365.3	69.	167.	348.	657.	1009.	1.00	1.00	20.02	751.
	STR -(										
		>- 370	60.	266.	348.	1057.	1026.	1.00	1.00	20.02	907.
	STR -(										
		>- 370.1	65.	189.	348.	960.	857.	1.00	1.00	20.02	799.
	STR -(										
		>- 370.2	77.	142.	348.	1087.	590.	1.00	1.00	20.02	770.
	STR -(										
		>- 370.3	114.	193.	348.	804.	450.	1.00	1.00	20.02	590.
	STR -(										
		>- 380N	127.	148.	348.	316.	696.	1.00	1.00	20.02	503.
	(										
	BEND -(	380M	126.	140.	704.	305.	406.	1.00	1.00	20.02	520.
	(										
		>- 380F	93.	175.	760.	284.	307.	1.00	1.00	20.02	520.
	STR -(										
		>- 385N	93.	175.	760.	302.	291.	1.00	1.00	20.02	520.
	(										
	BEND -(	385M	87.	174.	518.	318.	628.	1.00	1.00	20.02	524.
	(										
		>- 385F	117.	156.	349.	358.	726.	1.00	1.00	20.02	528.
	STR -(										
		>- 385F.1	112.	139.	349.	716.	687.	1.00	1.00	20.02	630.
	STR -(										
		>- 385F.2	126.	109.	349.	849.	670.	1.00	1.00	20.02	681.
	STR -(										
		>- 385F.3	126.	109.	349.	741.	485.	1.00	1.00	20.02	571.
	STR -(										
		>- 390N	147.	168.	349.	871.	281.	1.00	1.00	20.02	587.
	(										
	BEND -(	390M	192.	147.	260.	881.	330.	1.00	1.00	20.02	585.
	(										
		>- 390F	151.	189.	264.	817.	283.	1.00	1.00	20.02	542.
	STR -(										
		>- 390F.1	183.	242.	264.	339.	214.	1.00	1.00	20.02	288.
	STR -(										
		>- 395N	200.	244.	264.	995.	999.	1.00	1.00	20.02	860.
	(										
	BEND -(	395M	228.	219.	650.	1085.	692.	1.00	1.00	20.02	927.
	(										
		>- 395F	196.	257.	1107.	1106.	220.	1.00	1.00	20.02	947.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	>-	395F	196.	257.	1107.	1106.	220.	1.00	1.00	20.02	947.
	STR -(										
ANCHR	--	499	196.	257.	1107.	1215.	489.	1.00	1.00	20.02	1028. *

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 315	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 320	.000	.000	.000	.002	.002	.003
	RIGID -(		(1.4)	(1.9)	(.1)			
		>- 325	.001	.001	.000	.002	.002	.003
	STRAIGHT -(		(3.4)	(4.7)	(.1)			
		>- 330	.000	.000	.000	.006	.006	.008
	STRAIGHT -(		(.0)	(.0)	(.2)			
		>- 330.1	.011	.011	.000	.013	.016	.014
	STRAIGHT -(		(25.5)	(35.2)	(.3)			
		>- 330.2	.030	.022	.000	.008	.022	.021
	STRAIGHT -(		(42.4)	(56.9)	(.4)			
		>- 330.3	.053	.022	.000	.010	.026	.027
	STRAIGHT -(		(35.2)	(43.3)	(.5)			
		>- 3450	.077	.000	.000	.038	.027	.033
	(		(48.6)	(.0)	(.6)			
	BEND -(	345N	.079	.005	.002	.046	.027	.034
	(		(50.9)	(5.7)	(2.9)			
		>- 345F	.077	.007	.008	.053	.027	.035
	STRAIGHT -(		(47.9)	(8.2)	(9.1)			
		>- 345F.1	.056	.007	.067	.076	.028	.038
	STRAIGHT -(		(36.5)	(8.2)	(62.0)			
		>- 345F.2	.056	.007	.140	.084	.031	.037
	STRAIGHT -(		(69.4)	(8.2)	(90.2)			
		>- 3500	.060	.007	.214	.087	.036	.035
	(		(95.7)	(8.2)	(75.6)			
	BEND -(	350N	.059	.010	.223	.088	.037	.034
	(		(94.7)	(6.1)	(71.1)			
		>- 350F	.057	.020	.227	.090	.038	.034
	STRAIGHT -(		(86.6)	(11.2)	(69.0)			
		>- 350F.1	.048	.071	.227	.093	.040	.033

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 355F.1	.048	.071	.227	.093	.040	.033
	STRAIGHT -(		(34.6)	(63.7)	(69.0)			
		>- 360N	.045	.124	.227	.092	.041	.033
	(		(21.6)	(164.2)	(69.0)			
	BEND -(	360M	.047	.133	.226	.091	.041	.033
	(		(26.7)	(184.6)	(68.1)			
		>- 360F	.047	.135	.225	.090	.040	.034
	STRAIGHT -(		(28.6)	(188.3)	(65.9)			
		>- 365	.047	.124	.223	.086	.040	.034
	STRAIGHT -(		(28.6)	(177.0)	(57.7)			
		>- 365.1	.047	.099	.220	.078	.036	.036
	STRAIGHT -(		(28.7)	(163.6)	(50.6)			
		>- 365.2	.047	.069	.217	.071	.029	.039
	STRAIGHT -(		(28.7)	(138.9)	(63.8)			
		>- 365.3	.047	.033	.208	.064	.024	.040
	STRAIGHT -(		(28.7)	(80.6)	(76.1)			
		>- 370	.047	.000	.190	.056	.029	.033
	STRAIGHT -(		(28.7)	(.0)	(73.3)			
		>- 370.1	.047	.026	.157	.049	.040	.019
	STRAIGHT -(		(28.7)	(95.9)	(60.5)			
		>- 370.2	.047	.035	.114	.041	.050	.004
	STRAIGHT -(		(28.6)	(149.1)	(59.4)			
		>- 370.3	.047	.025	.073	.035	.052	.019
	STRAIGHT -(		(28.6)	(112.9)	(63.7)			
		>- 380N	.047	.000	.058	.030	.047	.027
	(		(28.5)	(.0)	(73.5)			
	BEND -(	380M	.047	.003	.060	.030	.045	.028
	(		(23.9)	(14.8)	(71.2)			
		>- 380F	.047	.004	.062	.029	.044	.028
	STRAIGHT -(		(17.5)	(21.1)	(62.6)			
		>- 385N	.049	.004	.068	.028	.040	.028
	(		(43.0)	(21.0)	(45.2)			
	BEND -(	385M	.049	.005	.070	.027	.039	.028
	(		(57.6)	(18.2)	(43.7)			
		>- 385F	.049	.006	.071	.026	.038	.028
	STRAIGHT -(		(64.4)	(13.4)	(44.1)			
		>- 385F.1	.059	.025	.071	.016	.031	.027
	STRAIGHT -(		(62.4)	(85.6)	(44.1)			
		>- 385F.2	.072	.034	.071	.005	.026	.029
	STRAIGHT -(		(83.1)	(110.0)	(44.1)			
		>- 385F.3	.081	.029	.071	.013	.022	.034
	STRAIGHT -(		(61.2)	(75.7)	(44.1)			
		>- 390N	.088	.012	.071	.024	.018	.040
	(		(84.7)	(45.5)	(44.0)			
	BEND -(	390M	.087	.009	.070	.027	.017	.041

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	BEND -(	390M	.087	.009	.070	.027	.017	.041
	(		(46.4)	(47.4)	(43.3)			
		>- 390F	.082	.008	.066	.029	.017	.042
	STRAIGHT -(		(45.5)	(48.7)	(41.6)			
		>- 390F.1	.041	.008	.034	.034	.010	.040
	STRAIGHT -(		(43.9)	(46.5)	(39.5)			
		>- 395N	.006	.008	.003	.024	.005	.027
	(		(12.6)	(46.1)	(10.1)			
	BEND -(	395M	.003	.007	.001	.020	.005	.023
	(		(10.5)	(45.2)	(3.3)			
		>- 395F	.002	.005	.000	.015	.004	.019
	STRAIGHT -(		(8.1)	(37.0)	(.0)			
ANCHOR		-- 400	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
315	2330.	956.	1262.	2817.	2392.	5832.	3481.	7201.
400	901.	345.	1243.	1574.	6493.	10402.	7713.	14487.
RESTRAINTS:								
330	3116.	0.	0.	3116.	0.	0.	0.	0.
330	0.	2012.	0.	2012.	0.	0.	0.	0.
3450	0.	1110.	0.	1110.	0.	0.	0.	0.
370	0.	885.	0.	885.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
5800	0.	503.	0.	503.	0.	0.	0.	0.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS

THE MAXIMUM STRESS OF 8681. OCCURS AT POINT 400

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.

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(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.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM. TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 315	1262.	2519.	3481.	2392.	5832.	1.00	1.00	20.02	4315.
	STR -(	>- 320	1262.	2519.	3481.	479.	1172.	1.00	1.00	20.02	2220.
	RIGID -(	>- 325	1262.	2513.	3481.	1431.	3486.	1.00	1.00	20.02	3075.
	STR -(	>- 330	1262.	1327.	3481.	5239.	12790.	1.00	1.00	20.02	8541. *
	STR -(	>- 330.1	1262.	1310.	3481.	414.	9213.	1.00	1.00	20.02	5907.
	STR -(	>- 330.2	1262.	1274.	3481.	4387.	5749.	1.00	1.00	20.02	4810.
	STR -(	>- 330.3	1262.	1231.	3481.	9062.	2687.	1.00	1.00	20.02	6047.
	STR -(	>- 345N	1262.	826.	3481.	13693.	1920.	1.00	1.00	20.02	8544. *
	BEND -(	345M	1035.	1095.	3157.	13435.	2252.	1.00	1.00	20.02	8380. *
	(	>- 345F	494.	1411.	2206.	3040.	12786.	1.00	1.00	20.02	7986. *
	STR -(	>- 345F.1	498.	1339.	2206.	1234.	7559.	1.00	1.00	20.02	4776.
	STR -(	>- 345F.2	501.	1204.	2206.	2774.	3165.	1.00	1.00	20.02	2848.
	STR -(	>- 350N	501.	1204.	2206.	4978.	3456.	1.00	1.00	20.02	3865.
	BEND -(	350M	836.	850.	3047.	3750.	4686.	1.00	1.00	20.02	4033.
	(	>- 350F	954.	716.	5338.	3719.	2321.	1.00	1.00	20.02	4139.
	STR -(	>- 350F.1	870.	697.	5338.	2853.	3007.	1.00	1.00	20.02	4050.
	STR -(	>- 360N	758.	654.	5338.	2398.	3927.	1.00	1.00	20.02	4223.
	BEND -(	360M	550.	748.	4098.	4090.	4058.	1.00	1.00	20.02	4237.
	(	>- 360F	414.	814.	2349.	4142.	5085.	1.00	1.00	20.02	4175.
	STR -(	>- 365	381.	753.	2349.	4360.	4338.	1.00	1.00	20.02	3945.
	STR -(	>- 365.1	319.	662.	2349.	3170.	5445.	1.00	1.00	20.02	4029.
	STR -(	>- 365.2	245.	583.	2349.	2614.	6550.	1.00	1.00	20.02	4454.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	>-	365.2	245.	583.	2349.	2614.	6550.	1.00	1.00	20.02	4454.
	STR -(>-	365.3	195.	555.	2349.	3378.	7235.	1.00	1.00	20.02	4988.
	STR -(>-	370	182.	564.	2349.	5107.	7388.	1.00	1.00	20.02	5563.
	STR -(>-	370.1	217.	479.	2349.	3660.	6999.	1.00	1.00	20.02	4938.
	STR -(>-	370.2	286.	558.	2349.	2598.	6359.	1.00	1.00	20.02	4350.
	STR -(>-	370.3	370.	659.	2349.	2270.	6144.	1.00	1.00	20.02	4170.
	STR -(>-	380N	461.	754.	2349.	3154.	7033.	1.00	1.00	20.02	4829.
	BEND -(	380M	513.	780.	5660.	3098.	5004.	1.00	1.00	20.02	4893.
	(>-	380F	403.	848.	7286.	2881.	2073.	1.00	1.00	20.02	4857.
	STR -(>-	385N	404.	878.	7286.	2235.	1852.	1.00	1.00	20.02	4700.
	BEND -(	385M	740.	663.	3864.	1859.	6359.	1.00	1.00	20.02	4596.
	(>-	385F	707.	698.	1920.	1783.	6904.	1.00	1.00	20.02	4425.
	STR -(>-	385F.1	755.	737.	1920.	1844.	4491.	1.00	1.00	20.02	3128.
	STR -(>-	385F.2	642.	774.	1920.	3045.	2728.	1.00	1.00	20.02	2706.
	STR -(>-	385F.3	1045.	854.	1920.	4363.	3772.	1.00	1.00	20.02	3643.
	STR -(>-	390N	1045.	854.	1920.	5669.	6713.	1.00	1.00	20.02	5390.
	BEND -(	390M	995.	1014.	5980.	5577.	4190.	1.00	1.00	20.02	5506.
	(>-	390F	333.	1460.	7253.	1335.	5052.	1.00	1.00	20.02	5357.
	STR -(>-	390F.1	336.	1529.	7253.	2818.	666.	1.00	1.00	20.02	4680.
	STR -(>-	395N	336.	1529.	7253.	7041.	6468.	1.00	1.00	20.02	7191.
	BEND -(	395M	1070.	1152.	2755.	7072.	10190.	1.00	1.00	20.02	7614.
	(>-	395F	1243.	965.	7713.	7215.	7812.	1.00	1.00	20.02	7873. *

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	>-	395F	1243.	365.	7713.	7215.	7812.	1.00	1.00	20.02	7873. *
	STR -(										
ANCHR	--	400	1243.	365.	7713.	6495.	10402.	1.00	1.00	20.02	8681. **

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 315	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 320	.008	.003	.000	.012	.029	.038
	RIGID -(		(2.2)	(2.3)	(.1)			
		>- 325	.020	.008	.000	.012	.029	.038
	STRAIGHT -(		(5.4)	(5.6)	(.1)			
		>- 330	.000	.000	.000	.044	.106	.113
	STRAIGHT -(		(.0)	(.0)	(.2)			
		>- 330.1	.207	.075	.000	.097	.315	.199
	STRAIGHT -(		(45.2)	(42.1)	(.4)			
		>- 330.2	.582	.158	.000	.059	.456	.285
	STRAIGHT -(		(98.5)	(71.1)	(.5)			
		>- 330.3	1.059	.161	.001	.069	.533	.371
	STRAIGHT -(		(147.1)	(54.7)	(.7)			
		>- 345N	1.560	.000	.001	.285	.548	.457
	(		(207.0)	(.0)	(.8)			
	BEND. -(	345M	1.659	.035	.016	.343	.546	.468
	(		(211.1)	(8.6)	(4.2)			
		>- 345F	1.727	.051	.057	.400	.543	.481
	STRAIGHT -(		(205.2)	(12.5)	(13.9)			
		>- 345F.1	2.116	.051	.508	.581	.517	.512
	STRAIGHT -(		(141.9)	(12.5)	(106.3)			
		>- 345F.2	2.530	.051	1.080	.671	.493	.499
	STRAIGHT -(		(145.7)	(12.5)	(192.6)			
		>- 350N	2.917	.051	1.693	.678	.473	.447
	(		(169.3)	(12.4)	(268.4)			
	BEND -(	350M	2.980	.082	1.768	.669	.470	.431
	(		(169.1)	(14.4)	(277.6)			
		>- 350F	3.046	.156	1.798	.659	.465	.417
	STRAIGHT -(		(162.6)	(26.6)	(281.3)			
		>- 350F.1	3.291	.527	1.798	.632	.448	.362

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 350F.1	3.291	.527	1.798	.632	.448	.362
	STRAIGHT -(		(124.6)	(123.4)	(281.3)			
		>- 360N	3.521	.883	1.799	.605	.420	.317
	(		(116.3)	(233.3)	(281.3)			
	BEND -(	360M	3.563	.937	1.802	.595	.406	.310
	(		(119.3)	(252.6)	(279.3)			
		>- 360F	3.580	.933	1.810	.588	.393	.302
	STRAIGHT -(		(120.7)	(256.9)	(274.5)			
		>- 365	3.580	.805	1.854	.559	.361	.286
	STRAIGHT -(		(120.7)	(239.5)	(257.7)			
		>- 365.1	3.580	.568	1.942	.505	.294	.266
	STRAIGHT -(		(120.7)	(210.7)	(242.7)			
		>- 365.2	3.580	.343	1.995	.452	.229	.241
	STRAIGHT -(		(120.7)	(168.2)	(246.4)			
		>- 365.3	3.580	.146	1.977	.398	.199	.197
	STRAIGHT -(		(120.7)	(93.6)	(252.9)			
		>- 370	3.580	.000	1.869	.345	.234	.126
	STRAIGHT -(		(120.7)	(.0)	(247.0)			
		>- 370.1	3.580	.084	1.633	.285	.323	.048
	STRAIGHT -(		(120.7)	(104.6)	(222.9)			
		>- 370.2	3.580	.099	1.284	.226	.419	.024
	STRAIGHT -(		(120.7)	(160.0)	(191.4)			
87		>- 370.3	3.580	.068	.850	.168	.502	.053
	STRAIGHT -(		(120.7)	(120.4)	(163.1)			
		>- 380N	3.580	.000	.439	.114	.570	.085
	(		(120.6)	(.0)	(157.8)			
	BEND -(	380M	3.576	.010	.418	.108	.584	.094
	(		(119.6)	(15.9)	(157.9)			
		>- 380F	3.567	.014	.416	.101	.597	.103
	STRAIGHT -(		(118.6)	(22.7)	(156.3)			
		>- 385N	3.537	.014	.441	.095	.626	.114
	(		(126.8)	(22.7)	(156.1)			
	BEND -(	385M	3.497	.017	.450	.092	.640	.122
	(		(132.7)	(20.3)	(158.4)			
		>- 385F	3.422	.025	.453	.091	.658	.129
	STRAIGHT -(		(133.9)	(17.2)	(159.7)			
		>- 385F.1	2.772	.102	.453	.075	.720	.168
	STRAIGHT -(		(141.1)	(98.3)	(159.7)			
		>- 385F.2	2.077	.155	.453	.036	.739	.210
	STRAIGHT -(		(157.4)	(129.1)	(159.7)			
		>- 385F.3	1.390	.153	.453	.041	.704	.255
	STRAIGHT -(		(169.2)	(76.2)	(159.6)			
		>- 390N	.760	.072	.453	.133	.607	.301
	(		(197.9)	(52.1)	(159.6)			
	BEND -(	390M	.766	.056	.446	.157	.579	.305

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	BEND -(	390M	.706	.056	.446	.157	.579	.305
	(		(198.1)	(51.5)	(157.2)			
	>-	390F	.644	.049	.427	.179	.555	.309
	STRAIGHT -(		(189.4)	(51.7)	(150.6)			
	>-	390F.1	.342	.049	.218	.222	.369	.293
	STRAIGHT -(		(97.5)	(51.5)	(84.1)			
	>-	395B	.093	.049	.021	.153	.183	.196
	(		(23.9)	(51.2)	(12.4)			
	BEND -(	395M	.066	.043	.005	.123	.156	.164
	(		(18.5)	(47.7)	(3.8)			
	>-	395F	.044	.031	.000	.092	.123	.136
	STRAIGHT -(		(13.9)	(38.7)	(.1)			
ANCHOR	--	400	.000	.000	.000	.000	.000	.000

```
PROJECT      100KW SOLAR PILOT PLANT - C-21700
JOB          HS VALVE TO THER STOR (X-HS-3-A-1)
DATE         2/26/80

                         * * * * * * * * * *
                         *                 *
                         * 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.

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
315	3906	1807	317	4315
320	2112	666	161	2220
325	2833	1174	226	3075
330	7624	3801	621	8541
330.1	5629	1764	311	5907
330.2	4005	2626	445	4810
330.3	3294	5013	764	6047
345N	3879	7531	1113	8544
345M	3759	7407	1111	8380
345F	3574	7062	1053	7986
345F.1	2220	4175	674	4776
345F.2	2007	1846	819	2848
350N	2970	2196	1136	3865
350M	3075	2356	1123	4033
350F	3177	2435	1054	4139
350F.1	3324	2237	596	4050
360N	3642	2005	477	4223
360M	3696	2011	497	4237
360F	3666	1897	496	4175
365	3545	1652	512	3945
365.1	3449	1968	662	4029

STRESSES ARE IN PSI

LOC. NO.	EJ (12) SHOCK 1	EJ (12) SHOCK 2	EJ (12) SHOCK 3	EJ (12) SHOCK 4
365.2	3493	2664	739	4454
365.3	3608	3360	751	4988
370	3762	3996	907	5563
370.1	3717	3151	799	4938
370.2	3671	2200	770	4350
370.3	3697	1837	590	4170
380N	3845	2877	503	4829
380M	3524	3068	520	4893
380F	3766	3022	520	4857
385N	3623	2943	520	4700
385M	3515	2914	524	4596
385F	3351	2842	528	4425
385F.1	1993	2328	630	3128
385F.2	1302	2273	681	2706
385F.3	2812	2669	571	3643
390N	4165	3370	587	5390
390M	4351	3323	585	5596
390F	4387	3026	542	5357
390F.1	4540	1080	286	4686
395N	5800	4163	866	7191
395M	6052	4526	927	7614

STRESSES ARE IN PSI

LOC. ID.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
395F	6294	4633	947	7873
400	7493	4417	1028	8681

DYNAFLEX

TABLE OF CONTENTS

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LINE MS-4 MAIN STEAM - INTERNAL ANCHOR TO CONDENSER

Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

10MWe SOLAR PILOT PLANT

C-21700

MAIN STEAM - INTERNAL ANCHOR TO CONDENSER

PIPING SYSTEM

10"-MS-7-FEA

95

CONDITIONS ANALYZED/ANAL. I.D. NO.

THERMAL	T-21700-MS-4-A-5
DEAD WEIGHT	W-21700-MS-4-A-3
PRESSURE	P-21700-MS-4-A-0
SEISMIC	X-21700-MS-4-A-1

CODE REFERENCE: ANSI B31.1-1973
W/ ADDENDA C.
(SUMMER 1979)

ANALYST G.H. MAY DATE 7-24-80

TRANSMITTAL

T/W/X-MS-4-A-513/1

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS
Des. Sect. ____
Sect. Supv. ____
Div. ____

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

STANDARD NUMBER EE16.01.2

PAGE 1 OF 1

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

PIPING ANALYSIS RESULTS

Date FEB. 28, 1980

TO: T.E. OLSON

FROM: G.H. MAY, Piping Engineering Group

Client DOE Project SOLAR I Job No. C-21700

Pipe Line Analyzed MAIN STEAM CONDENSER DUMP / 10"-MS-7-FEA

Reference Dwg. P13-2 △A

This piping has been analyzed for the THERMAL, DEAD WEIGHT, PRESSURE & OPERATIONAL BASIS EARTHQUAKE loading condition and is found to be:

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

COMMENT (1) ALL PIPE STRESSES ARE SATISFACTORY.
(2) ALL FORCES AND MOMENTS ARE REASONABLE AND SHOULD BE ACCEPTED.
(3) ROUTING IN THE EPGS AREA IS "BEST ESTIMATE."

RECOMMENDATION (1) USE THE REFERENCED ROUTING.
(2) SUBMIT THE CONDENSER FORCES AND MOMENTS TO SCE FOR APPROVAL.

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					
MM	P	PP	SH	FI	SP

APPROVALS
Des. Sect. [illegible signature]
Sect. Supv. [illegible signature]
Div. ______

Stearns-Roger
INCORPORATED
ENGINEERING STANDARD

PIPE STRESS SUMMARY REPORT

ANSI B31.1 - 1973 EDITION

STANDARD NUMBER EE16.01.8

PAGE 1 OF 1

ISSUED 5/27/75
REVISED

10MWE SOLAR PILOT PLANT - DOE
Job Name

C-21700
Job No.

MAIN STEAM CONDENSER DUMP/10"-MS-7-FEA
System/Pipe Line Name

MS-4
Analysis No.

1. Loading Conditions Analyzed — Analysis Ident. Code

		Analysis Ident. Code
Pressure	X	P-MS-4-A-0
Weight	X	W-MS-4-A-3
Thermal Expansion	X	T-MS-4-A-5
Sustained Mech. Loads		
Occasional Loads	X	X-MS-4-A-1

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} \leq 1.0\ S_h$ — 1756 psi ≤ 13500 psi

PRESS = 100 PSIG ⇒ S_{LP} = 662 PSI

Material: - ASTM A335 P11 — Temp = 885°F @ PT. 455N

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{0.75\ iM_B}{Z} \leq KS_h$ — 9396 psi ≤ 16200 psi

Material: - ASTM A335 P11 — Temp = 885°F @ PT. 455N

Eq. (13) $S_E = \frac{iM_C}{Z} \leq S_A$ — 14355 psi ≤ 19910 psi

Material: - ASTM A335 P11 — Temp = 885°F @ PT. 460F

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{iM_C}{Z} \leq (S_h + S_A)$ — 15174 psi ≤ 33410 psi

Material: - ASTM A335 P11 — Temp = 885°F @ PT. 460F

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) EQ.12 INCLUDES STRESSES DUE TO AN OPERATIONAL BASIS EARTHQUAKE BASED ON GROUND RESPONSE SPECTRUM.

[signature] Prepared By — 2-28-80 Date

[signature] Approved By — 2-28-80 Date

CUSTOMER: DOE
PROJECT: 10MWE SOLAR PILOT PLANT
JOB NO: C-21700
BY: GHM DATE: FEB. 28, 1980
REF. DWGS: P13-2 A
ANALYSIS CODE: T/W/X-MS-4-A-5/3/1

SUMMARY OF FORCES & MOMENTS ON SYSTEM TERMINAL EQUIPMENT

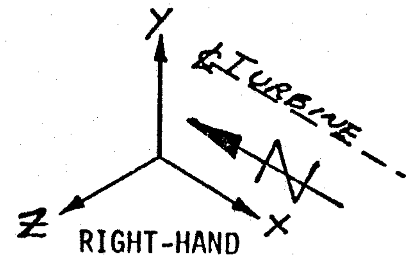
(SYSTEM)

MAIN STEAM CONDENSER DUMP LINE
10"-MS-7-FEA

DIVISION USAGE: MM P PP SH FI SP — X

APPROVALS: Des. Sect. / Sect. Supv. / Div.

THE REPORTED REACTIONS BASED ON A THERMAL EXPANSION ANALYSIS FROM ..70..°F TO 885/358°F USING E_c, THE COLD MOD. OF ELASTICITY, AND ....0..% COLD SPRING.



RIGHT-HAND CARTESIAN COORDINATE SYSTEM

EQUIPMENT CONNECTIONS		LOC. NO.	FORCES (LBS) X	FORCES (LBS) Y	FORCES (LBS) Z	FORCES (LBS) RESULTANT	MOMENTS (FT.-LBS) X	MOMENTS (FT.-LBS) Y	MOMENTS (FT.-LBS) Z	MOMENTS (FT.-LBS) RESULTANT
CONDENSER	THERMAL	525	769	-733	408	1138	4180	3230	1130	5402
CONN. INTERFACE	WEIGHT	525	2	487	-3	487	-243	68	-508	567
12	SEISMIC	525	1641	246	440	1717	1541	5735	5710	7832

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

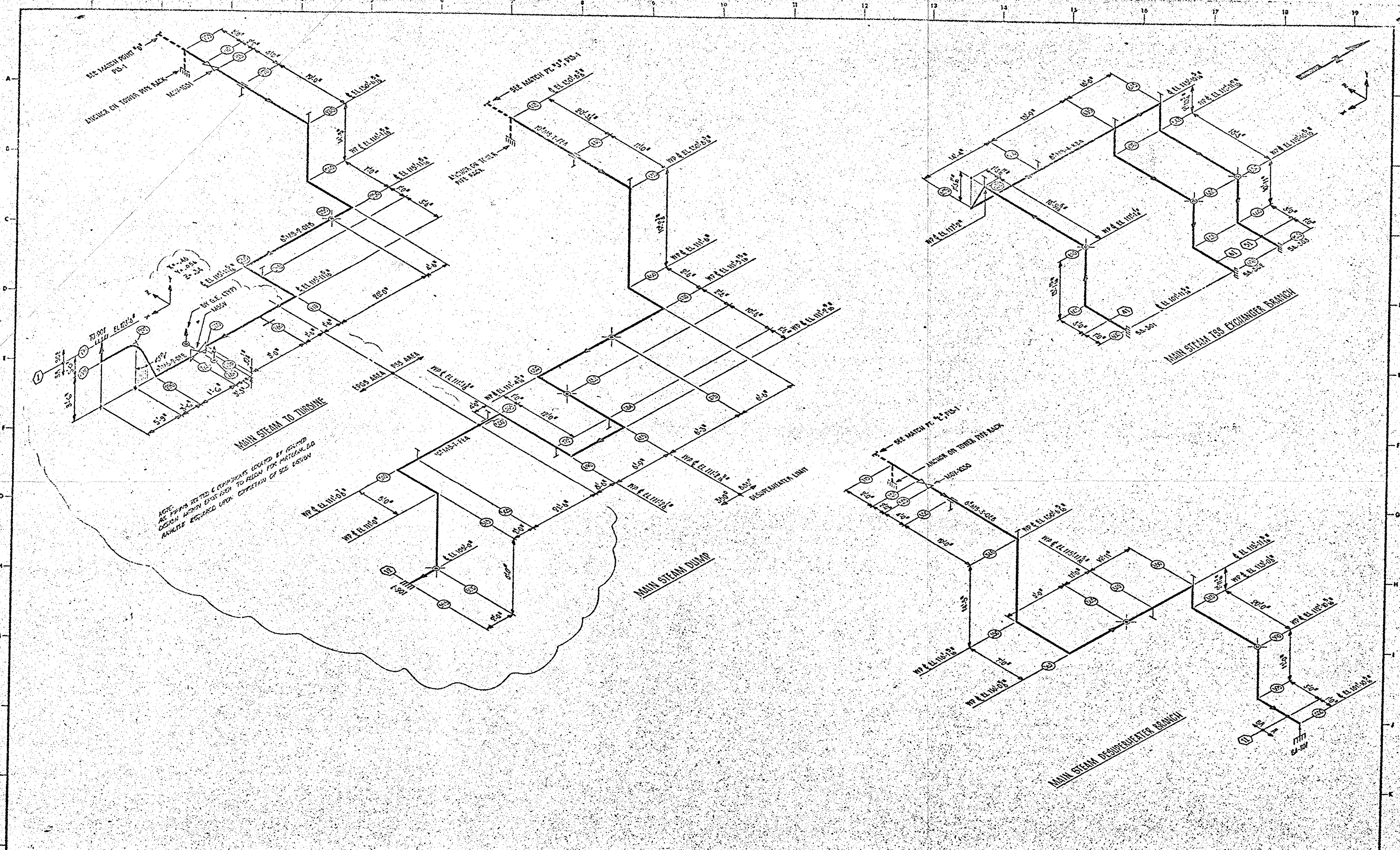
SUMMARY OF FORCES & MOMENTS PER. ANSI B31.1-1973 PWR. PIPING CODE

STANDARD NUMBER EE 16.01.7

PAGE 1 OF 1

ISSUED 2/28/74
REVISED 4/18/78

ISOMETRIC



NOTE:

Piping configuration shown on this drawing is for Thermal, Weight and Seismic Analysis ONLY. See P9 series drawings for piping erection.

NO	REVISIONS	DATE	BY	DOC NO	REFERENCE DRAWINGS
B	UPDATED PER LATEST ANALYSIS DOCUMENTS	7/29/80	M.S	P9-3	RS TOWER PIPING-PLANS
				P9-7	YARD PIPING NORTH HALF 110'-0" LEVEL-PLAN
				P9-5	YARD PIPING SOUTH HALF 110'-0" LEVEL-PLAN
				P9-9	YARD PIPING NORTH HALF 115'-0" LEVEL-PLAN
				P9-10	YARD PIPING SOUTH HALF 115'-0" LEVEL-PLAN
				SK7361-M2EA	TURBINE PIPING LAYOUT (PRELIM)

PRINT RECORD

DRAWN	T.D.M.	12-1-79
CHECKED		
MECH CK		5-29-80
ELECT CK	CEB	5/14/80
STRUCT CK	Dro	11/21/80
APPROVED	Tco	5-2-80

C-21700

XL-22934

P13-2

REV. B

SOLAR FACILITIES DESIGN INTEGRATOR

McDONNELL DOUGLAS | Rockwell International Rocketdyne Division

STEARNS ROGER

ROCKETDYNE

MDAC

SFDI

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE

SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

TITLE

101 ANALYSIS ISOMETRIC
MAIN STEAM - PSS, TSS & EPGS

SCALE NONE

DATE 5-7-80

ANALYSIS ISOMETRIC (P13-2)

DRAWING NO. 40P2005131921

SHEET NO. 1 of 1

REV. B

2

BRANCH CONNECTION SYMBOLS
UNREINFORCED PIPE—PIPE INTERSECTION
REINFORCED PIPE—PIPE INTERSECTION
A S A TEE
WELDOLET
SWEEPOLET

PIPE SUPPORT SYMBOLS
CONSTANT SUPPORT
VARIABLE SPRING SUPPORT
RIGID ROD OR STRUT
HYDRAULIC SNUBBER
RIGID GUIDE
ANCHOR

MODELING SYMBOLS
POINT OF INTEREST
DATA POINT NO.
MASS POINT OR CENTER OF GRAVITY
INTERFACE POINT

PIPING SYMBOLS
ELBOW
BEND
VALVES (ASSUMED RIGID)
REDUCER OR INCREASER
EQUIPMENT NOZZLE

ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN. X	Y	Z	ANCHOR &/OR TERM. POINTS	COORDINATE X	Y	Z
205	0.0	0.0	0.0	205} MS-2	0'-0"	0'-0"	0'-0"
300	-.46	.056	.35	300	48'-0½"	-6'-10 5/16"	-38'-6"
315	0.0	0.0	0.0	315} MS-3	0'-0"	0'-0"	0'-0"
400				400	39'-11"	-38'-4 3/16"	-58'-0"
415				415} MS-4	0'-0"	0'-0"	0'-0"
525				525	33'-6"	-25'-2⅜"	-33'-0⅛"
600				600}	0'-0"	0'-0"	0'-0"
665				665} MS-5	46'-1"	0'-0½"	-0'-2"
690				690	-28'-1"	0'-0½"	-0'-2"

ANALYZED CONDITIONS			VALVES & SPECIAL COMPONENTS			
OPERATING TEMP (°F)	DESIGN PRESSURE (P S I G)	CASE	VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS
960	1565	MS-2	MSSV	3000	EST	GE Prelim. Turbine Info.
960	1565	MS-3	MOV-1031	1315	EST	Powell 125023 WE
885	100	MS-4/PT 415-485	MOV-1030	1315	EST	" " "
350	100	MS-4/PT 485-525				
650	1385	MS-5				

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 FROM	TO	PIPE MATERIAL	LINE SPEC.	PIPE SIZE (IN.) O. D.	W. T.	WEIGHT LBS./LINEAR FT. PIPE	FLUID	INSULATION	INS. THK.
205 / 315	300 / 400	A335 P22	QEB	6.625	.864	54.3	3.1	15.2	5
415	484	↓ P11	FEH	10.75	.365	41.3	34.1	20.6	5
600	645 / 690	A106 Gr. B	KEA	8.625	.500	43.4	19.8	11.1	3½
484	525	A335 P11	FEA	10.75	.365	41.3	34.1	8.7	3½

NO.	REFERENCES	NO.	ANALYSIS CODES	NO.	REVISIONS	DATE	BY	CH'D	APP'D
			T/W/X-MS-2-A-4/5/3						
			T/W/X-MS-3-A-3/3/1						
			T/W/X-MS-4-A-3/3/1						
			T/W/X-MS-5-A-3/3/1						

PIPING ANALYSIS DATA

Stearns-Roger INCORPORATED (PI3-2)

10 MWE SOLAR PILOT PLANT - DAGGET, CALIF.

MAIN STEAM - PSS TSS & EPGS

FOR ISOMETRIC PI3-2

DRAWN: KCM	DATE: 2-13-80	ANAL. BY GHM	DATE: 2-28-80
CHECKED: [illegible]	DATE: 3-3-80	APP'D. BY [illegible]	DATE: 3-19-80
JOB NO. C-21700	SYSTEM NO. MS-2,3,4,5		SHEET 1 OF 1

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THERMAL

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS VALVE TO TURBINE DUMP(T/W-MS-4-A-5/3)

DATE 2/25/80

INPUT DATA - (CARD IMAGES)

LINE NUMBER	:1 TYP	:4 LOC NO.	:7 FRO	:10 TO	:13 DELTA X	:25 DELTA Y	:37 DELTA Z	:49 RADIUS	:60 ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP., 2/25/80,PROJ.10MW SOLAR PILOT PLANT - C-21700,JOBMS VALVE TO TURBINE DUMP(T/W-MS-4-A-5/3)	1
2	GEN								APPLY B31.1-1973,EXA	2
3			415	440			-20-3-1/8		MAT=LCM,OD=10.75, WT=.365,UNIF=20.62, TEMP=885.	3
4				455			-11-0	L		4
5				460		-19-2-3/8		L		5
6				470			-2-6	L		6
7				475	6-6					7
8				[illegible]	6-3			L		8
9				482			-2-6			9
10				[illegible]			-10-6			10
11				[illegible]			-1-6	L		11
12				[illegible]	6-[illegible]			L	TEMP=350.,UNIF=8.67	12
13				[illegible]			1-6			13
14				[illegible]			12-0	L		14
15				[illegible]	4-0					15
16				[illegible]	26-[illegible]					16
17				[illegible]	2-0			L		17
18				515			-5-0	L		18
19				520		-6-0		L		19
20				525	2-[illegible]					20
21	ANC	415								21
22	ANC	525								22
23	RAD	440			RIGID					23
24	RAD	440				RIGID				24
25	RAD	455	Y			RIGID				25
26	RAD	[illegible]				RIGID				26
27	RAD	482				RIGID				27
28	RAD	500				RIGID				28
29	RAD	500					RIGID			29
30	RAD	505				RIGID				30
31	PGR								LOC(475,482,520N)	31

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DYNAFLEX

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
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.

STEARNS - ROGER CORP

10MW SOLAR PILOT PLANT - C-21700

MS VALVE TO TURBINE DUMP(T7[illegible]-MS-4-A-5/3)

2/25/80

DYNAFLEX (M00204F-UCC)

LAST UPDATE - 12/25/79

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INPUT DATA - (CARD IMAGES)

LINE NUMBER	:1 TYP	:4 LOC NO.	:7 FRE	:10 TO	:13 DELTA X	:25 DELTA Y	:37 DELTA Z	:49 RADIUS	:60 ADDITIONAL DATA	LINE NUMBER
									,USE TABLE 1	
32	CCC	525			53-6	-25-2-378	-39-9-178			32

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS VALVE TO TURBINE DUMP(T/W-MS-4-A-5/3)

DATE 2/25/80

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,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.

(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) 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 415, WHICH IS THE ORIGIN

                       HANGER DESIGN DATA:
                          THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION = .10 INCHES.
                          VARIABLE SPRING HANGERS SELECTED FROM TABLE Ø1Ø

                 MATERIALS USED  (TEMPERATURE DEPENDENT PROPERTIES ARE SHOWN AT POINT OF TEMPERATURE CHANGE)
                 --------------
                          LCM - LOW CHROME MOLY STEEL
                                YOUNGS MODULUS AT AMBIENT TEMPERATURE = 29,900,000. PSI
                                POISSONS RATIO = .30
                                DENSITY = 500. POUNDS PER CUBIC FOOT

                 LOADING CONDITIONS ANALYZED
                 ---------------------------
                           ØFREEØ THERMAL
                           ØRESTRAINEDØ WEIGHT
                                                                                                                     DIST. LOADS
                                                                                                                     (LBS PER FT)
                  POINT       COORDINATES (FT)                                   OUTSIDE  WALL          TEMP         -----------
POINT   ELEMENT   LOC.    ----------------------  RADIUS  LENGTH    ANGLE   DIAMETER THICK        (DEG) PRESS PIPE
TYPE  DESIGNATION NO.        X       Y       Z      (FT)    (FT)     (DEG)     (IN)    (IN)  MATL (FAHR) (PSI)  WT.   UNIF
----- ----------- ------ ------- ------- ------- ------  ------    -----  -------- ----- ---- ------ ----- ----  ----
                                                                         :        :      :    :      :     :     :     :
ANCHR             --415    0.00    0.00    0.00                          :        :      :    :      :     :     :     :
                 (                                                       :        :      :    :      :     :     :     :
     STRAIGHT  -(                                          20.26         :10.750:   .365: LCM: 885.:       : 41.3: 20.6:
                 (                                                       :        :      :    :      :     :     :     :
109              ( * THERMAL EXPANSION OF LCM BETWEEN AMBIENT AND 885.   :        :      :    :      :     :     :     :
                 (   DEGREES FAHRENHEIT IS 7.64 INCHES PER 100 FEET      :        :      :    :      :     :     :     :
                 (                                                       :        :      :    :      :     :     :     :
                 ( * A UNIFORM DISTRIBUTED LOAD OF 20.62 PLF IS ACTING   :        :      :    :      :     :     :     :
                 (   IN THE -Y DIRECTION.                                :        :      :    :      :     :     :     :
                 (                                                       :        :      :    :      :     :     :     :
                  >-440    0.00    0.00  -20.26                          :        :      :    :      :     :     :     :

                  * NOTES PERTAINING TO POINT 440  APPEAR ON THE FOLLOWING PAGE
```

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	085.		41.3	20.6
		>-440	0.00	0.00	-20.26										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 440 IN DIRECTION X													
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 440 IN DIRECTION Y													
	STRAIGHT						9.75								
		>-455N	0.00	0.00	-30.01										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 455N IN DIRECTION Y													
	BEND	455M	0.00	-.37	-30.89	1.25	1.96	90.000							
		>-455F	0.00	-1.25	-31.26										
	STRAIGHT						16.70								
		>-460N	0.00	-17.95	-31.26										
	BEND	460M	0.00	-18.83	-31.63	1.25	1.96	90.000							
		>-460F	0.00	-19.20	-32.51										
		* POINT 460F IS EQUIVALENT TO POINT 470N													
	BEND	470M	.37	-19.20	-33.39	1.25	1.96	90.000							
		>-470F	1.25	-19.20	-33.76										
	STRAIGHT						5.25								
		>-475	6.50	-19.20	-33.76										

* DATA PERTAINING TO POINT 475 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	885.		41.3	20.6
		>-475	6.50	-19.20	-33.76										
	* TENTATIVE HANGER AT POINT 475 - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.														
	STRAIGHT						5.00								
		>-480N	11.50	-19.20	-33.76										
	BEND	480M	12.36	-19.20	-34.13	1.25	1.96	90.000							
		>-480F	12.75	-19.20	-35.01										
	STRAIGHT						1.25								
		>-482	12.75	-19.20	-36.26										
	* TENTATIVE HANGER AT POINT 482 - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.														
	STRAIGHT						10.50								
		>-484	12.75	-19.20	-46.76										
	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 484 IN DIRECTION Y														
	STRAIGHT						.25								
		>-485N	12.75	-19.20	-47.01										
	BEND	485M	13.12	-19.20	-47.89	1.25	1.96	90.000							
		>-485F	14.00	-19.20	-48.26										
	STRAIGHT						4.25					350.			8.7
	* THERMAL EXPANSION OF LCM BETWEEN AMBIENT AND 350. DEGREES FAHRENHEIT IS 2.26 INCHES PER 100 FEET														
	* A UNIFORMLY DISTRIBUTED LOAD OF 8.67 PLF IS ACTING IN THE -Y DIRECTION.														
		>-490	18.25	-19.20	-48.26										

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	350.		41.3	8.7
		>-496B	18.25	-19.20	-48.26										
	BEND -(	496M	19.13	-19.20	-47.89	1.25	1.96	90.000							
		>-496E	19.50	-19.20	-47.01										
	STRAIGHT -(						.25								
		>-492	19.50	-19.20	-46.76										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 492 IN DIRECTION Y														
	STRAIGHT -(						10.75								
		>-495B	19.50	-19.20	-36.01										
	BEND -(	495M	19.87	-19.20	-35.13	1.25	1.96	90.000							
		>-495E	20.75	-19.20	-34.76										
	STRAIGHT -(						2.75								
		>-500	23.50	-19.20	-34.76										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 500 IN DIRECTION Z														
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 500 IN DIRECTION Y														
	STRAIGHT -(						26.00								
		>-505	49.50	-19.20	-34.76										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 505 IN DIRECTION Y														
	STRAIGHT -(						.75								
		>-510B	50.25	-19.20	-34.76										
	BEND -(	510M	51.13	-19.20	-35.13	1.25	1.96	90.000							
		>-510E	51.50	-19.20	-36.01										

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	350.		41.3	8.7
		>-510F	51.50	-19.20	-36.01										
	STRAIGHT -(						2.50								
		>-515N	51.50	-19.20	-38.51										
	BEND -(	515M	51.50	-19.56	-39.39	1.25	1.96	90.000							
		>-515F	51.50	-20.45	-39.76										
	STRAIGHT -(						3.50								
		>-520N	51.50	-23.95	-39.76										
	(	* TENTATIVE HANGER AT POINT 520N - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIFU.													
	BEND -(	520M	51.87	-24.83	-39.76	1.25	1.96	90.000							
		>-520F	52.75	-25.20	-39.76										
	STRAIGHT -(						.75								
ANCHR		--525	53.50	-25.20	-39.76										

* CONTROL COORDINATES OF POINT 525, IN FEET :
X = 53.50, Y = -25.20, Z = -39.76
RESULTANT DIFFEPENCE IS ZERO

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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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	FORCES (POUNDS) RESULTANT	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z	MOMENTS (FOOT-POUNDS) RESULTANT
ANCHORS:								
415	279.	-86.	861.	909.	-579.	-1869.	-4803.	5186.
525	769.	-733.	408.	1138.	4180.	3230.	-1130.	5402.
RESTRAINTS:								
440	-1048.	0.	0.	1048.	0.	0.	0.	0.
440	0.	848.	0.	848.	0.	0.	0.	0.
455[illegible]	0.	310.	0.	310.	0.	0.	0.	0.
484	0.	-1816.	0.	1816.	0.	0.	0.	0.
492	0.	1545.	0.	1545.	0.	0.	0.	0.
500	0.	0.	-1269.	1269.	0.	0.	0.	0.
50[illegible]	0.	-852.	0.	852.	0.	0.	0.	0.
505	0.	784.	0.	784.	0.	0.	0.	0.

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

THE MAXIMUM STRESS OF 14,355. OCCURS AT POINT 460F

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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI	
ANCHR		-- 415	861.	292.	4603.	579.	1669.	1.00	1.00	29.90	2081.	
	STR -(	>- 440	861.	1082.	4603.	1176.	3779.	1.00	1.00	29.90	2497.	
	STR -(	>- 455N	861.	1319.	4803.	6255.	3718.	2.61	2.61	29.90	9114.	
	BEND -(	455M	1366.	783.	6306.	6887.	88.	2.61	2.61	29.90	9762.	
	(	>- 455F	1072.	1154.	4679.	6519.	3842.	2.61	2.61	29.90	9300.	
	STR -(	>- 460N	1072.	1154.	4679.	7853.	8997.	2.61	2.61	29.90	13408.	*
	BEND -(	460M	1366.	783.	3535.	8222.	10349.	2.61	2.61	29.90	14251.	*
	(	>- 460F	861.	1319.	9958.	7590.	5640.	2.61	2.61	29.90	14355.	**
	BEND -(	470M	1152.	1074.	2067.	6004.	11461.	2.61	2.61	29.90	13697.	*
	(	>- 470F	769.	1374.	6250.	5525.	8618.	2.61	2.61	29.90	12539.	
	STR -(	>- 475	769.	1374.	6250.	2992.	1006.	1.00	1.00	29.90	2810.	
116	STR -(	>- 480N	769.	1374.	6250.	3297.	2366.	2.61	2.61	29.90	7790.	
	BEND -(	480M	1152.	1074.	6485.	3777.	1800.	2.61	2.61	29.90	8067.	
	(	>- 480F	861.	1319.	3705.	3412.	4911.	2.61	2.61	29.90	7354.	
	STR -(	>- 482	861.	1319.	3705.	3571.	2451.	1.00	1.00	29.90	2287.	
	STR -(	>- 484	861.	1319.	3705.	7680.	5622.	1.00	1.00	29.90	4099.	
	STR -(	>- 485N	861.	1076.	3705.	5614.	7494.	2.61	2.61	29.90	10645.	
	BEND -(	485M	1152.	747.	2407.	6178.	7262.	2.61	2.61	29.90	10280.	
	(	>- 485F	769.	1138.	6564.	5699.	2775.	2.61	2.61	29.90	9540.	
	STR -(	>- 490N	769.	1138.	6564.	2041.	387.	2.61	2.61	29.90	7198.	
	BEND -(	490M	65.	1376.	[illegible]	999.	5573.	2.61	2.61	29.90	7305.	
	(	>- 490F	861.	1070.	1317.	4.	7494.	2.61	2.61	29.90	7954.	

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
		>- 490F	861.	1070.	1317.	4.	7494.	2.61	2.61	29.90	7954.
	STR -(										
		>- 492	861.	1110.	1317.	7680.	188.	1.00	1.00	29.90	3128.
	STR -(										
		>- 495N	861.	1110.	1317.	8453.	.931.	2.61	2.61	29.90	8996.
	(										
	BEND -(	495M	65.	1403.	1683.	9408.	436.	2.61	2.61	29.90	10081.
	(										
		>- 495F	769.	1176.	1933.	10490.	315.	2.61	2.61	29.90	11156.
	STR -(										
		>- 500	769.	411.	1933.	1888.	12857.	1.00	1.00	29.90	5272.
	STR -(										
		>- 505	769.	839.	1933.	552.	2246.	1.00	1.00	29.90	1210.
	STR -(										
		>- 510N	769.	839.	1933.	1940.	1191.	2.61	2.61	29.90	3086.
	(										
	BEND -(	510M	255.	1109.	2414.	1298.	60.	2.61	2.61	29.90	2866.
	(										
		>- 510F	408.	1062.	2017.	469.	1016.	2.61	2.61	29.90	2412.
	STR -(										
		>- 515N	408.	1062.	2017.	816.	1453.	2.61	2.61	29.90	2735.
	(										
	BEND -(	515M	230.	1114.	2735.	1613.	280.	2.61	2.61	29.90	3332.
	(										
		>- 515F	733.	870.	2414.	2242.	1056.	2.61	2.61	29.90	3617.
	STR -(										
		>- 520N	733.	870.	2414.	1635.	3670.	2.61	2.61	29.90	4900.
	(										
	BEND -(	520M	1062.	469.	1038.	2046.	4663.	2.61	2.61	29.90	5432.
	(										
		>- 520F	769.	839.	4180.	1680.	2924.	2.61	2.61	29.90	5615.
	STR -(										
ANCHR		-- 525	769.	839.	4180.	1130.	3230.	1.00	1.00	29.90	2168.

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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
ANCHOR	--	415	279.	-86.	861.	-579.	-1869.	-4803.
	STRAIGHT -(							
	>-	440	-769.	762.	861.	1170.	3779.	-4803.
	STRAIGHT -(							
	>-	455N	-769.	1072.	861.	-6255.	-3718.	-4803.
	(							
	BEND -(	455[illegible]	-769.	1072.	861.	-6887.	-4397.	-4521.
	(							
	>-	455F	-769.	1072.	861.	-6519.	-4679.	-3842.
	STRAIGHT -(							
	>-	460N	-769.	1072.	861.	7853.	-4679.	8997.
	(							
	BEND -(	[illegible]	-769.	1072.	861.	8222.	-4960.	9676.
	(							
	>-	460F	-769.	1072.	861.	7590.	-5640.	9958.
	(							
	BEND -(	47[illegible]	-769.	1072.	861.	6643.	-6004.	9565.
	(							
	>-	470F	-769.	1072.	861.	6250.	-5525.	8618.
	STRAIGHT -(							
	>-	475	-769.	1072.	861.	6250.	-1006.	2992.
	STRAIGHT -(							
	>-	[illegible]	-769.	1072.	861.	6250.	3297.	-2366.
	(							
	BEND -(	[illegible]	-769.	1072.	861.	5858.	3777.	-3313.
	(							
	>-	[illegible]F	-769.	1072.	861.	4911.	3412.	-3705.
	STRAIGHT -(							
	>-	[illegible]	-769.	1072.	861.	3571.	2451.	-3705.
	STRAIGHT -(							
	>-	[illegible]	-769.	1072.	861.	-7680.	-5622.	-3705.
	STRAIGHT -(							
	>-	[illegible]	-769.	-744.	861.	-7494.	-5814.	-3705.
	(							
	BEND -(	[illegible]	-769.	-744.	861.	-6837.	-6178.	-3433.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
	BEND -(	485M	-769.	-744.	861.	-6837.	-6178.	-3433.
	(	>- 485F	-769.	-744.	861.	-6564.	-5699.	-2775.
	STRAIGHT -(							
		>- 490B	-769.	-744.	861.	-6564.	-2041.	387.
	(							
	BEND -(	490M	-769.	-744.	861.	-6837.	-999.	1044.
	(							
		>- 490F	-769.	-744.	861.	-7494.	-4.	1317.
	STRAIGHT -(							
		>- 492	-769.	801.	861.	-7680.	188.	1317.
	STRAIGHT -(							
		>- 495B	-769.	801.	861.	931.	8453.	1317.
	(							
	BEND -(	495M	-769.	801.	861.	1639.	9448.	1023.
	(							
		>- 495F	-769.	801.	861.	1933.	10490.	315.
	STRAIGHT -(							
		>- 500	-769.	-51.	-408.	1933.	12857.	-1888.
	STRAIGHT -(							
		>- 505	-769.	733.	-408.	1933.	2246.	-552.
	STRAIGHT -(							
		>-.510B	-769.	733.	-408.	1933.	1940.	-1101.
	(							
	BEND -(	510M	-769.	733.	-408.	1664.	1298.	-1749.
	(							
		>- 510F	-769.	733.	-408.	1016.	469.	-2017.
	STRAIGHT -(							
		>- 515B	-769.	733.	-408.	-816.	-1453.	-2017.
	(							
	BEND -(	515M	-769.	733.	-408.	-1613.	-2133.	-1736.
	(							
		>- 515F	-769.	733.	-408.	-2242.	-2414.	-1056.
	STRAIGHT -(							
		>- 520B	-769.	733.	-408.	-3670.	-2414.	1635.
	(							
	BEND -(	520M	-769.	733.	-408.	-4031.	-2563.	2046.
	(							
		>- 520F	-769.	733.	-408.	-4180.	-2924.	1680.
	STRAIGHT -(							
ANCHOR		-- 525	-769.	733.	-408.	-4180.	-3230.	1130.

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DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	-.000	.000	-.000	-.000	-.000
	STRAIGHT -(							
		>- [illegible]	-.000	.000	-1.547	.010	.033	-.217
	STRAIGHT -(							
		>- 455B	-.091	.000	-2.291	-.032	.034	-.322
	(							
	BEND -(	455M	-.119	-.042	-2.352	-.123	.004	-.326
	(							
		>- 455F	-.182	-.121	-2.348	-.216	.000	-.358
	STRAIGHT -(							
		>- 460A	-1.415	-1.396	-1.502	-.197	-.174	-.284
	(							
	BEND -(	460M	-1.441	-1.473	-1.503	-.066	-.229	-.158
	(							
		>- 460F	-1.399	-1.506	-1.567	.023	-.327	-.097
	(							
	BEND -(	470M	-1.303	-1.496	-1.606	.142	-.408	-.030
	(							
		>- 470F	-1.202	-1.475	-1.550	.203	-.488	.099
	STRAIGHT -(							
		>- 475	-.801	-1.332	-.993	.277	-.517	.151
	STRAIGHT -(							
		>- 480A	-.420	-1.168	-.453	.346	-.507	.154
	(							
	BEND -(	480M	-.316	-1.113	-.391	.361	-.458	.143
	(							
		>- 480F	-.298	-1.031	-.425	.411	-.408	.149
	STRAIGHT -(							
		>- 482	-.102	-.922	-.520	.420	-.401	.138
	STRAIGHT -(							
		>- 484	.784	-.000	-1.322	.383	-.430	.051
	STRAIGHT -(							
		>- 485A	.806	.020	-1.341	.380	-.432	.049
	(							
	BEND -(	485M	.921	.083	-1.371	.283	-.515	.008
	(							
		>- 485F	1.030	.099	-1.296	.243	-.598	-.052
	STRAIGHT -(							
		>- 490A	1.126	.046	-.749	.181	-.626	-.061

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 490N	1.126	.046	-.749	.181	-.626	-.061
	BEND -(	490M	1.097	.024	-.622	.149	-.647	-.028
		>- 490F	.985	.003	-.552	.061	-.653	.003
	STRAIGHT -(							
		>- 492	.950	.000	-.547	.058	-.653	.003
	STRAIGHT -(							
		>- 495N	-.461	-.029	-.303	-.004	-.574	.035
	BEND -(	495M	-.549	-.027	-.245	.006	-.452	.035
		>- 495F	-.560	-.021	-.166	.011	-.315	.036
	STRAIGHT -(							
		>- 500	-.498	-.000	-.000	.023	-.260	.032
	STRAIGHT -(							
		>- 505	.089	.000	.279	.135	.077	-.022
	STRAIGHT -(							
		>- 510N	.106	-.003	.267	.138	.080	-.023
	BEND -(	510M	.119	.002	.241	.140	.103	-.033
		>- 510F	.107	.026	.213	.149	.115	-.036
	STRAIGHT -(							
		>- 515N	.046	.105	.156	.149	.113	-.047
	BEND -(	515M	.023	.123	.126	.133	.099	-.048
		>- 515F	.006	.113	.095	.106	.095	-.056
	STRAIGHT -(							
		>- 520N	-.036	.034	.023	.088	.076	-.054
	BEND -(	520M	-.035	.011	.007	.034	.051	-.028
		>- 520F	-.017	.000	.000	.007	.004	-.002
	STRAIGHT -(							
ANCHOR		-- 525	.000	-.000	.000	.000	.000	-.000

WEIGHT

* *

* 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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
415	11.	-687.	-11.	687.	-2519.	-73.	55.	2520.
525	2.	487.	-3.	487.	-243.	68.	-508.	567.
RESTRAINTS:								
440	-13.	0.	0.	13.	0.	0.	0.	0.
440	0.	-663.	0.	863.	0.	0.	0.	0.
455	0.	-1640.	0.	1640.	0.	0.	0.	0.
475	0.	-770.	0.	770.	0.	0.	0.	0.
482	0.	-421.	0.	421.	0.	0.	0.	0.
484	0.	-551.	0.	551.	0.	0.	0.	0.
492	0.	-545.	0.	585.	0.	0.	0.	0.
500	0.	0.	14.	14.	0.	0.	0.	0.
500	0.	-1146.	0.	1146.	0.	0.	0.	0.
505	0.	-857.	0.	857.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
5200	0.	-916.	0.	916.	0.	0.	0.	0.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS

THE MAXIMUM STRESS OF 1094. OCCURS AT POINT 455N

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.

(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.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHP		-- 415	11.	687.	55.	2519.	73.	1.00	1.00	29.90	1011. *
	STR -(	>- 440	11.	568.	55.	1313.	147.	1.00	1.00	29.90	531.
	STR -(	>- 455N	11.	1330.	55.	1388.	128.	2.61	2.61	29.90	1094. **
	BEND -(	455M	995.	899.	129.	242.	50.	2.61	2.61	29.90	219.
	(	>- 455F	1298.	11.	126.	205.	58.	2.61	2.61	29.90	194.
	STR -(	>- 460N	173.	11.	126.	22.	90.	2.61	2.61	29.90	123.
	BEND -(	460M	87.	72.	154.	61.	24.	2.61	2.61	29.90	131.
	(	>- 460F	11.	52.	93.	128.	124.	2.61	2.61	29.90	157.
	BEND -(	470M	6.	13.	36.	118.	173.	2.61	2.61	29.90	167.
	(	>- 470F	2.	71.	137.	107.	60.	2.61	2.61	29.90	145.
	STR -(	>- 475	2.	375.	137.	1161.	50.	1.00	1.00	29.90	470.
	STR -(	>- 480N	2.	66.	137.	5.	61.	2.61	2.61	29.90	118.
	BEND -(	480M	6.	10.	124.	15.	83.	2.61	2.61	29.90	118.
	(	>- 480F	11.	57.	36.	21.	122.	2.61	2.61	29.90	101.
	STR -(	>- 482	11.	287.	36.	2.	24.	1.00	1.00	29.90	17.
	STR -(	>- 484	11.	167.	36.	408.	44.	1.00	1.00	29.90	164.
	STR -(	>- 485N	11.	172.	36.	44.	359.	2.61	2.61	29.90	285.
	BEND -(	485M	6.	111.	173.	50.	155.	2.61	2.61	29.90	186.
	(	>- 485F	2.	51.	199.	61.	83.	2.61	2.61	29.90	175.
	STR -(	>- 490N	2.	163.	199.	107.	156.	2.61	2.61	29.90	215.
	BEND -(	490M	9.	212.	316.	116.	136.	2.61	2.61	29.90	285.
	(	>- 490F	11.	261.	403.	116.	82.	2.61	2.61	29.90	336.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 490F	11.	261.	403.	118.	82.	2.61	2.61	29.90	336.
	STR -(										
		>- 492	11.	312.	403.	149.	118.	1.00	1.00	29.90	179.
	STR -(										
		>- 495N	11.	226.	403.	97.	313.	2.61	2.61	29.90	407.
	BEND -(	495M	9.	275.	417.	99.	286.	2.61	2.61	29.90	404.
		>- 495F	2.	324.	14.	108.	764.	2.61	2.61	29.90	605.
	STR -(										
		>- 500	2.	462.	14.	1844.	136.	1.00	1.00	29.90	742.
	STR -(										
		>- 505	2.	241.	14.	959.	69.	1.00	1.00	29.90	386.
	STR -(										
		>- 510N	2.	203.	14.	67.	793.	2.61	2.61	29.90	624.
	BEND -(	510M	3.	154.	502.	65.	394.	2.61	2.61	29.90	503.
		>- 510F	3.	105.	583.	66.	190.	2.61	2.61	29.90	484.
	STR -(										
		>- 515N	3.	20.	583.	297.	71.	2.61	2.61	29.90	516.
127	BEND -(	515M	51.	47.	463.	260.	360.	2.61	2.61	29.90	503.
		>- 515F	118.	3.	73.	231.	581.	2.61	2.61	29.90	493.
	STR -(										
		>- 520N	623.	5.	73.	574.	240.	2.61	2.61	29.90	491.
	BEND -(	520M	404.	407.	223.	356.	120.	2.61	2.61	29.90	342.
		>- 520F	2.	524.	243.	129.	70.	2.61	2.61	29.90	223.
	STR -(										
ANCHR		-- 525	2.	487.	243.	508.	68.	1.00	1.00	29.90	228.

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) X	Y	Z	MOMENTS (FOOT-POUNDS) X	Y	Z
ANCHOR	--	415	11.	-687.	-11.	-2519.	-73.	55.
	STRAIGHT -(							
	>-	440	11.	568.	-11.	-1313.	147.	55.
	STRAIGHT -(							
	>-	455N	-2.	-1330.	-11.	-1388.	128.	55.
	(							
	BEND -(	455M	-2.	-1269.	-11.	-242.	127.	56.
	(							
	>-	455F	-2.	-1208.	-11.	205.	126.	58.
	STRAIGHT -(							
	>-	460N	-2.	-173.	-11.	22.	126.	90.
	(							
	BEND -(	460M	-2.	-113.	-11.	61.	125.	92.
	(							
	>-	460F	-2.	-52.	-11.	128.	124.	93.
	(							
	BEND -(	470N	-2.	9.	-11.	148.	118.	97.
	(							
	>-	470F	-2.	70.	-11.	137.	107.	60.
	STRAIGHT -(							
	>-	475	-2.	-375.	-11.	137.	50.	-1161.
	STRAIGHT -(							
	>-	480N	-2.	-65.	-11.	137.	-5.	-61.
	(							
	BEND -(	480M	-2.	-4.	-11.	146.	-15.	-29.
	(							
	>-	480F	-2.	57.	-11.	122.	-21.	-36.
	STRAIGHT -(							
	>-	482	-2.	-287.	-11.	2.	-24.	-36.
	STRAIGHT -(							
	>-	484	-2.	-147.	-11.	-464.	-44.	-36.
	STRAIGHT -(							
	>-	485N	-2.	-172.	-11.	-359.	-44.	-36.
	(							
	BEND -(	485M	-2.	-111.	-11.	-232.	-50.	13.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
	BEND -(	485N	-2.	-111.	-11.	-232.	-50.	13.
	(	>- 485F	-2.	-50.	-11.	-199.	-61.	83.
	STRAIGHT -(	>- 490N	-2.	162.	-11.	-199.	-107.	-156.
	BEND -(	490M	-2.	211.	-11.	-128.	-116.	-320.
	(	>- 490F	-2.	261.	-11.	82.	-118.	-403.
	STRAIGHT -(	>- 492	-2.	-312.	-11.	149.	-118.	-403.
	STRAIGHT -(	>- 495N	-2.	226.	-11.	-313.	-97.	-403.
	BEND -(	495M	-2.	275.	-11.	-93.	-99.	-498.
	(	>- 495F	-2.	324.	-11.	14.	-108.	-764.
	STRAIGHT -(	>- 500	-2.	462.	-11.	14.	-138.	-1844.
	STRAIGHT -(	>- 505	-2.	-241.	3.	14.	-69.	-959.
	STRAIGHT -(	>- 510N	-2.	-203.	3.	14.	-67.	-793.
	BEND -(	510M	-2.	-154.	3.	77.	-65.	-634.
	(	>- 510F	-2.	-105.	3.	190.	-66.	-583.
	STRAIGHT -(	>- 515N	-2.	20.	3.	297.	-71.	-583.
	BEND -(	515M	-2.	69.	3.	260.	-73.	-582.
	(	>- 515F	-2.	118.	3.	231.	-73.	-581.
	STRAIGHT -(	>- 520N	-2.	-623.	3.	240.	-73.	-574.
	BEND -(	520M	-2.	-574.	3.	242.	-72.	-356.
	(	>- 520F	-2.	-524.	3.	243.	-70.	129.
ANCHOR	STRAIGHT -(	-- 525	-2.	-467.	3.	243.	-68.	508.

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DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	-.000	-.000	-.000	-.000	.000
	STRAIGHT -(							
		>- 440	-.000	-.000	-.000	.007	.001	.002
	STRAIGHT -(							
		>- 455B	-.005	-.000	-.000	-.007	.004	.004
	(							
	BEND -(	455M	-.006	-.003	.001	-.018	.005	.003
	(							
		>- 455F	-.005	-.004	.005	-.017	.005	.004
	STRAIGHT -(							
		>- 460B	.011	-.005	.058	-.014	.010	.006
	(							
	BEND -(	460M	.011	-.006	.060	-.013	.010	.006
	(							
		>- 460F	.010	-.008	.061	-.012	.011	.006
	(							
	BEND -(	470M	.008	-.010	.060	-.010	.013	.007
	(							
		>- 470F	.007	-.009	.058	-.009	.014	.009
	STRAIGHT -(							
		>- 475	.007	-.000	.041	-.008	.015	.005
	STRAIGHT -(							
		>- 480B	.007	.002	.025	-.006	.015	.001
	(							
	BEND -(	480M	.005	.002	.023	-.006	.015	.001
	(							
		>- 480F	.003	.001	.021	-.004	.015	.001
	STRAIGHT -(							
		>- 482	-.001	-.000	.021	-.004	.015	.001
	STRAIGHT -(							
		>- 484	-.033	-.000	.021	.003	.014	.000
	STRAIGHT -(							
		>- 485B	-.034	.000	.021	.003	.014	.000
	(							
	BEND -(	485M	-.037	.000	.020	-.001	.014	-.001
	(							
		>- 485F	-.036	-.000	.018	-.002	.013	-.001
	STRAIGHT -(							
		>- 490B	-.038	-.000	.007	-.004	.012	-.000

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 490N	-.038	-.000	.007	-.004	.012	-.000
	BEND -(	490M	-.037	-.000	.005	-.003	.011	-.003
		>- 490F	-.035	-.000	.004	-.002	.009	-.004
	STRAIGHT -(							
		>- 492	-.035	-.000	.004	-.002	.009	-.004
	STRAIGHT -(							
		>- 495N	-.017	.015	.004	-.013	.007	-.014
	BEND -(	495M	-.015	.016	.003	-.013	.006	-.015
		>- 495F	-.015	.014	.002	-.011	.004	-.022
	STRAIGHT -(							
		>- 500	-.015	-.000	.000	-.011	.004	-.028
	STRAIGHT -(							
		>- 505	-.015	-.000	-.006	-.011	-.001	.035
	STRAIGHT -(							
		>- 510N	-.015	.005	-.006	-.011	-.001	.034
	BEND -(	510M	-.015	.010	-.006	-.013	-.002	.026
		>- 510F	-.014	.009	-.006	-.013	-.003	.024
	STRAIGHT -(							
		>- 515N	-.013	.002	-.006	-.012	-.003	.020
	BEND -(	515M	-.011	.001	-.005	-.008	-.002	.018
		>- 515F	-.008	-.000	-.004	-.005	.000	.012
	STRAIGHT -(							
		>- 520N	-.001	-.000	-.000	-.004	-.001	.008
	BEND -(	520M	.000	.000	-.000	-.001	.000	.001
		>- 520F	.000	.000	.000	-.000	.000	-.000
	STRAIGHT -(							
ANCHOR		-- 525	.000	.000	-.000	-.000	.000	-.000

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HANGER DESIGN DATA

EXPLANATORY NOTES:
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(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 USERØS MANUAL, A CONSTANT SUPPORT HANGER IS RECOMMENDED.

(7) 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 ØTHEORETICALØ 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) X	Z	PRELIMINARY HANGER SELECTION TYPE	SPECIFICATION	SWING LENGTH (FEET)	ANGLE (DEG)
475	770.	-1.33	-.80	-.99	VSH	1 - MIDDLE RANGE SPRING. SPRING RATE = 150 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 570 LBS SPRING LOAD IN THE OPERATING CONDITION = 770 LBS	N/A	N/A
482	421.	-.92	-.10	-.52	VSH	1 - MIDDLE RANGE SPRING. SPRING RATE = 84 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 343 LBS SPRING LOAD IN THE OPERATING CONDITION = 421 LBS	N/A	N/A
520N	916.	.03	-.04	.02	RIGID	REQUIRED MINIMUM CROSS SECTIONAL ROOT AREA = .13 SQ IN BASED ON AN ALLOWABLE STRESS OF 9000 PSI	N/A	N/A

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* * * * * * * * * * * * * * * * * *
*                                 *
* STATIC SOLUTION ACCURACY CHECKS *
*                                 *
* * * * * * * * * * * * * * * * * *
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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 - ZFEEEC THERMAL

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

LOADING - CRESTRAINEDC WEIGHT (+UNIF)

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

DYNAFLEX

TABLE OF CONTENTS

SEISMIC

DYNAFLEX

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
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.

STEARNS - ROGER CORP, 2/26/80,PROJ.10MW
SOLAR PILOT PLANT - C-21700,JOBHS VALVE
TO 11700,JOBHS VALVE TO TURBINE DUMP(X=M
S-4-A-1)

DYNAFLEX (MOD204F-UCC)

LAST UPDATE - 12/25/79

STEARNS - ROGER CORP, 2/
26/80,PROJ.10MW SOLAR PI
LOT PLANT - C-21700,JOBM
S VALVE TO ~~T1700,JOBMS V~~
~~ALVE TO~~ TURBINE DUMP(X-M
S-4-A-1)

INPUT DATA - (CARD IMAGES)

:1	:4	:7	:10	:13	:25	:37	:49	:60		
LINE NUMBER	TYP	LOC NO.	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP, 2/26/80,PROJ.10MW SOLAR PILOT PLANT - C-21700,JOBMS VALVE TO T~~1700,JOBMS VALVE TO T~~URBINE DUMP(X-MS-4-A-1)	1
2	GEN								APPLY B31.1-1973,EXA	2
3			415	440			-20-3-1/8		MAT=LCM,OD=10.75, WT=.365,UNIF=20.62, TEMP=885.	3
4				455			-11-0	L		4
5				460		-19-2-3/8		L		5
6				470			-2-6	L		6
7				475	6-6					7
8				480	6-3			L		8
9				482			-2-6			9
10				484			-10-6			10
11				485			-1-6	L		11
12				490	6-9			L	TEMP=350.,UNIF=8.67	12
13				492			1-6			13
14				495			12-0	L		14
15				500	4-0					15
16				505	26-0					16
17				515	2-0			L		17
18				519			-5-0	L		18
19				520		-6-0		L		19
20				525	2-0					20
21	ANC	415								21
22	ANC	525								22
23	RAD	440			RIGID					23
24	RAD	440				RIGID				24
25	RAD	455	0			RIGID				25
26	RAD	484				RIGID				26
27	RAD	482				RIGID				27
28	RAD	500				RIGID				28
29	RAD	500					RIGID			29
30	RAD	505				RIGID				30

INPUT DATA - (CARD IMAGES)

LINE NUMBER	TYP (:1)	LOC NO. (:4)	FRE (:7)	TO (:10)	DELTA X (:13)	DELTA Y (:25)	DELTA Z (:37)	RADIUS (:49)	ADDITIONAL DATA (:60)	LINE NUMBER
31	CCC	525			53-6	-25-2-3/8	-39-9-1/8			31
32	CYL								SPEC 1(FRE/G,.1/.013,	32
									.25/.082,2.5/.638,	
									9./.531,33./.125),	
									SPEC 2(FRE/G,.1/.009,	
									.25/.055,2.5/.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	
33	DPO								LUMP POINTS(AUTOMATIC	33
									,MAX SPACING=5-0	
									,EXCLUDE ALL M NODES)	
									,MODE CUTOFF=20,	
									FREQUENCY CUTOFF=33	
34	OUT								SHOCK 1,SHOCK 2,	34
									SHOCK 3,SHOCK 4	

STEARNS - ROGER CORP, 27
26/80,PROJ.1918 SOLAR PI
LOT PLANT - C-21700,JOHN
S VALVE TO ~~T1700,J1 ...-V~~
~~ALVE TO~~ TURBINE 9/10/(X-M
S-4-A-1)

* * * * * * * * * * * * * * * * * * *
*   *
* 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.

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(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 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.

(15) 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 #15, WHICH IS THE ORIGIN

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

LCM - LOW CHROME MOLY STEEL
YOUNGS MODULUS AT AMBIENT TEMPERATURE = 29,900,000. PSI
POISSONS RATIO = .30
DENSITY = 500. POUNDS PER CUBIC FOOT

SHOCK AND SPECTRUM DATA

MODE CUTOFF SET AT 20

FREQUENCY CUTOFF SET AT 33.00 CPS

SPECTRUM 1 (LOGARITHMIC INTERPOLATION) FREQUENCY CPS	G	SPECTRUM 2 (LOGARITHMIC INTERPOLATION) FREQUENCY CPS	G
.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

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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.

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

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
ANCHOR		--415	0.00	0.00	0.00										
	STRAIGHT -(						4.05		10.750	.365	LCM	885.		41.3	20.6
	(* THERMAL EXPANSION OF LCM BETWEEN AMBIENT AND 885. DEGREES FAHRENHEIT IS 7.64 INCHES PER 100 FEET														
	(* A UNIFORM DISTRIBUTED LOAD OF 20.62 PLF IS ACTING IN THE -Y DIRECTION.														
		>-415.1	0.00	0.00	-4.05										
	STRAIGHT -(						4.05								
		>-415.2	0.00	0.00	-8.10										
	STRAIGHT -(						4.05								
		>-415.3	0.00	0.00	-12.15										

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	885.		41.3	20.6
		>-415.3	0.00	0.00	-12.16										
	STRAIGHT -(						4.05								
		>-415.4	0.00	0.00	-16.21										
	STRAIGHT -(						4.05								
		>-440	0.00	0.00	-20.25										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 440 IN DIRECTION X														
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 440 IN DIRECTION Y														
	STRAIGHT -(						4.88								
		>-440.1	0.00	0.00	-25.14										
	STRAIGHT -(						4.88								
		>-455N	0.00	0.00	-30.01										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 455N IN DIRECTION Y														
	BEND -(	455M	0.00	-.37	-30.89	1.25	1.96	90.000							
		>-455F	0.00	-1.25	-31.26										
	STRAIGHT -(						4.17								
		>-455F.1	0.00	-5.42	-31.26										
	STRAIGHT -(						4.17								
		>-455F.2	0.00	-9.60	-31.26										
	STRAIGHT -(						4.17								
		>-455F.3	0.00	-13.77	-31.26										
	STRAIGHT -(						4.17								
		>-460N	0.00	-17.95	-31.26										
	BEND -(	460M	0.00	-18.83	-31.63	1.25	1.96	90.000							
		>-460F	0.00	-19.20	-32.51										

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* NOTES PERTAINING TO POINT 460F APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	885.		41.3	20.6
		>-460F	0.00	-19.20	-32.51										
		* POINT 460F IS EQUIVALENT TO POINT 470N													
	BEND -(	470M	.37	-19.20	-33.39	1.25	1.96	90.000							
		>-470F	1.25	-19.20	-33.76										
	STRAIGHT -(						2.63								
		>-470F.1	3.88	-19.20	-33.76										
	STRAIGHT -(						2.63								
		>-475	6.50	-19.20	-33.76										
	STRAIGHT -(						2.50								
		>-475.1	9.00	-19.20	-33.76										
	STRAIGHT -(						2.50								
		>-480N	11.50	-19.20	-33.76										
	BEND -(	480M	12.38	-19.20	-34.13	1.25	1.96	90.000							
		>-480F	12.75	-19.20	-35.01										
144	STRAIGHT -(						1.25								
		>-482	12.75	-19.20	-36.26										
	STRAIGHT -(						3.50								
		>-482.1	12.75	-19.20	-39.76										
	STRAIGHT -(						3.50								
		>-482.2	12.75	-19.20	-43.26										
	STRAIGHT -(						3.50								
		>-484	12.75	-19.20	-46.76										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 484 IN DIRECTION Y													
	STRAIGHT -(						.25								
		>-485N	12.75	-19.20	-47.01										
	BEND -(	485M	13.12	-19.20	-47.39	1.25	1.96	90.000							
		>-485F	14.00	-19.20	-48.26										

* NOTES PERTAINING TO POINT 485F APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	885.		41.3	20.6
		>-465F	14.00	-19.20	-48.26										
	STRAIGHT -(						4.25					350.			8.7
	(	* INTERNAL EXPANSION OF LCM BETWEEN AMBIENT AND 350. DEGREES FAHRENHEIT IS 2.26 INCHES PER 100 FEET													
	(	* A UNIFORM DISTRIBUTED LOAD OF 8.67 PLF IS ACTING IN THE -Y DIRECTION.													
		>-490N	18.25	-19.20	-48.25										
	BEND -(	490M	19.13	-19.20	-47.89	1.25	1.96	90.000							
		>-490F	19.50	-19.20	-47.61										
	STRAIGHT -(						.25								
		>-492	19.50	-19.20	-46.76										
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 492 IN DIRECTION Y													
	STRAIGHT -(						3.58								
145		>-492.1	19.50	-19.20	-43.18										
	STRAIGHT -(						3.58								
		>-492.2	19.50	-19.20	-39.59										
	STRAIGHT -(						3.58								
		>-495N	19.50	-19.20	-36.01										
	BEND -(	495M	19.87	-19.20	-35.13	1.25	1.96	90.000							
		>-495F	20.75	-19.20	-34.76										
	STRAIGHT -(						2.75								
		>-500	23.50	-19.20	-34.76										

* NOTES PERTAINING TO POINT 500 APPEAR ON THE FOLLOWING PAGE

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	350.		41.3	8.7
		>-500	23.50	-19.20	-34.76										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 500 IN DIRECTION Y														
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 500 IN DIRECTION Z														
STRAIGHT -(							4.33								
		>-500.1	27.83	-19.20	-34.76										
STRAIGHT -(							4.33								
		>-500.2	32.17	-19.20	-34.76										
STRAIGHT -(							4.33								
		>-500.3	36.50	-19.20	-34.76										
STRAIGHT -(							4.33								
		>-500.4	40.83	-19.20	-34.76										
STRAIGHT -(							4.33								
		>-500.5	45.17	-19.20	-34.76										
STRAIGHT -(							4.33								
		>-505	49.50	-19.20	-34.76										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 505 IN DIRECTION Y														
STRAIGHT -(							.75								
		>-510B	50.25	-19.20	-34.76										
BEND -(		510	51.13	-19.20	-35.13	1.25	1.96	90.000							
		>-510E	51.50	-19.20	-36.01										
STRAIGHT -(							2.50								
		>-515B	51.50	-19.20	-38.51										
BEND -(		515	51.50	-19.56	-39.37	1.25	1.96	90.000							
		>-515E	51.50	-20.45	-39.76										
STRAIGHT -(							3.50								
		>-520B	51.50	-23.95	-39.76										
BEND -(		520	51.87	-24.33	-39.76	1.25	1.96	90.000							

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									10.750	.365	LCM	350.		41.3	8.7
	BEND -(	520B	51.87	-24.83	-39.76	1.25	1.96	90.000							
	(														
		>-520F	52.75	-25.20	-39.76										
	STRAIGHT -(						.75								
ANCHR		--525	53.50	-25.20	-39.76										

* CONTROL COORDINATES OF POINT 525, IN FEET :
X = 53.50, Y = -25.20, Z = -39.76
RESULTANT DIFFERENCE IS ZERO

* * * * * * * * * * * * *
* 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.

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LOC. NO.	DISPLACEMENT FREEDOM: WEIGHT (POUNDS)	DIRECTION			ROTATIONAL FREEDOM: MOMENT OF INERTIA (LB - IN X IN) X	Y	Z
415	126.				0.	0.	0.
415.1	251.	X	Y	Z	0.	0.	0.
415.2	251.	X	Y	Z	0.	0.	0.
415.3	251.	X	Y	Z	0.	0.	0.
415.4	251.	X	Y	Z	0.	0.	0.
440	277.			Z	0.	0.	0.
440.1	302.	X	Y	Z	0.	0.	0.
455N	212.	X		Z	0.	0.	0.
455F	190.	X	Y	Z	0.	0.	0.
455F.1	259.	X	Y	Z	0.	0.	0.
455F.2	259.	X	Y	Z	0.	0.	0.
455F.3	259.	X	Y	Z	0.	0.	0.
460N	199.	X	Y	Z	0.	0.	0.

LOC. NO.	DISPLACEMENT FREEDOM WEIGHT (POUNDS)	DIRECTION			ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN) X	Y	Z
460F	122.	X	Y	Z	0.	0.	0.
470F	142.	X	Y	Z	0.	0.	0.
470F.1	163.	X	Y	Z	0.	0.	0.
475	159.	X	Y	Z	0.	0.	0.
475.1	155.	X	Y	Z	0.	0.	0.
480U	133.	X	Y	Z	0.	0.	0.
480F	100.	X	Y	Z	0.	0.	0.
482	147.	X	Y	Z	0.	0.	0.
482.1	217.	X	Y	Z	0.	0.	0.
482.2	217.	X	Y	Z	0.	0.	0.
484	116.	X		Z	0.	0.	0.
485U	69.	X	Y	Z	0.	0.	0.
485F	167.	X	Y	Z	0.	0.	0.
490U	155.	X	Y	Z	0.	0.	0.
490F	55.	X	Y	Z	0.	0.	0.
492	96.	X		Z	0.	0.	0.
492.1	179.	X	Y	Z	0.	0.	0.
492.2	179.	X	Y	Z	0.	0.	0.
495U	139.	X	Y	Z	0.	0.	0.
495F	113.	X	Y	Z	0.	0.	0.
500	177.	X			0.	0.	0.
500.1	217.	X	Y	Z	0.	0.	0.
500.2	217.	X	Y	Z	0.	0.	0.

	DISPLACEMENT FREEDOM				ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION			X	Y	Z
500.3	217.	X	Y	Z	0.	0.	0.
500.4	217.	X	Y	Z	0.	0.	0.
500.5	217.	X	Y	Z	0.	0.	0.
505	127.	X		Z	0.	0.	0.
510N	68.	X	Y	Z	0.	0.	0.
510F	112.	X	Y	Z	0.	0.	0.
515N	112.	X	Y	Z	0.	0.	0.
515F	137.	X	Y	Z	0.	0.	0.
520N	137.	X	Y	Z	0.	0.	0.
520F	68.	X	Y	Z	0.	0.	0.
525	19.				0.	0.	0.

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NUMBER OF DYNAMIC DEGREES OF FREEDOM = 127, TOTAL MASS OF SYSTEM = 7949. POUNDS

* *

* FREQUENCIES, PERIODS OF VIBRATION AND MASS PARTICIPATION FACTORS *

* *

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS X	Y	Z
1	1.90055	.52616	3.18847055	.19734389	.51729546
2	2.29481	.43577	.39934866	.05364096	2.14600820
3	5.36138	.18652	1.84092416	.03236287	1.03682192
4	5.90161	.16944	.82598151	1.22215502	.01870259
5	6.69972	.14926	.20199215	.83437125	.25487094
6	8.80448	.11358	.53352223	.62929805	.13437585
7	9.23293	.10831	.57422589	.29945055	.29759387
8	11.00971	.09083	.42321912	.24158472	1.85664116
9	12.21764	.08185	.32050904	1.25248901	.32421996
10	19.05302	.05249	.08555753	.09100971	1.22583314
11	23.40000	.04274	.05532389	.12709661	.71966985
12	24.39459	.04099	.38504365	.08513607	.22510560
13	27.36154	.03655	.17309114	.03512859	.93335955
14	29.38517	.03403	.01501677	1.57166913	.05681710
15	30.26057	.03305	1.54785242	.02300938	.02042861

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 = 8.47

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

MODE ORTHOGONALITY CHECK

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

OFF DIAGONAL TERMS: MAX. = 1.61338×10^{-13} MIN. = -1.34390×10^{-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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
415	445.	34.	287.	530.	229.	2950.	4445.	5340.
525	1554.	153.	298.	1589.	1124.	4924.	5440.	7423.
RESTRAINTS:								
440	1098.	0.	0.	1098.	0.	0.	0.	0.
440	0.	332.	0.	332.	0.	0.	0.	0.
455N	0.	206.	0.	206.	0.	0.	0.	0.
484	0.	129.	0.	129.	0.	0.	0.	0.

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LOADING - SHOCK LOADING NO. 1

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
492	0.	144.	0.	144.	0.	0.	0.	0.
500	0.	343.	0.	343.	0.	0.	0.	0.
500	0.	0.	568.	568.	0.	0.	0.	0.
505	0.	216.	0.	216.	0.	0.	0.	0.

* *

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS

* *

THE MAXIMUM STRESS OF 6426. OCCURS AT POINT 485F

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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 415	287.	446.	4445.	229.	2950.	1.00	1.00	29.90	2143.
	STR -(										
		>- 415.1	287.	442.	4445.	90.	1153.	1.00	1.00	29.90	1843.
	STR -(										
		>- 415.2	287.	442.	4445.	48.	642.	1.00	1.00	29.90	1802.
	STR -(										
		>- 415.3	287.	429.	4445.	186.	2390.	1.00	1.00	29.90	2027.
	STR -(										
		>- 415.4	287.	429.	4445.	322.	4111.	1.00	1.00	29.90	2433.
	STR -(										
		>- 440	286.	739.	4445.	458.	5817.	1.00	1.00	29.90	2944.
	STR -(										
		>- 440.1	286.	722.	4445.	999.	2542.	1.00	1.00	29.90	2094.
	STR -(										
		>- 455N	286.	684.	4445.	2452.	801.	2.61	2.61	29.90	4030.
	(										
	BEND -(	455M	370.	642.	3674.	2524.	2128.	2.61	2.61	29.90	3990.
	(										
		>- 455F	262.	693.	1537.	2348.	3679.	2.61	2.61	29.90	3628.
	STR -(										
		>- 455F.1	264.	611.	1537.	1288.	1183.	1.00	1.00	29.90	934.
156	STR -(										
		>- 455F.2	264.	611.	1537.	1289.	347.	1.00	1.00	29.90	817.
	STR -(										
		>- 455F.3	265.	527.	1537.	3092.	1134.	1.00	1.00	29.90	1458.
	STR -(										
		>- 460N	266.	321.	1537.	2061.	4494.	2.61	2.61	29.90	4059.
	(										
	BEND -(	460M	314.	275.	2309.	2158.	4399.	2.61	2.61	29.90	4247.
	(										
		>- 460F	205.	363.	4786.	2046.	1796.	2.61	2.61	29.90	4317.
	(										
	BEND -(	470M	258.	277.	2221.	1365.	4541.	2.61	2.61	29.90	4224.
	(										
		>- 470F	185.	330.	1801.	1775.	4483.	2.61	2.61	29.90	4035.
	STR -(										
		>- 470F.1	126.	318.	1801.	3855.	1405.	1.00	1.00	29.90	1798.
	STR -(										
		>- 475	185.	312.	1801.	3235.	1148.	1.00	1.00	29.90	1555.
	STR -(										
		>- 475.1	264.	311.	1801.	2643.	1052.	1.00	1.00	29.90	1351.
	STR -(										
		>- 480N	341.	319.	1801.	1116.	2039.	2.61	2.61	29.90	2305.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	: LONGITUDINAL: STRESS PSI :
		>- 480N	341.	319.	1601.	1116.	2039.	2.61	2.61	29.90	2305.
	BEND -(	480M	257.	390.	682.	1098.	2392.	2.61	2.61	29.90	2132.
		>- 480F	142.	445.	1721.	992.	1471.	2.61	2.61	29.90	1938.
	STR -(	>- 482	161.	574.	1721.	1130.	969.	1.00	1.00	29.90	913.
	STR -(	>- 482.1	193.	681.	1721.	443.	2122.	1.00	1.00	29.90	1111.
	STR -(	>- 482.2	235.	780.	1721.	1328.	4102.	1.00	1.00	29.90	1863.
	STR -(	>- 483	235.	780.	1721.	2537.	6509.	1.00	1.00	29.90	2887.
	STR -(	>- 485N	275.	838.	1721.	6695.	2611.	2.61	2.61	29.90	5794. *
	BEND -(	485M	655.	589.	3158.	7336.	940.	2.61	2.61	29.90	6305. *
		>- 485F	781.	408.	2982.	7514.	1350.	2.61	2.61	29.90	6426. **
	STR -(	>- 490N	944.	442.	2982.	6978.	290.	2.61	2.61	29.90	5954. *
	BEND -(	490M	609.	846.	2176.	6537.	1912.	2.61	2.61	29.90	5606.
		>- 490F	326.	990.	433.	5676.	2616.	2.61	2.61	29.90	4912.
	STR -(	>- 492	330.	1015.	433.	2543.	5436.	1.00	1.00	29.90	2415.
	STR -(	>- 492.1	349.	1095.	433.	1925.	1915.	1.00	1.00	29.90	1104.
	STR -(	>- 492.2	363.	1138.	433.	1316.	2251.	1.00	1.00	29.90	1061.
	STR -(	>- 495N	373.	1156.	433.	6173.	750.	2.61	2.61	29.90	4887.
	BEND -(	495M	759.	951.	779.	7234.	132.	2.61	2.61	29.90	5705.
		>- 495F	1144.	414.	593.	7804.	579.	2.61	2.61	29.90	6153. *
	STR -(	>- 500	1165.	313.	593.	1007.	8371.	1.00	1.00	29.90	3392.
	STR -(	>- 500.1	1224.	309.	593.	467.	7559.	1.00	1.00	29.90	3048.
	STR -(	>- 500.2	1224.	309.	593.	897.	6761.	1.00	1.00	29.90	2747.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 500.2	1224.	309.	593.	897.	6761.	1.00	1.00	29.90	2747.
	STR -(										
		>- 500.3	1267.	304.	593.	1598.	5950.	1.00	1.00	29.90	2484.
	STR -(										
		>- 500.4	1315.	303.	593.	2287.	5108.	1.00	1.00	29.90	2258.
	STR -(										
		>- 500.5	1368.	309.	593.	2949.	4247.	1.00	1.00	29.90	2089.
	STR -(										
		>- 505	1425.	320.	593.	3603.	3431.	1.00	1.00	29.90	2011.
	STR -(										
		>- 510N	1479.	324.	593.	3305.	3644.	2.61	2.61	29.90	3885.
	(										
	BEND -(	510M	931.	1194.	3014.	2627.	2213.	2.61	2.61	29.90	3583.
	(										
		>- 510F	283.	1488.	3719.	1316.	526.	2.61	2.61	29.90	3121.
	STR -(										
		>- 515N	292.	1539.	3719.	599.	2585.	2.61	2.61	29.90	3582.
	(										
	BEND -(	515M	274.	1545.	4997.	579.	615.	2.61	2.61	29.90	3974.
	(										
		>- 515F	159.	1559.	4477.	394.	1806.	2.61	2.61	29.90	3798.
	STR -(										
		>- 520N	153.	1582.	4477.	3622.	763.	2.61	2.61	29.90	4555.
	(										
	BEND -(	520M	1148.	1099.	2630.	4971.	3857.	2.61	2.61	29.90	5347.
	(										
		>- 520F	1554.	335.	1124.	5485.	4752.	2.61	2.61	29.90	5758.
	STR -(										
ANCHR		-- 525	1554.	335.	1124.	5440.	4924.	1.00	1.00	29.90	2979.

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 415.1	.007	.001	.000	.001	.014	.040
	STRAIGHT -(		(23.5)	(.4)	(.0)			
		>- 415.2	.021	.002	.000	.001	.016	.080
	STRAIGHT -(		(58.0)	(1.1)	(.0)			
		>- 415.3	.032	.002	.000	.000	.006	.121
	STRAIGHT -(		(66.5)	(1.3)	(.1)			
		>- 415.4	.026	.002	.000	.001	.017	.161
	STRAIGHT -(		(40.8)	(.8)	(.1)			
		>- 440	.000	.000	.000	.004	.052	.201
	STRAIGHT -(		(.0)	(.0)	(.1)			
		>- 440.1	.073	.004	.000	.002	.086	.249
	STRAIGHT -(		(51.8)	(1.0)	(.1)			
		>- 455D	.168	.000	.000	.013	.094	.298
	(		(117.6)	(.0)	(.2)			
	BEND -(	455M	.208	.005	.003	.047	.099	.312
	(		(128.5)	(1.2)	(.7)			
		>- 455F	.275	.010	.015	.081	.107	.353
	STRAIGHT -(		(130.0)	(2.2)	(3.5)			
		>- 455F.1	.588	.010	.092	.093	.094	.371
	STRAIGHT -(		(127.1)	(2.2)	(21.1)			
		>- 455F.2	.912	.010	.176	.098	.081	.371
	STRAIGHT -(		(148.4)	(2.2)	(39.6)			
		>- 455F.3	1.230	.010	.261	.094	.069	.356
	STRAIGHT -(		(184.9)	(2.2)	(57.8)			
		>- 460D	1.530	.010	.339	.084	.058	.330
	(		(226.0)	(2.2)	(74.8)			
	BEND -(	460M	1.566	.015	.352	.060	.041	.273
	(		(234.4)	(3.3)	(78.0)			
		>- 460F	1.609	.023	.356	.043	.036	.247

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 460F	1.609	.023	.356	.043	.036	.247
	(		(236.9)	(6.2)	(79.1)			
	BEND -(	470M	1.604	.038	.356	.049	.052	.221
	(		(236.1)	(8.3)	(78.2)			
		>- 470F	1.601	.065	.359	.066	.074	.165
	STRAIGHT -(		(235.7)	(12.2)	(76.2)			
		>- 470F.1	1.601	.146	.376	.074	.080	.147
	STRAIGHT -(		(235.7)	(40.9)	(73.1)			
		>- 475	1.601	.220	.400	.082	.085	.132
	STRAIGHT -(		(235.7)	(73.0)	(75.9)			
		>- 475.1	1.601	.285	.427	.090	.089	.119
	STRAIGHT -(		(235.7)	(103.4)	(82.8)			
		>- 480N	1.601	.344	.458	.099	.092	.110
	(		(235.7)	(132.8)	(92.9)			
	BEND -(	480M	1.595	.354	.470	.113	.100	.082
	(		(234.5)	(139.1)	(97.5)			
		>- 480F	1.579	.336	.475	.135	.107	.069
	STRAIGHT -(		(231.0)	(133.8)	(99.9)			
		>- 482	1.557	.300	.475	.138	.107	.064
	STRAIGHT -(		(225.9)	(120.4)	(99.9)			
		>- 482.1	1.500	.198	.475	.140	.103	.051
	STRAIGHT -(		(215.3)	(80.8)	(99.8)			
160		>- 482.2	1.453	.096	.475	.136	.091	.037
	STRAIGHT -(		(212.6)	(39.8)	(99.8)			
		>- 484	1.427	.000	.475	.124	.074	.024
	STRAIGHT -(		(215.9)	(.0)	(99.8)			
		>- 485N	1.426	.006	.475	.123	.073	.023
	(		(216.3)	(2.7)	(99.8)			
	BEND -(	485M	1.431	.025	.471	.098	.099	.026
	(		(218.0)	(10.3)	(99.2)			
		>- 485F	1.440	.028	.446	.091	.186	.019
	STRAIGHT -(		(219.0)	(11.4)	(93.2)			
		>- 490N	1.439	.014	.260	.062	.235	.014
	(		(219.0)	(5.8)	(50.4)			
	BEND -(	490M	1.417	.007	.209	.050	.324	.006
	(		(216.5)	(3.5)	(42.2)			
		>- 490F	1.350	.001	.182	.019	.405	.007
	STRAIGHT -(		(208.4)	(.6)	(39.1)			
		>- 492	1.329	.000	.182	.018	.408	.007
	STRAIGHT -(		(205.9)	(.0)	(39.1)			
		>- 492.1	1.016	.008	.182	.006	.429	.008
	STRAIGHT -(		(174.6)	(7.4)	(39.1)			
		>- 492.2	.750	.009	.182	.008	.427	.010
	STRAIGHT -(		(157.1)	(13.0)	(39.0)			
		>- 495N	.442	.010	.182	.014	.402	.013

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	495N	.402	.010	.182	.014	.402	.013
	(		(160.8)	(16.5)	(39.0)			
	BEND -(	495M	.342	.011	.156	.020	.310	.013
	(		(163.6)	(18.5)	(35.8)			
	>-	495F	.323	.010	.109	.021	.207	.016
	STRAIGHT -(		(164.4)	(14.9)	(27.4)			
	>-	500	.323	.000	.000	.024	.169	.018
	STRAIGHT -(		(164.3)	(.0)	(.0)			
	>-	500.1	.323	.018	.127	.030	.111	.020
	STRAIGHT -(		(164.3)	(23.3)	(39.6)			
	>-	500.2	.323	.035	.204	.036	.060	.017
	STRAIGHT -(		(164.3)	(41.4)	(71.3)			
	>-	500.3	.323	.047	.235	.041	.017	.008
	STRAIGHT -(		(164.2)	(49.3)	(90.2)			
	>-	500.4	.322	.048	.227	.047	.031	.007
	STRAIGHT -(		(164.1)	(44.7)	(93.4)			
	>-	500.5	.322	.034	.186	.053	.063	.026
	STRAIGHT -(		(164.0)	(27.7)	(81.0)			
	>-	505	.322	.000	.117	.058	.090	.050
	STRAIGHT -(		(163.9)	(.0)	(56.5)			
	>-	510N	.322	.008	.102	.059	.094	.054
	(		(163.9)	(5.7)	(51.5)			
161	BEND -(	510M	.313	.018	.081	.049	.132	.095
	(		(161.1)	(11.9)	(44.0)			
	>-	510F	.246	.014	.070	.041	.157	.109
	STRAIGHT -(		(150.5)	(11.5)	(40.0)			
	>-	515N	.204	.004	.070	.043	.154	.129
	(		(116.2)	(4.8)	(40.0)			
	BEND -(	515M	.168	.013	.067	.047	.129	.132
	(		(99.3)	(5.2)	(38.3)			
	>-	515F	.133	.016	.058	.050	.121	.145
	STRAIGHT -(		(79.9)	(9.6)	(32.9)			
	>-	520N	.026	.016	.021	.049	.086	.139
	(		(15.2)	(9.6)	(10.2)			
	BEND -(	520M	.004	.008	.008	.023	.064	.080
	(		(2.6)	(4.9)	(3.8)			
	>-	520F	.000	.001	.001	.002	.006	.007
	STRAIGHT -(		(.0)	(.3)	(.2)			
ANCHOR	--	525	.000	.000	.000	.000	.000	.000

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	415	80.	109.	687.	700.	727.	529.	2052.	2240.
	525	517.	182.	303.	626.	969.	1405.	1703.	2414.
RESTRAINTS:									
	440	246.	0.	0.	246.	0.	0.	0.	0.
	440	0.	1052.	0.	1052.	0.	0.	0.	0.
	455N	0.	809.	0.	809.	0.	0.	0.	0.
	484	0.	486.	0.	486.	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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
492	0.	284.	0.	284.	0.	0.	0.	0.
500	0.	131.	0.	131.	0.	0.	0.	0.
503	0.	0.	718.	718.	0.	0.	0.	0.
505	0.	214.	0.	214.	0.	0.	0.	0.

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* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS *

THE MAXIMUM STRESS OF 6469. OCCURS AT POINT 455N

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.

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(15) 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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 415	687.	135.	2052.	727.	529.	1.00	1.00	29.90	899.
	STR -(	>- 415.1	687.	134.	2052.	286.	205.	1.00	1.00	29.90	835.
	STR -(	>- 415.2	687.	134.	2052.	154.	117.	1.00	1.00	29.90	827.
	STR -(	>- 415.3	687.	130.	2052.	590.	428.	1.00	1.00	29.90	874.
	STR -(	>- 415.4	687.	130.	2052.	1022.	727.	1.00	1.00	29.90	965.
	STR -(	>- 440	686.	969.	2052.	1450.	1017.	1.00	1.00	29.90	1088.
	STR -(	>- 440.1	686.	966.	2052.	3164.	1119.	1.00	1.00	29.90	1578.
	STR -(	>- 455N	686.	250.	2052.	7767.	1883.	2.61	2.61	29.90	6469. **
	BEND -(	455M	583.	440.	2820.	7637.	377.	2.61	2.61	29.90	6390. *
	(	>- 455F	146.	716.	2113.	7082.	1804.	2.61	2.61	29.90	5964. *
	STR -(	>- 455F.1	149.	710.	2113.	1002.	4245.	1.00	1.00	29.90	1945.
	STR -(	>- 455F.2	153.	666.	2113.	416.	1584.	1.00	1.00	29.90	1073.
	STR -(	>- 455F.3	157.	582.	2113.	551.	822.	1.00	1.00	29.90	936.
	STR -(	>- 460N	164.	348.	2113.	2682.	847.	2.61	2.61	29.90	2758.
	BEND -(	460M	355.	149.	1280.	2924.	1898.	2.61	2.61	29.90	2911.
	(	>- 460F	342.	176.	692.	2909.	2117.	2.61	2.61	29.90	2906.
	BEND -(	470M	222.	239.	2293.	2182.	1790.	2.61	2.61	29.90	2851.
	(	>- 470F	79.	317.	2705.	2398.	951.	2.61	2.61	29.90	2931.
	STR -(	>- 470F.1	169.	257.	2705.	1212.	2858.	1.00	1.00	29.90	1652.
	STR -(	>- 475	152.	210.	2705.	1576.	3101.	1.00	1.00	29.90	1768.
	STR -(	>- 475.1	193.	178.	2705.	1955.	3158.	1.00	1.00	29.90	1844.
	STR -(	>- 480N	285.	203.	2705.	3076.	2328.	2.61	2.61	29.90	3694.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 480N	285.	203.	2705.	3076.	2328.	2.61	2.61	29.90	3694.
	BEND -(	480M	205.	284.	3584.	2919.	428.	2.61	2.61	29.90	3640.
		>- 480F	134.	323.	2502.	2665.	2519.	2.61	2.61	29.90	3481.
	STR -(										
		>- 482	168.	342.	2502.	2345.	2321.	1.00	1.00	29.90	1662.
	STR -(										
		>- 482.1	220.	364.	2502.	1907.	1400.	1.00	1.00	29.90	1382.
	STR -(										
		>- 482.2	377.	344.	2502.	1529.	1139.	1.00	1.00	29.90	1262.
	STR -(										
		>- 484	420.	482.	2502.	1214.	1805.	1.00	1.00	29.90	1330.
	STR -(										
		>- 485N	445.	473.	2502.	1863.	1307.	2.61	2.61	29.90	2652.
	BEND -(	485M	277.	587.	2017.	2064.	573.	2.61	2.61	29.90	2775.
		>- 485F	281.	586.	1775.	2209.	2027.	2.61	2.61	29.90	2732.
	STR -(										
		>- 490N	224.	630.	1775.	3378.	448.	2.61	2.61	29.90	3013.
	BEND -(	490M	454.	490.	1117.	3666.	1216.	2.61	2.61	29.90	3152.
		>- 490F	502.	441.	211.	3659.	1309.	2.61	2.61	29.90	3052.
	STR -(										
		>- 492	501.	241.	211.	1217.	3617.	1.00	1.00	29.90	1534.
	STR -(										
		>- 492.1	501.	244.	211.	662.	3122.	1.00	1.00	29.90	1302.
	STR -(										
		>- 492.2	502.	247.	211.	515.	2857.	1.00	1.00	29.90	1168.
	STR -(										
		>- 495N	504.	245.	211.	2854.	235.	2.61	2.61	29.90	2251.
	BEND -(	495M	441.	346.	297.	3024.	71.	2.61	2.61	29.90	2383.
		>- 495F	221.	515.	219.	3383.	254.	2.61	2.61	29.90	2665.
	STR -(										
		>- 500	229.	244.	219.	478.	4574.	1.00	1.00	29.90	1647.
	STR -(										
		>- 500.1	250.	227.	219.	493.	3652.	1.00	1.00	29.90	1560.
	STR -(										
		>- 500.2	250.	227.	219.	661.	3216.	1.00	1.00	29.90	1321.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 500.2	250.	227.	219.	661.	3218.	1.00	1.00	29.90	1321.
	STR -(										
		>- 500.3	261.	203.	219.	817.	2625.	1.00	1.00	29.90	1107.
	STR -(										
		>- 500.4	319.	195.	219.	902.	2003.	1.00	1.00	29.90	886.
	STR -(										
		>- 500.5	362.	215.	219.	950.	1369.	1.00	1.00	29.90	675.
	STR -(										
		>- 505	408.	246.	219.	1030.	1077.	1.00	1.00	29.90	604.
	STR -(										
		>- 510N	451.	317.	219.	1114.	1077.	2.61	2.61	29.90	1227.
	BEND -(	510M	401.	379.	943.	1034.	689.	2.61	2.61	29.90	1223.
		>- 510F	256.	488.	1189.	724.	210.	2.61	2.61	29.90	1104.
	STR -(										
		>- 515N	282.	529.	1189.	604.	694.	2.61	2.61	29.90	1179.
	BEND -(	515M	326.	504.	1450.	660.	296.	2.61	2.61	29.90	1270.
		>- 515F	136.	570.	1254.	482.	571.	2.61	2.61	29.90	1145.
	STR -(										
		>- 520N	182.	599.	1254.	1233.	596.	2.61	2.61	29.90	1456.
	BEND -(	520M	450.	435.	949.	1653.	1196.	2.61	2.61	29.90	1764.
		>- 520F	517.	353.	969.	1762.	1321.	2.61	2.61	29.90	1686.
	STR -(										
ANCHR		-- 525	517.	353.	969.	1703.	1409.	1.00	1.00	29.90	969.

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DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 415.1	.001	.002	.000	.004	.003	.019
	STRAIGHT -(		(2.9)	(1.5)	(.1)			
		>- 415.2	.004	.005	.000	.004	.003	.037
	STRAIGHT -(		(8.1)	(4.0)	(.2)			
		>- 415.3	.006	.008	.000	.001	.001	.056
	STRAIGHT -(		(11.0)	(4.9)	(.3)			
		>- 415.4	.005	.007	.000	.004	.003	.074
	STRAIGHT -(		(8.8)	(3.4)	(.5)			
		>- 440	.000	.000	.000	.013	.009	.093
	STRAIGHT -(		(.0)	(.0)	(.6)			
		>- 440.1	.013	.014	.001	.006	.016	.115
	STRAIGHT -(		(19.5)	(4.0)	(.7)			
		>- 455N	.033	.000	.001	.040	.025	.137
	(		(43.8)	(.0)	(.8)			
	BEND -(	455M	.037	.017	.009	.146	.039	.139
	(		(46.6)	(4.5)	(2.9)			
		>- 455F	.047	.031	.046	.247	.041	.154
	STRAIGHT -(		(44.4)	(8.0)	(12.1)			
		>- 455F.1	.170	.031	.282	.288	.059	.164
	STRAIGHT -(		(43.3)	(8.0)	(66.6)			
		>- 455F.2	.313	.031	.545	.309	.077	.168
	STRAIGHT -(		(67.8)	(8.0)	(120.4)			
		>- 455F.3	.459	.031	.818	.311	.096	.168
	STRAIGHT -(		(100.2)	(8.0)	(172.9)			
		>- 460N	.604	.031	1.086	.299	.116	.165
	(		(131.4)	(7.9)	(227.9)			
	BEND -(	460M	.625	.052	1.138	.261	.126	.150
	(		(135.1)	(10.9)	(239.2)			
		>- 460F	.612	.096	1.157	.221	.151	.140

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	466F	.612	.096	1.157	.221	.151	.140
	(		(130.6)	(21.1)	(243.4)			
	BEND -(	470M	.585	.123	1.144	.169	.180	.147
	(		(123.1)	(28.8)	(240.6)			
	>-	470F	.571	.110	1.108	.160	.212	.149
	STRAIGHT -(		(119.8)	(27.5)	(233.0)			
	>-	470F.1	.571	.039	.989	.164	.223	.145
	STRAIGHT -(		(119.8)	(16.9)	(209.0)			
	>-	475	.571	.059	.864	.149	.237	.139
	STRAIGHT -(		(119.8)	(20.9)	(185.9)			
	>-	475.1	.571	.125	.738	.134	.250	.131
	STRAIGHT -(		(119.8)	(33.9)	(165.8)			
	>-	480N	.571	.191	.605	.119	.263	.122
	(		(119.8)	(48.7)	(149.3)			
	BEND -(	480M	.551	.203	.554	.117	.304	.104
	(		(114.6)	(51.7)	(144.9)			
	>-	480F	.498	.191	.530	.097	.342	.103
	STRAIGHT -(		(101.1)	(49.1)	(143.5)			
	>-	482	.421	.166	.530	.092	.347	.096
	STRAIGHT -(		(81.7)	(43.4)	(143.5)			
	>-	482.1	.256	.103	.530	.080	.358	.076
	STRAIGHT -(		(54.2)	(28.0)	(143.5)			
	>-	482.2	.300	.048	.530	.070	.362	.057
169	STRAIGHT -(		(87.2)	(13.5)	(143.4)			
	>-	484	.507	.000	.530	.062	.360	.037
	STRAIGHT -(		(134.3)	(.0)	(143.3)			
	>-	485N	.524	.003	.530	.061	.360	.036
	(		(137.6)	(.9)	(143.3)			
	BEND -(	485M	.563	.011	.503	.053	.346	.031
	(		(146.1)	(3.4)	(137.6)			
	>-	485F	.608	.011	.441	.054	.330	.012
	STRAIGHT -(		(147.7)	(3.7)	(118.9)			
	>-	490N	.608	.006	.155	.037	.314	.003
	(		(147.7)	(2.3)	(53.3)			
	BEND -(	490M	.566	.004	.102	.029	.272	.007
	(		(146.7)	(1.8)	(57.4)			
	>-	490F	.541	.001	.082	.012	.230	.012
	STRAIGHT -(		(140.8)	(.5)	(58.3)			
	>-	492	.530	.000	.082	.012	.228	.012
	STRAIGHT -(		(136.4)	(.0)	(58.3)			
	>-	492.1	.365	.006	.082	.006	.211	.012
	STRAIGHT -(		(109.9)	(7.4)	(58.4)			
	>-	492.2	.225	.009	.082	.003	.194	.013
	STRAIGHT -(		(63.0)	(14.9)	(58.4)			
	>-	495N	.112	.010	.082	.004	.177	.013

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	495A	.112	.010	.082	.004	.177	.013
	(		(92.6)	(22.8)	(58.3)			
	BEND -(	495B	.098	.010	.071	.006	.137	.013
	(		(98.4)	(23.0)	(53.4)			
	>-	495F	.094	.007	.049	.006	.094	.013
	STRAIGHT -(		(100.5)	(18.6)	(40.4)			
	>-	500	.094	.000	.000	.007	.076	.013
	STRAIGHT -(		(100.5)	(.0)	(.0)			
	>-	500.1	.094	.011	.055	.010	.046	.011
	STRAIGHT -(		(100.5)	(29.2)	(58.5)			
	>-	500.2	.094	.019	.085	.012	.022	.007
	STRAIGHT -(		(100.5)	(51.0)	(105.7)			
	>-	500.3	.094	.022	.094	.014	.009	.002
	STRAIGHT -(		(100.5)	(59.2)	(132.4)			
	>-	500.4	.094	.021	.086	.016	.019	.005
	STRAIGHT -(		(100.4)	(51.5)	(133.5)			
	>-	500.5	.094	.013	.066	.018	.029	.012
	STRAIGHT -(		(100.4)	(30.0)	(114.5)			
	>-	505	.094	.000	.039	.020	.034	.018
	STRAIGHT -(		(100.3)	(.0)	(94.9)			
	>-	510A	.094	.003	.034	.020	.034	.020
	(		(100.3)	(5.5)	(93.5)			
	BEND -(	510B	.092	.006	.028	.017	.039	.031
	(		(100.3)	(10.7)	(92.5)			
	>-	510F	.065	.006	.025	.015	.044	.035
	STRAIGHT -(		(97.8)	(10.0)	(92.1)			
	>-	515A	.064	.003	.025	.014	.043	.042
	(		(89.1)	(9.0)	(92.1)			
	BEND -(	515B	.055	.004	.024	.015	.036	.043
	(		(82.2)	(8.7)	(90.1)			
	>-	515F	.044	.005	.021	.019	.034	.048
	STRAIGHT -(		(68.3)	(7.8)	(78.2)			
	>-	520A	.008	.005	.007	.019	.025	.046
	(		(12.8)	(7.8)	(17.1)			
	BEND -(	520B	.001	.003	.002	.008	.018	.026
	(		(2.1)	(3.9)	(4.5)			
	>-	520F	.000	.000	.000	.002	.002	.002
	STRAIGHT -(		(.0)	(.3)	(.4)			
ANCHOR	--	525	.000	.000	.000	.000	.000	.000

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	415	206.	68.	81.	232.	327.	1347.	301.	1419.
	525	114.	63.	115.	174.	416.	370.	316.	640.
RESTRAINTS:									
171	445	437.	0.	0.	437.	0.	0.	0.	0.
	440	0.	101.	0.	101.	0.	0.	0.	0.
	4550	0.	220.	0.	220.	0.	0.	0.	0.
	484	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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	FORCES (POUNDS) RESULTANT	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z	MOMENTS (FOOT-POUNDS) RESULTANT
RESTRAINTS(CONTINUED) -								
492	0.	37.	0.	37.	0.	0.	0.	0.
500	0.	135.	0.	135.	0.	0.	0.	0.
500	0.	0.	116.	116.	0.	0.	0.	0.
505	0.	160.	0.	160.	0.	0.	0.	0.

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*                                                     *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS    *
* ------------------------------------------------    *
*                                                     *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 1373. OCCURS AT POINT 480M

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.

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(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) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 415	81.	217.	301.	327.	1347.	1.00	1.00	29.90	569.
	STR -(	>- 415.1	81.	209.	301.	52.	513.	1.00	1.00	29.90	239.
	STR -(	>- 415.2	81.	209.	301.	162.	308.	1.00	1.00	29.90	184.
	STR -(	>- 415.3	81.	193.	301.	214.	1086.	1.00	1.00	29.90	460.
	STR -(	>- 415.4	81.	180.	301.	103.	1803.	1.00	1.00	29.90	735.
	STR -(	>- 440	81.	283.	301.	194.	2468.	1.00	1.00	29.90	1001.
	STR -(	>- 440.1	81.	243.	301.	243.	1156.	1.00	1.00	29.90	489.
	STR -(	>- 455N	81.	263.	301.	527.	323.	2.61	2.61	29.90	539.
	BEND -(	455M	154.	228.	346.	495.	337.	2.61	2.61	29.90	543.
	(	>- 455F	201.	189.	397.	446.	399.	2.61	2.61	29.90	563.
	STR -(	>- 455F.1	200.	138.	397.	764.	197.	1.00	1.00	29.90	354.
	STR -(	>- 455F.2	200.	92.	397.	940.	243.	1.00	1.00	29.90	421.
	STR -(	>- 455F.3	199.	75.	397.	987.	327.	1.00	1.00	29.90	446.
	STR -(	>- 460N	198.	101.	397.	277.	1016.	2.61	2.61	29.90	882.
	BEND -(	460M	142.	172.	724.	304.	826.	2.61	2.61	29.90	894.
	(	>- 460F	192.	210.	1034.	370.	449.	2.61	2.61	29.90	930.
	BEND -(	470M	104.	209.	1068.	339.	405.	2.61	2.61	29.90	934.
	(	>- 470F	67.	224.	681.	280.	801.	2.61	2.61	29.90	853.
	STR -(	>- 470F.1	75.	228.	681.	388.	296.	1.00	1.00	29.90	336.
	STR -(	>- 475	84.	202.	681.	387.	620.	1.00	1.00	29.90	401.
	STR -(	>- 475.1	94.	161.	681.	635.	980.	1.00	1.00	29.90	542.
	STR -(	>- 480N	102.	124.	681.	1323.	801.	2.61	2.61	29.90	1325. *

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 480N	102.	124.	681.	1323.	801.	2.61	2.61	29.90	1325. *
	BEND -(	480M	155.	43.	197.	1395.	1040.	2.61	2.61	29.90	1373. **
		>- 480F	121.	106.	811.	1359.	690.	2.61	2.61	29.90	1354. *
	STR -(	>- 482	107.	117.	811.	644.	1238.	1.00	1.00	29.90	648.
	STR -(	>- 482.1	89.	154.	811.	313.	875.	1.00	1.00	29.90	495.
	STR -(	>- 482.2	75.	221.	811.	299.	573.	1.00	1.00	29.90	416.
	STR -(	>- 484	75.	221.	811.	942.	473.	1.00	1.00	29.90	534.
	STR -(	>- 485N	91.	158.	811.	476.	973.	2.61	2.61	29.90	1061.
	BEND -(	485M	78.	164.	1304.	480.	240.	2.61	2.61	29.90	1105.
		>- 485F	98.	154.	1126.	463.	661.	2.61	2.61	29.90	1086.
	STR -(	>- 490N	86.	166.	1126.	552.	253.	2.61	2.61	29.90	1003.
175	BEND -(	490M	133.	131.	744.	589.	821.	2.61	2.61	29.90	984.
		>- 490F	118.	145.	229.	546.	984.	2.61	2.61	29.90	900.
	STR -(	>- 492	125.	123.	229.	956.	524.	1.00	1.00	29.90	447.
	STR -(	>- 492.1	134.	130.	229.	674.	226.	1.00	1.00	29.90	300.
	STR -(	>- 492.2	143.	133.	229.	389.	269.	1.00	1.00	29.90	211.
	STR -(	>- 495N	151.	134.	229.	606.	97.	2.61	2.61	29.90	514.
	BEND -(	495M	161.	122.	149.	661.	163.	2.61	2.61	29.90	546.
		>- 495F	100.	175.	49.	635.	209.	2.61	2.61	29.90	525.
	STR -(	>- 500	95.	147.	49.	326.	617.	1.00	1.00	29.90	281.
	STR -(	>- 500.1	93.	[illegible]	49.	540.	623.	1.00	1.00	29.90	331.
	STR -(	>- 500.2	93.	164.	49.	897.	695.	1.00	1.00	29.90	456.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 500.2	93.	108.	49.	697.	695.	1.00	1.00	29.90	456.
	STR -(										
		>- 500.3	92.	44.	49.	1003.	720.	1.00	1.00	29.90	496.
	STR -(										
		>- 500.4	94.	57.	49.	799.	630.	1.00	1.00	29.90	409.
	STR -(										
		>- 500.5	97.	124.	49.	351.	422.	1.00	1.00	29.90	221.
	STR -(										
		>- 505	101.	166.	49.	385.	212.	1.00	1.00	29.90	177.
	STR -(										
		>- 510N	106.	113.	49.	215.	386.	2.61	2.61	29.90	349.
	BEND -(	510M	115.	104.	292.	209.	264.	2.61	2.61	29.90	349.
		>- 510F	93.	124.	397.	149.	64.	2.61	2.61	29.90	336.
	STR -(										
		>- 515N	107.	128.	397.	215.	185.	2.61	2.61	29.90	382.
	BEND -(	515M	118.	118.	435.	234.	121.	2.61	2.61	29.90	399.
		>- 515F	63.	154.	312.	174.	273.	2.61	2.61	29.90	353.
	STR -(										
		>- 520N	63.	162.	312.	227.	279.	2.61	2.61	29.90	373.
	BEND -(	520M	103.	140.	359.	300.	329.	2.61	2.61	29.90	448.
		>- 520F	114.	131.	416.	323.	331.	2.61	2.61	29.90	487.
	STR -(										
ANCHR		-- 525	114.	131.	416.	316.	370.	1.00	1.00	29.90	257.

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 415.1	.003	.001	.000	.001	.006	.003
	STRAIGHT -(		(5.9)	(24.9)	(.0)			
		>- 415.2	.010	.002	.000	.001	.007	.005
	STRAIGHT -(		(17.3)	(61.2)	(.1)			
		>- 415.3	.014	.002	.000	.000	.002	.008
	STRAIGHT -(		(25.3)	(69.5)	(.1)			
		>- 415.4	.012	.001	.000	.001	.008	.011
	STRAIGHT -(		(21.9)	(40.7)	(.2)			
		>- 440	.000	.000	.000	.001	.023	.014
	STRAIGHT -(		(.0)	(.0)	(.2)			
		>- 440.1	.032	.001	.000	.000	.038	.017
	STRAIGHT -(		(55.4)	(14.8)	(.2)			
177		>- 455B	.074	.000	.000	.003	.043	.020
	(		(126.3)	(.0)	(.3)			
	BEND -(	455M	.081	.001	.001	.010	.042	.021
	(		(137.4)	(3.5)	(1.5)			
		>- 455F	.083	.002	.003	.016	.041	.025
	STRAIGHT -(		(137.7)	(4.9)	(5.3)			
		>- 455F.1	.077	.002	.018	.018	.040	.028
	STRAIGHT -(		(111.1)	(5.0)	(28.2)			
		>- 455F.2	.075	.002	.034	.018	.039	.032
	STRAIGHT -(		(79.5)	(5.0)	(51.7)			
		>- 455F.3	.079	.002	.049	.017	.038	.036
	STRAIGHT -(		(45.7)	(5.1)	(72.9)			
		>- 460B	.091	.002	.063	.016	.038	.039
	(		(22.6)	(5.2)	(91.5)			
	BEND -(	460M	.095	.003	.065	.015	.037	.046
	(		(24.2)	(6.6)	(95.0)			
		>- 460F	.096	.005	.066	.016	.036	.049

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	460F	.096	.005	.066	.016	.036	.049
	(		(26.2)	(11.0)	(96.3)			
	BEND -(	470M	.096	.006	.064	.018	.039	.050
	(		(32.0)	(14.2)	(91.8)			
	>-	470F	.097	.009	.057	.018	.041	.055
	STRAIGHT -(		(35.6)	(17.8)	(79.9)			
	>-	470F.1	.097	.038	.040	.022	.041	.056
	STRAIGHT -(		(35.6)	(54.7)	(43.2)			
	>-	475	.097	.068	.031	.025	.039	.056
	STRAIGHT -(		(35.6)	(98.1)	(15.2)			
	>-	475.1	.097	.097	.034	.028	.036	.054
	STRAIGHT -(		(35.6)	(139.5)	(32.5)			
	>-	480B	.097	.125	.045	.032	.031	.051
	(		(35.6)	(179.4)	(60.2)			
	BEND -(	480M	.096	.130	.048	.037	.015	.039
	(		(37.5)	(187.9)	(67.3)			
	>-	480F	.095	.125	.049	.048	.014	.033
	STRAIGHT -(		(37.8)	(180.8)	(68.5)			
	>-	482	.094	.113	.049	.049	.015	.031
	STRAIGHT -(		(34.5)	(162.6)	(68.5)			
	>-	482.1	.089	.075	.049	.052	.020	.025
	STRAIGHT -(		(28.0)	(109.2)	(68.5)			
	>-	482.2	.087	.037	.049	.052	.023	.018
	STRAIGHT -(		(40.1)	(53.7)	(68.5)			
	>-	484	.089	.000	.049	.048	.024	.012
	STRAIGHT -(		(60.4)	(.0)	(68.5)			
	>-	485B	.090	.003	.049	.048	.024	.012
	(		(62.0)	(3.7)	(68.5)			
	BEND -(	485M	.091	.010	.047	.039	.025	.012
	(		(67.0)	(13.9)	(66.0)			
	>-	485F	.093	.011	.043	.037	.026	.008
	STRAIGHT -(		(68.6)	(15.3)	(59.1)			
	>-	490B	.093	.005	.021	.026	.026	.005
	(		(68.6)	(8.3)	(27.5)			
	BEND -(	490M	.091	.003	.016	.021	.027	.003
	(		(67.0)	(5.7)	(23.6)			
	>-	490F	.088	.000	.014	.010	.029	.006
	STRAIGHT -(		(61.9)	(1.4)	(23.1)			
	>-	492	.084	.000	.014	.009	.029	.006
	STRAIGHT -(		(60.2)	(.0)	(23.1)			
	>-	492.1	.063	.005	.014	.005	.030	.007
	STRAIGHT -(		(35.9)	(16.9)	(23.1)			
	>-	492.2	.042	.008	.014	.004	.029	.009
	STRAIGHT -(		(15.0)	(36.9)	(23.1)			
	>-	495B	.023	.010	.014	.004	.027	.010

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 495N	.023	.010	.014	.004	.027	.010
	(		(19.5)	(53.6)	(23.0)			
	BEND -(	495M	.020	.010	.013	.003	.021	.011
	(		(22.1)	(53.2)	(22.3)			
		>- 495F	.019	.008	.009	.003	.017	.013
	STRAIGHT -(		(22.2)	(42.3)	(18.1)			
		>- 500	.019	.000	.000	.003	.015	.014
	STRAIGHT -(		(22.2)	(.0)	(.0)			
		>- 500.1	.019	.012	.012	.003	.012	.012
	STRAIGHT -(		(22.3)	(66.9)	(27.8)			
		>- 500.2	.019	.020	.021	.003	.007	.007
	STRAIGHT -(		(22.3)	(116.2)	(49.7)			
		>- 500.3	.019	.023	.025	.003	.002	.001
	STRAIGHT -(		(22.3)	(132.7)	(61.5)			
		>- 500.4	.019	.020	.024	.003	.003	.007
	STRAIGHT -(		(22.2)	(111.9)	(61.1)			
		>- 500.5	.019	.011	.019	.004	.007	.011
	STRAIGHT -(		(22.2)	(61.6)	(49.8)			
		>- 505	.019	.000	.012	.004	.009	.012
	STRAIGHT -(		(22.2)	(.0)	(32.7)			
		>- 510N	.019	.002	.010	.004	.009	.011
	(		(22.2)	(10.0)	(29.9)			
	BEND -(	510M	.018	.003	.009	.004	.010	.009
	(		(21.0)	(18.5)	(27.4)			
		>- 510F	.016	.003	.008	.005	.010	.008
	STRAIGHT -(		(17.9)	(17.7)	(27.0)			
		>- 515N	.012	.001	.008	.005	.010	.008
	(		(12.1)	(6.4)	(26.9)			
	BEND -(	515M	.010	.001	.008	.005	.009	.008
	(		(11.2)	(2.7)	(25.6)			
		>- 515F	.008	.001	.007	.007	.008	.009
	STRAIGHT -(		(9.8)	(1.3)	(21.5)			
		>- 520N	.002	.001	.002	.006	.006	.008
	(		(2.0)	(1.3)	(4.5)			
	BEND -(	520M	.000	.000	.001	.003	.005	.005
	(		(.4)	(.7)	(1.5)			
		>- 520F	.000	.000	.000	.001	.000	.000
	STRAIGHT -(		(.0)	(.1)	(.1)			
ANCHOR		-- 525	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
415	496.	133.	748.	908.	829.	3286.	4905.	5962.
525	1641.	246.	440.	1717.	1541.	5135.	5710.	7832.
RESTRAINTS:								
440	1207.	0.	0.	1207.	0.	0.	0.	0.
440	0.	1108.	0.	1108.	0.	0.	0.	0.
4550	0.	863.	0.	863.	0.	0.	0.	0.
484	0.	509.	0.	509.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
492	0.	321.	0.	321.	0.	0.	0.	0.
500	0.	391.	0.	391.	0.	0.	0.	0.
500	0.	0.	923.	923.	0.	0.	0.	0.
505	0.	344.	0.	344.	0.	0.	0.	0.

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*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
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THE MAXIMUM STRESS OF 7640. OCCURS AT POINT 455N

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.

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(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) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 415	748.	514.	4905.	829.	3286.	1.00	1.00	29.90	2392.
	STR -(	>- 415.1	748.	507.	4905.	304.	1278.	1.00	1.00	29.90	2038.
	STR -(	>- 415.2	748.	507.	4905.	228.	722.	1.00	1.00	29.90	1992.
	STR -(	>- 415.3	748.	463.	4905.	654.	2659.	1.00	1.00	29.90	2254.
	STR -(	>- 415.4	748.	483.	4905.	1076.	4548.	1.00	1.00	29.90	2719.
	STR -(	>- 440	748.	1251.	4905.	1533.	6400.	1.00	1.00	29.90	3294.
	STR -(	>- 440.1	748.	1230.	4905.	3326.	3009.	1.00	1.00	29.90	2667.
	STR -(	>- 455N	748.	774.	4905.	8162.	2072.	2.61	2.61	29.90	7640. **
	BEND -(	455M	708.	811.	4804.	8058.	2187.	2.61	2.61	29.90	7553. *
	(	>- 455F	361.	1014.	2642.	7474.	4117.	2.61	2.61	29.90	7004. *
	STR -(	>- 455F.1	363.	985.	2642.	1802.	4411.	1.00	1.00	29.90	2186.
	STR -(	>- 455F.2	364.	909.	2642.	1649.	1640.	1.00	1.00	29.90	1412.
	STR -(	>- 455F.3	366.	789.	2642.	3292.	1438.	1.00	1.00	29.90	1790.
	STR -(	>- 460N	370.	484.	2642.	3393.	4685.	2.61	2.61	29.90	4986.
	BEND -(	460M	494.	357.	2737.	3647.	4862.	2.61	2.61	29.90	5226.
	(	>- 460F	405.	455.	4977.	3584.	2801.	2.61	2.61	29.90	5286.
	BEND -(	470M	356.	421.	3366.	2891.	4898.	2.61	2.61	29.90	5181.
	(	>- 470F	212.	509.	3320.	2996.	4652.	2.61	2.61	29.90	5059.
	STR -(	>- 470F.1	182.	476.	3320.	4059.	3199.	1.00	1.00	29.90	2465.
	STR -(	>- 475	212.	444.	3320.	3619.	3365.	1.00	1.00	29.90	2389.
	STR -(	>- 475.1	283.	416.	3320.	3346.	3470.	1.00	1.00	29.90	2349.
	STR -(	>- 480N	456.	398.	3320.	3530.	3197.	2.61	2.61	29.90	4551.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 480N	456.	398.	3320.	3530.	3197.	2.61	2.61	29.90	4551.
	BEND -(	480M	363.	480.	3654.	3416.	2643.	2.61	2.61	29.90	4436.
		>- 480F	230.	560.	3143.	3152.	2998.	2.61	2.61	29.90	4208.
	STR -(										
		>- 482	247.	613.	3143.	2682.	2803.	1.00	1.00	29.90	2004.
	STR -(										
		>- 482.1	363.	799.	3143.	1983.	2689.	1.00	1.00	29.90	1841.
	STR -(										
		>- 482.2	451.	861.	3143.	2047.	4296.	1.00	1.00	29.90	2288.
	STR -(										
		>- 484	451.	881.	3143.	2967.	6771.	1.00	1.00	29.90	3224.
	STR -(										
		>- 485N	531.	975.	3143.	6966.	3078.	2.61	2.61	29.90	6460.
	BEND -(	485M	716.	848.	4420.	7636.	1127.	2.61	2.61	29.90	6977. *
		>- 485F	836.	730.	3648.	7846.	2524.	2.61	2.61	29.90	7067. *
	STR -(										
		>- 490N	974.	787.	3648.	7772.	590.	2.61	2.61	29.90	6747.
	BEND -(	490M	771.	986.	2557.	7518.	2410.	2.61	2.61	29.90	6506.
		>- 490F	610.	1093.	533.	6775.	3087.	2.61	2.61	29.90	5852.
	STR -(										
		>- 492	617.	1066.	533.	2977.	6550.	1.00	1.00	29.90	2895.
	STR -(										
		>- 492.1	625.	1129.	533.	2215.	3670.	1.00	1.00	29.90	1733.
	STR -(										
		>- 492.2	636.	1172.	533.	1466.	3648.	1.00	1.00	29.90	1592.
	STR -(										
		>- 495N	645.	1191.	533.	6828.	792.	2.61	2.61	29.90	5405.
	BEND -(	495M	493.	1019.	847.	7868.	222.	2.61	2.61	29.90	6207.
		>- 495F	1159.	688.	634.	8529.	666.	2.61	2.61	29.90	6726.
	STR -(										
		>- 500	1211.	423.	634.	1161.	9559.	1.00	1.00	29.90	3872.
	STR -(										
		>- 500.1	1252.	393.	634.	862.	8506.	1.00	1.00	29.90	3440.
	STR -(										
		>- 500.2	1252.	398.	634.	1430.	7520.	1.00	1.00	29.90	3082.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 500.2	1252.	398.	634.	1430.	7520.	1.00	1.00	29.90	3082.
	STR -(										
		>- 500.3	1301.	366.	634.	2056.	6543.	1.00	1.00	29.90	2764.
	STR -(										
		>- 500.4	1357.	365.	634.	2585.	5523.	1.00	1.00	29.90	2460.
	STR -(										
		>- 500.5	1419.	396.	634.	3116.	4483.	1.00	1.00	29.90	2206.
	STR -(										
		>- 505	1486.	436.	634.	3767.	3603.	1.00	1.00	29.90	2107.
	STR -(										
		>- 510N	1550.	467.	634.	3494.	3819.	2.61	2.61	29.90	4089.
	(										
	BEND -(	510M	1021.	1257.	3172.	2831.	2333.	2.61	2.61	29.90	3802.
	(										
		>- 510F	393.	1571.	3925.	1509.	570.	2.61	2.61	29.90	3327.
	STR -(										
		>- 515N	420.	1633.	3925.	877.	2683.	2.61	2.61	29.90	3790.
	(										
	BEND -(	515M	442.	1627.	5221.	908.	694.	2.61	2.61	29.90	4191.
	(										
		>- 515F	253.	1667.	4660.	646.	1914.	2.61	2.61	29.90	3982.
	STR -(										
		>- 520N	246.	1699.	4660.	3833.	1008.	2.61	2.61	29.90	4796.
	(										
	BEND -(	520M	1238.	1190.	2819.	5247.	4052.	2.61	2.61	29.90	5648.
	(										
		>- 520F	1641.	504.	1541.	5770.	4944.	2.61	2.61	29.90	6079.
	STR -(										
ANCHR		-- 525	1641.	504.	1541.	5710.	5135.	1.00	1.00	29.90	3143.

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 415	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 415.1	.003	.002	.000	.004	.016	.044
	STRAIGHT -(		(24.4)	(24.9)	(.1)			
		>- 415.2	.024	.006	.000	.004	.018	.089
	STRAIGHT -(		(61.0)	(61.3)	(.2)			
		>- 415.3	.035	.008	.000	.002	.006	.133
	STRAIGHT -(		(72.0)	(69.7)	(.4)			
		>- 415.4	.031	.007	.000	.005	.019	.177
	STRAIGHT -(		(47.1)	(46.9)	(.5)			
		>- 440	.000	.000	.001	.014	.057	.222
	STRAIGHT -(		(.0)	(.0)	(.6)			
		>- 440.1	.081	.014	.001	.006	.096	.275
	STRAIGHT -(		(78.3)	(15.4)	(.8)			
186		>- 455N	.187	.000	.001	.042	.106	.329
	(		(178.0)	(.0)	(.9)			
	BEND -(	455M	.226	.018	.010	.154	.114	.343
	(		(193.8)	(5.8)	(3.4)			
		>- 455F	.291	.032	.049	.261	.121	.386
	STRAIGHT -(		(194.5)	(9.6)	(13.7)			
		>- 455F.1	.617	.032	.297	.303	.117	.406
	STRAIGHT -(		(174.3)	(9.7)	(75.3)			
		>- 455F.2	.967	.032	.574	.324	.119	.408
	STRAIGHT -(		(181.9)	(9.7)	(136.9)			
		>- 455F.3	1.315	.032	.860	.326	.125	.395
	STRAIGHT -(		(215.2)	(9.7)	(196.3)			
		>- 460N	1.647	.032	1.139	.311	.135	.371
	(		(262.4)	(9.7)	(256.7)			
	BEND -(	460M	1.709	.054	1.193	.268	.137	.315
	(		(271.6)	(13.2)	(268.9)			
		>- 460F	1.720	.099	1.212	.225	.160	.288

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION		LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>-	468F	1.724	.099	1.212	.225	.160	.288
		(		(271.7)	(24.5)	(273.5)			
	BEND	-(	470B	1.710	.129	1.200	.197	.192	.270
		(		(266.2)	(33.2)	(269.1)			
		>-	470F	1.703	.129	1.166	.192	.228	.229
	STRAIGHT	-(		(266.8)	(35.0)	(257.8)			
		>-	470F.1	1.703	.155	1.059	.181	.241	.214
	STRAIGHT	-(		(266.8)	(70.3)	(225.6)			
		>-	475	1.703	.238	.952	.172	.255	.199
	STRAIGHT	-(		(266.8)	(124.0)	(201.4)			
		>-	475.1	1.703	.326	.853	.164	.268	.186
	STRAIGHT	-(		(266.8)	(177.0)	(188.1)			
		>-	480B	1.703	.413	.760	.158	.281	.172
		(		(266.8)	(228.4)	(185.9)			
	BEND	-(	480M	1.690	.428	.728	.166	.320	.138
		(		(263.7)	(239.4)	(187.2)			
		>-	480F	1.658	.406	.714	.173	.358	.128
	STRAIGHT	-(		(255.0)	(230.2)	(187.8)			
		>-	482	1.616	.361	.714	.173	.364	.119
	STRAIGHT	-(		(242.7)	(206.9)	(187.8)			
		>-	482.1	1.524	.236	.714	.170	.373	.095
	STRAIGHT	-(		(223.8)	(138.7)	(187.7)			
		>-	482.2	1.487	.114	.714	.161	.374	.070
	STRAIGHT	-(		(233.3)	(68.3)	(187.7)			
		>-	484	1.517	.000	.714	.147	.368	.046
	STRAIGHT	-(		(261.3)	(.0)	(187.6)			
		>-	485B	1.522	.008	.714	.146	.368	.044
		(		(263.7)	(4.6)	(187.6)			
	BEND	-(	485M	1.548	.029	.691	.118	.361	.042
		(		(270.9)	(17.6)	(182.0)			
		>-	485F	1.565	.032	.629	.112	.379	.024
	STRAIGHT	-(		(273.0)	(19.4)	(162.2)			
		>-	490B	1.565	.016	.304	.077	.393	.016
		(		(273.0)	(10.4)	(78.3)			
	BEND	-(	490M	1.536	.009	.233	.062	.424	.010
		(		(270.0)	(5.9)	(75.1)			
		>-	490F	1.457	.001	.201	.025	.467	.015
	STRAIGHT	-(		(259.0)	(1.6)	(73.9)			
		>-	492	1.433	.000	.201	.024	.468	.016
	STRAIGHT	-(		(255.3)	(.0)	(73.9)			
		>-	492.1	1.083	.012	.201	.010	.479	.017
	STRAIGHT	-(		(206.0)	(21.6)	(73.9)			
		>-	492.2	.736	.015	.201	.009	.470	.019
	STRAIGHT	-(		(178.3)	(41.9)	(73.9)			
		>-	495B	.418	.016	.201	.015	.440	.021

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	495S	.416	.016	.201	.015	.440	.021
	(		(196.6)	(61.3)	(73.8)			
	BEND -(	495B	.356	.018	.172	.021	.340	.022
	(		(192.2)	(60.8)	(68.0)			
	>-	495F	.337	.015	.120	.022	.226	.024
	STRAIGHT -(		(193.9)	(48.5)	(52.0)			
	>-	500	.337	.000	.000	.026	.186	.026
	STRAIGHT -(		(193.9)	(.0)	(.0)			
	>-	500.1	.337	.024	.139	.032	.121	.026
	STRAIGHT -(		(193.9)	(76.6)	(75.9)			
	>-	500.2	.337	.045	.221	.038	.064	.019
	STRAIGHT -(		(193.9)	(133.5)	(136.8)			
	>-	500.3	.337	.057	.255	.044	.019	.009
	STRAIGHT -(		(193.8)	(153.4)	(171.6)			
	>-	500.4	.336	.056	.244	.050	.036	.011
	STRAIGHT -(		(193.7)	(131.0)	(174.0)			
	>-	500.5	.336	.038	.198	.056	.070	.030
	STRAIGHT -(		(193.6)	(73.9)	(148.8)			
	>-	505	.336	.000	.123	.062	.097	.054
	STRAIGHT -(		(193.5)	(.0)	(115.2)			
	>-	510S	.336	.009	.108	.063	.101	.059
	(		(193.5)	(12.8)	(110.9)			
	BEND -(	510B	.327	.019	.086	.052	.138	.100
	(		(190.9)	(24.5)	(106.0)			
	>-	510F	.279	.019	.075	.044	.164	.114
	STRAIGHT -(		(156.4)	(23.3)	(104.0)			
	>-	515S	.214	.005	.075	.046	.160	.136
	(		(146.9)	(12.0)	(103.9)			
	BEND -(	515B	.177	.013	.071	.050	.134	.139
	(		(129.4)	(12.3)	(101.2)			
	>-	515F	.140	.017	.062	.055	.126	.153
	STRAIGHT -(		(105.5)	(12.4)	(87.6)			
	>-	520S	.027	.017	.022	.053	.090	.147
	(		(26.0)	(12.5)	(20.4)			
	BEND -(	520B	.005	.009	.008	.024	.066	.084
	(		(3.4)	(6.3)	(6.0)			
	>-	520F	.000	.001	.001	.003	.006	.007
	STRAIGHT -(		(.6)	(.4)	(.5)			
ANCHOR	--	525	.000	.000	.000	.000	.000	.000

PROJECT 10MW SOLAR PILOT PLANT - C-21700
JOB MS VALVE TO T1700
DATE 2/26/80

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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STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
415	2143	849	569	2392
415.1	1843	835	239	2036
415.2	1802	827	184	1992
415.3	2027	874	460	2254
415.4	2433	965	755	2719
440	2944	1088	1061	3294
440.1	2694	1578	689	2667
455N	4030	6469	539	7640
455M	3990	6390	543	7553
455F	3628	5964	563	7004
455F.1	934	1945	354	2186
455F.2	817	1073	421	1412
455F.3	1458	936	446	1790
460N	4059	2756	882	4986
460M	4247	2911	794	5226
460F	4317	2966	930	5286
470M	4224	2851	954	5181
470F	4035	2931	853	5059
470F.1	1798	1652	336	2465
475	1555	1768	461	2389
475.1	1551	1800	502	2349

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
480N	2305	3694	1325	4551
480M	2132	3640	1373	4436
480F	1958	3481	1350	4208
482	913	1662	648	2008
482.1	1111	1382	495	1841
482.2	1863	1262	416	2288
484	2887	1330	534	3224
485N	5794	2652	1061	6460
485M	6305	2775	1105	6977
485F	6426	2742	1066	7057
490N	5954	3013	1003	6747
490M	5606	3152	944	6506
490F	4912	3052	900	5852
492	2415	1534	447	2895
492.1	1108	1302	300	1733
492.2	1061	1168	211	1592
495N	4887	2251	514	5405
495M	5705	2383	546	6207
495F	6153	2665	525	6726
500	3392	1847	281	3872
500.1	3048	1560	331	3406

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
500.2	2747	1321	456	3062
500.3	2484	1107	496	2764
500.4	2258	886	409	2460
500.5	2089	675	221	2206
505	2011	604	177	2107
510N	3885	1227	349	4089
510M	3583	1223	349	3802
510F	3121	1104	336	3327
515N	3582	1179	382	3796
515M	3974	1270	399	4191
515F	3798	1145	353	3982
520N	4555	1456	373	4796
520M	5347	1764	448	5646
520F	5758	1866	467	6079
525	2979	969	257	3143

DYNAFLEX

TABLE OF CONTENTS

LINE MS-5 MAIN STEAM - TSS EXCHANGER BRANCH

Stearns-Roger

PIPE STRESS ANALYSIS REPORT

FOR

10MWe SOLAR PILOT PLANT

C-21700

MAIN STEAM TSS EXCHANGER BRANCH

PIPING SYSTEM

8"-MS-4-KBA

CONDITIONS ANALYZED/ANAL. I.D. NO.

THERMAL	T-21700-MS-5-A-2
DEAD WEIGHT	W-21700-MS-5-A-2
PRESSURE	P-21700-MS-5-A-0
SEISMIC	X-21700-MS-5-A-1

CODE REFERENCE: ANSI B31.1-1973
W/ ADDENDA C.
(SUMMER 1979)

ANALYST G.H. MAY DATE 7-25-80

195

TRANSMITTAL

T/W/X-MS-5-A-2/2/1

DIVISION USAGE						Stearns-Roger Incorporated ENGINEERING STANDARD	STANDARD NUMBER EE16.01.2
MM	P	PP	SH	FI	SP		

APPROVALS
Des. Sect.
Sect. Supv.
Div.

PIPING ANALYSIS RESULTS

PAGE 1 OF 1
ISSUED 8-31-73
REVISED 4-15-74

Date FEB. 28, 1980

TO: T.E. OLSON

FROM: G.H. MAY, Piping Engineering Group

Client DOE Project SOLAR I Job No. C-21700

Pipe Line Analyzed MAIN STEAM TSS EXCHANGER BRANCH 18"-MS-4-KBA

Reference Dwg. P13-2 A

This piping has been analyzed for the THERMAL, DEAD WEIGHT, PRESSURE & OPERATIONAL BASIS EARTHQUAKE loading condition and is found to be:

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

COMMENT (1) ALL PIPE STRESSES ARE SATISFACTORY.
(2) ALL ANCHOR FORCES AND MOMENTS ARE REASONABLE AND SHOULD BE ACCEPTED.

RECOMMENDATION (1) SUBMIT THE FORCES AND MOMENTS TO ROCKETDYNE FOR APPROVAL.
(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
M.E. NOBLE

DIVISION USAGE					
MM	P	PP	SH	FI	SP

APPROVALS
Des. Sect. [signature]
Sect. Supv. [signature]
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

PIPE STRESS SUMMARY REPORT

ANSI B31.1 - 1973 EDITION

STANDARD NUMBER EE16.01.8

PAGE 1 OF 1

ISSUED 5/27/75
REVISED

10 MWE SOLAR PILOT PLANT - DOE — Job Name
C-21700 — Job No.

MAIN STEAM TSS EXCHANGER BRANCH/18"-MS-4-KBA — System/Pipe Line Name
MS-5 — Analysis No.

1. Loading Conditions Analyzed — Analysis Ident. Code

		Analysis Ident. Code
Pressure	X	P-MS-5-A-0
Weight	X	W-MS-5-A-2
Thermal Expansion	X	T-MS-5-A-2
Sustained Mech. Loads		X-MS-5-A-1
Occasional Loads	X	

2. Stress Evaluation (Code Equations)

Eq. (11) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} \leq 1.0\ S_h$ — 5649 psi $\leq$ 15000 psi

PRESS = 1385 PSIG ⇒ S_{LP} = 4955 psi

Material: - ASTM A106 GR. B — Temp = 650°F @ PT. 655N

Eq. (12) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{0.75\ iM_B}{Z} \leq KS_h$ — 14733 psi $\leq$ 18000 psi

Material: - ASTM A106 GR. B — Temp = 650°F @ PT. 605N

Eq. (13) $S_E = \frac{iM_C}{Z} \leq S_A$ — 4446 psi $\leq$ 22500 psi

Material: - ASTM A106 GR. B — Temp = 650°F @ PT. 605N

Eq. (14) $\frac{Pd^2}{Do^2-d^2} + \frac{0.75\ iM_A}{Z} + \frac{iM_C}{Z} \leq (S_h + S_A)$ — 9462 psi $\leq$ 37500 psi

Material: - ASTM A106 GR. B — Temp = 650°F @ PT. 605N

3. Stress Evaluation (Local or Special)

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

REMARKS:

1) ALL PIPE STRESSES ARE SATISFACTORY.
2) EQ. 12 INCLUDES AN OPERATIONAL BASIS EARTHQUAKE BASED ON A GROUND RESPONSE SPECTRUM.

Prepared By [signature] — Date 2-28-80

Approved By [signature] — Date 2-28-80

CUSTOMER: DOE
PROJECT: 10MWe SOLAR PILOT PLANT
JOB NO: C-21700
BY: GHM DATE: FEB. 28, 1980
REF. DWGS: P13-2 A
ANALYSIS CODE: T/W/X-MS-5-A-2/2/1

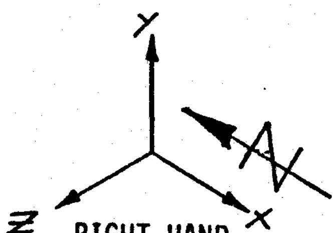
SUMMARY OF FORCES & MOMENTS ON SYSTEM TERMINAL EQUIPMENT

(SYSTEM)

MAIN STEAM TSS EXCHANGER BRANCH

8."-MS-4-KBA

THE REPORTED REACTIONS BASED ON A THERMAL EXPANSION ANALYSIS FROM ...70..°F TO 650.°F USING E_c, THE COLD MOD. OF ELASTICITY, AND ....0..% COLD SPRING.



RIGHT-HAND CARTESIAN COORDINATE SYSTEM

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EQUIPMENT CONNECTIONS		LOC. NO.	FORCES (LBS) X	Y	Z	RESULTANT	MOMENTS (FT.-LBS) X	Y	Z	RESULTANT
DESUPERHEATER DS-301	THERMAL	600	346	-212	-120	423	2171	3970	-3934	5996
STEAM OUTLET, 10" EAST	WEIGHT	600	3	-136	-3	136	94	22	63	115
4I, (SA-301)	SEISMIC	600	813	627	1658	1950	9931	6524	8235	14457
TSS COND. E-302	THERMAL	665	-317	-173	-173	400	1769	-3886	2804	5108
STEAM INLET, 10" EAST	WEIGHT	665	-4	58	-3	58	-484	-57	-11	488
5I, (SA-303)	SEISMIC	665	792	366	1119	1419	4851	8038	6679	11522
TSS COND. E-301	THERMAL	690	-29	24	293	296	3577	-398	249	3608
STEAM INLET, 10" EAST	WEIGHT	690	1	83	6	83	-532	12	29	533
6I (SA-302)	SEISMIC	690	959	431	1388	1741	6085	8731	7742	13160

DIVISION USAGE

MM	P	PP	SH	FI	SP
X					

APPROVALS
Des. Sec.
Sect. Supv.
Div.

Stearns-Roger INCORPORATED
ENGINEERING STANDARD

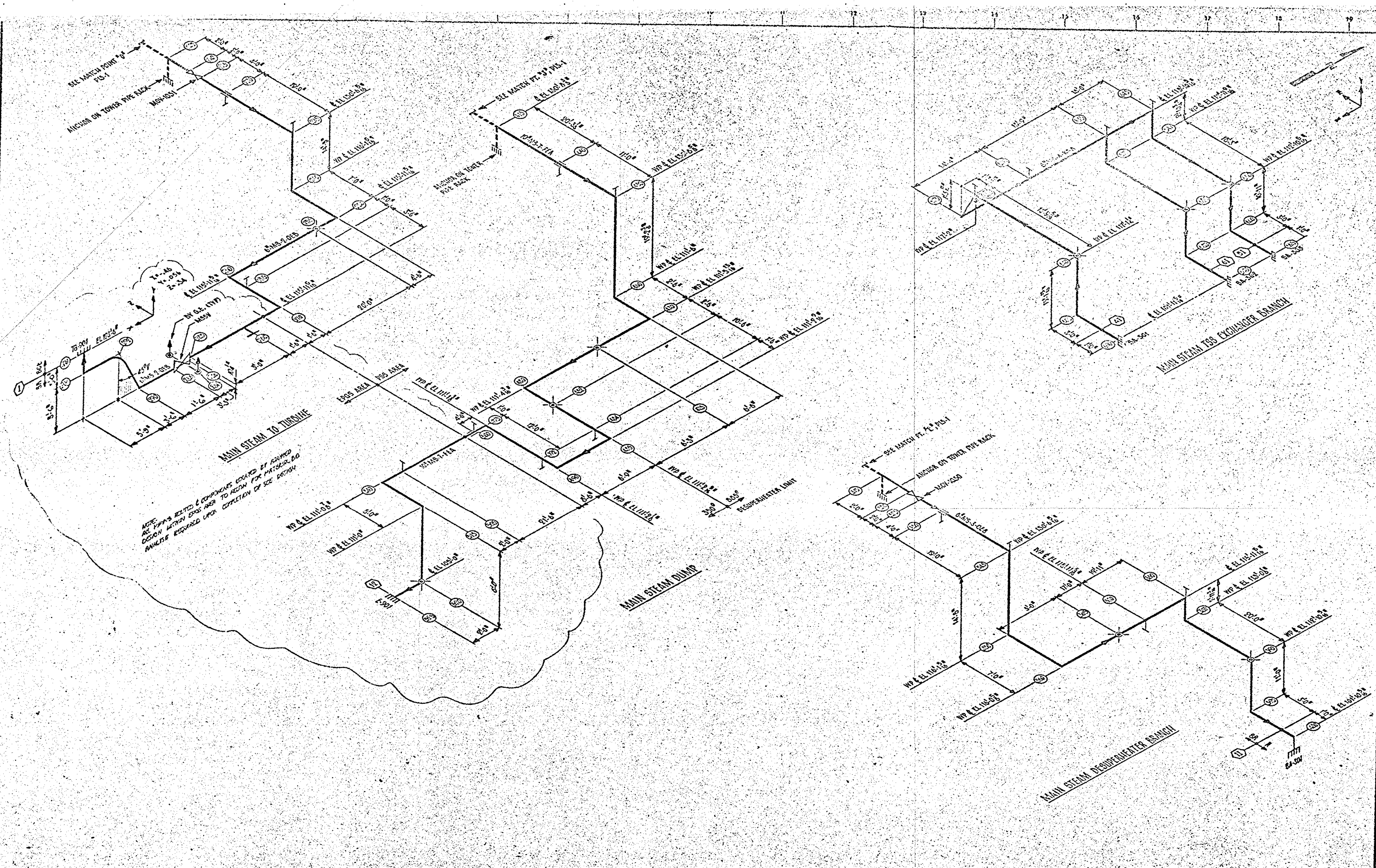
SUMMARY OF FORCES & MOMENTS
PER. ANSI B31.1-1973 PWR. PIPING CODE

STANDARD NUMBER
EE 16.01.7

PAGE 1 OF 1

ISSUED 2/28/74
REVISED 4/18/78

ISOMETRIC



NOTE:
Piping configuration shown on this drawing is for Thermal, Weight and Seismic Analysis ONLY. See P9 series drawings for piping erection.

NO	REVISIONS	DATE	BY
B	UPDATED PER LATEST ANALYSIS DOCUMENTS	7/21/80	MAB

DOC NO	REFERENCE DRAWINGS
P9-5	RS TOWER PIPING-PLANS
P9-7	YARD PIPING NORTH HALF 100'0" LEVEL-PLAN
P9-8	YARD PIPING SOUTH HALF 100'0" LEVEL-PLAN
P9-9	YARD PIPING NORTH HALF 115'0" LEVEL-PLAN
P9-10	YARD PIPING SOUTH HALF 115'0" LEVEL-PLAN
SA7365MEEA	TURBINE PIPING LAYOUT (PRELIM)

PRINT RECORD

DRAWN	T.D.M.	12-1-19
CHECKED		
MECH CK		3-24-80
ELECT CK		5/28/80
STRUCT CK		3/13/80
PIPING CK		3/5/80

C-21700
XI-22934
P13-2

SOLAR FACILITIES DESIGN INTEGRATOR
McDONNELL DOUGLAS
Rockwell International

DEPARTMENT OF ENERGY
SAN FRANCISCO OPERATIONS OFFICE
SOLAR TEN MEGAWATT PROJECT OFFICE
9550 FLAIR DRIVE, SUITE 210
EL MONTE, CALIFORNIA 91731

10 MWe SOLAR PILOT PLANT - DAGGETT, CALIFORNIA

201

TITLE
ANALYSIS ISOMETRIC
MAIN STEAM - PSS, TSS & EPGS

ANALYSIS ISOMETRIC (P13-2)

SCALE NONE
DATE 5-9-80
DRAWING NO. 40P2005131921
SHEET NO. 1 of 1
REV. B

Form 22679

BRANCH CONNECTION SYMBOLS	PIPE SUPPORT SYMBOLS
UNREINFORCED PIPE—PIPE INTERSECTION	CONSTANT SUPPORT
REINFORCED PIPE—PIPE INTERSECTION	VARIABLE SPRING SUPPORT
A S A TEE	RIGID ROD OR STRUT
WELDOLET	HYDRAULIC SNUBBER
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

ANCHOR OR RESTRAINT NO.	DISPLACEMENT (COLD TO HOT) IN. X	Y	Z	ANCHOR &/OR TERM. POINTS	COORDINATE X	Y	Z
205	0.0	0.0	0.0	205 } MS-2	0'-0"	0'-0"	0'-0"
300	-.46	.056	.35	300	43'-0½"	-6'-10 5/16"	-38'-6"
315	0.0	0.0	0.0	315 } MS-3	0'-0"	0'-0"	0'-0"
400				400	-39'-11"	-28'-4 3/16"	-58'-0"
415				415 } MS-4	0'-0"	0'-0"	0'-0"
525				525	53'-6"	-25'-2 3/8"	-39'-9⅛"
600				600 }	0'-0"	0'-0"	0'-0"
665				665 MS-5	-46'-1"	0'-0½"	-0'-2"
690				690	-23'-1"	0'-0½"	-0'-2"

ANALYZED CONDITIONS: OPERATING TEMP (°F)	DESIGN PRESSURE (P S I G)	CASE	VALVES & SPECIAL COMPONENTS: VALVE OR SPEC. COMP. NO.	WGT. (LBS.)	STATUS EST. OR FINAL	REFERENCE & COMMENTS
960	1565	MS-2	MSSV	3000	EST	GE Prelim Turbine Info
960	1565	MS-3	MOV-1031	1315	EST	Powell 125023 WE
885	100	MS-4 / PT 415-485	MOV-1030	1315	EST	" " "
350	100	MS-4 / PT 485-525				
650	1385	MS-5				

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 FROM	TO	PIPE MATERIAL	LINE SPEC.	PIPE SIZE (IN.) O.D.	W.T.	WEIGHT LBS./LINEAR FT. PIPE	FLUID	INSULATION	INS. THK.
205 / 315	300 / 400	A335 P22	QEB	6.625	.864	54.3	3.1	15.2	5
415	484	↓ P11	FEA	10.75	.365	41.3	34.1	20.6	5
600	665 / 690	A106 Gr. B	KBA	8.625	.500	43.4	19.8	11.1	3½
484	525	A335 P11	FEA	10.75	.365	41.3	34.1	8.7	3½

NO.	REFERENCES	NO.	ANALYSIS CODES	NO.	REVISIONS	DATE	BY	CH'D	APP'D
			T/W/X-MS-2-A-4/3/3						
			T/W/X-MS-3-A-3/3/1						
			T/W/X-MS-4-A-5/3/1						
			T/W/X-MS-5-A-3/3/1						

PIPING ANALYSIS DATA

Stearns-Roger INCORPORATED (P13-2)

10 MWE SOLAR PILOT PLANT - DAGGET, CALIF.
MAIN STEAM - PSS TSS & EPGS
FOR ISOMETRIC P13-2

DRAWN: KEN	DATE: 2-15-80	ANAL. BY G H M	DATE: 2-28-80
CHECKED: [illegible]	DATE: 3-3-80	APP'D. BY 203 [illegible]	DATE: 3-19-80
JOB NO. C-21700	SYSTEM NO. MS-2,3,4 & 5	SHEET 1 OF 1	

THERMAL

```
*********   **      **  **      **   ********   **********  **          **********  **      **
**********   **    **   ***     **  **********  **********  **          **********   **    **
**      **    **  **    ** *    **  **      **  **          **          **            **  **
**      **     ****     ** **   **  **      **  **          **          **             ****
**      **      **      **  **  **  **      **  ******      **          ******          **
**      **      **      **   ** **  **********  ******      **          ******         ****
**      **      **      **    ****  **********  **          **          **            **  **
**      **      **      **     ***  **      **  **          **          **           **    **
**********      **      **     ***  **      **  **          **********  **********  **      **
*********       **      **      **  **      **  **          **********  **********  **      **
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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
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.

STEARNS - ROGER CORP

10MW SOLAR PILOT PLANT - C-21700

MS DESUP TO TH STOR HTR(T/W-MS-C5-A-272)

2/25/80

DYNAFLEX (MOD204F-UCC)

LAST UPDATE - 12/25/79

205

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS DESUP TO TH STOR HTR(T/W-MS-05-A-2/2)

DATE 2/25/80

INPUT DATA - (CARD IMAGES)

:1 :4 :7 :10 :13 :25 :37 :49 :60 :

LINE NUMBER	TYP	LOC NO.	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
1	HED								STEARNS - ROGER CORP., 2/25/80,PROJ.10MW SOLAR PILOT PLANT - C-21700,JOBMS DESUP TO TH STOR HTR(T/W-MS-05-A-2/2)	1
2	GEN								APPLY B31.1-1973,EXA	2
3			600	605			4-0	L	MAT=LCS,OD=8.625, WT=.500,UNIF=11.1, TEMP=650.	3
4				610		15-1-15/16		L		4
5				620			16-9-5/16	L		5
6				625		-1-3-11/16	1-3-11/16	L		6
7				630	-14-4					7
8				635	-13-9				WLT	8
9				645	-18-0			L		9
10				650		-2-10-3/4		L		10
11				655			-18-3	L		11
12				660		-10-11		L		12
13				665			-4-0			13
14			635	670		-2-10-3/4		L		14
15				680			-18-3	L		15
16				685		-10-11		L		16
17				690			-4-0			17
18	ANC	600								18
19	ANC	665								19
20	ANC	690								20
21	RAD	620	N			RIGID				21
22	RAD	630				RIGID				22
23	RAD	635				RIGID				23
24	RAD	645	N			RIGID				24
25	HGR								LOC(610F,655N,680N), USE TABLE 1	25
26	CCC	665			-46-1	0-0-1/2	-0-2			26
27	CCC	690			-26-1	0-0-1/2	-0-2			27

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PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - HS DESUP TO TH STOR HTR(T/W-HS-05-A-2/2)

DATE 2/25/80

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.

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(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.

(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.

(15) 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 600, WHICH IS THE ORIGIN

HANGER DESIGN DATA:
THE MAXIMUM RIGID SUPPORT DISPLACEMENT CRITERION = .10 INCHES.
VARIABLE SPRING HANGERS SELECTED FROM TABLE @1@

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

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
ANCH@		--600	0.00	0.0C	0.00										
	STRAIGHT -(						3.00		8.625	.500	LCS	650.		43.4	11.1
	(	* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 650. DEGREES FAHRENHEIT IS 5.11 INCHES PER 100 FEET													
	(	* A UNIFORM DISTRIBUTED LOAD OF 11.10 PLF IS ACTING IN THE -Y DIRECTION.													
	(	>-605N	0.00	0.00	3.00										
	BEND -(	605M	0.00	.29	3.71	1.00	1.57	90.000							
	(	>-605F	0.00	1.00	4.00										
	STRAIGHT -(						13.16								
	(	>-610N	0.00	14.16	4.00										
	BEND -(	610M	0.00	14.87	4.2?	1.00	1.57	90.000							

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
	BEND -(	610M	0.00	14.87	4.29	1.00	1.57	90.000							
	(>-	610F	0.00	15.16	5.00										
	(* TENTATIVE HANGER AT POINT 610F - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.														
	STRAIGHT -(						15.36								
	(>-	620N	0.00	15.16	20.36										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 620N IN DIRECTION Y														
	BEND -(	620M	0.00	15.09	20.74	1.00	.79	45.000							
	(>-	620F	0.00	14.87	21.07										
	STRAIGHT -(						.43								
	>-	625N	0.00	14.56	21.38										
	BEND -(	625M	-.29	14.06	21.88	1.00	1.57	90.000							
	(>-	625F	-1.00	13.85	22.08										
	STRAIGHT -(						13.33								
	>-	630	-14.33	13.85	22.08										
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 630 IN DIRECTION Y														
	STRAIGHT -(						13.75								
BR PT	(>-	635	-28.08	13.85	22.08										

* NOTES PERTAINING TO POINT 635 APPEAR ON THE FOLLOWING PAGE

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
BR PT		>-635	-28.08	13.85	22.08										
		* WELDING TEE AT POINT 635													
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 635 IN DIRECTION Y													
	STRAIGHT -						17.00								
		>-645N	-45.08	13.85	22.08										
		* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 645N IN DIRECTION Y													
	BEND -	645M	-45.79	13.56	22.08	1.00	1.57	90.000							
		>-645F	-46.08	12.85	22.08										
	STRAIGHT -						.90								
		>-647N	-46.08	11.96	22.08										
	BEND -	647M	-46.08	11.25	21.79	1.00	1.57	90.000							
		>-647F	-46.08	10.96	21.08										
	STRAIGHT -						16.25								
		>-655N	-46.08	10.96	4.83										
		* TENTATIVE HANGER AT POINT 655N - SEE NOTE (9) ABOVE. HANGER LENGTH NOT SPECIFIED.													
	BEND -	655M	-46.08	10.67	4.13	1.00	1.57	90.000							
		>-655F	-46.08	9.96	3.83										
	STRAIGHT -						8.92								
		>-660N	-46.08	1.04	3.83										
	BEND -	660M	-46.08	.33	3.54	1.00	1.57	90.000							
		>-660F	-46.08	.04	2.83										

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
		>-660E	-46.08	.04	2.83										
	STRAIGHT -(						3.00								
ANCHR		--665	-46.08	.04	-.17										

* CONTROL COORDINATES OF POINT 665, IN FEET :
X = -46.08, Y = .04, Z = -.17
RESULTANT DIFFERENCE IS ZERO

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)
BR PT		--635	-28.08	13.85	22.08			

* WELDING TEE AT POINT 635

* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 635
IN DIRECTION Y

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)
	STRAIGHT -(						1.90	
		>-670B	-28.08	11.96	22.08			
	BEND -(	670M	-28.08	11.25	21.79	1.00	1.57	90.000
		>-670E	-28.08	10.96	21.08			
	STRAIGHT -(						16.25	
		>-680B	-28.08	10.96	4.83			

* TENTATIVE HANGER AT POINT 680M - SEE NOTE (9) ABOVE.
HANGER LENGTH NOT SPECIFIED.

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)
	BEND -(	680M	-28.08	10.67	4.13	1.00	1.57	90.000
		>-680E	-28.08	9.96	3.83			
	STRAIGHT -(						8.92	
		>-685B	-28.08	1.04	3.83			
	BEND -(	685M	-28.08	.33	3.54	1.00	1.57	90.000
		>-685E	-28.08	.04	2.83			
	STRAIGHT -(						3.00	
ANCHR		--690	-28.08	.04	-.17			

* NOTES PERTAINING TO POINT 690 APPEAR ON THE FOLLOWING PAGE

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	COORDINATES (FT) Y	COORDINATES (FT) Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	DIST. LOADS (LBS PER FT) UNIF
									8.625	.500	LCS	650.		43.4	11.1
ANCHOR		--690	-28.08	.04	-.17										

* CONTROL COORDINATES OF POINT 690, IN FEET :
X = -28.08, Y = .04, Z = -.17
RESULTANT DIFFERENCE IS ZERO

* *

* 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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	600	346.	-212.	-120.	423.	2171.	3970.	-3934.	5996.
	665	-317.	-173.	-173.	400.	1769.	-3886.	2804.	5108.
	690	-29.	24.	293.	296.	3577.	-398.	249.	3608.
RESTRAINTS:									
	620H	0.	285.	0.	285.	0.	0.	0.	0.
213	630	0.	-262.	0.	262.	0.	0.	0.	0.
	635	0.	299.	0.	299.	0.	0.	0.	0.
	645H	0.	40.	0.	40.	0.	0.	0.	0.

```
* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 4445. OCCURS AT POINT 605N

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.

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(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) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
ANCHR		-- 600	120.	406.	3934.	2171.	3970.	1.00	1.00	24.51	2935.
	STR -(	>- 605N	120.	405.	3934.	1534.	2933.	1.77	1.77	24.51	4446. **
	BEND -(	605M	235.	352.	809.	1419.	4611.	1.77	1.77	24.51	4231. *
	(	>- 605F	212.	366.	2587.	1442.	3588.	1.77	1.77	24.51	4024. *
	STR -(	>- 610N	212.	366.	2587.	3024.	965.	1.77	1.77	24.51	3541.
	BEND -(	610M	235.	352.	2613.	3046.	902.	1.77	1.77	24.51	3558.
	(	>- 610F	120.	406.	1311.	2931.	2241.	1.77	1.77	24.51	3387.
	STR -(	>- 620N	120.	353.	1311.	331.	3073.	1.77	1.77	24.51	2904.
	BEND -(	620M	139.	347.	2414.	312.	2470.	1.77	1.77	24.51	2999.
	(	>- 620F	136.	347.	3202.	315.	1491.	1.77	1.77	24.51	3067.
	STR -(	>- 625N	136.	348.	3202.	1641.	329.	1.77	1.77	24.51	3125.
215	BEND -(	625M	341.	152.	2507.	1846.	2007.	1.77	1.77	24.51	3204.
	(	>- 625F	346.	140.	363.	1851.	3168.	1.77	1.77	24.51	3189.
	STR -(	>- 630	346.	225.	363.	1896.	1947.	1.00	1.00	24.51	1342.
BR PT	STR -(	-- 635	346.	225.	363.	715.	294.	1.35	1.35	24.51	567.
BR PT		-- 635	317.	219.	308.	870.	42.	1.35	1.35	24.51	612.
	STR -(	>- 645N	317.	245.	308.	1397.	2987.	1.77	1.77	24.51	2865.
	BEND -(	645M	346.	261.	2380.	1427.	2017.	1.77	1.77	24.51	2968.
	(	>- 645F	173.	361.	3160.	1254.	134.	1.77	1.77	24.51	2943.
	STR -(	>- 647N	173.	361.	3160.	21.	970.	1.77	1.77	24.51	2859.
	BEND -(	647M	245.	317.	1641.	93.	2697.	1.77	1.77	24.51	2732.
	(	>- 647F	173.	361.	654.	21.	2844.	1.77	1.77	24.51	2524.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
ANCHR		-- 600	120.	406.	3934.	2171.	3970.	1.00	1.00	24.51	2935.
	STR -(										
		>- 605N	120.	405.	3934.	1534.	2933.	1.77	1.77	24.51	4446. **
	BEND -(	605M	235.	352.	809.	1419.	4611.	1.77	1.77	24.51	4231. *
		>- 605F	212.	366.	2587.	1442.	3588.	1.77	1.77	24.51	4024. *
	STR -(										
		>- 610N	212.	366.	2587.	3024.	965.	1.77	1.77	24.51	3541.
	BEND -(	610M	235.	352.	2613.	3046.	902.	1.77	1.77	24.51	3558.
		>- 610F	120.	406.	1311.	2931.	2241.	1.77	1.77	24.51	3387.
	STR -(										
		>- 620N	120.	353.	1311.	331.	3073.	1.77	1.77	24.51	2904.
	BEND -(	620M	139.	347.	2414.	312.	2470.	1.77	1.77	24.51	2999.
		>- 620F	136.	348.	3202.	315.	1491.	1.77	1.77	24.51	3067.
	STR -(										
		>- 625N	136.	348.	3202.	1641.	329.	1.77	1.77	24.51	3125.
216	BEND -(	625M	341.	152.	2507.	1846.	2007.	1.77	1.77	24.51	3204.
		>- 625F	346.	140.	363.	1851.	3168.	1.77	1.77	24.51	3189.
	STR -(										
		>- 630	346.	225.	363.	1896.	1947.	1.00	1.00	24.51	1342.
	STR -(										
BR PT		-- 635	346.	225.	363.	715.	294.	1.35	1.35	24.51	567.
BR PT		-- 635	317.	219.	308.	870.	42.	1.35	1.35	24.51	612.
	STR -(										
		>- 645N	317.	245.	308.	1397.	2987.	1.77	1.77	24.51	2865.
	BEND -(	645M	346.	261.	2380.	1427.	2017.	1.77	1.77	24.51	2968.
		>- 645F	173.	361.	3160.	1254.	134.	1.77	1.77	24.51	2943.
	STR -(										
		>- 647N	173.	361.	3160.	21.	970.	1.77	1.77	24.51	2859.
	BEND -(	647M	245.	317.	1641.	93.	2697.	1.77	1.77	24.51	2732.
		>- 647F	173.	361.	654.	21.	2844.	1.77	1.77	24.51	2524.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	EXPANSION STRESS PSI
		>- 647F	173.	361.	654.	21.	2844.	1.77	1.77	24.51	2524.
	STR -(										
		>- 655N	173.	361.	654.	2794.	2303.	1.77	1.77	24.51	3182.
	BEND -(	655M	245.	317.	2183.	2866.	1390.	1.77	1.77	24.51	3340.
		>- 655F	173.	361.	2620.	2794.	337.	1.77	1.77	24.51	3325.
	STR -(										
		>- 660N	173.	361.	2620.	1249.	2487.	1.77	1.77	24.51	3306.
	BEND -(	660M	245.	317.	1.	1177.	3835.	1.77	1.77	24.51	3470.
		>- 660F	173.	361.	2804.	1249.	2936.	1.77	1.77	24.51	3674.
	STR -(										
ANCHR		-- 665	173.	361.	2604.	1769.	3886.	1.00	1.00	24.51	2501.
BR PT		-- 635	24.	295.	253.	155.	56.	1.35	1.35	24.51	200.
	STR -(										
		>- 670N	24.	295.	253.	612.	99.	1.77	1.77	24.51	579.
	BEND -(	670M	224.	193.	117.	812.	228.	1.77	1.77	24.51	737.
		>- 670F	293.	38.	70.	881.	224.	1.77	1.77	24.51	789.
	STR -(										
		>- 680N	293.	38.	70.	493.	252.	1.77	1.77	24.51	483.
	BEND -(	680M	224.	193.	236.	563.	149.	1.77	1.77	24.51	543.
		>- 680F	24.	295.	281.	763.	41.	1.77	1.77	24.51	704.
	STR -(										
		>- 685N	24.	295.	281.	3379.	220.	1.77	1.77	24.51	2939.
	BEND -(	685M	224.	193.	34.	3580.	375.	1.77	1.77	24.51	3113.
		>- 685F	293.	38.	249.	3649.	310.	1.77	1.77	24.51	3175.
	STR -(										
ANCHR		-- 690	293.	38.	249.	3577.	398.	1.00	1.00	24.51	1766.

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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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
ANCHOR		-- 600	346.	-212.	-120.	2171.	3970.	-3934.
	STRAIGHT -(							
		>- 605N	346.	-212.	-120.	1534.	2933.	-3934.
	BEND -(	605M	346.	-212.	-120.	1419.	2688.	-3832.
		>- 605F	346.	-212.	-120.	1442.	2587.	-3588.
	STRAIGHT -(							
		>- 610N	346.	-212.	-120.	3024.	2587.	965.
	BEND -(	610M	346.	-212.	-120.	3046.	2485.	1210.
		>- 610F	346.	-212.	-120.	2931.	2241.	1311.
	STRAIGHT -(							
		>- 620N	346.	72.	-120.	-331.	-3073.	1311.
	BEND -(	620M	346.	72.	-120.	-312.	-3206.	1285.
		>- 620F	346.	72.	-120.	-315.	-3318.	1210.
	STRAIGHT -(							
		>- 625N	346.	72.	-120.	-329.	-3424.	1104.
	BEND -(	625M	346.	72.	-120.	-353.	-3562.	952.
		>- 625F	346.	72.	-120.	-363.	-3549.	931.
	STRAIGHT -(							
		>- 630	346.	-190.	-120.	-363.	-1947.	1896.
	STRAIGHT -(							
BRANCH PT.		-- 635	346.	-190.	-120.	-363.	-294.	-715.
BRANCH PT.		-- 635	317.	133.	173.	-308.	-42.	-870.
	STRAIGHT -(							
		>- 645N	317.	173.	173.	-308.	-2987.	1397.
	BEND -(	645M	317.	173.	173.	-257.	-3110.	1427.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
	BEND -(	645M	317.	173.	173.	-257.	-3110.	1427.
	(	>- 645F	317.	173.	173.	-134.	-3160.	1254.
	STRAIGHT -(							
		>- 647N	317.	173.	173.	21.	-3160.	970.
	BEND -(	647M	317.	173.	173.	93.	-3068.	746.
	(	>- 647F	317.	173.	173.	21.	-2844.	654.
	STRAIGHT -(							
		>- 655N	317.	173.	173.	-2794.	2303.	654.
	BEND -(	655M	317.	173.	173.	-2866.	2527.	561.
	(	>- 655F	317.	173.	173.	-2794.	2620.	337.
	STRAIGHT -(							
		>- 660N	317.	173.	173.	-1249.	2620.	-2487.
	BEND -(	660M	317.	173.	173.	-1177.	2712.	-2711.
	(	>- 660F	317.	173.	173.	-1249.	2936.	-2804.
	STRAIGHT -(							
ANCHOR		-- 665	317.	173.	173.	-1769.	3886.	-2804.
BRANCH PT.		-- 635	29.	-24.	-293.	-56.	-253.	155.
	STRAIGHT -(							
		>- 670N	29.	-24.	-293.	-612.	-253.	99.
	BEND -(	670M	29.	-24.	-293.	-612.	-244.	78.
	(	>- 670F	29.	-24.	-293.	-881.	-224.	70.
	STRAIGHT -(							
		>- 680N	29.	-24.	-293.	-493.	252.	70.
	BEND -(	680M	29.	-24.	-293.	-563.	272.	61.
	(	>- 680F	29.	-24.	-293.	-763.	281.	41.
	STRAIGHT -(							
		>- 685N	29.	-24.	-293.	-3379.	281.	-220.
	BEND -(	685M	29.	-24.	-293.	-3580.	289.	-241.
	(	>- 685F	29.	-24.	-293.	-3649.	310.	-249.
	STRAIGHT -(							
ANCHOR		-- 690	29.	-24.	-293.	-3577.	398.	-249.

DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 600	.000	-.000	-.000	.000	.000	-.000
	STRAIGHT -(							
		>- 605N	.010	-.005	.153	.016	.029	-.043
	BEND -(	605M	.020	.006	.191	.030	.062	-.065
		>- 605F	.037	.040	.211	.044	.082	-.103
	STRAIGHT -(							
		>- 610N	.428	.713	.433	.127	.205	-.152
	BEND -(	610M	.463	.740	.469	.157	.213	-.148
		>- 610F	.505	.729	.515	.187	.231	-.148
	STRAIGHT -(							
		>- 620N	1.282	.000	1.300	.243	.213	-.075
	BEND -(	620M	1.297	-.023	1.316	.241	.199	-.075
		>- 620F	1.307	-.051	1.322	.240	.188	-.077
	STRAIGHT -(							
		>- 625N	1.314	-.082	1.322	.239	.183	-.075
	BEND -(	625M	1.309	-.128	1.333	.243	.162	-.078
		>- 625F	1.276	-.138	1.354	.249	.130	-.073
	STRAIGHT -(							
		>- 630	.595	-.000	1.560	.232	.028	-.020
	STRAIGHT -(							
BRANCH PT.		-- 635	-.107	.000	1.562	.213	-.016	.003
BRANCH PT.		-- 635	-.107	.000	1.562	.213	-.016	.003
	STRAIGHT -(							
		>- 645N	-.976	.000	1.420	.194	-.088	.015
	BEND -(	645M	-1.010	-.018	1.393	.200	-.113	.030
		>- 645F	-1.020	-.056	1.356	.206	-.126	.043
	STRAIGHT -(							
		>- 647N	-1.011	-.102	1.317	.205	-.136	.046

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 647N	-1.011	-.102	1.317	.205	-.136	.046
	BEND -(	647M	-.995	-.126	1.272	.206	-.151	.060
		>- 647F	-.966	-.110	1.223	.207	-.178	.070
	STRAIGHT -(							
		>- 655N	-.271	.523	.393	.144	-.191	.109
	BEND -(	655M	-.238	.527	.349	.115	-.171	.106
		>- 655F	-.212	.498	.319	.087	-.161	.104
	STRAIGHT -(							
		>- 660N	-.032	.042	.210	.037	-.076	.077
	BEND -(	660M	-.019	.008	.191	.025	-.059	.048
		>- 660F	-.010	-.004	.153	.013	-.029	.031
	STRAIGHT -(							
ANCHOR		-- 665	-.000	-.000	-.000	.000	-.000	.000
BRANCH PT.		-- 635	-.107	.000	1.562	.213	-.016	.003
	STRAIGHT -(							
221		>- 670N	-.106	-.097	1.477	.212	-.017	.003
	BEND -(	670M	-.104	-.120	1.431	.204	-.019	.005
		>- 670F	-.101	-.106	1.383	.196	-.021	.006
	STRAIGHT -(							
		>- 680N	-.025	.503	.552	.165	-.020	.010
	BEND -(	680M	-.022	.512	.506	.159	-.018	.009
		>- 680F	-.019	.485	.468	.153	-.017	.009
	STRAIGHT -(							
		>- 685N	-.003	.030	.220	.101	-.008	.007
	BEND -(	685M	-.002	-.002	.193	.067	-.006	.004
		>- 685F	-.001	-.009	.153	.030	-.003	.003
	STRAIGHT -(							
ANCHOR		-- 690	-.000	.000	.000	.000	-.000	.000

WEIGHT

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	600	3.	-136.	-3.	136.	94.	22.	63.	115.
	665	-4.	58.	-3.	58.	-484.	-57.	-11.	488.
	690	1.	83.	6.	83.	-532.	12.	29.	533.
RESTRAINTS:									
223	610F	0.	-1364.	0.	1364.	0.	0.	0.	0.
	620[illegible]	0.	-817.	0.	817.	0.	0.	0.	0.
	630	0.	-809.	0.	809.	0.	0.	0.	0.
	635	0.	-1446.	0.	1448.	0.	0.	0.	0.
	645[illegible]	0.	-1000.	0.	1000.	0.	0.	0.	0.
	655[illegible]	0.	-1409.	0.	1409.	0.	0.	0.	0.
	680[illegible]	0.	-1428.	0.	1428.	0.	0.	0.	0.

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* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 694. OCCURS AT POINT 655N

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.

224 (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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	:	LONGITUDINAL STRESS PSI	:	
ANCHR		-- 600	3.	136.	63.	94.	22.	1.00	1.00	24.51	:	56.	:	
	STR -(	>- 605N	3.	28.	63.	68.	14.	1.77	1.77	24.51	:	61.	:	
	BEND -(	605M	44.	52.	53.	33.	37.	1.77	1.77	24.51	:	47.	:	
		>- 605F	114.	4.	11.	6.	66.	1.77	1.77	24.51	:	43.	:	
	STR -(	>- 610N	831.	4.	11.	29.	103.	1.77	1.77	24.51	:	70.	:	
	BEND -(	610M	616.	620.	82.	283.	67.	1.77	1.77	24.51	:	196.	:	
		>- 610F	3.	917.	106.	917.	8.	1.77	1.77	24.51	:	599.	:	
	STR -(	>- 620N	3.	427.	106.	482.	35.	1.77	1.77	24.51	:	321.	:	
	BEND -(	620M	153.	375.	112.	323.	7.	1.77	1.77	24.51	:	222.	:	
		>- 620F	269.	273.	101.	194.	48.	1.77	1.77	24.51	:	145.	:	
	STR -(	>- 625N	253.	256.	101.	47.	79.	1.77	1.77	24.51	:	88.	:	
	BEND. -(	625M	155.	277.	88.	24.	43.	1.77	1.77	24.51	:	65.	:	
		>- 625F	3.	274.	156.	170.	117.	1.77	1.77	24.51	:	168.	:	
	STR -(	>- 630	3.	453.	156.	986.	2.	1.00	1.00	24.51	:	489.	:	
BR PT	STR -(	-- 635	3.	394.	156.	1245.	35.	1.35	1.35	24.51	:	624.	:	
BR PT		-- 635	4.	503.	49.	1295.	14.	1.35	1.35	24.51	:	645.	*:	
	STR -(	>- 645N	4.	576.	49.	615.	36.	1.77	1.77	24.51	:	401.	:	
	BEND -(	645M	374.	380.	61.	221.	7.	1.77	1.77	24.51	:	149.	:	
		>- 645F	399.	5.	39.	66.	46.	1.77	1.77	24.51	:	58.	:	
	STR -(	>- 647N	442.	5.	39.	43.	62.	1.77	1.77	24.51	:	55.	:	
	BEND -(	647M	270.	264.	15.	80.	66.	1.77	1.77	24.51	:	69.	:	
		>- 647F	3.	356.	58.	347.	34.	1.77	1.77	24.51	:	229.	:	

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 647F	3.	356.	56.	347.	34.	1.77	1.77	24.51	229.
	STR -(										
		>- 655N	3.	879.	56.	1068.	36.	1.77	1.77	24.51	694. **
	BEND -(	655M	529.	593.	68.	460.	13.	1.77	1.77	24.51	302.
		>- 655F	794.	5.	40.	217.	54.	1.77	1.77	24.51	148.
	STR -(										
		>- 660N	397.	5.	40.	191.	15.	1.77	1.77	24.51	127.
	BEND -(	660M	165.	189.	38.	107.	21.	1.77	1.77	24.51	75.
		>- 660F	5.	222.	11.	65.	44.	1.77	1.77	24.51	51.
	STR -(										
ANCHR		-- 665	5.	58.	11.	484.	57.	1.00	1.00	24.51	239.
BR PT		-- 635	551.	6.	21.	50.	107.	1.35	1.35	24.51	60.
	STR -(										
		>- 670N	448.	6.	21.	118.	47.	1.77	1.77	24.51	83.
	BEND -(	670M	290.	282.	18.	1.	47.	1.77	1.77	24.51	33.
		>- 670F	6.	362.	45.	270.	19.	1.77	1.77	24.51	178.
	STR -(										
		>- 680N	6.	904.	45.	1049.	5.	1.77	1.77	24.51	681. *
	BEND -(	680M	613.	605.	36.	426.	28.	1.77	1.77	24.51	278.
		>- 680F	418.	6.	6.	182.	44.	1.77	1.77	24.51	122.
	STR -(										
		>- 685N	332.	6.	6.	232.	31.	1.77	1.77	24.51	152.
	BEND -(	685M	206.	200.	26.	147.	16.	1.77	1.77	24.51	97.
		>- 685F	6.	246.	29.	39.	8.	1.77	1.77	24.51	32.
	STR -(										
ANCHR		-- 690	6.	83.	29.	532.	12.	1.00	1.00	24.51	261.

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) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
ANCHOR		-- 600	3.	-136.	-3.	94.	22.	63.
	STRAIGHT -(							
		>- 605N	3.	28.	-3.	-68.	14.	63.
	BEND -(	605M	3.	71.	-3.	-33.	12.	64.
		>- 605F	3.	114.	-3.	-6.	11.	66.
	STRAIGHT -(							
		>- 610N	3.	831.	-3.	29.	11.	103.
	BEND -(	610M	3.	874.	-3.	283.	10.	105.
		>- 610F	3.	917.	-3.	917.	8.	106.
	STRAIGHT -(							
		>- 620N	3.	-427.	-3.	482.	-35.	106.
	BEND -(	620M	3.	-405.	-3.	323.	-37.	106.
		>- 620F	3.	-384.	-3.	194.	-37.	105.
	STRAIGHT -(							
		>- 625N	3.	-360.	-3.	79.	-38.	104.
	BEND -(	625M	3.	-317.	-3.	-92.	-39.	6.
		>- 625F	3.	-274.	-3.	-156.	-38.	-203.
	STRAIGHT -(							
		>- 630	3.	453.	-3.	-156.	-2.	986.
	STRAIGHT -(							
BRANCH PT.		-- 635	3.	394.	-3.	-156.	35.	1245.
BRANCH PT.		-- 635	4.	-503.	3.	-49.	14.	1295.
	STRAIGHT -(							
		>- 645N	4.	-576.	3.	-49.	-36.	615.
	BEND -(	645M	4.	-533.	3.	-48.	-38.	221.

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

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	FORCES (POUNDS) X	FORCES (POUNDS) Y	FORCES (POUNDS) Z	MOMENTS (FOOT-POUNDS) X	MOMENTS (FOOT-POUNDS) Y	MOMENTS (FOOT-POUNDS) Z
	BEND -(	645M	4.	-533.	3.	-48.	-38.	221.
	(							
	>-	645F	4.	-490.	3.	-46.	-39.	66.
	STRAIGHT -(							
	>-	647N	4.	-442.	3.	-43.	-39.	62.
	(							
	BEND -(	647M	4.	-399.	3.	80.	-38.	59.
	(							
	>-	647F	4.	-356.	3.	347.	-34.	58.
	STRAIGHT -(							
	>-	655N	4.	-879.	3.	-1068.	36.	58.
	(							
	BEND -(	655M	4.	-836.	3.	-460.	39.	57.
	(							
	>-	655F	4.	-794.	3.	-217.	40.	54.
	STRAIGHT -(							
	>-	660N	4.	-307.	3.	-191.	40.	15.
	(							
	BEND -(	660M	4.	-264.	3.	-107.	41.	12.
	(							
228	>-	660F	4.	-222.	3.	65.	44.	11.
	STRAIGHT -(							
ANCHOR	--	665	4.	-58.	3.	484.	57.	11.
BRANCH PT.	--	635	-1.	-551.	-6.	-107.	21.	-50.
	STRAIGHT -(							
	>-	670N	-1.	-448.	-6.	-118.	21.	-47.
	(							
	BEND -(	670M	-1.	-405.	-6.	1.	20.	-46.
	(							
	>-	670F	-1.	-362.	-6.	270.	19.	-45.
	STRAIGHT -(							
	>-	680N	-1.	-904.	-6.	-1049.	-5.	-45.
	(							
	BEND -(	680M	-1.	-861.	-6.	-426.	-6.	-45.
	(							
	>-	680F	-1.	-818.	-6.	-182.	-6.	-44.
	STRAIGHT -(							
	>-	685N	-1.	-332.	-6.	-232.	-6.	-31.
	(							
	BEND -(	685M	-1.	-289.	-6.	-147.	-7.	-30.
	(							
	>-	685F	-1.	-246.	-6.	39.	-8.	-29.
	STRAIGHT -(							
ANCHOR	--	[illegible]	-1.	-83.	-6.	532.	-12.	-29.

DISPLACEMENTS AND ROTATIONS

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 600	.000	-.000	-.000	.000	.000	.000
	STRAIGHT -(	>- 605N	.000	-.000	-.000	-.000	.000	.001
	BEND -(	605M	.000	.000	-.000	-.001	.000	.001
		>- 605F	-.000	.000	-.000	-.001	.000	.001
	STRAIGHT -(	>- 610N	-.008	.000	-.002	-.001	.001	.005
	BEND -(	610M	-.009	.000	-.003	.001	.000	.005
		>- 610F	-.009	-.000	-.002	.006	.000	.006
	STRAIGHT -(	>- 620N	-.009	-.000	-.002	-.010	-.000	.012
	BEND -(	620M	-.009	.001	-.002	-.008	-.001	.012
		>- 620F	-.008	.001	-.002	-.006	-.000	.012
	STRAIGHT -(	>- 625N	-.008	.001	-.002	-.006	-.001	.012
	BEND -(	625M	-.006	.001	-.001	-.006	-.001	.013
		>- 625F	-.006	-.000	-.001	-.007	-.001	.011
	STRAIGHT -(	>- 630	-.006	-.000	-.004	-.014	-.001	-.004
BRANCH PT.	STRAIGHT -(	-- 635	-.006	-.000	-.008	-.022	-.001	.006
BRANCH PT.		-- 635	-.006	-.000	-.008	-.022	-.001	.006
	STRAIGHT -(	>- 645N	-.006	-.000	-.011	-.025	-.001	-.011
	[illegible] -(	645M	-.006	.001	-.010	-.025	-.002	-.007
		>- 645F	-.007	.002	-.006	-.025	-.002	-.006
	STRAIGHT -(	>- 647N	-.003	.002	-.001	-.026	-.002	-.006

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 647N	-.004	.002	-.001	-.026	-.002	-.006
	BEND -(	647M	-.009	.000	.003	-.026	-.002	-.005
		>- 647F	-.009	-.004	.004	-.023	-.002	-.005
	STRAIGHT -(							
		>- 655N	.000	-.000	.004	.015	-.002	-.001
	BEND -(	655M	.001	.001	.004	.007	-.002	-.001
		>- 655F	.001	.002	.003	.004	-.002	-.001
	STRAIGHT -(							
		>- 660N	-.000	.002	-.000	-.001	-.001	-.000
	BEND -(	660M	-.000	.002	-.000	-.002	-.001	-.000
		>- 660F	-.000	.001	-.000	-.003	-.000	-.000
	STRAIGHT -(							
ANCHOR		-- 665	-.000	.000	-.000	-.000	-.000	-.000
BRANCH PT.		-- 635	-.006	-.009	-.008	-.022	-.001	.006
	STRAIGHT -(							
		>- 670N	-.004	-.000	.001	-.023	-.001	.006
	BEND -(	670M	-.003	-.001	.004	-.023	-.000	.005
		>- 670F	-.002	-.005	.006	-.022	-.000	.005
	STRAIGHT -(							
		>- 680N	-.002	-.000	.006	.015	.000	.002
	BEND -(	680M	-.002	.002	.005	.008	.000	.002
		>- 680F	-.002	.002	.004	.005	.000	.002
	STRAIGHT -(							
		>- 685N	-.000	.002	-.000	-.000	.000	.001
	BEND -(	685M	.000	.002	-.000	-.002	.000	.000
		>- 685F	.000	.001	.000	-.003	.000	.000
	STRAIGHT -(							
ANCHOR		-- 6[illegible]	.000	.000	.000	-.000	.000	.000

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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

231 SPRING TABLE (1) OF THE USER'S MANUAL, A CONSTANT SUPPORT HANGER IS RECOMMENDED.

(7) 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) X	HORIZONTAL MOVEMENT (INCHES) Z	PRELIMINARY HANGER SELECTION TYPE	PRELIMINARY HANGER SELECTION SPECIFICATION	SWING LENGTH (FEET)	SWING ANGLE (DEG)
610F	1364.	.73	.50	.52	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 680 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1860 LBS SPRING LOAD IN THE OPERATING CONDITION = 1364 LBS	N/A	N/A
655N	1409.	.52	-.27	.39	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 680 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1765 LBS SPRING LOAD IN THE OPERATING CONDITION = 1409 LBS	N/A	N/A
680N	1428.	.50	-.03	.55	VSH	1 - SHORT RANGE SPRING. SPRING RATE = 680 LBS/IN THEORETICAL SPRING INSTALLATION LOAD = 1770 LBS SPRING LOAD IN THE OPERATING CONDITION = 1428 LBS	N/A	N/A

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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 - ØFREEØ THERMAL

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

LOADING - ØRESTRAINEDØ WEIGHT (+UNIF)

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

DYNAFLEX

TABLE OF CONTENTS

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SEISMIC

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*********    **      **  **     **   ********   **********  **          **********  **      **
**********    **    **   ***    **  **********  **********  **          **********   **    **
**      **     **  **    ** *   **  **      **  **          **          **            **  **
**      **      ****     **  ** **  **      **  ******      **          ******         ****
**      **       **      **   ****  **********  ******      **          ******          **
**      **       **      **    ***  **********  **          **          **             ****
**      **       **      **     **  **      **  **          **          **            **  **
**********       **      **     **  **      **  **          **********  **********   **    **
*********        **      **     **  **      **  **          **********  **********  **      **
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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
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.

STEARNS - ROGER CORP

10MW SOLAR PILOT PLANT - C-21700

MS DESUP TO TH STOR HTR(X-MS-05-A-1)

2/26/80

DYNAFLEX (000204F-UCC)

LAST UPDATE - 12/25/79

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS DESUP TO TH STOR HTR(X-MS-05-A-1)

DATE 2/26/80

INPUT DATA - (CARD IMAGES)

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LINE NUMBER	TYP (:1)	LOC NO. (:4)	FRM (:7)	TO (:10)	DELTA X (:13)	DELTA Y (:25)	DELTA Z (:37)	RADIUS (:49)	ADDITIONAL DATA (:60)	LINE NUMBER
1	HED								STEARNS - ROGER CORP,	1
									2/26/80,PROJ.10MW SO	
									LAR PILOT PLANT - C-2	
									1700,JOBMS DESUP TO T	
									H STOR HTR(X-MS-05-A-	
									1)	
2	GEN								APPLY B31.1-1973,EXA	2
3			600	605			4-0	L	MAT=LCS,OD=8.625,	3
									WT=.500,UNIF=II.1,	
									TEMP=650.	
4				610		15-1-15/16		L		4
5				620			16-9-5/16	L		5
6				625		-1-3-11/16	1-3-11/16	L		6
7				630	-14-4					7
8				635	-13-9				WLT	8
9				645	-16-0			L		9
10				647		-2-10-3/4		L		10
11				655			-18-3	L		11
12				660		-10-11		L		12
13				665			-4-0			13
14			635	670		-2-10-3/4		L		14
15				[illegible]			-18-3	L		15
16				675		-10-11		L		16
17				[illegible]			-4-0			17
18	ANC	[illegible]								18
19	ANC	665								19
20	ANC	660								20
21	[illegible]	62[illegible]				[illegible]1610				21
22	[illegible]	64[illegible]				[illegible]1610				22
23	[illegible]	655				[illegible]1610				23
24	[illegible]	645				R1610				24
25	CCC	665			-86-1	0-0-1/2	-0-2			25
26	CCC	67[illegible]			-27-1	0-0-1/2	-0-2			26
27	[illegible]								SPEC 1(FRE/G,.17.013,	27
									.25/.082,2.5/.638,	
									9./.531,33./.125),	
									SPEC 2(FRE/G,.17.009,	
									.25/.055,2.5/.638,	

INPUT DATA - (CARD IMAGES)

LINE NUMBER	:1 TYP	:4 LOC NO.	:7 FR	:10 TO	:13 DELTA X	:25 DELTA Y	:37 DELTA Z	:49 RADIUS	:60 ADDITIONAL DATA	LINE NUMBER
									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	
28	DMO								LUMP POINTS(AUTOMATIC	28
									,MAX SPACING=5-0	
									,EXCLUDE ALL M NODES)	
									,MODE CUTOFF=20,	
									FREQUENCY CUTOFF=33	
29	OUT								SHOCK 1,SHOCK 2,	29
									SHOCK 3,SHOCK 4	

INPUT DATA - (CARD IMAGES)

:1	:4	:7	:10	:13	:25	:37	:49	:60	
LINE NUMBER	TYP	LOC NO.	FRM	TO	DELTA X	DELTA Y	DELTA Z	RADIUS	ADDITIONAL DATA	LINE NUMBER
									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	
28	OPO								LUMP POINTS(AUTOMATIC	28
									,MAX SPACING=5-0	
									,EXCLUDE ALL M NODES)	
									,MODE CUTOFF=20,	
									FREQUENCY CUTOFF=33	
29	OUT								SHOCK 1,SHOCK 2,	29
									SHOCK 3,SHOCK 4	

PROJECT - 10MW SOLAR PILOT PLANT - C-21700
JOB - MS DESUP TO TH STOR HTR(X-MS-05-A-1)

DATE 2/26/80

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* * * * * * * * * * * * * * * * * * *
*                                   *
* 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,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.

(15) 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 600, 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 20

FREQUENCY CUTOFF SET AT 33.00 CPS

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

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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.

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

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SHOCK 1
SHOCK 2
SHOCK 3
SHOCK 4

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
ANCHR		--600	0.00	0.00	0.00										
	STRAIGHT -(						3.00		8.625	.500	LCS	650.		43.4	11.1
	(* THERMAL EXPANSION OF LCS BETWEEN AMBIENT AND 650. DEGREES FAHRENHEIT IS 5.11 INCHES PER 100 FEET														
	(* A UNIFORM DISTRIBUTED LOAD OF 11.10 PLF IS ACTING IN THE -Y DIRECTION.														
		>-605N	0.00	0.00	3.00										
	BEND -(	605M	0.00	.29	3.71	1.00	1.57	90.000							
		>-605F	0.00	1.00	4.00										

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
		>-605F	0.00	1.00	4.00										
	STRAIGHT -(						4.39								
		>-605F.1	0.00	5.39	4.00										
	STRAIGHT -(						4.39								
		>-605F.2	0.00	9.77	4.00										
	STRAIGHT -(						4.39								
		>-610N	0.00	14.16	4.00										
	(														
	BEND -(	610M	0.00	14.87	4.29	1.00	1.57	90.000							
	(														
		>-610F	0.00	15.16	5.00										
	STRAIGHT -(						3.84								
		>-610F.1	0.00	15.16	8.84										
	STRAIGHT -(						3.84								
		>-610F.2	0.00	15.16	12.68										
	STRAIGHT -(						3.84								
		>-610F.3	0.00	15.16	16.52										
	STRAIGHT -(						3.84								
		>-620N	0.00	15.16	20.35										
	(														
	(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 620N IN DIRECTION Y														
	(														
	(														
	(														
	BEND -(	620M	0.00	15.09	20.74	1.00	.79	45.000							
	(														
		>-620F	0.00	14.87	21.07										
	STRAIGHT -(						.43								
		>-625N	0.00	14.56	21.38										
	(														
	BEND -(	625M	-.29	14.06	21.88	1.00	1.57	90.000							
	(														
		>-625F	-1.00	13.85	22.08										
	STRAIGHT -(						4.44								
		>-625F.1	-5.44	13.85	22.08										
	STRAIGHT -(						4.44								
		>-625F.2	-9.89	13.85	22.08										
	STRAIGHT -(						4.44								
		>-630	-14.33	13.85	22.08										

* NOTES PERTAINING TO POINT 630 APPEAR ON THE FOLLOWING PAGE

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POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
		>-630	-14.33	13.85	22.08										
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 630 IN DIRECTION Y													
	STRAIGHT -(						4.58								
		>-630.1	-18.92	13.85	22.08										
	STRAIGHT -(						4.58								
		>-630.2	-23.50	13.85	22.08										
	STRAIGHT -(						4.58								
BR PT		>-635	-28.08	13.85	22.08										
		(* WELDING TEE AT POINT 635													
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 635 IN DIRECTION Y													
	STRAIGHT -(						4.25								
		>-635.1	-32.33	13.85	22.08										
	STRAIGHT -(						4.25								
		>-635.2	-36.58	13.85	22.08										
	STRAIGHT -(						4.25								
		>-635.3	-40.83	13.85	22.08										
	STRAIGHT -(						4.25								
		>-645N	-45.08	13.85	22.08										
		(* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 645N IN DIRECTION Y													
	BEND -(	645M	-45.79	13.56	22.08	1.00	1.57	90.000							
		>-645F	-46.08	12.85	22.08										
	STRAIGHT -(						.90								
		>-647N	-46.08	11.96	22.08										
	BEND -(	647M	-46.08	11.25	21.79	1.00	1.57	90.000							
		>-647F	-46.08	10.96	21.08										

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
		>-647F	-46.08	10.96	21.08										
	STRAIGHT -(						4.06								
		>-647F.1	-46.08	10.96	17.02										
	STRAIGHT -(						4.06								
		>-647F.2	-46.08	10.96	12.96										
	STRAIGHT -(						4.06								
		>-647F.3	-46.08	10.96	8.90										
	STRAIGHT -(						4.06								
		>-655G	-46.08	10.96	4.83										
	(														
	BEND -(	655B	-46.08	10.67	4.13	1.00	1.57	90.000							
	(														
		>-655F	-46.08	9.96	3.83										
	STRAIGHT -(						4.46								
		>-655F.1	-46.08	5.50	3.83										
	STRAIGHT -(						4.46								
		>-660G	-46.08	1.04	3.83										
	(														
	BEND -(	660B	-46.08	.33	3.54	1.00	1.57	90.000							
	(														
		>-660F	-46.08	.04	2.83										
	STRAIGHT -(						3.00								
ANCHR		--665	-46.08	.04	-.17										
		* CONTROL COORDINATES OF POINT 665, IN FEET : X = -46.08, Y = .04, Z = -.17 RESULTANT DIFFERENCE IS ZERO													
BR PT		--635	-28.08	13.85	22.08										
	(	* WELDING TEE AT POINT 635													
	(	* RIGID RESTRAINT AGAINST DISPLACEMENT AT POINT 635 IN DIRECTION Y													
	STRAIGHT -(						1.90								
	(														
		>-670G	-28.08	11.96	22.08										
	(														
	BEND -(	670B	-28.08	11.25	21.77	1.00	1.57	90.000							
	(														
		>-670F	-28.08	10.96	21.08										

POINT TYPE	ELEMENT DESIGNATION	POINT LOC. NO.	COORDINATES (FT) X	Y	Z	RADIUS (FT)	LENGTH (FT)	ANGLE (DEG)	OUTSIDE DIAMETER (IN)	WALL THICK (IN)	MATL	TEMP (DEG) (FAHR)	PRESS (PSI)	DIST. LOADS (LBS PER FT) PIPE WT.	UNIF
									8.625	.500	LCS	650.		43.4	11.1
		>-670F	-28.08	10.96	21.08										
	STRAIGHT -(						4.06								
		>-670F.1	-28.08	10.96	17.02										
	STRAIGHT -(						4.06								
		>-670F.2	-28.08	10.96	12.96										
	STRAIGHT -(						4.06								
		>-670F.3	-28.08	10.96	8.90										
	STRAIGHT -(						4.06								
		>-680N	-28.08	10.96	4.83										
	(														
	BEND -(	680M	-28.08	10.67	4.13	1.00	1.57	90.000							
	(														
		>-680F	-28.03	9.96	3.83										
	STRAIGHT -(						4.46								
		>-680F.1	-28.08	5.50	3.83										
	STRAIGHT -(						4.46								
		>-685N	-28.08	1.04	3.83										
	(														
	BEND -(	685M	-28.08	.33	3.54	1.00	1.57	90.000							
	(														
		>-685F	-28.08	.04	2.83										
	STRAIGHT -(						3.00								
ANCHR		--690	-28.08	.04	-.17										

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* CONTROL COORDINATES OF POINT 690, IN FEET :
X = -28.08, Y = .04, Z = -.17
RESULTANT DIFFERENCE IS ZERO

* 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.

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	DISPLACEMENT FREEDOM				ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION			X	Y	Z
600	82.				0.	0.	0.
605G	125.	X	Y	Z	0.	0.	0.
605F	162.	X	Y	Z	0.	0.	0.
605F.1	239.	X	Y	Z	0.	0.	0.
605F.2	239.	X	Y	Z	0.	0.	0.
610G	162.	X	Y	Z	0.	0.	0.
610F	148.	X	Y	Z	0.	0.	0.
610F.1	209.	X	Y	Z	0.	0.	0.
610F.2	209.	X	Y	Z	0.	0.	0.
610F.3	209.	X	Y	Z	0.	0.	0.
620G	126.	X		Z	0.	0.	0.
620F	33.	X	Y	Z	0.	0.	0.
625G	55.	X	Y	Z	0.	0.	0.

	DISPLACEMENT FREEDOM				ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN)		
LOC. NO.	WEIGHT (POUNDS)	DIRECTION			X	Y	Z
625F	164.	X	Y	Z	0.	0.	0.
625F.1	242.	X	Y	Z	0.	0.	0.
625F.2	242.	X	Y	Z	0.	0.	0.
630	246.	X		Z	0.	0.	0.
630.1	250.	X	Y	Z	0.	0.	0.
630.2	250.	X	Y	Z	0.	0.	0.
635	293.	X		Z	0.	0.	0.
635.1	232.	X	Y	Z	0.	0.	0.
635.2	232.	X	Y	Z	0.	0.	0.
635.3	232.	X	Y	Z	0.	0.	0.
645D	159.	X		Z	0.	0.	0.
645F	67.	X	Y	Z	0.	0.	0.
647A	67.	X	Y	Z	0.	0.	0.
647F	154.	X	Y	Z	0.	0.	0.
647F.1	222.	X	Y	Z	0.	0.	0.
647F.2	222.	X	Y	Z	0.	0.	0.
647F.3	222.	X	Y	Z	0.	0.	0.
655D	154.	X	Y	Z	0.	0.	0.
655F	164.	X	Y	Z	0.	0.	0.
655F.1	243.	X	Y	Z	0.	0.	0.
660[illegible]	164.	X	Y	Z	0.	0.	0.
660F	125.	X	Y	Z	0.	0.	0.
665	32.				0.	0.	0.

LUMPED DYNAMIC MODEL (CONTINUED)

LOC. NO.	DISPLACEMENT FREEDOM WEIGHT (POUNDS)	DIRECTION			ROTATIONAL FREEDOM MOMENT OF INERTIA (LB - IN X IN) X	Y	Z
670N	95.	X	Y	Z	0.	0.	0.
670F	159.	X	Y	Z	0.	0.	0.
670F.1	222.	X	Y	Z	0.	0.	0.
670F.2	222.	X	Y	Z	0.	0.	0.
670F.3	222.	X	Y	Z	0.	0.	0.
680N	154.	X	Y	Z	0.	0.	0.
680F	160.	X	Y	Z	0.	0.	0.
680F.1	245.	X	Y	Z	0.	0.	0.
685N	160.	X	Y	Z	0.	0.	0.
685F	125.	X	Y	Z	0.	0.	0.
690	82.				0.	0.	0.

NUMBER OF DYNAMIC DEGREES OF FREEDOM = 128, TOTAL MASS OF SYSTEM = 8270. POUNDS

FREQUENCIES, PERIODS OF VIBRATION AND MASS PARTICIPATION FACTORS

MODE NO.	FREQUENCY (CPS)	PERIOD (SECONDS)	MASS PARTICIPATION FACTORS X	Y	Z
1	1.52635	.65516	3.88951712	.01630599	.27545956
2	2.76993	.36102	.63427009	.19195003	3.30186102
3	3.73092	.26803	.42244403	.23227909	2.45624379
4	4.58370	.21816	.15246088	.12506582	.87394329
5	5.41246	.18476	.82814111	.06446611	.21491020
6	6.86071	.14576	.13441814	.00978226	.04569968
7	7.66594	.13045	1.28663528	.03953791	.04643485
8	11.88211	.08416	.04389780	.25333829	.13978470
9	15.06787	.06637	.01175935	1.60590947	.26273959
10	18.11271	.05521	.01160239	.21226547	.07721311
11	19.60632	.05100	.04154665	.13389753	.06830509
12	21.66634	.04615	.12628511	.55265724	.14247040
13	22.29184	.04486	.23922217	1.13469082	.15453501
14	24.57877	.04069	.28300172	.05131970	.10034304
15	24.83101	.04027	.24212571	1.27905980	.29040153
16	27.29943	.03663	.05264097	1.61575727	.27436827
17	27.45644	.03642	.04139636	.06307545	.13956712
18	30.64919	.03263	.24465225	.87840792	.28348253
19	31.97122	.03128	.26542495	.01197196	.02177699

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 = 6.74

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

MODE ORTHOGONALITY CHECK

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

OFF DIAGONAL TERMS: MAX. = 1.79014×10^{-13} MIN. = -1.12708×10^{-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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:								
600	749.	231.	624.	1002.	3880.	6478.	7661.	10757.
665	776.	268.	682.	1067.	2725.	7992.	6544.	10683.
690	925.	104.	384.	1007.	1762.	8657.	7447.	11555.
RESTRAINTS:								
620	0.	147.	0.	147.	0.	0.	0.	0.
630	0.	128.	0.	128.	0.	0.	0.	0.
635	0.	178.	0.	178.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
645	0.	81.	0.	81.	0.	0.	0.	0.

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* * * * * * * * * * * * * * * * * * * * * * * * * * *
*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 6414. OCCURS AT POINT 605N

EXPLANATORY NOTES:
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(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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHOR		-- 600	623.	784.	7661.	3860.	6478.	1.00	1.00	24.51	5266.
	STR -(	>- 605N	624.	783.	7661.	4571.	4265.	1.77	1.77	24.51	6414. **
	BEND -(	605M	665.	798.	2742.	4551.	7869.	1.77	1.77	24.51	6159. *
	(	>- 605F	231.	974.	3537.	4177.	6913.	1.77	1.77	24.51	5720.
	STR -(	>- 605F.1	235.	949.	3537.	3644.	1446.	1.00	1.00	24.51	2585.
	STR -(	>- 605F.2	237.	907.	3537.	455.	1234.	1.00	1.00	24.51	1847.
	STR -(	>- 610N	238.	867.	3537.	3793.	2593.	1.77	1.77	24.51	3761.
	BEND -(	610M	563.	701.	4508.	4118.	480.	1.77	1.77	24.51	3973.
	(	>- 610F	559.	704.	3254.	4114.	2882.	1.77	1.77	24.51	3882.
	STR -(	>- 610F.1	505.	625.	3254.	3192.	549.	1.00	1.00	24.51	2247.
	STR -(	>- 610F.2	505.	625.	3254.	2254.	1775.	1.00	1.00	24.51	2124.
	STR -(	>- 610F.3	476.	566.	3254.	1307.	3700.	1.00	1.00	24.51	2495.
	STR -(	>- 620N	433.	426.	3254.	413.	5321.	1.77	1.77	24.51	4055.
	BEND -(	620M	325.	513.	5047.	365.	3843.	1.77	1.77	24.51	4120.
	(	>- 620F	174.	582.	6143.	164.	1827.	1.77	1.77	24.51	4158.
	STR -(	>- 625N	166.	551.	6143.	1979.	124.	1.77	1.77	24.51	4187.
	BEND -(	625M	346.	461.	4511.	2166.	3997.	1.77	1.77	24.51	4155.
	(	>- 625F	330.	472.	518.	2154.	5705.	1.77	1.77	24.51	3970.
	STR -(	>- 625F.1	159.	442.	518.	1692.	3734.	1.00	1.00	24.51	2023.
	STR -(	>- 625F.2	96.	432.	518.	759.	2046.	1.00	1.00	24.51	1098.
	STR -(	>- 630	96.	432.	518.	226.	556.	1.00	1.00	24.51	388.
	STR -(	>- 630.1	149.	376.	518.	595.	1382.	1.00	1.00	24.51	779.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 630.1	149.	376.	516.	595.	1382.	1.00	1.00	24.51	779.
	STR -(										
		>- 630.2	252.	367.	516.	1001.	2948.	1.00	1.00	24.51	1545.
	STR -(										
BR PT		-- 635	366.	360.	518.	1410.	4504.	1.35	1.35	24.51	2362.
BR PT		-- 635	47.	650.	294.	2511.	4259.	1.35	1.35	24.51	2463.
	STR -(										
		>- 635.1	87.	651.	294.	1229.	1880.	1.00	1.00	24.51	1109.
	STR -(										
		>- 635.2	87.	651.	294.	74.	883.	1.00	1.00	24.51	457.
	STR -(										
		>- 635.3	194.	653.	294.	1340.	3172.	1.00	1.00	24.51	1692.
	STR -(										
		>- 645N	389.	652.	294.	2621.	5628.	1.77	1.77	24.51	4032.
	(										
	BEND -(	645M	460.	598.	4331.	2703.	4217.	1.77	1.77	24.51	4296.
	(										
		>- 645F	279.	701.	6215.	2522.	362.	1.77	1.77	24.51	4357.
	STR -(										
		>- 647N	280.	742.	6215.	876.	2167.	1.77	1.77	24.51	4307.
	(										
	BEND -(	647M	614.	501.	3042.	1213.	5592.	1.77	1.77	24.51	4204.
	(										
		>- 647F	595.	524.	1747.	1193.	5773.	1.77	1.77	24.51	3988.
	STR -(										
		>- 647F.1	663.	584.	1747.	252.	3706.	1.00	1.00	24.51	2009.
	STR -(										
		>- 647F.2	629.	712.	1747.	1123.	1340.	1.00	1.00	24.51	1210.
	STR -(										
		>- 647F.3	645.	754.	1747.	2222.	1432.	1.00	1.00	24.51	1551.
	STR -(										
		>- 655N	658.	776.	1747.	3319.	4237.	1.77	1.77	24.51	3670.
	(										
	BEND -(	655M	656.	777.	4410.	3316.	2526.	1.77	1.77	24.51	3885.
	(										
		>- 655F	271.	980.	4955.	2931.	1026.	1.77	1.77	24.51	3793.
	STR -(										
		>- 655F.1	269.	1030.	4955.	2332.	59.	1.00	1.00	24.51	2681.
	STR -(										
		>- 660N	262.	1033.	4955.	3093.	5769.	1.77	1.77	24.51	5325.
	(										
	BEND -(	660M	569.	831.	1187.	3498.	8079.	1.77	1.77	24.51	5762.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	BEND -(	660M	669.	831.	1187.	3498.	8079.	1.77	1.77	24.51	5762.
	(	>- 660F	682.	821.	6544.	3511.	5707.	1.77	1.77	24.51	6075. *
	STR -(										
ANCHR		-- 665	682.	821.	6544.	2725.	7992.	1.00	1.00	24.51	5230.
BR PT		-- 635	124.	600.	6524.	3920.	768.	1.35	1.35	24.51	4682.
	STR -(	>- 670N	124.	642.	6524.	344.	2959.	1.77	1.77	24.51	5857. *
	BEND -(	670M	281.	590.	4184.	290.	7680.	1.77	1.77	24.51	5676.
	(	>- 670F	287.	587.	2423.	259.	7954.	1.77	1.77	24.51	5396.
	STR -(	>- 670F.1	308.	737.	2423.	461.	5359.	1.00	1.00	24.51	2688.
	STR -(	>- 670F.2	323.	799.	2423.	915.	2450.	1.00	1.00	24.51	1745.
	STR -(	>- 670F.3	342.	846.	2423.	1374.	928.	1.00	1.00	24.51	1437.
	STR -(	>- 680N	356.	872.	2423.	1618.	4204.	1.77	1.77	24.51	3361.
	BEND -(	680M	328.	883.	4889.	1791.	1975.	1.77	1.77	24.51	3612.
	(	>- 680F	109.	936.	5055.	1571.	1565.	1.77	1.77	24.51	3580.
	STR -(	>- 680F.1	106.	996.	5055.	2431.	92.	1.00	1.00	24.51	2746.
	STR -(	>- 685N	105.	1000.	5055.	1786.	6524.	1.77	1.77	24.51	5478.
	BEND -(	685M	344.	905.	1692.	2027.	8768.	1.77	1.77	24.51	5940. *
	(	>- 685F	384.	930.	7447.	2067.	5944.	1.77	1.77	24.51	6325. *
	STR -(										
ANCHR		-- 690	384.	931.	7447.	1762.	8657.	1.00	1.00	24.51	5656.

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DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		== 600	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>= 605N	.016	.011	.000	.035	.045	.084
	(		(2.6)	(3.1)	(.0)			
	BEND -(	605M	.032	.019	.004	.081	.097	.124
	(		(4.5)	(4.7)	(.8)			
		>= 605F	.063	.025	.020	.125	.128	.194
	STRAIGHT -(		(8.3)	(5.7)	(3.6)			
		>= 605F.1	.274	.025	.153	.160	.184	.259
	STRAIGHT -(		(40.9)	(5.7)	(26.8)			
		>= 605F.2	.527	.025	.304	.161	.241	.284
	STRAIGHT -(		(79.1)	(5.7)	(52.1)			
		>= 610N	.785	.025	.440	.130	.297	.271
	(		(118.2)	(5.7)	(74.7)			
257	BEND -(	610M	.842	.031	.457	.050	.305	.254
	(		(124.1)	(6.6)	(77.5)			
		>= 610F	.908	.042	.461	.049	.325	.248
	STRAIGHT -(		(126.2)	(8.4)	(78.2)			
		>= 610F.1	1.171	.064	.461	.010	.343	.202
	STRAIGHT -(		(129.4)	(16.0)	(78.2)			
		>= 610F.2	1.443	.060	.461	.019	.336	.157
	STRAIGHT -(		(141.3)	(17.3)	(78.2)			
		>= 610F.3	1.702	.035	.462	.039	.307	.112
	STRAIGHT -(		(159.1)	(11.0)	(78.2)			
		>= 620N	1.929	.000	.462	.047	.258	.066
	(		(179.2)	(.0)	(78.2)			
	BEND -(	620M	1.947	.004	.462	.049	.235	.065
	(		(181.0)	(1.2)	(78.4)			
		>= 620F	1.960	.007	.465	.050	.219	.065
	STRAIGHT -(		(182.3)	(2.1)	(78.7)			
		>= 625N	1.970	.010	.468	.050	.210	.060

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 625T	1.970	.010	.468	.050	.210	.060
	(		(183.3)	(3.1)	(79.1)			
	BEND -(	625M	1.984	.013	.463	.061	.179	.055
	(		(184.6)	(4.6)	(79.2)			
		>- 625F	1.989	.010	.445	.072	.130	.034
	STRAIGHT -(		(185.4)	(6.1)	(77.9)			
		>- 625F.1	1.989	.012	.358	.063	.077	.008
	STRAIGHT -(		(185.4)	(14.6)	(68.3)			
		>- 625F.2	1.989	.010	.307	.055	.049	.008
	STRAIGHT -(		(185.4)	(11.8)	(59.7)			
		>- 630	1.989	.000	.273	.047	.042	.011
	STRAIGHT -(		(185.4)	(.0)	(54.7)			
		>- 630.1	1.989	.009	.241	.038	.045	.006
	STRAIGHT -(		(185.4)	(7.7)	(55.7)			
		>- 630.2	1.989	.011	.197	.030	.063	.004
	STRAIGHT -(		(185.4)	(6.7)	(57.1)			
BRANCH PT.		-- 635	1.989	.000	.129	.021	.104	.019
			(185.4)	(.0)	(53.9)			
BRANCH PT.		-- 635	1.989	.000	.129	.021	.104	.019
	STRAIGHT -(		(185.4)	(.0)	(53.9)			
		>- 635.1	1.989	.006	.076	.025	.071	.003
	STRAIGHT -(		(185.4)	(6.8)	(45.5)			
		>- 635.2	1.989	.001	.072	.028	.067	.010
	STRAIGHT -(		(185.3)	(9.8)	(34.7)			
		>- 635.3	1.989	.008	.113	.032	.089	.002
	STRAIGHT -(		(185.3)	(6.7)	(36.9)			
		>- 645T	1.989	.000	.202	.036	.139	.022
	(		(185.3)	(.0)	(53.6)			
	BEND -(	645M	1.987	.005	.224	.024	.188	.049
	(		(185.1)	(1.5)	(57.1)			
		>- 645F	1.977	.009	.234	.011	.213	.075
	STRAIGHT -(		(184.4)	(2.2)	(59.5)			
		>- 647T	1.963	.009	.233	.010	.233	.081
	(		(183.3)	(2.2)	(61.2)			
	BEND -(	647M	1.933	.009	.233	.010	.262	.112
	(		(180.6)	(2.2)	(62.6)			
		>- 647F	1.[illegible]	.007	.233	.019	.317	.133
	STRAIGHT -(		(175.3)	(2.6)	(63.2)			
		>- 647F.1	1.589	.015	.233	.025	.371	.158
	STRAIGHT -(		(147.2)	(11.7)	(63.2)			
		>- 647F.2	1.2[illegible]	.0[illegible]	.233	.019	.399	.184
	STRAIGHT -(		(129.4)	(17.4)	(63.2)			
		>- 647F.3	.919	.043	.233	.003	.398	.210
	STRAIGHT -(		(128.0)	(17.0)	(63.2)			
		>- 655	.594	.0[illegible]	.233	.032	.367	.235

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
	>-	655N	.594	.030	.233	.032	.367	.235
	(		(139.4)	(7.4)	(63.2)			
	BEND -(	655B	.528	.023	.230	.065	.331	.232
	(		(138.3)	(7.0)	(62.2)			
	>-	655F	.474	.018	.218	.096	.314	.232
	STRAIGHT -(		(129.7)	(5.7)	(58.6)			
	>-	655F.1	.257	.019	.116	.114	.234	.224
	STRAIGHT -(		(66.8)	(5.7)	(31.4)			
	>-	660N	.068	.019	.015	.095	.154	.174
	(		(10.9)	(5.7)	(4.1)			
	BEND -(	660B	.038	.014	.003	.061	.119	.110
	(		(4.5)	(4.5)	(.9)			
	>-	660F	.019	.008	.000	.026	.057	.071
	STRAIGHT -(		(2.0)	(2.7)	(.0)			
ANCHOR	--	665	.000	.000	.000	.000	.000	.000
			(.0)	(.0)	(.0)			
BRANCH PT.	--	635	1.969	.000	.129	.021	.104	.019
	STRAIGHT -(		(185.4)	(.0)	(53.9)			
	>-	670N	1.977	.000	.135	.019	.161	.038
	(		(184.4)	(.0)	(55.8)			
	BEND -(	670B	1.958	.001	.138	.018	.201	.080
	(		(182.5)	(.6)	(56.7)			
	>-	670F	1.917	.004	.139	.018	.277	.109
	STRAIGHT -(		(178.0)	(1.8)	(57.2)			
	>-	670F.1	1.648	.018	.139	.016	.352	.144
	STRAIGHT -(		(158.4)	(9.2)	(57.2)			
	>-	670F.2	1.328	.029	.139	.008	.396	.180
	STRAIGHT -(		(146.6)	(14.9)	(57.1)			
	>-	670F.3	.936	.030	.139	.005	.405	.216
	STRAIGHT -(		(159.4)	(14.8)	(57.1)			
	>-	680N	.653	.019	.139	.023	.377	.251
	(		(182.5)	(8.4)	(57.1)			
	BEND -(	680B	.545	.014	.136	.041	.343	.251
	(		(131.7)	(6.3)	(56.3)			
	>-	680F	.527	.011	.129	.058	.327	.256
	STRAIGHT -(		(176.8)	(5.1)	(53.2)			
	>-	680F.1	.246	.011	.068	.067	.245	.251
	STRAIGHT -(		(80.3)	(5.1)	(28.5)			
	>-	685N	.074	.011	.009	.056	.163	.195
	(		(10.1)	(5.1)	(3.7)			
	BEND -(	685B	.041	.009	.002	.037	.126	.124
	(		(5.6)	(4.1)	(.8)			
	>-	685F	.021	.005	.000	.016	.061	.081
	STRAIGHT -(		(2.4)	(2.5)	(.0)			
ANCHOR	--	690	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	600	313.	565.	1532.	1663.	9113.	764.	3002.	9626.
	665	159.	227.	883.	925.	3981.	856.	1331.	4284.
	690	253.	401.	1330.	1412.	5795.	1131.	2111.	6270.
RESTRAINTS:									
	620U	0.	762.	0.	762.	0.	0.	0.	0.
	630	0.	153.	0.	153.	0.	0.	0.	0.
	635	0.	530.	0.	530.	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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
6456	0.	337.	0.	337.	0.	0.	0.	0.

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*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
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THE MAXIMUM STRESS OF 7284. OCCURS AT POINT 605N

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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	: LONGITUDINAL: STRESS PSI :
ANCHR		-- 600	1532.	646.	3602.	9113.	764.	1.00	1.00	24.51	: 4712. :
	STR -(	>- 605N	1532.	646.	3002.	10806.	554.	1.77	1.77	24.51	: 7284. **:
	BEND -(	605M	1985.	751.	2460.	10759.	1709.	1.77	1.77	24.51	: 7244. *:
	(	>- 605F	566.	1564.	778.	9841.	2690.	1.77	1.77	24.51	: 6637. *:
	STR -(	>- 605F.1	575.	1557.	778.	1331.	3147.	1.00	1.00	24.51	: 1715. :
	STR -(	>- 605F.2	598.	1339.	778.	111.	3246.	1.00	1.00	24.51	: 1635. :
	STR -(	>- 610N	605.	1199.	778.	9037.	889.	1.77	1.77	24.51	: 5912. :
	BEND -(	610M	1267.	445.	473.	9698.	1203.	1.77	1.77	24.51	: 6347. :
	(	>- 610F	1187.	628.	1056.	9618.	895.	1.77	1.77	24.51	: 6303. :
	STR -(	>- 610F.1	1060.	629.	1056.	7251.	1219.	1.00	1.00	24.51	: 3636. :
	STR -(	>- 610F.2	881.	648.	1056.	4793.	1371.	1.00	1.00	24.51	: 2495. :
263	STR -(	>- 610F.3	704.	670.	1056.	2259.	1417.	1.00	1.00	24.51	: 1404. :
	STR -(	>- 620N	429.	155.	1056.	470.	1451.	1.77	1.77	24.51	: 1203. :
	BEND -(	620M	420.	177.	1463.	447.	1051.	1.77	1.77	24.51	: 1204. :
	(	>- 620F	359.	291.	1689.	470.	658.	1.77	1.77	24.51	: 1215. :
	STR -(	>- 625N	299.	253.	1689.	697.	528.	1.77	1.77	24.51	: 1234. :
	BEND -(	625M	219.	325.	845.	600.	1614.	1.77	1.77	24.51	: 1291. :
	(	>- 625F	193.	377.	676.	946.	1769.	1.77	1.77	24.51	: 1374. :
	STR -(	>- 625F.1	101.	269.	676.	533.	2497.	1.00	1.00	24.51	: 1293. :
	STR -(	>- 625F.2	94.	168.	676.	197.	2630.	1.00	1.00	24.51	: 1333. :
	STR -(	>- 630	96.	236.	676.	691.	2209.	1.00	1.00	24.51	: 1169. :
	STR -(	>- 630.1	92.	437.	676.	466.	1673.	1.00	1.00	24.51	: 912. :

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM. TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 630.1	92.	437.	676.	466.	1673.	1.00	1.00	24.51	912.
	STR -(										
		>- 630.2	99.	535.	676.	340.	2325.	1.00	1.00	24.51	1197.
	STR -(										
BR PT		-- 635	99.	535.	676.	246.	4247.	1.35	1.35	24.51	2143.
BR PT		-- 635	59.	149.	213.	620.	1625.	1.35	1.35	24.51	872.
	STR -(										
		>- 635.1	32.	98.	213.	358.	1644.	1.00	1.00	24.51	830.
	STR -(										
		>- 635.2	32.	136.	213.	123.	1604.	1.00	1.00	24.51	794.
	STR -(										
		>- 635.3	41.	220.	213.	216.	1424.	1.00	1.00	24.51	713.
	STR -(										
		>- 645N	50.	415.	213.	473.	1417.	1.77	1.77	24.51	979.
	(										
	BEND -(	645M	231.	343.	1160.	424.	938.	1.77	1.77	24.51	1006.
	(										
		>- 645F	313.	277.	1506.	410.	337.	1.77	1.77	24.51	1036.
	STR -(										
		>- 647N	313.	332.	1506.	574.	369.	1.77	1.77	24.51	1072.
	(										
	BEND -(	647M	449.	79.	827.	706.	1285.	1.77	1.77	24.51	1092.
	(										
		>- 647F	327.	313.	322.	583.	1455.	1.77	1.77	24.51	1038.
	STR -(										
		>- 647F.1	490.	311.	322.	714.	1210.	1.00	1.00	24.51	705.
	STR -(										
		>- 647F.2	588.	293.	322.	1918.	900.	1.00	1.00	24.51	1049.
	STR -(										
		>- 647F.3	687.	246.	322.	3050.	541.	1.00	1.00	24.51	1524.
	STR -(										
		>- 655N	756.	283.	322.	4097.	323.	1.77	1.77	24.51	2674.
	(										
	BEND -(	655M	710.	383.	370.	4051.	254.	1.77	1.77	24.51	2644.
	(										
		>- 655F	269.	767.	366.	3590.	189.	1.77	1.77	24.51	2344.
	STR -(										
		>- 655F.1	235.	892.	366.	473.	86.	1.00	1.00	24.51	295.
	STR -(										
		>- 660N	229.	397.	365.	4006.	1172.	1.77	1.77	24.51	2714.
	(										
	BEND -(	660M	785.	490.	797.	4558.	1079.	1.77	1.77	24.51	3082.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	BEND -(	660M	785.	490.	797.	4558.	1079.	1.77	1.77	24.51	3082.
	(>-	660F	883.	278.	1331.	4656.	456.	1.77	1.77	24.51	3155.
	STR -(										
ANCHR	--	665	883.	277.	1331.	3981.	856.	1.00	1.00	24.51	2097.
BR PT	--	635	488.	723.	2893.	849.	508.	1.35	1.35	24.51	1520.
	STR -(>-	670N	454.	763.	2893.	997.	650.	1.77	1.77	24.51	2029.
	(BEND -(	670M	872.	243.	1627.	1374.	2420.	1.77	1.77	24.51	2091.
	(>-	670F	754.	501.	540.	1250.	2781.	1.77	1.77	24.51	2008.
	STR -(>-	670F.1	919.	497.	540.	754.	2284.	1.00	1.00	24.51	1207.
	STR -(>-	670F.2	1020.	488.	540.	2668.	1700.	1.00	1.00	24.51	1571.
	STR -(>-	670F.3	1125.	478.	540.	4513.	1025.	1.00	1.00	24.51	2281.
	STR -(>-	680N	1196.	474.	540.	6272.	390.	1.77	1.77	24.51	4092.
265	(BEND -(	680M	1145.	508.	433.	6222.	412.	1.77	1.77	24.51	4054.
	(>-	680F	421.	1216.	363.	5501.	322.	1.77	1.77	24.51	3582.
	STR -(>-	680F.1	409.	1349.	366.	741.	156.	1.00	1.00	24.51	412.
	STR -(>-	685N	403.	1354.	366.	6061.	1859.	1.77	1.77	24.51	4119.
	(BEND -(	685M	1224.	705.	1371.	6884.	1556.	1.77	1.77	24.51	4664.
	(>-	685F	1330.	475.	2111.	6990.	479.	1.77	1.77	24.51	4747.
	STR -(										
ANCHR	--	690	1330.	474.	2111.	5795.	1131.	1.00	1.00	24.51	3069.

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 600	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 605N	.002	.025	.000	.084	.004	.033
	(		(1.3)	(9.2)	(.1)			
	BEND -(	605M	.004	.045	.010	.192	.009	.044
	(		(2.6)	(15.6)	(3.1)			
		>- 605F	.013	.059	.046	.295	.013	.067
	STRAIGHT -(		(7.1)	(19.9)	(14.8)			
		>- 605F.1	.097	.059	.362	.375	.017	.092
	STRAIGHT -(		(49.9)	(19.9)	(113.5)			
		>- 605F.2	.176	.059	.713	.374	.027	.100
	STRAIGHT -(		(101.2)	(19.9)	(222.7)			
		>- 610N	.266	.059	1.029	.299	.038	.096
	(		(153.5)	(19.9)	(320.9)			
	BEND -(	610M	.280	.073	1.067	.205	.043	.086
	(		(159.9)	(24.0)	(332.7)			
		>- 610F	.280	.096	1.077	.108	.051	.080
	STRAIGHT -(		(158.8)	(30.7)	(336.0)			
		>- 610F.1	.252	.145	1.077	.017	.061	.066
	STRAIGHT -(		(132.5)	(46.2)	(336.0)			
		>- 610F.2	.220	.130	1.078	.047	.072	.052
	STRAIGHT -(		(101.6)	(42.4)	(336.1)			
		>- 610F.3	.189	.075	1.078	.085	.083	.038
	STRAIGHT -(		(66.5)	(24.7)	(336.1)			
		>- 620N	.167	.000	1.078	.095	.093	.025
	(		(34.0)	(.0)	(336.1)			
	BEND -(	620M	.165	.008	1.079	.094	.097	.024
	(		(31.8)	(2.5)	(336.6)			
		>- 620F	.164	.014	1.083	.092	.099	.023
	STRAIGHT -(		(35.1)	(8.6)	(337.9)			
		>- 625N	.163	.020	1.089	.092	.100	.021

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>= 625S	.163	.020	1.089	.092	.100	.021
	(		(29.1)	(6.6)	(339.6)			
	BEND -(	625	.161	.029	1.095	.084	.104	.016
	(		(28.7)	(9.8)	(340.7)			
		>= 625F	.161	.032	1.088	.078	.115	.011
	STRAIGHT -(		(28.9)	(11.2)	(337.3)			
		>= 625F.1	.161	.023	1.010	.068	.132	.012
	STRAIGHT -(		(28.9)	(12.3)	(307.7)			
		>= 625F.2	.161	.011	.913	.057	.151	.013
	STRAIGHT -(		(28.9)	(8.3)	(277.8)			
		>= 630	.161	.000	.797	.047	.168	.009
	STRAIGHT -(		(28.9)	(.0)	(248.3)			
		>= 630.1	.161	.005	.668	.036	.173	.002
	STRAIGHT -(		(28.9)	(5.5)	(220.8)			
		>= 630.2	.161	.005	.546	.027	.159	.003
	STRAIGHT -(		(28.9)	(5.2)	(199.5)			
BRANCH PT.		-- 635	.161	.000	.453	.020	.121	.006
			(28.9)	(.0)	(186.8)			
BRANCH PT.		-- 635	.161	.000	.453	.020	.121	.006
	STRAIGHT -(		(28.9)	(.0)	(186.8)			
		>= 635.1	.161	.003	.396	.018	.106	.001
	STRAIGHT -(		(28.9)	(8.8)	(181.4)			
		>= 635.2	.161	.003	.353	.018	.094	.002
	STRAIGHT -(		(28.9)	(10.0)	(177.5)			
		>= 635.3	.161	.001	.321	.018	.082	.002
	STRAIGHT -(		(28.9)	(7.0)	(172.7)			
		>= 645S	.161	.000	.300	.018	.069	.003
	(		(28.9)	(.0)	(168.3)			
	BEND -(	645	.161	.001	.299	.019	.058	.007
	(		(28.8)	(1.3)	(168.4)			
		>= 645F	.160	.001	.301	.022	.053	.011
	STRAIGHT -(		(28.5)	(1.9)	(169.9)			
		>= 647S	.158	.001	.305	.022	.049	.012
	(		(28.0)	(1.9)	(172.1)			
	BEND -(	647	.156	.002	.308	.029	.044	.018
	(		(28.3)	(2.6)	(174.3)			
		>= 647F	.155	.007	.310	.035	.035	.022
	STRAIGHT -(		(25.0)	(5.5)	(175.3)			
		>= 647F.1	.147	.037	.310	.034	.030	.027
	STRAIGHT -(		(36.4)	(24.7)	(175.3)			
		>= 647F.2	.134	.061	.310	.019	.029	.032
	STRAIGHT -(		(40.1)	(36.0)	(175.3)			
		>= 647F.3	.116	.066	.310	.009	.030	.036
	STRAIGHT -(		(46.4)	(39.3)	(175.2)			
		>= 655S	.097	.042	.310	.050	.029	.041

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION		LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>-	655[illegible]	.097	.042	.310	.050	.029	.041
		(		(39.8)	(24.1)	(175.2)			
	BEND	-(	655[illegible]	.092	.032	.305	.091	.027	.042
		(		(38.7)	(18.2)	(172.5)			
		>-	655F	.044	.026	.289	.129	.026	.044
	STRAIGHT	-(		(35.9)	(14.6)	(163.1)			
		>-	655F.1	.044	.026	.154	.151	.020	.042
	STRAIGHT	-(		(17.4)	(14.6)	(86.8)			
		>-	660[illegible]	.009	.026	.020	.126	.015	.032
		(		(3.2)	(14.6)	(11.3)			
	BEND	-(	660[illegible]	.004	.020	.004	.083	.011	.021
		(		(1.3)	(11.2)	(2.4)			
		>-	660F	.002	.011	.000	.036	.005	.015
	STRAIGHT	-(		(.6)	(6.4)	(.1)			
ANCHOR		--	665	.000	.000	.000	.000	.000	.000
				(.0)	(.0)	(.0)			
BRANCH PT.		--	635	.161	.000	.453	.020	.121	.006
	STRAIGHT	-(		(26.9)	(.0)	(186.8)			
		>-	670[illegible]	.159	.000	.460	.021	.102	.010
		(		(26.2)	(.0)	(190.2)			
	BEND	-(	670[illegible]	.159	.002	.464	.033	.089	.022
		(		(29.1)	(1.4)	(192.0)			
		>-	670F	.161	.008	.466	.047	.066	.031
	STRAIGHT	-(		(31.6)	(4.9)	(193.0)			
		>-	670F.1	.172	.051	.466	.049	.043	.039
	STRAIGHT	-(		(43.9)	(25.2)	(192.9)			
		>-	670F.2	.173	.086	.466	.030	.031	.047
	STRAIGHT	-(		(50.6)	(40.0)	(192.9)			
		>-	670F.3	.183	.096	.466	.011	.029	.055
	STRAIGHT	-(		(51.9)	(42.2)	(192.8)			
		>-	[illegible]	.148	.062	.466	.072	.029	.062
		(		(50.7)	(26.3)	(192.8)			
	BEND	-(	[illegible]	.142	.047	.459	.135	.028	.065
		(		(49.1)	(19.9)	(189.9)			
		>-	[illegible]F	.131	.038	.434	.194	.027	.068
	STRAIGHT	-(		(45.6)	(15.9)	(179.6)			
		>-	[illegible]F.1	.067	.038	.231	.227	.023	.065
	STRAIGHT	-(		(23.4)	(15.9)	(95.6)			
		>-	[illegible]	.012	.034	.030	.188	.019	.049
		(		(4.1)	(16.0)	(12.4)			
	BEND	-(	[illegible]	.006	.029	.006	.124	.014	.032
		(		(1.7)	(12.3)	(2.6)			
		>-	[illegible]F	.002	.016	.000	.054	.007	.023
	STRAIGHT	-(		(.7)	(6.9)	(.1)			
ANCHOR		--	[illegible]	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	600	50.	140.	100.	179.	717.	114.	320.	793.
	665	18.	105.	90.	140.	505.	61.	120.	523.
	690	20.	121.	102.	159.	581.	74.	149.	604.
RESTRAINTS:									
269	620	0.	60.	0.	60.	0.	0.	0.	0.
	630	0.	30.	0.	30.	0.	0.	0.	0.
	635	0.	71.	0.	71.	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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
6458	0.	69.	0.	69.	0.	0.	0.	0.

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*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
* * * * * * * * * * * * * * * * * * * * * * * * * * *
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THE MAXIMUM STRESS OF 471. OCCURS AT POINT 605N

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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 600	100.	149.	320.	717.	114.	1.00	1.00	24.51	388.
	STR -(										
		>- 605N	100.	142.	320.	648.	64.	1.77	1.77	24.51	471. **
	BEND -(	605M	122.	123.	278.	643.	161.	1.77	1.77	24.51	466. *
		>- 605F	133.	111.	105.	592.	280.	1.77	1.77	24.51	431. *
	STR -(										
		>- 605F.1	118.	108.	105.	168.	259.	1.00	1.00	24.51	160.
	STR -(										
		>- 605F.2	78.	93.	105.	134.	255.	1.00	1.00	24.51	150.
	STR -(										
		>- 610N	69.	88.	105.	547.	93.	1.77	1.77	24.51	366.
	BEND -(	610M	91.	61.	37.	584.	135.	1.77	1.77	24.51	390.
		>- 610F	81.	78.	97.	575.	104.	1.77	1.77	24.51	384.
	STR -(										
		>- 610F.1	72.	73.	97.	456.	177.	1.00	1.00	24.51	244.
	STR -(										
		>- 610F.2	61.	50.	97.	367.	239.	1.00	1.00	24.51	220.
	STR -(										
		>- 610F.3	51.	47.	97.	233.	202.	1.00	1.00	24.51	158.
	STR -(										
		>- 620N	40.	56.	97.	130.	143.	1.77	1.77	24.51	140.
	BEND -(	620M	35.	59.	121.	123.	128.	1.77	1.77	24.51	139.
		>- 620F	29.	63.	142.	116.	113.	1.77	1.77	24.51	140.
	STR -(										
		>- 625N	27.	63.	142.	126.	110.	1.77	1.77	24.51	142.
	BEND -(	625M	42.	55.	107.	150.	137.	1.77	1.77	24.51	149.
		>- 625F	53.	44.	103.	160.	137.	1.77	1.77	24.51	152.
	STR -(										
		>- 625F.1	52.	34.	103.	121.	197.	1.00	1.00	24.51	124.
	STR -(										
		>- 625F.2	50.	29.	103.	75.	232.	1.00	1.00	24.51	129.
	STR -(										
		>- 630	43.	36.	103.	76.	234.	1.00	1.00	24.51	130.
	STR -(										
		>- 630.1	47.	36.	103.	87.	213.	1.00	1.00	24.51	123.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 630.1	47.	35.	103.	87.	213.	1.00	1.00	24.51	123.
	STR -(										
		>- 630.2	46.	51.	103.	99.	218.	1.00	1.00	24.51	128.
	STR -(										
BR PT		-- 635	46.	51.	103.	91.	339.	1.35	1.35	24.51	182.
BR PT		-- 635	25.	68.	35.	75.	284.	1.35	1.35	24.51	147.
	STR -(										
		>- 635.1	25.	60.	35.	84.	211.	1.00	1.00	24.51	113.
	STR -(										
		>- 635.2	23.	25.	35.	128.	335.	1.00	1.00	24.51	177.
	STR -(										
		>- 635.3	23.	25.	35.	98.	269.	1.00	1.00	24.51	141.
	STR -(										
		>- 645N	23.	103.	35.	88.	98.	1.77	1.77	24.51	88.
	(										
	BEND -(	645B	36.	99.	94.	60.	97.	1.77	1.77	24.51	96.
	(										
		>- 645F	56.	89.	147.	45.	94.	1.77	1.77	24.51	117.
	STR -(										
		>- 647N	56.	93.	147.	172.	37.	1.77	1.77	24.51	148.
	(										
273	BEND -(	647B	60.	90.	106.	241.	105.	1.77	1.77	24.51	184.
	(										
		>- 647F	90.	60.	40.	287.	140.	1.77	1.77	24.51	209.
	STR -(										
		>- 647F.1	79.	33.	40.	421.	144.	1.00	1.00	24.51	219.
	STR -(										
		>- 647F.2	77.	57.	40.	448.	130.	1.00	1.00	24.51	229.
	STR -(										
		>- 647F.3	78.	87.	40.	367.	72.	1.00	1.00	24.51	184.
	STR -(										
		>- 655N	80.	92.	40.	415.	36.	1.77	1.77	24.51	271.
	(										
	BEND -(	655B	109.	55.	32.	428.	44.	1.77	1.77	24.51	280.
	(										
		>- 655F	91.	81.	42.	388.	35.	1.77	1.77	24.51	254.
	STR -(										
		>- 655F.1	100.	91.	42.	42.	49.	1.00	1.00	24.51	38.
	STR -(										
		>- 665N	103.	91.	42.	396.	103.	1.77	1.77	24.51	267.
	(										
	BEND -(	665B	117.	73.	92.	448.	79.	1.77	1.77	24.51	301.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

			FORCES (POUNDS)		MOMENTS (FOOT-POUNDS)			SIF		SECTION	LONGITUDINAL
POINT TYPE	ELEM. TYPE	LOC. NO.	AXIAL	RESULTANT SHEAR	TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	IN PLANE	OUT-OF PLANE	MODULUS (IN (3))	STRESS PSI
	BEND -(	660M	117.	73.	92.	448.	79.	1.77	1.77	24.51	301.
	(>-	660F	90.	105.	120.	455.	35.	1.77	1.77	24.51	306.
ANCHR	STR -(--	665	90.	107.	120.	505.	61.	1.00	1.00	24.51	256.
BR PT	--	635	65.	141.	213.	79.	111.	1.35	1.35	24.51	126.
	STR -(>-	670N	65.	139.	213.	172.	46.	1.77	1.77	24.51	180.
	BEND -(	670M	91.	123.	137.	271.	164.	1.77	1.77	24.51	224.
	(>-	670F	136.	70.	46.	327.	200.	1.77	1.77	24.51	251.
	STR -(>-	670F.1	112.	40.	46.	467.	169.	1.00	1.00	24.51	244.
	STR -(>-	670F.2	102.	63.	46.	503.	136.	1.00	1.00	24.51	256.
	STR -(>-	670F.3	102.	63.	46.	420.	80.	1.00	1.00	24.51	211.
	STR -(>-	680N	96.	104.	46.	477.	36.	1.77	1.77	24.51	312.
274	BEND -(	680M	127.	61.	34.	490.	44.	1.77	1.77	24.51	320.
	(>-	680F	103.	97.	37.	442.	35.	1.77	1.77	24.51	288.
	STR -(>-	680F.1	114.	103.	37.	50.	47.	1.00	1.00	24.51	38.
	STR -(>-	685N	118.	104.	37.	453.	129.	1.77	1.77	24.51	307.
	BEND -(	685M	132.	85.	107.	513.	101.	1.77	1.77	24.51	346.
	(>-	685F	102.	120.	149.	521.	35.	1.77	1.77	24.51	352.
ANCHR	STR -(--	690	102.	122.	149.	581.	74.	1.00	1.00	24.51	296.

DISPLACEMENTS AND ROTATIONS

EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 600	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 605N	.000	.002	.000	.005	.000	.003
	(		(4.5)	(26.4)	(.1)			
	BEND -(	605H	.000	.003	.001	.012	.001	.005
	(		(7.2)	(37.2)	(4.7)			
		>- 605F	.001	.004	.003	.018	.001	.007
	STRAIGHT -(		(11.6)	(41.7)	(15.3)			
		>- 605F.1	.009	.004	.022	.022	.002	.009
	STRAIGHT -(		(39.6)	(42.1)	(60.1)			
		>- 605F.2	.018	.004	.042	.022	.003	.010
	STRAIGHT -(		(49.1)	(42.4)	(55.3)			
		>- 610N	.027	.004	.061	.018	.005	.010
	(		(37.1)	(42.6)	(23.7)			
	BEND -(	610H	.028	.005	.063	.012	.005	.009
	(		(32.2)	(49.0)	(24.6)			
		>- 610F	.028	.006	.064	.007	.006	.008
	STRAIGHT -(		(25.5)	(37.2)	(25.3)			
		>- 610F.1	.024	.009	.064	.002	.007	.007
	STRAIGHT -(		(37.5)	(53.8)	(25.4)			
		>- 610F.2	.019	.008	.064	.003	.008	.006
	STRAIGHT -(		(60.5)	(64.7)	(25.4)			
		>- 610F.3	.014	.005	.064	.006	.009	.005
	STRAIGHT -(		(53.4)	(44.3)	(25.5)			
		>- 620N	.010	.000	.064	.007	.010	.004
	(		(23.1)	(.0)	(25.5)			
	BEND -(	620H	.009	.001	.064	.007	.010	.004
	(		(19.2)	(5.0)	(25.4)			
		>- 620F	.009	.001	.064	.007	.010	.004
	STRAIGHT -(		(14.6)	(9.4)	(25.5)			
		>- 625N	.009	.001	.065	.007	.010	.003

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DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 625N	.009	.001	.065	.007	.010	.003
	(		(9.8)	(13.7)	(26.2)			
	BEND -(	625N	.009	.002	.065	.007	.010	.003
	(		(5.0)	(20.2)	(28.9)			
		>- 625F	.009	.002	.064	.007	.011	.002
	STRAIGHT -(		(5.1)	(22.7)	(30.8)			
		>- 625F.1	.009	.002	.059	.008	.011	.001
	STRAIGHT -(		(5.2)	(32.6)	(34.7)			
		>- 625F.2	.009	.001	.053	.008	.012	.001
	STRAIGHT -(		(5.2)	(25.0)	(35.2)			
		>- 630	.009	.000	.047	.010	.012	.001
	STRAIGHT -(		(5.3)	(.0)	(32.5)			
		>- 630.1	.009	.001	.042	.011	.012	.001
	STRAIGHT -(		(5.3)	(19.4)	(36.3)			
		>- 630.2	.009	.001	.037	.012	.010	.001
	STRAIGHT -(		(5.3)	(19.9)	(37.3)			
BRANCH PT.		-- 635	.009	.000	.034	.014	.008	.002
			(5.4)	(.0)	(43.0)			
BRANCH PT.		-- 635	.009	.000	.034	.014	.008	.002
	STRAIGHT -(		(5.4)	(.0)	(43.0)			
		>- 635.1	.009	.001	.033	.013	.008	.001
	STRAIGHT -(		(5.4)	(26.5)	(70.7)			
		>- 635.2	.009	.002	.032	.013	.007	.000
	STRAIGHT -(		(5.4)	(38.5)	(92.5)			
		>- 635.3	.009	.001	.031	.013	.007	.001
	STRAIGHT -(		(5.4)	(26.4)	(83.7)			
		>- 645N	.009	.000	.030	.013	.007	.002
	(		(5.4)	(.0)	(54.4)			
	BEND -(	645N	.009	.000	.029	.013	.006	.002
	(		(6.1)	(4.3)	(44.1)			
		>- 645F	.009	.000	.029	.013	.005	.002
	STRAIGHT -(		(8.5)	(6.0)	(29.4)			
		>- 647N	.009	.000	.030	.012	.005	.002
	(		(12.4)	(6.0)	(20.6)			
	BEND -(	647N	.009	.001	.030	.011	.004	.002
	(		(14.8)	(9.6)	(25.1)			
		>- 647F	.009	.002	.030	.008	.003	.003
	STRAIGHT -(		(15.2)	(29.4)	(28.2)			
		>- 647F.1	.009	.008	.030	.005	.002	.003
	STRAIGHT -(		(25.6)	(67.7)	(28.3)			
		>- 647F.2	.009	.010	.030	.002	.002	.003
	STRAIGHT -(		(26.1)	(31.8)	(28.4)			
		>- 647F.3	.008	.009	.030	.004	.002	.003
	STRAIGHT -(		(11.3)	(59.7)	(28.4)			
		>- 655N	.009	.000	.030	.007	.002	.003

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 655[illegible]	.008	.004	.030	.007	.002	.003
	(		(21.4)	(17.7)	(28.4)			
	BEND -(	655[illegible]	.008	.003	.030	.010	.002	.003
	(		(25.2)	(11.4)	(27.1)			
		>- 655F	.007	.003	.028	.013	.002	.004
	STRAIGHT -(		(25.5)	(9.6)	(24.8)			
		>- 655F.1	.004	.003	.015	.015	.001	.004
	STRAIGHT -(		(14.5)	(9.5)	(13.2)			
		>- 660[illegible]	.001	.003	.002	.012	.001	.003
	(		(2.0)	(9.3)	(2.2)			
	BEND -(	660[illegible]	.000	.002	.000	.008	.001	.002
	(		(1.0)	(6.8)	(.8)			
		>- 660F	.000	.001	.000	.004	.000	.001
	STRAIGHT -(		(.6)	(6.7)	(.0)			
ANCHOR		-- 665	.000	.000	.000	.000	.000	.000
			(.0)	(.0)	(.0)			
BRANCH PT.		-- 635	.009	.000	.034	.014	.008	.002
	STRAIGHT -(		(5.4)	(.0)	(43.0)			
		>- 670[illegible]	.009	.000	.034	.013	.007	.002
	(		(12.2)	(.1)	(22.9)			
	BEND -(	670[illegible]	.009	.001	.035	.012	.006	.002
	(		(16.2)	(6.9)	(34.6)			
		>- 670F	.009	.002	.035	.009	.004	.003
	STRAIGHT -(		(17.9)	(20.4)	(39.3)			
		>- 670F.1	.010	.009	.035	.006	.003	.003
	STRAIGHT -(		(23.0)	(70.8)	(39.5)			
		>- 670F.2	.011	.012	.035	.002	.002	.003
	STRAIGHT -(		(22.6)	(92.2)	(39.6)			
		>- 670F.3	.010	.010	.035	.005	.002	.004
	STRAIGHT -(		(11.5)	(66.6)	(39.7)			
		>- 680[illegible]	.010	.005	.035	.008	.002	.004
	(		(17.6)	(21.4)	(39.7)			
	BEND -(	680[illegible]	.010	.004	.034	.011	.002	.004
	(		(20.5)	(14.1)	(37.9)			
		>- 680F	.009	.003	.032	.015	.002	.005
	STRAIGHT -(		(20.1)	(12.0)	(34.7)			
		>- 6[illegible]F.1	.005	.003	.017	.017	.002	.004
	STRAIGHT -(		(10.7)	(11.3)	(18.7)			
		>- 685[illegible]	.001	.003	.002	.014	.001	.003
	(		(1.7)	(11.7)	(3.2)			
	BEND -(	685[illegible]	.000	.002	.000	.009	.001	.002
	(		(1.3)	(10.9)	(1.1)			
		>- 685F	.000	.001	.000	.004	.000	.002
	STRAIGHT -(		(.8)	(5.2)	(.0)			
ANCHOR		-- 690	.000	.000	.000	.000	.000	.000

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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
ANCHORS:									
	600	813.	627.	1658.	1950.	9931.	6524.	8235.	14457.
	665	792.	366.	1119.	1419.	4851.	8038.	6679.	11522.
	690	959.	431.	1388.	1741.	6085.	8731.	7742.	13160.
RESTRAINTS:									
	6200	0.	779.	0.	779.	0.	0.	0.	0.
	630	0.	201.	0.	201.	0.	0.	0.	0.
	635	0.	563.	0.	563.	0.	0.	0.	0.

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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) X	Y	Z	RESULTANT	MOMENTS (FOOT-POUNDS) X	Y	Z	RESULTANT
RESTRAINTS(CONTINUED) -								
6450	0.	353.	0.	353.	0.	0.	0.	0.

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*                                                   *
* INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS  *
* ------------------------------------------------  *
*                                                   *
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THE MAXIMUM STRESS OF 9717. OCCURS AT POINT 605N

EXPLANATORY NOTES:
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(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.

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(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) AXIAL	RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	IN-PLANE BENDING	OUT-OF-PLANE BENDING	SIF IN PLANE	OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
ANCHR		-- 600	1658.	1026.	8235.	9931.	6524.	1.00	1.00	24.51	7077.
	STR -(										
		>- 605N	1658.	1026.	8235.	11751.	4301.	1.77	1.77	24.51	9717. **
	(										
	BEND -(	605M	1608.	1103.	3695.	11699.	8054.	1.77	1.77	24.51	9520. *
	(										
		>- 605F	627.	1846.	3624.	10708.	7423.	1.77	1.77	24.51	8773. *
	STR -(										
		>- 605F.1	632.	1839.	3624.	3883.	3473.	1.00	1.00	24.51	3106.
	STR -(										
		>- 605F.2	648.	1620.	3624.	487.	3482.	1.00	1.00	24.51	2472.
	STR -(										
		>- 610N	654.	1482.	3624.	9816.	2743.	1.77	1.77	24.51	7017.
	(										
	BEND -(	610M	1390.	832.	4535.	10553.	1302.	1.77	1.77	24.51	7498.
	(										
		>- 610F	1314.	947.	3422.	10477.	3020.	1.77	1.77	24.51	7413.
	STR -(										
		>- 610F.1	1190.	926.	3422.	7936.	1349.	1.00	1.00	24.51	4282.
	STR -(										
		>- 610F.2	1018.	902.	3422.	5310.	2256.	1.00	1.00	24.51	3284.
	STR -(										
		>- 610F.3	851.	878.	3422.	2620.	3967.	1.00	1.00	24.51	2868.
	STR -(										
		>- 620N	611.	456.	3422.	639.	5517.	1.77	1.77	24.51	4232.
	(										
	BEND -(	620M	532.	546.	5256.	555.	3986.	1.77	1.77	24.51	4294.
	(										
		>- 620F	392.	654.	6372.	511.	1945.	1.77	1.77	24.51	4334.
	STR -(										
		>- 625N	343.	610.	6372.	2102.	553.	1.77	1.77	24.51	4367.
	(										
	BEND -(	625M	411.	567.	4591.	2314.	4313.	1.77	1.77	24.51	4353.
	(										
		>- 625F	351.	606.	858.	2359.	5974.	1.77	1.77	24.51	4204.
	STR -(										
		>- 625F.1	188.	481.	856.	1778.	4496.	1.00	1.00	24.51	2404.
	STR -(										
		>- 625F.2	188.	481.	858.	787.	3340.	1.00	1.00	24.51	1732.
	STR -(										
		>- 630	190.	494.	856.	647.	2290.	1.00	1.00	24.51	1236.
	STR -(										
		>- 630.1	190.	497.	858.	761.	2180.	1.00	1.00	24.51	1206.

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INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
		>- 639.1	180.	457.	858.	761.	2180.	1.00	1.00	24.51	1206.
	STR -(	>- 639.2	382.	647.	858.	1062.	3761.	1.00	1.00	24.51	1959.
BR PT	STR -(	-- 635	382.	647.	858.	1435.	6200.	1.35	1.35	24.51	3194.
BR PT		-- 635	66.	672.	365.	2588.	4567.	1.35	1.35	24.51	2617.
	STR -(	>- 635.1	95.	660.	365.	1283.	2506.	1.00	1.00	24.51	1390.
	STR -(	>- 635.2	198.	668.	365.	192.	1861.	1.00	1.00	24.51	933.
	STR -(	>- 635.3	198.	668.	365.	1361.	3488.	1.00	1.00	24.51	1841.
	STR -(	>- 645N	384.	779.	365.	2665.	5805.	1.77	1.77	24.51	4150.
	BEND -(	645M	516.	699.	4485.	2737.	4321.	1.77	1.77	24.51	4413.
	(	>- 645F	423.	759.	6396.	2555.	503.	1.77	1.77	24.51	4480.
	STR -(	>- 647N	423.	816.	6396.	1061.	2198.	1.77	1.77	24.51	4441.
282	BEND -(	647M	763.	516.	3155.	1424.	5738.	1.77	1.77	24.51	4347.
	(	>- 647F	665.	616.	1777.	1358.	5956.	1.77	1.77	24.51	4127.
	STR -(	>- 647F.1	724.	667.	1777.	866.	3901.	1.00	1.00	24.51	2141.
	STR -(	>- 647F.2	865.	774.	1777.	2267.	1619.	1.00	1.00	24.51	1617.
	STR -(	>- 647F.3	946.	811.	1777.	3791.	1532.	1.00	1.00	24.51	2183.
	STR -(	>- 655N	1065.	631.	1777.	5289.	4249.	1.77	1.77	24.51	4549.
	BEND -(	655M	973.	662.	4426.	5253.	2341.	1.77	1.77	24.51	4707.
	(	>- 655F	379.	[illegible]	4966.	4651.	1044.	1.77	1.77	24.51	4466.
	STR -(	>- 655F.1	376.	1365.	4966.	2380.	115.	1.00	1.00	24.51	2697.
	STR -(	>- [illegible]	367.	1371.	4966.	5072.	5688.	1.77	1.77	24.51	5983.
	BEND -(	[illegible]	1035.	967.	1433.	5763.	8151.	1.77	1.77	24.51	6542.

INTERNAL FORCES, MOMENTS AND STRESS CALCULATIONS (CONTINUED)

POINT TYPE	ELEM TYPE	LOC. NO.	FORCES (POUNDS) AXIAL	FORCES (POUNDS) RESULTANT SHEAR	MOMENTS (FOOT-POUNDS) TORSION	MOMENTS (FOOT-POUNDS) IN-PLANE BENDING	MOMENTS (FOOT-POUNDS) OUT-OF-PLANE BENDING	SIF IN PLANE	SIF OUT-OF PLANE	SECTION MODULUS (IN (3))	LONGITUDINAL STRESS PSI
	BEND -(	660M	1539.	967.	1433.	5763.	8151.	1.77	1.77	24.51	6542.
	(	>- 660F	1119.	873.	6679.	5849.	5725.	1.77	1.77	24.51	6853.
	STR -(										
ANCHR		-- 665	1119.	873.	6679.	4851.	8038.	1.00	1.00	24.51	5640.
BR PT		-- 635	507.	950.	9004.	4011.	927.	1.35	1.35	24.51	4924.
	STR -(	>- 670N	507.	1006.	9004.	1068.	3029.	1.77	1.77	24.51	6201.
	(										
	BEND -(	670M	920.	650.	4491.	1430.	8054.	1.77	1.77	24.51	6053.
	(	>- 670F	618.	775.	2483.	1317.	8428.	1.77	1.77	24.51	5763.
	STR -(	>- 670F.1	976.	890.	2483.	999.	5828.	1.00	1.00	24.51	3139.
	STR -(	>- 670F.2	1075.	939.	2483.	2865.	2985.	1.00	1.00	24.51	2362.
	STR -(	>- 670F.3	1178.	977.	2483.	4736.	1385.	1.00	1.00	24.51	2704.
	STR -(	>- 680N	1251.	1000.	2483.	6548.	4222.	1.77	1.77	24.51	5304.
	(										
	BEND -(	680M	1198.	1063.	4908.	6493.	2017.	1.77	1.77	24.51	5439.
	(	>- 680F	450.	1537.	5068.	5738.	1598.	1.77	1.77	24.51	5073.
	STR -(	>- 680F.1	434.	1680.	5068.	2542.	187.	1.00	1.00	24.51	2777.
	STR -(	>- 685N	433.	1687.	5068.	6335.	6785.	1.77	1.77	24.51	6860.
	(										
	BEND -(	685M	1279.	1182.	2181.	7195.	8906.	1.77	1.77	24.51	7560.
	(	>- 685F	1388.	1051.	7742.	7308.	5963.	1.77	1.77	24.51	7916.
	STR -(										
ANCHR		-- 690	1366.	1051.	7742.	6085.	8731.	1.00	1.00	24.51	6442.

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* DISPLACEMENTS AND ROTATIONS *

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EXPLANATORY NOTES:

VALUES IN PARENTHESES ARE ACCELERATIONS (IN PER SECOND SQUARED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
ANCHOR		-- 600	.000	.000	.000	.000	.000	.000
	STRAIGHT -(		(.0)	(.0)	(.0)			
		>- 605A	.016	.027	.000	.091	.045	.090
	(		(5.3)	(28.1)	(.1)			
	BEND -(	605B	.033	.049	.011	.209	.097	.131
	(		(8.9)	(40.6)	(5.7)			
		>- 605F	.064	.064	.051	.321	.129	.205
	STRAIGHT -(		(15.9)	(46.5)	(21.5)			
		>- 605F.1	.288	.064	.394	.408	.185	.275
	STRAIGHT -(		(75.7)	(46.9)	(131.2)			
		>- 605F.2	.556	.064	.776	.408	.242	.301
	STRAIGHT -(		(137.6)	(47.2)	(235.3)			
		>- 610A	.830	.064	1.121	.326	.299	.287
	(		(197.3)	(47.3)	(330.3)			
284	BEND -(	610B	.888	.080	1.162	.224	.308	.268
	(		(205.0)	(47.1)	(342.5)			
		>- 610F	.947	.105	1.174	.119	.329	.261
	STRAIGHT -(		(210.4)	(48.9)	(345.9)			
		>- 610F.1	1.198	.159	1.174	.020	.348	.213
	STRAIGHT -(		(169.0)	(72.7)	(346.0)			
		>- 610F.2	1.460	.144	1.174	.051	.343	.165
	STRAIGHT -(		(188.2)	(79.2)	(346.0)			
		>- 610F.3	1.712	.083	1.174	.094	.318	.118
	STRAIGHT -(		(180.6)	(51.9)	(346.0)			
		>- 620A	1.536	.000	1.174	.107	.275	.071
	(		(183.9)	(.0)	(346.0)			
	BEND -(	620B	1.555	.009	1.176	.106	.254	.069
	(		(184.8)	(5.7)	(346.5)			
		>- 620F	1.967	.016	1.181	.105	.240	.069
	STRAIGHT -(		(185.3)	(10.7)	(347.8)			
		>- 625A	1.976	.022	1.187	.104	.233	.064

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>= 625I	1.976	.022	1.187	.104	.233	.064
	(		(185.8)	(15.5)	(349.7)			
	BEND -(	625M	1.991	.032	1.190	.104	.208	.058
	(		(187.1)	(22.9)	(351.0)			
		>= 625F	1.996	.034	1.177	.106	.174	.036
	STRAIGHT -(		(187.7)	(26.0)	(347.6)			
		>= 625F.1	1.996	.026	1.073	.093	.153	.015
	STRAIGHT -(		(187.7)	(37.8)	(317.1)			
		>= 625F.2	1.996	.015	.965	.080	.160	.016
	STRAIGHT -(		(187.7)	(26.8)	(286.4)			
		>= 630	1.996	.000	.844	.067	.173	.015
	STRAIGHT -(		(187.7)	(.0)	(256.3)			
		>= 630.1	1.996	.010	.711	.054	.179	.007
	STRAIGHT -(		(187.7)	(21.5)	(230.6)			
		>= 630.2	1.996	.012	.581	.042	.172	.005
	STRAIGHT -(		(187.7)	(21.7)	(210.8)			
BRANCH PT.		-- 635	1.996	.000	.472	.032	.159	.020
			(187.7)	(.0)	(199.1)			
BRANCH PT.		-- 635	1.996	.000	.472	.032	.159	.020
	STRAIGHT -(		(187.7)	(.0)	(199.1)			
		>= 635.1	1.996	.007	.405	.033	.128	.003
	STRAIGHT -(		(187.7)	(28.2)	(200.0)			
		>= 635.2	1.996	.004	.362	.036	.115	.010
285	STRAIGHT -(		(187.7)	(41.0)	(203.1)			
		>= 635.3	1.996	.008	.342	.039	.121	.003
	STRAIGHT -(		(187.7)	(28.1)	(195.4)			
		>= 645I	1.995	.000	.363	.043	.155	.022
	(		(187.7)	(.0)	(184.8)			
	BEND -(	645M	1.993	.005	.374	.033	.197	.049
	(		(187.5)	(4.7)	(183.2)			
		>= 645F	1.984	.009	.382	.027	.219	.076
	STRAIGHT -(		(186.8)	(6.7)	(182.4)			
		>= 647I	1.969	.009	.385	.027	.238	.082
	(		(185.9)	(6.7)	(183.9)			
	BEND -(	647M	1.940	.009	.388	.032	.266	.113
	(		(183.4)	(10.2)	(186.9)			
		>= 647F	1.889	.010	.389	.040	.319	.135
	STRAIGHT -(		(179.5)	(21.4)	(188.5)			
		>= 647F.1	1.556	.041	.389	.042	.372	.161
	STRAIGHT -(		(153.7)	(73.0)	(188.5)			
		>= 647F.2	1.267	.071	.389	.027	.400	.187
	STRAIGHT -(		(137.9)	(91.9)	(188.5)			
		>= 647F.3	.927	.079	.389	.011	.400	.213
	STRAIGHT -(		(138.7)	(73.5)	(188.4)			
		>= 655I	.662	.052	.389	.059	.368	.239

DISPLACEMENTS AND ROTATIONS (CONTINUED)

POINT DESIGNATION	ELEMENT DESIGNATION	LOC. NO.	DISPLACEMENTS (INCHES) X	Y	Z	ROTATIONS (DEGREES) ABOUT X AXIS	Y AXIS	Z AXIS
		>- 655N	.602	.052	.389	.059	.368	.239
	(		(146.6)	(31.4)	(188.4)			
	BEND -(	655M	.536	.040	.363	.112	.332	.236
	(		(145.8)	(22.6)	(185.4)			
		>- 655F	.482	.032	.363	.162	.315	.236
	STRAIGHT -(		(137.0)	(18.4)	(175.2)			
		>- 655F.1	.261	.032	.193	.190	.235	.228
	STRAIGHT -(		(70.8)	(18.3)	(93.3)			
		>- 660N	.068	.032	.025	.158	.154	.177
	(		(11.5)	(18.2)	(12.2)			
	BEND -(	660M	.038	.024	.005	.103	.120	.112
	(		(4.8)	(14.9)	(2.7)			
		>- 660F	.020	.013	.000	.045	.058	.073
	STRAIGHT -(		(2.2)	(9.6)	(.1)			
ANCHOR		-- 665	.000	.000	.000	.000	.000	.000
			(.0)	(.0)	(.0)			
BRANCH PT.		-- 635	1.996	.000	.472	.032	.159	.020
	STRAIGHT -(		(187.7)	(.0)	(199.1)			
		>- 670N	1.984	.000	.481	.032	.190	.039
	(		(186.9)	(.1)	(199.5)			
	BEND -(	670M	1.964	.002	.485	.040	.220	.083
	(		(185.5)	(7.0)	(203.1)			
		>- 670F	1.923	.009	.488	.051	.285	.113
	STRAIGHT -(		(181.7)	(21.0)	(205.1)			
		>- 670F.1	1.656	.054	.488	.052	.355	.150
	STRAIGHT -(		(162.1)	(79.5)	(205.1)			
		>- 670F.2	1.339	.092	.487	.031	.397	.186
	STRAIGHT -(		(156.7)	(101.6)	(205.0)			
		>- 670F.3	.999	.101	.487	.013	.406	.222
	STRAIGHT -(		(168.0)	(81.9)	(205.0)			
		>- 680N	.676	.065	.487	.076	.378	.259
	(		(190.2)	(34.9)	(205.0)			
	BEND -(	680M	.602	.050	.480	.142	.344	.259
	(		(189.3)	(25.2)	(201.6)			
		>- 680F	.543	.040	.454	.203	.328	.265
	STRAIGHT -(		(177.9)	(20.6)	(190.5)			
		>- 680F.1	.294	.040	.241	.238	.246	.259
	STRAIGHT -(		(92.5)	(20.5)	(101.5)			
		>- 685N	.075	.040	.031	.197	.164	.201
	(		(14.8)	(20.4)	(13.3)			
	BEND -(	685M	.041	.030	.007	.129	.127	.128
	(		(6.0)	(16.9)	(2.9)			
		>- 685F	.021	.017	.000	.056	.062	.084
	STRAIGHT -(		(2.6)	(11.0)	(.1)			
ANCHOR		-- 690	.000	.000	.000	.000	.000	.000

```
PROJECT     10MW SOLAR PILOT PLANT - C-21700
JOB         MS DESUP TO TH STOR HTR(X-MS-05-A-1)
DATE        2/26/80
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* * * * * * * * * *
*                 *
* 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.

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
600	5266	4712	388	7077
605N	6414	7284	471	9717
605M	6159	7244	466	9520
605F	5720	6637	431	8773
605F.1	2565	1715	160	3106
605F.2	1847	1635	150	2472
610N	3761	5912	366	7017
610M	3973	6347	390	7498
610F	3882	6303	384	7413
610F.1	2247	3636	244	4282
610F.2	2124	2495	220	3264
610F.3	2495	1400	158	2868
620N	4055	1203	143	4232
620M	4120	1204	139	4294
620F	4158	1215	140	4334
625N	4187	1234	142	4367
625M	4155	1251	140	4353
625F	3970	1374	152	4204
625F.1	2023	1293	124	2404
625F.2	1098	1333	129	1732
630	388	1169	130	1238

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
630.1	779	912	123	1206
630.2	1545	1137	128	1959
635	2362	2143	182	3194
635	2463	872	147	2617
635.1	1109	830	113	1390
635.2	457	794	177	933
635.3	1692	713	141	1841
645N	4032	979	28	4150
645M	4296	1006	96	4413
645F	4357	1036	117	4480
647N	4307	1072	148	4441
647M	4204	1092	184	4347
647F	3968	1038	209	4127
647F.1	2009	705	219	2141
647F.2	1210	1649	229	1617
647F.3	1551	1524	184	2183
655N	3570	2674	271	4549
655M	3885	2644	289	4707
655F	3793	2344	254	4466
655F.1	2681	295	38	2697
660M	5325	2714	267	5983

STRESSES ARE IN PSI

LOC. NO.	EQ (12) SHOCK 1	EQ (12) SHOCK 2	EQ (12) SHOCK 3	EQ (12) SHOCK 4
660M	5762	3082	301	6542
660F	6075	3155	306	6853
665	5230	2097	256	5640
635	4682	1520	126	4920
670N	5857	2029	160	6201
670M	5676	2091	224	6053
670F	5396	2008	251	5763
670F.1	2808	1207	244	3139
670F.2	1745	1571	256	2362
670F.3	1437	2281	211	2704
680N	3361	4092	312	5304
680M	3512	4054	320	5439
680F	3580	3582	288	5073
680F.1	2746	412	38	2777
685N	5478	4119	307	6860
685M	5940	4664	346	7560
685F	6325	4747	352	7916
690	5656	3969	296	6442

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TABLE OF CONTENTS

STMPO 190

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:

Primary Document No.	Secondary No.	Brief Title
DOE/SF/10499-T100	STMPO 185	PSS Final Design Calculations (Book 10 of 26)
DOE/SF/10499-T101	STMPO 186	PSS Final Design Calculations (Book 11 of 26)
DOE/SF/10499-T102	STMPO 187	PSS Final Design Calculations (Book 12 of 26)
DOE/SF/10499-T103	STMPO 188	PSS Final Design Calculations (Book 13 of 26)
DOE/SF/10499-T104	STMPO 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.	~~(STMPO 190)~~ DOE/SF/10499-T105
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

1. Document Title: Plant Support Subsystems Final Design Calculations (Book 15 of 26)

2. Type of Document: ☒ Technical Report, ☐ Conference Paper, ☐ Journal Article, ☐ Abstract or Summary, ☐ Copy of Oral Presentation, ☐ Other (please specify): ______

3. In order to meet a publication schedule or submission deadline, patent clearance by (Routine) 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:

a. Attention should be directed to pages ______ of this document.

b. This document describes matter relating to an invention:

i. Contractor Invention Docket No. ______.
ii. A disclosure of the invention was submitted to DOE on ______ (date)
iii. A disclosure of the invention will be submitted shortly ______ (approximate date)
iv. 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.

6. Remarks: Provide copy of clearance to: Solar One Project Office
P.O. Box 366, Daggett, CA 92327

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 OFFICE OF PATENT COUNSEL (OPC)

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

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See Instructions on Reverse Side

1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10499-T105 (STMPO 190)	DE-AC03-79SF10499	UC-62, 62c, 62d

4. Title
Plant Support Subsystems Final Design Calculations (Book 15 of 26)

5. Type of Document ("x" one)
- [x] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference ______

______ Date of conference ______

Exact location of conference ______ Sponsoring organization ______
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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

DOE/SF/10499-T105
STMPO 190
SAN/0499-50
MDC G8502

DOE_FILE_COPY

10 MWe Solar Thermal
Central Receiver Pilot Plant

SOLAR FACILITIES DESIGN INTEGRATION

PSS FINAL DESIGN CALCULATIONS BOOK 15 OF 26--MAIN STEAM PIPING CONSTRUCTION PACKAGE 9 (RADL ITEM 7-8)

September 1980

WORK PERFORMED UNDER CONTRACT
DE-AC03-79SF10499

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

U.S. Department of Energy

McDONNELL DOUGLAS CORPORATION | Stearns-Roger | Solar Energy

SAN/0499-50
MDC G8502

DOE/SF/10499-T105
STMPO 190

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

PSS FINAL DESIGN CALCULATIONS BOOK 15 OF 26--MAIN STEAM PIPING CONSTRUCTION PACKAGE 9 (RADL 7-8)

September 1980

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

H009-M-948

DOE Form RA-426
(10/80)

U.S. DEPARTMENT OF ENERGY

OMB NO. 038-R0190

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See Instructions on Reverse Side

1. DOE Report No.	2. Contract No.	3. Subject Category No.
DOE/SF/10499-T105 (STMPO 190)	DE-AC03-79SF10499	UC-62, 62c, 62d

4. Title
Plant Support Subsystems Final Design Calculations (Book 15 of 26)

5. Type of Document ("x" one)
- [X] a. Scientific and technical report
- [ ] b. Conference paper: Title of conference ______

______ Date of conference ______

Exact location of conference ______ Sponsoring organization ______

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Make available only
- [ ] b. To U.S. Government agencies and their contractors.
- [ ] c. within DOE and to DOE contractors.
- [ ] d. within DOE.
- [ ] e. to those listed in item 13 below.
- [X] f. Other (Specify) Archive/Issue on request

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- [ ] b. Recommend the following announcement limitations:

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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

H009-M-948

SAN FORM 70 10/80

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.	(STMPO 190) DOE/SF/10499-T105
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

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ii. A disclosure of the invention was submitted to DOE on ______ (date)
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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
Office of Patent Counsel/Livermore Office

☐ No patent objection to above-identified release.

☐ Please defer release until advised by this office.