

The attached is only a PORTION of the ETEC stress analysis

J Kane  
Rec'd 10/22/80  
from T. Cappucci

Energy Technology Engineering Center  
Energy Systems Group  
P.O. Box 1449  
Canoga Park, CA 91304  
(213) 341-1000



Rockwell  
International

Operated for U.S. Department of Energy

October 1, 1980

10/6

80ETEC-DRF-4220

Mr. R. J. Bosnak, Chief  
Mechanical Engineering Branch  
Division of Engineering  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Subject: Midland Plant Units 1 & 2: Bending Stresses in Underground Piping Due to Differential Soil Settlement

Reference: "Responses to the NRC 10 CFR 50.54(f) Request Regarding Plant Fill For Midland Plant Units 1 & 2, Consumer Power Company, Docket Numbers 50-329 and 50-330", Rev. 6, April 1, 1980

Dear Mr. Bosnak:

Enclosed are 7 copies of the ETEC stress analysis of several of the underground pipe lines as profiled in the reference. All the copies are being sent to your office per the instructions of Mr. A. J. Cappucci.

Sincerely yours,

J. O. Bates, Program Manager  
Energy Programs Office  
Energy Technology Engineering Center

Enclosures  
As Noted

cc w/o encls.: H. L. Brammer, NRC  
A. J. Cappucci, NRC

8408030068 840718  
PDR FOIA PDR  
RICEB4-96

**ETEC**

JIR 19-19-80

NO. \_\_\_\_\_

PAGE 1 OF \_\_\_\_\_

PREPARED BY / DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SUBJECT \_\_\_\_\_ REV / DATE \_\_\_\_\_

REINFORCING STRESSES IN UNDERGROUND PIPING DUE TO DIFFERENTIAL SOIL SETTLEMENT - MIDLAND PLANT UNITS 1&amp;2

## INTRODUCTION

THE PROFILES OF SEVERAL OF THE LINES OF FIGURES 17.2 AND 19.1 OF REF. 1 WERE ANALYSED BY AN ETEC IN HOUSE COMPUTER PROGRAM IN AN ATTEMPT TO VERIFY THE MAXIMUM STRESSES FOR THESE LINES PER REF. 1. THE MAXIMUM STRESSES OBTAINED FROM THIS ANALYSIS WERE CONSIDERABLY HIGHER THAN THOSE OF REF. 1. HAND CALCULATIONS WERE ALSO MADE AS AN ADDITIONAL CHECK, WITH THE RESULTS BEING SIMILAR TO THOSE OF THE COMPUTER ANALYSIS.

## COMPUTER ANALYSIS

- 1) THE DEFLECTIONS OF THE PIPES AS OBTAINED FROM THE PROFILES OF FIGURES 17.2 AND 19.1 WERE INPUT INTO THE PROGRAM AT THE NODAL POINTS SHOWN ON THE NODAL MAPS ENCLOSED WITH THE COMPUTER PRINTOUT.
- 2) TWO CASES WERE RUN FOR EACH LINE. CASE 1 ASSUMED THE ENDS OF THE LINES WERE COMPLETELY FIXED. CASE 2 ASSUMED THE ENDS OF THE LINES HAD NO MOMENT CARRYING CAPABILITY.
- 3) WALL THICKNESSES OF STANDARD PIPE WERE USED IN THE ANALYSIS. AS THE ACTUAL WALL THICKNESSES WERE NOT KNOWN, THIS WOULD NOT AFFECT THE STRESSES AS THEY ARE



JB/9-19-80

PREPARED BY / DATE  
 BENDING STRESSES IN UNDERGROUND PIPING DUE TO

CHECKED BY

DATE \_\_\_\_\_

SUBJECT  
 DIFFERENTIAL SOIL SETTLEMENT - MIDLAND

REV / DATE \_\_\_\_\_

PIANT UNITS 198

STRAIN CONTROLLED. IT WOULD HOWEVER, AFFECT THE LOADS REQUIRED TO CAUSE THESE DEFLECTIONS

4) THE CLOSER THE NODE SPACING THE MORE ACCURATE THE ANALYSIS AS THE ACTUAL SHAPE OF THE CURVE IS MORE NEARLY APPROXIMATED. HOWEVER, IT IS FELT THE SPACING USED WILL GIVE FAIRLY REALISTIC VALUES AND IS PROBABLY AS GOOD AS THE ORIGINAL MEASUREMENTS

5) THE RAPID CHANGE IN SLOPE IN SOME AREAS OF THE LINES WOULD INDICATE THERE ARE SOME HIGH LOCAL LOADS. THIS IS VERIFIED BY LOADS AT THESE NODAL POINTS IN THE COMPUTER OUTPUT.

6) THE NODAL LOADINGS SHOWN IN THE COMPUTER OUTPUT ARE THE RESULTANT EXTERNAL LOADS ON THE PIPE THAT WOULD BE REQUIRED TO DEFORM THE PIPE AS PROFILED. THEY ARE NOT THE ACTUAL PIPE LOADS.

7) SUMMARY OF THE MAXIMUM BENDING STRESSES DUE TO GROUND SETTLEMENT ONLY

LINE NO.	FIG	CASE	NODE	STRESS
26" OHBC-54	19.1	1	6	212200 PSI
"	19.1	2	6	216200 PSI
26" OHBC-55	17.2	1	25	179200 PSI
"	17.2	2	2	46000 PSI
8" HBC-81	19.1	1	20	84700 PSI
"	19.1	2	20	85200 PSI
20" HCO-169	17.2	1	54	191800 PSI
"	17.2	2	54	192500 PSI

JB/9-19-80

PREPARED BY / DATE

CHECKED BY

BEHAVIOR STRESSES IN UNDERGROUND PIPING DUE

DATE \_\_\_\_\_

SUBJECT

TO DIFFERENTIAL SOIL SETTLEMENT - MIDLAND  
PIPING UNITS 192

REV / DATE \_\_\_\_\_

7) CONT

THE STRESSES SHOWN WERE BASED ON AN ELASTIC ANALYSIS. OBVIOUSLY PLASTIC DEFORMATION WOULD OCCUR LONG BEFORE SOME OF THESE STRESSES WERE REACHED

### HAND CALCULATIONS

SIMPLE HAND CALCULATIONS WERE MADE TO VERIFY THE COMPUTER ANALYSIS FOR THE SECTION OF LINE 26" OHBC-57 IN THE AREA OF THE DIP BETWEEN NODES 5 AND 7

1) THE SECTION OF THE LINE BETWEEN NODES 5 & 7 WAS ASSUMED TO BE A SIMPLY SUPPORTED UNIFORMLY LOADED BEAM WITH THE MAXIMUM DEFLECTION AT NODE 6

$$\text{MAX } \gamma = \frac{5WL^3}{384EI}$$

$$W = \frac{(\gamma)(384)(EI)}{5L^3}$$

$$\text{MAX } M = \frac{WL}{8} = \frac{(\gamma)(384)(E)(I)(L)}{(5)(256)(L^3)}$$

$$\sigma = \frac{MC}{I} = \frac{(\gamma)(48)(E)(I)(L/2)}{(5)(L^3)(I)}$$

$$\gamma \approx 2.46 \text{ in} \quad L = 240'' \quad D/2 = 13''$$

$$\sigma = \frac{(2.46)(48)(29)(10)^6(13)}{(5)(240)^2} = \underline{154,570 \text{ P.S.I.}}$$

J.B./9-19-80

PREPARED BY / DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_  
 BEHAVIOR STRESSES IN UNDERGROUND PIPING DUE TO

SUBJECT  
 DIFFERENTIAL SOIL SETTLEMENT - MIDLAND PLANT  
 UNIT # 1A2

2) AS THE SLOPE OF THE LINE CHANGES AT NODES 5 & 7 THE LINE IS NOT SIMPLY SUPPORTED AT THESE POINTS BUT IS CARRYING MOMENT.

ASSUME THE SECTION OF THE LINE BETWEEN NODES 5 & 7 IS UNIFORMLY LOADED WITH BOTH ENDS FIXED.

$$y = \frac{wl^3}{384EI}$$

$$w = \frac{384EI}{l^3}$$

$$MAY M = \frac{wl}{12} = \frac{(1)(384)(E)(I)(13)}{(12)(13)^2}$$

$$\sigma = \frac{(1)(32)(E)(13)(D/2)}{(12)(I)}$$

$$\sigma = \frac{(2.46)(32)(29)(10)^4(13)}{(240)^2} = 515233 \text{ P.S.I.}$$

THE ACTUAL STRESS WOULD BE BETWEEN CASE 1 & 2. CLOSER TO 1

3) SINCE THE LINE TAKES A SUDDEN DIP BETWEEN NODES 5 & 7 ASSUME THAT THIS SECTION OF THE LINE IS A SIMPLY SUPPORTED BEAM LOADED AT NODE 6

$$y = \frac{wl^3}{48EI}$$

$$w = (1)(48)(E)(I) / l^3$$

$$m = \frac{(1)(48)(E)(I)(13)}{(13)^2(I)(4)}$$

JP/4-19-80

PREPARED BY / DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_  
 BENDING STRESSES IN UNDERGROUND PIPING DUE TO  
 SUBJECT: \_\_\_\_\_ DATE \_\_\_\_\_  
 TO DIFFERENTIAL SOIL SETTLEMENT - MIDLAND  
 PLANT UNITS 199 REV / DATE \_\_\_\_\_

$$\sigma = \frac{(12)(Y)(E)(I)(D/2)}{I^2 I}$$

$$\sigma = \frac{(12)(2.46)(29)(10)^6(13)}{(840)^2} = 193,200 \text{ P.S.I.}$$

- 4) SAME AS 3 EXCEPT NODES 5 & 7 ASSUMED FIXED.

$$Y = \frac{W L^3}{192 EI}$$

$$W = \frac{(Y)(192)(E)(I)}{L^3}$$

$$M = \frac{(Y)(192)(E)(I)(L)}{(8)(L^3)^2}$$

$$\sigma = \frac{(Y)(24)(E)(D/2)(I)}{(L^2)(2I)}$$

$$\sigma = (Y)(24)(29)(10)^6(13)/240^2 = 386,420 \text{ P.S.I.}$$

- 5) THE METHOD GIVEN IN RESPONSE TO QUESTION 19 OF REF 1 IS AT BEST A ROUGH APPROXIMATION, BUT EVEN THIS METHOD GIVES VERY HIGH BENDING STRESSES FOR THE AREA BETWEEN NODES 5 & 7

$$\sigma_B = \frac{(E)(D)(R)(E)}{2 L^2}$$

$$\sigma_B = \frac{(29)(10)^6(26)(E)(2.46)}{(2)(240)^2} = 178,800 \text{ P.S.I.}$$



ETEC

NO. 6

PAGE \_\_\_\_\_ OF \_\_\_\_\_

JB/G-19-80

PREPARED BY / DATE \_\_\_\_\_ CHECKED BY \_\_\_\_\_ DATE \_\_\_\_\_

SUBJECT BENDING STRESSES IN UNDERGROUND PIPING DUE TO DIFFERENTIAL SOIL SETTLEMENT - MIDLAND PLANT UNITS 1 & 2 REV / DATE \_\_\_\_\_

THE HAND CALCULATIONS OF THE BENDING STRESSES [CASES 1-47] CONFIRM THE COMPUTER OUTPUT STRESSES IN GENERAL. IF THE END FIXITY AT NODES 5 & 7 WERE FACTORED IN THERE WOULD BE BETTER AGREEMENT.

IN ALL CASES THE STRESSES WERE WELL ABOVE THE YIELD STRENGTH OF THE MATERIAL AND ALSO THE CODE ALLOWABLES.

Ref:

- (1) "RESPONSES TO THE NRC 10 CFR 50.54(f) REQUEST REGARDING PLANT FILL FOR MIDLAND PLANT UNITS 1 AND 2, CONSUMER POWER COMPANY, DOCKET NUMBERS 50-359 AND 50-330" Rev. 6, APRIL 1, 1980

LINE 26" OHBC-54

NODE MAP & COMPUTER OUTPUT

ETEC

NO. \_\_\_\_\_

JB79-17-80

PAGE \_\_\_\_\_ OF \_\_\_\_\_

PREPARED BY / DATE

CHECKED BY

BENDING STRESSES IN UNDERGROUND PIPING DUE DATE

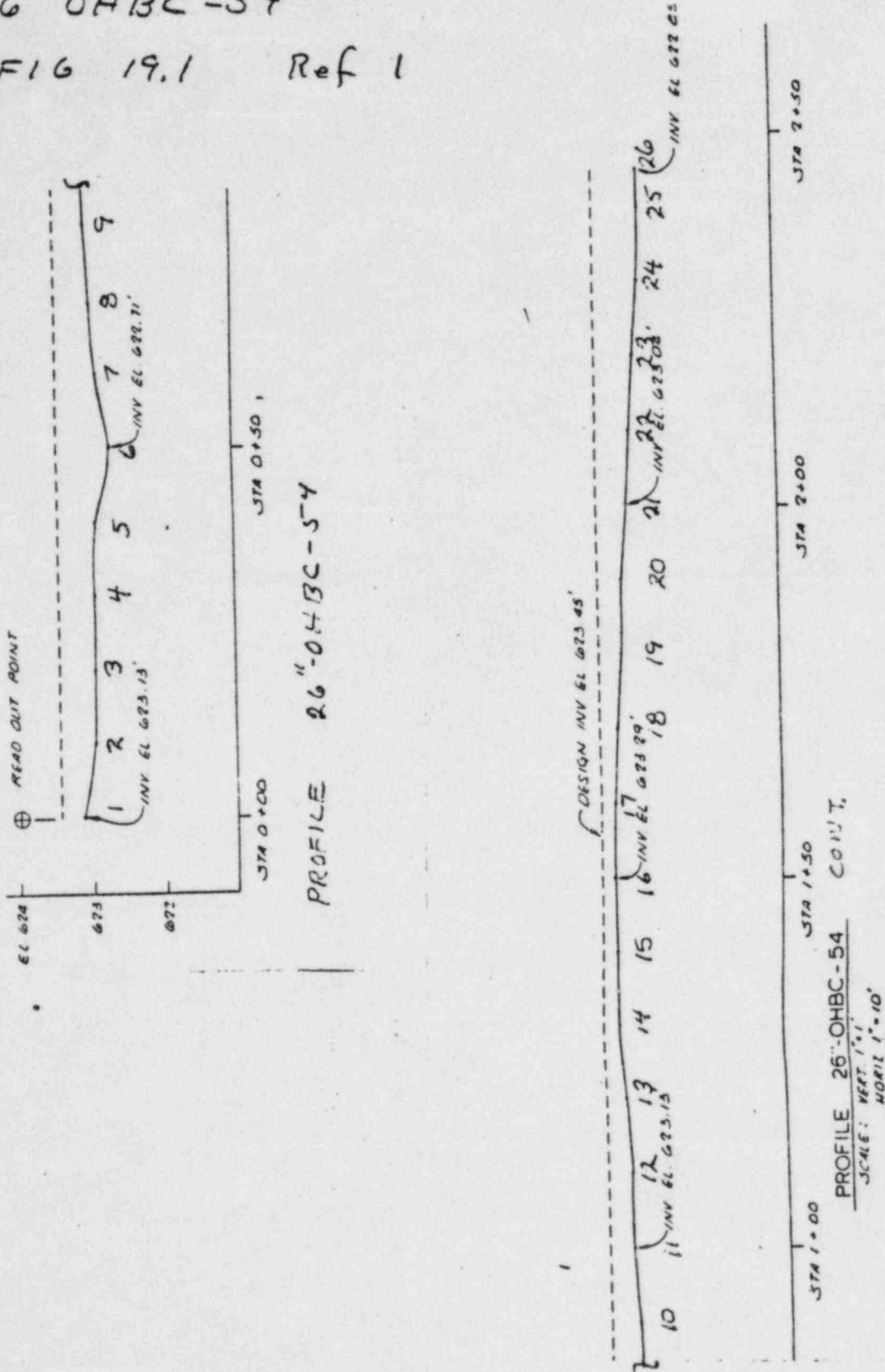
SUBJECT

TO DIFFERENTIAL SOIL SETTLEMENT - MIDLAND PLANT UNITS 197

REV / DATE \_\_\_\_\_

26" OHBC-54

FIG 19.1 Ref 1





PRODUCED & DIRECTED BY RVL INC  
MIDLAND PLANT SURVEYED PIPELINE PROFILE

0  
0

RUN OPTION CODE	1
PLOT OPTION CODE	1
MULTIPLE LOAD CASE CODE	2
RIGID BODY OPTION CODE	0
SKEW RESTRAINT OPTION CODE	0
NON-LINEAR OPTION	0
RENUMBERING OPTION CODE	0
COORDINATE UNITS CODE	1
DATA CHECK OPTION CODE	1
INPUT FORMAT OPTION CODE	1
NATURAL FREQ. OPTION CODE	0



MIDLAND PLANT SURVEYED PIPELINE PROFILE

BP	NODE	X-COORD	Y-COORD	Z-COORD	BND RAD	MATL ID	PIPE ID	INSL ID
1	1	0.0	0.0	0.0		1	1	1
	2	10.000	0.0	0.0		1	1	1
	3	20.000	0.0	0.0		1	1	1
	4	30.000	0.0	0.0		1	1	1
	5	40.000	0.0	0.0		1	1	1
	6	50.000	0.0	0.0		1	1	1
	7	60.000	0.0	0.0		1	1	1
	8	70.000	0.0	0.0		1	1	1
	9	80.000	0.0	0.0		1	1	1
	10	90.000	0.0	0.0		1	1	1
	11	100.000	0.0	0.0		1	1	1
	12	110.000	0.0	0.0		1	1	1
	13	120.000	0.0	0.0		1	1	1
	14	130.000	0.0	0.0		1	1	1
	15	140.000	0.0	0.0		1	1	1
	16	150.000	0.0	0.0		1	1	1
	17	160.000	0.0	0.0		1	1	1
	18	170.000	0.0	0.0		1	1	1
	19	180.000	0.0	0.0		1	1	1
	20	190.000	0.0	0.0		1	1	1
	21	200.000	0.0	0.0		1	1	1
	22	210.000	0.0	0.0		1	1	1
	23	220.000	0.0	0.0		1	1	1
	24	230.000	0.0	0.0		1	1	1
	25	240.000	0.0	0.0		1	1	1
	26	245.000	0.0	0.0		1	1	1

\*\* GEOMETRY DATA \*\*





MIDLAND PLANT SURVEYED PIPELINE PROFILE

INSULATION WT. PROPERTIES

INSULATION ID                      INSULATION WT. (LBS/IN)

1    0.0



FLUID WEIGHT PROPERTIES

FLUID ID	TEMP.	DENSITY	TEMP.	DENSITY	TEMP.	DENSITY
----------	-------	---------	-------	---------	-------	---------

1	0.	0.0				
---	----	-----	--	--	--	--

MIDLAND PLANT SURVEYED PIPELINE PROFILE

\*\*\* RESEQUENCING DATA \*\*\*

NODE	WAS	NOW	NODE	WAS	NOW	NODE	WAS	NOW
1	1	1	2	2	2	3	3	3
4	4	4	5	5	5	6	6	6
7	7	7	8	8	8	9	9	9
10	10	10	11	11	11	12	12	12
13	13	13	14	14	14	15	15	15
16	16	16	17	17	17	18	18	18
19	19	19	20	20	20	21	21	21
22	22	22	23	23	23	24	24	24
25	25	25	26	26	26			

ORIGINAL BANDWIDTH= 1 NEW BANDWIDTH= 1

RESULTS FROM DATA CHECK ROUTINE

\*\*\*\* NO ERRORS HAVE BEEN DETECTED IN THE GEOMETRY PORTION OF THE MODEL \*\*\*\*

## ELEMENT DATA SUMMARY

ELEMENT	N1 - N2	TYPE	AREA	IX	IY	IZ	LENGTH	RAD	PHI	WEIGHT
1	1 - 2	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
2	2 - 3	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
3	3 - 4	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
4	4 - 5	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
5	5 - 6	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
6	6 - 7	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
7	7 - 8	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
8	8 - 9	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
9	9 - 10	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
10	10 - 11	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
11	11 - 12	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
12	12 - 13	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
13	13 - 14	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
14	14 - 15	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
15	15 - 16	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
16	16 - 17	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
17	17 - 18	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
18	18 - 19	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
19	19 - 20	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
20	20 - 21	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
21	21 - 22	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
22	22 - 23	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
23	23 - 24	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
24	24 - 25	0	30.189	4956.85	2478.43	2478.43	120.00			1027.02
25	25 - 26	0	30.189	4956.85	2478.43	2478.43	60.00			513.51

TOTAL WEIGHT= 25162.02

RB WEIGHT= 0.0

FLUID VOLUME= 1472177.



MIDLAND PLANT SURVEYED PIPELINE PROFILE

P.I.E AND INSULATION DATA SUMMARY

IDENTIFICATION NO.	TOTAL PIPE LENGTH	TOTAL INSULATION WT.
1	2940.000	-
	-----	-----
	2940.000	0.0

MIDLAND PLANT SURVEYED PIPELINE PROFILE

PLOT CONTROL DATA (GEOMETRY PLOTS)

PLOT NO	NPLOT	OX	OY	OZ	XBIG	XSML	YBIG	YSML	ZBIG	ZSML	VA
1	-1	-1.000	-1.000	-1.000	0.0	0.0	0.0	0.0	0.0	0.0	2
2	1	1.000	-1.000	-1.000	0.0	0.0	0.0	0.0	0.0	0.0	2
3	1	1.000	-1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	2
4	1	-1.000	-1.000	1.000	0.0	0.0	0.0	0.0	0.0	0.0	2



LOAD DUE TO DEFLECTION

LOAD CASE 1 NODE DATA

NODE - TEMPERATURE	FX DX	FY DY	FZ DZ	MX TX	MY TY	MZ TZ	SYSTEM
1 70.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
2 70.0	0.0 .....	0.0 -2.040000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
3 70.0	0.0 .....	0.0 -2.160000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
4 70.0	0.0 .....	0.0 -2.160000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
5 70.0	0.0 .....	0.0 -2.280000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
6 70.0	0.0 .....	0.0 -5.040000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
7 70.0	0.0 .....	0.0 -2.880000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
8 70.0	0.0 .....	0.0 -1.920000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0
9 70.0	0.0 .....	0.0 -1.200000	0.0 .....	0.0 .....	0.0 .....	0.0 .....	0



LOAD DUE TO DEFLECTION

LOAD CASE 1 NODE DATA

NODE - TEMPERATURE	FX DX	FY DY	FZ DZ	MX TX	MY TY	MZ TZ	SYSTEM
10 70.0	0. ....	0. -0.720000	0. ....	0. ....	0. ....	0. ....	0
11 70.0	0. ....	0. 0.0	0. ....	0. ....	0. ....	0. ....	0
12 70.0	0. ....	0. 0.0	0. ....	0. ....	0. ....	0. ....	0
13 70.0	0. ....	0. 0.600000	0. ....	0. ....	0. ....	0. ....	0
14 70.0	0. ....	0. 1.320000	0. ....	0. ....	0. ....	0. ....	0
15 70.0	0. ....	0. 1.560000	0. ....	0. ....	0. ....	0. ....	0
16 70.0	0. ....	0. 1.920000	0. ....	0. ....	0. ....	0. ....	0
17 70.0	0. ....	0. 1.560000	0. ....	0. ....	0. ....	0. ....	0
18 70.0	0. ....	0. 0.840000	0. ....	0. ....	0. ....	0. ....	0

LOAD DUE TO DEFLECTION

LOAD CASE 1 NODE DATA

NODE - TEMPERATURE	FX DX	FY DY	FZ DZ	MX TX	MY TY	MZ TZ	SYSTEM
19 70.0	0. ....	0. 0.240000	0. ....	0. ....	0. ....	0. ....	0
20 70.0	0. ....	0. 0.0	0. ....	0. ....	0. ....	0. ....	0
21 70.0	0. ....	0. -1.080000	0. ....	0. ....	0. ....	0. ....	0
22 70.0	0. ....	0. -1.680000	0. ....	0. ....	0. ....	0. ....	0
23 70.0	0. ....	0. -2.280000	0. ....	0. ....	0. ....	0. ....	0
24 70.0	0. ....	0. -3.240000	0. ....	0. ....	0. ....	0. ....	0
25 70.0	0. ....	0. -3.600000	0. ....	0. ....	0. ....	0. ....	0
26 70.0	0. 0.0	0. -3.360000	0. 0.0	0. 0.0	0. 0.0	0. 0.0	0

LOAD CASE 2

PRESSURE= 0.0 FLUID ID= 0 GRAVITY DIRECTION COSINES(X= 0.0 ,Y= 0.0 ,Z= 0.0 )

SUBSET LOAD FACTORS,

PRESSURE	=	0.0	FLUID WT.	=	0.0	GRAVITY	=	0.0
SEISMIC	=	0.0	TEMP. (CON)	=	0.0	TEMP. (VARY)	=	0.0
POINT LOADS	=	0.0	WIND LOADS	=	0.0	DISPLACEMENTS	=	1.00
COLD SPRINGING	=	0.0	LINEAR K	=	0.0	S-ALLOW FACTOR	=	0.0

NF VALUES 0 0 0 0 0 0 0 0 1 0 0 0

THE TEMPERATURE OF THE ENTIRE PIPING SYSTEM IS CONSTANT AND IS EQUAL TO 70.0 DEGS

LOAD DUE TO DEFLECTION

LOAD CASE 2 NODE DATA

NODE - TEMPERATURE	FX DX	FY DY	FZ DZ	MX TX	MY TY	MZ TZ	SYSTEM
1 70.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
2 70.0	0.0 -2.040000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
3 70.0	0.0 -2.160000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
4 70.0	0.0 -2.160000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
5 70.0	0.0 -2.280000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
6 70.0	0.0 -5.040000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
7 70.0	0.0 -2.880000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
8 70.0	0.0 -1.920000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0
9 70.0	0.0 -1.200000	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0



LOAD DUE TO DEFLECTION

LOAD CASE 2 NODE DATA

MODE - TEMPERATURE	FX DX	FY DY	FZ DZ	MX TX	MY TY	MZ TZ	SYSTEM
10 70.0	0. ....	0. -0.720000	0. ....	0. ....	0. ....	0. ....	0
11 70.0	0. ....	0.0 ....	0. ....	0. ....	0. ....	0. ....	0
12 70.0	0. ....	0.0 ....	0. ....	0. ....	0. ....	0. ....	0
13 70.0	0. ....	0. 0.600000	0. ....	0. ....	0. ....	0. ....	0
14 70.0	0. ....	0. 1.320000	0. ....	0. ....	0. ....	0. ....	0
15 70.0	0. ....	0. 1.560000	0. ....	0. ....	0. ....	0. ....	0
15 70.0	0. ....	0. 1.920000	0. ....	0. ....	0. ....	0. ....	0
17 70.0	0. ....	0. 1.560000	0. ....	0. ....	0. ....	0. ....	0
18 70.0	0. ....	0. 0.840000	0. ....	0. ....	0. ....	0. ....	0



LOAD DUE TO DEFLECTION

CALCULATED DISPLACEMENTS FOR LOAD CASE 1

NODE	MSYS	X-DISP	Y-DISP	Z-DISP	X-ROT	Y-ROT	Z-ROT
1	0	0.0	0.0	0.0	0.0	0.0	0.0
2	0	0.0	-2.0400D+00	0.0	0.0	0.0	-1.2642D-02
3	0	0.0	-2.1600D+00	0.0	0.0	0.0	1.2952D-03
4	0	0.0	-2.1600D+00	0.0	0.0	0.0	2.1310D-03
5	0	0.0	-2.2800D+00	0.0	0.0	0.0	-1.6234D-02
6	0	0.0	-5.0400D+00	0.0	0.0	0.0	-3.6986D-03
7	0	0.0	-2.8800D+00	0.0	0.0	0.0	1.7584D-02
8	0	0.0	-1.9200D+00	0.0	0.0	0.0	5.4103D-03
9	0	0.0	-1.2000D+00	0.0	0.0	0.0	4.8379D-03
10	0	0.0	-7.2000D-01	0.0	0.0	0.0	5.4484D-03
11	0	0.0	0.0	0.0	0.0	0.0	2.7866D-03
12	0	0.0	0.0	0.0	0.0	0.0	1.6822D-03
13	0	0.0	6.0000D-01	0.0	0.0	0.0	6.5461D-03
14	0	0.0	1.3200D+00	0.0	0.0	0.0	3.7757D-03
15	0	0.0	1.5600D+00	0.0	0.0	0.0	2.6423D-03
16	0	0.0	1.9200D+00	0.0	0.0	0.0	4.7017D-04
17	0	0.0	1.5600D+00	0.0	0.0	0.0	-5.1333D-03
18	0	0.0	8.4000D-01	0.0	0.0	0.0	-6.1151D-03
19	0	0.0	2.4000D-01	0.0	0.0	0.0	-2.6081D-03
20	0	0.0	0.0	0.0	0.0	0.0	-5.6101D-03
21	0	0.0	-1.0800D+00	0.0	0.0	0.0	-7.8086D-03
22	0	0.0	-1.6800D+00	0.0	0.0	0.0	-4.1059D-03
23	0	0.0	-2.2800D+00	0.0	0.0	0.0	-6.9280D-03
24	0	0.0	-3.2400D+00	0.0	0.0	0.0	-6.6263D-03
25	0	0.0	-3.6000D+00	0.0	0.0	0.0	1.8950D-03
26	0	0.0	-3.3600D+00	0.0	0.0	0.0	0.0

LOAD DUE TO DEFLECTION

CALCULATED DISPLACEMENTS FOR LOAD CASE 2

NODE	NSYS	X-DISP	Y-DISP	Z-DISP	X-ROT	Y-ROT	Z-ROT
1	0	0.0	0.0	0.0	0.0	0.0	-2.0135D-02
2	0	0.0	-2.0400D+00	0.0	0.0	0.0	-8.6955D-03
3	0	0.0	-2.1600D+00	0.0	0.0	0.0	5.2169D-04
4	0	0.0	-2.1600D+00	0.0	0.0	0.0	2.2826D-03
5	0	0.0	-2.2800D+00	0.0	0.0	0.0	-1.6264D-02
6	0	0.0	-5.0400D+00	0.0	0.0	0.0	-3.6928D-03
7	0	0.0	-2.8800D+00	0.0	0.0	0.0	1.7583D-02
8	0	0.0	-1.9200D+00	0.0	0.0	0.0	5.4105D-03
9	0	0.0	-1.2000D+00	0.0	0.0	0.0	4.8379D-03
10	0	0.0	-7.2000D-01	0.0	0.0	0.0	5.4484D-03
11	0	0.0	0.0	0.0	0.0	0.0	2.7866D-03
12	0	0.0	0.0	0.0	0.0	0.0	1.6822D-03
13	0	0.0	6.0000D-01	0.0	0.0	0.0	6.5461D-03
14	0	0.0	1.3200D+00	0.0	0.0	0.0	3.7757D-03
15	0	0.0	1.5600D+00	0.0	0.0	0.0	2.6423D-03
16	0	0.0	1.9200D+00	0.0	0.0	0.0	4.7017D-04
17	0	0.0	1.5600D+00	0.0	0.0	0.0	-5.1333D-03
18	0	0.0	8.4000D-01	0.0	0.0	0.0	-6.1151D-03
19	0	0.0	2.4000D-01	0.0	0.0	0.0	-2.6081D-03
20	0	0.0	0.0	0.0	0.0	0.0	-5.6100D-03
21	0	0.0	-1.0800D+00	0.0	0.0	0.0	-7.8090D-03
22	0	0.0	-1.6800D+00	0.0	0.0	0.0	-4.1039D-03
23	0	0.0	-2.2800D+00	0.0	0.0	0.0	-6.9385D-03
24	0	0.0	-3.2400D+00	0.0	0.0	0.0	-6.5730D-03
25	0	0.0	-3.6000D+00	0.0	0.0	0.0	1.6231D-03
26	0	0.0	-3.3600D+00	0.0	0.0	0.0	4.2530D-03



ELEMENT INTERNAL FORCES AND MOMENTS  
LOAD CASE 1

ELEMENT	NODES	SYSTEM	FX(LBS)	FY(LBS)	FZ(LBS)	MX(FT-LBS)	MY(FT-LBS)	MZ(FT-LBS)
1	1	(G)	0.0	453903.8	0.0	0.0	0.0	2876581.7
	2	(G)	0.0	-453903.8	0.0	0.0	0.0	1662456.3
2	2	(G)	0.0	-198639.6	0.0	0.0	0.0	-1662456.3
	3	(G)	0.0	198639.6	0.0	0.0	0.0	-323939.2
3	3	(G)	0.0	72814.6	0.0	0.0	0.0	323939.2
	4	(G)	0.0	-72814.6	0.0	0.0	0.0	404206.5
4	4	(G)	0.0	-257218.3	0.0	0.0	0.0	-404206.5
	5	(G)	0.0	257218.3	0.0	0.0	0.0	-2167976.3
5	5	(G)	0.0	553985.0	0.0	0.0	0.0	2167976.3
	6	(G)	0.0	-553985.0	0.0	0.0	0.0	3371874.1
6	6	(G)	0.0	-469974.0	0.0	0.0	0.0	-3371874.1
	7	(G)	0.0	469974.0	0.0	0.0	0.0	-1327865.9
7	7	(G)	0.0	148653.2	0.0	0.0	0.0	1327865.9
	8	(G)	0.0	-148653.2	0.0	0.0	0.0	158666.4
8	8	(G)	0.0	-37229.8	0.0	0.0	0.0	-158666.4
	9	(G)	0.0	37229.8	0.0	0.0	0.0	-213631.8
9	9	(G)	0.0	48589.0	0.0	0.0	0.0	213631.8
	10	(G)	0.0	-48589.0	0.0	0.0	0.0	272257.9
10	10	(G)	0.0	-80014.9	0.0	0.0	0.0	-272257.9
	11	(G)	0.0	80014.9	0.0	0.0	0.0	-527891.6



ELEMENT INTERNAL FORCES AND MOMENTS  
LOAD CASE 1

ELEMENT	NODES	SYSTEM	FX(LBS)	FY(LBS)	FZ(LBS)	MX(FT-LBS)	MY(FT-LBS)	MZ(FT-LBS)
21	21	(G)	0.0	-40688.4	0.0	0.0	0.0	-381241.7
	22	(G)	0.0	40688.4	0.0	0.0	0.0	-25642.4
22	22	(G)	0.0	-21974.7	0.0	0.0	0.0	25642.4
	23	(G)	0.0	21974.7	0.0	0.0	0.0	-245389.1
23	23	(G)	0.0	51976.0	0.0	0.0	0.0	245389.1
	24	(G)	0.0	-51976.0	0.0	0.0	0.0	274371.4
24	24	(G)	0.0	26963.0	0.0	0.0	0.0	-274371.4
	25	(G)	0.0	-26963.0	0.0	0.0	0.0	544001.9
25	25	(G)	0.0	-290397.9	0.0	0.0	0.0	-544001.9
	26	(G)	0.0	290397.9	0.0	0.0	0.0	-907987.8

## LOAD DUE TO DEFLECTION

PAGE 25

ELEMENT INTERNAL FORCES AND MOMENTS  
LOAD CASE 2

ELEMENT	NODES	S/STEM	FX(LBS)	FY(LBS)	FZ(LBS)	MX(FT-LBS)	MY(FT-LBS)	MZ(FT-LBS)
1	1	(G)	0.0	109863.7	0.0	0.0	0.0	0.0
2	2	(G)	0.0	-109863.7	0.0	0.0	0.0	1098637.4
2	2	(G)	0.0	-131206.6	0.0	0.0	0.0	-1098637.4
3	3	(G)	0.0	131206.6	0.0	0.0	0.0	-213429.0
3	3	(G)	0.0	59597.5	0.0	0.0	0.0	213429.0
4	4	(G)	0.0	-59597.5	0.0	0.0	0.0	382546.1
4	4	(G)	0.0	-254627.7	0.0	0.0	0.0	-382546.1
5	5	(G)	0.0	254627.7	0.0	0.0	0.0	-2163730.8
5	5	(G)	0.0	553477.3	0.0	0.0	0.0	2163730.8
6	6	(G)	0.0	-553477.3	0.0	0.0	0.0	3371042.0
6	6	(G)	0.0	-469874.5	0.0	0.0	0.0	-3371042.0
7	7	(G)	0.0	469874.5	0.0	0.0	0.0	-1327702.8
7	7	(G)	0.0	148633.7	0.0	0.0	0.0	327702.8
8	8	(G)	0.0	-148633.7	0.0	0.0	0.0	158634.4
8	8	(G)	0.0	-37226.0	0.0	0.0	0.0	-158634.4
9	9	(G)	0.0	37226.0	0.0	0.0	0.0	-213625.5
9	9	(G)	0.0	48588.2	0.0	0.0	0.0	213625.5
10	10	(G)	0.0	-48588.2	0.0	0.0	0.0	272256.7
10	10	(G)	0.0	-80014.8	0.0	0.0	0.0	-272256.7
11	11	(G)	0.0	80014.8	0.0	0.0	0.0	-527891.4

ELEMENT INTERNAL FORCES AND MOMENTS  
LOAD CASE 2

ELEMENT	NODES	SYSTEM	FX(LBS)	FY(LBS)	FZ(LBS)	MX(FT-LBS)	MY(FT-LBS)	MZ(FT-LBS)
11	11	(G)	0.0	94971.7	0.0	0.0	0.0	527891.4
	12	(G)	0.0	-94971.7	0.0	0.0	0.0	421825.6
12	12	(G)	0.0	-37652.8	0.0	0.0	0.0	-421825.6
	13	(G)	0.0	37652.8	0.0	0.0	0.0	45297.2
13	13	(G)	0.0	-35666.1	0.0	0.0	0.0	-45297.2
	14	(G)	0.0	35666.1	0.0	0.0	0.0	-311363.9
14	14	(G)	0.0	51388.4	0.0	0.0	0.0	311363.9
	15	(G)	0.0	-51388.4	0.0	0.0	0.0	202519.7
15	15	(G)	0.0	-61365.3	0.0	0.0	0.0	-202519.7
	16	(G)	0.0	61365.3	0.0	0.0	0.0	-41133.5
16	16	(G)	0.0	28411.7	0.0	0.0	0.0	41133.5
	17	(G)	0.0	-28411.7	0.0	0.0	0.0	-127016.1
17	17	(G)	0.0	15974.3	0.0	0.0	0.0	127016.1
	18	(G)	0.0	-15974.3	0.0	0.0	0.0	32726.8
18	18	(G)	0.0	27134.9	0.0	0.0	0.0	-32726.8
	19	(G)	0.0	-27134.9	0.0	0.0	0.0	304075.3
19	19	(G)	0.0	-89644.8	0.0	0.0	0.0	-304075.3
	20	(G)	0.0	89644.8	0.0	0.0	0.0	-592373.1
20	20	(G)	0.0	97355.7	0.0	0.0	0.0	592373.1
	21	(G)	0.0	-97355.7	0.0	0.0	0.0	381184.4



ELEMENT INTERNAL FORCES AND MOMENTS  
LOAD CASE 2

ELEMENT	NODES	SYSTEM	FX (LBS)	FY (LBS)	FZ (LBS)	MX (FT-LBS)	MY (FT-LBS)	MZ (FT-LBS)
21	21	(G)	0.0	-40553.4	0.0	0.0	0.0	-381184.4
	22	(G)	0.0	40553.4	0.0	0.0	0.0	-25349.9
22	22	(G)	0.0	-22153.2	0.0	0.0	0.0	25349.9
	23	(G)	0.0	22153.2	0.0	0.0	0.0	-246881.6
23	23	(G)	0.0	52886.8	0.0	0.0	0.0	246881.6
	24	(G)	0.0	-52886.8	0.0	0.0	0.0	281986.1
24	24	(G)	0.0	22316.6	0.0	0.0	0.0	-281986.1
	25	(G)	0.0	-22316.6	0.0	0.0	0.0	505152.1
25	25	(G)	0.0	-101030.4	0.0	0.0	0.0	-505152.1
	26	(G)	0.0	101030.4	0.0	0.0	0.0	-0.0

ELEMENT STRESS DATA  
LOAD CASE 1

ELEMENT	N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
1	1- 2	0.0 0.0	0.0 0.0	0.0 0.0	181061.2 -104640.3	1.000 1.000	0.0 0.0	181061.2 104640.3	181061.2 104640.3
2	2- 3	0.0 0.0	0.0 0.0	0.0 0.0	-104640.3 20389.8	1.000 1.000	0.0 0.0	104640.3 20389.8	104640.3 20389.8
3	3- 4	0.0 0.0	0.0 0.0	0.0 0.0	20389.8 -25442.0	1.000 1.000	0.0 0.0	20389.8 25442.0	20389.8 25442.0
4	4- 5	0.0 0.0	0.0 0.0	0.0 0.0	-25442.0 136459.4	1.000 1.000	0.0 0.0	25442.0 136459.4	25442.0 136459.4
5	5- 6	0.0 0.0	0.0 0.0	0.0 0.0	136459.4 -212236.5	1.000 1.000	0.0 0.0	136459.4 212236.5	136459.4 212236.5
6	6- 7	0.0 0.0	0.0 0.0	0.0 0.0	-212236.5 83580.1	1.000 1.000	0.0 0.0	212236.5 83580.1	212236.5 83580.1
7	7- 8	0.0 0.0	0.0 0.0	0.0 0.0	83580.1 -9987.0	1.000 1.000	0.0 0.0	83580.1 9987.0	83580.1 9987.0
8	8- 9	0.0 0.0	0.0 0.0	0.0 0.0	-9987.0 13446.7	1.000 1.000	0.0 0.0	9987.0 13446.7	9987.0 13446.7
9	9- 10	0.0 0.0	0.0 0.0	0.0 0.0	13446.7 -17136.8	1.000 1.000	0.0 0.0	13446.7 17136.8	13446.7 17136.8
10	10- 11	0.0 0.0	0.0 0.0	0.0 0.0	-17136.8 33227.2	1.000 1.000	0.0 0.0	17136.8 33227.2	17136.8 33227.2

\*\* STRESS INDICIES= PRESS=0. , MOMENT=1

LOAD DUE TO DEFLECTION

ELEMENT STRESS DATA  
LOAD CASE 1

ELEMENT	N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
11	11- 12	0.0	0.0	0.0	33227.2	1.000	0.0	33227.2	33227.2
		0.0	0.0	0.0	-26551.1	1.000	0.0	26551.1	26551.1
12	12- 13	0.0	0.0	0.0	-26551.1	1.000	0.0	26551.1	26551.1
		0.0	0.0	0.0	-2851.1	1.000	0.0	2851.1	2851.1
13	13- 14	0.0	0.0	0.0	-2851.1	1.000	0.0	2851.1	2851.1
		0.0	0.0	0.0	19598.2	1.000	0.0	19598.2	19598.2
14	14- 15	0.0	0.0	0.0	19598.2	1.000	0.0	19598.2	19598.2
		0.0	0.0	0.0	-12747.2	1.000	0.0	12747.2	12747.2
15	15- 16	0.0	0.0	0.0	-12747.2	1.000	0.0	12747.2	12747.2
		0.0	0.0	0.0	25878.1	1.000	0.0	25878.1	25878.1
16	16- 17	0.0	0.0	0.0	25878.1	1.000	0.0	25878.1	25878.1
		0.0	0.0	0.0	7994.8	1.000	0.0	7994.8	7994.8
17	17- 18	0.0	0.0	0.0	7994.8	1.000	0.0	7994.8	7994.8
		0.0	0.0	0.0	-2059.9	1.000	0.0	2059.9	2059.9
18	18- 19	0.0	0.0	0.0	-2059.9	1.000	0.0	2059.9	2059.9
		0.0	0.0	0.0	-19139.6	1.000	0.0	19139.6	19139.6
19	19- 20	0.0	0.0	0.0	-19139.6	1.000	0.0	19139.6	19139.6
		0.0	0.0	0.0	37286.6	1.000	0.0	37286.6	37286.6
20	20- 21	0.0	0.0	0.0	37286.6	1.000	0.0	37286.6	37286.6
		0.0	0.0	0.0	-23996.6	1.000	0.0	23996.6	23996.6

\*\* STRESS INDICIES\* PRESS=0. , MOMENT=1

LOAD DUE TO DEFLECTION

ELEMENT STRESS DATA  
LOAD CASE 1

ELEMENT	N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
21	21- 22	0.0 0.0	0.0 0.0	0.0 0.0	-23996.6 1614.0	1.000 1.000	0.0 0.0	23996.6 1614.0	23996.6 1614.0
22	22- 23	0.0 0.0	0.0 0.0	0.0 0.0	1614.0 15445.6	1.000 1.000	0.0 0.0	1614.0 15445.6	1614.0 15445.6
23	23- 24	0.0 0.0	0.0 0.0	0.0 0.0	15445.6 -17269.8	1.000 1.000	0.0 0.0	15445.6 17269.8	15445.6 17269.8
24	24- 25	0.0 0.0	0.0 0.0	0.0 0.0	-17269.8 -34241.2	1.000 1.000	0.0 0.0	17269.8 34241.2	17269.8 34241.2
25	25- 26	0.0 0.0	0.0 0.0	0.0 0.0	-34241.2 57151.6	1.000 1.000	0.0 0.0	34241.2 57151.6	34241.2 57151.6

\*\* STRESS INDICIES\* PRESS=0. , MOMENT=1

LOAD DUE TO DEFLECTION

ELEMENT STRESS DATA  
LOAD CASE 2

ELEMENT	N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
1	1- 2	0.0 0.0	0.0 0.0	0.0 -69151.7	0.0 1.000	1.000	0.0 0.0	0.0 69151.7	0.0 69151.7
2	2- 3	0.0 0.0	0.0 0.0	0.0 13433.9	1.000 1.000	1.000	0.0 0.0	69151.7 13433.9	69151.7 13433.9
3	3- 4	0.0 0.0	0.0 0.0	0.0 -24078.7	1.000 1.000	1.000	0.0 0.0	13433.9 24078.7	13433.9 24078.7
4	4- 5	0.0 0.0	0.0 0.0	0.0 136192.1	1.000 1.000	1.000	0.0 0.0	24078.7 136192.1	24078.7 136192.1
5	5- 6	0.0 0.0	0.0 0.0	0.0 -212184.1	1.000 1.000	1.000	0.0 0.0	136192.1 212184.1	136192.1 212184.1
6	6- 7	0.0 0.0	0.0 0.0	0.0 83569.9	1.000 1.000	1.000	0.0 0.0	212184.1 83569.9	212184.1 83569.9
7	7- 8	0.0 0.0	0.0 0.0	0.0 -9985.0	1.000 1.000	1.000	0.0 0.0	83569.9 9985.0	83569.9 9985.0
8	8- 9	0.0 0.0	0.0 0.0	0.0 13446.3	1.000 1.000	1.000	0.0 0.0	9985.0 13446.3	9985.0 13446.3
9	9- 10	0.0 0.0	0.0 0.0	0.0 -17136.7	1.000 1.000	1.000	0.0 0.0	13446.3 17136.7	13446.3 17136.7
10	10- 11	0.0 0.0	0.0 0.0	0.0 33227.2	1.000 1.000	1.000	0.0 0.0	17136.7 33227.2	17136.7 33227.2

\*\* STRESS INDICIES= PRESS=0. , MOMENT=I



LOAD DUE TO DEFLECTION  
ELEMENT STRESS DATA  
LOAD CASE 2

ELEMENT N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
11- 12	0.0 0.0	0.0 0.0	0.0 0.0	33227.2 -26551.0	1.000 1.000	0.0 0.0	33227.2 26551.0	33227.2 26551.0
12- 13	0.0 0.0	0.0 0.0	0.0 0.0	-26551.0 -2851.1	1.000 1.000	0.0 0.0	26551.0 2851.1	26551.0 2851.1
13- 14	0.0 0.0	0.0 0.0	0.0 0.0	-2851.1 19598.2	1.000 1.000	0.0 0.0	2851.1 19598.2	2851.1 19598.2
14- 15	0.0 0.0	0.0 0.0	0.0 0.0	19598.2 -12747.2	1.000 1.000	0.0 0.0	19598.2 12747.2	19598.2 12747.2
15- 16	0.0 0.0	0.0 0.0	0.0 0.0	-12747.2 25878.1	1.000 1.000	0.0 0.0	12747.2 25878.1	12747.2 25878.1
16- 17	0.0 0.0	0.0 0.0	0.0 0.0	25878.1 7994.8	1.000 1.000	0.0 0.0	25878.1 7994.8	25878.1 7994.8
17- 18	0.0 0.0	0.0 0.0	0.0 0.0	7994.8 -2059.9	1.000 1.000	0.0 0.0	7994.8 2059.9	7994.8 2059.9
18- 19	0.0 0.0	0.0 0.0	0.0 0.0	-2059.9 -19139.5	1.000 1.000	0.0 0.0	2059.9 19139.5	2059.9 19139.5
19- 20	0.0 0.0	0.0 0.0	0.0 0.0	-19139.5 37285.9	1.000 1.000	0.0 0.0	19139.5 37285.9	19139.5 37285.9
20- 21	0.0 0.0	0.0 0.0	0.0 0.0	37285.9 -23993.0	1.000 1.000	0.0 0.0	37285.9 23993.0	37285.9 23993.0

\*\* STRESS INDICIES= PRESS=0. , MOMENT=1

LOAD DUE TO DEFLECTION

ELEMENT STRESS DATA  
LOAD CASE 2

ELEMENT	N1 - N2	F/A	TC/J	(MC/I)Y	(MC/I)Z	INDEX	PM	PB	SO**
21	21- 22	0.0 0.0	0.0 0.0	0.0 0.0	-23993.0 1595.6	1.000 1.000	0.0 0.0	23993.0 1595.6	23993.0 1595.6
22	22- 23	0.0 0.0	0.0 0.0	0.0 0.0	1595.6 15539.5	1.000 1.000	0.0 0.0	1595.6 15539.5	1595.6 15539.5
23	23- 24	0.0 0.0	0.0 0.0	0.0 0.0	15539.5 -17749.1	1.000 1.000	0.0 0.0	15539.5 17749.1	15539.5 17749.1
24	24- 25	0.0 0.0	0.0 0.0	0.0 0.0	-17749.1 -31795.9	1.000 1.000	0.0 0.0	17749.1 31795.9	17749.1 31795.9
25	25- 26	0.0 0.0	0.0 0.0	0.0 0.0	-31795.9 0.0	1.000 1.000	0.0 0.0	31795.9 0.0	31795.9 0.0

\*\* STRESS INDICIES= PRESS=0. , MOMENT=1

MAXIMUM STRESS SUMMARY TABLE

LOAD NO. 1 MAX. STRESS=212237. PSI, IT OCCURS IN ELEMENT 5 - 6 , 120.00 INS. FROM NODE 5

LOAD NO. 2 MAX. STRESS=212184. PSI, IT OCCURS IN ELEMENT 5 - 6 , 120.00 INS. FROM NODE 5

## LOAD DUE TO DEFLECTION

PAGE 35

HANGER/SUPPORT REACTIONS  
LOAD CASE 1

NODE	RESTRAINT TYPE	FX(LBS)	FY(LBS)	FZ(LBS)	MX(IN-LB)	MY(IN-LB)	MZ(IN-LB)
1	SPECIFIED DISP.	0.0	453903.8	0.0	0.0	0.0	34518980.3
2	SPECIFIED DISP.	0.0	-652543.3	0.0	0.0	0.0	0.0
3	SPECIFIED DISP.	0.0	271454.1	0.0	0.0	0.0	0.0
4	SPECIFIED DISP.	0.0	-330032.8	0.0	0.0	0.0	0.0
5	SPECIFIED DISP.	0.0	811203.3	0.0	0.0	0.0	0.0
6	SPECIFIED DISP.	0.0	-1023959.0	0.0	0.0	0.0	0.0
7	SPECIFIED DISP.	0.0	618627.2	0.0	0.0	0.0	0.0
8	SPECIFIED DISP.	0.0	-185883.0	0.0	0.0	0.0	0.0
9	SPECIFIED DISP.	0.0	85818.8	0.0	0.0	0.0	0.0
10	SPECIFIED DISP.	0.0	-128603.9	0.0	0.0	0.0	0.0
11	SPECIFIED DISP.	0.0	174986.7	0.0	0.0	0.0	0.0
12	SPECIFIED DISP.	0.0	-132624.6	0.0	0.0	0.0	0.0
13	SPECIFIED DISP.	0.0	1986.7	0.0	0.0	0.0	0.0
14	SPECIFIED DISP.	0.0	87054.5	0.0	0.0	0.0	0.0
15	SPECIFIED DISP.	0.0	-112753.7	0.0	0.0	0.0	0.0

## LOAD DUE TO DEFLECTION

PAGE 36

HANGER/SUPPORT REACTIONS  
LOAD CASE 1

NODE	RESTRAINT TYPE	FX(LBS)	FY(LBS)	FZ(LBS)	MX(IN-LB)	MY(IN-LB)	MZ(IN-LB)
16	SPECIFIED DISP.	0.0	89777.1	0.0	0.0	0.0	0.0
17	SPECIFIED DISP.	0.0	-12437.5	0.0	0.0	0.0	0.0
18	SPECIFIED DISP.	0.0	11160.9	0.0	0.0	0.0	0.0
19	SPECIFIED DISP.	0.0	-116781.3	0.0	0.0	0.0	0.0
20	SPECIFIED DISP.	0.0	187008.8	0.0	0.0	0.0	0.0
21	SPECIFIED DISP.	0.0	-138051.0	0.0	0.0	0.0	0.0
22	SPECIFIED DISP.	0.0	18713.7	0.0	0.0	0.0	0.0
23	SPECIFIED DISP.	0.0	73950.7	0.0	0.0	0.0	0.0
24	SPECIFIED DISP.	0.0	-25013.0	0.0	0.0	0.0	0.0
25	SPECIFIED DISP.	0.0	-317361.0	0.0	0.0	0.0	0.0
26	SPECIFIED DISP.	0.0	290397.9	0.0	0.0	0.0	-10895853.0
***SUMMATION OF LOADS***		0.0	0.0	0.0	0.0	0.0	23623127.3



LOAD DUE TO DEFLECTION  
 HANGER/SUPPORT REACTIONS  
 LOAD CASE 2

NODE	RESTRAINT TYPE	FX(LBS)	FY(LBS)	FZ(LBS)	MX(IN-LB)	MY(IN-LB)	MZ(IN-LB)
1	SPECIFIED DISP.	0.0	109863.7	0.0	0.0	0.0	0.0
2	SPECIFIED DISP.	0.0	-241070.4	0.0	0.0	0.0	0.0
3	SPECIFIED DISP.	0.0	190804.1	0.0	0.0	0.0	0.0
4	SPECIFIED DISP.	0.0	-314225.2	0.0	0.0	0.0	0.0
5	SPECIFIED DISP.	0.0	808105.0	0.0	0.0	0.0	0.0
6	SPECIFIED DISP.	0.0	-1023351.8	0.0	0.0	0.0	0.0
7	SPECIFIED DISP.	0.0	618508.2	0.0	0.0	0.0	0.0
8	SPECIFIED DISP.	0.0	-185859.7	0.0	0.0	0.0	0.0
9	SPECIFIED DISP.	0.0	85814.2	0.0	0.0	0.0	0.0
10	SPECIFIED DISP.	0.0	-128603.0	0.0	0.0	0.0	0.0
11	SPECIFIED DISP.	0.0	174986.5	0.0	0.0	0.0	0.0
12	SPECIFIED DISP.	0.0	-132624.5	0.0	0.0	0.0	0.0
13	SPECIFIED DISP.	0.0	1986.7	0.0	0.0	0.0	0.0
14	SPECIFIED DISP.	0.0	87054.5	0.0	0.0	0.0	0.0
15	SPECIFIED DISP.	0.0	-112753.7	0.0	0.0	0.0	0.0

LOAD DUE TO DEFLECTION

HANGER/SUPPORT REACTIONS  
LOAD CASE 2

NODE	RESTRAINT TYPE	FX(LBS)	FY(LBS)	FZ(LBS)	MX(IN-LB)	MY(IN-LB)	MZ(IN-LB)
16	SPECIFIED DISP.	0.0	89777.1	0.0	0.0	0.0	0.0
17	SPECIFIED DISP.	0.0	-12437.5	0.0	0.0	0.0	0.0
18	SPECIFIED DISP.	0.0	11160.6	0.0	0.0	0.0	0.0
19	SPECIFIED DISP.	0.0	-116779.7	0.0	0.0	0.0	0.0
20	SPECIFIED DISP.	0.0	187000.6	0.0	0.0	0.0	0.0
21	SPECIFIED DISP.	0.0	-138009.2	0.0	0.0	0.0	0.0
22	SPECIFIED DISP.	0.0	18500.3	0.0	0.0	0.0	0.0
23	SPECIFIED DISP.	0.0	75039.9	0.0	0.0	0.0	0.0
24	SPECIFIED DISP.	0.0	-30570.2	0.0	0.0	0.0	0.0
25	SPECIFIED DISP.	0.0	-123347.0	0.0	0.0	0.0	0.0
26	SPECIFIED DISP.	0.0	101030.4	0.0	0.0	0.0	0.0

\*\*\*SUMMATION OF LOADS\*\*\*

( 0.0 ) ( 2559631.8 ) ( 0.0 )

Ref. Midland Pipe Settlement

1-3-80  
by D. Gupta

I have tried to correlate the settlement of the area around the Diesel Generator Bldg with that of the pipe-lines in that area. I have reached the following conclusions:-

(i) The pipelines were profiled before the surcharge was removed. The profiles shown in Fig 19-1, Vol 1 of the "Responses to NRC Questions" are dated 4-24-79. The <sup>full</sup> surcharge was on the building from 4-4-79 to 8-15-79. Pipeline Profiles could have been from Jan '79 or Feb '79.

Some of the drawings Joe has, except Joe's drawings have no date on them

(ii) Without knowing even the approximate date of profiling, it is difficult to correlate the settlement data.

(iii) The stress calculations performed by ETEC are based on very conservative assumptions, e.g. no soil support at the base of the pipe-line. Essentially, the method used computes the pipe bending stresses for the given deformed shape of the pipeline (assumed on the basis of settlement data) <sup>and</sup> assuming some end conditions (fixed etc). NO soil support or weight of pipe is considered.

Copy mailed to H. Singh on 10/23/80

J Kane  
Rec'd 10/23/80

OCT 20 1980

DISTRIBUTION:

Docket Files  
LB#3 Files  
NRC PDR  
LPDR  
RTedesco  
FMiraglia  
DHood  
JLee  
IE(3)  
ACappucci  
GLear  
JKane  
LHetter

FRinaldi  
EGallagher,  
IE, III  
RBosnak

bcc:  
NSIC  
TIC  
ACRS

Docket Nos. 50-329/330 OM

Mr. J. W. Cook  
Vice President  
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Dear Mr. Cook:

Subject: Request for Details of Stress Analyses for Underground Piping

On September 8, 1980, members of our Mechanical Engineering Branch and our consultant Energy Technology Engineering Center (ETEC) discussed with your staff by telephone, differences in bending stresses in underground piping due to differential soil settlement at the Midland site. The discussion regarded significant differences in the results calculated by ETEC compared to results reported by Table 17-2 of your "Response to the NRC 10 CFR 50.54(f) Request Regarding Plant Fill," Revision 2, dated July 9, 1980.

A comparison of the maximum bending stresses due to soil settlement for three service water lines and one condensate water line are indicated by Enclosure 1, consisting of your Table 17-2 marked to add the ETEC results. The ETEC stress calculations are based upon an elastic analysis using certain conservative assumptions with their in-house computer program, the results of which are verified by a simple hand calculation. The ETEC analyses indicate that the maximum bending stress due to soils settlement for several of the pipe profiles from Figures 17-2 and 19-1, last updated by Revision 5 of your response, already exceed the ASME Code allowable stresses and the material yield strength. The rapid change in slope in some areas of the lines indicate the existence of high local stress. The nodal points, output and other assumptions for ETEC's computer analyses are given in Enclosure 2.

We believe reconciliation of your results with those of ETEC warrants your prompt attention. We request that you provide ETEC and us with the details of your methodology, assumptions and inputs used to obtain the results reported by Table 17-2 within one week of receipt of this letter. Upon examination of these details, we propose a prompt follow-up meeting, if appropriate, to resolve these differences. Please contact the licensing project manager if you are unable to meet this schedule and to arrange this meeting.

Sincerely,

Original signed by  
Robert L. Tedesco

Robert L. Tedesco  
Assistant Director for Licensing  
Division of Licensing

Enclosures:  
As stated

~~8011110-170~~  
4 pp.

OFFICE	See next page	DL:LB#3	MEB	DL:LB#3	A/D: NRR
SURNAME		DHood	RBosnak	FMiraglia	RTedesco
DATE		10/17/80	10/20/80	10/20/80	10/20/80



cc: Michael I. Miller, Esq.  
Ronald G. Zamarin, Esq.  
Alan S. Farnell, Esq.  
Isham, Lincoln & Beale  
Suite 4200  
1 First National Plaza  
Chicago, Illinois 60603

James E. Brunner, Esq.  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Myron M. Cherry, Esq.  
1 IBM Plaza  
Chicago, Illinois 60611

Ms. Mary Sinclair  
5711 Summerset Drive  
Midland, Michigan 48640

Frank J. Kelley, Esq.  
Attorney General  
State of Michigan Environmental  
Protection Division  
720 Law Building  
Lansing, Michigan 48913

Mr. Wendell Marshall  
Route 10  
Midland, Michigan 48640

Mr. Steve Gadler  
2120 Carter Avenue  
St. Paul, Minnesota 55108

Mr. Dun van Farowe, Chief  
Division of Radiological Health  
Department of Public Health  
P.O. Box 33035  
Lansing, Michigan 48909

William J. Scanlon, Esq.  
2034 Pauline Boulevard  
Ann Arbor, Michigan 48103

U. S. Nuclear Regulatory Commission  
Resident Inspectors Office  
Route 7  
Midland, Michigan 48640

Ms. Barbara Staminis  
5795 N. River  
Freeland, Michigan 48623

Ms. Sharon K. Warren  
636 Hillcrest  
Midland, Michigan 48640



cc: Commander, Naval Surface Weapons Center  
ATTN: P. C. Huang  
G-402  
White Oak  
Silver Spring, Maryland 20910

Mr. L. J. Auge, Manager  
Facility Design Engineering  
Energy Technology Engineering Center  
P. O. Box 1449  
Canoga Park, California 91304

Mr. William Lawhead  
U. S. Corps of Engineers  
NCEED - T  
7th Floor  
477 Michigan Avenue  
Detroit, Michigan 48226

Charles Bechhoefer, Esq.  
Atomic Safety & Licensing Board  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Mr. Gustave A. Linenberger  
Atomic Safety & Licensing Board  
U. S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dr. Frederick P. Cowan  
Apt. B-125  
6125 N. Verde Trail  
Boca Raton, Florida 33433

Enclosure 1

TABLE 17-2

SETTLEMENT STRESSES OF PROFILED SYSTEMS

Line	Seismic Category I	Location Shown in Figure	Profile Shown in Figure	Stress (1) (ksi)	Code Allowable (2) (ksi)	ETEC Results (1556)	
						Case 1 (3)	Case 2 (4)
<i>Service water lines</i>							
26"/36"-OHBC-16	Yes	17-1	17-2	14.0	52.5		
26"/36"-OHBC-19	Yes	17-1	17-2	27.0	52.5		
26"-OHBC-54	Yes	17-1 & 19-1	17-2 & 19-1	22.0	52.5		
26"-OHBC-55	Yes	17-1 & 19-1	17-2 & 19-1	27.0	52.5	212.2	212.2
10"-OHBC-27	Yes	17-1 & 19-1	17-2 & 19-1	27.0	52.5	179.2	46
8"-1HBC-81	Yes	19-1	19-1	21.9	45.0		
8"-1HBC-82	Yes	19-1	19-1	17.7	45.0	84.7	85.2
8"-1HBC-311	Yes	19-1	19-1	11.5	45.0		
26"-1JBD-2	No	19-1	19-1	24.1	47.1		
26"-2JBD-1	No	19-1	19-1	23.0	47.1		
<i>Condensate water line</i>							
20"-1HCD-169	No	17-1 & 19-1	17-2 & 19-1	22.0	47.7	191.8	192.5

- (1) Analytical values generated from settlement gage data. Rounding in excess of the accuracy of the gage was necessary in several zones. These zones will be subjected to further investigation.
- (2) Equation 10a, ASME Section III, Division 1, Subsection NC

- (3) Case 1 assumes the ends of the lines are completely fixed.
- (4) Case 2 assumes the ends of the lines have no moment carrying capability.

J. Kame  
Rec'd 12/18/81

App. B - Report No. 1

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Report No. 1

Prepared for

Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

August 1981



SOUTHWEST RESEARCH INSTITUTE  
SAN ANTONIO HOUSTON

~~8172230536~~ 44pp

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Report No. 1

Prepared for

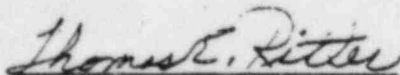
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

August 1981

Written by

  
Thomas E. Ritter  
Project Manager  
Mechanical Engineering

Approved by

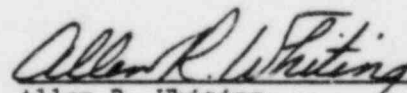

  
Allen R. Whiting  
Executive Director 

TABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION . . . . .	1
B. PIPES PROFILED . . . . .	1
C. PROFILE MEASUREMENTS . . . . .	1
D. SUMMARY . . . . .	2

APPENDICES

- A Pipe Data Point Locations
- B Pipe Calibration and Elevation Data Records
- C Operating Procedure



## PIPE PROFILE MEASUREMENTS AT MIDLAND

### A. Introduction

On April 3, 1981, Southwest Research Institute (SwRI) was contracted by Consumers Power Company (CPC) to determine by measurement pipe elevation profiles for designated buried piping at the Midland Plants, Units 1 and 2. An elevation profile measurement system was designed and developed. Laboratory tests of the profile measurement system demonstrated that changes in elevation could be measured to within  $\pm 1/16$ -inch (or better) accuracy.

A prototype of the profile measurement system was field tested at Midland during the week of July 6, 1981, which involved actual elevation measurements of a selected pipe at the plant. The experience and information acquired from this test provided a basis for the final production design of the measurement system and the establishment of an operating procedure. During the next four weeks, two profile measurement systems were final designed, built, and tested. Also, an operating procedure including full Quality Assurance coverage was developed (see Appendix C).

On August 10, 1981, SwRI returned to Midland to measure the elevation profiles of four pipes selected by CPC. The pipe lengths and weld locations were identified and measured by CPC personnel. Each point at which an elevation measurement was to be made was marked and numbered. The data was taken in accordance with this established plan.

### B. Pipes Profiled

Four pipes were measured to determine their elevation profiles. These pipes are shown on SwRI drawing D-6224-065 and Bechtel Yard Piping Plan drawings M-169(Q) and M-167(Q) and can be identified by the following numbers:

- (1) 26" - OHBC-55
- (2) 26" - OHBC-56
- (3) 26" - 2JBC-1
- (4) 26" - 2JBD-2

The pipes were entered from the valve pit located east of the Diesel Generator Building at S. 5091.00 and E. 373.50. The datum (zero elevation) was selected at the edge of the pipe at the point of entry. The elevation measurements made at each point throughout the entire length of the pipe are compared with the datum. A sketch of the valve pit identifying the datum point for each pipe profiled is included in Appendix A. Information identifying each pipe segment is also included in Appendix A. *ref this App. B Key: 1*

### C. Profile Measurements

The original data record sheets for both calibration and pipe profile measurements are included in Appendix B. The pipe profile is shown in Figure 1. Note that all four pipes are shown on the same graph and change in elevation is directly related to the datum (zero elevation) point selected for each pipe. The actual sea level elevation at each datum point was measured by CPC and is recorded on the valve pit sketch. The difference between the actual sea level elevation and the datum point is not shown on the pipe profile graph.

D. Summary

The pipe profile measurement system performed well. Elevation measurements made of known dimensions (10 and 20 inches) on the calibration/reference block before and after making pipe measurements compared within 0.020 inch. Also the measurement of the datum point before and after pipe measurements compared within 0.047 inch. This is a good indication of the point-to-point and pipe end-to-end accuracy obtained.

The four pipes measured (842 ft.) are approximately 17 percent of the total buried 26-inch pipe at Midland. Future visits are planned to obtain elevation measurements of the remaining pipes.

DATE

0 DATUM

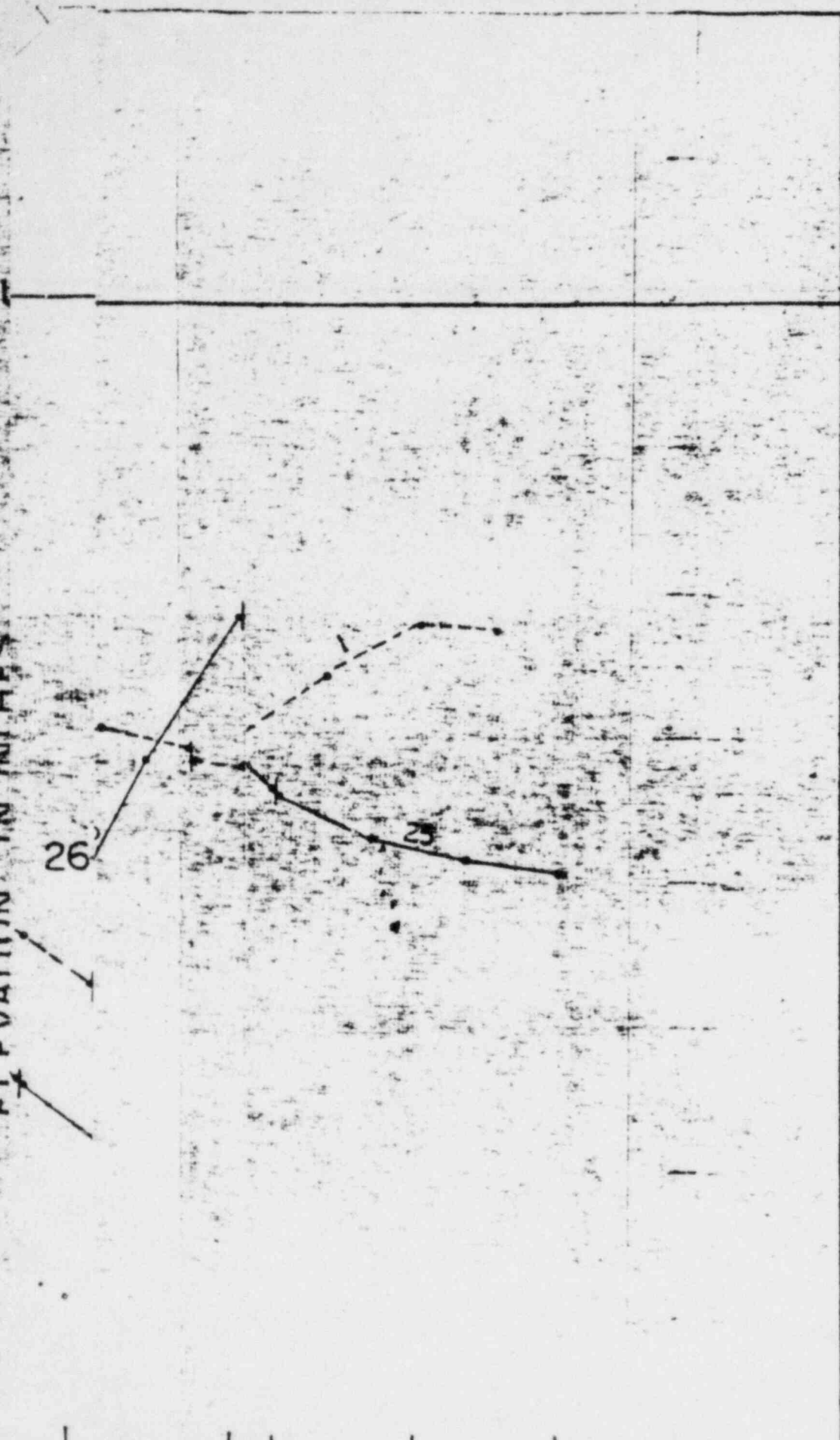
ELEVATION IN INCHES

26

25

90.0 24360 370 380 390 400

2  
1  
0  
-1  
-2  
-3  
-4  
-5  
-6  
-7  
8

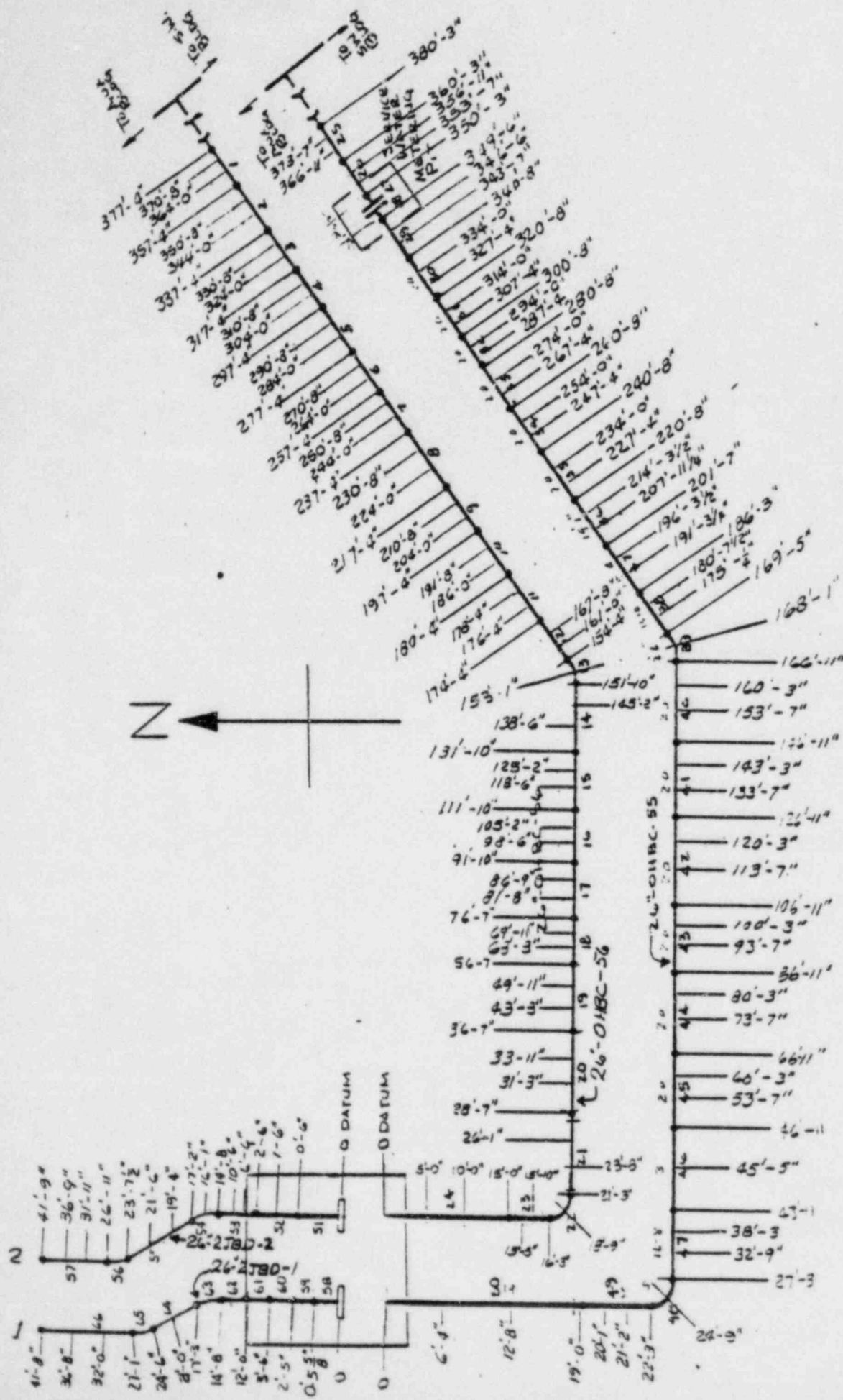


APPENDIX A

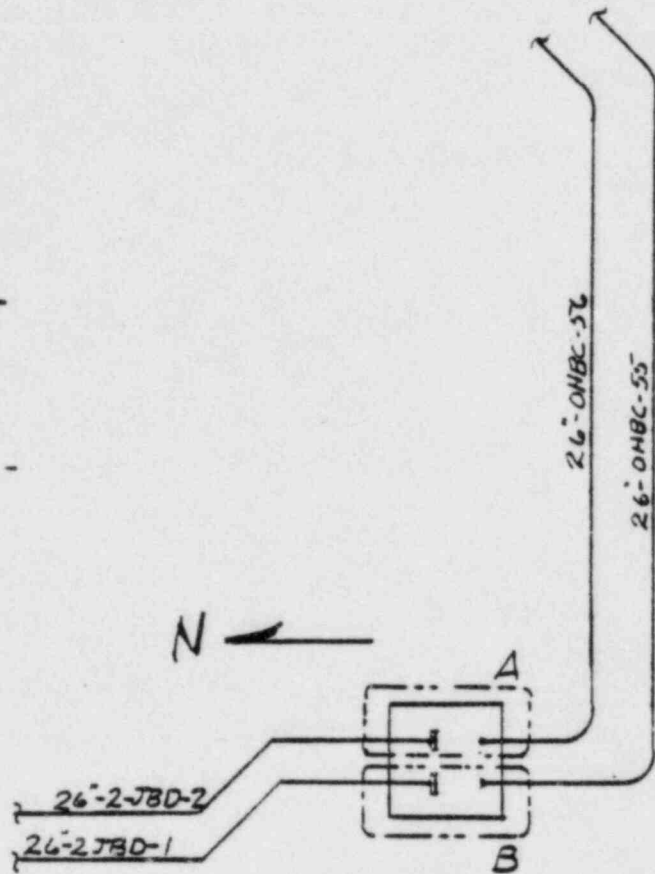
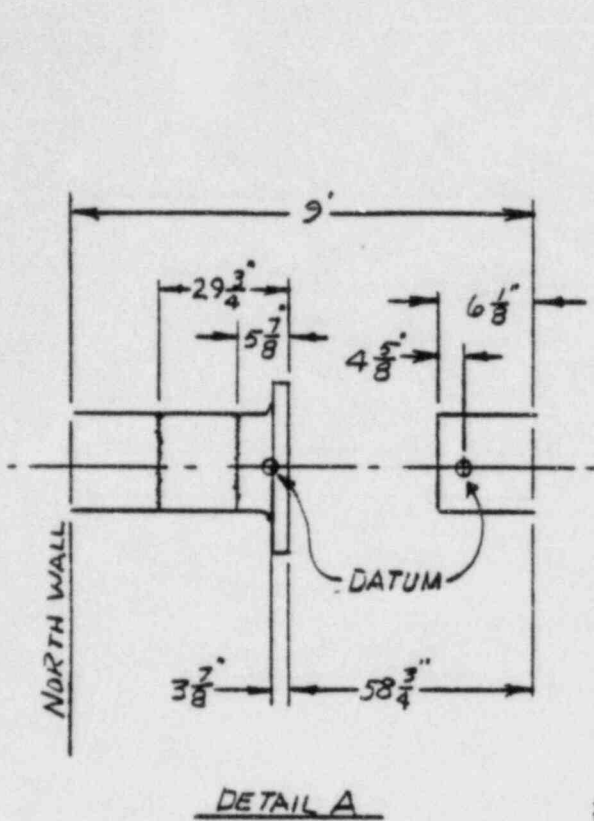
PIPE DATA POINT LOCATIONS

•







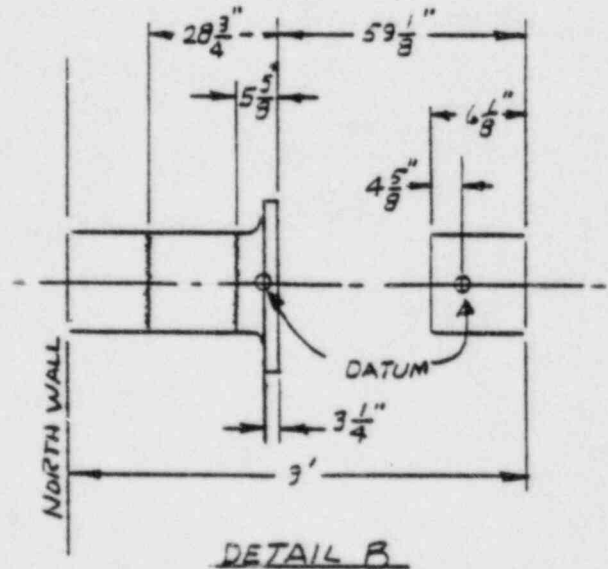


**NOTES:**

- 1) DESIGN INVERT OF ALL PIPES WAS 623'-5.375"
- 2) ZERO "DATUM" POINT ELEV MEASUREMENT MADE BY CPC.

PIPE	ELEVATION
26-OHBC-55	623'-1.440"
26-OHBC-56	623'-1.320"
26-2JBD-1	623'-2.288"
26-2JBD-2	623'-2.328"

- 3) DATUM POINT LOCATED ON INSIDE BOTTOM SURFACE OF PIPE.



DATUM POINT LOCATION

PIPE 26"-OHBC-56

<u>Item</u>	<u>Piece</u>	<u>Length</u>	<u>Sections</u>	<u>Section Length</u>	<u>Remarks</u>
1	Pipe	20'-0"	ABCD	6'-8"	
2	Pipe	20'-0"	ABCD	6'-8"	
3	Pipe	20'-0"	ABCD	6'-8"	
4	Pipe	20'-0"	ABCD	6'-8"	
5	Pipe	20'-0"	ABCD	6'-8"	
6	Pipe	20'-0"	ABCD	6'-8"	
7	Pipe	20'-0"	ABCD	6'-8"	
8	Pipe	20'-0"	ABCD	6'-8"	
9	Pipe	20'-0"	ABCD	6'-8"	
10	Pipe	17'-0"	ABCD	5'-8"	
11	Pipe	6'-0"	ABCD	2'-0"	
12	Pipe	20'-0"	ABCD	6'-8"	
13	45° ELL	2'-6"	ABC	1'-3"	
14	Pipe	20'-0"	ABCD	6'-8"	
15	Pipe	20'-0"	ABCD	6'-8"	
16	Pipe	20'-0"	ABCD	6'-8"	
17	Pipe	15'-3"	ABCD	5'-1"	
18	Pipe	20'-0"	ABCD	6'-8"	
19	Pipe	20'-0"	ABCD	6'-8"	
20	Pipe	8'-0"	ABCD	2'-8"	
21	Pipe	7'-4"	ABCD	2'-5"	
22	90° ELL	5'-0"	ABC	2'-6"	
23	Pipe	1'-3 1/2"	ABCD	0'-5"	May be ABC at 7 3/4"
24	Pipe	15'-0"	ABCD	5'-0"	

PIPE 26"-OHBC-55

<u>Item</u>	<u>Piece</u>	<u>Length</u>	<u>Sections</u>	<u>Section Length</u>	<u>Remarks</u>
25	Pipe	20'-0"	ABCD	6'-8"	
26	Pipe	10'-0"	ABCD	3'-4"	
27	Flange	0'-4 1/2"	A	0'-4 1/2"	EL measured at edge of flange
28	Flange	0'-4 1/2"	A	0'-4 1/2"	EL measured at edge of flange
29	Pipe	8'-10"	ABCD	2'-11"	
30	Pipe	20'-0"	ABCD	6'-8"	
31	Pipe	20'-0"	ABCD	6'-8"	
32	Pipe	20'-0"	ABCD	6'-8"	
33	Pipe	20'-0"	ABCD	6'-8"	
34	Pipe	20'-0"	ABCD	6'-8"	
35	Pipe	20'-0"	ABCD	6'-8"	
36	Pipe	19'-1"	ABCD	6'-4 1/4"	
37	Pipe	15'-4"	ABCD	5'-1 1/4"	
38	Pipe	16'-10"	ABCD	5'-7 1/4"	
39	45° ELL	2'-6"	ABC	1'-3"	
40	Pipe	20'-0"	ABCD	6'-8"	
41	Pipe	20'-0"	ABCD	6'-8"	
42	Pipe	20'-0"	ABCD	6'-8"	
43	Pipe	20'-0"	ABCD	6'-8"	
44	Pipe	20'-0"	ABCD	6'-8"	
45	Pipe	20'-0"	ABCD	6'-8"	
46	Pipe	3'-0"	ABC	1'-6"	May be ABCD at 1'-0"
47	Pipe	16'-8"	ABCD	5'-6"	
48	90° ELL	5'-0"	ABC	2'-6"	
49	Pipe	3'-3"	ABCD	1'-1"	May be ABC at 1'-7 1/2"
50	Pipe	19'-0"	ABCD	6'-4"	

PIPE 26"-2JBD-1

<u>Item</u>	<u>Piece</u>	<u>Length</u>	<u>Sections</u>	<u>Section Length</u>	<u>Remarks</u>
51	Tapered Flange	0'-6"	A	0'-6"	EL measured 3" from edge
52	Pipe	2'-0"	ABC	1'-0"	
53	Pipe	12'-2"	ABCD	4'-8"	
54	45° ELL	2'-6"	ABC	1'-3"	
55	Pipe	6'-5 1/2"	ABCD	2'-2"	
56	45° ELL	2'-7"	ABC	1'-3"	
57	Pipe	14'-10 1/2"	ABCD	4'-11 1/2"	

PIPE 26"-2JBD-2

<u>Item</u>	<u>Piece</u>	<u>Length</u>	<u>Sections</u>	<u>Section Length</u>	<u>Remarks</u>
58	Tapered Flange	0'-5 5/8"	A	0'-5 5/8"	EL measured 3-1/4" from edge
59	Pipe	1'-11"	ABC	0'-11 1/2"	
60	Pipe	1'-1"	AB		Measured 2" from welds
61	Pipe	8'-5 1/2"	ABC	4'-2 3/4"	
62	Pipe	2'-8"	ABC	1'-4"	
63	45° ELL	2'-7"	ABC	1'-3 1/2"	
64	Pipe	7'-3"	ABC	3'-7 1/2"	
65	45° ELL	2'-7"	ABC	1'-3 1/2"	
66	Pipe	14'-7"	ABCD	4'-10 1/2"	

APPENDIX B

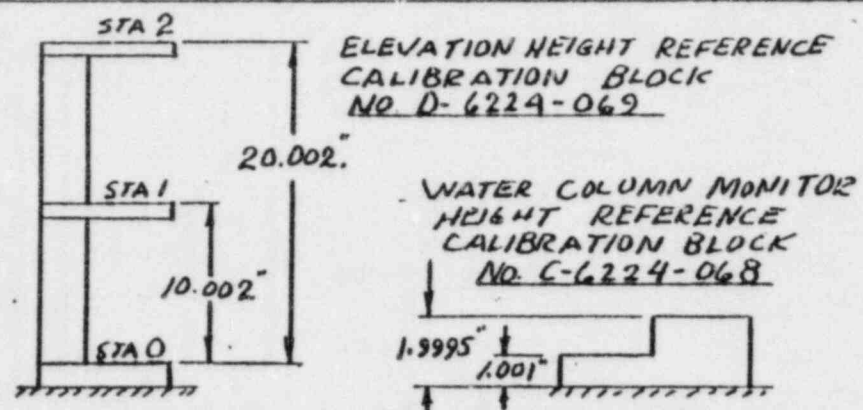
PIPE CALIBRATION AND ELEVATION DATA RECORDS



# SWRI CALIBRATION RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/11/81	TIME (24 HR CLOCK) 0841	SHEET NO. 0002
1) EXAMINER (SIGNATURE) <i>W.K. ...</i>	PROCEDURE NO. IX-ME-101-1 Dev. 1	INSTRUMENT (WTR. COL. MON) NORTEC	SERIAL NO. 1310-312 1310-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>J.E. Ritter</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLTM.) ENI	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. AECOTECH 12006

HEIGHT (IN)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TYP (F)	D.V.M. CORR. FOR TEMP (VOLTS)	CONVERSION CONSTANT 'C' (INCHES/VOLT)	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.720	.9587	66	-	-	0850	1.001	2.000	0848	NORTEC 1310-312
10.002		.7781	67	.7780		0852	1.001	2.000	0921	
20.002		.5974	67.5	.5972	55.331	0853	1.001	2.000-1	0944	
0		.9587	67	.9587		0855	1.001	2.000-1	0958	
10.002		.7781	67	.7781		0856	1.001	1.999-2.000	1020	
20.002		.5974	68	.5973	55.384	0857	1.001	1.999-2.000	1040	
							1.001	1.999-2.000	1105	
0		.9590	72	-		1504	1.001	2.000	1119	
10.002		.7785	72	-		1506	1.001	2.000	1244	
20.002		.5979	72	-	55.392	1507	1.001	2.000	1308	
0		.9590	72	-		1508	1.001	2.000	1328	
10.002		.7785	71 1/2	.7786		1509	1.001	2.000	1350	
20.002		.5979	71 1/2	.5980	55.399	1510	1.001	1.999-2.000	1415	
AVERAGE 'C' FOR ALL RUNS						55.377	1.001	2.000	1440	
							1.001	2.000	1503	



IX-ME-101-1  
August 1981  
Page 9 of 10

# SwRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-003	MIDLAND	8/11/81	0903	0004		
1) EXAMINER (SIGNATURE) <i>W. K. [Signature]</i>	PROCEDURE NO. DEVI IX-ME-101-1	INSTRUMENT (WTR COL NUM) NORTEC	SERIAL NO. 131D-312	WATER COLUMN TRANSDUCER SwRI 2034		
2) EXAMINER <i>J. E. Ritter</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. AERO TECH 12036		
TEST PIPE IDENTIFICATION						
26 OHBC 56 FROM VALVE PIT TO 36 OHBC 20						
PIPE POSITION (FT)	DIGITAL VOLT METER (VOLTS)	TRANSducer TEMP (°F)	D.V.M. CORR FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN)	TIME	REMARKS
24D DATA	.8257	69	.8257	0	0903	DATUM POINT - PLE TEMP 66°
24C	.8429-30	69	.8429-30	-.955	0908	
24B	.8558	69	.8558	-1.667	0909	
24A	.8700	69	.8700	-2.453	0911	
23C	.8717-13	69	.8717-18	-2.550	0916	ON LONG SEAM
23B	.8723-4	69	.8723-4	-2.583	0917	" } ≈ 5" MIN
23A	.8727-8	69	.8727-8	-2.605	0919	"
22C	.8752-3	69	.8752-3	-2.744	0922	FL BOW
22B	.8817	69	.8817	-3.101	0926	"
22A	.8854	69	.8854	-3.306	0928	"
21D	.8840-1	69	.8840-1	-3.231	0929	8804-8825
21C	.8809	69	.8809	-3.057	0931	
21B	.8771-2	69	.8771-2	-2.849	0932	
21A	.8738	68 1/2	.8739	-2.669	0934	
20D	.8722	68 1/2	.8723	-2.581	0936	STEP UP APPROX 1/8"
20C	.8709	68 1/2	.8710	-2.509	0938	
20B	.8685-6	68	.8687	-2.381	0940	
20A	.8669-70	68	.8671	-2.293	0942	
19D	.8669	68	.8670	-2.290	0944	} 7 FOOT DISTANCE
19C	.8664	68	.8665	-2.262	0947	
19B	.8694	67 1/2	.8696	-2.431	0949	

IX-ME-101-1  
August 1981  
Page 10 of 10

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/11/81	TIME (24 HR CLOCK) 0951	SHEET NO. 0005			
1) EXAMINER (SIGNATURE) <i>W. K. ...</i>	PROCEDURE NO. IX-ME-101-1 DEV 1	INSTRUMENT (WTR COL MTR) NURTEC	SERIAL NO. 131D-312	WATER COLUMN TRANSDUCER SWRI 2034			
2) EXAMINER <i>J. E. ...</i>	PRESSURE TRANSDUCER SETRA -1081	INSTRUMENT (DIGIT VOLT MTR) EM1	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. ALERTECH 12006			
TEST PIPE IDENTIFICATION 26 OHBC 56 FROM VALVE PIT TO 36 OHBC 20							
PIPE POSITION (FT)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN)	TIME	REMARKS
17A	1.700	.8735	67 1/2	.8737	-2.658	0951	
17D	A	.8736	67	.8738	-2.666	0953	
17C		.8803	66 1/2	.8806	-3.040	0955	PIT TEMP 69°
17B ?		.8872	66 1/2	.8875	-3.422	1000	
17A		.8918	66 1/2	.8911	-3.677	1001	
16D		.8924-5	66	.8928	-5.663	1004	
16C		.8993	66	.8997	-4.098	1006	1/2 FT FROM CIRCLE
16B		.9039	65 1/2	.9044	-4.355	1008	IN CIRCLE
16A		.9049	65 1/2	.9054	-4.411	1010	MISMATCH
15D		.9111	65 1/2	.9116	-4.754	1011	1/16" LOWER
15C		.9123-4	65 1/2	.9128	-4.823	1013	
15B		.9203-4	65 1/2	.9208	-5.200	1015	
15A		.9272	65 1/2	.9277	-5.046	1018	
14D		.9334	65 1/2	.9339	-5.984	1024	VIBRATION IN PIPE
14C		.9340-1	65	.9346	-6.028	1027	"
14B		.9414	65	.9419	-6.435	1030	MISMATCH 1/16" LOWER
		.9470	65	.9475	-6.745	1032	
		.9501	64 1/2	.9507	-6.922	1034	
		.9511	64 1/2	.9517	-6.978	1036	
		.9539	64 1/2	.9544	-7.127		
		.9551-2	64 1/2	.9557	-7.202		

IX-ME-101-1  
August 1981  
Page 10 of 10



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-003	MIDLAND	8/11/81	1036	0006			
TEST PIPE IDENTIFICATION							
26 OMB 56 FROM VALVE PIT TO 36 OMB C 20							
1) EXAMINER (SIGNATURE)	PROCEDURE NO.	INSTRUMENT (WIR COL MON)	SERIAL NO.	WATER COLUMN TRANSDUCER			
<i>W. R. ...</i>	IX-ME-101-1 DEVI	NOLTEC	1310-317	SWRI 2094			
2) EXAMINER (SIGNATURE)	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M)	SERIAL NO.	THICKNESS TRANSDUCER NO.			
<i>J. E. Rutter</i>	SETIA 41081	EMI	38521	AERATERM 12006			
AVERAGE °C							
55.377							
CALIBRATION SHEET NO.							
0002							
PIPE POSITION (FE)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
14A	1.700	.9556	64 1/2	.9562	-7.227	1039	
13C	A	.9561-2	65	.9566	-7.252	1040	
13B		.9557-8	65	.9562	-7.229	1043	} 45° ELBOW 5" APART
13A		.9569	65	.9574	-7.293	1045	
12D		.9580	65	.9585	-7.354	1046	
12C		.9582	65	.9587	-7.365	1049	
12B		.9592	65	.9597	-7.421	1051	
12A		.9582	65	.9587	-7.365	1055	} NOIS MATCH NUMBER
11D		.9596	65 1/2	.9601	-7.440	1056	
11C		.9587	65 1/2	.9592	-7.390	1059	} 2 1/2' BETWEEN POINTS
11B		.9588	65 1/2	.9593	-7.396	1100	
11A		.9591	65 1/2	.9596	-7.412	1103	
10D		.9595	65	.9600	-7.437	1107	INTERMITTENT FULLER MARKS (IN. MARKS)
10C		.9553	65	.9558	-7.205	1112	"
10B		.9461	65	.9466	-6.695	1116	"
10A		.9351	65	.9356	-6.086	1119	CHANGING MARKS
9D		.9352-3	64 1/2	.9358	-6.099	1251 C	USING NOLTEC 1310-317 -
9C		.9356-7	64 1/2	.9362	-6.122	1253	
9B		.9185	65	.9190	-5.167	1256	
9A		.9038	65 1/2	.9043	-4.350	1259	
		.8926	66	.8930	-3.727	1304	MARKED 1/8 LOW

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO 17-6542-003		SITE MIDLAND		DATE (DAY-MO-YR) 8/11/81		TIME (24 HR CLOCK) 1304		SHEET NO 0007	
1) EXAMINER (SIGNATURE) <i>W.R. ...</i>		PROCEDURE NO. IX-ME-101-1 DEVI		INSTRUMENT (WTR COL NO) NORTEC		SERIAL NO 131D-317		WATER COLUMN TRANSDUCER SWRI 2034	
2) EXAMINER <i>J.E. Ritten</i>		PIESURE TRANSDUCER SETRA 41081		INSTRUMENT (DIGIT VOLT M) ENI		SERIAL NO 38521		THICKNESS TRANSDUCER NO. AEROTECH 12006	
TEST PIPE IDENTIFICATION 26 DHBC 56 VALVE PIT TO 360HBC 30									
PIPE POSITION (FT)	WATER COL. NOM. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN)	TIME	REMARKS		
8D	1.700	.8703	66 1/2	.8906	-3.594	1305			
8C		.8813	66 1/2	.8816	-3.096	1309			
8B		.8785-6	67	.8757	-2.941	1312			
8A		.8811	67	.8813	-3.082	1314			
7D		.8822	67 1/2	.8825	-3.140	1315			
7C		.8846	68	.8847	-3.270	1318			
7B		.8869	68 1/2	.8870	-3.400	1321			
7A		.8907	68 1/2	.8908	-3.611	1324			
6D		.8914	68 1/2	.8915	-3.649	1326			
6C		.8894	69	.8894	-3.528	1329			
6B		.8857	69 1/2	.8857	-3.320	1332			
6A		.8800	69 1/2	.8800	-3.204	1335			
5D		.8795	69 1/2	.8775	-2.977	1336			
5C		.8757	69 1/2	.8757	-2.766	1341			
5B		.8697	69 1/2	.8697	-2.434	1344			
5A		.8656	70	.8655	-2.204	1347			
4D		.8650	70	.8649	-2.171	1348			
4C		.8635	70	.8634	-2.098	1352			
4B		.8625	70	.8614	-2.032	1355			
4A		.8637	70 1/2	.8635	-2.013	1358			
3D		.8637	70 1/2	.8635	-2.093	1401			
							MARKING IN PIPE FWM 142		

IX-ME-101-1  
August 1981  
Page 10 of 10

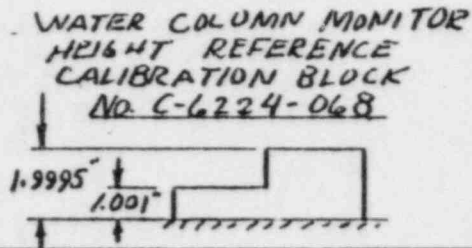
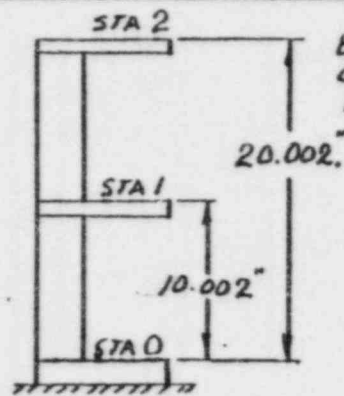




# SWRI CALIBRATION RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/11/81	TIME (24 HR CLOCK) 1700	SHEET NO. 0003
1) EXAMINER (SIGNATURE) <i>J. S. Ritter</i>	PROCEDURE NO. DEV. I IX-ME-101-1	INSTRUMENT (WTR. COL. MON.) NUTECH	SERIAL NO. 1310-317	WATER COLUMN TRANSDUCER SWRI 2734
2) EXAMINER <i>W. C. ...</i>	PRESSURE TRANSDUCER S67K 41081	INSTRUMENT (DIGIT. VOLT M.) E.N.I.	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. A.F.H. 101-1

HEIGHT (IN)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.K.M. CORR. FOR TEMP (VOLTS)	CONVERSION CONSTANT °C (INCHES/VOLT)	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0		.9586	68	-		1712	1.000	2.000	1708	
10.002		.7780	↑	-		1714	1.000	2.001	1735	
20.002		.5972	↑	-	55.346	1715	1.000	2.000	1802	
0		.7586	↓	-		1716				
10.002		.7781	↓	-		1717				
20.002		.5974	68	-	55.378	1718				
0		.9594	75°	-		1805				
10.002		.7790	75°	-		1807				
20.002		.5982	75°	-	55.377	1809				
0		.9574	75°	-		1810				
10.002		.7789	75°	-		1811				
20.002		.5981	75°	-	55.361	1812				
AVERAGE °C FOR ALL RUNS					55.365					



IX-ME-101-1  
 August 1981  
 Page 9 of 10

# SwRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-003	MIDLAND	8/11/81	1720	0009			
1) EXAMINER (SIGNATURE) <i>J. E. Ritter</i>	PROCEDURE NO. DEV. I IX-ME-101-1	INSTRUMENT (WTR COL. MIN)	SERIAL NO.	WATER COLUMN TRANSDUCER			
2) EXAMINER'S <i>(Signature)</i>	PRESSURE TRANSDUCER SETRA 41081	NON-T.C.	131D-317	SwRI 2084			
TEST PIPE IDENTIFICATION		INSTRUMENT (DIGIT VOLT-M)	SERIAL NO.	THICKNESS TRANSDUCER NO.			
North East PIPE - BWARD TURBINE B.I.B.		F.N.I	35521	AEROSTICH 1-1000			
AVERAGE "C" CALIBRATION SHEET NO.			55.365	0003			
PIPE POSITION (FT)	WATER COL. MIN. (IN.)	DIGITAL VOLT-METER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
51A (3")	1.700	.8070	70	-	0	1722	Transition Piece
52A (8")		.8057	70	-	+0.072	1723	
52B (1'-6")		.8110	70	-	-0.221	1724	T TAPER TRANSDUCER
52C (2'-4")		.8197	70	-	-0.703	1725	
53A (2'-8")		.8196	70	-	-0.698	1724	
53B (6'-6")		.8141	70 1/2	.8140	-0.390	1728	
53C (10'-6")		.8089	71	.8088	-0.099	1729	
53D (14'-6")		.8042	71	.8041	+0.162	1730	
54A (14'-10")		.8043	72	.8041	+0.163	1731	START INTO 45° AIR-9/4
54B (16'-1")		.8048	72	.8045	+0.136	1732	Center of Elbow
54C (17')		.8011	72	.8009	+0.340	1734	End of Elbow
55A (17'-4")		.7967	72	.7965	+0.584	1735	
55B (18'-4")		.7904	72	.7961	+0.601	1738	
55C (21'-6")		.7952	72	.7950	+0.667	1740	
56A (23'-6")		.7948	72 1/2	.7945	+0.692	1742	
56B (25'-10")		.7941	72 1/2	.7946	+0.687	1744	Start into 45° Elbow
56C (26'-4")		.7936	73	.7932	+0.764	1746	Center of Elbow
57A (27')		.7921	73	.7917	+0.547	1747	End of Elbow
57B (31'-10")		.7895	73	.7891	+0.991	1748	
57C (36'-9")		.7847	73	.7843	+1.257	1749	
		.7798	74	.7793	+1.534	1751	

IX-ME-101-1  
August 1981  
Page 10 of 10

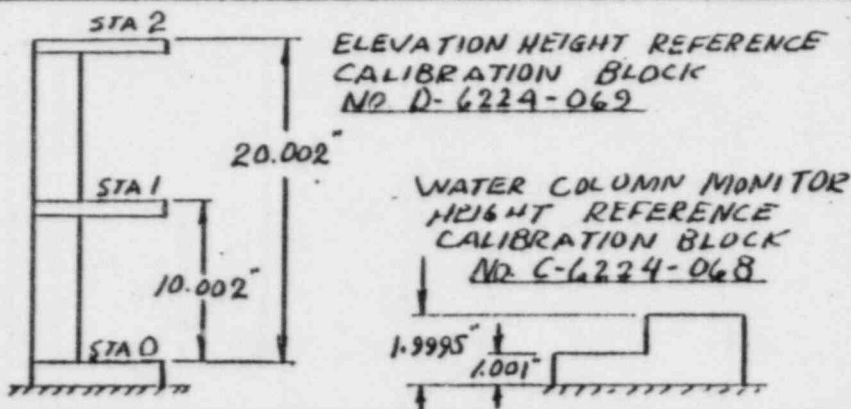




# SWRI CALIBRATION RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/11/81	TIME (24 HR CLOCK) 1815	SHEET NO. 0004
1) EXAMINER (SIGNATURE) <i>J. P. Pittor</i>	PROCEDURE NO. DEV. I IX-ME-101-1	INSTRUMENT (WTR. COL. MON) NJRTEC	SERIAL NO. 131D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>W. K. [Signature]</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLTM.) EMI	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. AERATEC 12006

HEIGHT (IN)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CONVERSION CONSTANT "C" (INCHES VOLT)	TIME	WATER		REMARKS
							COL. MON. 1" THICK	COL. MON. 2" THICK	
0		.9591	73°	-		1819	1.001	2.001	1825
10.002		.7786	73°	-		1820	1.001	2.001	1847
20.000		.5981	73°	-	55.407	1821	1.001	2.001	1915
0		.9590	73°	-		1822			
10.002		.7787	73°	-		1823			
20.002		.5980	73°	-	55.407	1823			
0		.9547	73°	-		1921			
10.000		.7792	73°	-		1922			
20.000		.5984	73°	-	55.361	1923			
0		.9595	73°	-		1924			
10.002		.7790	73°	-		1926			
10.002		.5984	73°	-	55.392	1927			
AVERAGE "C" FOR ALL RUNS					55.392				



IX-ME-101-1  
 August 1981  
 Page 9 of 10



# SwRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/11/81	TIME (24 HR CLOCK) 1823	SHEET NO. 0011
1) EXAMINER (SIGNATURE) <i>J.G. Ruff</i>	PROCEDURE NO. DEX I IX-ME-101-1	INSTRUMENT (WTR COL MTR) NURTEC	SERIAL NO. 131D-317	WATER COLUMN TRANSDUCER SwRI 2034
2) EXAMINER <i>W.K. ...</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLT M) EMI	SERIAL NO. 38521	THINNEST TRANSDUCER NO. AERTRON 12006
TEST PIPE IDENTIFICATION NucIn West Pipe - Turbine 8-LDs.		AVERAGE 'C' 55.392		
CALIBRATION SHEET NO. 0004				

PIPE POSITION (FT)	WATER COL. MM. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSUCER TEMP (°F)	DIV. CORR. FOUR TEMP (VOLTS)	CHANGE IN ELEVATION (IN)	TIME	REMARKS
58A - DATUM	1.700	.7952	73°	-	0	1826	TRANSITION (FLANGE)
59A (8")	↑	.7937	73°	-	+0.83	1828	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> </div>
59B (1'-5")		.8000	74°	.7999	-0.260	1830	
59C (2'-3")		.8114	74°	.8113	-0.892	1831	
60A (2'-7")		.8115	74°	.8114	-0.897	1832	
60B (3'-4")		.8137	74°	.8136	-1.019	1833	
61A (3'-8")		.8129	74°	.8128	-0.975	1834	
61B (7'-8")		.8083	74 1/2	.8031	-0.440	1837	
61C (11'-10")		.7942	75	.7940	+0.069	1838	
62A (12'-2")		.7922	75°	.7920	+0.179	1839	
62E (13'-6")		.7908	75°	.7906	+0.257	1840	
62C (14'-6")		.7896	75°	.7894	+0.323	1841	
63A (14'-10")		.7894	75°	.7892	+0.335	1842	
63B (16')		.7863	75	.7861	+0.506	1844	
63C (17')		.7910	75	.7908	+0.246	1845	
64A (17'-5")		.7922	75	.7920	+0.179	1850	
64B (21')		.8054	75	.8052	-0.952	1852	
64C (24'-4")		.8121	75°	.8172	-1.216	1853	
65A (24'-8")		.8200	75°	.8198	-1.360	1854	
65B (25'-9")	↓	.8256	75°	.8254	-1.671	1855	
65C (27')	1.700	.8262	75°	.8260	-1.704	1857	

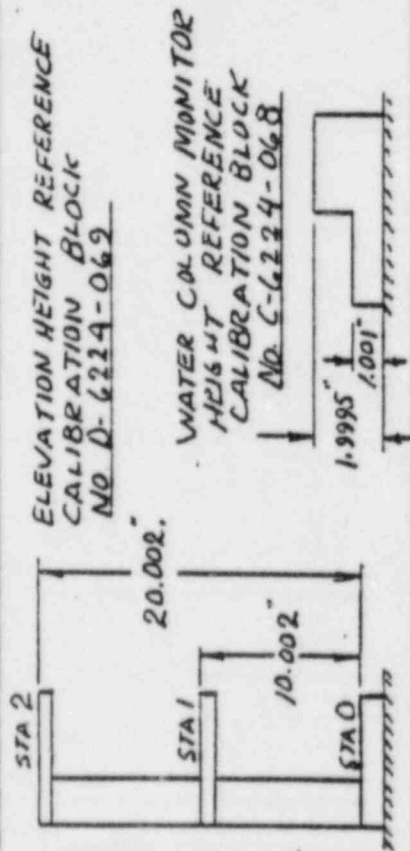
IX-ME-101-1  
August 1981  
Page 10 of 10



# SWRI CALIBRATION RECORD

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.						
17-6542-003	MIDLAND	8/12/81	0827	0005						
EXAMINER (SIGNATURE) <i>W. R. [Signature]</i>		INSTRUMENT (MTR. GL. MON)		WATER COLUMN TRANSDUCER						
1) EX-101-1 DEV 1		NORTEC		Serial No. 2034						
2) EXAMINER (SIGNATURE) <i>J. K. [Signature]</i>		INSTRUMENT (DIGIT VOLT M)		THICKNESS TRANSDUCER NO						
SETRA 41081		FAN		Serial No. 12006						
HEIGHT (IN)	DIGITAL VOLTMETER (VOLTS)	TEMP (°F)	DVM CORR. FOR TEMP (VOLTS)	CONVERSION CONSTANT "C" (INCHES/VOLT)	TIME	WATER COL. MM. 1" THICK	WATER COL. MM. 2" THICK	WATER COL. MM. 2" THICK	TIME	REMARKS
0	.9586	66 1/2	-	-	0842	1.001	1.997200	1.997200	0827	
10.002	.7780	66 1/2	-	-	0843	1.001	1.999200	1.999200	0852	
20.002	.5973	66 1/2	-	55.361	0844	1.001	1.999200	1.999200	0803	
0	.9586	67	-	-	0846	1.001	1.999200	1.999200	0922	
10.002	.7780	67	-	-	0847	1.001	1.999200	1.999200	0943	
20.002	.5973	67	-	55.361	0848	1.001	2.000	2.000	1007c	
0	.9580	72	-	-	1312	1.001	2.000	2.000	1032	
10.002	.7776	72	-	-	1313	1.001	2.000	2.000	1046	
20.002	.5972	72	-	55.438	1314	1.001	2.000	2.000	1114	
0	.9583	73	-	-	1316	1.001	2.000	2.000	1155	
10.002	.7777	73	-	-	1317	1.001	2.000	2.000	1225	
20.002	.5971	73	-	55.377	1318	1.001	2.000	2.000	1247	
AVERAGE "C" FOR ALL RUNS					55.384					

IX-ME-101-1  
August 1981  
Page 9 of 10





# SwRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO			
17-6542-003	MIDLAND	8/12/81	0849	0013			
1) EXAMINER (SIGNATURE) W.P. [Signature]							
2) EXAMINER J.E. [Signature]							
TEST PIPE IDENTIFICATION							
26 OHBC-55 FROM VALVE PIT TO 36 OHBC 19							
PIPE POSITION (FT)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.M. CORR FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
50D	1.700	.82056	68	-	0	08490	
50C		.8500	68	-	-1.631	0854	
50B		.87623	68	-	-3.085	0855	
50A		.9047	68	-	-4.661	0857	
49D		.9061	68 1/2	.9060	-4.733	0858	
49C		.9111-14	68 1/2	.9110	-5.012	0859	
49B		.9145	68 1/2	.9144	-5.198	0901	
49A		.9175	68 1/2	.9174	-5.364	0902	
48C		.9215	68 1/2	.9214	-5.585	0905	
48B		.9271	68 1/2	.9270	-5.896	0906	ELBOW
48A		.9284	69	.9283	-5.965	0907	"
47D		.9289-90	69	.9288	-5.995	0908	"
47C		.9200	69	.9219	-5.500	0910	
47B		.9120	69	.9119	-5.057	0911	
47A		.9042-3	69	.9041	-4.627	0912	
46C		.9035-6	69	.9034	-4.589	0914	
46B		.9017	69	.9016	-4.486	0915	
46A		.9011	69	.9010	-4.453	0916	
45D		.9002	69 1/2	.9000	-4.400	0918	
45C		.8925	69 1/2	.8923	-3.974	0919	
45B		.8914	69 1/2	.8912	-3.913	0921	

IX-ME-101-1  
August 1981  
Page 10 of 10

# SwRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLK)	SHEET NO			
17-6542-003	MIDLAND	8/12/81	0923	0014			
1) EXAMINER (SIGNATURE) <i>W.R. ...</i>		INSTRUMENT (WTR COL MAX)			WATER COLUMN TRANSDUCER		
2) EXAMINER (SIGNATURE) <i>J.C. ...</i>		INSTRUMENT (DIGIT VOL-T.M.)			THICKNESS TRANSDUCER NO.		
TEST PIPE IDENTIFICATION		AVERAGE 'C'			CALIBRATION SHEET NO.		
26 OHBC 55		FARM VALUE PIT TO 36 OHBC 19			55.384		
PIPE POSITION (FI)	WATER COL. NON. (IN.)	DIGITAL VOLT-METER (VOLTS)	TRANSDUCER TEMP (°F)	DVM. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
41A	1.700	.8950	69 1/2	.8948	-4.112	0923c	
41D		.8950	69	.8949	-4.115	0925	
41C		.9016	69	.9015	-4.481	0926	
44B		.9102	69	.9101	-4.957	0928	
44A		.9185	69	.9184	-5.417	0930	
43D		.9191	69	.9190	-5.450	0931	
43C		.9277	69	.9276	-5.926	0934	
43B		.9362	69	.9361	-6.397	0935	
43A		.9438	69	.9437	-6.818	0937	
42D		.9450	68 1/2	.9449	-6.887	0938	
42C		.9491	68 1/2	.9490	-7.114	0942c	
42B		.9522	68	-	-7.291	0945	
42A		.9543	68	-	-7.408	0947	
41D		.9543	68	-	-7.408	0948	
41C		.9556	68	-	-7.480	0950	
41B		.9553	68	-	-7.463	0953	
41A		.9539	68	-	-7.385	0955	
40D		.9538	68	-	-7.380	0956	
40C		.9550	68	-	-7.446	0958	
40B		.9563	68	-	-7.518	1001	
40A		.9581	68	-	-7.618	1003	

IX-ME-101-1  
August 1981  
Page 10 of 10



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 8/12/81	TIME (24 HR CLK) 1005	SHEET NO 0015
1) EXAMINER (SIGNATURE) <i>W.R. ...</i>	PROCEDURE NO. IX-ME-101-1 Dev 1	INSTRUMENT (WTR COL. MAN.) NORTEC	SERIAL NO. 131D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>J.E. ...</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLT-M.) ENC	SERIAL NO. 38521	THICKNESS TRANSDUCER NO. ACRTECH 12006
TEST PIPE IDENTIFICATION 26 OHBC 55 FROM VALVE PIT TO 36 OHBC 19			AVERAGE "C" 55.384	CALIBRATION SHEET NO. 0005

PIPE POSITION (FT)	WATER COL. MAN. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
39C	1.700	.9602	68	-	-7.734	1005	ELBOW 45°
39B		.9615	68	-	-7.806	1007	
39A		.9610	68	-	-7.779	1009	
38D		.9593	68	-	-7.685	1011	
38C		.95984	68	-	-7.715	1013	
38B		.96056	68	-	-7.754	1015	
38A		.9619	68	-	-7.829	1017	
37D		.9620	67 1/2	.9621	-7.837	1018	
37C		.95878	67 1/2	.9588	-7.657	1021	
37B		.9569	68	-	-7.552	1023	
37A		.9552	68	-	-7.457	1026	
36D		.9552	68	-	-7.457	1027	
36C		.9481	68 1/2	.9480	-7.059	1030	
36B		.9363	68 1/2	.9362	-6.405	1032	
36A		.9204	68 1/2	.9203	-5.525	1035	
35D		.9200	68 1/2	.9199	-5.502	1037	
35C		.8994	68 1/2	.8993	-4.362	1040	
35B		.8777	68 1/2	.8776	-3.160	1043	
35A		.8600	69	.8599	-2.177	1046	
34D		.8595	66	.8598	-2.171	1135	
34C		.8492-3	66 1/2	.8494	-1.600	1137	

IX-ME-101-1  
 August 1981  
 Page 10 of 10

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO. 17-6542-003	SITE MIDLAND	DATE (DAY-MO.-YR.) 8/12/81	TIME (24 HR. C-355) 1138	SHEET NO. 0016
1) EXAMINER (SIGNATURE) <i>W.H. ...</i>		INSTRUMENT (WIR. COL. MOD.) NORTEC		
2) EXAMINER <i>F. ...</i>		INSTRUMENT (DIGIT. VOLT-M.) ENI		
TEST PIPE IDENTIFICATION 26 OMB55		AVERAGE "C" 55.384		
FROM VALVE PIT TO 36 OMB19		CALIBRATION SHEET NO. 0005		

PIPE POSITION (FT)	WATER COL. MOD. (IN.)	DIGITAL VOLT-METER (VOLTS)	TEMPERATURE (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN)	TIME (H:MM:SS)	REMARKS
341B	1.700	.8431	67	.8432	-1.254	1140	
34A		.8404	67 1/2	.8405	-1.102	1142	
33D		.8404	67 1/2	.8405	-1.102	1143	
33C		.8393	67 1/2	.8394	-1.041	1145	
33B		.8393	68	-	-1.038	1148	
33A		.8400	68	-	-1.077	1150	
32D		.8398	68	-	-1.066	1151	
32C		.8400	68	-	-1.077	1153	
32B		.8400	68	-	-1.077	1155	
32A		.8389	68 1/2	.8388	-1.011	1157	
31D		.8390	68 1/2	.8387	-1.016	1158	
31C		.8392	69	.8391	-1.025	1159	
31B		.8380	69	.8379	-.958	1202	
31A		.8352	69	.8351	-.803	1205	
30D		.8352	69	.8351	-.803	1206	
30C		.8372	69	.8371	-.914	1208	
30B		.8421	69	.8420	-1.185	1210	
30A		.8506	69	.8505	-1.656	1213	
29D		.8504	69	.8503	-1.645	1214	ON 20.16 56.24
29C		.8513	69	.8512	-1.861	1216	"
29B		.8574	69	.8573	-2.033	1218	"

IX-ME-101-1  
August 1981  
Page 10 of 10



APPENDIX C

OPERATING PROCEDURE





**SOUTHWEST RESEARCH INSTITUTE  
NUCLEAR PROJECTS  
OPERATING PROCEDURE**

IX-ME-101-2  
August 1981  
Page 1 of 10

Title

MIDLAND UNITS 1 AND 2 PIPE PROFILE MEASUREMENTS

**EFFECTIVITY AND APPROVAL**

Revision 2 of this procedure became effective on 9/3/81. This procedure consists of the pages and changes listed below.

<u>Page No</u>	<u>Change</u>	<u>Date Effective</u>
1-10		9/3/81

SA

*CK*

**Approvals**

Written By <i>J. E. Rutter</i>	Date <i>8/27/81</i>	Technical Review <i>J. Faure</i>	Date <i>8/31/81</i>
Manager of Q.A. <i>Bruce Melick</i>	Date <i>9/2/81</i>	Cognizant Director <i>Allen R. Whitling</i>	Date <i>9/3/81</i>



# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

LX-ME-101-2

August 1981

Page 2 of 10

## MIDLAND UNITS 1 AND 2 PIPE PROFILE MEASUREMENTS

### 1.0 PURPOSE

This procedure provides a description of the activities necessary to measure the elevation profile of the designated piping at the Midland Units 1 and 2 nuclear power plant.

### 2.0 SCOPE AND APPLICATION

2.1 This procedure is limited to the acquisition of relative elevation measurements which may be used to establish the elevation profile of certain piping systems located at the Midland Units 1 and 2 nuclear power plants.

2.2 This procedure is limited to the acquisition of data at those locations designated by the authorized representative of Consumers Power Company (CPCo).

#### 2.3 Applicable Documents

The following documents are considered to form a part of this procedure as applicable:

- (1) Nuclear Quality Assurance Program Manual (NQAPM), Procedures 1-1, 3-1, 4-1, 6-1, 9-1, 10-1, 11-1 and 13-1.

### 3.0 RESPONSIBILITY

- (1) The Director of the Department of Research and Development, Quality Assurance Systems and Engineering Division shall be responsible for the preparation, review, approval and control of this procedure.
- (2) The Manager of the Mechanical Engineering Section, Department of Research and Development shall be responsible for the implementation of this procedure in accordance with the NQAPM in effect on the date this procedure is approved.

### 4.0 PERSONNEL REQUIREMENTS

Personnel performing elevation profile measurements shall demonstrate adequate proficiency in their assigned tasks as determined by the Project Manager and in accordance with NQAP 1-1.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

LX-ME-101-2

August 1981

Page 3 of 10

### 5.0 PROCEDURE REQUIREMENTS

- (1) A schematic drawing of the instrumentation system and calibration block shall be prepared and controlled in accordance with NQAPs 3-1 and 4-1.
- (2) A test procedure (this procedure) shall be prepared in accordance with NQAP 6-1.
- (3) This procedure shall be controlled in accordance with NQAP 9-1.
- (4) The water column monitor instrument (Nortec Model 131D) shall be controlled in accordance with NQAP 10-1. The Pressure Transducers shall be certified by the manufacturer. Also, a temperature compensation curve for the Pressure Transducer will be provided.
- (5) Deviations and nonconformances shall be reported in accordance with NQAP 13-1. Customer notification forms shall be employed in accordance with NQAP 13-1. Compliance with 10CFR, Part 21 and 10CFR50.55(e) shall also be in accordance with NQAP 13-1.

### 6.0 TEST CONDUCT

#### 6.1 Witness

The Project Manager shall keep the utility informed of the approximate testing dates and times to the best of his ability. It shall be the responsibility of the utility to notify any test witnesses and to establish hold points, if any. The Project Manager shall abide by all hold points.

#### 6.2 Test Environment

- (a) An area shaded from sunlight shall be provided for the instruments and water column of the profile measurement system.
- (b) The inside area of the pipes are to be free of water puddles and any significant amount of rust or debris that may have accumulated in the bottom of the pipe.

#### 6.3 Instruments

The following instruments or their equivalent shall be used. A description of the instruments actually used to make the profile measurements shall be included in the test data and shall include instrument description, model, and serial number.



- (1) Water column monitor instrument, Nortec, Model 131D
- (2) Pressure transducer, Setra, Model 270

#### 6.4 Calibration

- (1) Establish a stable base for reference water column (head) and calibration block. The water column shall be no lower than 6 inches above the highest point being profiled within the pipe.
- (2) The water used within the profile measurement system shall be distilled water with a few drops of food coloring or fountain pen ink for coloring.
- (3) Set up the instruments including the pressure transducer, reference water column and water column monitoring instrument. A minimum of 30 minutes warmup time is required.
- (4) Calibrate the water column monitoring instrument. If the Nortec Model 131D is used, calibrate the instrument as follows:
  - (a) Make the following settings on the front panel:
    - "Damping" at zero
    - "Reject" at zero
    - "+6 DB Switch" at Norm
    - "Rate" switch in the down position
    - "Filter" at 1
    - "Freq" set at the frequency of the transducer  $\pm 25$  MHz
  - (b) Adjust the "Delay" and "Range" controls to produce a 2 inch screen using a UVAII (or equivalent) acrylic plastic stepped calibration block with 1 and 2 inch steps

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

IX-ME-101-2

August 1981

Page 5 of 10

- (c) On the gate package, select "single", "sound path", "1st Auto", "20 Out Mils".
  - (d) Adjust the "Range" and "Delay" controls of the gate to include a range of 1 to slightly more than 2 inches in the gate.
  - (e) Adjust the "Zero" and "Cal" controls of the digital output to read the calibration block thickness. Adjust the "gain" such that all readings are taken with a signal height between 8 and 9 screen divisions. The instrument is now calibrated in inches of Lucite.
  - (f) Select a convenient operating height for the water column. The height should be selected, between 1.000 inches and 2.000 inches, such that the level can be monitored visually as well as present an easily identifiable number on the digital readout of the water column monitoring instrument. A value of 1.700 inches is suggested as a convenient figure. Within a particular calibration and data run, pressure transducer readings are valid only after the water column height has been restored to this "selected" value  $\pm 0.002$  inches.
- (5) Acquire measurements that are required to establish the pressure transducer elevation versus meter reading relationship (conversion constant C) as follows:
- (a) Refer to the drawing of calibration block with certified dimensions. (Actual dimensions are stamped on block)
  - (b) Assure the calibration block is on a stable surface and is level.
  - (c) Position the pressure transducer at Station 0.
  - (d) Record pressure transducer readout and temperature.
  - (e) Position the pressure transducer at Station 1.
  - (f) Record pressure transducer readout and temperature.
  - (g) Position the pressure transducer at Station 2.



# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

IX-ME-101-2

August 1981

Page 6 of 10

- (h) Record pressure transducer readout and temperature.
  - (i) Repeat steps (c) through (h) for a total of two (2) readings at each station.
- (6) Record all readings and system component identification data on the calibration sheet No. 6542-1A.

### 6.5 Test Procedures

- (1) Assure that the requirements of Section 6.4 (calibration) have been satisfied.
- (2) Establish and record the position and elevation of the datum point for the particular pipe to be measured.
- (3) Identify the measurement positions. The positions to be measured will be established by the CPCo representative.
- (4) Place the pressure transducer at each position identified in (3). Record the identification, temperature and elevation data at each position on data sheet No. 6542-2A.
- (5) The reference water column height shall be adjusted as necessary immediately prior to each data acquisition to within  $\pm 0.002$  inch of the selected operating setting. (see 6.4(4)(f)).
- (6) Calibration of the water column monitoring instrument as specified in 6.4(4) shall be verified at intervals of no greater than thirty (30) minutes and adjustments made as required.
- (7) If the calibration of the water column monitoring instrument is found to be out of adjustment by more than  $\pm 0.005$  inch (as measured on the UVA II acrylic calibration block), all data taken since the previous valid calibration check shall be voided.
- (8) At the conclusion of the test, Sections 6.4.(5c through i) shall be performed and recorded on the calibration sheet and Section 6.5(6) and (7) shall be verified.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

IX-ME-101-2

August 1981

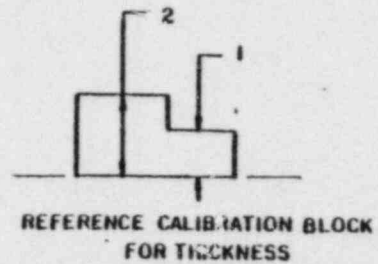
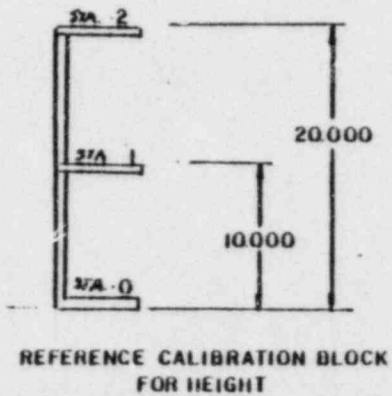
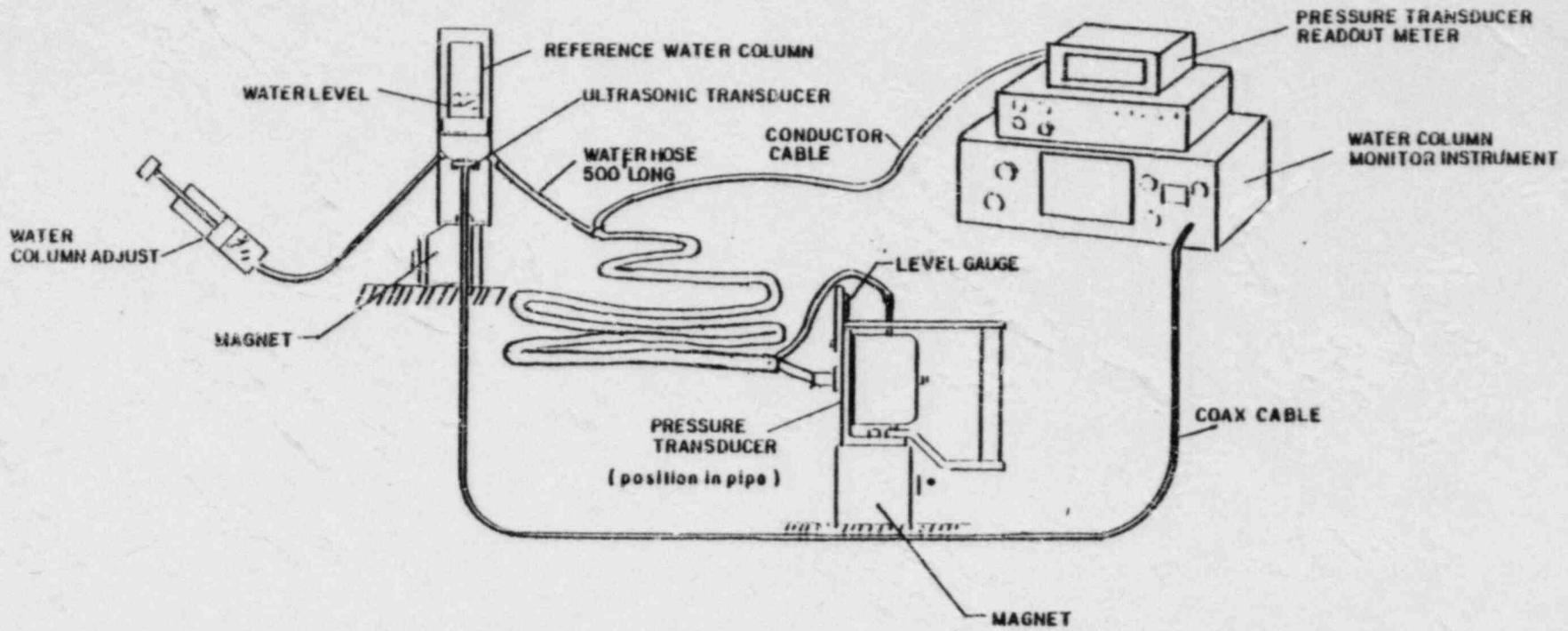
Page 7 of 10

### 7.0 ACCEPTABILITY OF MEASUREMENTS

- (1) The Project Manager or the authorized CPCo representative may void or repeat any set of measurements which has doubtful validity.
- (2) If the temperature of the Pressure Transducer varies more than  $\pm 4^{\circ}\text{F}$  during calibration and/or testing, the digital volt meter reading shall be corrected using the temperature compensation curve described in Section 5.0 (4).

### 8.0 TEST RESULTS

- (1) The test results shall be reported to the utility using a format mutually acceptable to the Project Manager and the utility.
- (2) The Project Manager and the Manager of Quality Assurance shall review the test results for compliance with Section 7.0 of this procedure.
- (3) The utility shall receive copies of documents generated in accordance with this procedure.
- (4) Permanent documents generated in accordance with this procedure shall be stored and retained by the utility.



SCHMATIC - PIPE ELEVATION PROFILE MEASUREMENT SYSTEM







APPENDIX A

Teledyne Engineering Services Letter to W. Cloutier of  
Consumers Power Company, November 11, 1981

12/10/81

 **TELEDYNE  
ENGINEERING SERVICES**

303 BEAR HILL ROAD

WALTHAM, MASSACHUSETTS 02254

(617) 890-3350 TWX (710) 324-7508

November 11, 1981  
5171-4

Mr. William Cloutier  
Consumers Power Co.  
1945 West Parnall Road  
Jackson, MI 49201

Subject: Technical Discussion - Buried Pipe at Midland Nuclear Station

Dear Mr. Cloutier:

Attached please find the subject technical discussion which essentially summarizes my thoughts on the buried pipe at Midland.

If you have any questions, please do not hesitate to contact me.

Very truly yours,

TELEDYNE ENGINEERING SERVICES

*Donald F. Landers*

Donald F. Landers  
Senior Vice President  
Engineering Operations

DFL/mac

Enclosure

cc: J. C. Tsacoyeanes (TES)

**RECEIVED**

NOV 13 1981

**MIDLAND PROJECT  
MANAGEMENT**

Discussion Regarding  
Buried Pipe at Midland Nuclear Station

1.0 Introduction

At the Midland nuclear generating station it has been determined that some of the buried piping systems have been subjected to loading associated with settlement of the soil around them. Measurements of the amount of settlement have been made using various techniques. These measurements have been used as input to a piping flexibility analysis and stress results obtained. The real technical questions are associated with:

1. The capability of the system to perform its intended function,
2. The validity of the calculated stress results using the measurement data as input, and
3. Code requirements.

2.0 Functional Capability

The important question to be answered is whether the piping system is capable to perform its intended function over the life of the plant. Soil settlement is a loading condition that occurs over a long period of time and is not cyclic in nature.

The only concern therefore is whether significant deformation has occurred to produce collapse of the pipe or to significantly reduce flow area.

The USNRC has provided guidance to the industry in this area in the past with Mechanical Engineering Branch Position Paper MEB-6.1 and currently with Preliminary Standard Review Plan PSRP-3.9.3. Since PSRP-3.9.3 is significantly more definitive it will be used to draw some guidance from. The baseline criteria of acceptability under PSRP-3.9.3 is to limit stresses for specified load conditions or load combinations to Service Limit B allowables. The basis for this is that calculated elastic stresses are limited to values which demonstrate the theoretical limit load is not reached. However, recognizing the restrictiveness of this approach, PSRP-3.9.3 provides alternatives which allow a significant increase in stress if it can be demonstrated analytically or experimentally (or combinations thereof) that discontinuity areas retain sufficient dimensional stability so as not to impair the component functional capability. Retaining sufficient dimensional stability is, in fact, the only basic question to be answered and is directly related to assuring functional capability of the piping. Consumers Power has inspected the pipe geometry

or will



to determine cross-sectional shape (ovality) which is directly related to stability. These inspections indicate ovality readings of less than 2% generally with maximum values of 3%. These values are well within the tolerances of manufactured pipe and Code ovality allowables and, in fact, could have been present when the pipe was received at the site.

Paragraph NC-4223.2 of Section III allows 8% ovality in pipe after bending. Ovality that exceeds 8% must be justified by the design calculations. In the Class 2 Piping Design article of Section III the only concern related to ovality is the effect on pipe bends. Paragraph NC-3642 requires that, for pipe bends, the 8% ovality requirements of NC-4223.2 must be met. Since the measured ovalities are well within the Code allowables for fabricated pipe, functional capability is demonstrated using the techniques permitted by PSRP-3.9.3.

### 3.0 Calculated Stress

The calculated stresses that were based on deflection measurements are difficult to rely on because the measurements can include things other than soil settlement. For example, allowable angular mismatches at weld joints that occurred during fabrication are magnified over a long length of pipe and can appear as "knees" along a straight line. Assuming these "knees" are due to soil settlement can result in significantly overestimating the stress levels. Obviously, deflections of this type resulting from settlement would result in local deformations that would be apparent during the examination work that was performed and, using the calculated stresses, would produce ovality well beyond 8%. This, of course, is not the case and therefore the calculated stresses should not be relied on to determine acceptability.

The problem is further magnified by the presence of the soil around the pipe and how to consider this in the calculations. In areas where calculations indicate large deformations (ovality) will occur the presence of compacted soil will have an effect. As the pipe tries to deform (ovalize) a significant pressure is developed between the pipe and the soil which counteracts the ovalization. If compacted soil is not present throughout the entire system (which is the calculation assumption) then the results would be reasonable.

### 4.0 Code Requirements

For the piping systems we are addressing here it is important to recognize that the entire buried pipe was subjected to soil settlement. This is really a different situation than that addressed in current Section III criteria (NC-3611.2(f)) for non-repeated anchor movements. Many of the reasons for this difference have been discussed above and demonstrate the important variations between non-repeated anchor motions (building settlement for a non-buried pipe) and general soil settlement.

The major reason for this discussion is really related to the development of the Code criteria related to allowable stress for non-repeated stresses. The need for a criteria was raised because design agents were being asked by regulatory authorities to include the effect of relative building settlements in the piping analysis. In the development of the Code criteria the majority working group on piping reaction was "that it was not a matter of concern" since it was a single non-repeated anchor point motion and was deflection controlled. However, the industry needed a criteria in order to accommodate regulatory comments and the allowable value of  $3.0 S_c$  was determined to be appropriate.

J. Kern  
For Rich Miller  
GSK

APP. B - ADDENDUM TO RPT. NO. 1

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Addendum to Report No. 1

Prepared for

Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared for

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981

~~8112290542~~



SOUTHWEST RESEARCH INSTITUTE  
SAN ANTONIO HOUSTON

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Addendum to Report No. 1

Prepared for

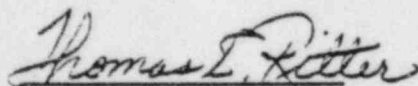
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared for

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981

Written by

  
Thomas E. Ritter  
Project Manager  
Mechanical Engineering

Approved by

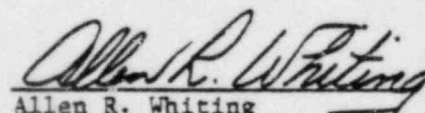
  
Allen R. Whiting  
Executive Director



TABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION . . . . .	1
B. PIPE OUT-OF-ROUNDNESS MEASUREMENTS . . . . .	1
C. SUMMARY . . . . .	1

APPENDICES

- A. Pipe Calibration and Out-of-Roundness Data Records
- B. Tabulation of Percent Ovalness Calculations

PIPE PROFILE MEASUREMENTS AT MIDLAND  
ADDENDUM TO REPORT NO. 1

A. Introduction

On September 8, 1981, Consumers Power Co. (CPCo) broadened the scope of Southwest Research Institute (SwRI) Project 17-6542 to include the fabrication of an instrument with which to measure the out-of-roundness of designated buried piping at the Midland Plant, Units 1 and 2. A device which would measure the maximum and minimum pipe diameters with an accuracy of 1 mm (0.040 inch) was designed and developed. An operating procedure with full Quality Assurance coverage was developed for the performance of pipe out-of-roundness measurements. The operating procedure which includes a description of the instrument is contained in Appendix D of Report No. 2.

On September 14, 1981, SwRI personnel traveled to Midland to perform pipe out-of-roundness and pipe elevation measurements.

This Addendum contains the results of out-of-roundness measurements for pipelines measured for elevation profiles during the August 10, 1981, trip to Midland. These are:

- (1) 26-OHBC-55
- (2) 26-OHBC-56

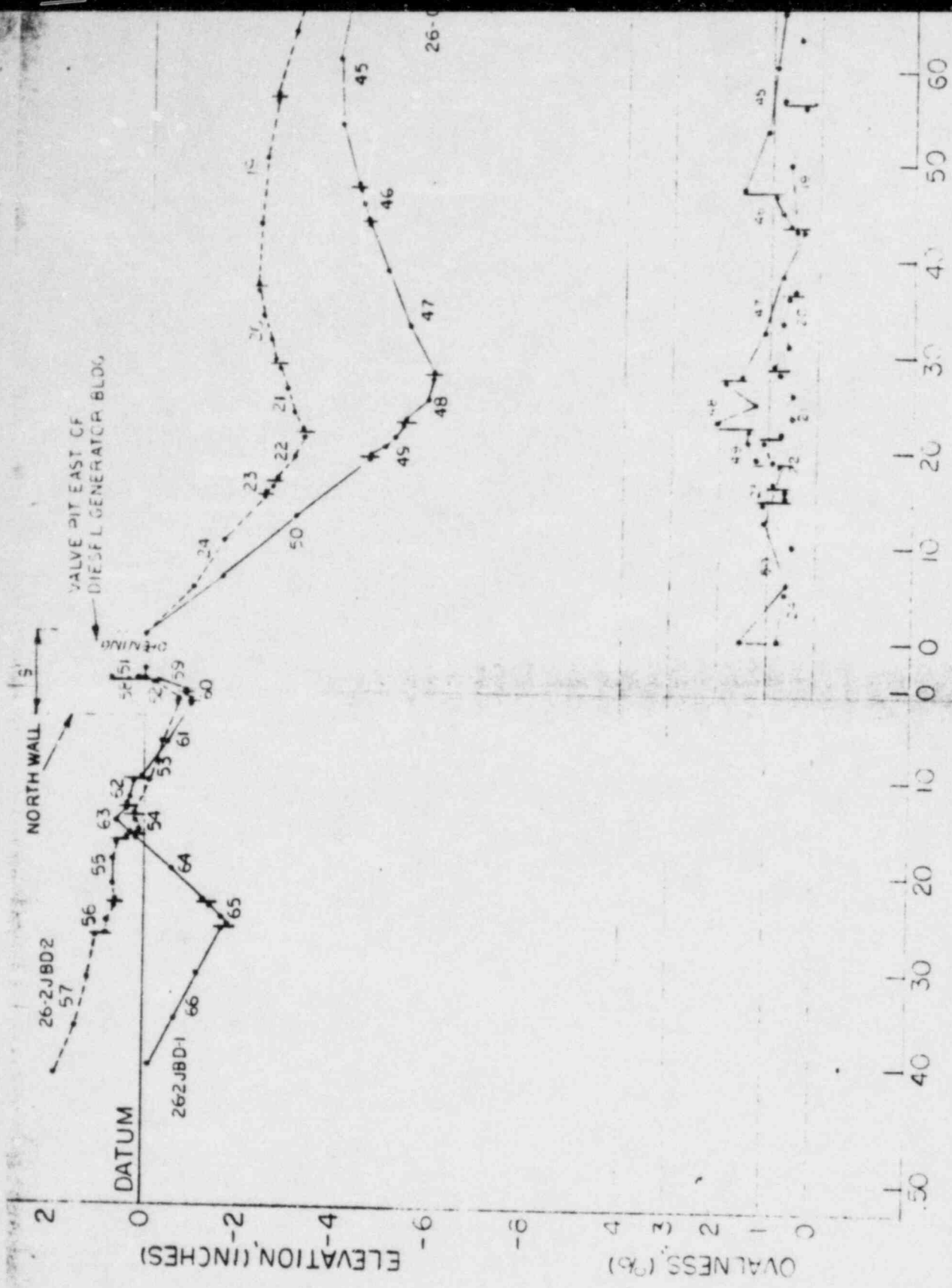
B. Pipe Out-of-Roundness

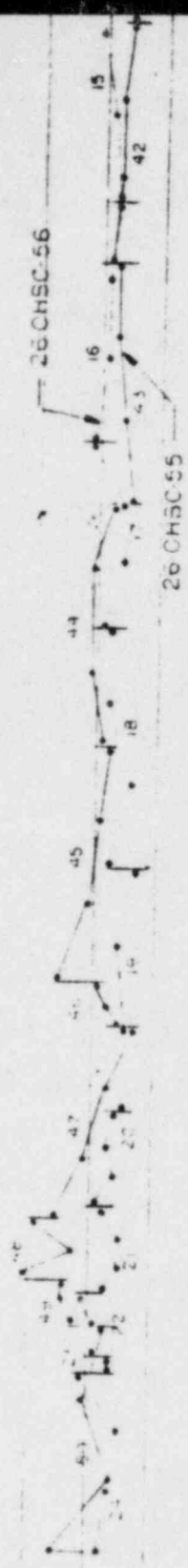
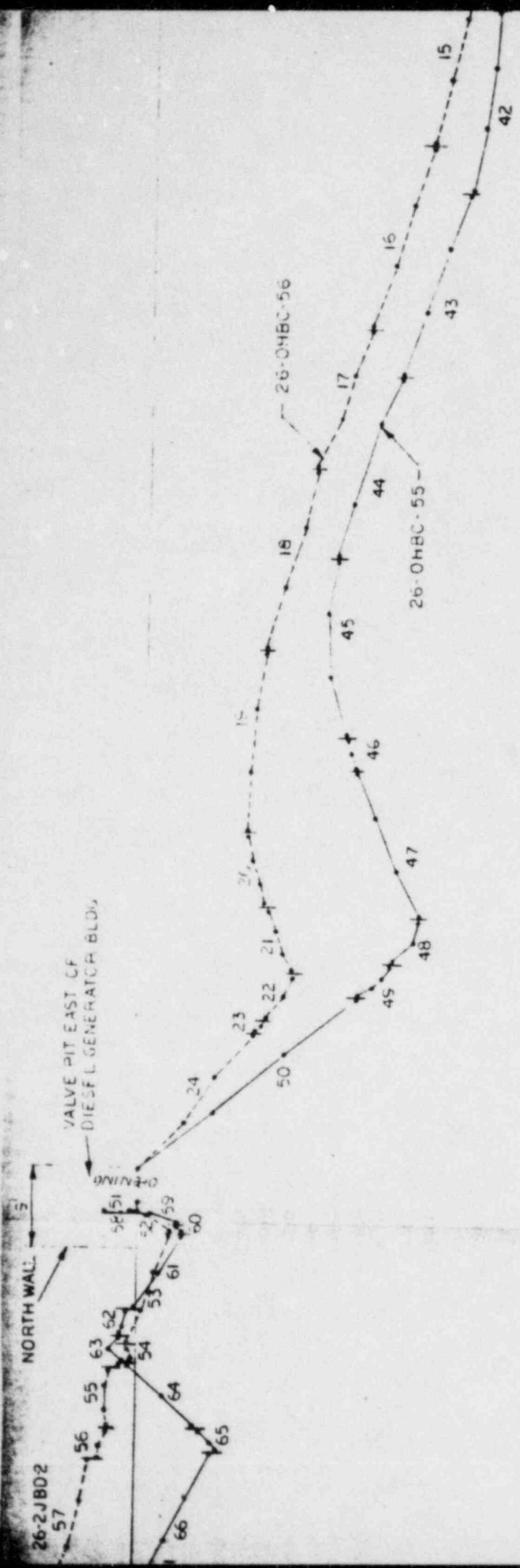
The data sheets for the pipe out-of-roundness measurements are included as Appendix A. A tabulation of the calculated value of percent ovalness are included as Appendix B. The calculated percent ovalness and the elevation profiles for pipelines 26-OHBC-55 and 26-OHBC-56 are shown in Figure 1. Note that the vertical scale for the elevation profiles has been changed from Report No. 1 to allow room for the percent ovalness plots on the same graph. An explanation of the percent ovalness calculation is contained in Section C, Report No. 2.

C. Summary

Pipe out-of-roundness measurements were made on pipes previously measured for elevation profiles with an instrument developed by SwRI. The instrument measures the maximum and minimum pipe diameters with an accuracy of  $\pm 1$  mm (0.040 inch). The results of the measurements were converted to percent ovalness and are shown on the graph in Figure 1.

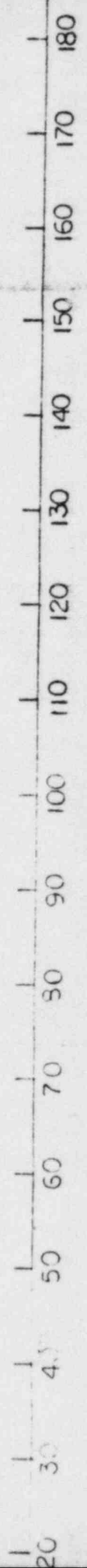
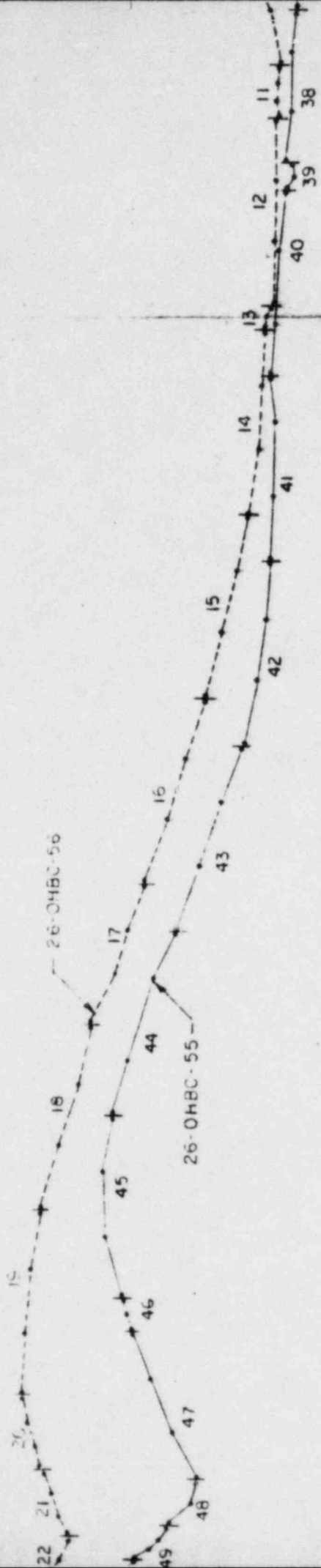
The  $\pm 1$  mm accuracy represents the ultimate attainable accuracy. The actual accuracy of pipe measurements would be dependent upon the cleanliness of the pipe where the measurements were taken. Although the pipes were cleaned, there were some areas where rust scale was present. In these instances where the accuracy could have been influenced by the condition in the pipe, a note was added in the remarks column of the data record sheet indicating the interference.

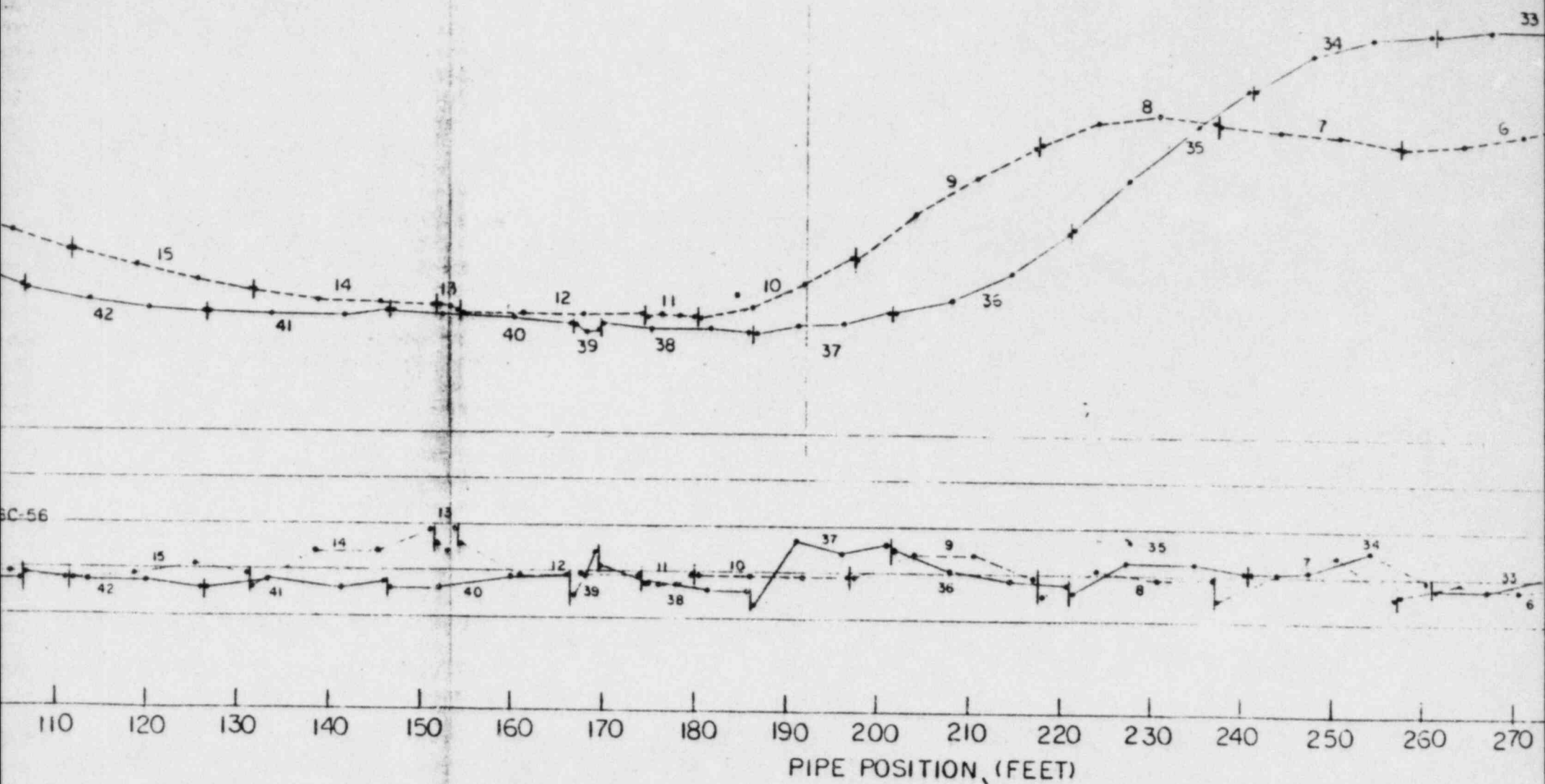






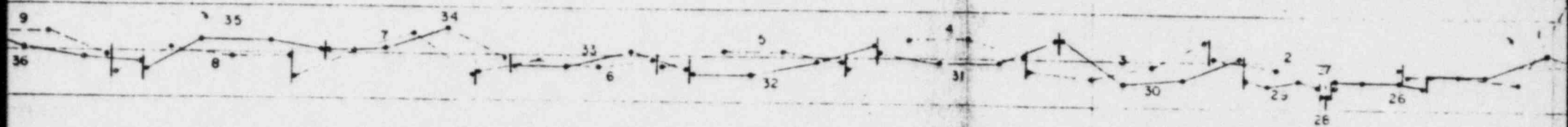
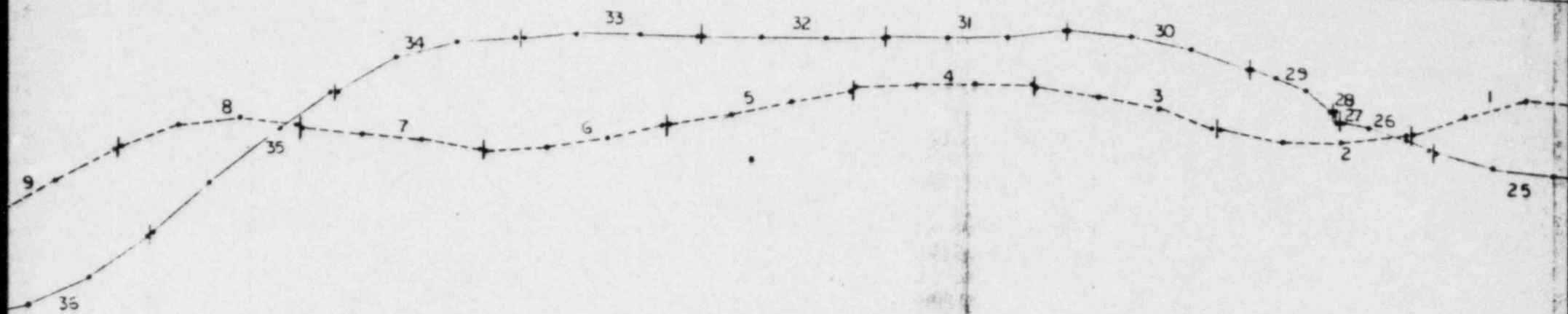
T. CF  
ATOR BLDG.





BC-56

PIPE POSITION, (FEET)



ION, (FEET)

210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370

PIPELINES  
26 OHBC55  
AND  
26 OHBC56

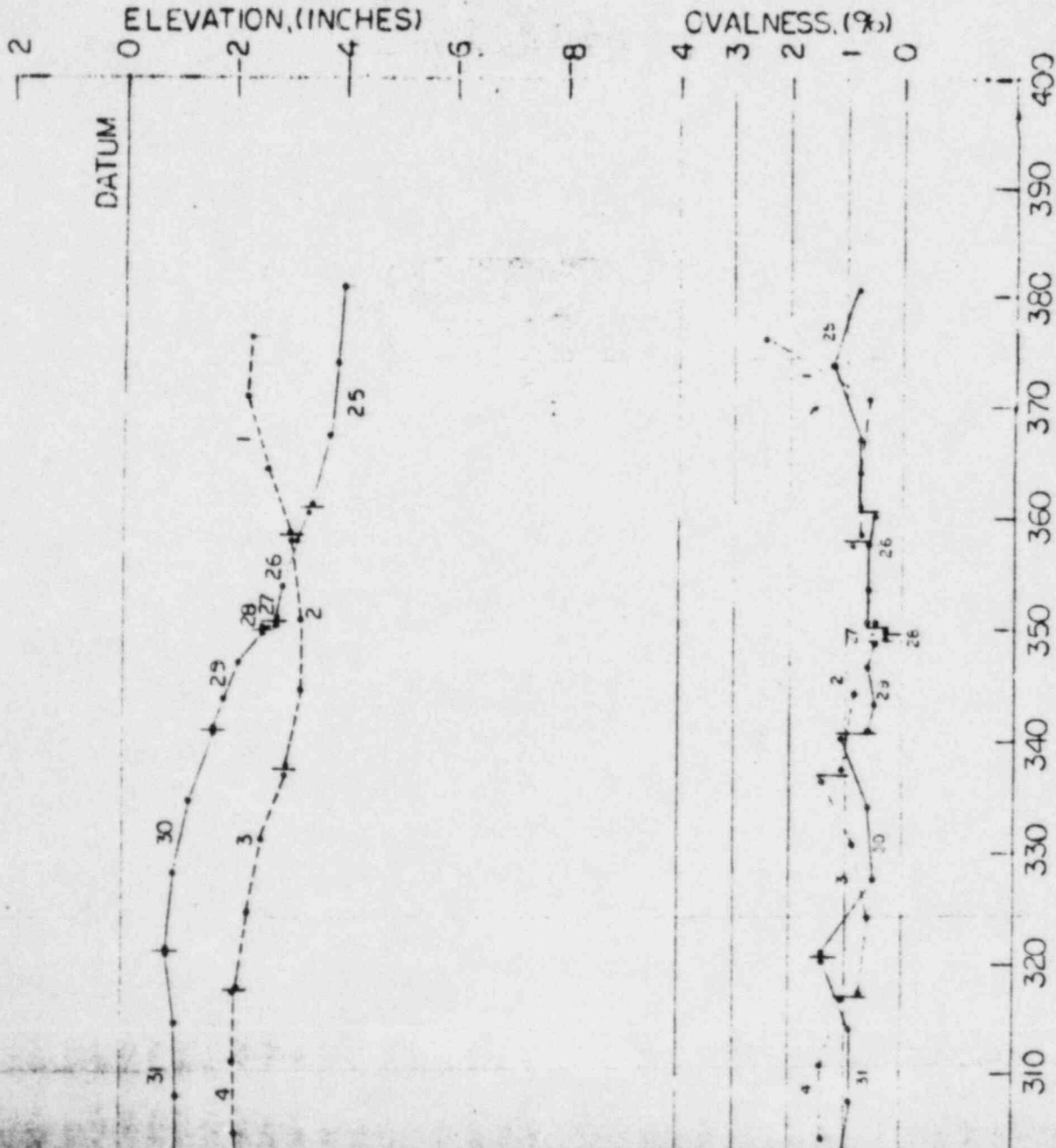


FIGURE I



APPENDIX A

PIPE CALIBRATION AND OUT-OF-ROUNDNESS DATA RECORDS

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-0542-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT 81	TIME (24-HR CLOCK) 1345	SHEET NO. 021
EXAMINER <i>P. Williams</i>	EXAMINER A. Williams	INSTRUMENT SWRI QUALNESS	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
23.5"		23.5"		23.5"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-654Z-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEP 1981	TIME (24 HR CLOCK) 1430	SHEET NO. 022
EXAMINER R. H. P. [Signature]	EXAMINER A. Williams	INSTRUMENT SWRI OVALNESS	PROCEDURE NO. X-ME-102-0	
TEST IDENTIFICATION J6-DHBC-55		CALIBRATION SHEET NO. 021		

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
25A	64	63.5	130/14	150	1450	
25B	64.1	63.3	134/38	158	1451	
25C	64.0	63.5	346/38	157	1453	
25D	64.0	63.5	358/35	159	1454	
26A	64.0	63.7	160/103	175	1456	
26B	63.64	63.6	103/005	176	1456	
26C	64.2	63.8	167/053	176	1458	
26D	64.0	63.6	085/040	178	1500	
27A	64.2	64.0	078/178	0°	1503	8" Length NO WELD 0° SWRI
28A	64.2	64.0	147/180	0°	1504	8" Length " " " SWRI
29A	64.1	63.8	102/008	174	1505	
29B	64.1	63.7	078/171	175	1508	
29C	64.0	63.7	069/008	174	1509	
29D	64.0	63.6	033/141	173	1510	
30A	64.1	63.4	000/372	208	1513	
30B	64.0	63.6	005/333	209	1515	
30C	64.0	63.7	221/327	210	1517	
30D	64.2	63.3	230/315	211	1519	
31A	64.1	63.2	228/318	20	1524	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6543-006	MIDLAND	18 SEPT 1981	1526	023		
EXAMINER <i>R. Williams</i>	EXAMINER <i>JR</i>	INSTRUMENT SWRI DIALNESS	PROCEDURE No. 1X-ME-102-0	CALIBRATION SHEET No.		
TEST IDENTIFICATION 26-DHBC-85						
021						
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
29B 31B	64.1	63.5	208 / 290	20	1527	
29C 31C	64.1	63.5	212 / 293	19	1528	
31 D	64.0	63.3	214 / 295	20	1529	
32 A	64.2	63.4	020 / 315	40	1531	
32 B	64.2	63.6	025 / 290	3741	1532	
32 C	64.0	63.6	345 / 230	38	1533	
32 D	64.0	63.6	221 / 305	39	1535	
33 A	64.0	63.7	038 / 316	65 55	1536	
33 B	64.2	63.5	038 / 290	65 55	1538	
33 C	64.1	63.6	040 / 284	54	1539	
33 D	64.1	63.6	345 / 240	53	1542	
34 A	64.0	63.4	280 / 044	225	1544	
34 B	64.5	63.5	283 / 045	225	1546	
34 C	64.4	63.7	085 / 040	275	1549	
34 D	64.0	63.3	088 / 322	275	1551	
35 A	64.1	63.4	055 / 335	304	1553	
35 B	64.1	63.3	018 / 303	302	1555	
35 C	64.2	63.4	014 / 302	302	1556	
35 D	64.0	63.6	038 / 302	303	1559	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-004	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT 1981	TIME (24 HR CLOCK) 1600	SHEET NO. 024
EXAMINER <i>Edgar E. Eckert</i>	EXAMINER J.R.	INSTRUMENT SWRI Ovalness	PROCEDURE No. 1X-ME-102-0	
TEST IDENTIFICATION 26-04BC-55		CALIBRATION SHEET No. 021		

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
36A	64.0	63.5	183/222	310	1602	
36B	64.1	63.5	137/186	310	1604	
36C	64.2	63.5	137/258	309	1605	
36D	63.9	63.6	208/168	308	1607	
37A	63.9	63.5	183/115	<del>308</del> 386	1610	
37B	64.2	63.3	183/141	83	1612	
37C	64.4	63.3	086/135	85	1613	
37D	63.9	63.7	085/124	85	1615	
38A	64.1	63.7	252/285	45	1617	
38B	64.1	63.7	250/190	45	1618	
38C	64.1	63.5	260/005	46	1620	
38D	64.6	63.5	258/000	46	1623	BEGINNING OF 45° BEND
39B	66.1	63.7	258/000	0°	1625	CENTER OF BEND 0°
40A	64.2	63.6	270/337	80	1628	
40B	64.2	63.6	271/030	78	1631	
40C	64.1	63.7	056/302	79	1633	
40D	64.0	63.6	263/033	78	1635	
41A	64.1	63.6	070/347	94	1637	
41B	64.1	63.7	285/328	93	1639	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6543-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT	TIME (24 HR CLOCK) 1639	SHEET NO. 025
EXAMINER <i>E. A. Caldwell</i>	EXAMINER H. Williams	INSTRUMENT SWRI OVALNESS	PROCEDURE No. IX-ME-102-O	
TEST IDENTIFICATION 26-OHBC-55		CALIBRATION SHEET No. 021		

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
41C	64.1	63.6	280 / 048	94	1640	
41D	64.1	63.7	300 / 080	92	1641	
42A	64.0	63.6	205 / 337	112	1642	
42B	64.1	63.6	<del>058</del> / 351	112	1643	
42C	64.1	63.6	096 / 355	112	1644	
42D	64.1	63.5	102 / 345	112	1645	
43A	64.0	63.5	204 / 012	235	1647	
43B	64.1	63.6	030 / 280	235	1648	
43C	64.1	63.7	270 / 025	235	1649	
43D	63.9	63.6	038 / 268	234	1650	
44A	64.0	63.5	060 / 290	245	1651	
44B	64.2	63.5	247 / 291	244	1653	
44C	64.2	63.5	248 / 296	245	1654	
44D	64.1	63.5	251 / 355	245	1655	
45A	64.0	63.5	089 / 320	275	1656	
45B	64.2	63.6	070 / 324	275	1657	
45C	64.2	63.5	073 / 325	274	1658	
46A	64.1	63.1	083 / 310	273	1659	
46B	64.1	63.5	080 / 320	96	1701	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT 1981	TIME (24 HR CLOCK) 1702	SHEET NO. 026
EXAMINER Edna H. P. [Signature]	EXAMINER JFK	INSTRUMENT SWRI OVALNESS	PROCEDURE NO. 1X-ME-102-0	
TEST IDENTIFICATION 26-OHBC-55	R. Williams		CALIBRATION SHEET NO. 021	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
46B	64.0	63.5	062 / 300	94	1703	
46C	64.0	63.6	055 / 292	95	1703	
46D 47A	63.9	63.7	060 / 290	120	1704	
47B	63.64.1	63.6	065 / 105	121	1707	
47C	64.2	63.5	071 / 070	121	1708	
47D	64.4	63.5	110 / 000	120	1711	BEGINNING OF 90° TURN <u>PAR</u>
48B	68.4	64.4	090 / 174	0°	1716	NO WELD 0° <u>PAR</u>
49A	64.4	63.2	108 / 003	120	1721	END OF 90° TURN <u>PAR</u>
49B	64.2	63.3	110 / 004	131	1722	
49C	64.2	63.3	106 / 004	131	1723	
49D	64.2	63.4	112 / 008	131	1725	
50A	64.1	63.6	080 / 024	153	1726	
50B	64.2	63.5	076 / 010	153	1727	
50C	64.0	63.6	070 / 019	152	1728	
50D	64.1	63.6	070 / 014	152	1730	<u>PAR</u>
50E	64.3	63.3	085 / 010	153	1731	

NOTE: See Note Page 2 ME



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	18 Sept. 81	1745	027		
EXAMINER <i>Richard A. Williams</i>	EXAMINER J.R.	INSTRUMENT SWRI ORNESS	PROCEDURE No. 1X-ME-102-O			
TEST IDENTIFICATION 26-OHBC-56			CALIBRATION SHEET No. 021			
PIPE POSITION	MAX. DIA. -IN. / CM.	MIN. DIA. -IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
1A	64.6	63	209° / 285°	145°	1759	
1B	64.1	63.7	226° / 272°	145°	1801	
1C	64.1	63.6	311° / 265°	141°	1803	
1D	64.1	63.6	305° / 270°	139°	1805	
2A	64.1	63.5	325° / 295°	161°	1807	
2B	64.1	63.8	321° / 291°	159°	1809	
2C	64.2	63.6	199° / 284	156°	1811	
2D	64.2	63.5	159° / 292°	155°	1812	
3A	64.3	63.4	191° / 257°	176°	1813	
3B	64.1	63.5	338° / 263°	125°	1814	
3C	64.1	63.7	339° / 225°	174°	1816	
3D	64.1	63.6	302° / 283°	176°	1817	
4A	64.3	63.6	203° / 85°	29°	1818	
4B	64.2	63.4	202° / 79°	28°	1820	
4C	64.3	63.4	198° / 80°	27°	1822	
4D	64	63.5	199° / 83°	27°	1824	
5A	64.1	63.5	220° / 119°	47°	1825	
5B	64.4	63.7	58° / 175°	45°	1826	
5C	64.4	63.7	78° / 109°	43°	1830	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	18 SEPT. 81	1831	028		
EXAMINER E. H. ELLIOTT	EXAMINER J. R.	INSTRUMENT SWRI ORALNESS	PROCEDURE NO. 1X-ME-102-0			
TEST IDENTIFICATION 2-6-DHBC-56		CALIBRATION SHEET NO. 021				
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
5D	64.2	63.7	310° / 88°	34°	1832	
6A	64.2	63.6	231° / 101°	57° 57°	1833	
6B	64.3	63.8	230° / 136°	56°	1834	
6C	64.4	63.8	54° / 187°	55°	1835	
6D	64.2	63.8	230° / 120°	54°	1837	
7A	64.	63.5	231° / 280°	114°	1838	
7D	64.3	63.5	308° / 225°	113°	1839	
7C	64.2	63.5	210° / 280°	113°	1841	
7D	64	63.7	209° / 285°	112°	1842	
8A	64.2	63.6	309° / 177°	136°	1843	
8B	64.2	63.6	296° / 180°	135°	1845	
8C	64.3	63.6	306° / 192°	134°	1847	
8D	64.3	63.8	246° / 265°	131°	1849	
9A	64.2	63.6	179° / 242°	150°	1850	
9D	64.4	63.5	175° / 280°	150°	1852	
9C	64.3	63.4	230° / 285°	148°	1853	
9D	64.2	63.6	227° / 288°	148	1854	
10A	64.1	63.5	65° / 139°	2°	1856	
10B	64.2	63.6	41° / 135°	1°	1858	

## SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT 81	TIME (24 HR CLOCK) 1859	SHEET NO. 029
EXAMINER <i>Eddie H. E...</i>	EXAMINER K. Williams <i>JEL</i>	INSTRUMENT SWAZ OVALNESS	PROCEDURE NO. 1X-ME-102-0	
TEST IDENTIFICATION 26-01+BC-56			CALIBRATION SHEET NO. 021	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
10C	64.3	63.7	24° / 101°	2°	1900	
10D	64	63.8	59° / 136°	0°	1901	
11A	64.1	63.5	20° / 127°	1°	1902	
11D	64	63.5	20° / 131°	0°	1904	
11C	64	63.5	21° / 130°	359°	1905	
11D	64	63.5	16° / 129°	0°	1907	
12A	64.1	63.5	187° / 145°	14°	1908	
12D	64.0	63.7	189° / 145°	14°	1909	
12C	64.4	63.8	190° / 146°	14°	1910	
12D	65.5	63.8	106° / 188°	20°	1912	START 45° BEND
13B	67.7	64.3	91° / 180°	0°	1914	45° BEND SEAM WELD NOT ABLE TO LOCATE
14A	64.3	63.5	324° / 50°	276°	1917	END OF 45° BEND
14B	64.5	63.6	90° / 26°	274°	1919	
14C	64.4	63.5	88° / 29°	273°	1921	NOTE: See Note Page 7
14D	64	63.6	333° / 46°	275°	1922	
15A	64.1	63.5	103° / 25°	287°	1924	
15B	64.2	63.5	100° / 8°	285°	1925	
15C	64.2	63.6	84° / 15°	284°	1927	
15D	64.1	63.6	91° / 359°	283°	1928	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MILWAUKEE	DATE (DAY-MO-YR) 18 SEPT 81	TIME (24 HR CLOCK) 8 1929	SHEET NO. 000
EXAMINER Edwin R. [unclear]	EXAMINER J. K. WILLIAMS	INSTRUMENT SWRI OVALNESS	PROCEDURE No. IX-MAE-102-0	
TEST IDENTIFICATION 26-OHOC-56			CALIBRATION SHEET NO. 021	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		TIME	REMARKS
			MAX. / MIN.	SEAM WELD		
16A	64	63.5	266° / 147°	278°	1930	
16B	64.1	63.5	264° / 345°	297°	1932	
16C	64.1	63.5	113° / 343°	298°	1934	
16D	64.2	63.5	100° / 15°	297°	1935	
17A	64.2	63.5	210° / 175°	292°	1936	(293°)
17B	64.1	63.7	108° / 198°	293°	1939	
17C	64	63.6	114° / 65°	290°	1941	
17D	64.1	63.5	108° / 10°	292°	1943	
18A	64.1	63.6	118° / 4°	318°	1945	
18B	64.2	63.7	127° / 60°	319°	1946	
18C	64.5	63.6	135° / 63°	320°	1947	
18D	64.2	63.7	136° / 68°	321°	1949	
19A	64	63.8	161° / 50°	349°	1950	
19B	64.1	63.7	137° / 48°	347°	1951	
19C	64.1	63.8	141° / 29°	346°	1952	
19D	64	63.7	54° / 129°	346°	1954	
20A	64	63.6	87° / 313°	271°	1955	
20B	64.1	63.6	69° / 313°	271°	1957	
20C	64.1	63.7	72° / 312°	271	1958	







# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24-HR CLOCK)	SHEET NO.
17-06542-006	MIDLAND	18 SEP 81	2028	037 032
EXAMINER	EXAMINER	INSTRUMENT	PROCEDURE	
Colin R. Emery	R. WILLIAMS	SWRI OWNERS	IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
23.5		23.5"		23.5"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 19 SEPT 81	TIME (24-HR CLOCK) 10 48	SHEET No. 039
EXAMINER <i>Phillip N. Elliott</i>	EXAMINER K. Williams	INSTRUMENT SWRI QUALNESS	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
23.5		23.5"		23.5	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 19 SEPT 81	TIME (24 HR CLOCK) 1058	SHEET NO. 040
EXAMINER Col. N. C. [Signature]	EXAMINER K. WILLIAMS	INSTRUMENT SWRI QUALNESS	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-2JBD-2			CALIBRATION SHEET NO. 039	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
57D				CAN'T BE MEASURED		limited to [unclear] DUE TO PIPE DROE OFF. (PAC)
57C	64.1	63.6	15° / 94°	285°	1100	
57B	64	63.7	15° / 86°	286°	1102	
(PAC) 57A	64	63.6	18° / 345°	281°	1104	* Two 57As (PAC)
57A	64	63.5	15° / 310°	281°	1105	
56C				** NO MEASUREMENT TAKEN BECAUSE, NO (PAC)		
56B				ACCURATE MEASUREMENT CAN BE TAKEN (PAC)		
56A				AT THE BEND DUE TO THE (PAC)		
55D				CONFIGURATION OF THE SWRI QUALNESS (PAC)		
55C	63.8	63.4	235° / 191°	80	1109	" " " "
55B	63.9	63.2	77° / 187°	62°	1111	
55A	64	63.1	237° / 187°	62°	1113	
57A						SAME AS NOTE ABOVE **
57C						" " " " **
57D						" " " " **
57A						" " " " **
57D						
57C	64	63.5	295° / 225°	175°	1115	
57A	64.1	63.5	343 / 270°	15	1117	





# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	19 SEPT 81	1128	042		
EXAMINER <i>Edith H. Caruth</i>	EXAMINER K. WILLIAMS	INSTRUMENT SWRI OPALNESS	PROCEDURE NO. IX-ME-102-0			
TEST IDENTIFICATION 26-25BD-1			CALIBRATION SHEET NO. 039			
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
66D			CAN'T BE MEASURED DUE TO PIPE DROP OFF.			
66B	64.3	63.7	12° / 155°	335°	1133	
66D	64.2	63.6	12° / 147°	337°	1134	
66A	64.3	63.6	15° / 145°	337°	1135	
65C			** NO MEASUREMENT			TAKEN BECAUSE NO ACCURATE
65B			MEASUREMENT CAN BE TAKEN AT THE			END OF
65A			DUE TO THE CONFIGURATION OF THE			PIPE
64C			SWRI OPALNESS DEVICE.			
64D	64	63.7	80° / 155°	338°	1139	
64A	64.1	63.8	134° / 70°	338°	1139	
63C						** SAME AS NOTE ABOVE
63D						** SAME AS NOTE ABOVE
63A						** SAME AS NOTE ABOVE
62C						** SAME AS NOTE ABOVE
62D	64.1	63.8	89° / 174°	9°	1141	
62A	64	63.8	93° / 259°	9°	1143	
61C	64	63.6	138° / 38°	345°	1144	
61B	67	63.8	140° / 26°	345°	1145	
61A	67.2	63.8	160° / 44°	345°	1147	



# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 19 SEPT 81	TIME (24-HR CLOCK) 1156	SHEET NO. 044
EXAMINER Cedric H. Cantata	EXAMINER K. Williams	INSTRUMENT SWRI DUNKES	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
23.5		23.5		23.5"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 23 SEPT 81	TIME (24-HR CLOCK) 08.30	SHEET NO. 050
EXAMINER <i>[Signature]</i>	EXAMINER N/A	INSTRUMENT SWRI OVALNESS MAPV	PROCEDURE IX-ME-102-0 CHANGE 1	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
N/A					→

POSITION	AZIMUTH
1	N / A
2	
3	
4	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS) ELBOWS

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	WILSON	23 SEPT 81	0845	051		
EXAMINER <i>[Signature]</i>	EXAMINER NA	INSTRUMENT SWRI OVALNESS	PROCEDURE NO.			
TEST IDENTIFICATION		ASBL	IX-ME-102-D, CHANGE 1	CALIBRATION SHEET NO.		
26" OHAOC-56 AND 26" OHAOC-55 050						
PIPE POSITION	MAX DIA - IN - CM	MIN DIA - IN - CM	AZIMUTH - MAX - MIN	AZIMUTH - SEAM - WELD	TIME	REMARKS
PIPE POSITION	0.180" DIA	0.210" DIA	60° & 240° DIA	92° & 220° DIA	120° & 300°	REMARKS
13A	64.3	64.2	63.8	63.1	63.4	63.9 CM 26" OHAOC-55 (P)
13B	64.3	64.3	64.1	63.5	63.4	63.9 CM
13C	64.2	64.3	63.6	63.4	63.3	63.3 CM
12D	64.2	64.4	63.6	63.4	63.4	64.1 CM
21D	63.6	63.8	63.8	63.9	63.5	64.0 CM
22A	64.1	64.1	64.3	63.6	63.7	63.7 CM
22B	64.2	64.7	64.3	64.0	63.8	63.8 CM
22C	63.6	63.9	64.0	64.1	63.8	63.5 CM 26" OHAOC-56 (P)
38A	63.5	63.9	63.6	63.7	63.9	63.2 CM 26" OHAOC-55 (P)
39A	64.0	63.9	63.8	64.2	64.2	63.3 CM
39B	63.8	63.6	64.0	64.2	64.3	63.9 CM
39C	63.8	63.7	63.9	64.0	64.0	63.9 CM
47D	63.7	64.2	64.2	63.6	63.2	63.2 CM
48A	63.9	64.4	64.3	63.5	63.3	63.2 CM
48B	64.1	64.4	64.2	64.4	63.6	63.9 CM
48C	63.7	63.9	64.4	63.3	63.1	63.5 CM 26" OHAOC-55 (P)
	CM	CM	CM	CM	CM	CM
	CM	CM	CM	CM	CM	CM

\* 0° IS LOCATED AT VERTICAL BOTTOM OF PIPE.

# SWRI DATA RECORD (OUT-OF-ROUNDNESS) ELBOWS

PROJECT NO. 17-6542-006	SITE MIGLAND	DATE (DAY-MO-YR) 23 SEPT 81	TIME (24 HR CLOCK) 1040	SHEET NO. 052
EXAMINER <i>William E. ...</i>	EXAMINER NA	PROCEDURE NO. IX-ME-102-0, CHANGE 1		
TEST IDENTIFICATION 36" - 2JBB1 AND 36" - 2JBB-2				
CALIBRATION SHEET NO. 050				

PIPE POSITION	MAX-DIA		MIN-DIA		AZIMUTH MAX	AZIMUTH SEAM WELD	TIME	REMARKS
	IN-EM	OUT-EM	IN-EM	OUT-EM				
PIPE POSITION	150° & 330° DIA		90° & 270° DIA					REMARKS
66A	64.1	64.1	63.6	63.6	63.4	63.5	63.6	36-2JBB-1 (P)
65A	64.2	64.1	63.7	63.7	63.7	63.6	64.0	
65B	64.3	64.3	64.2	64.2	63.9	63.7	64.2	
65A	64.3	64.5	63.3	63.3	63.6	63.7	64.0	
64A	63.7	63.4	63.4	63.4	63.2	63.3	63.8	
63C	63.5	63.6	63.9	63.9	63.4	63.2	63.6	
63B	63.7	64.1	64.1	64.1	63.5	63.8	63.5	
63A	64.0	63.7	63.8	63.7	63.6	64.1	63.7	36-2JBB-1 (P)
57A	64.0	63.6	63.4	63.4	63.3	63.3	63.8	36-2JBB-2 (P)
56C	64.1	64.1	63.8	63.8	63.6	63.5	63.4	
54B	64.1	63.9	64.3	64.3	63.9	63.7	64.0	
54A	64.0	63.5	63.6	63.6	63.7	63.3	64.1	
55A	63.1	63.1	64.0	64.0	63.7	63.6	63.1	
54C	63.5	64.0	64.0	64.0	63.8	63.8	63.4	
54B	63.7	63.8	64.4	64.4	64.0	64.0	63.5	
54A	63.4	64.0	64.3	64.3	64.1	64.2	63.8	36-2JBB-2 (P)
	64.0	64.0	64.1	64.1	64.1	64.1	64.1	

\* 0° IS LOCATED AT VERTICAL BOTTOM OF PIPE.

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 23 SEPT 81	TIME (24-HR CLOCK) 1145	SHEET NO. 053
EXAMINER <i>[Signature]</i>	EXAMINER N/A	INSTRUMENT SWRI OVALNESS ANAL	PROCEDURE 1X-ME-102-0, CHANGE 1	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
N/A					

POSITION	AZIMUTH
1	N/A
2	
3	
4	

APPENDIX B

TABULATION OF PERCENT OVALNESS CALCULATIONS



OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26-OHBC-55

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.

Pipe Position	% Ovalness	Pipe Position	% Ovalness	Pipe Position	% Ovalness
25A	0.78	37B	1.40		
25B	1.25	37C	1.72	38D	1.09
25C	0.78	37D	0.3	39A	1.40
25D	0.78	38A	0.6	39B	0.9
26A	0.48	38B	0.6	39C	0.47
26B	0.6	38C	0.78	47D	1.56
26C	0.6	40A	0.9	48A	1.87
26D	0.6	40B	0.9	48B	1.25
27A	0.3	40C	0.6	48C	2.03
28A	0.3	40D	0.6		
29A	0.48	41A	0.78		
29B	0.60	41B	0.6		
29C	0.48	41C	0.78		
29D	0.60	41D	0.6		
30A	1.09	42A	0.6		
30B	0.6	42B	0.78		
30C	0.48	42C	0.78		
30D	1.40	42D	0.9		
31A	1.40	43A	0.78		
31B	0.9	43B	0.78		
31C	0.9	43C	0.6		
31D	1.09	43D	0.47		
32A	1.25	44A	0.78		
32B	0.9	44B	1.09		
32C	0.6	44C	1.09		
32D	0.6	44D	0.9		
33A	0.48	45A	0.78		
33B	1.09	45B	0.9		
33C	0.78	45C	1.09		
33D	0.78				
34A	0.9	45D	1.56		
34B	1.56	46A	0.9		
34C	1.09	46B	0.78		
34D	1.09	46C	0.6		
35A	1.09	47A	0.3		
35B	1.25	47B	0.78		
35C	1.25	47C	1.09		
35D	0.6	49A	1.40		
36A	0.78	49B	1.40		
36B	0.9	49D	1.25		
36C	1.09	50A	0.78		
36D	0.47	50B	1.09		
37A	0.6	50C	0.6		
		50D	1.56		

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26-OHBC-56

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.

Pipe Position	% Ovalness	Pipe Position	% Ovalness	Pipe Position	% Ovalness
1A	2.49	11D	0.78	13A	1.87
1B	0.60	12A	0.9	13B	1.40
1C	0.78	12B	0.9	13C	1.56
1D	0.78	12C	0.9	12D	1.56
2A	0.9	14A	1.87	21D	0.78
2B	0.47	14B	1.40	22A	1.09
2C	0.9	14C	1.40	22B	0.9
2D	1.09	14D	0.6	22C	0.9
3A	1.40	15A	0.9		
3B	0.90	15B	1.09		
3C	0.6	15C	0.9		
3D	0.78	15D	0.78		
4A	1.09	16A	0.78		
4B	1.25	16B	0.9		
4C	1.40	16C	0.9		
4D	0.78	16D	1.09		
5A	0.9	17A	1.09		
5B	1.09	17B	0.6		
5C	1.09	17C	0.6		
5D	0.78	17D	0.9		
6A	0.9	18A	0.78		
6B	0.78	18B	0.78		
6C	0.9	18C	1.40		
6D	0.6	18D	0.78		
7A	0.78	19A	0.3		
7B	1.25	19B	0.6		
7C	1.09	19C	0.47		
7D	0.47	19D	0.47		
8A	0.9	20A	0.6		
8B	0.9	20B	0.78		
8C	1.09	20C	0.6		
8D	0.78	20D	1.09		
9A	0.9	21A	0.78		
9B	1.40	21B	0.47		
9C	1.40	21C	0.47		
9D	0.9	23B	0.6		
10A	0.9	23C	0.6		
10B	0.9	24A	1.09		
10C	0.9	24B	0.47		
11A	0.9	24C	0.6		
11B	0.78	24D	0.78		
11C	0.78				

J. Keane  
Rec'd 11/19/81

APP. B - REPORT NO. 2

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542.  
Report No. 2

Prepared for

Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981



~~8112230547~~

SOUTHWEST RESEARCH INSTITUTE  
SAN ANTONIO HOUSTON

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Report No. 2

Prepared for

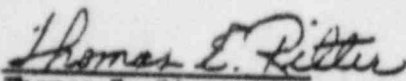
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981

Written by

  
Thomas E. Ritter  
Project Manager  
Mechanical Engineering

Approved by

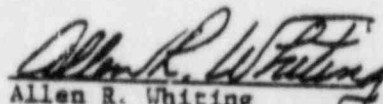
  
Allen R. Whiting  
Executive Director



TABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION . . . . .	1
B. PIPES PROFILED . . . . .	1
C. ELEVATION PROFILE MEASUREMENTS . . . . .	1
D. PIPE OUT-OF-ROUNDNESS MEASUREMENTS . . . . .	2
E. SUMMARY . . . . .	2

APPENDICES

- A. Pipe Data Point Locations
- B. Pipe Calibration and Elevation Data Records
- C. Pipe Calibration and Out-of-Roundness Data Records
- D. Tabulation of Percent Ovalness Calculations
- E. Operating Procedure for Pipe Out-of-Roundness Measurements

## PIPE PROFILE MEASUREMENTS AT MIDLAND

### A. Introduction

This is the second report on measurements of pipe elevation profiles at Midland Units 1 and 2 which took place from September 12 through 16, 1981. During this trip, the pipes were also measured for out-of-roundness with an instrument developed at Southwest Research Institute (SwRI). This instrument measures the maximum and minimum diameter of the pipe at selected points within the pipe. In this case, out-of-roundness measurements were made at each point where elevation measurements were taken. An operating procedure for the pipe out-of-roundness measurement is included as Appendix E. The operating procedure for pipe elevation profiles was included in Appendix C of Report No. 1.

### B. Pipes Profiled

Four pipes were measured to determine their elevation and out-of-roundness profiles. These pipes are shown on SwRI drawing D-6224-065 and Bechtel Yard Pipe Plan drawing M-167(Q) and are identified by the following numbers:

- (1) 26" - OHBC - 19
- (2) 26" - OHBC - 20
- (3) 36" - OHBC - 19
- (4) 36" - OHBC - 20

Four pipes previously measured for elevation profiles only and reported in Report No. 1 were measured for out-of-roundness. These pipes are 26-OHBC-55 and -56 and 26-2JBD-1 and -2. The results of these measurements are reported under separate cover as an Addendum to Report No. 1.

The 26" pipes are interconnected with the 36" pipes through a reducer coupling. The pipes were entered at an opening created by removing a section of the pipe. The pipes were uncovered by digging a pit due East of the Auxiliary building. The four coordinates of the pit are north side S4673, south side S4703, west side E548 and east side E575. The datum (zero elevation) was selected at the point of entry to each pipe. The elevation measurements made at each point through the entire length of the pipe are compared to the datum. A sketch of the pit identifying the datum point for each pipe and information identifying each pipe segment is included in Appendix A.

### C. Elevation Profile Measurements

The data sheets for both calibration and pipe profile measurements are included in Appendix B. The pipe profiles are shown on the graph in Figure 1. Note that all four pipes are shown on the same graph and change in elevation is directly related to the datum (zero elevation) point selected for each pipe. Also shown on the lower portion of the graph is the percent ovalness of the pipes at each elevation data point.

#### D. Pipe Out-of-Roundness Measurements

The data sheets for the pipe out-of-roundness measurements are included as Appendix C. A tabulation of the calculated values of percent ovalness are included as Appendix D. The percent ovalness is shown on the graph in Figure 1. The percent ovalness is determined by performing the following calculation at each data point:

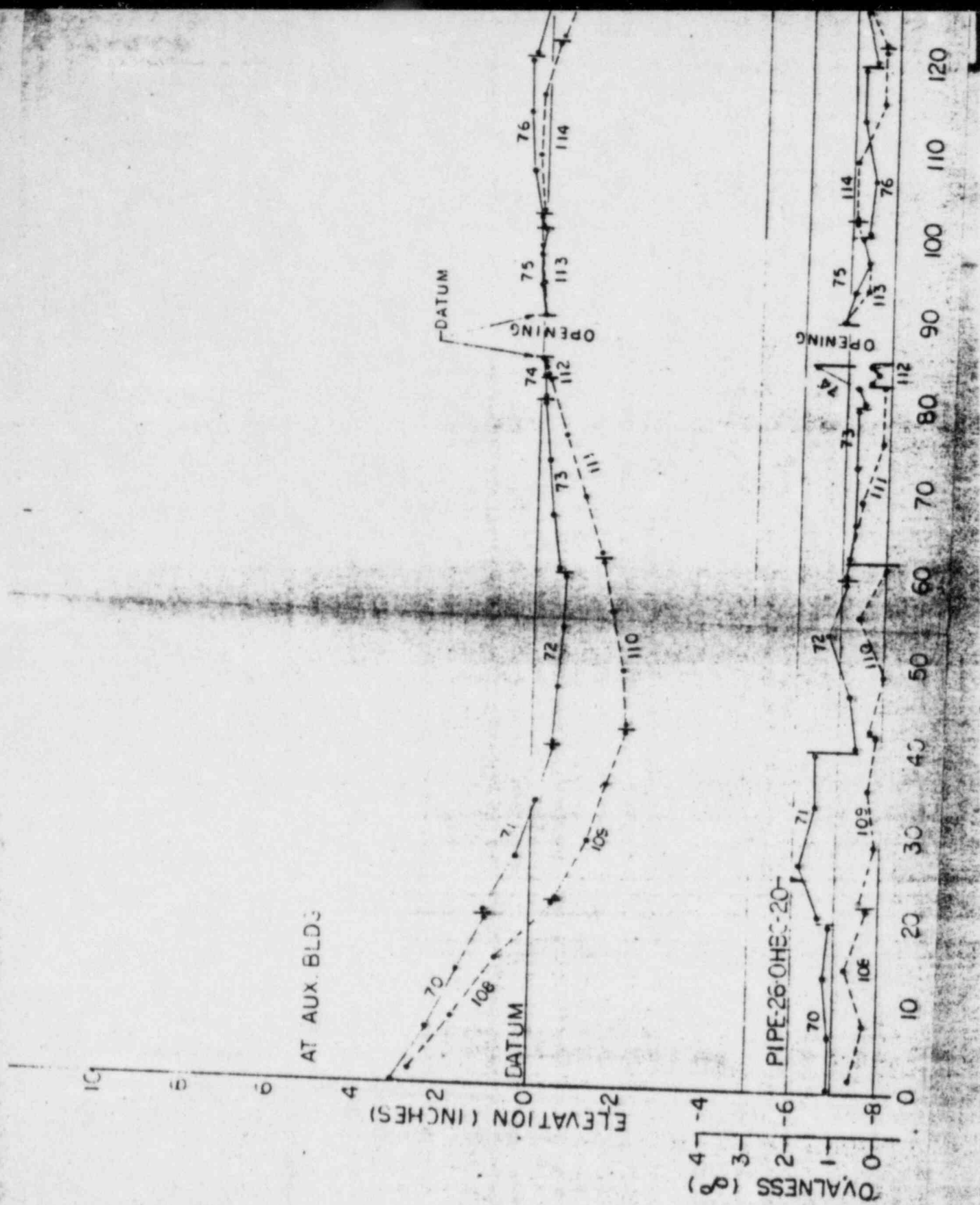
$$\% \text{ ovalness} = \frac{\text{Max Pipe I.D.} - \text{Min. Pipe I.D.}}{\text{Average Pipe I.D.}} \times 100$$

The maximum and minimum pipe diameters are measured values. The average pipe diameter is the nominal pipe O.D. minus 2-times the pipe wall thickness (or nominal pipe I.D.). The instrument used to measure the maximum and minimum pipe diameters is described in the operating procedure for pipe out-of-roundness measurements in Appendix E.

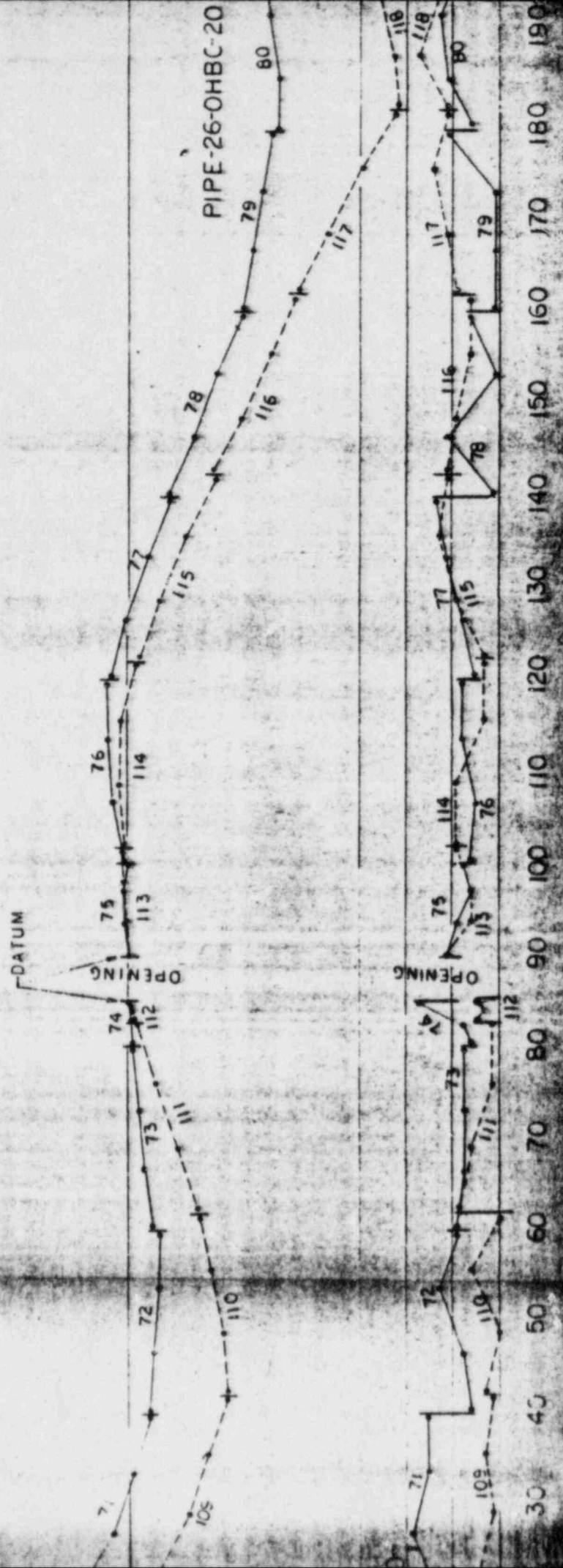
#### E. Summary

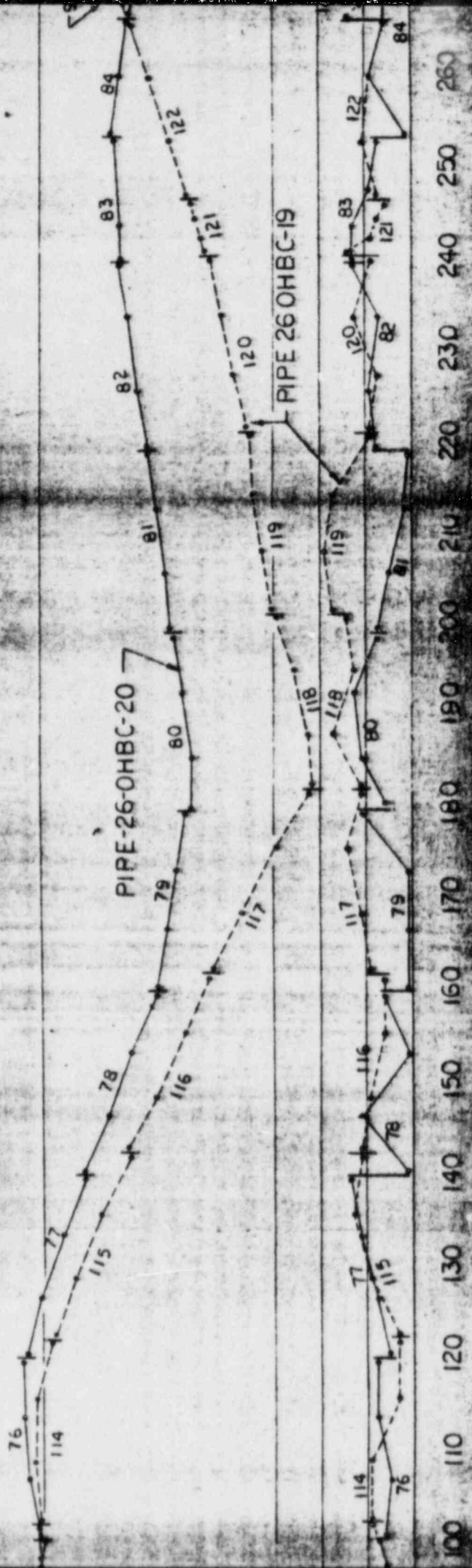
Both pipe elevation and out-of-roundness measurements were made. The results of the measurements are shown on the graph in Figure 1. There were no equipment-oriented problems encountered during the performance of these measurements. The equipment was designed to provide accuracies of  $\pm 1/16$  inch (1.59 mm) or better for pipe elevations and  $\pm 1$  mm (0.040 inch) for out-of-roundness measurements. These specifications represents the ultimate attainable accuracies. The actual accuracy of pipe measurements would be dependent upon the cleanliness of the pipe where the measurements were taken. Although the pipes were cleaned, there were some areas where rust scale was present. In those instances where the accuracy could have been influenced by the condition of the pipe, a note was added in the remarks column of the data record sheet indicating the interference.

Approximately 1260 feet of pipe were measured for elevation profiles and 2111 feet for out-of-roundness. These measurements and the data taken during the first trip characterize approximately 40 percent of the total buried 26-inch pipe at the Midland site. Future visits are planned to obtain measurements of the remaining pipes.





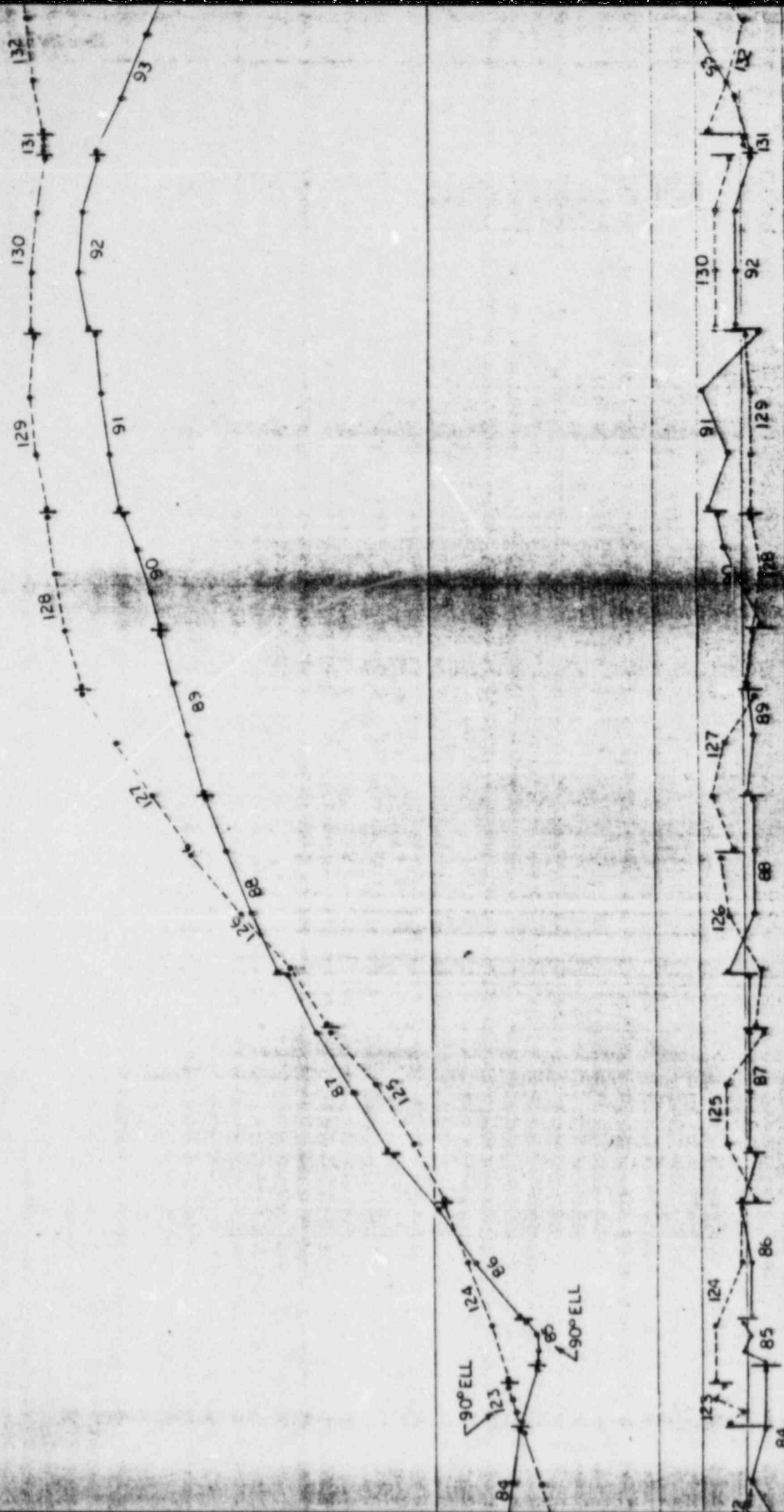




100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260



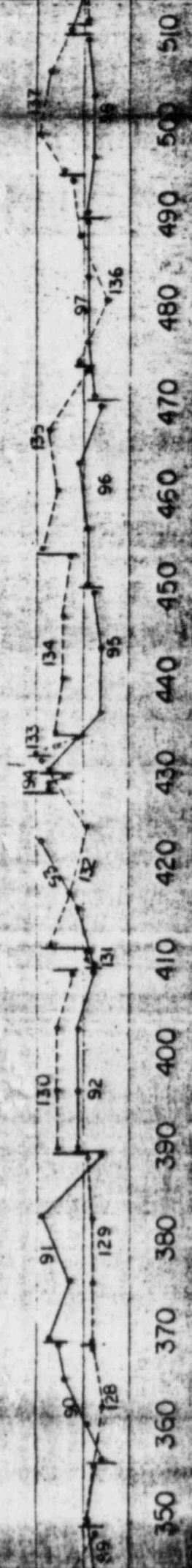
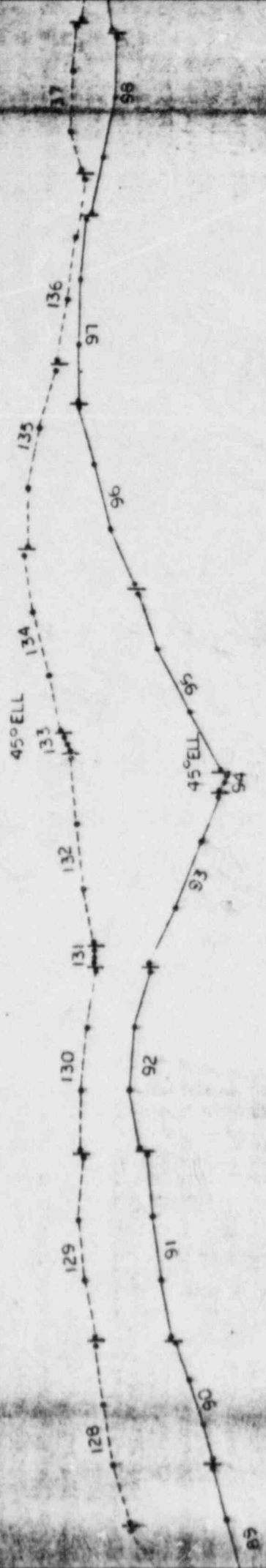




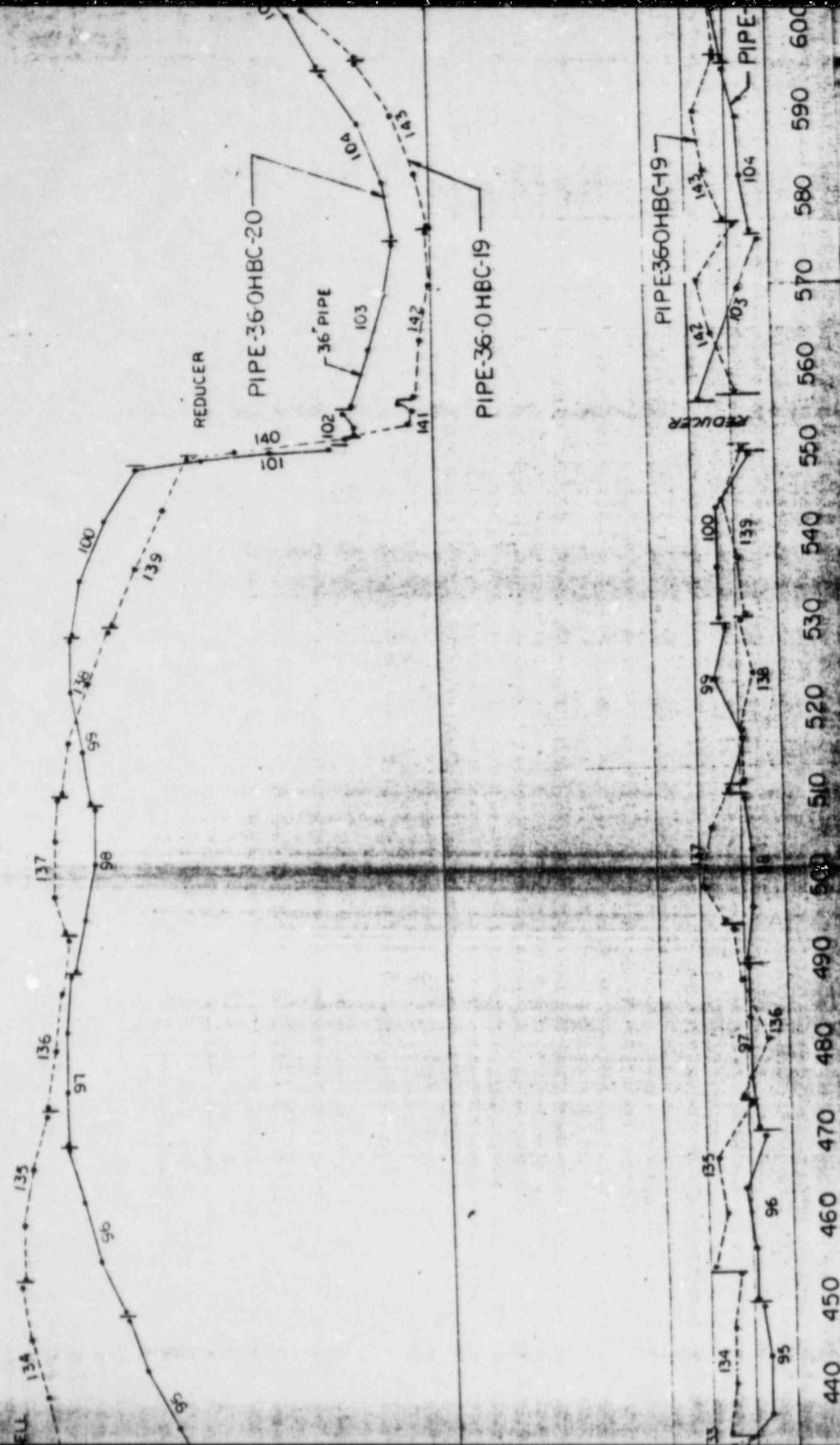
260 270 280 290 300 310 320 330 340 350 360 370 380 390 400 410 420

PIPE POSITION IN FEET





350 360 370 380 390 400 410 420 430 440 450 460 470 480 490 500 510



26/36-OHBC-20

AND

26/36-OHBC-19

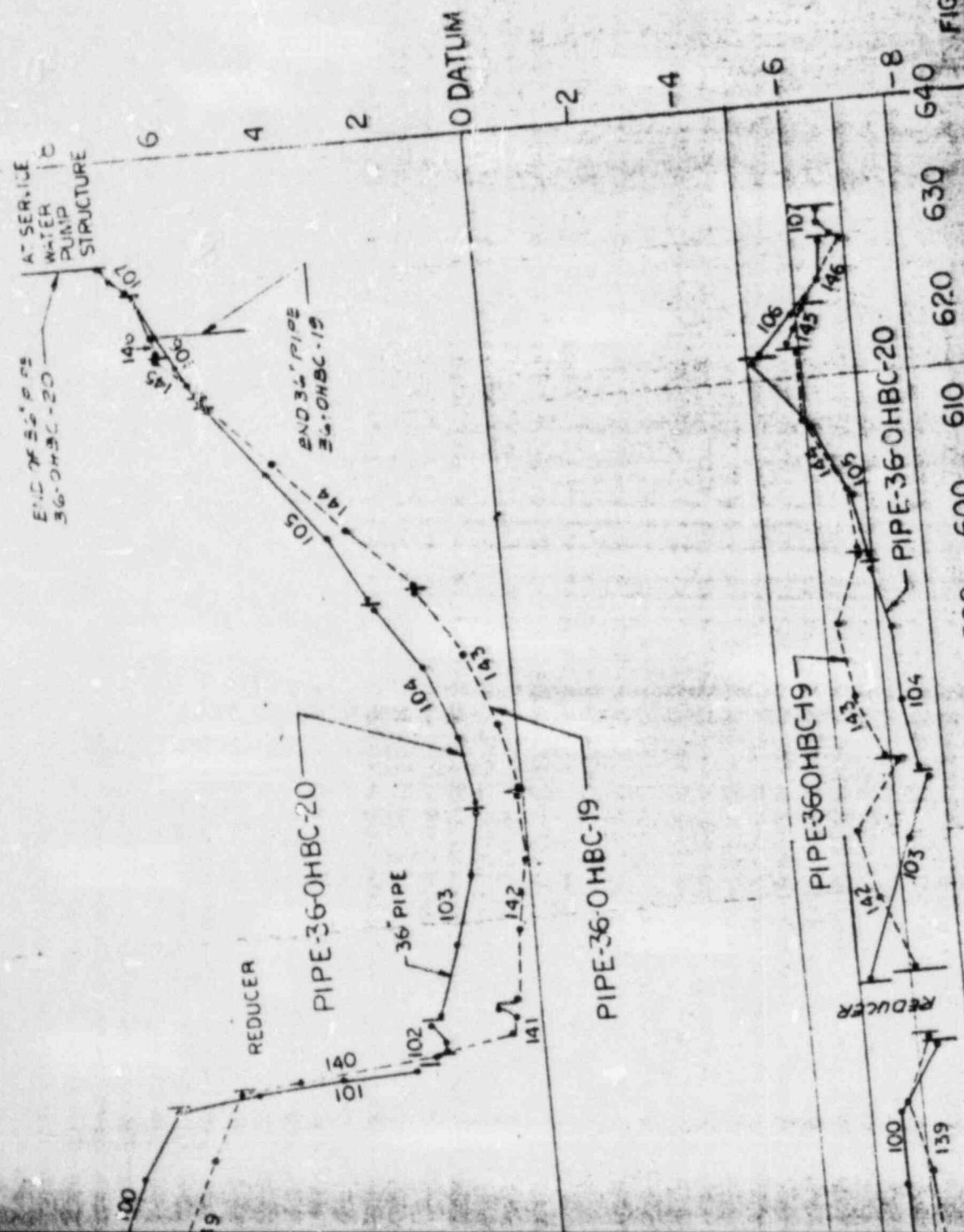


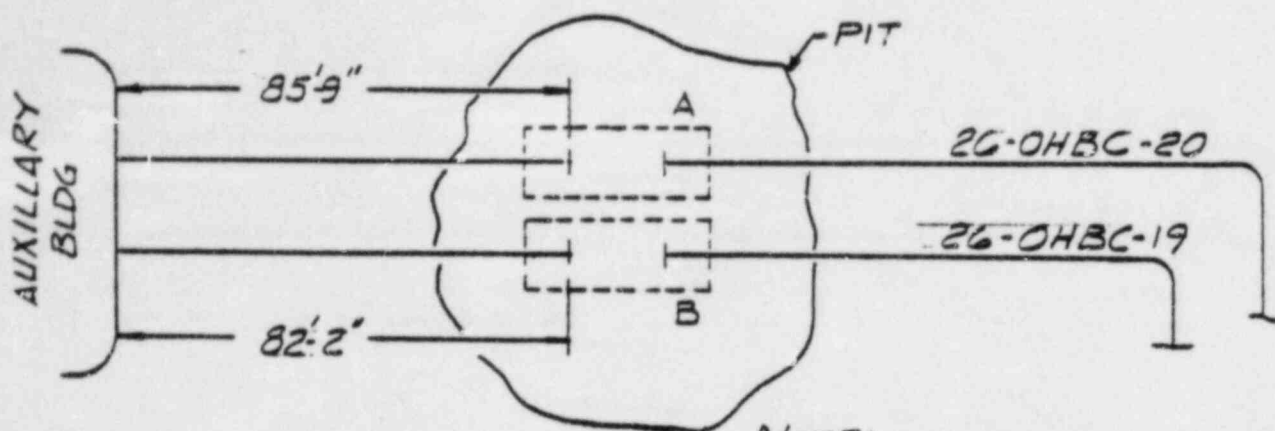
FIGURE 1



APPENDIX A

PIPE DATA POINT LOCATIONS

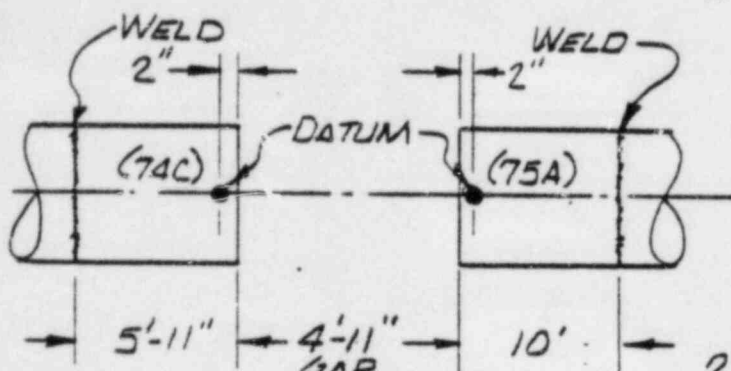




NOTE:

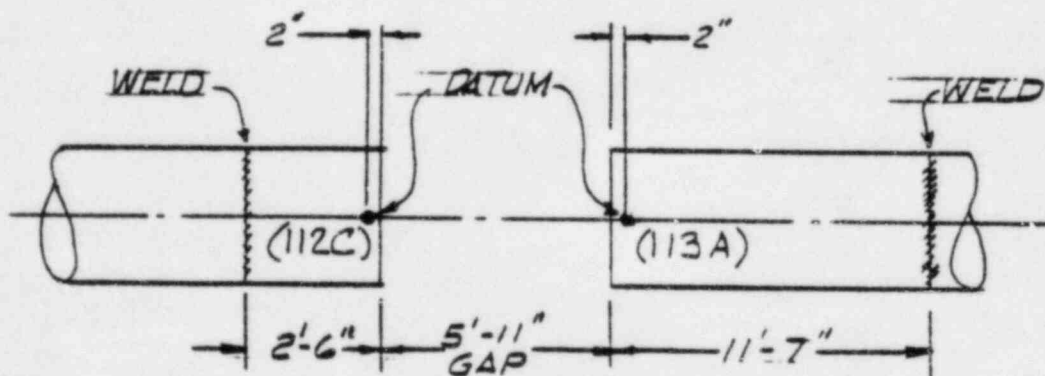
1. ZERO "DATUM" POINT ELEV. MEASUREMENT MADE BY CPCO.

PIPE	DATUM POINT	ELEV. (FT.)
26-OHBC-19	112C	625.326
26-OHBC-19	113A	625.337
26-OHBC-20	74C	625.338
26-OHBC-20	75A	625.372



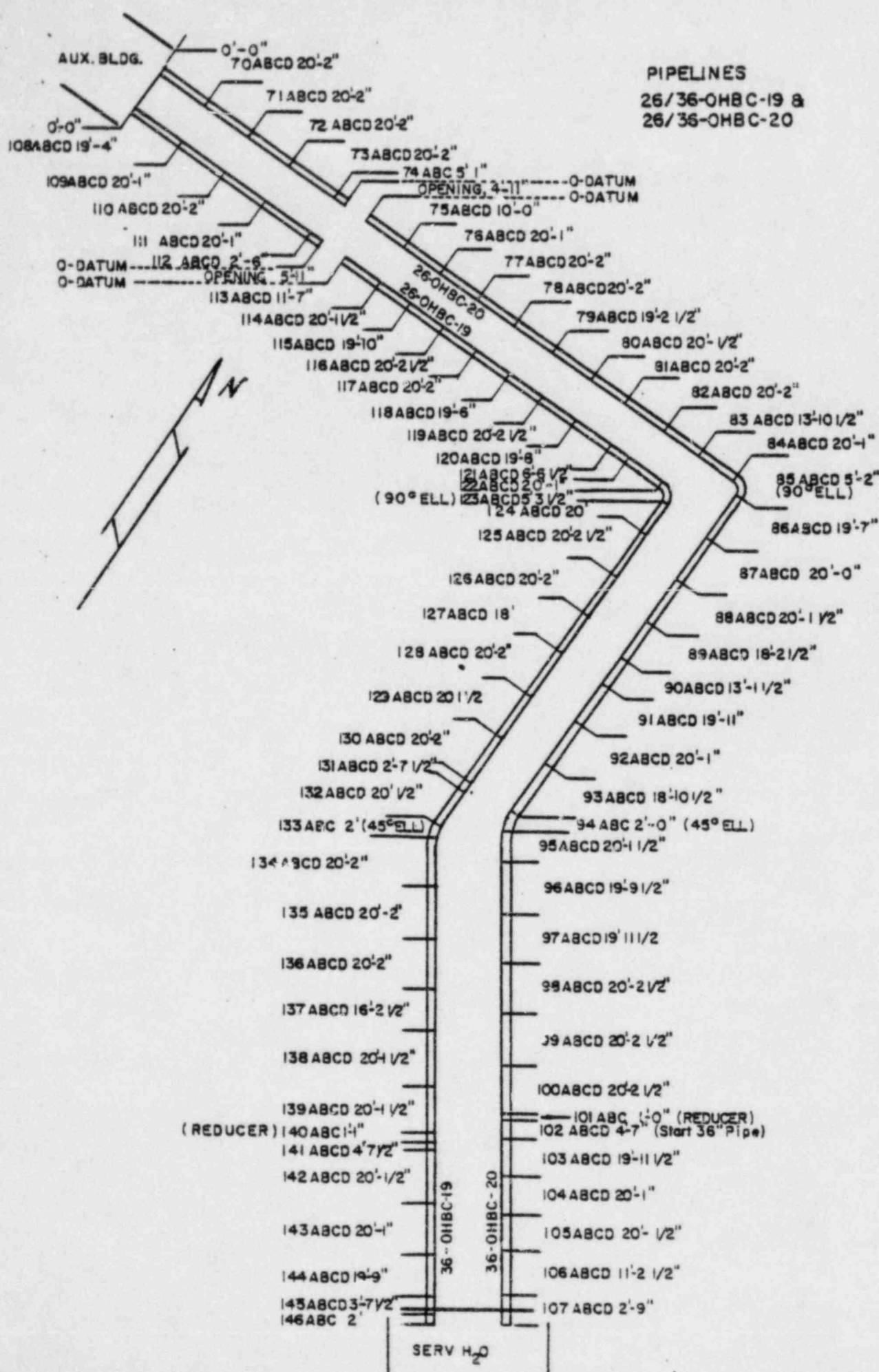
DETAIL A

2. DATUM POINT LOCATED ON INSIDE BOTTOM SURFACE OF PIPE.



DETAIL B

PIPELINES 26-OHBC-19 AND 26-OHBC-20  
DATUM POINT LOCATION



PIPELINES  
 26/36-OHBC-19 &  
 26/36-OHBC-20

AUX. BLDG.

0'-0"

108 ABCD 19'-4"

O-DATUM

O-DATUM

(REDUCER)

SERV H<sub>2</sub>O

134 ABCD 20'-2"

135 ABCD 20'-2"

136 ABCD 20'-2"

137 ABCD 16'-2 1/2"

138 ABCD 20'-1 1/2"

139 ABCD 20'-1 1/2"

140 ABC 1'-4"

141 ABCD 4'-7 1/2"

142 ABCD 20'-1 1/2"

143 ABCD 20'-1"

144 ABCD 19'-9"

145 ABCD 3'-7 1/2"

146 ABC 2'

130 ABCD 20'-2"

131 ABCD 2'-7 1/2"

132 ABCD 20'-1 1/2"

133 ABC 2' (45° ELL)

129 ABCD 20'-1 1/2"

128 ABCD 20'-2"

127 ABCD 18'

126 ABCD 20'-2"

125 ABCD 20'-2 1/2"

124 ABCD 20'

123 ABCD 5'-3 1/2"

122 ABCD 20'-1 1/2"

121 ABCD 6'-6 1/2"

120 ABCD 19'-8"

119 ABCD 20'-2 1/2"

118 ABCD 19'-6"

117 ABCD 20'-2"

116 ABCD 20'-2 1/2"

115 ABCD 19'-10"

114 ABCD 20'-1 1/2"

113 ABCD 11'-7"

112 ABCD 2'-9"

111 ABCD 20'-1"

110 ABCD 20'-2"

109 ABCD 20'-1"

108 ABCD 19'-4"

94 ABC 2'-0" (45° ELL)

93 ABCD 18'-10 1/2"

92 ABCD 20'-1"

91 ABCD 19'-11"

90 ABCD 13'-1 1/2"

89 ABCD 18'-2 1/2"

88 ABCD 20'-1 1/2"

87 ABCD 20'-0"

86 ABCD 19'-7"

85 ABCD 5'-2" (90° ELL)

84 ABCD 20'-1"

83 ABCD 13'-10 1/2"

82 ABCD 20'-2"

81 ABCD 20'-2"

80 ABCD 20'-1 1/2"

79 ABCD 19'-2 1/2"

78 ABCD 20'-2"

77 ABCD 20'-2"

76 ABCD 20'-1"

75 ABCD 10'-0"

74 ABC 5'-1"

73 ABCD 20'-2"

72 ABCD 20'-2"

71 ABCD 20'-2"

70 ABCD 20'-2"

0'-0"

PIPE 26-OHBC-19 and 36-OHBC-19

Item	Pipe	Length	Sections	Section Length	Remarks
108	Pipe	19'-4"	ABCD	6'-5"	At Auxiliary Building
109	Pipe	20'-1"	ABCD	6'-8"	
110	Pipe	20'-2"	ABCD	6'-8½"	
111	Pipe	20'-1"	ABCD	6'-8"	
112	Pipe	2'-6"	ABCD	0'-10"	
113	Pipe	11'-7"	ABCD	3'-10"	Opening Between 112 and 113
114	Pipe	20'-1½"	ABCD	6'-8½"	
115	Pipe	19'-10"	ABCD	6'-7"	
116	Pipe	20'-2½"	ABCD	6'-9"	
117	Pipe	20'-2"	ABCD	6'-8½"	
118	Pipe	19'-6"	ABCD	6'-6"	
119	Pipe	20'-2½"	ABCD	6'-9"	
120	Pipe	19'-8"	ABCD	6'-7"	
121	Pipe	6'-6½"	ABCD	2'-2"	
122	Pipe	20'-1"	ABCD	6'-8"	
123	90° ELL	5'-3½"	ABCD	1'-9"	
124	Pipe	20'-0"	ABCD	6'-8"	
125	Pipe	20'-2½"	ABCD	6'-9"	
126	Pipe	20'-2"	ABCD	6'-8½"	
127	Pipe	18'-0"	ABCD	6'-0"	
128	Pipe	20'-2"	ABCD	6'-8½"	
129	Pipe	20'-1½"	ABCD	6'-8½"	
130	Pipe	20'-2"	ABCD	6'-8½"	
131	Pipe	2'-7½"	ABCD	0'-10½"	
132	Pipe	20'-½"	ABCD	6'-8"	
133	45° ELL	2'-0"	ABC	1'-0"	
134	Pipe	20'-2"	ABCD	6'-8½"	
135	Pipe	20'-2"	ABCD	6'-8½"	
136	Pipe	20'-2"	ABCD	6'-8½"	
137	Pipe	16'-2½"	ABCD	5'-5"	
138	Pipe	20'-1½"	ABCD	6'-8½"	
139	Pipe	20'-1½"	ABCD	6'-8½"	End of 26-OHBC-19 36" to 26" Reducer
140	Reducer	1'-1"	ABC	0'-6½"	
141	Pipe	4'-7½"	ABCD	1'-6½"	Start 36-OHBC-19
142	Pipe	20'-½"	ABCD	6'-8"	
143	Pipe	20'-1"	ABCD	6'-8"	
144	Pipe	19'-9"	ABCD	6'-7"	
145	Pipe	3'-7½"	ABCD	1'-2½"	
146	Pipe	2'-0"	ABC	1'-0"	At Service Water Pump Structure

PIPE 26-OHBC-20 AND 36-OHEC-20

Item	Pipe	Length	Sections	Section Length	Remarks
70	Pipe	20'-2"	ABCD	6'-8½"	At Auxiliary Building
71	Pipe	20'-2"	ABCD	6'-8½"	
72	Pipe	20'-2"	ABCD	6'-8½"	Opening Between 74 and 75
73	Pipe	20'-2"	ABCD	6'-8½"	
74	Pipe	5'-1"	ABC	2'-6½"	
75	Pipe	10'-0"	ABCD	3'-4"	
76	Pipe	20'-1"	ABCD	6'-8"	
77	Pipe	20'-2"	ABCD	6'-8½"	
78	Pipe	20'-2"	ABCD	6'-8½"	
79	Pipe	19'-2½"	ABCD	6'-5"	
80	Pipe	20'-½"	ABCD	6'-8"	
81	Pipe	20'-2"	ABCD	6'-8½"	
82	Pipe	20'-2"	ABCD	6'-8½"	
83	Pipe	13'-10½"	ABCD	4'-7½"	
84	Pipe	20'-1"	ABCD	6'-8"	
85	90° ELL	5'-2"	ABCD	1'-9"	
86	Pipe	19'-7"	ABCD	6'-6"	
87	Pipe	20'-0"	ABCD	6'-8"	
88	Pipe	20'1½"	ABCD	6'-8½"	
89	Pipe	18'-2½"	ABCD	6'-1"	
90	Pipe	13'-1½"	ABCD	4'-4½"	
91	Pipe	19'-11"	ABCD	6'-8"	
92	Pipe	20'-1"	ABCD	6'-8"	
93	Pipe	18'-10½"	ABCD	6'-3½"	
94	45° ELL	2'-0"	ABC	1'-0"	
95	Pipe	20'-1½"	ABCD	6'-8½"	
96	Pipe	19'-9½"	ABCD	6'-7"	
97	Pipe	19'-11½"	ABCD	6'-8"	
98	Pipe	20'-2½"	ABCD	6'-9"	
99	Pipe	20'-2½"	ABCD	6'-9"	
100	Pipe	20'-2½"	ABCD	6'-9"	End of 26-OHBC-20
101	Reducer	1'-0"	ABC	0'-6"	36" to 26" Reducer
102	Pipe	4'-7"	ABCD	1'-6"	Start 36-OHEC-20
103	Pipe	19'-11½"	ABCD	6'-8"	
104	Pipe	20'-1"	ABCD	6'-8"	
105	Pipe	20'-½"	ABCD	6'-8"	
106	Pipe	11'-2½"	ABCD	3'-9"	
107	Pipe	2'-9"	ABCD	0'-11"	At Service Water Pump Structure



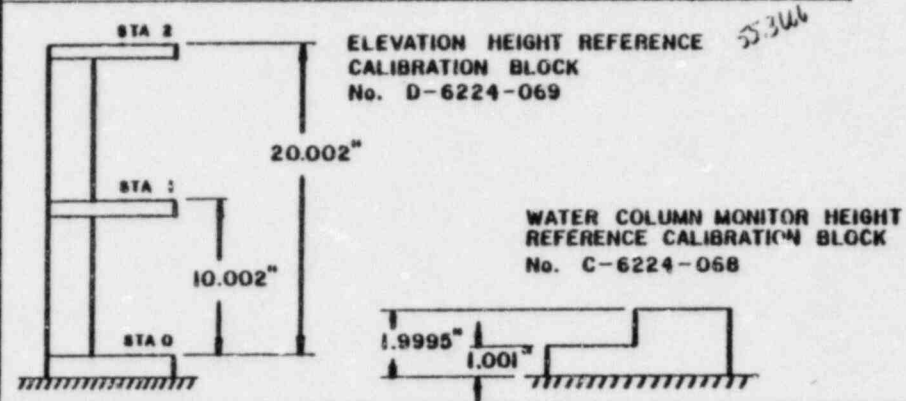
APPENDIX B

PIPE CALIBRATION AND ELEVATION DATA RECORDS

## SWRI CALIBRATION RECORD

PROJECT No. <b>17-6542-003</b>	SITE <b>MIDLAND</b>	DATE (DAY-MO-YR) <b>15-9-81</b>	TIME (24 HR CLOCK) <b>1345</b>	SHEET No. <b>0018</b>
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. <b>IX-ME-101-2</b>	INSTRUMENT (WTR COL MON) <b>MORTEC</b>	SERIAL No. <b>1310-317</b>	WATER COLUMN TRANSDUCER <b>SURE 2034</b>
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER <b>SETKA 41081</b>	INSTRUMENT (DIGIT VOLT M.) <b>ENT</b>	SERIAL No. <b>38521</b>	THICKNESS TRANSDUCER No. <b>AEROTEC 012661M</b>

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES/VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	.6189	71°	-	55.35	1348	1.001	2.000	1345	ENTERING PIPES 70-74
10.002	↓	.4382	71°	-	55.35	1350	1.000	2.000	1411	
20.002	↓	.2575	71°	-	55.35	1351	1.000	2.000	1428	
0	1.7	.6188	71°	-	55.41	1352	1.000	1.999	1442	
10.002	↑	.4383	71°	-	55.31	1352	1.000	1.997	1506	
20.002	1.7	.2575	71°	-	55.36	1353	.999	1.997	1532	
					55.305					
0	1.70	.6197	74°	-	55.32	1438				EXIT FROM PIPES 70-74
10.002	1.70	.4389	74°	-	55.40	1439				AND ENTERING PIPES 108-112
20.002	1.70	.2581	74°	-	55.36	1440				
0	1.700	.6199	73°	-	55.34	1528				EXIT FROM PIPES 108-112
10.002	1.70	.4394	73°	-	55.37	1530				
20.002	1.70	.2588	73°	-	55.39	1531				
AVERAGE "C" FOR ALL RUNS					55.361					



PP 26-0101-1

SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 15 SEP 81	TIME (24 HR CLOCK) 1356	SHEET No. 0019
1) EXAMINER (SIGNATURE) J.E. Rader	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Noetec	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SWRT 2034
2) EXAMINER S.P.A.	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. AEROTEC 012-661M
TEST PIPE IDENTIFICATION 26-0 HBC-20 -Toward Aux. BLDG (280 FT)		AVERAGE °C 55.361		CALIBRATION SHEET No. 0018

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
747A (74C)	1.70	.8257	69°	-.037	0	1356	First Point 2" from bot.
747A (74D)	"	.8257	69°	-	0	1400	Bottom of Trans. is off point
74B	"	.8265	70°	.8264	-.039	1404	due to weld bead at bottom
74A	"	.8276	71°	.8273	-.089	1406	No weld interference
73D	"	.8285	71°	.8282	-.138	1407	
73C	"	.8309	71	.8306	-.271	1408	
73B	"	.8330	71	.8327	-.388	1410	CAL. LOCITE
73A	"	.8361	71	.8358	-.559	1413	
72D	"	.8372	71	.8369	-.620	1414	
72C	"	.8372	72	.8368	-.615	1415	
72B	"	.8367	72	.8363	-.587	1416	
74A	"	.8340	72	.8336	-.437	1417	
71D	"	.8356	72	.8332	-.415	1418	
71C	"	.8276	72	.8272	-.083	1419	
71B	"	.8190	72	.8186	+3.93	1420	
71A	"	.8071	73	.8066	+1.057	1422	
70D	"	.8077	73	.8072	+1.024	1423	
70C	"	.7966	74	.7960	+1.644	1424	
70B	"	.7890	75	.7883	+2.347	1425	
70A	"	.7641	75	.7684	+3.172	1427	end
71C	"	.8276	75	.8269	-.066	1430	Re Bur. on way out

END







### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
5519-003	Northwood	15 Sep 81	1440	0021			
1) EXAMINER (SIGNATURE)	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
J. Ritter	1K-91F 101-2	Wortec	1310-317	SWRI 2034			
2) EXAMINER	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
J. Ritter	Serie 41081	ENV	38521	Acetesh 01266111			
TEST PIPE IDENTIFICATION			AVERAGE °C	CALIBRATION SHEET No.			
26-048C-19 - Toward Arr Bldg (280 ft.)			55.361	0018			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
112C	1.700	18254	71 <sup>0.0018</sup>	-	0	1449	START (REFERENCE POINT)
112B	1.7	18257	71 <sup>0</sup>	-	-0.018	1450	
112A	1.7	18273	71 <sup>0</sup>	-	-0.011	1451	
111D	1.7	18290	71 <sup>0</sup>	-	-0.020	1452	
111C	1.7	18358	71 <sup>0</sup>	-	-0.576	1454	in weld
111B	1.7	18435	71 <sup>0</sup>	-	-1.002	1458	side of weld on down
111C	1.7	18356	71 <sup>0</sup>	-	-0.565	1800	Re take on side of weld
111D	1.7	18290	71 <sup>0</sup>	-	-0.200	1501	Center, Pipe
111A	1.7	18514	71 <sup>0</sup>	-	-1.440	1503	side of weld
110D	1.7	18523	71 <sup>0</sup>	-	-1.490	1504	Center of Pipe
110C	1.7	18568	71 <sup>0</sup>	-	-1.740	1505	
110B	1.7	18619	71 <sup>0</sup>	-	-2.021	1507	
110A	1.7	18635	72 <sup>0.0018</sup>	0.8634	-2.103	1508	
109D	1.7	18633	72	0.8632	-2.092	1509	
109C	1.7	18581	72	0.8590	-1.804	1510	
109B	1.7	18488	72	0.8487	-1.290	1511	
109A	1.7	18362	72	0.8361	-0.592	1512	
108D	1.7	18356	72	0.8335	-0.448	1513	
108C	1.7	9109	72	0.8108	+0.825	1515	
108B	1.7	17933	73 <sup>0.0018</sup>	0.7932	+1.182	1516	
108A	1.7	17743	73	0.7741	+1.840	1517	END



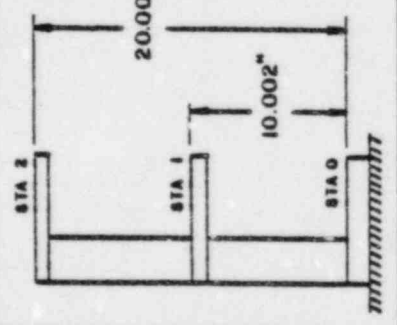
# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE Milled	DATE (DAY-MO-YR) No Sept 81	TIME (24 HR CLOCK) 0747	SHEET No. 0023
1) EXAMINER (SIGNATURE) [Signature]	PROCEDURE No. 1X-10E-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SwRI 2034
2) EXAMINER J.E. Ritter	PRESSURE TRANSDUCER Setra 41081	INSTRUMENT (DIGIT VOLT M.) EINL	SERIAL No. 38531	THICKNESS TRANSDUCER No. Aerotec 01266101

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSUCER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	1.6166	52	-	55.321	0749	1.000	2.000	0748	
10.002	1.7	1.4358	52	-	55.349	0750	1.001	2.000	0756	
20.002	1.7	1.2548	52	-	55.185	0751	1.000	2.001	0822	
0	1.7	1.6106	53	-	55.351	0752	1.001	1.997	0859	
10.002	1.7	1.4359	53	-	55.249	0753	1.002	2.000	0917	
20.002	1.7	1.2549	53	-	55.300	0754	1.001	2.001	0945	
0	1.7	1.685	68	-	55.321	1218	1.003	1.999	0956	
10.002	1.7	1.4350	66	-	55.371	1211	1.001	2.002	1039	
0	1.7	1.514	67	-	55.346	1221	1.002	2.002	1103	
10.002	1.7	1.4383	67	-	55.403	1222	1.001	2.000	1133	
20.002	1.7	1.2576	67	-	55.341	1213	1.002	2.002	1200	
					55.374	1224	1.003	2.003	1216	
AVERAGE "C" FOR ALL RUNS							1.003	2.003	1225	

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK No. D-6224-069



WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK No. C-6224-068



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Mildred	16 SEP 81	0804	024			
1) EXAMINER (SIGNATURE) S. J. C. [Signature]	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) NORTEC	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER S-218 2034			
2) EXAMINER J. E. Ritter	PRESSURE TRANSDUCER S-218 4081	INSTRUMENT (DIGIT VOLT M.) ENT	SERIAL No. 38521	THICKNESS TRANSDUCER No. A p. spec 0126614			
TEST PIPE IDENTIFICATION 26-0HBC - 20 toward water pit STA. 028							
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
75A	1.7	8165	55	-		0806	First Point & From Out
75B	1.7	8148	55	-	.094	0808	
75C	1.7	8136	55	-	.160	0809	
75A	1.7	8165	55	-	.000	0810	Recheck 1st Point
75D	1.7	8140	55	-	.138	0812	
76A	1.7	8135	55	-	.166	0813	
76B	1.7	8047	55	-	.376	0814	
76C	1.7	8084	55	-	.448	0815	
76D	1.7	8087	56	.8086	.437	0817	
77A	1.7	8094	56	.8093	.398	0818	
77B	1.7	8157	56	.8156	.050	0819	
77C	1.7	8247	56	.8246	-.448	0820	
77D	1.7	8337	56	.8336	-.946	0821	
78A	1.7	8336	56	.8335	-.940	0827	
78B	1.7	8427	57	.8424	-1.432	0824	
78C	1.7	8522	57	.8519	-1.958	0825	
79A	1.7	8609	57	.8606	-2.439	0826	
79B	1.7	8610	57	.8609	-2.444	0827	
79C	1.7	8666	57	.8663	-2.754	0828	
79D	1.7	8709	57	.8706	-2.992	0829	
79E	1.7	8741	58	.8737	-3.163	0830	



### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 16 SEPT 81	TIME (24 HR CLOCK) 11:30	SHEET No. 0025			
1) EXAMINER (SIGNATURE) G. J. A.	PROCEDURE No. IX-MIE-101-2	INSTRUMENT (WTR COL MON) WATER	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER SWRI 2034			
2) EXAMINER J. E. Ritter	PRESSURE TRANSDUCER G. P. T. 41081	INSTRUMENT (DIGIT VOLT M.) E.V.I.	SERIAL No. 38521	THICKNESS TRANSDUCER No. APERTURE 012661.9			
TEST PIPE IDENTIFICATION 26-OHBC-20 toward water pipe sta.							
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
80A	1.7	.8754	58	.8750	-3.235	0832	
80B	1.7	.8754	58	.8750	-3.235	0833	
80C	1.7	.8722	58	.8718	-3.051	0835	
80D	1.7	.8688	58	.8684	-2.870	0836	
81A	1.7	.8675	59	.8670	-2.793	0837	
81B	1.7	.8660	59	.8655	-2.710	0839	
81C	1.7	.8637	59	.8632	-2.583	0840	
81D	1.7	.8596	59	.8591	-2.356	0842	
82A	1.7	.8597	59	.8592	-2.361	0843	
82B	1.7	.8551	60	.8545	-2.101	0845	
82C	1.7	.8516	60	.8510	-1.908	0847	
82D	1.7	.8489	60	.8483	-1.759	0848	
83A	1.7	.8496	60	.8490	-1.797	0850	
83B	1.7	.8489	60	.8483	-1.759	0852	
83C	1.7	.8470	60	.8464	-1.653	0853	
83D	1.7	.8461	60	.8455	-1.604	0855	
84A	1.7	.8457	60	.8451	-1.582	0856	
84B	1.7	.8481	60	.8475	-1.714	0858	
84C	1.7	.8531	60	.8525	-1.991	0910	
84D	1.7	.8574	60	.8568	-2.229	0903	
85A	1.7	.8583	60	.8577	-2.278	0910	First check in 90° elbow

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
11-6542-023	Midland	16 Sept 81	0907	0026			
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
	X-ME-14-2	Nortec	1310-317	SWRI 2034			
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
	Septec 411081	EMT	38521	Arstech 026114			
TEST PIPE IDENTIFICATION	AVERAGE °C		CALIBRATION SHEET No.				
20-OHBC-20	55.301		0023				
PIPE POSITION (FT)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
85B	1.7	.9590	60	.8584	-2.317	0908	
85C	1.7	.8580	60	.8574	-2.262	0910	
85D	1.7	.8540	60	.8534	-2.041	0911	End of 90° Elbow
86A	1.7	.8516	60	.8510	-1.908	0912	
86B	1.7	.8396	61	.8338	-.957	0914	
86C	1.7	.8166	61	.8158	-.029	0919	
86D	1.7	.8002	61	.7994	+ .946	0922	
87A	1.7	.7982	61	.7974	+ 1.056	0923	
87B	1.7	.7857	61	.7849	+ 1.748	0925	
87C	1.7	.7103	61	.7695	+ 2.599	0926	
87D	1.7	.7562	62	.7553	+ 3.384	0928	
88A	1.7	.7544	62	.7535	+ 3.484	0929	
88B	1.7	.7444	62	.7435	+ 4.037	0931	
88C	1.7	.7330	62	.7321	+ 4.667	0933	
89A	1.7	.7240	62	.7231	+ 5.165	0935	
89B	1.7	.7245	62	.7236	+ 5.137	0936	
89C	1.7	.7175	62	.7169	+ 5.508	0938	
89D	1.7	.7117	62	.7108	+ 5.845	0939	
90A	1.7	.7071	63	.7061	+ 6.105	0941	
90B	1.7	.7071	63	.7061	+ 6.105	0943	
90C	1.7	.7025	63	.7018	+ 6.343	0944	

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17 65-6A-003	SITE midland	DATE (DAY-MO-YR) 16 Sept 81	TIME (24 HR CLOCK) 0945	SHEET No. 0287			
1) EXAMINER (SIGNATURE) <i>J. L. Little</i>	PROCEDURE No. 1X-PIPE-101-Z	INSTRUMENT (WTR COL MON) NORTE	SERIAL No. 13A0-317	WATER COLUMN TRANSDUCER SINKI 2035			
2) EXAMINER <i>J. L. Little</i>	PRESSURE TRANSDUCER 5720 4165	INSTRUMENT (DIGIT VOLT M.) J.I.	SERIAL No. 38521	THICKNESS TRANSDUCER No. Apostle 01261 m			
TEST PIPE IDENTIFICATION 20-0HBC-20		AVERAGE °C 55.301		CALIBRATION SHEET No. 022B			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
90C	1.7	.6977	63	.6967	+6.625	0946	
90D	1.7	.6939	63	.6929	+6.835	0947	
91A	1.7	.6927	63	.6917	+6.902	0948	
91B	1.7	.6670	63	.6860	+7.217	0950	
91C	1.7	.6836	64	.6825	+7.410	0953	
91D	1.7	.6809	64	.6797	+7.565	0954	
92A	1.7	.6791	64	.6780	+7.659	0955	
92B	1.7	.6757	64	.6746	+7.847	1004	
92C	1.7	.6765	64	.6754	+7.803	1007	
92D	1.7	.6808	64	.6797	+7.565	1009	
93A	1.7	.6815	64	.6807	+7.510	1010	
93B	1.7	.6929	64	.6917	+6.902	1011	
93C	1.7	.7033	65	.7020	+6.332	1013	
93D	1.7	.7104	65	.7091	+5.939	1015	
94A	1.7	.7121	65	.7108	+5.845	1017	START @ 45° SLOPE
94B	1.7	.7123	65	.7110	+5.834	1018	4 of 45°
94C	1.7	.7127	65	.7114	+5.812	1019	END of 45° SLOPE
95A	1.7	.7106	65	.7089	+5.956	1021	
95B	1.7	.6992	65	.6979	+6.559	1023	SIDE of weld
95C	1.7	.6565	66	.6654	+7.250	1025	"
55D	1.7	.6787	66	.6773	+7.698	1027	"



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-033	SITE Middleland	DATE 1.5.81	TIME (24 HR CLOCK) 1028	SHEET No. 0028
1) EXAMINER (SIGNATURE) G. J. Ritter	PROCEDURE No. 12-11E-10-2	INSTRUMENT (WTR COL LON) Nortec	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER Serial 2034
2) EXAMINER F. J. Ritter	PRESSURE TRANSDUCER S-4r2 41081	INSTRUMENT (DIGIT VOLT M.) 2.5E	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerated 102 (6.1) 11
TEST PIPE IDENTIFICATION 20-OHBC-20		AVERAGE °C 55.301		CALIBRATION SHEET No. 0023

PIPE POSITION (FT)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
96A	1.7	6796	66	6782	+7.648	1029	at bottom of pipe
96B	1.7	6669	66	6655	+8.350	1031	
96C	1.7	6613	66	6599	+8.660	1032	
96D	1.7	6533	65	6520	+9.097	1100	
97A	1.7	6533	65	6520	+9.097	1101	
97B	1.7	6533	65	6520	+9.097	1103	
97C	1.7	6548	65	6535	+9.014	1105	
97D	1.7	6586	65	6573	+8.804	1106	
98A	1.7	6593	65	6580	+8.765	1107	
98B	1.7	6696	65	6613	+8.583	1108	
98C	1.7	6689	66	6675	+8.240	1110	
98D	1.7	6689	66	6675	+8.240	1112	
99A	1.7	6682	66	6668	+8.279	1113	
99B	1.7	6656	66	6642	+8.422	1115	
99C	1.7	6603	66	6589	+8.715	1117	Side of world
99D	1.7	6603	66	6589	+8.715	1118	
100A	1.7	6621	66	6607	+8.616	1119	100/100
100B	1.7	6660	67	6645	+8.406	1120	
100C	1.7	6763	67	6748	+7.836	1122	
100D	1.7	6850	67	6875	+7.134	1123	
101A	1.7	7110	67	7165	+5.530	1125	Final 26' on between 36" pipe



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542	SITE Midland	DATE 16 Sept 71	TIME (24 HR CLOCK) 1125	SHEET No. 0024
1) EXAMINER (SIGNATURE) D. A. Ritter	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SWRT 2034
2) EXAMINER J. S. Ritter	PRESSURE TRANSDUCER Sair 41081	INSTRUMENT (DIGIT VOLT M.) Elli	SERIAL No. 38521	THICKNESS TRANSDUCER No. Accutec 01200174
TEST PIPE IDENTIFICATION 26.0HBC-20		AVERAGE °C 55.301	CALIBRATION SHEET No. 0023	

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
101 B	1.7	.7471	67 <sup>(.001)</sup>	.7466	+3.866	1126	Redden up body
102 A	1.7	.7736	67	.7721	+2.455	1129	Start of 36" pipe T Pipe
102 B	1.7	.7801	67	.7786	+2.096	1130	
102 C	1.7	.7830	67	.7815	+1.936	1132	
102 D	1.7	.7787	67	.7772	+2.173	1133	
103 A	1.7	.7831	67	.7816	+1.930	1134	
103 B	1.7	.7909	67	.7894	+1.499	1135	
103 C	1.7	.7983	67	.7968	+1.089	1136	END of Hose - MAX. REACH - SEE
96 C	1.7	.6594	68 <sup>(.001)</sup>	.6577	+8.782	1149	DATA SHEET NO. 0038 FOR
96 B	1.7	.6686	68	.6669	+8.273	1152	REMAINDER OF DATA POINTS
95 B	1.7	.6991	68	.6974	+6.586	1156	IN PIPE 36-0HBC-20
89 C	1.7	.7117	68	.7100	+5.890	1201	
82 D	1.7	.8502	68	.8495	-1.770	1208	Reconnect water from system.
77 B	1.7	.8161	69	.8144	+1.116	1212	
75 A	1.7	.9178	69	.9161	+1.022	1215	Start Point
75 A	1.7	.8185	69 <sup>(.001)</sup>	.8171	-1.033	1226	out for lunch
75 A	1.7	.8178	58 <sup>(.001)</sup>	.8174	-1.049	1344	

# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 16 SEP 81	TIME (24 HR CLOCK) 1345	SHEET No. 0030
1) EXAMINER (SIGNATURE) <i>D. G. A.</i>	PROCEDURE No. IX-1WE-101-2	INSTRUMENT (WTR COL MON) MURTEC	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>J. R. Little</i>	PRESSURE TRANSDUCER SETRA 44081	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Approved 012661M

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANS. TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES/VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.70	6.184	58	-	55.321	1339	1.001	2.000	1344	Entered by Pq-20-040c-20
10.002	1.70	4.376	55	-	55.249	1340	1.001	2.001	1415	
20.002	1.70	2.566	58	-	55.285	1342	1.001	2.001	1453	
0	1.70	6.182	58	-	55.382	1346	1.002	2.001	1526	
10.002	1.70	4.376	58	-	55.310	1347	1.002	2.001	1600	
20.002	1.70	2.528	58	-	55.346	1349	1.001	1.999	1657	
55.315										
0	1.70	6.184	64	-	55.361	1653				
10.002	1.70	4.377	64	-	55.279	1654				
20.002	1.70	2.568	64	-	55.315	1656				
0	1.70	6.186	62	-	55.321	1659				
10.002	1.70	4.378	62	-	55.493	1700				
20.002	1.70	2.576	62	-	55.410	1702				
AVERAGE "C" FOR ALL RUNS						55.338				
						55.341				

STA 2

20.002"

STA 1

10.002"

STA 0

1.9995"

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK No. D-6224-069

WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK No. C-6224-068

# SWHI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	MAIDLAND	16 SEP 81	1350	0031			
1) EXAMINER (SIGNATURE) S. J. Pitta	PROCEDURE No. 11-14E-101-2	INSTRUMENT (WTR COL MON) NORTEC	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SU-PE 1034			
2) EXAMINER S. J. Pitta	PRESSURE TRANSDUCER SETRA 41001	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. AEROTEC D12661M			
TEST PIPE IDENTIFICATION 26-DHBC-19 Toward Water Pump Station			AVERAGE °C 55.338	CALIBRATION SHEET No. 0030			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
113 A	1.7	.8214	58 <sup>0.0011</sup>	-	0	1351	2" from cut - start
113 B	1.7	.8208	58	-	+0.033	1352	
113 C	1.7	.8142	58	-	+1.122	1353	
113 D	1.7	.8180	56	-	+1.188	1355	
114 A	1.7	.8182	59 <sup>0.0011</sup>	.8181	+1.183	1358	
114 B	1.7	.8170	59	.8169	+1.249	1359	
114 C	1.7	.8174	59	.8173	+1.227	1400	
114 D	1.7	.8241	59	.8240	-1.144	1401	
115 A	1.7	.8256	59	.8255	-1.227	1402	
115 B	1.7	.8324	59	.8328	-1.631	1403	
115 C	1.7	.8434	59	.8433	-1.817	1404	
115 D	1.7	.8565	59	.8564	-1.940	1405	
116 A	1.7	.8561	59	.8560	-1.915	1406	start to weld on side
116 B	1.7	.8652	59	.8651	-2.418	1407	11
116 C	1.7	.8771	59	.8770	-3.077	1408	11
116 D	1.7	.8873	59	.8872	-3.641	1409	
117 A	1.7	.8818	59	.8817	-3.780	1410	
117 B	1.7	.8913	60 <sup>0.0013</sup>	.8911	-4.30	1411	
117 C	1.7	.9133	60	.9131	-5.074	1412	
117 D	1.7	.9254	60	.9252	-5.744	1413	
118 A	1.7	.9266	60	.9264	-5.810	1414	



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE 16 Sept 61	TIME (24 HR CLOCK) 1415	SHEET No. 0032
1) EXAMINER (SIGNATURE) <i>G. D. Pitt</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER SWRT 0031
2) EXAMINER <i>J. R. Little</i>	PRESSURE TRANSDUCER Setra 41081	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. A-101-11-01200-11
TEST PIPE IDENTIFICATION 26-01180-19			AVERAGE °C 55.338	CALIBRATION SHEET No. 0030

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
118 B	1.7	.9251	60.0002	.9219	-5.727	1416	
118 C	1.7	.9193	60	.9191	-5.406	1417	
118 D	1.7	.9129	60	.9127	-5.052	1418	
119 A	1.7	.9119	60	.9117	-4.997	1419	
119 B	1.7	.9083	60	.9081	-4.798	1420	
119 C	1.7	.9053	60	.9051	-4.632	1421	
119 D	1.7	.9024	61 (1.0004)	.9020	-4.460	1422	
120 A	1.7	.9015	61	.9011	-4.410	1424	
120 B	1.7	.8970	61	.8966	-4.161	1425	
120 C	1.7	.8937	61	.8933	-3.979	1426	
120 D	1.7	.8870	61	.8866	-3.608	1427	
121 A	1.7	.8862	61	.8858	-3.563	1428	
121 B	1.7	.8844	62 (1.0002)	.8839	-3.457	1429	
121 C	1.7	.8824	62	.8819	-3.348	1430	
121 D	1.7	.8801	62	.8796	-3.221	1431	
122 A	1.7	.8787	62	.8782	-3.143	1432	
122 B	1.7	.8718	62	.8713	-2.761	1433	
122 C	1.7	.8645	62	.8641	-2.303	1434	
122 D	1.7	.8568	62	.8563	-1.931	1436	
123 A	1.7	.8571	62	.8566	-1.948	1437	Start of 90° Elbow
123 B	1.7	.8570	62	.8565	-1.947	1438	



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
176542-002	Midland	16 Sept 81	1438	0033			
1) EXAMINER (SIGNATURE) <i>El Ota</i>	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
	IX-mE 101-2	1107tee	1310-37	SWRI 2034			
2) EXAMINER <i>J.R. Little</i>	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
	Sctra 41081	ENT	38524	Asst. Tech 012661 M			
TEST PIPE IDENTIFICATION	26-048C-19		AVERAGE °C	CALIBRATION SHEET No.			
			55.358	0030			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.Y. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
123 C	1.7	.8539	62.005	.8524	-1.771	1439	
123 D	1.7	.8522	62	.8517	-1.677	1440	ENT of 90° E. in W
124 A	1.7	.8510	62	.8505	-1.610	1441	
124 B	1.7	.8454	62	.8449	-1.300	1444	
124 C	1.7	.8356	62	.8351	-0.758	1446	
124 D	1.7	.8255	62	.8250	-1.199	1448	
125 A	1.7	.8259	63 (corr)	.8254	-0.221	1449	
125 B	1.7	.8140	64 (corr)	.8133	+ .448	1454	
125 C	1.7	.7975	64	.7968	+ 1.361	1455	
125 D	1.7	.7805	64	.7798	+2.302	1457	
126 A	1.7	.7786	64	.7779	+2.407	1457	
126 B	1.7	.7623	64	.7616	+3.509	1459	
126 C	1.7	.7424	64	.7417	+4.410	1500	
126 D	1.7	.7235	64	.7228	+5.456	1502	
127 A	1.7	.7236	64	.7229	+5.451	1503	
127 B	1.7	.7075	64	.7068	+6.342	1504	
127 C	1.7	.6924	64	.6917	+7.178	1505	
127 D	1.7	.6795	64	.6788	+7.891	1506	
128 A	1.7	.6719	64	.6712	+7.870	1507	
128 B	1.1	.6731	64	.6724	+8.245	1508	
128 C	1.7	.6625	64	.6617	+8.539	1510	

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 16 Sept 81	TIME (24 HR CLOCK) 15:10	SHEET No. 0034
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-mE-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER Srt. 41081	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec 01266141
TEST PIPE IDENTIFICATION <b>26-OHBC-19</b>			AVERAGE °C 55.338	CALIBRATION SHEET No. 0030

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
128 D	1.7	.6651	64	.6644	+ 8.689	15:11	
129 A	1.7	.6646	64	.6639	+ 8.716	15:12	
129 B	1.7	.6600	64	.6593	+ 8.970	15:13	
129 C	1.7	.6586	64	.6579	+ 9.048	15:14	
129 D	1.7	.6597	64	.6590	+ 8.987	15:16	
130 A	1.7	.6594	64	.6587	+ 9.003	15:17	
130 B	1.7	.6598	64	.6591	+ 8.981	15:18	
130 C	1.7	.6621	64	.6614	+ 8.854	15:20	
130 D	1.7	.6654	64	.6647	+ 8.671	15:21	
131 A	1.7	.6649	64	.6642	+ 8.699	15:22	
131 B	1.7	.6649	64	.6642	+ 8.649	15:23	
131 C	1.7	.6640	65 (over)	.6631	+ 8.760	15:24	
132 A	1.7	.6637	65	.6628	+ 8.777	15:25	
132 B	1.7	.6599	65	.6590	+ 8.987	15:26	
132 C	1.7	.6572	65	.6563	+ 9.136	15:27	
132 D	1.7	.6560	65	.6551	+ 9.203	15:29	
133 A	1.7	.6566	65	.6557	+ 9.170	15:30	Start of 45° Elbow
133 B	1.7	.6542	65	.6533	+ 9.302	15:31	
133 C	1.7	.6535	65	.6526	+ 9.341	15:32	End of 45° Elbow
134 A	1.7	.6515	65	.6506	+ 9.452	15:32	
134 B	1.7	.6462	65	.6453	+ 9.745	15:34	

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542 w/c	Midland	16 Sep 81	1535	2035			
1) EXAMINER (SIGNATURE) <i>W. Pitt</i>	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
	1X-ME-101-2	100701	B10-37	SWRI 2034			
2) EXAMINER (SIGNATURE) <i>F. Ritter</i>	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
	Set 2 41081	-1	3852	Arctec 01266101			
TEST PIPE IDENTIFICATION			AVERAGE °C	CALIBRATION SHEET No.			
	26-048C-19		55.338	0030			
PIPE POSITION (FT)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
134 C	1.7	.6410	65	.6401	+ 10.033	1535	
134 D	1.7	.6393	65	.6384	+ 10.127	1536	
135 A	1.7	.6395	65	.6386	+ 10.116	1538	
135 B	1.7	.6394	65	.6385	+ 10.121	1539	
135 C	1.7	.6431	65	.6422	+ 9.917	1541	
135 D	1.7	.6495	65	.6486	+ 9.562	1543	
136 A	1.7	.6492	65	.6483	+ 9.579	1544	
136 B	1.7	.6545	65	.6536	+ 9.386	1545	
136 C	1.7	.6580	65	.6571	+ 9.092	1547	
136 D	1.7	.6590	65	.6581	+ 9.057	1548	
137 A	1.7	.6598	65	.6589	+ 8.992	1550	
137 B	1.7	.6556	65	.6547	+ 9.225	1551	
137 C	1.7	.6557	65	.6546	+ 9.219	1553	
137 D	1.7	.6515	65	.6506	+ 9.120	1554	
138 A	1.7	.6589	65	.6580	+ 9.042	1555	
138 B	1.7	.6610	65	.6601	+ 8.926	1557	
138 C	1.7	.6710	65	.6701	+ 8.573	1558	
138 D	1.7	.6821	66	.6811	+ 7.764	1559	
139 A	1.7	.6836	66	.6825	+ 7.681	1600	
139 B	1.7	.6935	66	.6925	+ 7.133	1602	
139 C	1.7	.7055	66	.7045	+ 6.469	1603	



## SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. <i>17-6542-003</i>	SITE <i>midland</i>	DATE (DAY-MO-YR) <i>16 Sept 81</i>	TIME (24 HR CLOCK) <i>1604</i>	SHEET No. <i>0036</i>
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. <i>1X-ME-101-2</i>	INSTRUMENT (WTR COL MON) <i>Porter</i>	SERIAL No. <i>1310-37</i>	WATER COLUMN TRANSDUCER <i>SWRI 2034</i>
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER <i>Setra 410B1</i>	INSTRUMENT (DIGIT VOLT M.) <i>ENI</i>	SERIAL No. <i>28521</i>	THICKNESS TRANSDUCER No. <i>Aerotec 01266141</i>
TEST PIPE IDENTIFICATION <i>26-048C-19</i>			AVERAGE "C" <i>55.338</i>	CALIBRATION SHEET No. <i>0030</i>

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
139 D	1.7	.7159	66	.7149	+5.893	1605	END of 26" straight pipe
140 A	1.7	.7369	66	.7359	+4.731	1606	Start of Pipe Reducer downhill
140 B	1.7	.7859	66	.7849	+2.020	1607	Reduces downhill
141 A	1.7	.8044	66	.8034	+ .996	1609	"T" Pipe 36" Pipe
141 B	1.7	.8103	66	.8093	+ .680	1610	36" "T"
141 C	1.7	.8120	66	.8110	+ .576	1612	
* 141 D	1.7	.8085	66	.8075	+ .769	1613	
142 A	1.7	.8118	67 <sup>0.0011</sup>	.8107	+ .592	1615	Pipe drops at this point
142 B	1.7	.8179	67	.8168	+ .255	1617	
142 C	1.7	.8206	67	.8195	+ .105	1619	
142 D	1.7	.82080	67	.8069	+ .802	1622	MAX. SYSTEM REACH - See DATA Sheet 0041 FOR REMINDER OF DATA POINTS IN PIPE 36-048C-19
138 C	1.7	.6709	67	.6698	+8.389	1625	
134 C	1.7	.6404	67	.6393	+10.071	1631	
132 B	1.1	.6589	67	.6578	+9.053	1634	
127 B	1.7	.7076	66	.7066	+6.353	1640	
117 C	1.7	.9138	65	.9129	-5.063	1646	
113 A	1.7	.8214	64	.8207	+ .038	1651	
112 A	1.7	.8218	62	.8213	+ .006	1700	
113 A	1.7	.8218	62	.8213	+ .006	1704	



①

# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE MIDLAND	DATE 17 SEPT 81	TIME (24 HR CLOCK) 0912	SHEET No. 0037
1) EXAMINER (SIGNATURE) <i>J. C. Ritter</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) NOTIC	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>J. C. Ritter</i>	PRESSURE TRANSDUCER SETRA 41081	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec D12661M

WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANS. TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" JESSES VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	REMARKS
0	9543	58	-	55.382	0915	1.000	2.000	0913
10.002	7737	58	-	55.401	0916	1.000	2.000	0921
20.002	5932	58	-	55.392	0917	1.000	2.001	1002
0	9542	58	-	55.412	0918	1.001	2.001	1028
10.002	7737	58	-	55.401	0919	1.002	2.003	1053
20.002	5932	58	-	55.407	0920			
avg 55.399								
0	9549	67	-	55.138	1043			
10.002	7735	67	-	55.432	1044			
20.002	5931	67	-	55.285	1045			
0	9553	66	-	55.443	1049			
10.002	7749	66	-	55.340	1050			
20.002	5942	66	-	55.392	1051			
AVERAGE "C" FOR ALL RUNS 55.369								

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK No. D-6224-069

WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK No. C-6224-068

## SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003		SITE Middletown		DATE (DAY-MO-YR) 17 Sept 91		TIME (24 HR CLOCK) 0947		SHEET No. .0038	
1) EXAMINER (SIGNATURE) <i>(Signature)</i>		PROCEDURE No. IX-ME-101-2		INSTRUMENT (WTR COL MON) NORTEC		SERIAL No. 1310-37		WATER COLUMN TRANSDUCER SWRI 2034	
2) EXAMINER <i>J. Ritter</i>		PRESSURE TRANSDUCER SETRA 41081		INSTRUMENT (DIGIT VOLT M.) ENI		SERIAL No. 38521		THICKNESS TRANSDUCER No. AERITEC 012661M	
TEST PIPE IDENTIFICATION 36-DHAC-20 AT WATER PUMP STATION						AVERAGE "C" 55.369		CALIBRATION SHEET No. 0037	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS *	ADJUSTED ELEVATION	
100D	1.7	.1985	62 <sup>0011</sup>	-	+4.734	948	26" PIPE	7.189	
* 102A	A *	.2840	62	-	0 *	951	36" PIPE (DATUM)	2.455	
102B		.2917	62	-	-.426	952	* ADJUST ELEVATION	2.029	
102C		.2933	62	-	-.515	953	BY ADDING 2.455 INCHES	1.940	
102D		.2891	63 <sup>0017</sup>	.2890	-.277	955	IN ORDER TO TIE-IN	2.178	
103A		.2932	63	.2931	-.504	957	WITH DATA ON SHEET	1.951	
103B		.3020	63	.3019	-.991	958	No. 0029 FOR GRAPH	1.464	
103C		.3084	63	.3083	-1.345	1001	PRESENTATION.	1.110	
103D		.3114	63	.3113	-1.512	1003	COMMON DATA POINT	.943	
104A		.3120	64 <sup>0018</sup>	.3118	-1.539	1005	102A CHOSEN FOR	.916	
104B		.3082	64	.3080	-1.329	1006	DATUM.	1.126	
104C		.2990	64	.2988	-.819	1007		1.636	
104D		.2844	64	.2842	-.011	1008		2.444	
105A		.2836	65 <sup>0019</sup>	.2832	+0.044	1009		2.499	
105B		.2693	65	.2689	+0.836	1012		3.291	
105C		.2503	65	.2499	+1.888	1014		4.343	
105D		.2319	65	.2315	+2.907	1015		5.362	
106A		.2305	66 <sup>0021</sup>	.2300	+2.990	1016		5.445	
106B		.2230	66	.2225	+3.405	1017		5.860	
106C	V	.2159	66	.2154	+3.798	1018		6.253	
106D	1.7	.2102	66	.2097	+4.114	1019		6.569	

1A

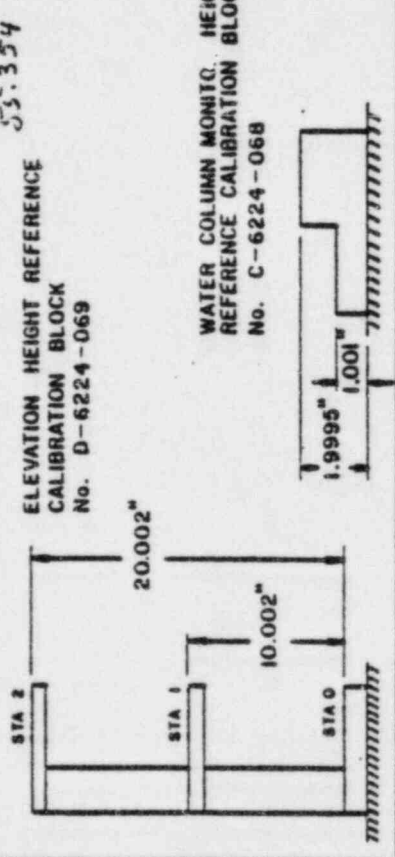
SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.				
17-6542-003	MIDLAND	17-SEP-81	1019	0039				
1) EXAMINER (SIGNATURE)	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER				
<i>J.P. Lett</i>	IX-ME-101-2	NoTEC	131037	SWRI 2034				
2) EXAMINER (SIGNATURE)	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.				
<i>J.P. Lett</i>	SETRA 41081	ENI	38521	Aerotec 012661M				
TEST PIPE IDENTIFICATION		AVERAGE °C		CALIBRATION SHEET No.				
36-04BC-20	AT WATER AMP Station.	55.369		0037				
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS	ADJUSTED ELEVATION
107A	1.1	.2092	66	.2087	+4.169	1020		6.624
107B	1.7	.2036	66	.2031	+4.479	1021		6.934
107C	1.7	.1995	66	.1990	+4.706	1022		7.161
100C	1.7	.2162	66	.2157	+3.781	1023		6.234
104A	1.7	.3124	66	.3117	-1.534	1025		.921
100D	1.7	.1990	66	.1985	+4.734	1029	start of EX-A01	7.189
100C	1.7	.1878	66	.1873	+5.354	1032		7.809
							* SEE NOTE ON SHEET NO. 0038	



# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003		SITE MIDLAND		DATE 17 Sept 81		TIME (24 HR CLOCK) 1058		SHEET No. 0040		
1) EXAMINER (SIGNATURE) <i>ELC</i>		PROCEDURE No. IX-ME-101-2		INSTRUMENT (WTR COL MON) NORTEC		SERIAL No. 1310-37		WATER COLUMN TRANSDUCER SWPI 2034		
2) EXAMINER (SIGNATURE) <i>J.R. Ritter</i>		PRESSURE TRANSDUCER SETRA 4081		INSTRUMENT (DIGIT VOLT M.) EMI		SERIAL No. 38521		THICKNESS TRANSDUCER No. Aerotec 012661M		
HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANS. TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES VOLTS	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	.9553	65	-	55.443	1056	1.002	2.002	1055	
10.002	1.7	.7749	65	-	55.340	1057	1.001	2.001	1115	
20.002	1.7	.5942	65	-	55.392	1059	1.002	2.002	1137	
							1.002	2.003	1201	
					65.392					
0	1.7	.9552	66	-	55.443	1156				
10.002	1.7	.7708	66	-	55.310	1156				
20.002	1.7	.5940	66	-	55.376	1157				
0	1.7	.9555	65	-	55.351	1158				
10.002	1.7	.7748	65	-	55.310	1159				
20.002	1.7	.5940	65	-	55.331	1159				
AVERAGE "C" FOR ALL RUNS					55.373					





2A

SWRI PIPE ELEVATION PROFILE DATA RECORD											
PROJECT No. 17-6542-003	SITE Widened	DATE 17-SEP-81	TIME (24 HR CLOCK) 1257	SHEET No. 0041							
1) EXAMINER (SIGNATURE) [Signature]	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 1310-37	WATER COLUMN TRANSDUCER SWRI 2034							
2) EXAMINER (SIGNATURE) [Signature]	PRESSURE TRANSDUCER SETEA 41081	INSTRUMENT (DIGIT VOLT M.) EM1	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec 0126.1M							
TEST PIPE IDENTIFICATION 36-OHBC-19 AT WATER AMP STATION		AVERAGE °C 55.373		CALIBRATION SHEET No. 0040							
PIPE POSITION (FT.)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS	* ADJUSTED ELEVATION			
139D	1.7	326.09	66	-	+ 4.911	1105	26" PIPE	5.907			
139C	1.7	316.4	66	-	+ 5.493	1106	26" PIPE	6.489			
141A	1.7	315.6	66	-	0 *	1109	36" PIPE (DATUM)	.996			
141B	1.7	324.0	65	.3241	- .471	1110	* ADJUST ELEVATION	.525			
141C	1.7	325.3	65	.3254	- .543	1111	BY ADDING .996 INCHES	.453			
141D	1.7	319.0	65	.3191	- .194	1112	IN ORDER TO TIE-IN	.802			
142A	1.7	322.7	65	.3228	- .399	1113	WITH DATA ON SHEET	.597			
142B	1.7	329.7	65	.3297	- .781	1114	NO. 0036 FOR GRAPH	.215			
142C	1.7	331.8	65	.3319	- .903	1115	PRESENTATION.	.093			
142D	1.7	331.0	65	.3311	- .858	1116	COMMON DATA POINT	.138			
143A	1.7	331.7	66	-	- .892	1117	141A CHOSEN FOR	.104			
143B	1.7	326.6	66	-	- .609	1120	DATUM.	.387			
143C	1.7	317.5	66	-	- .105	1121		.891			
143D	1.7	302.6	66	-	+ 7.20	1123		1.716			
144A	1.7	302.2	66	-	+ 7.42	1124		1.738			
144B	1.7	281.5	66	-	+ 1.888	1126		2.884			
144C	1.7	258.6	66	-	+ 3.156	1127		4.152			
144D	1.7	235.6	66	-	+ 4.430	1128		5.426			
145A	1.7	232	67	.2331	+ 4.563	1129		5.559			
145B	1.7	247.5	67	.2274	+ 4.878	1130		5.874			
145C	1.7	240.2	67	.2201	+ 5.283	1131		6.279			

## SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO 17-6542-003		SITE MIDLAND		DATE (DAY-MO-YR) 17-SEP-81		TIME (24 HR CLOCK) 1132		SHEET NO. 0042	
1) EXAMINER (SIGNATURE) <i>SLC</i>		PROCEDURE NO. IX-ME-101-2		INSTRUMENT (WTR COL MON) NORTEC		SERIAL NO. 1310-37		WATER COLUMN TRANSDUCER SWRI-2034	
2) EXAMINER <i>J. Ritter</i>		PRESSURE TRANSDUCER SETRA 41081		INSTRUMENT (DIGIT VOLT M.) ENI		SERIAL NO. 38521		THICKNESS TRANSDUCER NO. Aorotec 012661M	
TEST PIPE IDENTIFICATION 36-DHBC-19 AT WATER PUMP STN.						AVERAGE 'C' 53.373		CALIBRATION SHEET NO. 0040	
PIPE POSITION (FT)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS *	ADJUSTED ELEVATION	
146A	1.7	.2205	67	.2204	+5.272	1132		6.268	
146B	1.7	.2219	67	.2218	+5.194	1133		6.190	
146C	1.7	.2242	67	.2241	+5.067	1134		6.063	
144B	1.7	.2820	67	.2819	+1.867	1136		2.863	
141D	1.7	.3211	67	.3210	-.299	1139		.697	
139D	1.7	.2269	67	.2268	+4.917	1140		5.913	
139C	1.7	.2155	67	.2154	+5.548	1141		6.544	
							* SEE NOTE ON SHEET NO. 0041		

IX-ME-101-1  
 August 1981  
 Page 10 of 10

APPENDIX C

PIPE CALIBRATION AND OUT-OF-ROUNDNESS DATA RECORDS



# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DRY-MO-YR) 17-SEP-81	TIME (24-HR CLOCK) 0915	SHEET NO. 001
EXAMINER <i>Phillip K. Counts</i>	EXAMINER <i>K. Williams</i>	INSTRUMENT SWRI DUALNESS	PROCEDURE 1X-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27.00		27.00		27.00	
25.00		25.00		25.00	
23.50		23.50		23.50	

FOR PIPELINE  
26-043C-20

POSITION	AZIMUTH
1	0
2	90
3	180
4	270



# SwRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006		SITE MIDLAND		DATE (DAY-MO-YR) 17-SEP-81		TIME (24 HR CLOCK) 0920		SHEET NO. 002	
EXAMINER <i>Edwin A. ...</i>		EXAMINER <i>J.R. Ritter</i>		INSTRUMENT SwRI Omnipress		PROCEDURE No. IX-MIE-102-0		CALIBRATION SHEET No. 001	
TEST IDENTIFICATION PIPE 16-OHBC-20 - Toward Avx Bldg.									
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS			
74C	64.6	63.5	191 / 283	176	0927				
70A	64.0	63.3	125 / 105	336	0935				
70B	64.0	63.3	135 / 40	336	0937				
70C	64.1	63.3	137 / 40	330	0940				
70D	64.0	63.3	0 / 100	344	0943				
71A	64.2	63.3	8 / 108	354	0945				
71B	64.2	63.0	161 / 110	350	0947				
71C	64.1	63.1	15 / 114	350	0949				
71D	64.2	63.2	58 / 136	354	0951				
72A	64.0	63.6	115 / 55	18	0953				
72B	64.1	63.6	92 / <del>42</del> 55	14	0956				
72C	64.5	63.7	98 / 145	18	0958				
72D	64.1	63.5	94 / 54	17	1000				
73A	64.1	63.5	136 / 53	156	1002				
73B	64.0	63.5	51 / <del>51</del> 123	156	1004				
73C	64.0	63.5	50 / 116	158	1006				
73D	64.0	63.5	90 / 46	157	1009				
74A	63.9	63.5	69 / 45	175	1010				
74B	64.1	63.6	12 / 133	172	1011				

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT 81	TIME (24-HR CLOCK) 1023	SHEET NO. R2003 <del>103</del>
EXAMINER P. H. K. [Signature]	EXAMINER K. WILLIAMS	INSTRUMENT SWRT OVALING	PROCEDURE 1X-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27.00		27.00		27.00	
25.00		25.00		25.00	
23.50		23.50		23.50	

FOR PIPELINE  
26-048C-19

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT 81	TIME (24 HR CLOCK) 1026	SHEET NO. 004
EXAMINER Bob H. P. [Signature]	EXAMINER J. R. [Signature]	INSTRUMENT SWAGE OVALNESS	PROCEDURE No. 1X-ME-102-0	
TEST IDENTIFICATION 26-OHBC-19 - Toward Aux. Bldg.			CALIBRATION SHEET No. SAC 003 003	

PIPE POSITION	MAX. DIA. IN / CM.	MIN. DIA. IN / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
108A	64	63.6	<del>265°</del> 207°	215°	1035	64.135 = 25.25" - Avg Per Lin
108D	64	63.8	275° / 340°	225°	1038	
108C	64.2	63.7	290° / 341°	222°	1042	
108D	64	63.8	276° / 267°	225°	1044	
109A	64	63.7	325° / 270°	245°	1046	
108AB	64	63.9	248° / 273°	242°	1048	
108BC	64.1	63.9	235° / 305°	241°	1050	
109CD	64	63.9	250° / 277°	240°	1052	
10717/10A	64	63.8	261° / 279°	261°	1054	
106A/10B	64.2	64.2	265° / 246°	257°	1056	
110C	64.5	64.1	260° / 310°	257°	1058	
110D	64	64	236° / 295°	256°	1100	
111A	64	63.4	266° / 357°	192°	1102	
111B	64	63.6	233° / 309°	178°	1104	
111C	63.9	63.8	233° / 295°	175°	1106	
111D	63.9	63.8	277° / 242°	175°	1108	
112A	64	63.7	280° / 310°	195°	1110	
112B	64.1	63.9	279° / 277°	195°	1112	
112C	64	63.7	273° / 235°	195°	1114	



## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 Sept 1991	TIME (24-HR CLOCK) * 1258 / **	SHEET NO. 005 <del>003004</del>
EXAMINER <i>Eddie K. ...</i>	EXAMINER <i>FER</i> K. Williams	INSTRUMENT SWRI Ovalness	PROCEDURE 1X - ME - 102 - 0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
* / ** 27 / 27		27 / 27		27 / 27	
25 / 25		25 / 25		25 / 25	
23.5 / <del>23.5</del> <i>(23.5)</i>		23.5 / <del>23.5</del> <i>(23.5)</i>		23.5 / <del>23.5</del> <i>(23.5)</i>	

FOR PIPE LINE  
26-014B-20

POSITION	AZIMUTH
1	0
2	90
3	180
4	270

\* START TIME Calibration CHECK *(23.5)*  
 \*\* CALIBRATION CHECK *(23.5)*



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIRLAND	17 SEPT 1981	1300	006		
EXAMINER <i>E. K. ...</i>	EXAMINER A. C. Williams	INSTRUMENT SWRT QUALNESS	PROCEDURE No. IX-ME-102-0			
TEST IDENTIFICATION 26-OHOC-20	Toward Wttn Pump Sta.					
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
100D	64.0	63.6	43 / 4	142	1343	
100C	64.2	63.3	88 / 20	152	1346	
100B	64.2	63.2	90 / 19	152	1347	
100A	64.2	63.2	83 / 0	152	1352	
99D	64.2	63.4	86 / 8	176	1354	
99C	64.2	63.2	76 / 14	155 175	1356	
99B	64.1	63.5	85 / 13	170	1358	
99A	64.0	63.2	98 / 37	175	1400	
98D	64.1	63.5	116 / 178	205	1401	
98C	64.1	63.6	121 / 196	203	1403	
98B	64.0	63.5	89 / 196	204	1405	
98A	63.9	63.3	84 / 194	205	1406	
97D	63.9	63.3	125 / 10	144	1408	
97C	64.1	63.5	122 / 41	145	1409	
97B	64.0	63.6	66 / 18	140	1411	
97A	63.8	63.3	70 / 100	140	1413	
96D	63.9	63.5	68 / 150	155	1415	
96C	64.2	63.5	150 / 30	154	1422	
96B	64.2	63.6	346 / 38	163	1423	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT 1981	TIME (24 HR CLOCK) 1425	SHEET NO. 004
EXAMINER E. Williams	EXAMINER JER	INSTRUMENT SWRI OVALNESS	PROCEDURE NO. 1 X - ME - 101-0	
TEST IDENTIFICATION 26-OHBC-20			CALIBRATION SHEET NO. 005	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
96A	64.1	63.5	360 / 29	150	1426	
95D	64.0	63.5	202 / 83	172	1427	
95C	63.9	63.5	124 / 15	#7122	1430	
95B	64.0	63.6	002 / 28	171	1432	
95A	65.9	63.0	100 / 004	168	1435	
94C	68.5	63.3	87 / 006	135	1446	BEGINNING OF 45° BEND
97A	67.5	63.3	87 / 11	170	1447	45° BEND
97A	65.8	63.2	95 / 18	144	1449	END 45° BEND
93D	64.8	63.8	130 / 30	170	1452	END OF BEND
93C	64.5	63.3	240 / 29	160	1502	
93B	64.1	63.4	345 / 26	156	1503	
93A	64.0	63.5	76 / 346	155	1504	
9492D	64.2	63.7	66 / 147	220	1505	
92C	64.2	63.5	121 / 182	216	1507	
92B	64.2	63.5	135 / 88	216	1508	
92A	64.0	63.3	58 / 188	215	1510	
91D	64.1	63.7	225 / 166	239	1520	
91C	64.5	63.3	226 / 133	240	1521	
91B	64.3	63.5	66 / 162	239	1523	

Note: The out-of-round measurement instrument is designed to measure straight pipe only. The measurements taken in elbows is not qualified as valid data.  
 J.F. Keller

See Note 10

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIRLAND	DATE (DAY-MO-YR) 17 SEPT 1981	TIME (24 HR CLOCK) 1524	SHEET NO. 005 008
EXAMINER C. H. K. P.	EXAMINER JER	INSTRUMENT SWRI QUALNESS	PROCEDURE NO. 1X-ME-101-0	
TEST IDENTIFICATION 26-OHBC-20		CALIBRATION SHEET NO. 005		

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
91A	64.1	63.0	82 / 186	739	1525	
90D	64.2	63.2	83 / 354	282	1527	
90C	64.1	63.2	293 / 26	271	1529	
90B	64.1	63.5	269 / 359	270	1533	
90A	64.0	63.6	286 / 344	270	1535	
89D	63.9	63.4	63 / 189	50	1537	
89C	64.0	63.4	66 / 180	51	1538	
89B	64.1	63.6	66 / 175	54	1540	
89A	63.9	63.3	118 / 144	55	1548	
88D	64.1	63.6	336 / 187	77	1551	
88C	64.1	63.6	241 / 125	74	1553	
88B	64.1	63.6	90 / 188	74	1554	
88A	64.1	63.2	93 / 203	74	1556	
87D	64.1	63.5	108 / 209	90	1558	
87C	64.1	63.5	168 / 212	90	1559	
87B	64.1	63.5	176 / 219	90	1601	
87A	63.9	63.3	245 / 219	88	1604	
86D	64.0	63.5	102 / 209	35	1608	
86C	64.	63.4	150 / 40	35	1610	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT 1981	TIME (24 HR CLOCK) 1610	SHEET NO. 0000
EXAMINER E. J. ...	EXAMINER JER	INSTRUMENT SWRI OVALNESS	PROCEDURE NO. IX-ME-101-0	
TEST IDENTIFICATION 26-OHBC-20		CALIBRATION SHEET NO. 005		

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
86B	64.1	63.5	145 / 75	44	1611	BEGINNING OF 90° TURN: <del>SEA</del> <del>SEA</del> <del>SEA</del> <del>SEA</del> <del>SEA</del>
86A	64.8	63.5	100 / 161	35	1614	
86D	67.5	63.9	260 / 120	82	1618	
85C	67.8	63.9	262 / 168	90	1620	
85B	66.3	63.9	95 / 179	89	1624	
85A	64.3	63.8	264 / 159	91	1627	END OF 90° TURN: <del>SEA</del> <del>SEA</del> <del>SEA</del> <del>SEA</del> <del>SEA</del>
84D	64.1	63.7	221 / 338	201	1630	
84C	64.1	63.7	270 / 007	201	1632	
84B	64.1	63.5	271 / 003	218	1633	
84A	63.9	63.8	010 / 319	198	1635	
83D	64.0	63.5	220 / 336	216	1636	NOTE: The Out-of-Round measurement instrument is designed to measure straight pipes only. The measurements taken in elbows is not qualified as valid data. <del>FER</del>
83C	64.1	63.5	233 / 345	216	1637	
83B	64.1	63.3	232 / 345	216	1638	
83A	64.1	63.3	230 / 340	214	1640	
82D	64.1	63.3	261 / 354	261	1642	
82C	64.0	63.5	59 / 309	259	1643	
82B	64.1	63.5	70 / 300	258	1645	
82A	64.0	63.5	50 / 303	258	1646	
81D	64.0	63.4	26 / 319	273	1647	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.
17-6542-006	MIDLAND	17 SEPT 1981	1648	007 010
EXAMINER	JER	INSTRUMENT	PROCEDURE No.	
TEST IDENTIFICATION	SWRI QUALNESS		1 X - ME - 101-0	
26-OHBC-20			CALIBRATION SHEET No.	005

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS
81C	63.9	63.8	65 / 281	272	1649	
81B	64.0	63.7	63 / 25	271	1650	
81A	64.0	63.5	79 / 612	273	1653	
80D	64.1	63.6	299 / 005	295	1701	
80C	64.3	63.5	106 / 023	293	1703	
80B	64.3	63.6	102 / 050	291	1704	
80A	64.0	63.6	089 / 063	292	1706	
79D	64.3	63.6	104 / 000	118	1710	
79C	64.2	63.6	104 / 011	119	1712	
79B	64.2	63.6	114 / 351	118	1714	
79A	64.2	63.6	303 / 046	116	1715	
78D	64.0	63.6	121 / 048	128	1718	
78C	64.2	63.6	115 / 014	130	1719	
78B	64.2	63.5	318 / 044	129	1720	
78A	64.0	63.4	335 / 080	130	1722	
77D	64.1	63.3	341 / 026	145	1723	
77C	64.1	63.4	000 / 104	145	1724	
77B	64.1	63.6	332 / 100	143	1726	
77A	64.1	63.8	333 / 618	143	1727	



## SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT 81	TIME (24 HR CLOCK) 1800	SHEET NO. <del>00900</del> 012
EXAMINER Phillip H. Elliott	EXAMINER K. Williams	INSTRUMENT SWRI Ovalness	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-20 19 SEP			CALIBRATION SHEET NO. 005	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		TIME	REMARKS
			MAX. / MIN.	SEAM WELD		
1390	64	63.5	230° / 285°	200°	1815	
139C	64.3	63.5	300° / 243°	203°	1818	
139B	64.2	63.6	311° / 297°	204°	1821	
139A	64	63.5	235° / 333°	203°	1823	
138D	64.1	63.5	250° / 337°	230°	1825	
138C	64	63.6	250° / 343°	226°	1828	
138B	64.1	63.5	248° / 355°	230°	1831	
138A	64.1	63.5	254° / 355°	221°	1833	
137D	64.2	63.4	261° / 350°	246°	1836	
137C	64.5	63.4	265° / 0°	246°	1838	
137B	64.6	63.4	247° / 10°	245°	1841	
137A	64.5	63.6	247° / 297°	243°	1843	
136D	64.2	63.4	265° / 100°	101°	1845	
136C	64.3	63.6	268° / 153°	102°	1846	
136B	64.1	63.8	269° / 230°	102°	1847	
136A	64.3	63.6	109° / 210°	104°	1849	
135D	64.3	63.7	125° / 240°	115°	1851	
135C	64.5	63.7	145° / 235°	114°	1852	
135B	64.4	63.4	126° / 236°	113°	1854	



## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 Sept 1991	TIME (24-HR CLOCK) * 1258 / ** 2000	SHEET NO. 5 <del>00300</del> / 014
EXAMINER <i>E. H. C. [Signature]</i>	EXAMINER <i>JER</i> N. WILLIAMS	INSTRUMENT SWRI Ovalness	PROCEDURE 1X-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
* / ** 27/27		27/27		27/27	
25/25		25/25		25/25	
23.5 / <del>23.5</del>		23.5 / <del>23.5</del>		23.5 / <del>23.5</del>	

POSITION	AZIMUTH
1	0
2	90
3	180
4	270

\* START TIME Calibration CHECK RHE  
 \*\* CALIBRATION CHECK. RHE



## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DRY-MO-YR) 18 SEPT 81	TIME (24-HR CLOCK) 0750	SHEET NO. 015
EXAMINER Eddie H. [Signature]	EXAMINER K. Williams	INSTRUMENT SWRI QUALITY	PROCEDURE IX - ME - 102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
23.50"		23.50"		23.50"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

### SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	18 SEPT 81	0810	016		
EXAMINER	EXAMINER	INSTRUMENT	PROCEDURE No.			
Edna H. Elliott	R. Williams	SWRI OVALNESS	1 X MB-102-0			
TEST IDENTIFICATION		CALIBRATION SHEET No.				
26-OHDC-19 - <del>Forward</del> <sup>Toward THE Pump Station.</sup>		015				
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
130D	67.3	63.5	257° / 187°	93°	0816	
130C	67.4	63.4	262° / 186°	93°	0818	
130B	67.4	63.4	266° / 180°	93°	0820	
130A	67.7	63.4	268° / 169°	94°	0822	
129D	67	63.4	273° / 180°	118°	0825	
129C	67	63.5	268° / 136°	115°	0827	
<del>129B</del>	67	63.5	290° / 191°	115°	0829	
129A	67	63.5	252° / 192°	114°	0831	
128D	67.1	63.6	291° / 195°	133°	0833	
128C	67	63.6	308° / 178°	133°	0835	
128B	67.1	63.6	305° / 177°	132°	0836	
128A	67	63.4	219° / 168°	132°	0838	
127D	67.1	63.6	115° / 346°	312°	0840	
127C	67.3	63.4	112° / 5°	312°	0842	
127B	67.5	63.4	107° / 4°	314°	0844	
127A	67.3	63.5	116° / 6°	316°	0846	
126D	67.3	63.4	96° / 15°	337°	0849	
126C	67.3	63.5	137° / 16°	339°	0851	
126B	67.1	63.7	140° / 36°	339°	0853	

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT 81	TIME (24 HR CLOCK) 0854	SHEET NO. 017
EXAMINER Colleen B. Calvert	EXAMINER JEA	INSTRUMENT SWAI OVERPASS	PROCEDURE NO. X-ME-14-D	
TEST IDENTIFICATION		CALIBRATION SHEET NO. 015		

26 - CHAS. - 19 - ISSUED THE PUMP STATION

PIPE POSITION	MAX. DIA. - IN. / CM.	MIN. DIA. - IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
126A	64.2	63.7	87° / 17°	338°	0855	
125D	64.3	63.9	178° / 121°	6°	0858	
125C	64.4	63.5	28° / 125°	6°	0900	
125B	64.5	63.6	21° / 131°	4°	0902	
125A	64.2	63.5	44° / 132°	5°	0904	
124D	64.3	63.6	206° / 125°	54°	0907	
124C	64.3	63.6	215° / 176°	52°	0909	
124B	64.5	63.4	225° / 122°	53°	0911	
124A	64.8	63.5	244° / 149°	51°	0914	
124C	62.5	64.1	91° / 164°	6°	0917	
122D	63.9	63.5	25° / 98°	335°	0920	
122C	64	63.4	118° / 21°	334°	0922	
122B	64.2	63.5	120° / 16°	332°	0924	
122A	64.1	63.6	132° / 17°	332°	0925	
121D	64.1	63.7	140° / 104°	346°	0927	
121C	64.1	63.6	91° / 24°	345°	0928	
121B	64.2	63.6	89° / 20°	345°	0930	
121A	64.4	63.5	85° / 21°	344°	0931	
120D	64.1	63.5	98° / 8°	331°	0933	

START of 90° BEND (A)  
90° BEND (B) AS NO. (A)  
END of 90° BEND (B)

NOTE: THE OUT-OF-ROUND MEASUREMENT INSTRUMENT IS DESIGNED TO MEASURE STRAIGHT PIPES ONLY. THE MEASUREMENTS taken in ELBOWS IS NOT QUALIFIED AS VALID DATA

J.E. Pittman



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	18 SEPT 81	0933	018		
EXAMINER	EXAMINER JEA	INSTRUMENT	PROCEDURE No.			
<i>John A. Crutcher</i>	R. Williams	SWRI OVERNESS	14-ME-102-0			
TEST IDENTIFICATION			CALIBRATION SHEET No.			
			015			
26-048C-19-Toward THE PUMP STATION						
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
120C	64.2	63.7	132° / 18°	332°	0934	
120B	64	63.5	114° / 23°	329°	0935	
120A	64.1	63.5	95° / 28°	329°	0936	
119D	64.1	63.5	87° / 22°	345°	0938	
119C	64.5	63.7	79° / 347°	344°	0939	
119B	64.6	63.7	76° / 155°	344°	0940	
119A	67.7	63.3	84° / 343°	338°	0941	
118D	67.4	63.5	83° / 164°	359°	0943	
118C	67.2	63.7	84° / 131°	357°	0944	
118B	67.4	63.3	24° / 126°	355°	0945	
118A	67.3	63.6	17° / 124°	354°	0946	
117D	67.3	63.6	178° / 227°	155°	0949	
117C	64.4	63.5	331° / 206°	155°	0951	
117B	64.2	63.5	330° / 201°	154°	0952	
117A	64.1	63.5	331° / 197°	154°	0954	
116D	64	63.6	266° / 206°	179°	0956	
116C	64.2	63.8	225° / 242°	177°	0958	
116B	64.2	63.6	370° / 224°	177°	1010	
116A	64.1	63.7	355° / 241°	179°	1012	





## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 18 SEPT. 81	TIME (24-HR CLOCK) 1036	SHEET NO. 020
EXAMINER <i>Phillip B. Edwards</i>	EXAMINER K. Williams <i>JFK</i>	INSTRUMENT SWAI OVALNESS	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
23.5"		23.5"		23.5"	
25"		25"		25"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 6548-006 19-644	SITE MIDLAND EXAMINER R. Williams	DATE (DRY-MO-YR) 20 SEP 81	TIME (24-HR CLOCK) 0800
EXAMINER Edna H. Calvert	INSTRUMENT SWRI QUALNESS	PROCEDURE FX-ME-102-0	

SET DISTANCE	INDICATED DISTANCE				
	MAXIMUM		MINIMUM		
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
37"	* 37"	* 37"		* 37"	
35"	* 35"	* 35"		* 35"	
33.5	* 33.5"	* 33.5"		* 33.5"	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

\* SCALE READING PLUS 10"

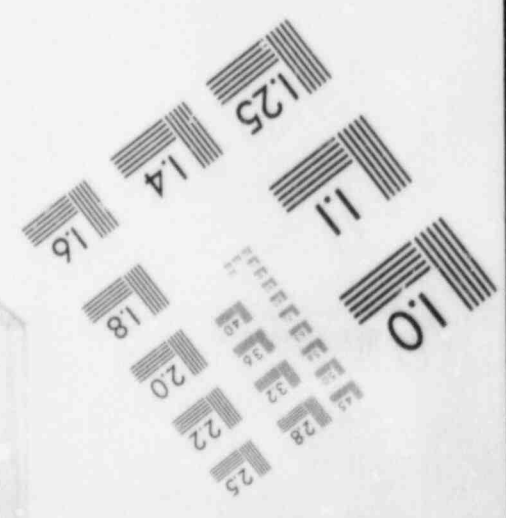
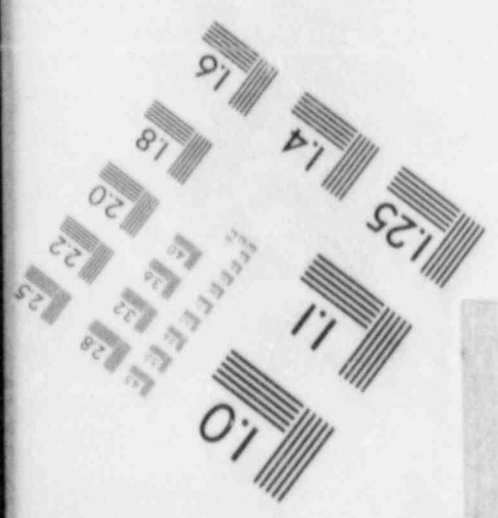
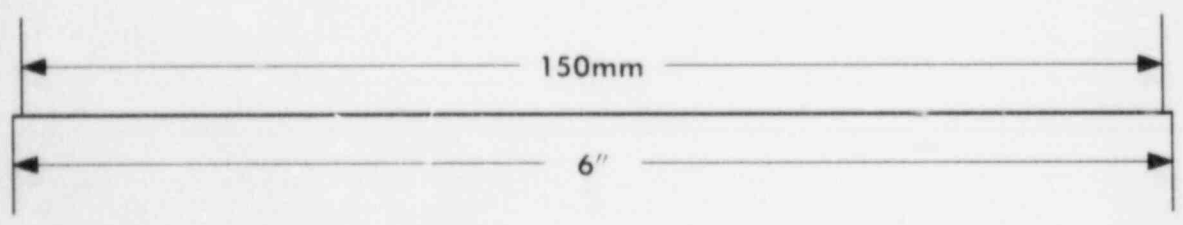
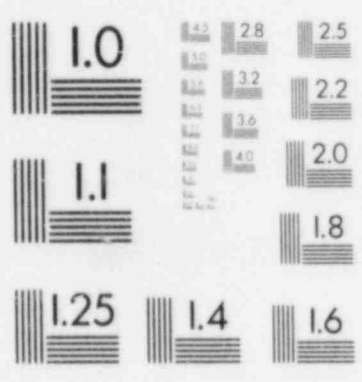
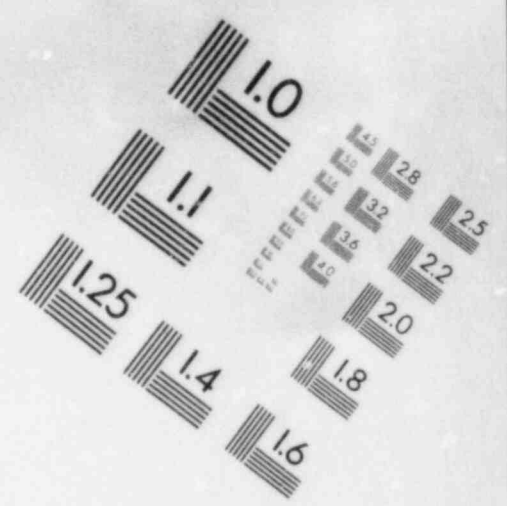
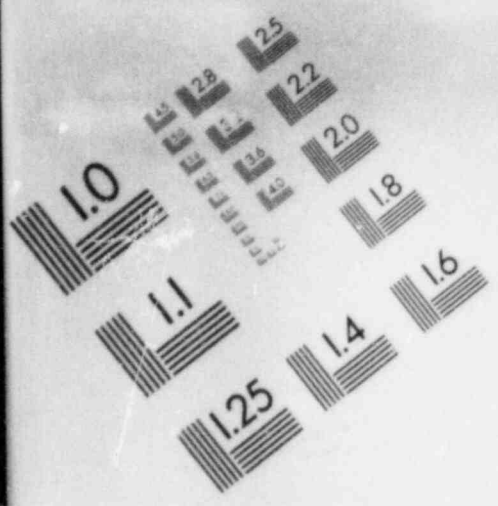


# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIDLAND	20 SEPT 81	0835	034		
EXAMINER <i>R. W. Williams</i>	EXAMINER	INSTRUMENT	PROCEDURE NO.			
TEST IDENTIFICATION	SWRI QUALNESS	IX-ME-102-0				
36-OHBC-20			CALIBRATION SHEET NO.	033		
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
102 A	1" / "	" / "	" / "	" / "	" / "	" / "
102 B	CAN NOT	Be measured	REP DUE TO	T CONNECTION		With app'ltes nozzle
102 C	" / "	" / "	" / "	" / "		
102 D	" / "	" / "	" / "	" / "		* ADD 10" TO EACH
103 A	65.2 /	63.6 /	268 / 15	47	0903	Diameter measurement
103 B	65 /	63.9 /	279 / 30	46	0904	↓ ↓ ↓
103 C	64.8 /	64.1 /	287 / 0	47	0905	↓ ↓ ↓
103 D	64.8 /	64.5 /	300 / 33	46	0907	↓ ↓ ↓
104 A	64.9 /	64.5 /	300 / 25	91	0908	↓ ↓ ↓
104 B	64.6 /	64.0 /	275 / 53	70	0909	↓ ↓ ↓
104 C	64.8 /	64.1 /	276 / 39	90	0911	↓ ↓ ↓
104 D	64.9 /	63.9 /	277 / 35.9	90	0912	↓ ↓ ↓
105 A	65.0 /	64.0 /	275 / 0	90	0913	↓ ↓ ↓
105 B	65.0 /	63.9 /	274 / 33.0	91	0914	↓ ↓ ↓
105 C	65.3 /	63.6 /	275 / 31.3	92	0917	↓ ↓ ↓
105 D	65.6 /	63.0 /	275 / 33.8	92	0919	↓ ↓ ↓
106 A	65.5 /	63.0 /	263 / 34.5	212	0921	↓ ↓ ↓
106 B	65.4 /	63.5 /	258 / 0	210	0923	↓ ↓ ↓
106 C	65.0 /	63.6 /	244 / 35.0	210	0924	↓ ↓ ↓



IMAGE EVALUATION  
TEST TARGET (MT-3)





# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.		
17-6542-006	MIRLAND	19 SEPT 1981	0955	036		
EXAMINER R Williams	EXAMINER E Escobedo	INSTRUMENT SWRI OUNNESS	PROCEDURE NO. IX-me-102-0			
TEST IDENTIFICATION 36-OHBC-2019						
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
141A	CANNOT BE DONE	DIET	TD T CONNECTION	"		* ADD 10" TO EACH
141B	"	"	"	"		DIAMETER MEASUREMENTS
141C	"	"	"	"		↓ ↓ ↓ ↓ ↓
141D	"	"	"	"		
142A	65.0 /	64.2 /	322 / 08	310	0958	
142B	65.0 /	63.7 /	080 / 120	311	1000	
142C	65.0 /	63.4 /	045 / 122	310	1002	
142D	64.9 /	64.1 /	035 / 086	310	1003	
143A	64.7 /	63.8 /	528 / 085	312	1005	
143B	65.0 /	63.6 /	389 / 075	312	1007	
143C	65.1 /	63.5 /	355 / 078	310	1008	
143D	64.9 /	63.8 /	315 / 070	312	1010	
144A	64.9 /	63.8 /	323 / 060	306	1011	
144B	65.0 /	63.8 /	115 / 033	305	1012	
144C	65.2 /	63.3 /	098 / 350	305	1013	
144D	65.2 /	63.2 /	088 / 347	304	1015	LARGE AMOUNTS OF CORROSION
145A	65.1 /	63.0 /	096 / 336	298	1018	
145B	65.1 /	63.3 /	093 / 354	298	1020	
145C	65.3 /	63.1 /	066 / 350	298	1021	





# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 19 SEPT. 81	TIME (24-HR CLOCK) 1038	SHEET NO. 038
EXAMINER C. A. E. [unclear]	EXAMINER R. Williams	INSTRUMENT SWRI OUTLINESS	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
37"		* 37"		* 37"	
35"		* 35"		* 35"	
33.5		* 33.5		* 33.5	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

\* SCALE READING PLUS 10"

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 23 SEPT. 81	TIME (24-HR CLOCK) 1305	SHEET NO. 054
EXAMINER <i>Ellie R. [Signature]</i>	EXAMINER N/A	INSTRUMENT SWRI OVALNESS MARK	PROCEDURE IX-ME-102-0, CHANGE 1	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
N/A					→

POSITION	AZIMUTH
1	
2	N/A
3	
4	N/A

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 17 SEPT. 81	TIME (24 HR CLOCK) 1855	SHEET NO. <del>012</del> 013
EXAMINER E. H. [Signature]	EXAMINER R. Williams	INSTRUMENT SWRI Ovalness	PROCEDURE NO. IX-ME-102-0	
TEST IDENTIFICATION 26-DHBC- <del>20</del> 19			CALIBRATION SHEET NO. 005	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS
135A	64.5	63.3	134° / 235°	110°	1857	
134D	67.3	63.5	309° / 199°	137°	1900	
134C	64.4	63.5	296° / 187°	135°	1903	
134B	64.4	63.5	308° / 185°	135°	1905	
134A	67.5	63.6	293° / 196°	138°	1909	BEGINNING 45° BEND
133C	67.2	64.3635	288° / 15°	245°	1915	45° BEND
133B	65	64.3	299° / 35°	240°	1922	45° BEND
133A	64.8	63.5	357° / 270°	240°	1927	45° BEND
132D	64.5	63.3	348° / 235°	235°	1931	END 45° BEND
132C	64.1	63.5	44° / 9°	235°	1932	
132B	64.2	63.4	35° / 355°	234°	1934	(See Note Page 7)
132A	64.5	63.4	45° / 3°	235°	1937	
131C	64.1	63.5	65° / 27°	250°	1942	
131B	64.1	63.5	65° / 15°	252°	1945	
131A	64	63.5	284° / 10°	252°	1950	



# SWRI DATA RECORD (OUT-OF-ROUNDNESS) ELBOWS

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 23 SEPT 81	TIME (24 HR CLOCK) 0555	SHEET NO. 055
EXAMINER E. H. [Signature]	EXAMINER N/A	INSTRUMENT SWRI OUNANAS	PROCEDURE NO. 053-042	
TEST IDENTIFICATION IX-ME-102-0. CHANGE / CALIBRATION SHEET NO.				

26" - OMBG-30 AND 26" - OMBG-19

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX / MIN	AZIMUTH SEAM-WELD	TIME	REMARKS
95A	63.9	63.8	60.9 / 340	90.9 / 20	63.1	MARKS
94C	63.9	64.3	64.1	64.0	63.5	26" OMBG-30
94B	63.6	64.3	64.3	64.0	63.2	
94A	63.5	64.3	64.2	64.0	63.3	
86A	64.0	63.9	63.6	63.5	64.0	
85B	64.0	63.6	63.9	63.5	64.2	
85C	64.1	63.7	64.0	64.2	64.1	
85B	64.2	64.0	64.1	63.5	64.1	
85A	64.0	63.8	64.1	64.2	63.9	26" OMBG-30
134A	63.3	64.3	64.3	63.7	63.5	26" OMBG-19
133B	64.3	64.1	64.1	63.8	64.0	
133B	64.5	64.6	63.9	63.4	64.4	
133A	64.6	64.4	63.7	63.3	64.3	
134A	63.7	63.3	63.3	63.5	64.1	
133D	64.0	63.6	63.5	63.7	64.2	
133C	64.2	63.4	63.5	64.0	64.3	
133B	64.1	63.9	63.7	64.0	64.2	
133A	64.1	63.4	63.4	63.3	64.3	

\* 0° IS 1 METER AT VERTICAL BOTTOM OF PIPE.



# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DRY-MO-YR) 23 SEPT. 81	TIME (24-HR CLOCK) 1455	SHEET NO. 055 056
EXAMINER <i>[Signature]</i>	EXAMINER N/A	INSTRUMENT SWRI OVALNESS HBR	PROCEDURE IX-ME-102-0, CHANGE 1	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27"		27"		27"	
25"		25"		25"	
N/A					→

POSITION	AZIMUTH
1	
2	N/A
3	N/A
4	N/A

APPENDIX D

TABULATION OF PERCENT OVALNESS CALCULATIONS

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26/36"OHBC-19

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 Do = 35.25 = 89.535cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.

Pipe Position	% Ovalness	Pipe Position	% Ovalness	Pipe Position	% Ovalness
108A	0.6	125A	1.09	113B	0.6
108B	0.3	124D	1.09	113A	1.09
108C	0.78	124C	1.09	139D	0.78
108D	0.3	124B	1.72	139C	1.25
109A	0.48	122D	0.6	139B	0.9
109B	0.16	122C	0.9	139A	0.78
109C	0.3	122B	1.09	138D	0.9
109D	0.16	122A	0.78	138C	0.6
110A	0.3	121D	0.6	138B	0.9
110B	0	121C	0.78	138A	0.9
110C	0.6	121B	0.9	137D	1.25
110D	0	121A	1.4	137C	1.72
111A	0.9	120D	0.9	137B	1.87
111B	0.6	120C	1.25	137A	1.40
111C	0.16	120B	0.78	136D	1.25
111D	0.16	120A	0.9	136C	1.09
112A	0.48	119D	0.9	136B	0.48
112B	0.3	119C	1.72	136A	1.09
112C	0.48	119B	1.87	135D	0.9
130D	1.25	119A	1.72	135C	1.72
130C	1.56	118D	1.40	135B	1.56
130B	1.56	118C	1.25	135A	1.87
130A	1.56	118B	1.72	134D	1.25
129D	0.9	118A	1.09	134C	1.40
129C	0.78	117D	1.09	134B	1.40
129B	0.78	117C	1.40	132D	1.87
129A	0.78	117B	1.09	132C	0.9
128D	0.78	117A	0.9	132B	1.25
128C	0.6	116D	0.6	132A	1.72
128B	0.78	116C	0.6	131C	0.9
128A	0.9	116B	0.9	131B	0.9
127D	0.78	116A	1.09	131A	0.78
127C	1.40	115D	1.09	142A	0.89
127B	1.72	115C	1.25	142B	1.45
127A	1.25	115B	0.9	142C	1.79
126D	1.56	115A	0.3	142D	0.89
126C	1.25	114D	0.3	143A	1.01
126B	0.6	114C	0.3	143B	1.56
126A	0.78	114B	0.9	143C	1.79
125D	0.6	114A	0.9	143D	1.23
125C	1.40	113D	0.9	144A	1.23
125B	1.40	113C	0.6	144B	1.34

OUT OF ROUNDNESS

PIPELINE: 26/36" OHBC - 19 (Cont'd)

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>
144C	2.12				
144D	2.12				
145B	2.35				
145B	2.01				
145C	1.90				
146A	1.80				
146C	1.12				
134A	1.56				
133C	1.09				
133B	1.56				
133A	2.03				
124A	1.72				
123D	1.56				
123C	1.72				
123B	1.09				
123A	1.40				



OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26/36"-OHBC-20

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

Pipe Position	% Ovalness	Pipe Position	% Ovalness	Pipe Position	% Ovalness
74C	1.72	98A	0.9	90B	0.9
70A	1.09	97D	0.9	90A	0.6
70B	1.09	97C	0.9	89D	0.78
70C	1.25	97B	0.9	89C	0.9
70D	1.09	97A	0.78	89B	0.78
71A	1.40	96D	0.6	89A	0.9
71B	1.87	96C	1.09	88D	0.78
71C	1.56	96B	0.9	88C	0.78
71D	1.56	96A	0.9	88B	0.78
72A	0.6	95D	0.78	88A	1.4
72B	0.78	95C	0.6	87D	0.9
72C	1.25	95B	0.6	87C	0.9
72D	0.9			87B	0.9
73A	0.9	93C	1.87	87A	0.9
73B	0.78	93B	1.09	86D	0.78
73C	0.78	93A	0.78	86C	1.09
73D	0.78	92D	0.78	86B	0.9
74A	0.6	92C	1.09	84D	0.6
74B	0.78	92B	1.09	84C	0.6
100D	0.6	92A	1.09	84B	0.9
100C	1.40	91D	0.6	84A	0.16
100B	1.40	91C	1.87	83D	0.78
100A	1.40	91B	1.25	83C	0.9
99D	1.25	91A	1.72	83B	1.25
99C	1.56	90D	1.56	83A	1.25
99B	0.9	90C	1.40	76C	0.78
99A	1.25	80A	0.6	76B	0.47
98D	0.9	79D	1.09	76A	0.6
98C	0.78	79C	0.9	75D	0.78
98B	0.78	79B	0.9	75C	0.6
82D	1.25	79A	0.9	75B	0.9
82C	0.78	78D	0.6	75A	1.09
82B	0.9	78C	0.9	103A	1.79
82A	0.78	78B	1.09	103C	0.78
81D	0.9	78A	0.9	103D	0.34
81C	0.16	77D	1.25	104A	0.45
81B	0.47	77C	1.09	104B	0.67
81A	0.78	77B	0.78	104C	0.78
80D	0.78	77A	0.47	104D	1.12
80C	1.25	76D	0.78	105A	1.12
80B	1.09	103B	1.23	105B	1.23

OUT OF ROUNDNESS

Pipeline: 26/36" OHBC-20 (cont'd)

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>
105C	1.90				
105D	2.90				
106A	2.79				
106B	2.12				
106C	1.56				
106D	1.45				
107A	1.23				
107B	1.45				
107C	1.45				
95A	1.72				
94C	1.40				
94B	1.72				
94A	1.72				
86A	0.9				
85D	1.09				
85C	0.9				
85B	1.09				
85A	0.6				

APPENDIX E

OPERATING PROCEDURE  
FOR  
MIDLAND UNITS 1 AND 2 PIPE OUT-OF-ROUNDESS  
MEASUREMENTS SwRI NO. IX-ME-102-0



**SOUTHWEST RESEARCH INSTITUTE  
NUCLEAR PROJECTS  
OPERATING PROCEDURE**

**CHANGE 2  
IX-ME-102-0  
October 1981**

Page 1 of 9

Title

MIDLAND UNITS 1 AND 2 PIPE OUT-OF-ROUNDNESS MEASUREMENTS

**EFFECTIVITY AND APPROVAL**

Revision 0 of this procedure became effective on 9/17/81. This procedure consists of the pages and changes listed below.

<u>Page No</u>	<u>Change</u>	<u>Date Effective</u>
1	2	Nov. , 1981
2	0	Sept.17, 1981
3	2	Nov. , 1981
3a	2	Nov. , 1981
4	2	Nov. , 1981
4a	2	Nov. , 1981
5	0	Sept.17, 1981
6	1	Oct. 02, 1981
6a	1	Oct. 02, 1981
7 through 9	0	Sept.17, 1981
9a	1	Oct. 02, 1981

SA

**Approvals**

Written By <i>J.R. Ritter</i>	Date 1-Nov-81	Technical Review <i>W.R. Anderson</i>	Date 11/6/81
Manager of Q.A. <i>Bruno Malanda</i>	Date 11/10/81	Cogniza - Director <i>Allen R. Whiting</i>	Date 11/14/81



# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
LX-ME-102-0

October 1981

Page 3 of 9

## 5.0 PROCEDURE REQUIREMENTS

- (1) A drawing of the out-of-roundness measurement instrument shall be prepared and controlled in accordance with NQAPs 3-1 and 4-1.
- (2) A test procedure (this procedure) shall be prepared in accordance with NQAP 6-1.
- (3) This procedure shall be controlled in accordance with NQAP 9-1.
- (4) Deviations and nonconformances shall be reported in accordance with NQAP 13-1. Customer notification forms shall be employed in accordance with NQAP 13-1. Compliance with 10CFR, Part 21, and 10CFR50.55(e) shall be in accordance with NQAP 13-1.

## 6.0 TEST CONDUCT

### 6.1 Witness

The Project Manager shall keep the utility informed of the approximate testing dates and times to the best of his ability. It shall be the responsibility of the utility to notify any test witnesses and to establish hold points, if any. The Project Manager shall abide by all hold points.

### 6.2 Test Environment

The inside area of the pipes is to be free of water puddles and any significant amount of rust or debris that may have accumulated in the bottom of the pipe. If it is the opinion of the technician performing the measurement that a significant amount of rust scale that would affect the accuracy of the reading is present, this shall be noted in the remarks section of the Data Record Sheets, Figures 3 and 4.

### 6.3 Instruments

The out-of-roundness instrument supplied by SwRI shall be used to measure the pipe diameters. A description of the instrument used to make the measurements shall be included in the test data.

# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
LX-ME-102-0

October 1981

Page 3a of 9

## 6.4 Calibration

### (1) Record the Length of Arm (See Figure 1)

- (a) Clamp slide arm No. 1 to slide arm No. 2 so that the overall distance (D), measured at the outside of the wall-following wheels is 27 inches (68.55 cm).
- (b) Position both slider blocks at their respective stops and read and record both scales on the Calibration Record Sheet, Figure 2.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
IX-ME-102-0

October 1981

Page 4 of 9

- (c) Reposition the slide arms so that the distance (D) is 25 inches (63.5 cm).
- (d) Repeat (b).
- (e) Reposition the slide arms so that the distance (D) is 23-1/2 inches (59.69 cm).
- (f) Repeat (b).

### (2) Azimuth

- (a) Position the wheeled carrier on a flat level surface.
- (b) Adjust the level indicator to read "level."
- (c) Position the measuring arm vertical using another level. (Position 1)
- (d) Adjust the azimuth indicator to read "0."
- (e) Invert the measuring arm and again assure that it is vertical. (Position 2)
- (f) Read and record the azimuth indication on the Calibration Record Sheet.
- (g) Position the measuring arm horizontal using a level. (Position 3)
- (h) Read and record the azimuth indication on the Calibration Record Sheet.
- (i) Position the measuring arm horizontal 180° from Position 3 and assure that it is level. (Position 4)
- (j) Read and record the azimuth on the Calibration Record Sheet.

# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
IX-ME-102-0

October 1981

Page 4a of 9

## (3) Optional Method for Calibration

- (a) Construct a reference calibration standard with exact known dimensions for distance (D) with nominal dimensions of 27, 25, and 23-1/2 inches. The exact distance (D) shall be measured and clearly marked on the calibration standard.
- (b) Position the measuring arm in the calibration standard, and with both slider blocks at their respective stops, read both scales and record the dimension on the Calibration Record Sheet, Figure 2.
- (c) Repeat (b) for each distance (D).
- (d) In those instances where the measuring arm is extended 10 inches to measure the out-of-roundness of 36-inch diameter pipe, the calibration standard shall have nominal distances for D of 37, 35, and 33-1/2 inches. However, since the scale on the measuring arm is set for measuring 26-inch pipes, it will be necessary to add 10 inches to each scale reading to obtain the actual measured distance (D). A note indicating this correction shall be added to the Calibration Record Sheet, Figure 2, as well as to the Data Record Sheets, Figures 3 and 4.

## 6.5 Test Procedure

### (1) Diameter Measurement

- (a) Retract the measuring arm.
- (b) Place the carrier/arm assembly in the pipe.







**SOUTHWEST RESEARCH INSTITUTE  
NUCLEAR PROJECTS  
OPERATING PROCEDURE**

CHANGE 2  
IX-ME-102-0  
October 1981

Page 1 of 9

Title

MIDLAND UNITS 1 AND 2 PIPE OUT-OF-ROUNDNESS MEASUREMENTS

**EFFECTIVITY AND APPROVAL**

Revision 0 of this procedure became effective on 9/17/81. This procedure consists of the pages and changes listed below.

<u>Page No</u>	<u>Change</u>	<u>Date Effective</u>
1	2	Nov. , 1981
2	0	Sept.17, 1981
3	2	Nov. , 1981
3a	2	Nov. , 1981
4	2	Nov. , 1981
4a	2	Nov. , 1981
5	0	Sept.17, 1981
6	1	Oct. 02, 1981
6a	1	Oct. 02, 1981
7 through 9	0	Sept.17, 1981
9a	1	Oct. 02, 1981

SA

**Approvals**

Written By	Date	Technical Review	Date
------------	------	------------------	------

Manager of Q.A.	Date	Cognizant Director	Date
-----------------	------	--------------------	------



### MIDLAND UNITS 1 AND 2 PIPE OUT-OF-ROUNDNESS MEASUREMENTS

#### 1.0 PURPOSE

This procedure provides a description of the activities necessary to measure the out-of-roundness of the designated piping at the Midland Units 1 and 2 nuclear power plant.

#### 2.0 SCOPE AND APPLICATION

2.1 This procedure is limited to the acquisition of measurements of the maximum and minimum pipe diameters of certain piping systems located at the Midland Units 1 and 2 nuclear power plants.

2.2 This procedure is limited to the acquisition of data at those locations designated by the authorized representative of Consumers Power Company (CPCo).

#### 2.3 Applicable Documents

The following documents, as applicable, are considered to form a part of this procedure.

- (1) Nuclear Quality Assurance Program Manual (NQAPM), Procedures 1-1, 3-1, 4-1, 6-1, 9-1, 10-1, 11-1, and 13-1.

#### 3.0 RESPONSIBILITY

- (1) The Director of the Department of Research and Development, Quality Assurance Systems and Engineering Division, shall be responsible for the preparation, review, approval, and control of this procedure.
- (2) The Manager of the Mechanical Engineering Section, Department of Research and Development, shall be responsible for the implementation of this procedure in accordance with the NQAPM in effect on the date this procedure is approved.

#### 4.0 PERSONNEL REQUIREMENTS

Personnel performing out-of-roundness measurements shall demonstrate adequate proficiency in their assigned tasks as determined by the Project Manager and in accordance with NQAP 1-1.

# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
IX-ME-102-0

October 1981

Page 3 of 9

## 5.0 PROCEDURE REQUIREMENTS

- (1) A drawing of the out-of-roundness measurement instrument shall be prepared and controlled in accordance with NQAPs 3-1 and 4-1.
- (2) A test procedure (this procedure) shall be prepared in accordance with NQAP 6-1.
- (3) This procedure shall be controlled in accordance with NQAP 9-1.
- (4) Deviations and nonconformances shall be reported in accordance with NQAP 13-1. Customer notification forms shall be employed in accordance with NQAP 13-1. Compliance with 10CFR, Part 21, and 10CFR50.55(e) shall be in accordance with NQAP 13-1.

## 6.0 TEST CONDUCT

### 6.1 Witness

The Project Manager shall keep the utility informed of the approximate testing dates and times to the best of his ability. It shall be the responsibility of the utility to notify any test witnesses and to establish hold points, if any. The Project Manager shall abide by all hold points.

### 6.2 Test Environment

The inside area of the pipes is to be free of water puddles and any significant amount of rust or debris that may have accumulated in the bottom of the pipe. If it is the opinion of the technician performing the measurement that a significant amount of rust scale that would affect the accuracy of the reading is present, this shall be noted in the remarks section of the Data Record Sheets, Figures 3 and 4.

### 6.3 Instruments

The out-of-roundness instrument supplied by SwRI shall be used to measure the pipe diameters. A description of the instrument used to make the measurements shall be included in the test data.



# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
LX-ME-102-0

October 1981

Page 3a of 9

## 6.4 Calibration

### (1) Record the Length of Arm (See Figure 1)

- (a) Clamp slide arm No. 1 to slide arm No. 2 so that the overall distance (D), measured at the outside of the wall-following wheels is 27 inches (68.55 cm).
- (b) Position both slider blocks at their respective stops and read and record both scales on the Calibration Record Sheet, Figure 2.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
IX-ME-102-0

October 1981

Page 4 of 9

- (c) Reposition the slide arm so that the distance (D) is 25 inches (63.5 cm).
- (d) Repeat (b).
- (e) Reposition the slide arm so that the distance (D) is 23-1/2 inches (59.69 cm).
- (f) Repeat (b).

### (2) Azimuth

- (a) Position the wheeled carrier on a flat level surface.
- (b) Adjust the level indicator to read "level."
- (c) Position the measuring arm vertical using another level. (Position 1)
- (d) Adjust the azimuth indicator to read "0."
- (e) Invert the measuring arm and again assure that it is vertical. (Position 2)
- (f) Read and record the azimuth indication on the Calibration Record Sheet.
- (g) Position the measuring arm horizontal using a level. (Position 3)
- (h) Read and record the azimuth indication on the Calibration Record Sheet.
- (i) Position the measuring arm horizontal 180° from Position 3 and assure that it is level. (Position 4)
- (j) Read and record the azimuth on the Calibration Record Sheet.

# SOUTHWEST RESEARCH INSTITUTE



NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 2  
IX-ME-102-0

October 1981

Page 4a of 9

## (3) Optional Method for Calibration

- (a) Construct a reference calibration standard with exact known dimensions for distance (D) with nominal dimensions of 27, 25, and 23-1/2 inches. The exact distance (D) shall be measured and clearly marked on the calibration standard.
- (b) Position the measuring arm in the calibration standard, and with both slider blocks at their respective stops, read both scales and record the dimension on the Calibration Record Sheet, Figure 2.
- (c) Repeat (b) for each distance (D).
- (d) In those instances where the measuring arm is extended 10 inches to measure the out-of-roundness of 36-inch diameter pipe, the calibration standard shall have nominal distances for D of 37, 35, and 33-1/2 inches. However, since the scale on the measuring arm is set for measuring 26-inch pipes, it will be necessary to add 10 inches to each scale reading to obtain the actual measured distance (D). A note indicating this correction shall be added to the Calibration Record Sheet, Figure 2, as well as to the Data Record Sheets, Figures 3 and 4.

## 6.5 Test Procedure

### (1) Diameter Measurement

- (a) Retract the measuring arm.
- (b) Place the carrier/arm assembly in the pipe.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

IX-ME-102-0

September 1981

Page 5 of 9

- (c) Adjust the position of the carrier so that all four wheels are in contact with the pipe and the level vial indicates level.
- (d) Move the carrier along the pipe until the measuring arm is at the station to be measured.
- (e) Extend the measuring arm.
- (f) Check to be sure that the conditions described in (c) are still true.
- (g) Locate longitudinal seam weld and place the lead measuring arm adjacent to the weld.
- (h) Move the sliders against their respective stops.
- (i) Record the azimuth position of the seam weld.
- (j) Rotate the lead measuring arm 180° until the following measuring arm is adjacent to the opposite side of the longitudinal seam weld.
- (k) Read and record the maximum and minimum diameters indicated by the sliders on the Data Record Sheet, Figure 3.

### (2) Azimuth Measurement

- (a) To determine the azimuth position of the maximum diameter, slowly rotate the measuring arm counter-clockwise and stop when the "maximum" slider first touches the "maximum" stop.
- (b) Read and record the azimuth indicated at the azimuth pointer on the Data Record Sheet.
- (c) Continue rotation of the measuring arm until the "minimum" slides first contact the "minimum" stop.
- (d) Repeat (b).
- (e) Retract the measuring arm and move to the next recording station.



# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 1

LX-ME-102-0

September 1981

Page 6 of 9

### 7.0 ACCEPTABILITY OF MEASUREMENTS

The Project Manager or the authorized CPCo representative may void or repeat any set of measurements which has doubtful validity.

### 8.0 TEST RESULTS

- (1) The test results shall be reported to the utility using a format mutually acceptable to the Project Manager and the utility.
- (2) The Project Manager and the Manager of Quality Assurance shall review the test results for compliance with Section 7.0 of this procedure.
- (3) The utility shall receive copies of documents generated in accordance with this procedure.
- (4) Permanent documents generated in accordance with this procedure shall be stored and retained by the utility.

### 9.0 PROCEDURE FOR OUT-OF-ROUNDNESS MEASUREMENTS IN ELBOWS

#### 9.1 Calibration

- (1) Record the Length of Arm (See Figure 1)

Use Procedure 6.4(1), (a) through (f) to check calibration of the pipe diameter measuring arm.

- (2) Azimuth

The azimuth portion of the instrument is not used in measuring elbows.

#### 9.2 Test Procedure

- (1) Mark the Pipe for Measurement

- (a) Locate the points in the elbow to be measured.
- (b) Measure the segment length (weld-to-weld) at the halfway horizontal height of both the short and the long side of the radius.
- (c) Divide each length into equal segments in accordance with the number of out-of-roundness measurements that are to be made.

# SOUTHWEST RESEARCH INSTITUTE



## NUCLEAR PROJECTS OPERATING PROCEDURE

CHANGE 1  
IX-ME-102-0

September 1981

Page 6a of 9

- (d) Mark the pipe according to the segment lengths on the short and the long radius. Draw a circumference in the pipe through these two points.
- (e) Locate the vertical bottom of the pipe. (Identify this point as "0".)
- (f) With a flexible circumference scale divided into twelve equal lengths, mark twelve points on the circumference, starting at point "0." Going clockwise, identify the points 0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, and 5. With the measuring arm placed across 0-0, the measured diameter is straight up (vertical). When placed across 1-1, the measured diameter is  $30^\circ$  off vertical; 2-2 is  $60^\circ$ ; 3-3 is  $90^\circ$ ; 4-4 is  $120^\circ$ ; and 5-5 is  $150^\circ$ .

### (2) Diameter Measurement

- (a) Place the measuring arm across diameters 0-0, 1-1, 2-2, 3-3, 4-4, and 5-5. Read and record on the Data Record Sheet, Figure 4, each diameter as indicated by the sliders on the measuring arm.

### (3) Azimuth Measurement

- (a) After all of the diameters have been measured, select the azimuth that matches the minimum and maximum diameters. Record the angle relative to vertical on the Data Record Sheet. [See 9.2(f) for a angle identification.]

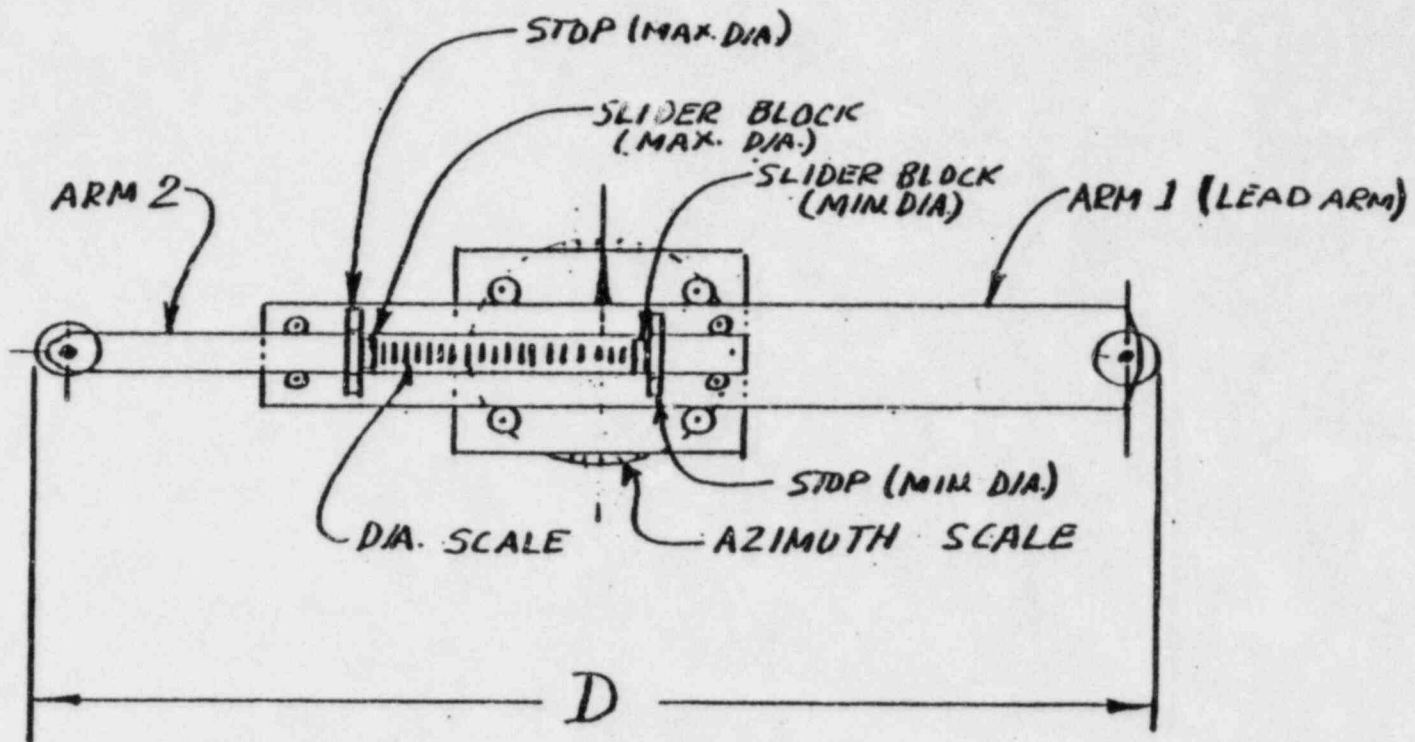


FIGURE 1  
 SKETCH - SWRI OUT-OF-ROUND MEASUREMENT EQUIPMENT

S <sub>w</sub> RI CALIBRATION RECORD (OUT-OF-ROUNDNESS)					
PROJECT NO.	SITE	DATE (DRY-MO-YE)	TIME (24-HR CLOCK)	SHEET No.	
EXAMINEE	EXAMINER	INSTRUMENT	PROCEDURE		
SET DISTANCE		INDICATED DISTANCE			
INCHES	CENTIMETERS	MAXIMUM INCHES	CENTIMETERS	MINIMUM INCHES	CENTIMETERS
POSITION		AZIMUTH			
1					
2					
3					
4					

FIGURE 2







APP B - REPORT NO. 3

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Report No. 3

Prepared for

Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981



~~8112230553~~

SOUTHWEST RESEARCH INSTITUTE  
SAN ANTONIO HOUSTON

PIPE PROFILE MEASUREMENTS AT MIDLAND

Consumers Power Company  
Midland Project  
Purchase Order No. CP10-4762

SwRI Project 17-6542  
Report No. 3

Prepared for

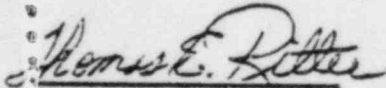
Consumers Power Company  
1945 West Parnall Road  
Jackson, Michigan 49201

Prepared by

Quality Assurance Systems and Engineering Division  
Southwest Research Institute

November 1981

Written by

  
Thomas E. Ritter  
Project Manager  
Mechanical Engineering

Approved by

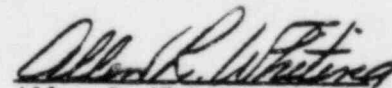
  
Allen R. Whiting  
Executive Director



TABLE OF CONTENTS

	<u>Page</u>
A. INTRODUCTION . . . . .	1
B. PIPES PROFILED . . . . .	1
C. ELEVATION PROFILE MEASUREMENTS . . . . .	1
D. PIPE OUT-OF-ROUNDNESS MEASUREMENTS . . . . .	2
E. SUMMARY . . . . .	2

APPENDICES

- A. Pipe Data Point Locations
- B. Pipe Calibration and Elevation Data Records
- C. Pipe Calibration and Out-of-Roundness Data Records
- D. Tabulation of Percent Ovalness Calculations

## PIPE PROFILE MEASUREMENTS AT MIDLAND

### A. Introduction

This is the third and final report on pipe elevation and out-of-roundness measurements for the profiling of buried pipelines at Midland Units 1 and 2. The measurements reported here were made by Southwest Research Institute (SwRI) personnel beginning on October 15, 1981 and ending on October 24, 1981. The equipment used in making elevation measurements is described in Report No. 1 and equipment for out-of-roundness measurements in Report No. 2.

### B. Pipes Profiled

Eight pipes were measured to determine their elevation and out-of-roundness profiles. These pipes are shown on SwRI drawing D-6224-065 and Bechtel Yard Pipe Plan Drawings M-166(Q), M-167(Q), M-168(Q) and M-169(Q) and are identified by the following numbers:

- |                 |                 |
|-----------------|-----------------|
| (1) 26"-OHBC-15 | (5) 26"-OHBC-53 |
| (2) 26"-OHBC-16 | (6) 26"-OHBC-54 |
| (3) 36"-OHBC-15 | (7) 26"-LJBD-1  |
| (4) 36"-OHBC-16 | (8) 26"-LJBD-2  |

This group of pipes make up two different, parallel pipeline systems which may be referred to as "pipeline trains." One train of two parallel pipes includes 26/36-OHBC-15 and 26/36-OHBC-16. The other train consists of 26-OHBC-53 interconnected with 26-LJBD-1 and 26-OHBC-54 interconnected with 26-LJBD-2.

Entry into the 26/36-OHBC-15 and -16 pipelines was obtained by cutting out a section of the pipe which was uncovered by digging a pit due east of the Auxiliary Building. The coordinates for the location of the pit are E560.5 and S4688.

Entry into pipelines 26-OHBC-53 and -54 and 26-LJBD-1 and -2 was obtained by cutting out a section of pipe in the valve pit. The valve pit is located west of the Diesel Generator Building at coordinates of E167 and S5115.

The datum (zero elevation) was selected at the edge of each pipe at the point of entry. The elevation measurements made at points throughout the entire length of the pipe are compared to the datum. A sketch of each pit identifying the datum point for each pipe profiled is included in Appendix A. Information identifying each pipe segment is also included in Appendix A.

### C. Elevation Profile Measurements

The data sheets for both calibration and pipe profile measurements are included in Appendix B. The pipe profiles are shown on the graphs in Figures 1, 2, 3, and 4. Note that the change in elevation is directly related to the datum (zero elevation) point selected for each pipe. Also shown on the lower portion of the graph is the percent ovalness of the pipe at each elevation data point.

Pipeline 26-OHBC-53 interconnects with pipeline 36-OHBC-15 by a "T" junction at the Service Water Pump Structure. Also, pipeline 26-OHBC-54 interconnects with pipeline 36-OHBC-16 in the same way. Elevation measurements were taken to show the relationship of one pipeline to the other at the junction point. This information is shown on the graphs in Figures 5 and 6.

D. Pipe Out-of-Roundness Measurements

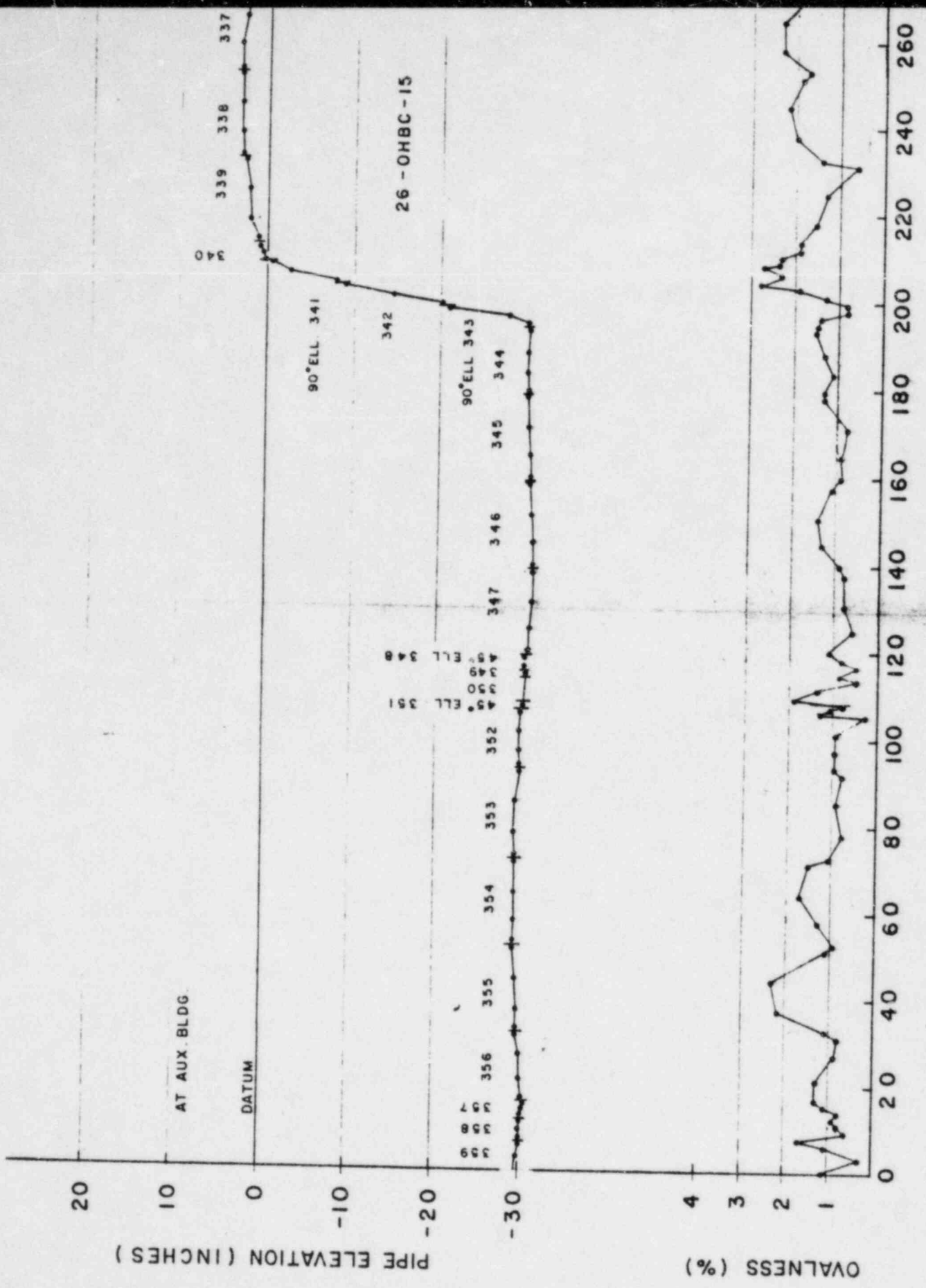
Out-of-roundness measurements were made at each point where elevation measurements were taken. The data sheets for pipe out-of-roundness measurements are included in Appendix C. A tabulation of the calculated values of percent ovalness is included as Appendix D. The percent ovalness is shown on the graphs in Figures 1, 2, 3, and 4 along with the elevation profiles for the same pipeline. An explanation on how the percent ovalness is calculated is contained in Section C, Report No. 2.

E. Summary

Both elevation and out-of-roundness measurements were made on approximately 3226 feet of pipe during this visit. This is approximately 60% of the total buried 26-inch pipe at Midland. This, along with the data taken on the two previous visits, as reported in Reports No. 1 and 2, accounts for all buried 26-inch pipe associated with Midland Units 1 and 2.

The equipment used to make these measurements was the same equipment used on the two previous visits. The equipment was designed to provide an accuracy in the order of  $\pm 1/16$  inch (1.59 mm) or better on pipe elevations and  $\pm 1$  mm (0.040 inch) on out-of-roundness measurements. This accuracy represents the ultimate attainable accuracy. The actual accuracy of pipe measurements would be dependent upon the cleanliness of the pipe where the measurements were taken. Although the pipes were cleaned, there were some areas where rust scale was present. In these instances where the accuracy could have been influenced by the condition in the pipe, a note was added in the remarks column of the data record sheet indicating the interference.

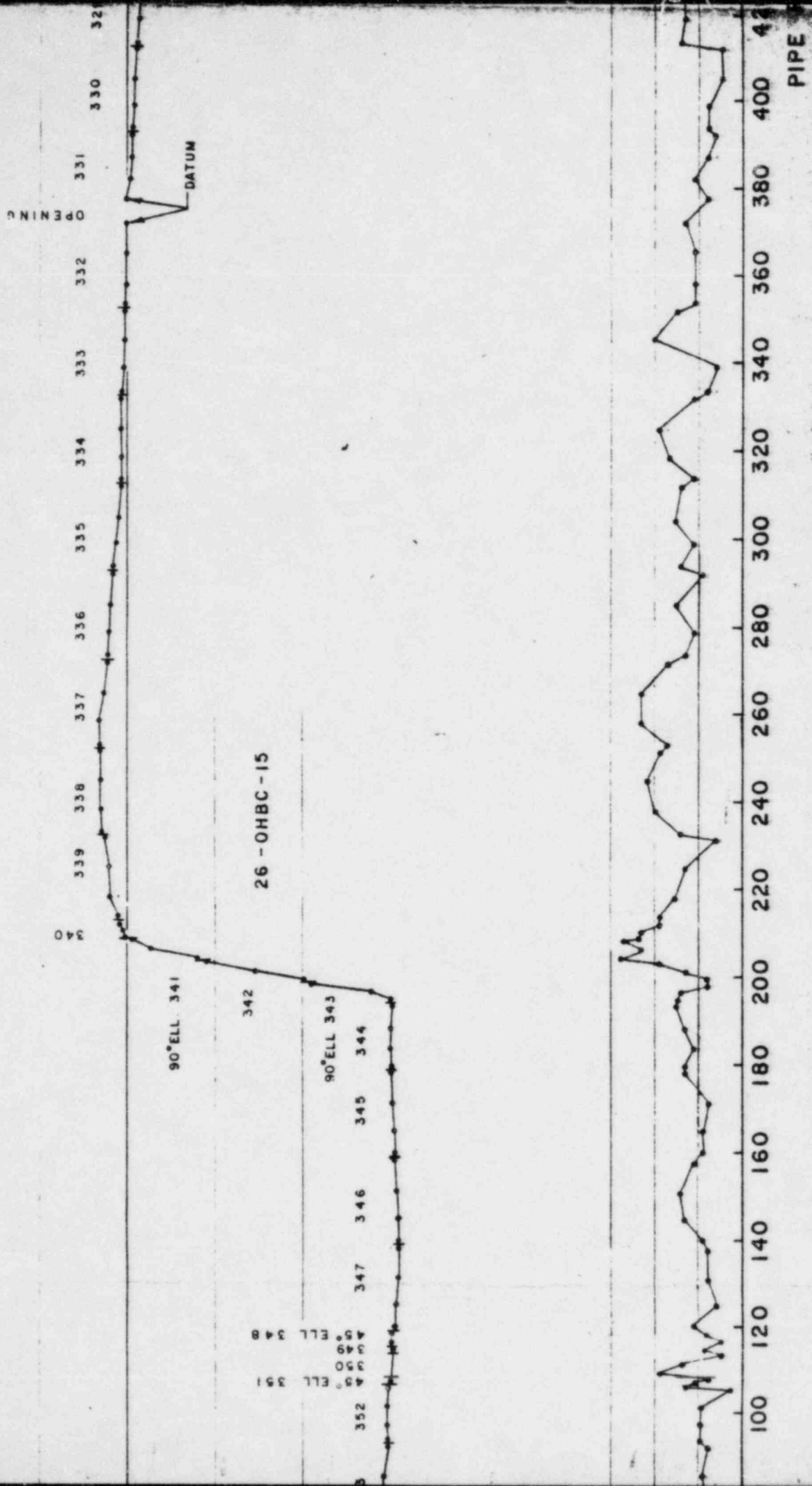
This report combined with Reports Nos. 1 and 2 contain all of the data taken on designated pipeline systems at Midland Units 1 and 2 in accordance with CPCo Contract/Purchase Order No. CP10-4762 dated April 24, 1981.



PIPE ELEVATION (INCHES)

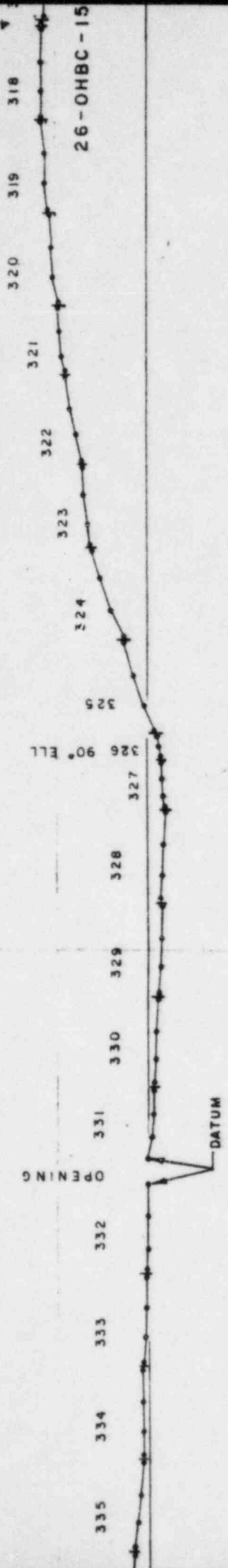
OVALNESS (%)



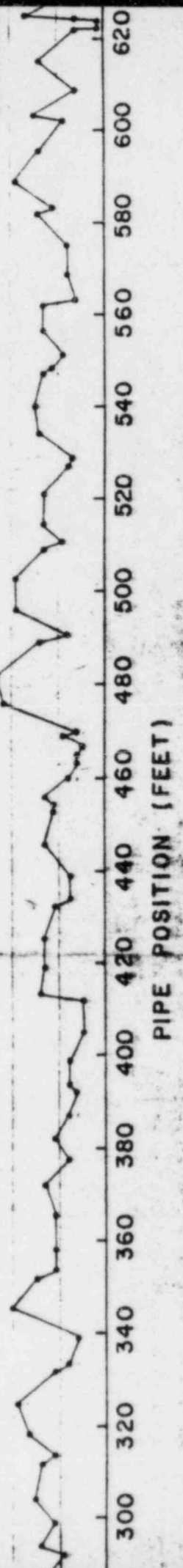


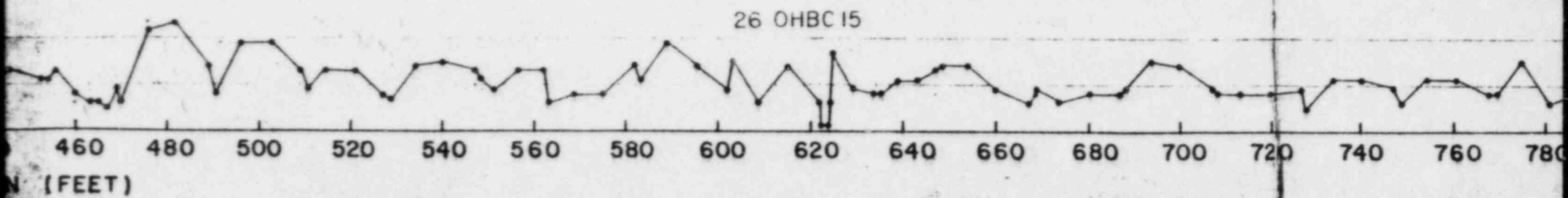
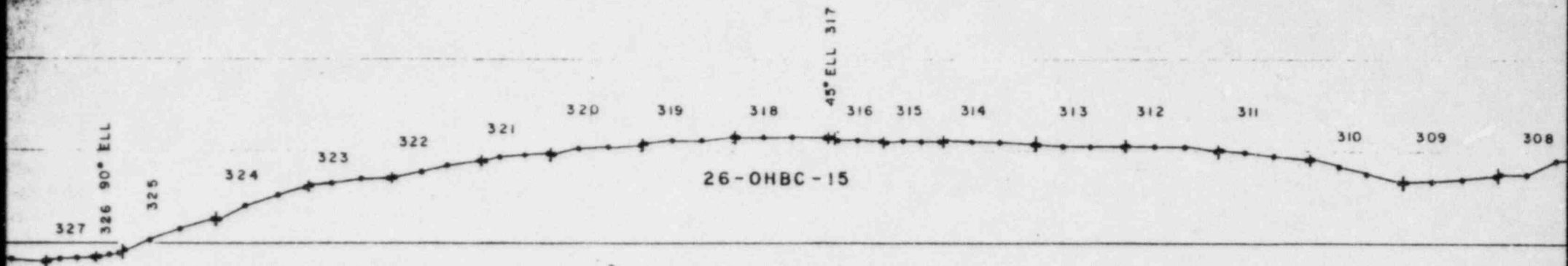
352  
 90° ELL. 341  
 348  
 90° ELL. 343  
 344  
 345  
 346  
 347  
 348

45° ELL 317



26 OHBC



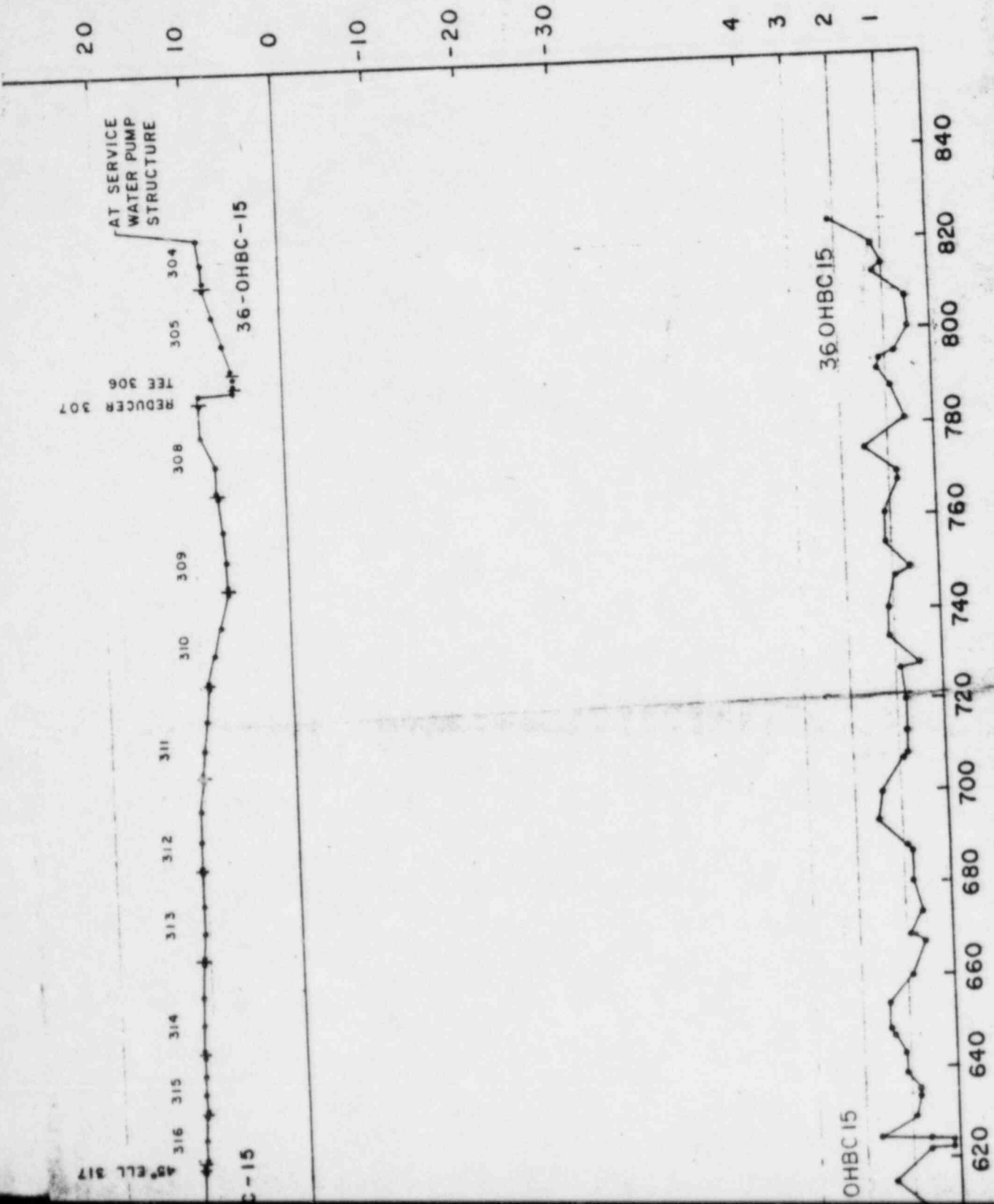


PIPE LINES  
26 OHBC 15  
AND  
36 OHBC 15

PIPE ELEVATION (INCHES)

OVALNESS (%)

FIGURE 1



AT SERVICE  
WATER PUMP  
STRUCTURE

304

305

306

307

308

309

310

311

312

313

314

315

316

317

36-OHBC-15

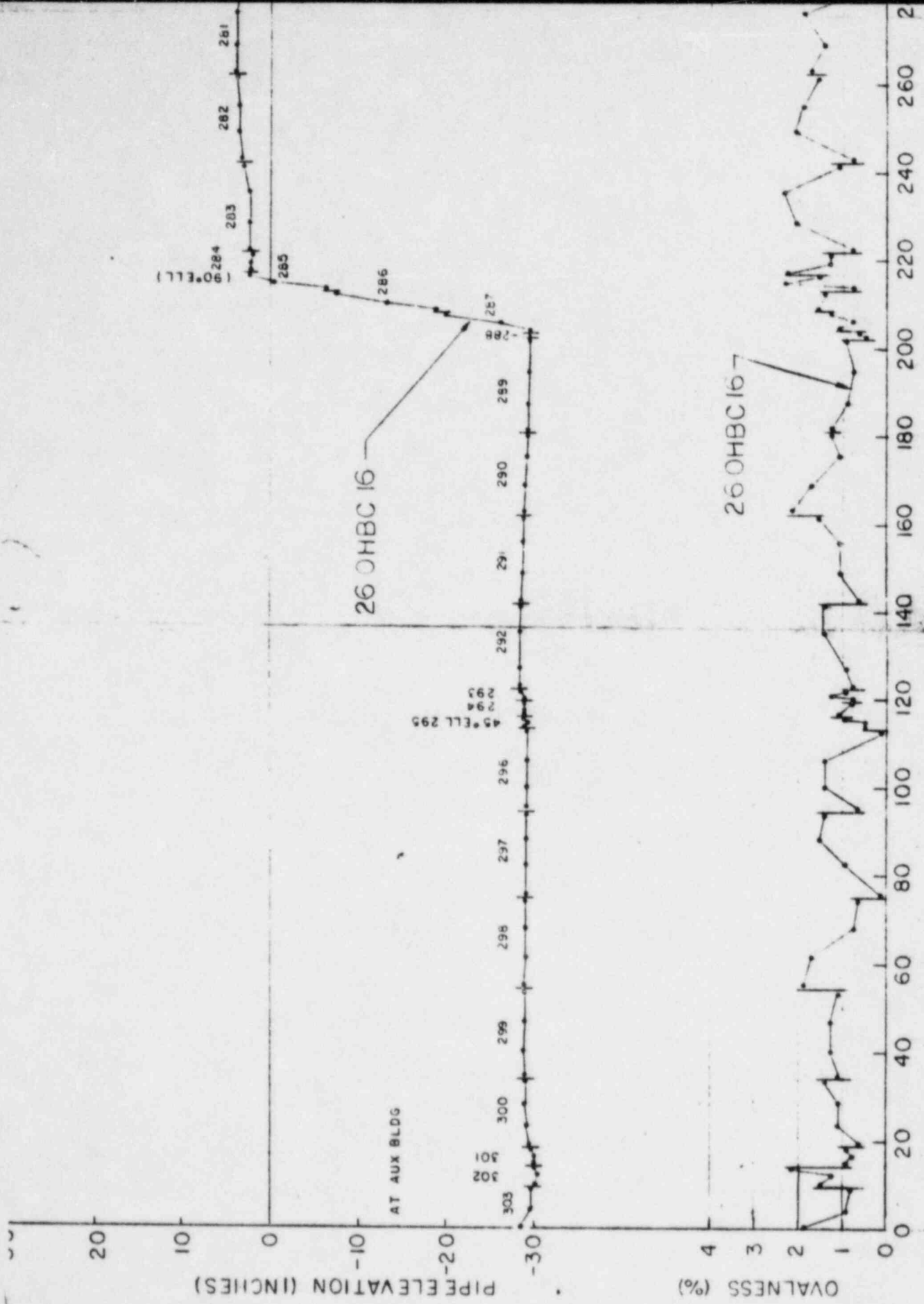
36 OHBC 15

OHBC 15

ELL 317

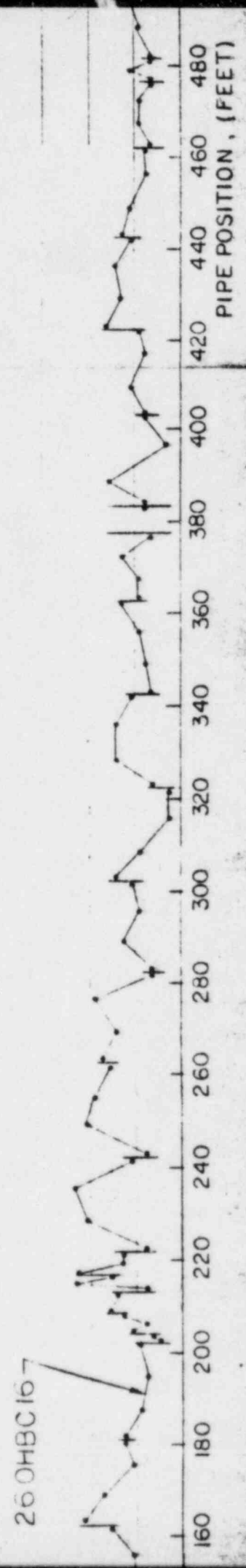
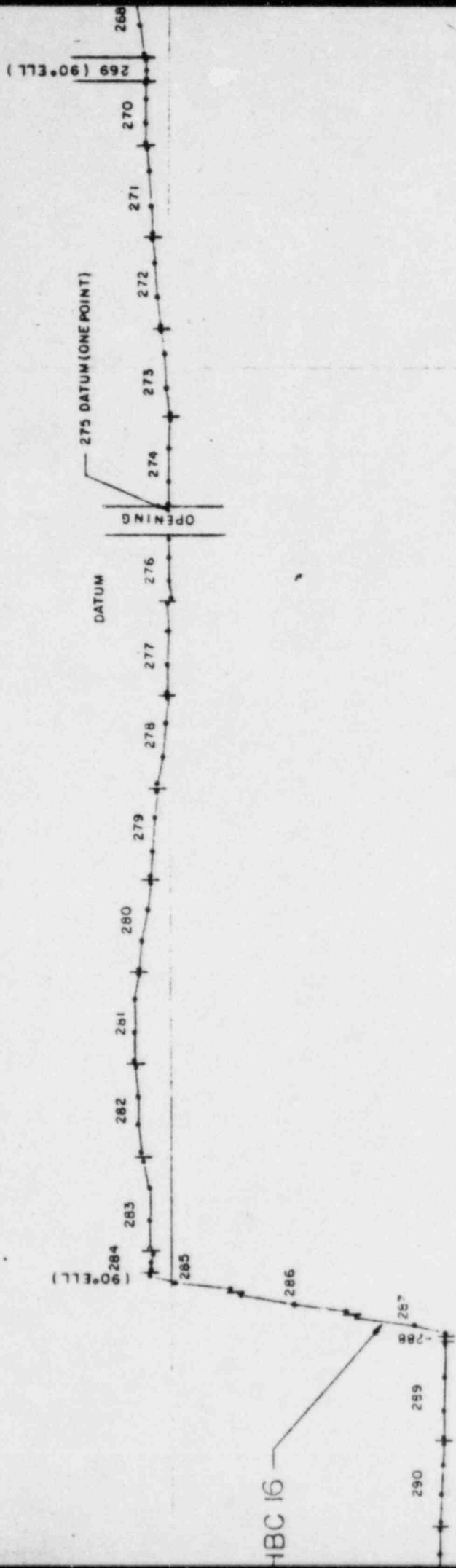
C-15

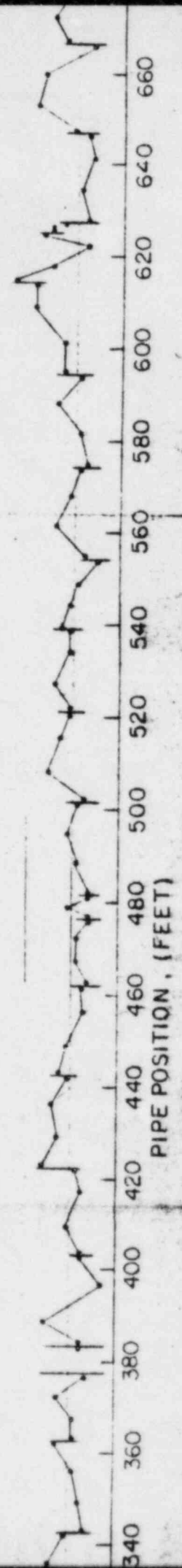
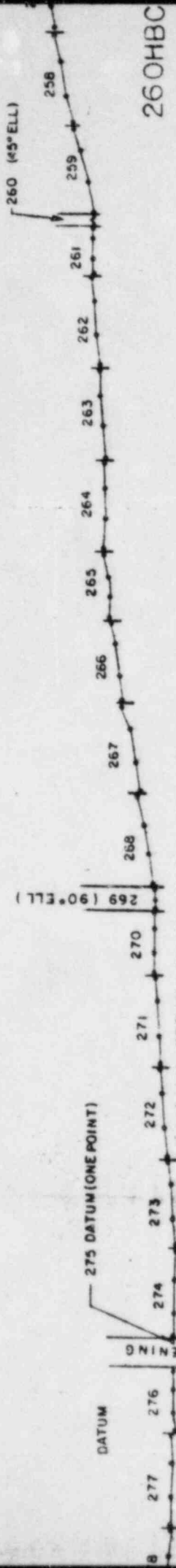


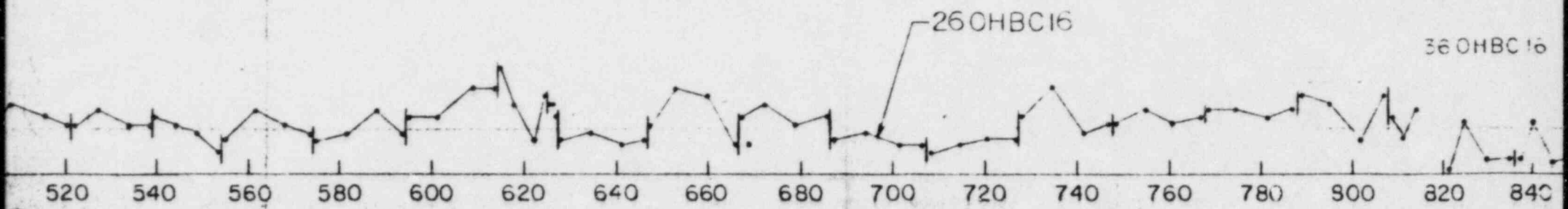
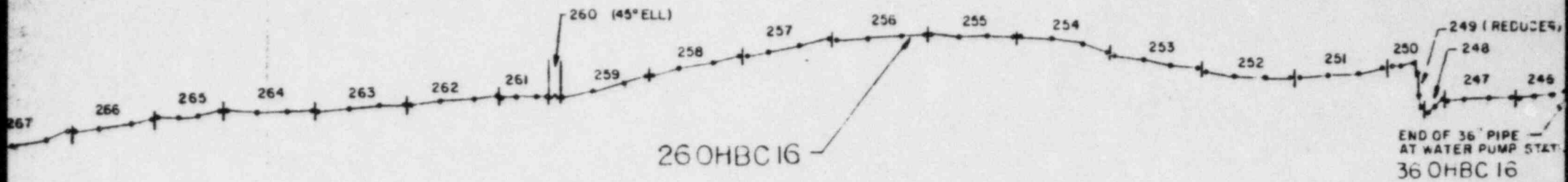


4.5" ELL 295  
 5.6"  
 6.2"

1.6" ELL  
 2.84  
 2.83  
 2.82  
 2.81









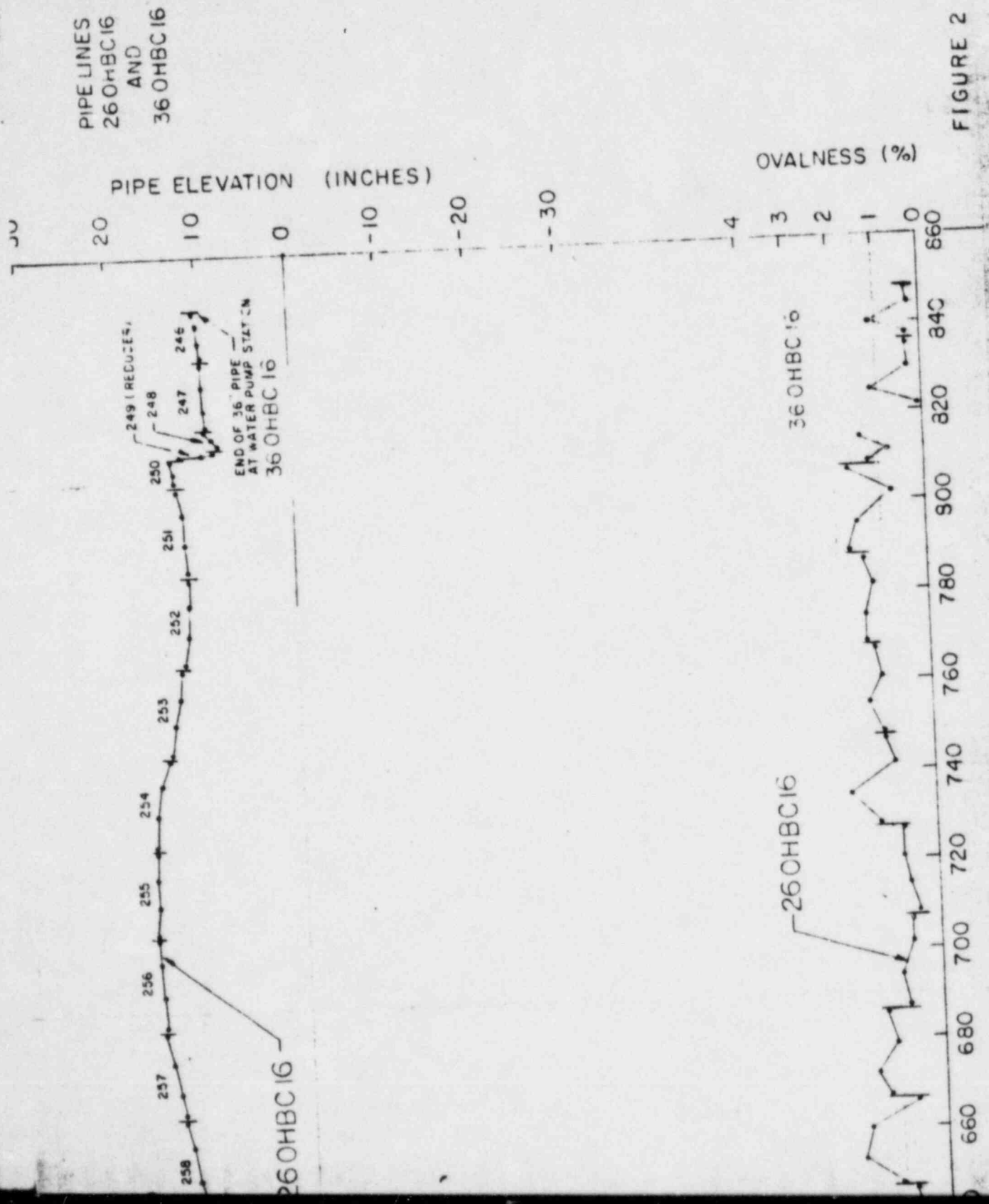
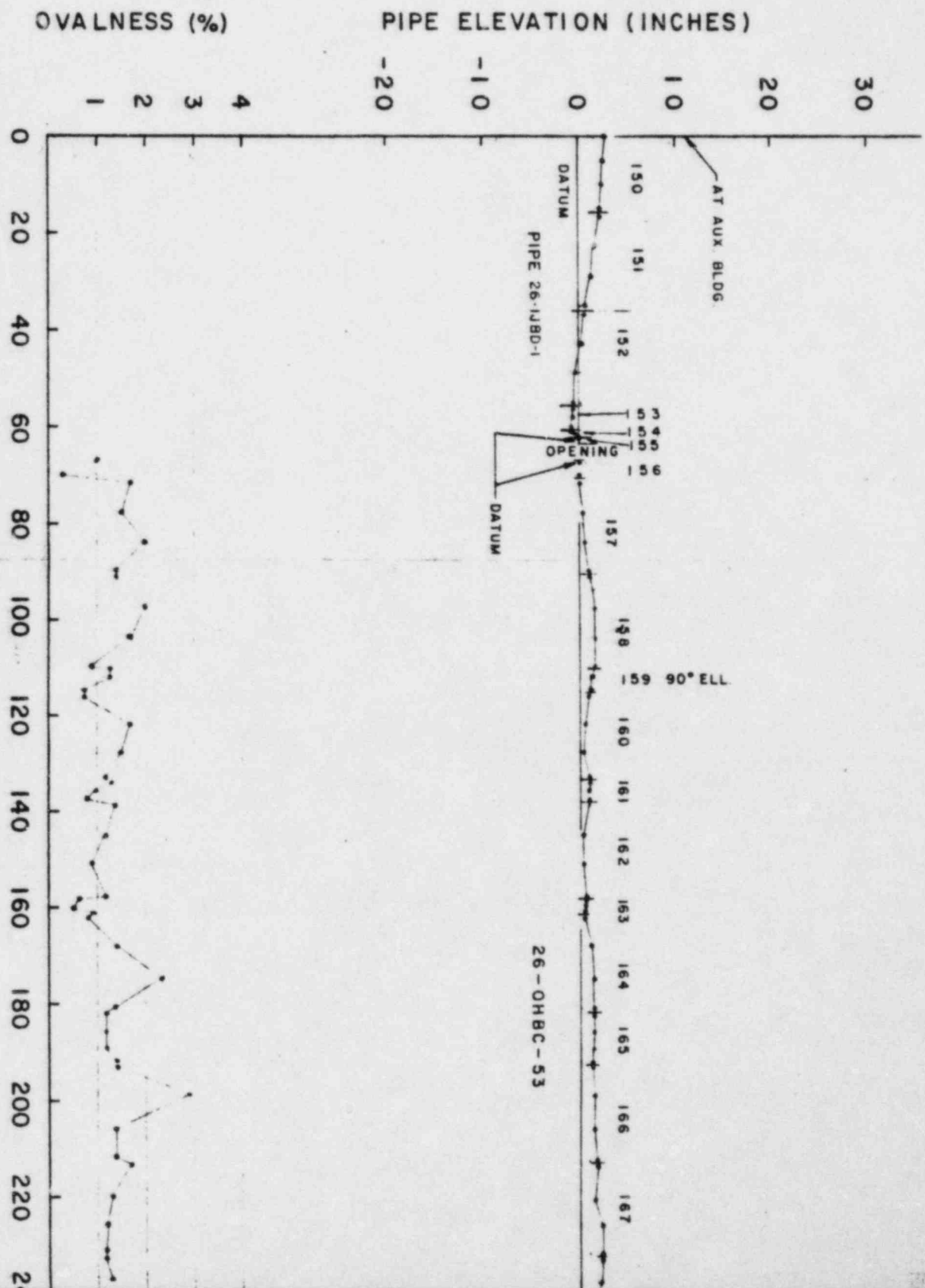


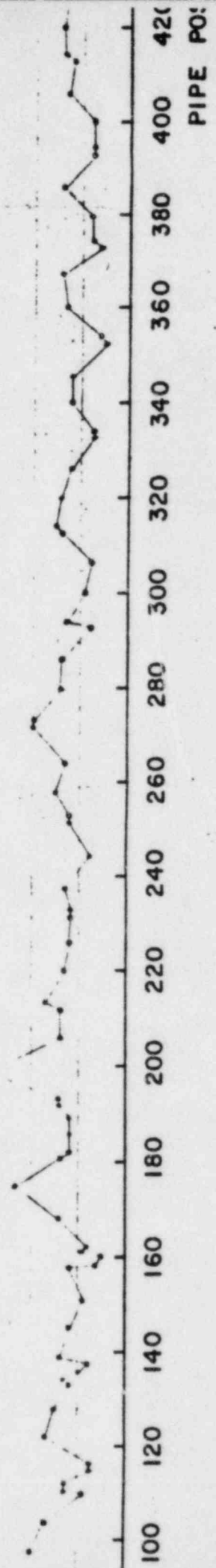
FIGURE 2



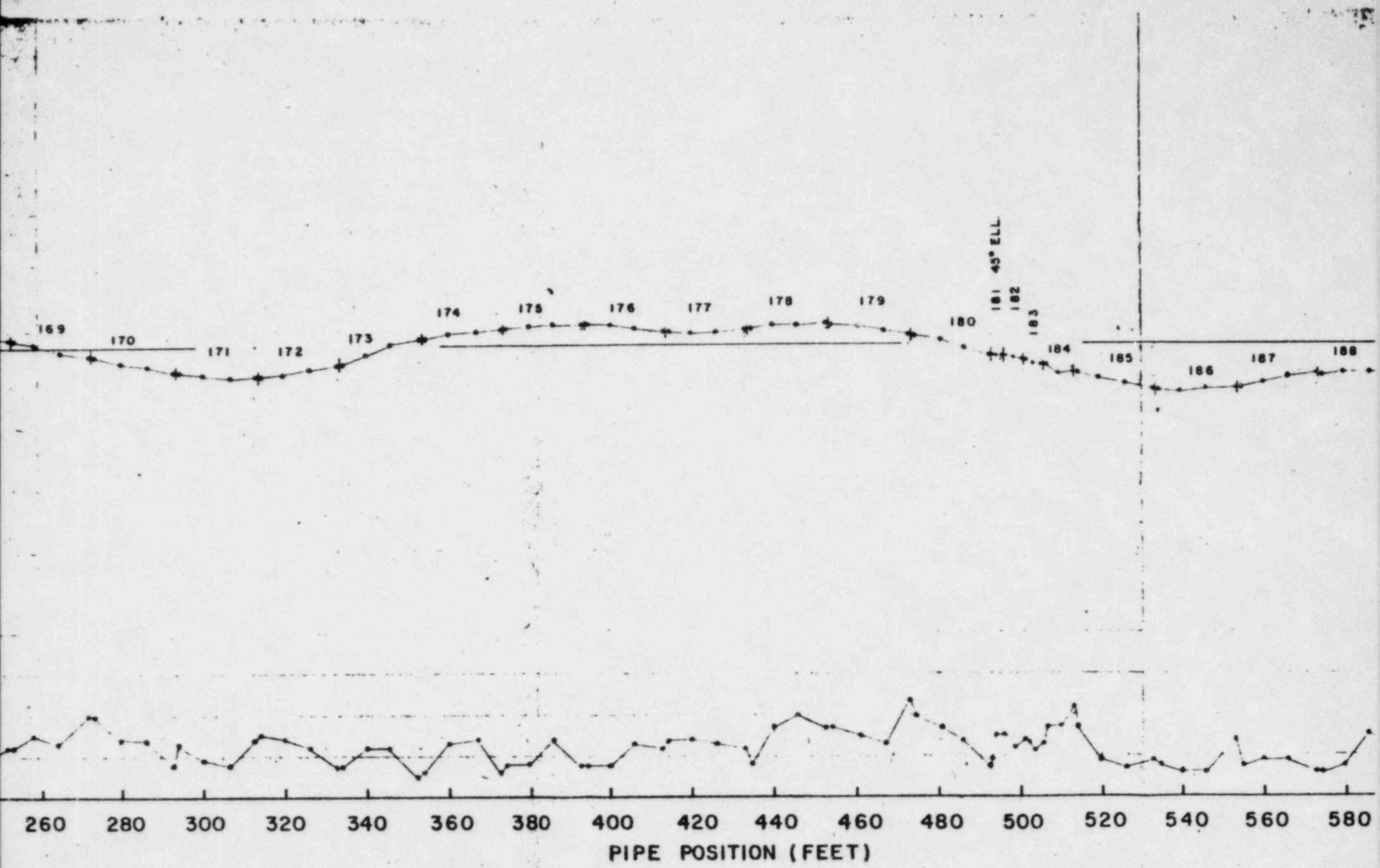
159 90° ELL

158 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 17

26-OHBC-53



PIPE POS



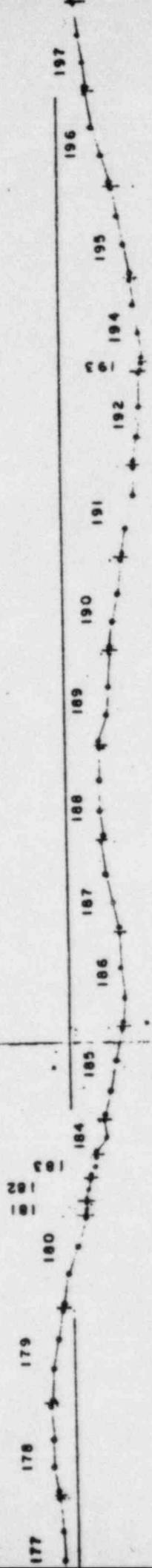
260 280 300 320 340 360 380 400 420 440 460 480 500 520 540 560 580

PIPE POSITION (FEET)



90° ELL  
361

45° ELL



420 440 460 480 500 520 540 560 580 600 620 640 660 680 700 720 740

POSITION (FEET)

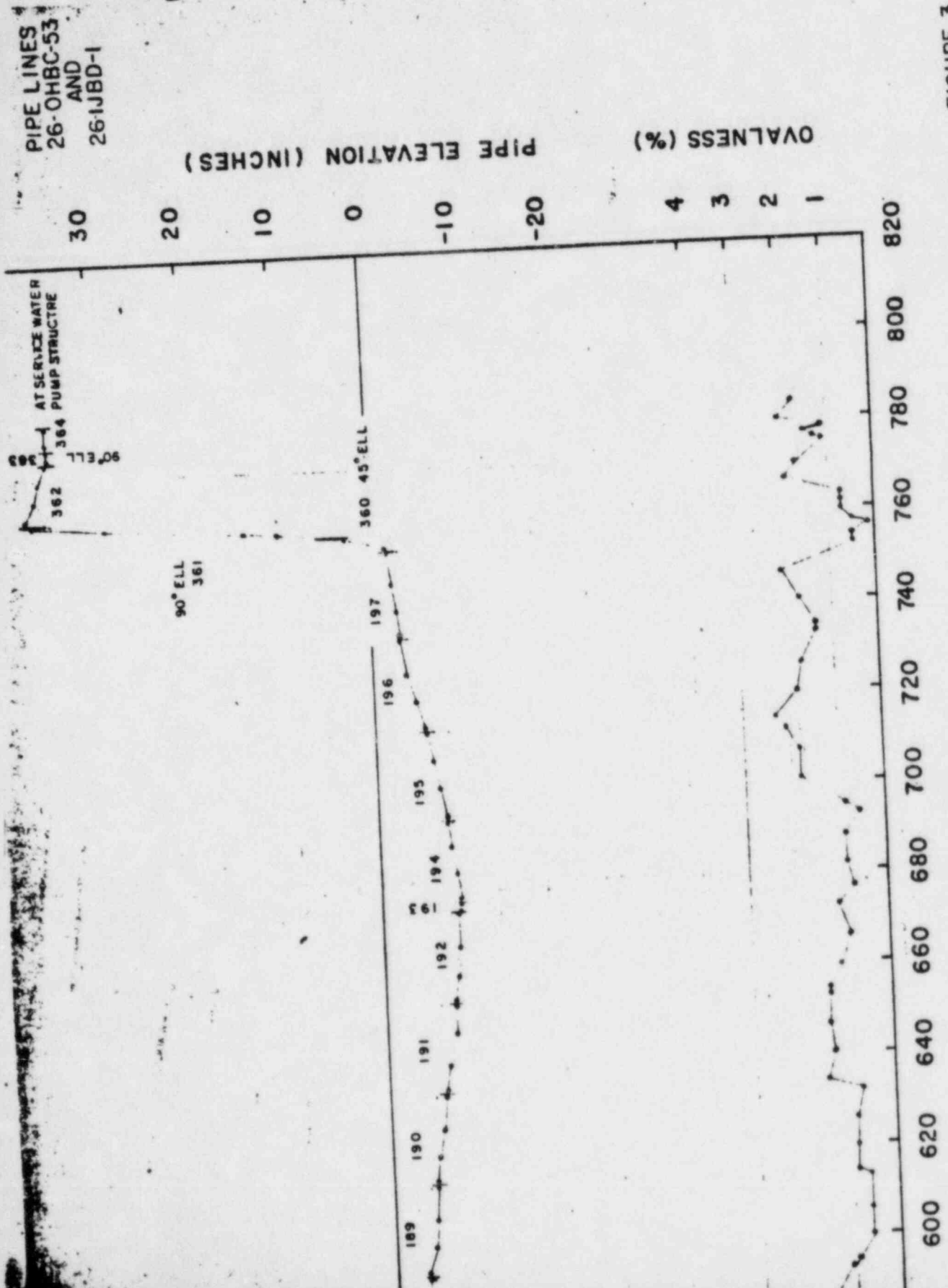
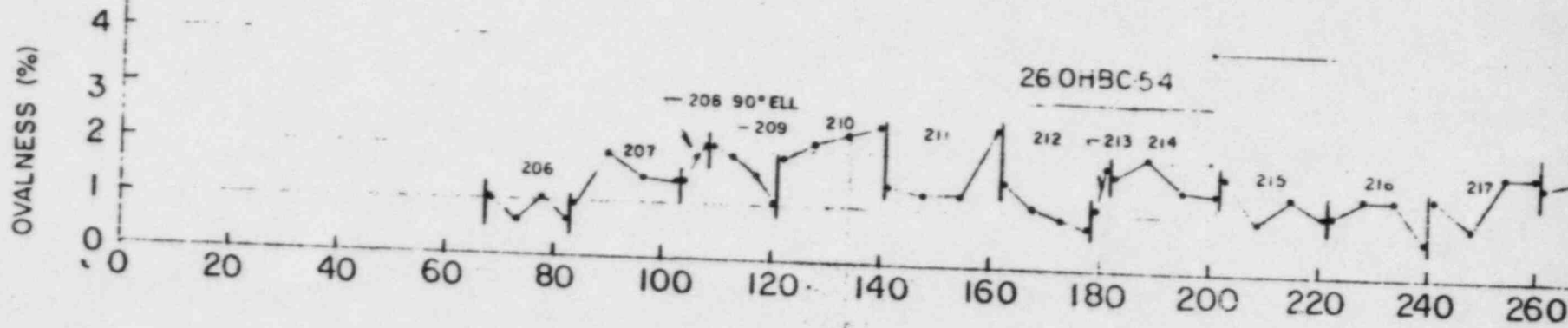
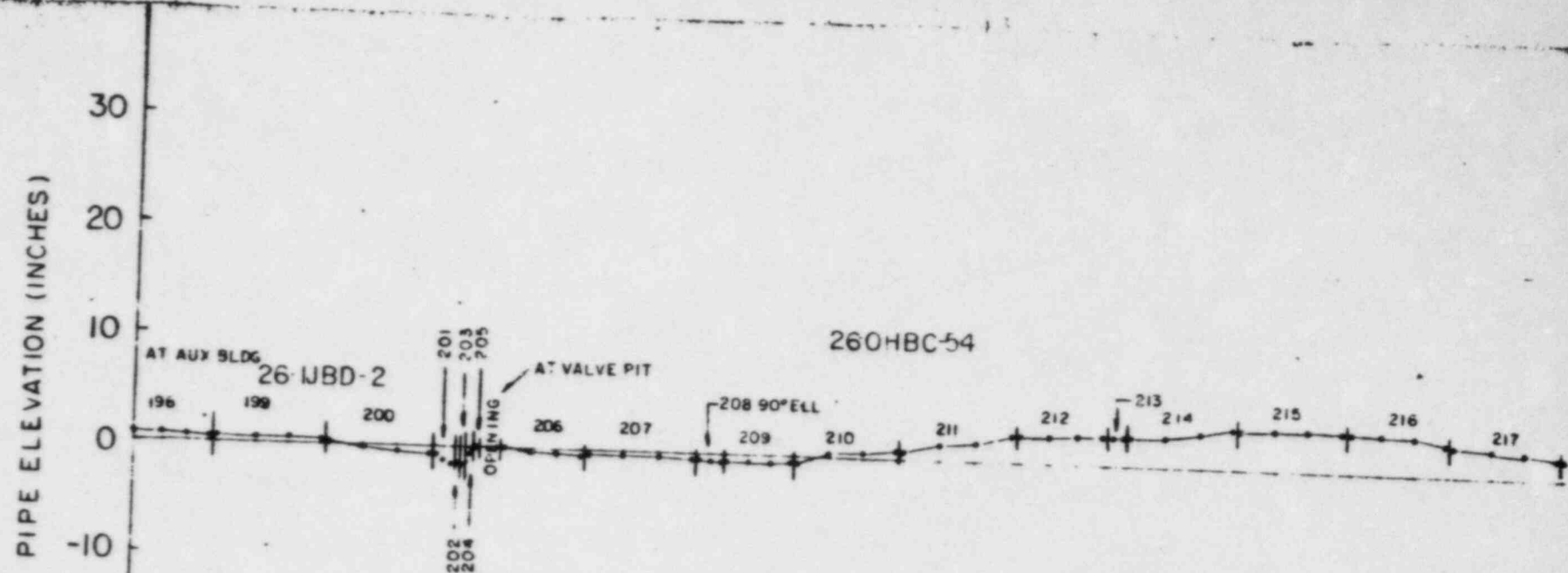


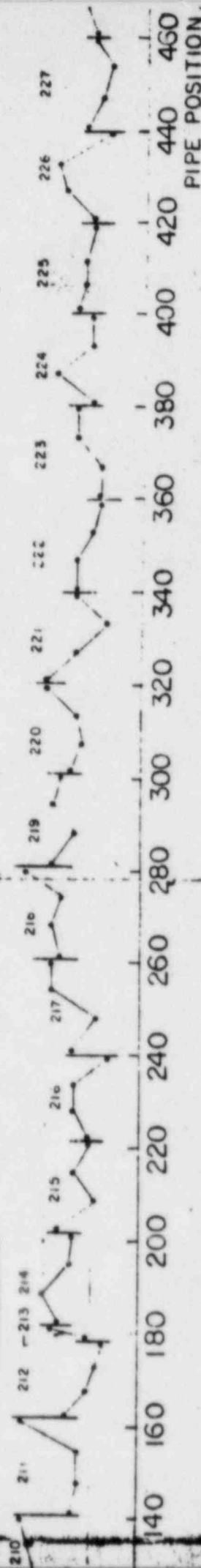
FIGURE 3



260HBC-54

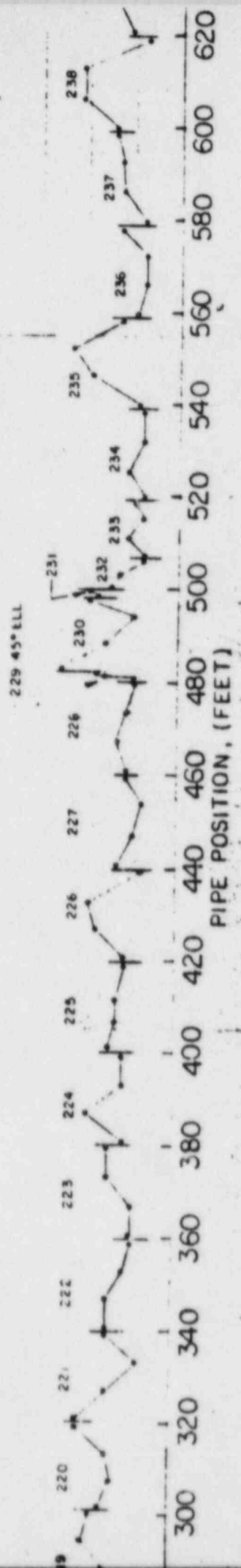
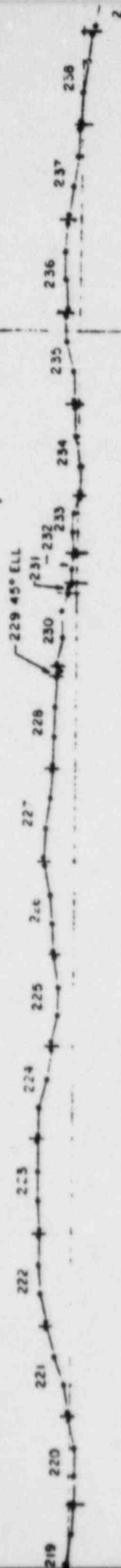


260HBC-54

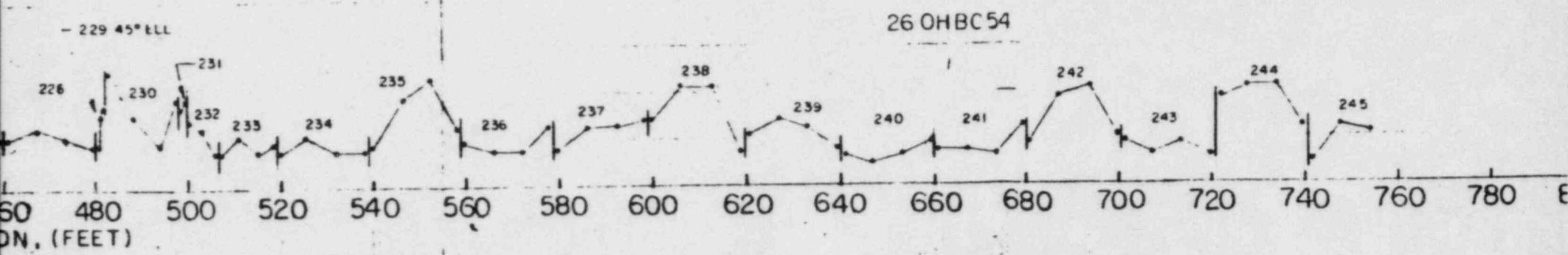
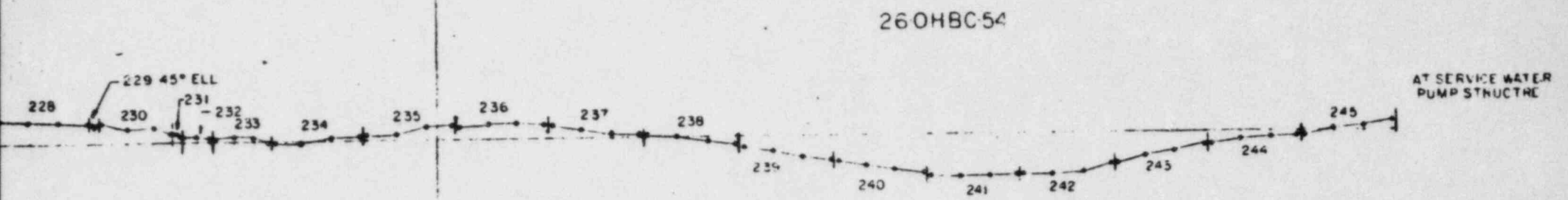


PIPE POSITION





PIPE POSITION, (FEET)



50 480 500 520 540 560 580 600 620 640 660 680 700 720 740 760 780 800

DN, (FEET)

PIPE LINES  
26-OHBC-54  
AND  
26-IJBD-2

PIPE ELEVATION (INCHES)

OVALNESS (%)

30

20

10

0

-10

-20

4

3

2

1

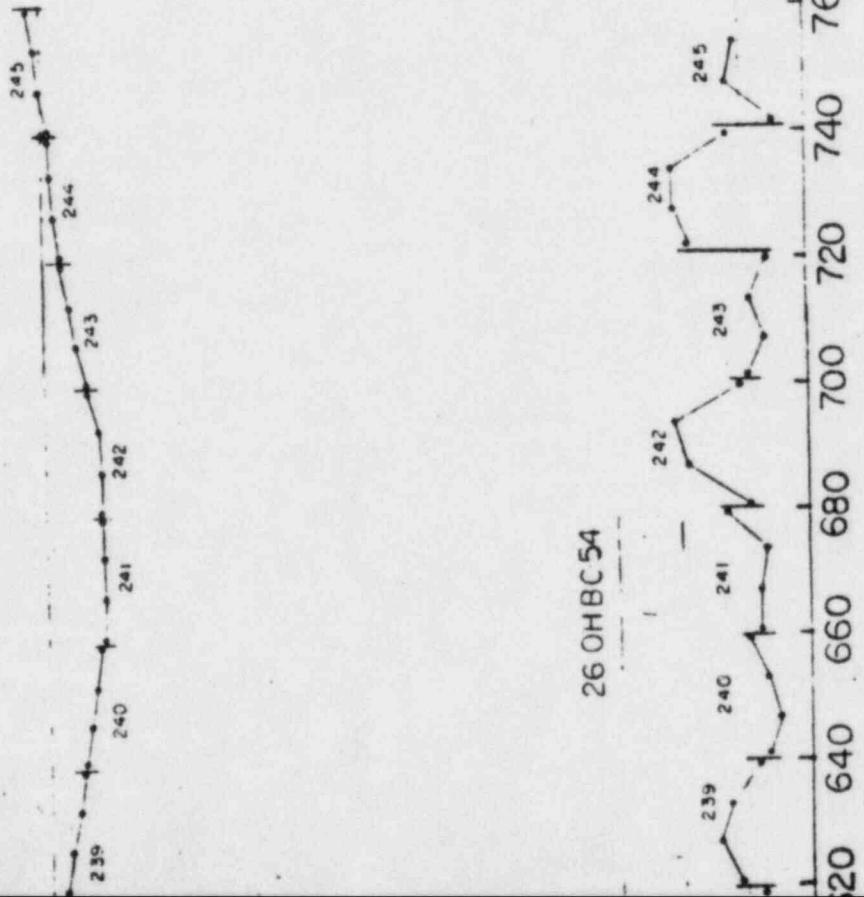
0

AT SERVICE WATER  
PUMP STRUCTURE

26-OHBC-54

26-OHBC-54

FIGURE 4



JUNCTION OF PIPES  
 26-OHBC-53 & 36-OHBC-15

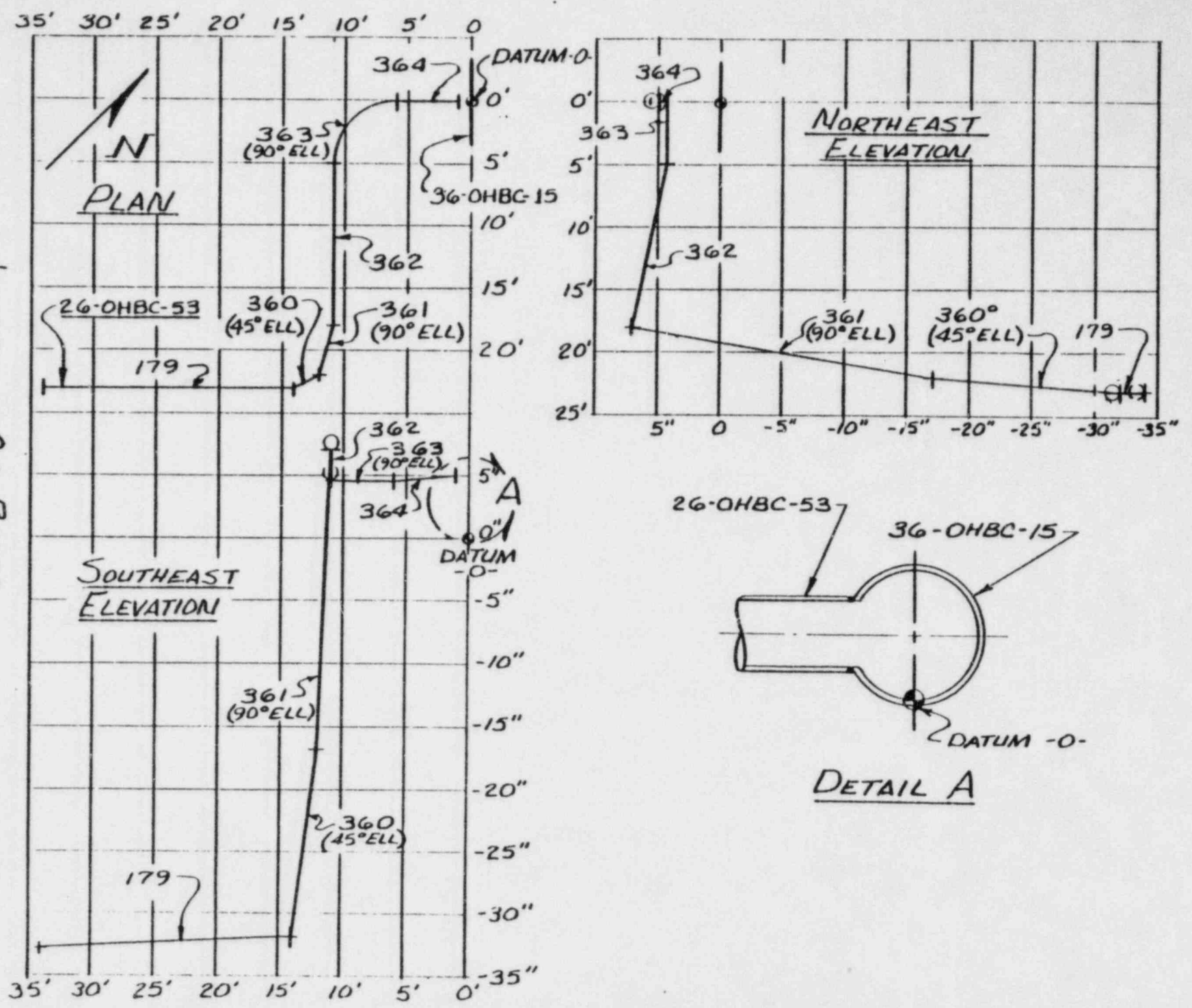


FIGURE 5



JUNCTION OF PIPES  
 26-OHBC-54 & 36-OHBC-16

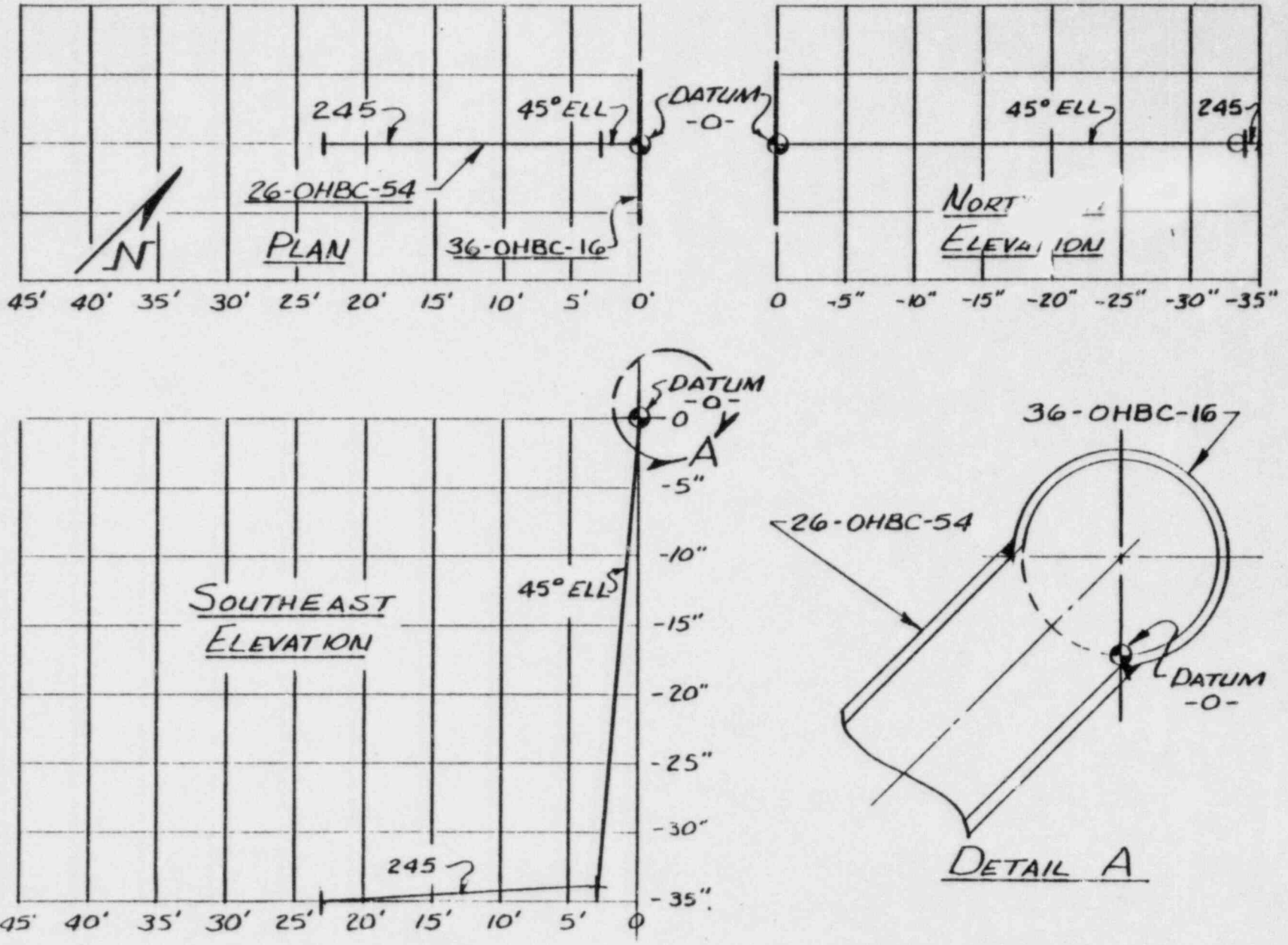
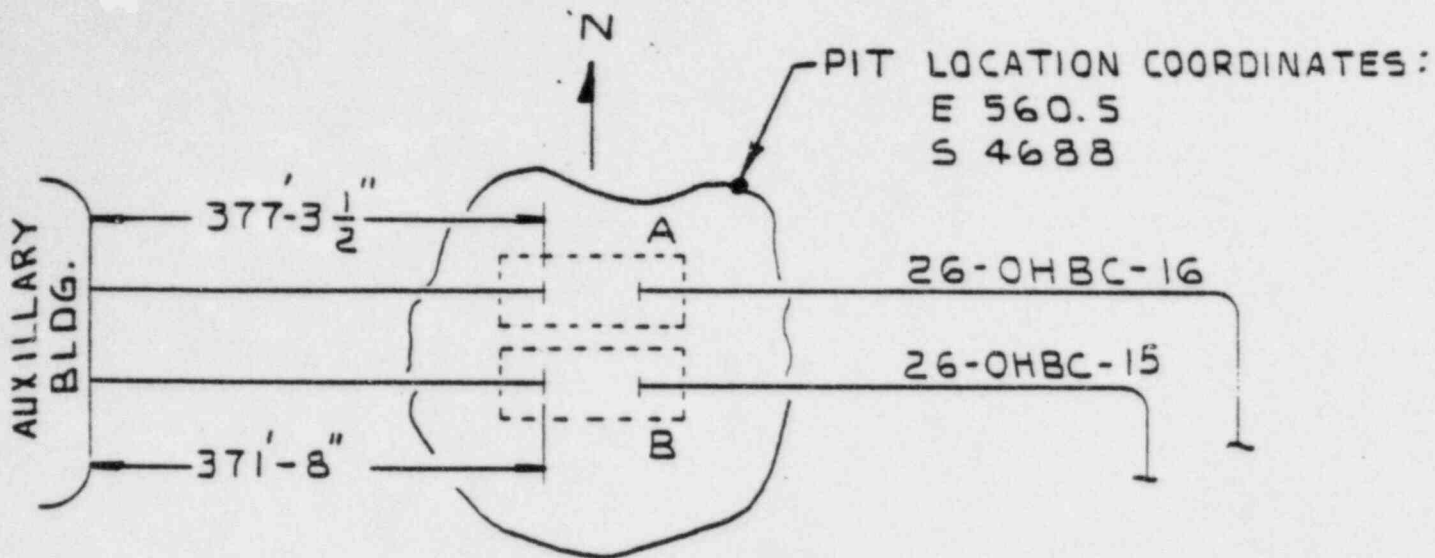


FIGURE 6

APPENDIX A

PIPE DATA POINT LOCATIONS

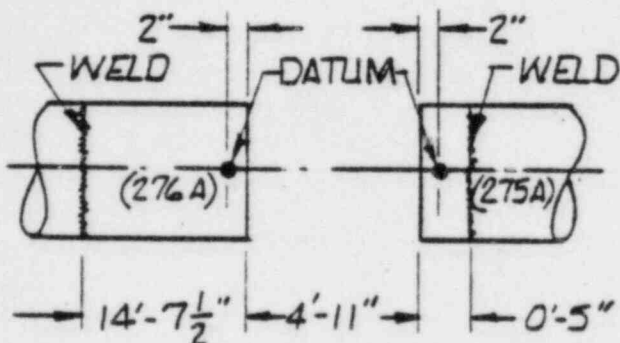


**NOTES:**

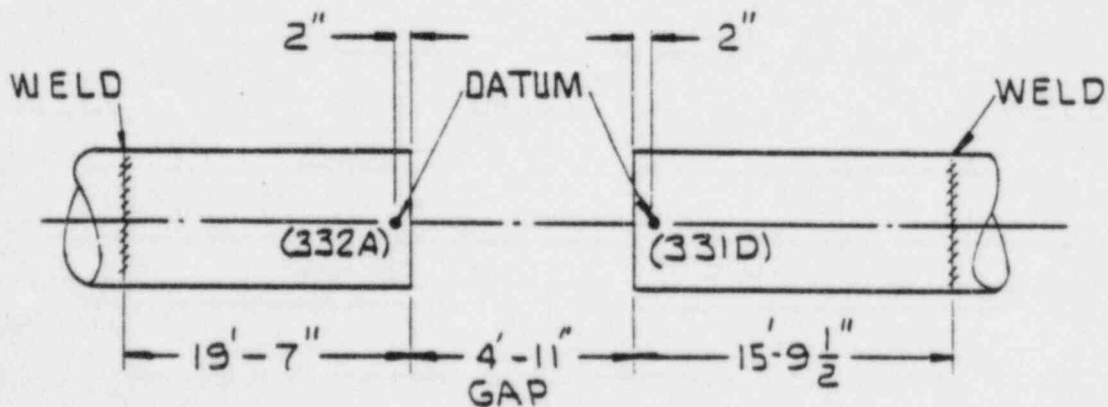
1. ZERO "DATUM" POINT ELEV. MEASUREMENT MADE BY CPCO.

PIPE	DATUM POINT	ELEVATION (FT)
26-OHBC-15	331D	625.114
26-OHBC-15	332A	625.138
26-OHBC-16	275A	625.052
26-OHBC-16	276A	625.086

2. DATUM POINT LOCATED ON INSIDE BOTTOM SURFACE OF PIPE.



DETAIL A

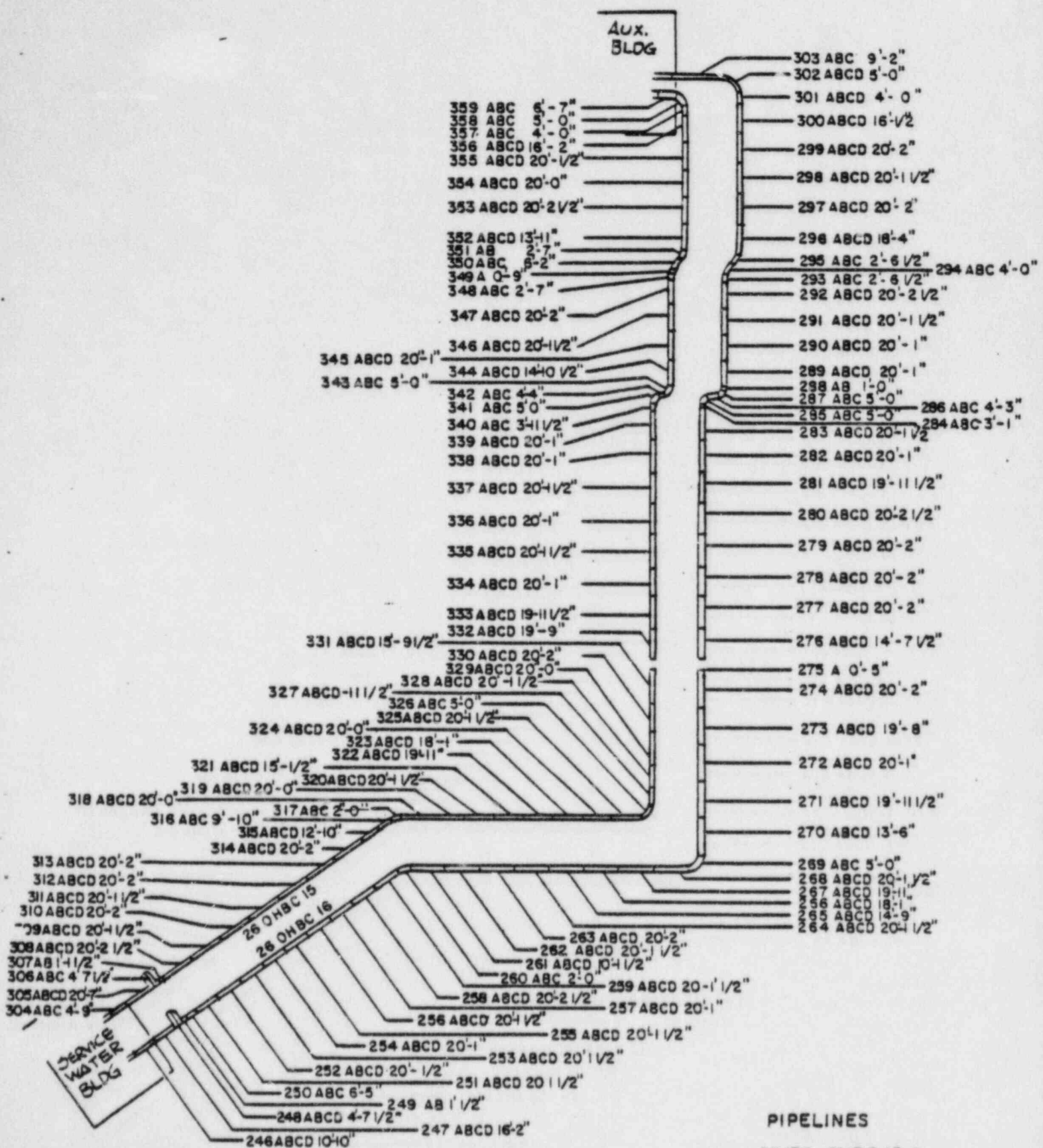


DETAIL B

PIPELINES 26-OHBC-15 AND 26-OHBC-16  
DATUM POINT LOCATION

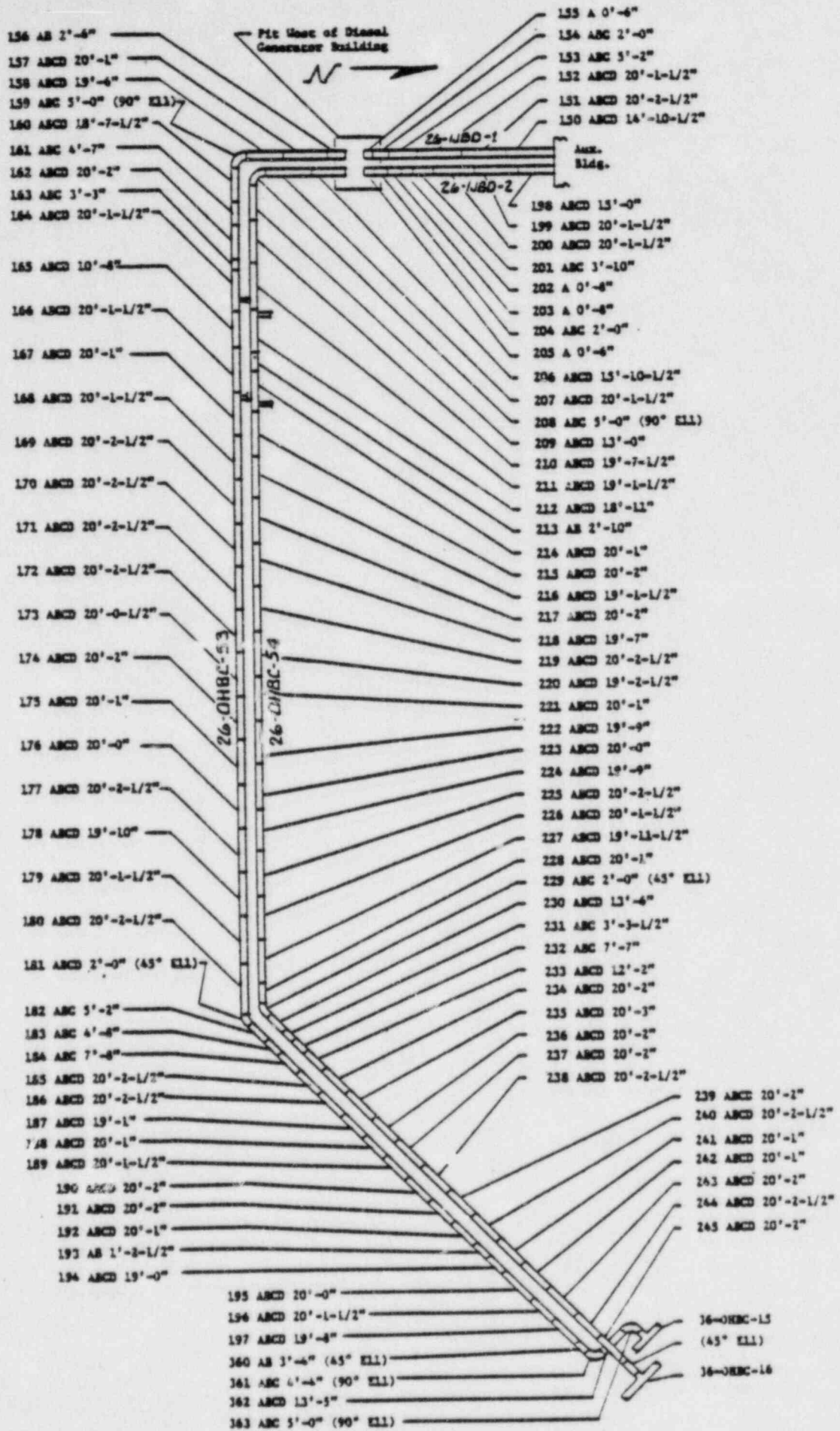






PIPELINES

26/36-OHBC-15 &  
26/36-OHBC-16



PIPELINES 26-OHBC-53 and 26-OHBC-54

PIPE 26/36 OHBC-15

Item	Pipe	Length	Sections	Section Length	Remarks
304	Pipe	9'-9"	ABC	4'-7"	36-OHBC-15 (At Service Water Pump Structure)
305	Pipe	20'-7"	ABCD	6'-8"	
306	Tee	4'-7½"	ABC	2'-4"	End of 36-OHBC-15 36" to 26" Reducer Start 26-OHBC-15
307	Reducer	1'-½"	AB	1'-½"	
308	Pipe	20'-2½"	ABCD	6'-7"	
309	Pipe	20'-1½"	ABCD	6'-7"	
310	Pipe	20'-2"	ABCD	6'-7"	
311	Pipe	20'-1½"	ABCD	6'-7"	
312	Pipe	20'-2"	ABCD	6'-7"	
313	Pipe	20'-2"	ABCD	6'-7"	
314	Pipe	20'-2"	ABCD	6'-7"	
315	Pipe	12'-10"	ABCD	4'-3"	
316	Pipe	9'-10"	ABC	4'-7"	
317	45°	2'-0"	ABC	1'-0"	
318	Pipe	20'-1½"	ABCD	6'-7"	
319	Pipe	20'-0"	ABCD	6'-7"	
320	Pipe	20'-1½"	ABCD	6'-7"	
321	Pipe	15'-½"	ABCD	5'-0"	
322	Pipe	19'-11"	ABCD	6'-7"	
323	Pipe	18'-1"	ABCD	6'-0"	
324	Pipe	20'-0"	ABCD	6'-7"	
325	Pipe	20'-1½"	ABCD	6'-7"	
326	90°	5'-0"	ABC	2'-6"	
327	Pipe	11'-1½"	ABCD	3'-8"	
328	Pipe	20'-1½"	ABCD	6'-7"	
329	Pipe	20'-0"	ABCD	6'-7"	
330	Pipe	20'-2"	ABCD	6'-7"	
331	Pipe	15'-9½"	ABCD	5'-3"	
	OPENING				
332	Pipe	19'-7"	ABCD	6'-6"	
333	Pipe	19'-11½"	ABCD	6'-7"	
334	Pipe	20'-1"	ABCD	6'-7"	
335	Pipe	20'-1½"	ABCD	6'-7"	
336	Pipe	20'-1"	ABCD	6'-7"	
337	Pipe	20'-1½"	ABCD	6'-7"	
338	Pipe	20'-1"	ABCD	6'-7"	
339	Pipe	20'-1"	ABCD	6'-7"	
340	Pipe	3'-11½"	ABC	2'-0"	
341	90°	5'-0"	ABC	2'-6"	
342	Pipe	4'-4"	ABC	2'-2"	
343	90°	5'-0"	ABC	2'-6"	
344	Pipe	14'-10½"	ABCD	4'-11"	
345	Pipe	20'-1"	ABCD	6'-7"	
346	Pipe	20'-1½"	ABCD	6'-7"	
347	Pipe	20'-2"	ABCD	6'-7"	

PIPE 26/36 OHBC-15 (Cont'd)

Item	Pipe	Length	Sections	Section Length	Remarks
348	45°	2'-7"	ABC	1'-3"	
349	Pipe	0'-9"	A	4'- $\frac{1}{2}$ "	
350	Pipe	6'-2"	ABC	3'-1"	
351	45°	2'-7"	ABC	1'-3"	
352	Pipe	13'-11"	ABCD	4'-8"	
353	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
354	Pipe	20'-0"	ABCD	6'-7"	
355	Pipe	20'- $\frac{1}{2}$ "	ABCD	6'-7"	
356	Pipe	16'-2"	ABCD	5'-4"	
357	Pipe	4'-0"	ABC	2'-0"	
358	90°	5'-0"	ABC	2'-6"	
359	Pipe	6'-7"	ABC	3'-3 $\frac{1}{2}$ "	At Auxiliary Building

NOTE: Points start and finish 2" from weld joint.



PIPE 26/36 OHBC-16

Item	Pipe	Length	Sections	Section Length	Remarks
246	Pipe	10'-10"	ABCD	3'-7"	36-OHBC-16
247	Pipe	16'-2"	ABCD	5'-4"	(At Service Water Pump Structure)
248	Tee	4'-7½"	ABCD	1'-6"	End 36-OHBC-16
249	Reducer	1'-½"	AB	1'-½"	36" to 26" Reducer
250	Pipe	6'-5"	ABC	3'-2½"	Start 26-OHBC-16
251	Pipe	20'-1½"	ABCD	6'-7"	
252	Pipe	20'-½"	ABCD	6'-7"	
253	Pipe	20'-1½"	ABCD	6'-7"	
254	Pipe	20'-1"	ABCD	6'-7"	
255	Pipe	20'-1½"	ABCD	6'-7"	
256	Pipe	20'-1½"	ABCD	6'-7"	
257	Pipe	20'-1"	ABCD	6'-7"	
258	Pipe	20'-2½"	ABCD	6'-7"	
259	Pipe	20'-1½"	ABCD	6'-7"	
260	45°	2'-0"	ABC	1'-0"	
261	Pipe	10'-1½"	ABCD	3'-7"	
262	Pipe	20'-1½"	ABCD	6'-7"	
263	Pipe	20'-2"	ABCD	6'-7"	
264	Pipe	20'-1½"	ABCD	6'-7"	
265	Pipe	14'-9"	ABCD	4'-10"	
266	Pipe	18'-1"	ABCD	6'-0"	
267	Pipe	19'-11"	ABCD	6'6"	
268	Pipe	20'-1½"	ABCD	6'-7"	
269	90°	5'-0"	ABC	2'-6"	
270	Pipe	13'-6"	ABCD	4'-6"	
271	Pipe	19'-11½"	ABCD	6'-6"	
272	Pipe	20'-1"	ABCD	6'-7"	
273	Pipe	19'-8"	ABCD	6'-6"	
274	Pipe	20'-2"	ABCD	6'-7"	
275	Pipe	0'-5"	A	2½"	
	OPENING				
276	Pipe	14'-7½"	ABCD	4'-10"	
277	Pipe	20'-2"	ABCD	6'-7"	
278	Pipe	20'-2"	ABCD	6'-7"	
279	Pipe	20'-2"	ABCD	6'-7"	
280	Pipe	20'-2½"	ABCD	6'-7"	
281	Pipe	19'-11½"	ABCD	6'-6"	
282	Pipe	20'-1"	ABCD	6'-7"	
283	Pipe	20'-1½"	ABCD	6'-7"	
284	Pipe	3'-11½"	ABC	2'-0"	
285	90°	5'-0"	ABC	2'-6"	
286	Pipe	4'-3"	ABC	2'-1½"	
287	90°	5'-0"	ABC	2'-6"	
288	Pipe	1'-0"	AB	1'-0"	
289	Pipe	20'-1"	ABCD	6'-7"	
290	Pipe	20'-1"	ABCD	6'-7"	
291	Pipe	20'-1½"	ABCD	6'-7"	
292	Pipe	20'-2½"	ABCD	6'-7"	
293	45°	2'-6½"	ABC	1'-3"	

PIPE 26/36 OHBC-16 (Cont'd)

Item	Pipe	Length	Sections	Section Length	Remarks
294	Pipe	4'-0"	ABC	2'-0"	
295	45°	2'-6½"	ABC	1'-3"	
296	Pipe	18'-4"	ABCD	6'-1"	
297	Pipe	20'-2"	ABCD	6'-7"	
298	Pipe	20'-1½"	ABCD	6'-7"	
299	Pipe	20'-2"	ABCD	6'-7"	
300	Pipe	16'-½"	ABCD	5'-4"	
301	Pipe	4'-0"	ABC	2'-0"	
302	90°	5'-0"	ABC	2'-6"	
303	Pipe	9'-2"	ABC	4'-6½"	Ends at Auxiliary Bldg

NOTE: Points start and finish 2" from weld joint.

PIPE 26-1 JBD-1 and 26-OHBC-53

Item	Pipe	Length	Sections	Section Length	Remarks
150	Pipe	14'-10 $\frac{1}{2}$ "	ABCD	4'-9"	26-1 JBD-1 (At Auxiliary Building)
151	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
152	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
153	Pipe	5'-2"	ABC	2'-7"	
154	Pipe	2'-0"	ABC	1'-0"	
155	Flange	0'-6"	A	0'-3"	
	OPENING				
156	Pipe	2'-6"	AB	2'-6"	26-OHBC-53 (At Valve Pit)
157	Pipe	20'-1"	ABCD	6'-7"	
158	Pipe	19'-6"	ABCD	6'-6"	
159	90°	5'	ABC	2'-6"	
160	Pipe	18'-7 $\frac{1}{2}$ "	ABCD	6'-2 $\frac{1}{2}$ "	
161	Pipe	4'-7"	ABC	2'-3 $\frac{1}{2}$ "	
162	Pipe	20'-2"	ABCD	6'-7"	
163	Pipe	3'-3"	ABC	1'-6 $\frac{1}{2}$ "	
164	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
165	Pipe	10'-8"	ABCD	3'-7"	
166	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
167	Pipe	20'-1"	ABCD	6'-7"	
168	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
169	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
170	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
171	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
172	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
173	Pipe	20'- $\frac{1}{2}$ "	ABCD	6'-7"	
174	Pipe	20'-2"	ABCD	6'-7"	
175	Pipe	20'-1"	ABCD	6'-7"	
176	Pipe	20'-0"	ABCD	6'-7"	
177	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
178	Pipe	19'-10"	ABCD	6'-6"	
179	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
180	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
181	45°	2'	ABC	1'-0"	
182	Pipe	5'-4"	ABC	2'-8"	
183	Pipe	4'-8"	ABC	2'-4"	
184	Pipe	7'-8"	ABC	3'-10"	
185	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
186	Pipe	20'-2 $\frac{1}{2}$ "	ABCD	6'-7"	
187	Pipe	19'-1"	ABCD	6'-4 $\frac{1}{2}$ "	
188	Pipe	20'-1"	ABCD	6'-7"	
189	Pipe	20'-1 $\frac{1}{2}$ "	ABCD	6'-7"	
190	Pipe	20'-2"	ABCD	6'-7"	
191	Pipe	20'-2"	ABCD	6'-7"	
192	Pipe	20'-1"	ABCD	6'-7"	
193	Pipe	1'-2 $\frac{1}{2}$ "	AB	1'-2 $\frac{1}{2}$ "	
194	Pipe	19'-0"	ABCD	6'- $\frac{1}{2}$ "	
195	Pipe	20'-0"	ABCD	6'-7"	

PIPE 26-1 JBD-1 and 26-OHBC-53 (Cont'd)

Item	Pipe	Length	Sections	Section Length	Remarks
196	Pipe	20'-1½"	ABCD	6'-7"	
197	Pipe	19'-8"	ABCD	6'-6½"	
360	45°	3'-4"	AB	3'-4"	
361	90°	4'-4"	ABC	2'-2"	
362	Pipe	13'-5"	ABCD	4'-5"	
363	90°	5'-0"	ABC	2'-6"	
364	Pipe	4'-9"	ABC	2'-4½"	At Service Water Pump Structure

NOTE: Points start & finish 2" from weld joint.



PIPE 26-1 JBD-2 and 26-OHBC-54

Item	Pipe	Length	Sections	Section Length	Remarks
198	Pipe	15'-0"	ABCD	5'-0"	26-1 JBD-2 (At Auxiliary Building)
199	Pipe	20'-1½"	ABCD	6'-7"	
200	Pipe	20'-1½"	ABCD	6'-7"	
201	Pipe	3'-10"	ABC	1'-11"	
202	Pipe	0'-8"	A	4"	
203	Pipe	0'-8"	A	4"	
204	Pipe	2'-0"	ABC	1'-0"	
205	Flange	6"	A	0'-3"	
OPENING					
206	Pipe	15'-10½"	ABCD	5'-3½"	26-OHBC-54 (At Valve Pit)
207	Pipe	20'-1½"	ABCD	6'-7"	
208	90°	5'-0"	ABC	2'-6"	
209	Pipe	13'-0"	ABCD	4'-4"	
210	Pipe	19'-7½"	ABCD	6'-6"	
211	Pipe	19'-1½"	ABCD	6'-5"	
212	Pipe	18'-11"	ABCD	6'-3½"	
213	Pipe	2'-10"	AB	2'-10"	
214	Pipe	20'-2"	ABCD	6'-7"	
215	Pipe	20'-2"	ABCD	6'-7"	
216	Pipe	19'-1½"	ABCD	6'-5"	
217	Pipe	20'-2"	ABCD	6'-7"	
218	Pipe	19'-7"	ABCD	6'-6"	
219	Pipe	20'-2½"	ABCD	6'-7"	
220	Pipe	19'-2½"	ABCD	6'-5"	
221	Pipe	20'-1"	ABCD	6'-7"	
222	Pipe	19'-9"	ABCD	6'-7"	
223	Pipe	20'-0"	ABCD	6'-7"	
224	Pipe	19'-9"	ABCD	6'-7"	
225	Pipe	20'-2½"	ABCD	6'-7"	
226	Pipe	20'-1½"	ABCD	6'-7"	
227	Pipe	19'-11½"	ABCD	6'-7"	
228	Pipe	20'-1"	ABCD	6'-7"	
229	45°	2'-0"	ABC	1'-0"	
230	Pipe	13'-6"	ABCD	4'-6"	
231	Pipe	3'-3½"	ABC	1'-7"	
232	Pipe	7'-7"	ABC	3'-9"	
233	Pipe	12'-2"	ABCD	4'-0"	
234	Pipe	20'-2"	ABCD	6'-7"	
235	Pipe	20'-3"	ABCD	6'-7"	
236	Pipe	20'-2"	ABCD	6'-7"	
237	Pipe	20'-2"	ABCD	6'-7"	
238	Pipe	20'-2½"	ABCD	6'-7"	
239	Pipe	20'-2"	ABCD	6'-7"	
240	Pipe	20'-2½"	ABCD	6'-7"	
241	Pipe	20'-1"	ABCD	6'-7"	
242	Pipe	20'-1"	ABCD	6'-7"	
243	Pipe	20'-2"	ABCD	6'-7"	
244	Pipe	20'-2½"	ABCD	6'-7"	
245	Pipe	20'-2"	ABCD	6'-7"	

NOTE: Points start and finish 2" from weld joint.

APPENDIX B

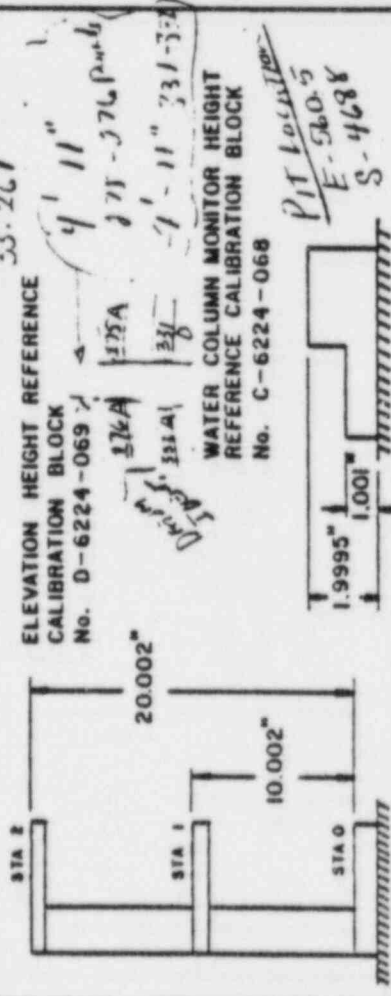
PIPE CALIBRATION AND ELEVATION DATA RECORDS

# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 15 OCT 81	TIME (24 HR CLOCK) 1140	SHEET No. 0043
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) NOK7EC	SERIAL No. 131D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER SETRA 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. AEROTEC 012601M

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSUCER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INHER. VOLTS	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.70	.7283	57	-.181	55.168	1146	1.001	2.000	1140	PIPE 20-011DC-16
1.002	1.70	.5470	57	-.181	55.188	1147	1.001	2.001	1210	
1.002	1.70	.3659	57	-.163	55.178	1147	1.001	2.001	1245	
0	1.7	.7282	57	-.181	55.198	1151	1.001	2.002	1308	
1.002	1.70	.5470	57	-.181	55.188	1152	1.003	2.003	1337	
1.002	1.70	.3655	57	-.163	55.193	1154	1.003	2.002	1357	
Avg. 55.186										
0	1.70	.7291	64	-.181	55.259	1450				
1.002		.5481	64	-.1805	55.279	1451				
1.002		.3672	64	-.169	55.269	1452				
0		.7292	65	-.180	55.250	1454				
1.002		.5483	65	-.181	55.218	1455				
1.002		.3672	65	-.163	55.254	1455				
AVERAGE "C" FOR ALL RUNS 55.223										



### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE 1111 1/2	DATE 15 Oct 81	TIME (24 HR CLOCK) 1156	SHEET No. 0044			
1) EXAMINER (SIGNATURE) S. H. G. A. 1.1.A	PROCEDURE No. IX - 105 - 101 - 2	INSTRUMENT (WTR COL MON) Aortel	SERIAL No. 131D-377	WATER COLUMN TRANSDUCER S. H. I. 2034			
2) EXAMINER J. E. Ritter	PRESSURE TRANSDUCER S. H. I. 39020	INSTRUMENT (DIGIT VOLT M.) E. A. I.	SERIAL No. 55521	THICKNESS TRANSDUCER No. A. H. S. 101			
TEST PIPE IDENTIFICATION 26 - OHBC - 16 Toward water pump station							
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
276 A	1.70	.8985	57	-		1157	
332 A	1.70	.8841	57	-		1159	
331 D	1.70	.8878	57	-		1200	
275 A	1.70	.9016	57	-	0	1201	DATA (Weld Joint 26" from Edge)
274 D	1.70	.9005	57	-	+0.061	1203	Side of weld
274 C	1.70	.9031	58	.9030	-0.083	1201	" " " "
274 B	1.70	.9034	58	.9033	-0.094	1211	" " " "
274 A	1.70	.9029	58	.9023	-0.039	1212	" " " "
273 D	1.70	.9031	55	.9026	-0.055	1213	End of pipe
273 C	1.70	.8967	59	.8965	+0.282	1214	
273 B	1.70	.8909	59	.8907	+0.602	1215	
273 A	1.70	.8755	59	.8853	+0.900	1215	
272 D	1.70	.8555	59	.8853	+0.900	1211	
272 C	1.70	.8784	59	.8782	+1.292	1220	
272 B	1.70	.8716	59	.8714	1.670	1221	
272 A	1.10	.8691	59	.8684	1.806	1222	
271 D	1.10	.8690	59	.8688	1.811	1223	Side of weld
271 C	1.10	.8656	59	.8654	1.999	1224	Side of weld
271 B	1.10	.8622	59	.8620	2.187	1225	" " " "
271 A	1.10	.5587	59	.8485	2.380	1226	" " " "
270 D	1.10	.5601	59	.8574	2.303	1227	End of pipe



3

SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003		SITE Midland		DATE 15 Oct 81		TIME (24 HR CLOCK) 1227		SHEET No. 0045	
1) EXAMINER (SIGNATURE) <i>John S. ...</i>		PROCEDURE No. 1X-WE-131-2		INSTRUMENT (WTR COL MON) Nortec		SERIAL No. 131231		WATER COLUMN TRANSDUCER G. ...	
2) EXAMINER <i>J. ...</i>		PRESSURE TRANSDUCER Gentra 39620		INSTRUMENT (DIGIT VOLT M.) ENL		SERIAL No. 38521		THICKNESS TRANSDUCER No. A ...	
TEST PIPE IDENTIFICATION 26-04BC-16									
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
270 C	1.70	.8585	59	.8583	2.391	1228			
270 B	1.70	.8576	59	.8574	2.441	1228			
270 A	1.70	.8573	59	.8571	2.457	1229			
269 C	1.70	.8575	60	.8572	2.452	1230			Start of 90' ± 0.00
269 B	1.70	.8574	60	.8571	2.457	1231			" "
269 A	1.70	.8531	60	.8527	2.689	1232			" "
268 D	1.70	.8507	60	.8504	2.827	1233			
268 C	1.70	.8440	61	.8436	3.203	1234			
268 B	1.70	.8370	61	.8366	3.589	1235			
268 A	1.70	.8286	61	.8282	4.053	1236			
267 D	1.70	.8294	61	.8290	4.009	1237			
267 C	1.70	.8178	61	.8174	4.650	1238			
267 B	1.70	.8054	61	.8050	5.335	1239			
267 A	1.70	.7911	61	.7907	6.124	1241			
266 D	1.70	.7922	62	.7917	6.069	1242			
266 C	1.70	.7807	62	.7804	6.693	1243			
266 B	1.70	.7716	62	.7711	7.207	1244			
266 A	1.70	.7628	62	.7623	7.692	1245			
265 D	1.70	.7635	62	.7630	7.654	1246			
265 C	1.70	.7586	62	.7581	7.925	1247			
265 B	1.70	.7537	62	.7532	8.195	1248			

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-003	1412400.d	15 Oct 81	1248	0342			
1) EXAMINER (SIGNATURE) <i>SP</i>	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
2) EXAMINER <i>De Ritter</i>	1X-WTE-101-2	Noted	131D-317	SWRI 2,134			
TEST PIPE IDENTIFICATION	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
26-0HBC-16	Set 2 39620	ENI	38521	Acrylic 01266141			
			AVERAGE °C	CALIBRATION SHEET No.			
			55.273	0043			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
265 A	1.7	.7504	62 <sup>-0.003</sup>	.7504	8.350	1255	
264 D	1.7	.7509	62	.7504	8.350	1256	
264 C	1.7	.7484	62	.7479	8.488	1257	
264 B	1.7	.7455	62	.7450	8.648	1258	
263 A	1.7	.7434	62	.7429	8.764	1259	
263 D	1.7	.7437	62	.7432	8.747	1300	
263 C	1.1	.7414	62	.7409	8.874	1301	
263 B	1.70	.7385	62	.7380	9.034	1302	
262 A	1.70	.7356	62	.7351	9.195	1303	
262 D	1.70	.7356	62	.7351	9.195	1304	
262 C	1.70	.7303	62	.7218	9.487	1305	
262 B	1.70	.7250	62	.7245	9.780	1306	
262 A	1.70	.7204	62	.7204	10.006	1307	
261 D	1.70	.7223	63 <sup>-0.004</sup>	.7217	9.935	1308	
261 C	1.70	.7223	63	.7217	9.935	1309	
261 B	1.70	.7224	63	.7218	9.929	1310	
261 A	1.70	.7157	63	.7181	10.133	1311	
260 C	1.70	.7214	63	.7208	9.984	1312	Start of 45° Elbow
260 B	1.70	.7211	63	.7205	10.000	1313	
260 A	1.70	.7201	63	.7201	10.023	1314	
259 D	1.70	.7200	63	.7200	10.028	1315	

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE ( DAY-MO-YR )	TIME ( 24 HR CLOCK )	SHEET No.			
11-6572-003	MIDDLELAND	15 OCT 81	1316	0047			
1) EXAMINER ( SIGNATURE ) <i>Scott Smith</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nootec	SERIAL No. 131D-317	WATER COLUMN TRANSDUCER SWRI 2034			
2) EXAMINER <i>J. E. Ritter</i>	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Herotec 012661M			
TEST PIPE IDENTIFICATION 16-OH3C-16		AVERAGE °C 55.223	CALIBRATION SHEET No. 0043				
PIPE POSITION ( FT. )	WATER COL. MON. ( IN. )	DIGITAL VOLTMETER ( VOLTS )	TRANSDUCER TEMP ( °F )	P. V. M. CORR. FOR TEMP. ( VOLTS )	CHANGE IN ELEVATION ( IN. )	TIME	REMARKS
259C	1.70	.7063	63	.7057	10.818	1316	
259B	1.70	.6924	63	.6918	11.586	1317	
265A	1.70	.6788	63	.6782	12.337	1318	
258D	1.70	.6788	63	.6782	12.337	1319	
258C	1.70	.6657	63	.6651	13.060	1320	
258B	1.70	.6525	63	.6519	13.789	1321	
258A	1.70	.6400	63	.6394	14.479	1322	
257D	1.70	.6408	63	.6402	14.435	1323	
257C	1.70	.6307	63	.6301	14.993	1324	
257B	1.70	.6203	63	.6197	15.567	1325	
267A	1.70	.6123	63	.6117	16.009	1327	
256D	1.70	.6138	63	.6132	15.926	1328	
256C	1.70	.6080	63	.6074	16.247	1329	Side of road
256B	1.70	.6022	63	.6016	16.567	1330	" " "
256A	1.70	.5991	63	.5985	16.738	1331	" " "
255D	1.70	.5990	63	.5984	16.744	1332	1 OF PIPE
255C	1.70	.5967	64	.5960	16.876	1333	
255B	1.70	.5975	64	.5968	16.832	1334	
255A	1.70	.5895	64	.5888	16.722	1336	
254D	1.70	.6009	64	.6002	16.644	1337	
254C	1.70	.6080	64	.6073	16.252	1338	



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
11 6542-003	1111d/3rd	15 Oct 61	1338	0044			
1) EXAMINER (SIGNATURE) <i>John Ritter</i>	PROCEDURE No. IX-11A-10-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131D-317	WATER COLUMN TRANSDUCER SwRI 20350			
2) EXAMINER <i>John Ritter</i>	PRESSURE TRANSDUCER Serts 34020	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aorotec 01260/M			
TEST PIPE IDENTIFICATION 26-OHBC-16			AVERAGE °C 55.223	CALIBRATION SHEET No. 0043			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
254 B	1.7	.6184	64	.6177	15.678	1338	
254 A	1.7	.6333	64	.6326	14.855	1340	
253 D	1.7	.6338	64	.6331	14.827	1342	
253 C	1.7	.6473	64	.6466	14.082	1344	
253 B	1.7	.6650	64	.6623	13.215	1345	
253 A	1.7	.6734	65	.6626	13.198	1346	
252 D	1.7	.6743	65	.6735	12.596	1347	
252 C	1.7	.6798	65	.6790	12.293	1348	
252 B	1.7	.6826	65	.6818	12.138	1350	
252 A	1.7	.6810	65	.6802	12.226	1351	
251 D	1.7	.6823	65	.6815	12.155	1353	
251 C	1.7	.6780	65	.6772	12.392	1353	
251 B	1.7	.6733	66	.6725	12.652	1354	
251 A	1.7	.6650	66	.6641	13.115	1355	
250 C	1.7	.6648	66	.6639	13.127	1356	
250 B	1.7	.6624	66	.6615	13.259	1357	
250 A	1.7	.6591	66	.6582	13.441	1357	End of 26" Pipe
249 B	1.7	.6761	66	.6751	12.508	1400	Reducer
249 A	1.7	.7287	66	.7278	9.998	1401	Reducer
248 D	1.7	.7466	66	.7457	8.609	1402	15' point in 36" pipe
248 C	1.7	.7490	66	.7481	8.477	1404	T-1160 26-OHBC-59



(7)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

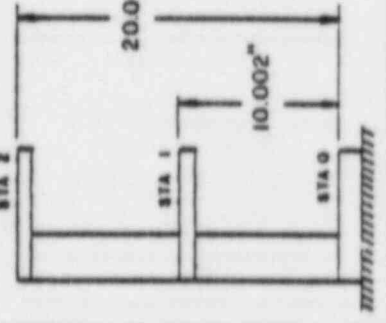
PROJECT No. 17-6541-003		SITE 11112-A		DATE 15 Oct 81		TIME (24 HR CLOCK) 14:15		SHEET No. 0019	
EXAMINER (SIGNATURE) R. P. A.		PROCEDURE No. IX-ME-101-7		INSTRUMENT (WTR COL MON) A-Drice		SERIAL No. 131 L-311		WATER COLUMN TRANSDUCER SWRI 2034	
EXAMINER J. E. Ritter		PRESSURE TRANSDUCER Sotra 39620		INSTRUMENT (DIGIT VOLT M.) E.N.I.		SERIAL No. 38521		THICKNESS TRANSDUCER No. AEROTECH 01261101	
TEST PIPE IDENTIFICATION 26-0HBC-16						AVERAGE "C" 53.223		CALIBRATION SHEET No. 0043	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
246 B	1.7	.7469	64	.7462	8.582	1406			
248 A	1.7	.7415	64	.7408	8.880	1407			
247 D	1.7	.7450	64	.7443	8.687	1408			
247 E	1.7	.7397	64	.7390	8.979	1409			
247 B	1.7	.7299	64	.7292	9.520	1410			
247 A	1.7	.7233	64	.7226	9.885	1411			
246 D	1.7	.7232	64	.7225	9.890	1412			
246 C	1.7	.7185	64	.7178	10.150	1413			
246 B	1.7	.7159	64	.7152	10.294	1414			
256 C	1.7	.7118	64	.7111	10.520	1415			LAST POINT IN 36" PIPE
248 A	1.7	.7415	64	.7408	8.880	1417			Re-check
249 A	1.7	.7298	64	.7291	9.526	1419			11
253 C	1.7	.6473	65	.6466	14.082	1423			6473 Note Rold
261 A	1.7	.7194	65	.7186	10.106	1427			2181
263 "	1.7	.7411	65	.7403	8.907	1430			7
266 C	1.7	.7823	65	.7815	6.632	1436			7121
268 D	1.7	.8371	65	.8363	3.606	1440			8371
271 A	1.7	.5587	65	.5579	2.413	1442			5587
274 A	1.7	.9024	67	.9017	-1.006	1444			
274 D	1.7	.7006	64	.6999	.094	1445			
275 A	1.7	.9021	64	.9014	.011	1447			Datum

END

# SWRI CALIBRATION RECORD

PROJECT No.		SITE		DATE ( DAY - MO - YR )		TIME ( 24 HR CLOCK )		SHEET No.			
11-6542-003		11/11/81		11 11 81		1500		0050			
1) EXAMINER ( SIGNATURE )		PROCEDURE No.		INSTRUMENT ( WTR COL MON )		SERIAL No.		WATER COLUMN TRANSDUCER			
<i>J. L. Ridd</i>		IX-ME-101-2		50700		17-317		PORT 2336			
2) EXAMINER		PRESSURE TRANSDUCER		INSTRUMENT ( DIGIT VOLT M. )		SERIAL No.		THICKNESS TRANSDUCER No.			
		SETRA 39620		EM1		38521		A. 5. 1. 1.			
HEIGHT ( IN. )	WATER COL. MON. ( IN. )	DIGITAL VOLTMETER ( VOLTS )	TRANSUCER TEMP. ( °F )	D.V.M. CORR. FOR TEMP. ( VOLTS )	CONVERSION CONSTANT "C" INCHES VOLTS	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS	
22.00	1.70	3.672	62	- .362	55.254	1500	1.001	2.001	1500	PIPE 2.378e-15	
15.00	1.70	5.484	62	- .182	55.188	1504	1.001	2.002	1525		
0	1.70	7.292	62	- .402	55.320	1508	1.002	2.002	1604		
20.00	1.70	3.671	61	- .361	55.254	1510	1.002	2.002	1636		
10.00	1.71	5.483	61	- .182	55.188	1516	1.002	2.002	1649		
0	1.71	7.291	61	- .1804	55.320	1518	1.002	2.002	1710		
Avg 55.254											
0	1.7	7.296	59	- .1804	55.290	1759			1735		
10.00	1.7	5.487	59	- .1811	55.218	1759			1807		
20.00	1.7	3.676	59	- .362	55.254	1801					
20.00	1.7	3.675	59	- .363	55.254	1803					
10.00	1.7	5.486	59	- .1811	55.218	1805					
0	1.7	7.295	59	- .1804	55.290	1806					
AVERAGE "C" FOR ALL RUNS											
55.254											

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK No. D-6224-069



WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK No. C-6224-068

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17 6242-003	Mt. Bald	15 Oct 81	1530	1151			
1) EXAMINER (SIGNATURE) <i>Ray C. O. A.</i>	PROCEDURE No. K-10-11-2	INSTRUMENT (WTR COL MON) Surtee	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER Surtee 2334			
2) EXAMINER <i>J. J. Little</i>	PRESSURE TRANSDUCER Surtee 39620	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. A. S. 101-1			
TEST PIPE IDENTIFICATION LG-0413C-15 - Toward Service Water Bldg.		AVERAGE °C 55.254	CALIBRATION SHEET No. 0050				
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
331 D	1.7	8898	60°	-	0	1534	DATUM POINT
331 C	↑	8944	60	-	-0.254	1537	
331 B		8989	60	-	-0.503	1538	
331 A		9023	60	-	-0.691	1539	
330 D		9034	60	-	-0.751	1540	
330 C		9068	60	-	-0.939	1541	
330 E		9097	61	0.9096	-1.094	1542	
330 A		9112	61	0.9111	-1.177	1542	
329 D		9125	61	0.9124	-1.249	1543	
329 C		9139	61	0.9138	-1.326	1543	
329 B		9153	61	0.9152	-1.403	1544	
329 A		9177	61	0.9176	-1.536	1544	
328 D		9171	62	0.9169	-1.497	1545	
328 C		9201	62	0.9199	-1.663	1545	
328 B		9235	62	0.9233	-1.851	1546	
328 A		9263	62	0.9261	-2.006	1546	
327 U		9258	62	0.9256	-1.978	1547	
327 C		9230	62	0.9228	-1.823	1547	
327 B		9202	62	0.9200	-1.669	1548	
327 A		9172	62	0.9170	-1.503	1548	
326 C	1.7	9174	62	0.9172	-1.514	1549	Start of 90° E 160w

10

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Middletown	15 Oct 81	1550	0052			
1) EXAMINER (SIGNATURE) Steve Wit	PROCEDURE No. IX-B.E. 101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131D-317	WATER COLUMN TRANSDUCER SWRI 2034			
2) EXAMINER J.F. Ritto	PRESSURE TRANSDUCER 101-29070	INSTRUMENT (DIGIT VOLT M.) ENT	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerstat 012-66141			
TEST PIPE IDENTIFICATION 76-04BC-15			AVERAGE °C 55.267	CALIBRATION SHEET No. 0050			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGES IN ELEVATION (IN.)	TIME	REMARKS
326 B	1.7	9158	62	.9156	-1.425	1550	
326 A		9083	62	.9081	-1.011	1552	END A 90° ELEV.
325 D		9060	62	.9058	-.884	1553	
325 C		8847	62	.8845	+2.793	1554	
325 B		8614	62	.8612	1.580	1555	
325 A		8386	62	.8384	2.840	1557	
324 D		8379	62	.8377	2.879	1557	
324 C		8148	62	.8146	4.105	1558	
324 B		7937	62	.7935	5.321	1559	
324 A		7787	62	.7787	6.139	1600	
323 D		7796	62	.7774	6.211	1601	
323 C		7702	62	.7700	6.619	1602	
323 B		7637	62	.7635	6.978	1603	
323 A		7602	62	.7500	7.172	1604	
322 D		7601	62	.7599	7.177	1605	
322 C		7479	62	.7477	7.852	1606	
322 B		7364	62	.7362	8.487	1607	
322 A		7255	62	.7283	8.924	1606	
321 D		7281	62	.7279	8.846	1609	
321 C		7231	62	.7229	9.212	1610	
321 B		7176	62	.7176	9.515	1611	



102

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-025		SITE midland		DATE (DAY-MO-YR) 15 Oct 61		TIME (24 HR CLOCK) 1611		SHEET No. 0053	
1) EXAMINER (SIGNATURE) G. J. Ritter		PROCEDURE No. IX-ME-10-2		INSTRUMENT (WTR COL MON) Nortec		SERIAL No. 131-D-37		WATER COLUMN TRANSDUCER SWRI 2034	
2) EXAMINER		PRESSURE TRANSDUCER set to 39620		INSTRUMENT (DIGIT VOLT M.) EMI		SERIAL No. 35521		THICKNESS TRANSDUCER No. Aerotec 076614	
TEST PIPE IDENTIFICATION 26-04BD-15		AVERAGE °C 55.254		CALIBRATION SHEET No. 9050					
PIPE POSITION (F.T.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHARGE IN ELEVATION (IN.)	TIME	REMARKS		
321 A	1.70	.7137	62	.7135	9.741	1611			
320 D		.7153	62	.7151	9.653	1612			
320 C		.7046	62	.7044	10.244	1613			
320 B		.6986	62	.6984	10.576	1614			
320 A		.6934	62	.6937	10.835	1615			
319 D		.6925	62	.6923	10.913	1616			
319 C		.6889	62	.6887	11.112	1617			
319 B		.6847	62	.6845	11.344	1618			
319 A		.6814	62	.6812	11.526	1619			
318 D		.6821	62	.6819	11.487	1620			
316 C		.6822	62	.6820	11.482	1621			
318 B		.6828	62	.6826	11.449	1622			
318 A		.6837	62	.6835	11.379	1624			
317 C		.6848	62	.6846	11.338	1626	Start of 95°		
317 B		.6859	62	.6857	11.277	1627			
311 A		.6897	62	.6890	11.095	1628			
316 C		.6896	62	.6894	11.073	1628			
316 B		.6915	62	.6913	10.968	1629			
311 A		.6915	62	.6913	10.968	1630			
315 D		.6920	62	.6918	10.940	1631			
315 C	1.70	.6905	62	.6903	11.023	1632			

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. <i>11 6542-28</i>		SITE <i>midland</i>		DATE (DAY-MO-YR) <i>15 04 81</i>		TIME (24 HR CLOCK) <i>1633</i>		SHEET No. <i>0054</i>	
1) EXAMINER (SIGNATURE) <i>[Signature]</i>		PROCEDURE No. <i>1K-101-</i>		INSTRUMENT (WTR COL MON) <i>noted</i>		SERIAL No. <i>171-D-37</i>		WATER COLUMN TRANSDUCER <i>SWRI 2034</i>	
2) EXAMINER <i>[Signature]</i>		PRESSURE TRANSDUCER <i>Suotra 39620</i>		INSTRUMENT (DIGIT VOLT M.) <i>ENI</i>		SERIAL No. <i>38521</i>		THICKNESS TRANSDUCER No. <i>Aerated 012121</i>	
TEST PIPE IDENTIFICATION <i>26 OHBC-15</i>						AVERAGE "C" <i>55.254</i>		CALIBRATION SHEET No. <i>0050</i>	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
<i>315 B</i>	<i>1.7</i>	<i>.6901</i>	<i>63<sup>-000</sup></i>	<i>.6898</i>	<i>11.051</i>	<i>1633</i>			
<i>315 A</i>	<i>1.7</i>	<i>.6889</i>	<i>63</i>	<i>.6885</i>	<i>11.117</i>	<i>1634</i>			
<i>314 D</i>	<i>✓</i>	<i>.6895</i>	<i>63</i>	<i>.6892</i>	<i>11.084</i>	<i>1635</i>			
<i>314 C</i>		<i>.6896</i>	<i>63</i>	<i>.6893</i>	<i>11.078</i>	<i>1636</i>			
<i>314 B</i>		<i>.6925</i>	<i>63</i>	<i>.6922</i>	<i>10.918</i>	<i>1637</i>			
<i>314 A</i>		<i>.6983</i>	<i>63</i>	<i>.6910</i>	<i>10.819</i>	<i>1638</i>			
<i>313 D</i>		<i>.6948</i>	<i>63</i>	<i>.6945</i>	<i>10.791</i>	<i>1639</i>			
<i>313 C</i>		<i>.6958</i>	<i>63</i>	<i>.6955</i>	<i>10.736</i>	<i>1640</i>			
<i>313 B</i>		<i>.6963</i>	<i>63</i>	<i>.6960</i>	<i>10.708</i>	<i>1641</i>			
<i>313 A</i>		<i>.6954</i>	<i>63</i>	<i>.6951</i>	<i>10.758</i>	<i>1644</i>			
<i>312 D</i>		<i>.6964</i>	<i>63</i>	<i>.6961</i>	<i>10.703</i>	<i>1650</i>			
<i>312 C</i>		<i>.7005</i>	<i>63</i>	<i>.7002</i>	<i>10.476</i>	<i>1652</i>			
<i>312 B</i>		<i>.7030</i>	<i>63</i>	<i>.7027</i>	<i>10.338</i>	<i>1653</i>			
<i>312 A</i>		<i>.7055</i>	<i>63</i>	<i>.7052</i>	<i>10.200</i>	<i>1654</i>			
<i>311 D</i>		<i>.7045</i>	<i>63</i>	<i>.7042</i>	<i>10.255</i>	<i>1655</i>			
<i>311 C</i>		<i>.7107</i>	<i>63</i>	<i>.7104</i>	<i>9.913</i>	<i>1656</i>			
<i>311 B</i>		<i>.7189</i>	<i>63</i>	<i>.7186</i>	<i>9.459</i>	<i>1657</i>			
<i>311 A</i>	<i>.7278</i>	<i>63</i>	<i>.7275</i>	<i>8.968</i>	<i>1658</i>				
<i>310 D</i>	<i>.7283</i>	<i>63</i>	<i>.7280</i>	<i>8.940</i>	<i>1659</i>	<i>side of creek</i>			
<i>310 C</i>	<i>.7416</i>	<i>63</i>	<i>.7413</i>	<i>8.205</i>	<i>1700</i>	<i>" "</i>			
<i>310 B</i>	<i>1.7</i>	<i>.7561</i>	<i>63</i>	<i>.7558</i>	<i>7.404</i>	<i>1701</i>	<i>" "</i>		

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE M11121	DATE (DAY-MO-YR) 15 Oct 81	TIME (24 HR CLOCK) 1501	SHEET No. 0055
1) EXAMINER (SIGNATURE) <i>Golf Pink</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SwRI 2034
2) EXAMINER <i>J E Ritter</i>	PRESSURE TRANSDUCER BOTRA 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotac 1126114
TEST PIPE IDENTIFICATION 26-OHBC-15			AVERAGE "C" 65.254	CALIBRATION SHEET No. 0050

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	0. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
310 A	1.7	.7655	63 <sup>000</sup>	.7652	6.885	1502	
309 D		.7671	62 <sup>000</sup>	.7669	6.791	1503	
309 C		.7685	62	.7683	6.713	1504	
309 E		.7650	62	.7648	6.907	1505	
309 A		.7529	62	.7527	7.575	1506	
308 D		.7522	62	.7520	7.614	1507	
308 C		.7378	62	.7376	7.410	1507	
308 B		.7247	62	.7247	7.122	1708	
308 A		.7121	61 <sup>000</sup>	.7220	9.272	1710	END of 26" Pipe
307 B		.7257	61	.7256	9.073	1711	Start of Kelusa
307 A		.7212	61	.7211	9.321	1712	
306 D		.7970	61	.7969	5.133	1713	Start of 36" Pipe
306 B		.7924	61	.7923	5.387	1714	
306 A		.7851	61	.7950	5.238	1715	
305 D		.7891	61	.7890	5.570	1716	
305 C		.7732	62 <sup>000</sup>	.7730	6.456	1717	
305 B		.7571	62	.7569	7.343	1718	
305 A		.7429	62	.7427	8.125	1719	
304 C		.7426	62	.7424	8.144	1720	
304 B		.7373	62	.7371	8.437	1721	
304 A	1.1	.7332	62	.7330	8.664	1722	LAST POINT IN PIPE (AT SOURCE WARSJA)

EWD







12

# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE MIDLAND	DATE (DAY-MO-YR) 16 OCT 81	TIME (24 HR CLOCK) 0823	SHEET No. 0057
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. 1X-ME-101-2	INSTRUMENT (WTR COL MON) NOIETEC	SERIAL No. 1310-317	WATER COLUMN TRANSDUCER SWRJS 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER SETRA 39620	INSTRUMENT (DIGIT VOLT-M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. AEROTEC 012661M

WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES/VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	REMARKS
0	1.70	.7284	51°	.134	55.321	0826	
10.002	1.70	.5476	51°	.181	55.198	0825	
20.002	1.70	.3664	51°	.361	55.254	0824	
0	1.70	.7284	51°	.181	55.259	0827	
10.002	1.70	.5474	51°	.181	55.250	0828	
20.002	1.70	.3664	51°	.362	55.264	0829	
				Avg. 55.264			
0	1.7	.7298	63	.1809	55.290	1053	
10.002	1.7	.5487	63	.181	55.248	1052	
20.002	1.7	.3679	63	.3619	55.269	1051	
10.002	1.7	.3682	63	.361	55.299	1052	
10.002	1.7	.5491	63	.1809	55.179	1053	
0	1.7	.7299	63	.1808	55.321	1054	
				AVERAGE "C" FOR ALL RUNS			

STA 2

20.002"

STA 1

10.002"

STA 0

1.9995"

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK  
No. D-6224-C69

55.284

WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK  
No. C-6224-068

12

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Milbrand	10 Oct 91	830	0058			
1) EXAMINER (SIGNATURE)	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
<i>[Signature]</i>	IX mic-101-2	No. 2 TEC	131-D-317	Serial 2034			
2) EXAMINER (SIGNATURE)	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
<i>[Signature]</i>	Setre 39620	FMI	39521	Serial 2034			
TEST PIPE IDENTIFICATION	AVERAGE °C						
26-ORBC-16 - Toward Avx Bldg.	55.269						
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
276 A	1.70	.8989	52	.8989	0	0830	DATUM POINT
276 B	1.70	.8986	52	.8986	.017	0839	
276 C	1.70	.8987	52	.8987	.011	0840	
276 D	1.70	.8996	52	.8996	-.039	0841	
277 A	1.70	.8985	52	.8985	.022	0842	
277 B	1.70	.8987	52	.8987	.011	0843	
277 C	1.70	.8972	53	.8971	.099	0844	
277 D	1.70	.8946	53	.8945	.143	0845	
278 A	1.70	.8954	53	.8953	.199	0846	
278 B	1.70	.8894	53	.8893	.531	0847	
278 C	1.70	.8816	54	.8814	.967	0848	
278 D	1.70	.8719	54	.8717	1.503	0849	
279 A	1.70	.8717	55	.8714	1.520	0850	
279 B	1.70	.8686	55	.8683	1.691	0851	
279 C	1.70	.8625	55	.8622	2.018	0852	
279 D	1.70	.8565	56	.8561	2.365	0853	
280 A	1.70	.8567	56	.8563	2.354	0854	
280 B	1.70	.8491	56	.8486	2.780	0855	
280 C	1.70	.8408	56	.8404	3.233	0856	
280 D	1.70	.8330	56	.8326	3.664	0857	
281 A	1.70	.8329	56	.8325	3.670	0858	

17

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET No.	
11-000-023		Middletown		1008 81		0857		0057	
1) EXAMINER (SIGNATURE)		PROCEDURE No.		INSTRUMENT (WTR COL MON)		SERIAL No.		WATER COLUMN TRANSDUCER	
G. L. Pitten		1X-MY-101-2		Montec		31-0-317		SCRT-2034	
2) EXAMINER		PRESSURE TRANSDUCER		INSTRUMENT (DIGIT VOLT M.)		SERIAL No.		THICKNESS TRANSDUCER No.	
G. L. Pitten		Extra 39020		EALF		38521		A 0250 0126004	
TEST PIPE IDENTIFICATION		DIGITAL VOLTMETER (VOLTS)		TRANSDUCER TEMP (°F)		P.V.M. CORR. FOR TEMP. (VOLTS)		AVERAGE "C"	
26-OHBC-16								55.169	
PIPE POSITION (FT.)	WATER COL. MON. (IN)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
281 B	1.7	.8256	57	.8251	4.079	0857			
281 C	1.7	.8298	57	.8243	4.123	0858			
281 D	1.7	.8244	57	.8239	4.145	0859			
282 A	1.7	.8264	58	.8268	4.040	0900			
282 B	1.7	.8291	58	.8285	3.891	0901			
282 C	1.7	.8343	58	.8337	3.604	0902			
282 D	1.7	.8414	58	.8408	3.211	0903			
283 A	1.7	.8421	58	.8415	3.172	0904			
283 B	1.7	.8482	58	.8476	2.835	0904			
283 C	1.7	.8554	58	.8548	2.437	0905			
283 D	1.7	.8526	60	.8518	2.603	0906	Rec'd		
284 A	1.7	.8625	60	.8617	2.056	0907			
284 B	1.7	.8612	60	.8604	2.128	0908			
284 C	1.7	.8608	60	.8600	2.150	0909			
285 A	1.7	.8623	60	.8615	2.067	0910	start of 90' line		
285 B	1.7	.9069	60	.9061	-.398	0911			
285 C	1.7	1.0175	60	1.0167	-6.511	0912	Final 11' line		
286 A	1.1	1.0503	61	1.0354	-7.544	0923			
286 B	1.7	1.1374	61	1.1365	-13.132	0924			
286 C	1.7	1.2422	61	1.2413	-18.924	0925			
287 A	1.7	1.2612	62	1.2602	-19.969	0926	start of 90' line		



18

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	midland	16 Oct 81	0927	0000			
1) EXAMINER (SIGNATURE)	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
Edy (N.D.A)	IX MF-101-2	North	131-0-47	Serial 2 830			
2) EXAMINER	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
Felutter	Setic 39620	EMT	38521	Approx 0126019			
TEST PIPE IDENTIFICATION			AVERAGE "C"	CALIBRATION SHEET No.			
26-0430-16			55.269	1057			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
287B	1.7	1.3737	62	1.3727	-26.186	0927	90° Elevation
281C	1.7	1.4361	62	1.4351	-25.635	0927	
286A		1.4350	62	1.4340	-25.574	0929	
288B		1.4352	62	1.4342	-25.585	0930	
289A		1.4365	61	1.4355	-29.657	0931	
289B		1.4342	63	1.4331	-25.525	0931	
289C		1.4338	63	1.4327	-25.503	0932	
289D		1.4343	63	1.4332	-25.530	0933	
290A		1.4353	63	1.4342	-25.585	0934	
290B		1.4332	63	1.4321	-25.469	0935	
290C		1.4275	63	1.4284	-25.265	0935	
290D		1.4252	63	1.4241	-25.027	0937	
291A		1.4245	63	1.4234	-28.989	0938	
291B		1.4240	63	1.4229	-28.961	0939	
291C		1.4223	64	1.4211	-28.861	0940	
291D		1.4198	64	1.4186	-28.723	0941	
292A		1.4198	64	1.4186	-28.723	0942	
292B		1.4198	64	1.4186	-28.723	0943	
292C		1.4224	64	1.4212	-28.867	0944	
292D		1.4226	64	1.4214	-28.878	0945	
293A		1.4224	64	1.4212	-28.867	0946	45° Elevation



(15)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Middle	16.00.91	0448	111			
1) EXAMINER (SIGNATURE) C. Hall	PROCEDURE No. 1X-MIC-101-2	INSTRUMENT (WTR COL MON) Hortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER			
2) EXAMINER (SIGNATURE) J. E. Miller	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) EMZ	SERIAL No. 38521	THICKNESS TRANSDUCER No.			
TEST PIPE IDENTIFICATION 26-0422-16			AVERAGE °C 55.269	CALIBRATION SHEET No. 0057			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEM. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
293 B	1.57	1.4245	64	1.4233	-28.983	0945	45° Elbow
293 C		1.4266	64	1.4254	-29.099	0949	45° Elbow
294 A		1.4255	64	1.4243	-29.038	0950	
294 B		1.4278	64	1.4266	-29.165	0951	
294 C		1.4286	64	1.4274	-29.210	0952	
295 A		1.4306	65	1.4293	-29.315	0953	45° Elbow
295 B		1.4329	65	1.4315	-29.436	0954	
295 C		1.4321	65	1.4308	-29.398	0955	
296 A		1.4307	65	1.4294	-29.320	0956	
296 B		1.4306	65	1.4293	-29.315	0957	
296 C		1.4296	65	1.4283	-29.259	0958	
296 D		1.4277	65	1.4264	-29.154	0959	
297 A		1.4285	65	1.4272	-29.199	0959	
297 B		1.4288	65	1.4275	-29.215	1000	
297 C		1.4299	65	1.4286	-29.276	1001	
297 D		1.4280	65	1.4267	-29.171	1002	
298 A		1.4280	65	1.4267	-29.171	1003	
298 B		1.4218	65	1.4265	-29.160	1004	
298 C		1.4271	66	1.4257	-29.114	1005	
298 D		1.4254	66	1.4240	-29.022	1006	
299 A		1.4269	66	1.4255	-29.105	1007	

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
11-636-003	Midland	16 Oct 81	1009	0002			
1) EXAMINER (SIGNATURE) <i>D. J. ...</i>	PROCEDURE No. 1A-111E-101 2	INSTRUMENT (WTR COL MON) Nortek	SERIAL No. 131-D-87	WATER COLUMN TRANSDUCER SURT-2034			
2) EXAMINER <i>L. P. ...</i>	PRESSURE TRANSDUCER S.H. 31.20	INSTRUMENT (DIGIT VOLT M.) E.M.I.	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec 0120.1			
TEST PIPE IDENTIFICATION 26-OHBC-16		AVERAGE °C 55.269	CALIBRATION SHEET No. 0057				
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
299 B	1.7	1.4266	66	1.4252	-29.088	1009	
299 C		1.4265	66	1.4251	-29.083	1010	
299 D		1.4272	66	1.4258	-29.121	1011	
300 A		1.4263	66	1.4249	-29.071	1012	
300 B		1.4299	66	1.4285	-29.270	1013	
300 C		1.4387	66	1.4333	-29.536	1014	
300 D		1.4404	66	1.4350	-29.851	1015	
301 A		1.4432	66	1.4418	-30.006	1016	
301 B		1.4445	66	1.4431	-30.077	1017	X
301 C		1.4438	66	1.4424	-30.039	1018	
302 A		1.4455	66	1.4441	-30.133	1019	N.E. 50.0
302 B		1.4456	66	1.4442	-30.138	1020	
302 C		1.4409	66	1.4395	-29.878	1020	
303 A		1.4393	66	1.4379	-29.790	1021	
303 B		1.4275	66	1.4261	-29.138	1022	
303 C		1.4165	66	1.4151	-28.530	1023	LAST POINT IN PIPE (AT AUK BWDG.)
302 C		1.4411	66	1.4397	-29.890	1024	3477 1.4409
301 B		1.4432	66	1.4418	-30.006	1025	30.077 1.4415
298 D		1.4252	66	1.4238	-29.010	1026	28.02 1.4254
295 B		1.4325	66	1.4311	-29.414	1027	34.93 1.4325 Hose Rolled on
290 C		1.4298	66	1.4284	-29.265	1029	34.65 1.4295 Ground

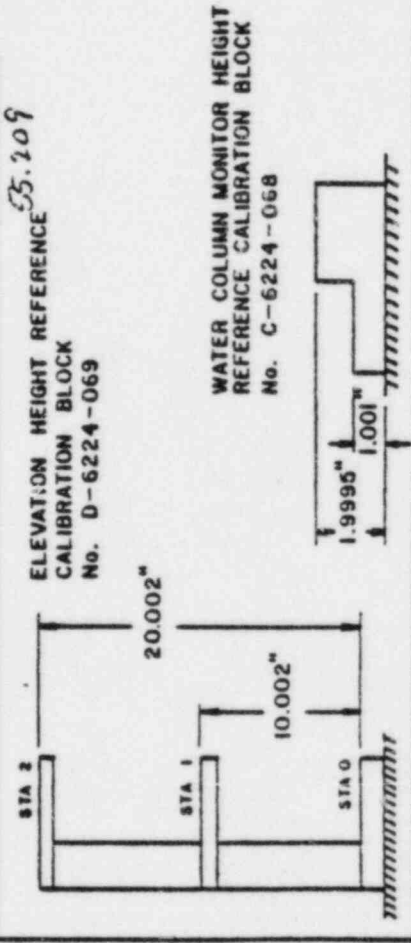
END





### SWRI CALIBRATION RECORD

PROJECT No. 17-6542-605		SITE midland		DATE (DAY-MO-YR) 16 Oct 81		TIME (24 HR CLOCK) 1121		SHEET No. 0064			
1) EXAMINER (SIGNATURE) <i>John C. ...</i>		PROCEDURE No. IX-ME-101-2		INSTRUMENT (WTR COL MON) Lortec		SERIAL No. 131-D-317		WATER COLUMN TRANSDUCER			
2) EXAMINER <i>J. ...</i>		PRESSURE TRANSDUCER STRA 39620		INSTRUMENT (DIGIT VOLT M.) ENV		SERIAL No. 38521		THICKNESS TRANSDUCER No. Aerotec 01266111			
HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	WATER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" JERREL VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS	
0	1.7	7292	60	- .1807	55.351	1121	1.002	2.000	1128	PIPE 26-DNBC-15	
1.002	1.7	5485	60	- .1812	55.188	1122	1.002	2.002	1210		
1.002	1.7	3672	60	- .362	55.254	1123	1.003	2.003	1237		
0	1.7	7298	60	- .1807	55.351	1125	1.003	2.003	1302		
1.002	1.7	5484	60	- .1812	55.188	1126	1.003	2.003	1318		
2.002	1.7	3672	60	- .3619	55.269	1127	1.003	2.003	1341		
Avg 55.267							1.004	2.004	1410		
0	1.7	7290	66	- .1811	55.229	1405					
1.002	1.7	5478	66	- .1814	55.127	1406					
2.002	1.7	3665	66	- .3635	55.178	1407					
0	1.7	7284	66	- .1812	55.199	1408					
1.002	1.7	5472	66	- .1808	55.279	1407					
2.002	1.7	3663	66	- .3621	55.239	1410					
AVERAGE "C" FOR ALL RUNS											
55.238											





### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 16 Oct 81	TIME (24 HR CLOCK) 1137	SHEET No. 0065
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 35521	THICKNESS TRANSDUCER No. Firsted 01-601-111
TEST PIPE IDENTIFICATION 26-04BC -15 Toward Aux. Bldg.			AVERAGE "C" 55.238	CALIBRATION SHEET No. 0064

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
332A	1.7	.8860	64	.8860	0	1139	DATUM POINT
332B		.8848	64	.8848	.066	1144	
332C		.8840	64	.8840	.110	1145	
332D		.8831	64	.8831	.160	1146	
333A		.8833	64	.8833	.149	1147	
333B		.8816	64	.8816	.243	1148	
333C		.8813	64	.8813	.260	1149	
333D		.8792	64	.8792	.376	1150	X
334A		.8818	64	.8818	.232	1151	
334B		.8790	64	.8790	.387	1158	
334C		.8757	64	.8757	.569	1159	
334D		.8705	64	.8705	.856	1200	
335A		.8712	64	.8712	.818	1200	
335B		.8679	64	.8679	1.000	1201	
335C		.8602	64	.8602	1.425	1202	
335D		.8533	64	.8533	1.806	1203	
336A	.8546	64	.8546	1.734	1203		
336B	.8504	64	.8504	1.970	1203		
336C	.8464	64	.8464	2.187	1204		
336D	.8447	64	.8447	2.281	1204		
337A	.8449	64	.8449	2.270	1205		

335

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-023	SITE Midland	DATE (DAY-MO-YR) 10 Oct 81	TIME (24 HR CLOCK) 1205	SHEET No. 0066
1) EXAMINER (SIGNATURE) <i>G. J. [Signature]</i>	PROCEDURE No. IX-ME-14-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D37	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>J. R. [Signature]</i>	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) EMJ	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aersta 01-65141
TEST PIPE IDENTIFICATION 26-OHBC-15			AVERAGE "C" 55.238	CALIBRATION SHEET No. 0704

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
337 B	1.7	.8346	64	.8346	2.839	1205	
337 C	1.7	.8292	64	.8292	3.138	1206	
337 D		.8293	64	.8293	3.132	1207	
338 A		.8295	64	.8295	3.121	1207	
338 B		.8297	64	.8297	3.110	1208	
C		.8294	64	.8294	3.126	1208	
D		.8329	64	.8329	2.933	1209	
339 A		.8395	64	.8395	2.569	1209	X
B		.8415	64	.8415	2.458	1210	
C		.8502	64	.8502	1.978	1210	
D		.8689	64	.8689	.945	1211	X
340 A		.8714	64	.8714	.806	1214	
B		.8735	64	.8735	.690	1214	
C		.8759	64	.8759	.558	1215	
341 A		.8770	65	.8769	.503	1216	90° Elbow
B		.9325	65	.9324	-2.563	1217	" "
C		1.0274	65	1.0273	-7.805	1218	" "
342 A		1.0470	65	1.0469	-8.888	1230	X 7
B		1.1533	65	1.1532	-14.760	1231	X ?
C		1.2506	65	1.2505	-20.134	1232	
343 A		1.2662	65	1.2661	-20.996	1233	90° Elbow

23

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET No.	
17-6542-003		Windward		16 Oct 81		1233		0067	
1) EXAMINER (SIGNATURE)		PROCEDURE No.		INSTRUMENT (WTR COL MON)		SERIAL No.		WATER COLUMN TRANSDUCER	
<i>[Signature]</i>		1A-ME-101-2		Nortco		131D-312		SWRI 2374	
2) EXAMINER		PRESSURE TRANSDUCER		INSTRUMENT (DIGIT VOLT M.)		SERIAL No.		THICKNESS TRANSDUCER No.	
<i>[Signature]</i>		Set. 2 39620		ENJ		38521		Applied Digital	
TEST PIPE IDENTIFICATION		DIGITAL VOLTMETER (VOLTS)		D. V. M. CORR. FOR TEMP. (VOLTS)		CHANGE IN ELEVATION (IN.)		CALIBRATION SHEET No.	
26-0H03C -15		TRANSDUCER TEMP (°F)		TIME		REMARKS			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
343 B	1.7	1.3845	65	1.3844	-27.752	1234	98 E/low		
1 C		1.4330	65	1.4329	-30.210	1235	" "		
344 A		1.4374	65	1.4313	-30.121	1236			
1 B		1.4287	65	1.4286	-29.972	1237			
1 C		1.4280	65	1.4279	-29.933	1238			
1 D		1.4309	65	1.4308	-30.094	1239			
345 A		1.4328	65	1.4327	-30.199	1240			
1 B		1.4343	65	1.4342	-30.281	1241			
1 C		1.4375	65	1.4374	-30.458	1242			
1 D		1.4375	65	1.4374	-30.569	1243			
346 A		1.4392	65	1.4391	-30.552	1243			
1 B		1.4425	65	1.4424	-30.734	1244			
1 C		1.4444	65	1.4443	-30.839	1245			
1 D		1.4456	65	1.4455	-30.906	1246			
347 A		1.4459	65	1.4458	-30.922	1247			
1 B		1.4464	65	1.4463	-30.950	1248			
1 C		1.4442	65	1.4441	-30.828	1249			
1 D		1.4396	65	1.4395	-30.574	1250			
348 A		1.4404	65	1.4403	-30.618	1251			
1 B		1.4400	65	1.4399	-30.596	1252			
1 C		1.4373	65	1.4372	-30.447	1253			

*45-100-X*  
" "



### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6543-023	Midland	16 Oct 81	1253	0064			
1) EXAMINER (SIGNATURE) <i>Ed G. Obit</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-27	WATER COLUMN TRANSDUCER SWRI 2034			
2) EXAMINER <i>J. R. Ritter</i>	PRESSURE TRANSDUCER S-TRA 39620	INSTRUMENT (DIGIT VOLT M.) EMF	SERIAL No. 385-21	THICKNESS TRANSDUCER No. Ag Steel 012661-11			
TEST PIPE IDENTIFICATION 26-OMBC-15			AVERAGE °C 55.238	CALIBRATION SHEET No. 0064			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
349 A	1.7	1.4364	65	1.4363	-30.397	1254	
350 A	1.7	1.4363	65	1.4362	-30.392	1255	X
↓ B		1.4324	65	1.4313	-30.177	1256	
↓ C		1.4292	65	1.4291	-30.000	1257	
351 A		1.4285	65	1.4284	-29.961	1258	45° E. flow
↓ B		1.4297	66	1.4295	-30.022	1259	" "
↓ C		1.4247	66	1.4245	-29.746	1259	" "
352 A		1.4236	66	1.4234	-29.685	1300	
↓ B		1.4226	66	1.4224	-29.630	1301	
↓ C		1.4217	66	1.4215	-29.580	1302	
↓ D		1.4220	66	1.4218	-29.597	1303	
353 A		1.4215	66	1.4213	-29.569	1304	
↓ B		1.4169	66	1.4167	-29.315	1305	
↓ C		1.4111	66	1.4109	-28.994	1306	
↓ D		1.4097	66	1.4095	-28.917	1307	
354 A		1.4099	66	1.4097	-28.928	1308	
↓ B		1.4111	66	1.4109	-28.994	1309	
↓ C		1.4118	66	1.4116	-29.033	1310	X
↓ D		1.4111	66	1.4109	-28.994	1311	
355 A		1.4128	66	1.4126	-29.088	1312	
↓ B		1.4166	66	1.4164	-27.298	1313	



23

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 16 Oct 81	TIME (24 HR CLOCK) 1314	SHEET No. 0069
1) EXAMINER (SIGNATURE) <i>Paul G. Witt</i>	PROCEDURE No. 1X-ME-101-2	INSTRUMENT (WTR COL MON) N12T00	SERIAL No. B1-D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER (SIGNATURE) <i>Felicitia</i>	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerstat 0126614
TEST PIPE IDENTIFICATION 26 018C -15			AVERAGE "C" 55.218	CALIBRATION SHEET No. 2094

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
355C	1.1	1.4194	66	1.4192	-19.453	1314	
D		1.4217	66	1.4215	-29.580	1315	
356A		1.4217	66	1.4215	-29.580	1315	
356B		1.4264	66	1.4262	-29.840	1316	
B C		1.4313	66	1.4311	-30.110	1317	
D		1.4359	66	1.4357	-30.364	1318	
357A		1.4376	66	1.4374	-30.458	1319	
B B		1.4376	66	1.4374	-30.458	1320	
B C		1.4383	66	1.4381	-30.497	1321	
358A		1.4392	66	1.4390	-30.547	1322	90° Elevation X
B B		1.4362	66	1.4360	-30.381	1323	" "
B C		1.4320	66	1.4318	-30.149	1324	" "
359A		1.4300	66	1.4308	-30.094	1325	
B B		1.4270	66	1.4268	-29.873	1326	
B C		1.4210	66	1.4208	-29.541	1327	END OF PIPE (ATRAUX RIDG)
358A		1.4394	66	1.4392	-30.578	1329	10.53 K. P. checked 1.4372
359C		1.4115	66	1.4113	-29.017	1333	29.033 1.4115
350A		1.4357	66	1.4355	-30.353	1336	30.182 1.4253
348A		1.4404	66	1.4402	-30.613	1337	30.618 1.4404
343A		1.2685	67	1.2682	-21.112	1343	30.596 1.2662
342B		1.1521	67	1.1518	-14.682	1345	30.728 1.2662

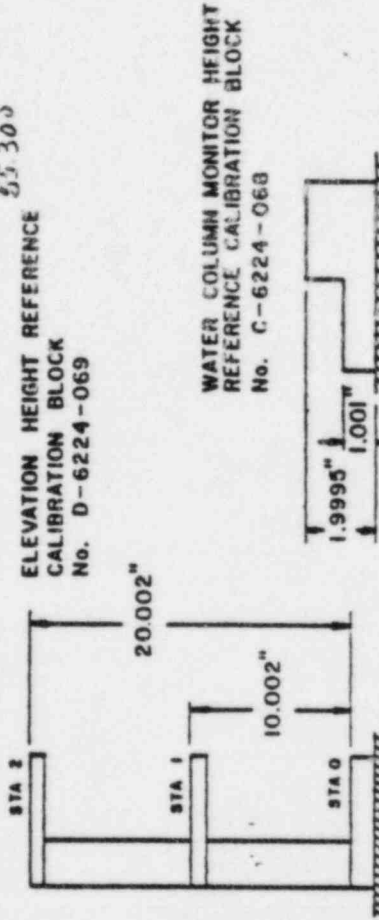
END

.011  
-.016  
-.039  
-.005  
-.116  
-.075



# SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003		SITE Midland		DATE (DAY-MO-YR) 16 Oct. 81		TIME (24 HR CLOCK) 15:20		SHEET No. 007/		
1) EXAMINER (SIGNATURE) S. H. O. D. A.		PROCEDURE No. IX-ME-01-2		INSTRUMENT (WTR COL MON) Norted		SERIAL No. 131-D-317		WATER COLUMN TRANSDUCER SWRI 2034		
2) EXAMINER J. R. Litter		PRESSURE TRANSDUCER Sera 39620		INSTRUMENT (DIGIT VOLT M.) FNI		SERIAL No. 38521		THICKNESS TRANSDUCER No. Aerctay 01210111		
HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANS. TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES VOLTS	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.70	.9496	65	-.1801	55.290	1525	1.001	2.001	1522	
10.002	1.70	.7687	65	-.1808	55.310	1526	1.000	1.999	1532	ENTER /-JBD-2
10.002	1.70	.5879	65	-.3412	55.300	1527	1.000	1.999	1600	EXIT 1-JBD-2/ENTER/1-JBD4
0	1.70	.9496	64	-.1808	55.321	1529	.999	1.998	1636	EXIT /-JBD-1
10.002	1.70	.7689	64	-.1808	55.310	1530	1.000	1.999	1833	
10.002	1.70	.5880	64	-.3414	55.315	1531				
Avg 55.310										
0	1.70	.9503	67	-.1805	55.290	1627				
10.002	1.70	.7694	67	-.1805	55.310	1630				
10.002	1.70	.5886	67	-.3417	55.300	1632				
0	1.70	.9503	66	-.1804	55.321	1633				
10.002	1.70	.7695	66	-.1801	55.379	1634				
10.002	1.70	.5886	66	-.3417	55.300	1635				
AVERAGE "C" FOR ALL RUNS										
55.305										





50

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE 16 Oct 81	TIME (24 HR CLOCK) 15-32	SHEET No. 0012			
1) EXAMINER (SIGNATURE) Blatt G. L.	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Mortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SwRI 2031			
2) EXAMINER F. P. R. L.	PRESSURE TRANSDUCER Setra 34620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Agrotech 012661M			
TEST PIPE IDENTIFICATION Right side Lookin' Aorta PIPE 1-JBD-2							
PIPE POSITION (F.T.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
205 A	1.7	.8305	64	.8305	0	1535	DATUM POINT (edge of flange)
204 C		.8307	64	.8307	-.011	1536	
204 B		.8381	65	.8380	-.415	1537	
204 A		.8497	65	.8491	-1.056	1538	
203 A		.8507	65	.8506	-1.112	1539	
202 A		.8506	65	.8505	-1.106	1540	
201 C		.8512	65	.8511	-1.139	1541	
1 B		.8495	65	.8494	-1.045	1541	
1 A		.8475	65	.8474	-.935	1542	
200 D		.8465	65	.8464	-.879	1543	
1 C		.8386	65	.8387	-.454	1544	
1 B		.8318	65	.8317	-.066	1545	
1 A		.8255	66	.8233	.398	1546	
199 D		.8229	66	.8227	.431	1547	Re check 8225
C		.8220	66	.8218	.481	1548	71002 1537
B		.8209	66	.8207	.542	1549	
A		.8205	66	.8203	.564	1550	
199 D		.8218	66	.8216	.492	1551	
C		.8196	66	.8194	.614	1552	
B		.8173	66	.8171	.741	1553	
A		.8155	66	.8153	.841	1554	LAST DATA POINT IN PIPE (171002)
205 A	1.7	.8303	66	.8301	.022	1559	



## SWRI PIPE ELEVATION PROFILE DATA RECORD

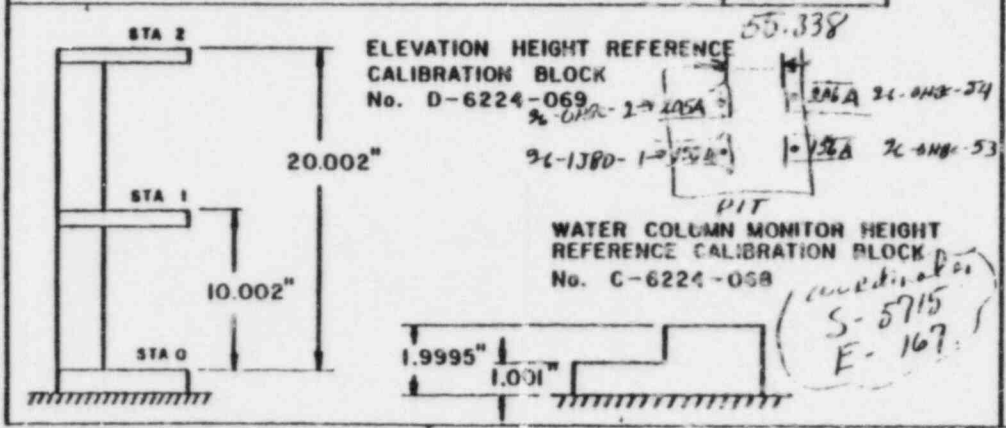
PROJECT No. 17-6542-003		SITE midland		DATE (DAY-MO-YR) 16 Oct 81		TIME (24 HR CLOCK) 1602		SHEET No. 073	
1) EXAMINER (SIGNATURE) <i>Dot D. D. X</i>		PROCEDURE No. IX-ME-101-2		INSTRUMENT (WTR COL MON) 1310317		SERIAL No. 1310317		WATER COLUMN TRANSDUCER SWRI 2034	
2) EXAMINER <i>J. J. Little</i>		PRESSURE TRANSDUCER Serte 39620		INSTRUMENT (DIGIT VOLT M.) ENI		SERIAL No. 38521		THICKNESS TRANSDUCER No. Aerotech 012661m	
TEST PIPE IDENTIFICATION Left side looking north PIPE I-JBD-1						AVERAGE "C" 55.305		CALIBRATION SHEET No. 0071	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
155A	1.7	.8147	66	.8147	0	1603	DATUM.		
154C		.8149	66	.8149	-.011	1604			
B		.8216	66	.8216	-.382	1605			
A		.8320	66	.8320	-.957	1606			
153C		.8320	66	.8320	-.957	1607			
B		.8306	66	.8306	-.879	1608			
A		.8284	66	.8284	-.758	1609			
152D		.8282	66	.8282	-.747	1610			
C		.8190	67 <sup>-.0001</sup>	.8189	-.232	1611			
B		.8101	67	.8100	.260	1612			
A		.7999	67	.7998	.824	1613			
151D		.8002	67	.81001	.807	1614			
C		.7925	67	.7927	1.217	1615			
B		.7841	67	.7840	1.698	1616			
A		.7759	68 <sup>-.0001</sup>	.7757	2.157	1617			
150D		.7757	68	.7755	2.168	1618			
C		.7720	68	.7718	2.373	1619			
B		.7657	68	.7655	2.721	1620			
A		.7613	68	.7611	2.964	1621	END OF TEST PIPE (AT AUX. Bldg)		
152R		.8100	68	.8098	.271	1622	Recheck		
155A		.8147	67 <sup>-.0001</sup>	.8146	.006	1625	.915		

### SWRI CALIBRATION RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 17 Oct 81	TIME (24 HR CLOCK) 0750	SHEET No. 0074
1) EXAMINER (SIGNATURE) <i>Glenn G. Obit</i>	PROCEDURE No. 1X-ME-101-2	INSTRUMENT (WTR CGL MON) NORtec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SwRI 2034
2) EXAMINER <i>J.R. Ritter</i>	PRESSURE TRANSDUCER Setra 39620	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec 012661M

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES/VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	9481	51°	-.1804	55.443	0756	1.000	2.001	0751	750 ft. haul + Trans. bio.
10.002	✓	7677	51	-.1809	55.279	0758	1.000	2.001	0830	
20.002	✓	5868	51	-.2625	55.331	0802	1.001	2.002	0901	
0	✓	9482	✓	-.1805	55.412	0804	1.002	2.003	0932	
10.002	✓	7677	✓	-.1808	55.310	0805	1.002	2.002	1001	
20.002	✓	5869	✓	-.2613	55.361	0810	1.003	2.003	1030	
Avg.					55.356		1.003	2.003	1102	
0	1.7	9497	65	-.1805	55.413	1332	1.002	2.012	1122	
10.002	1.7	7692	65	-.1810	55.249	1333	1.003	2.003	1218	
20.002	1.7	5882	65	-.2625	55.331	1334	1.001	2.001	1240	
0	✓	9496	65	-.1801	55.443	1336	1.002	2.002	1340	
10.002	✓	7692	65	-.1810	55.249	1337				
20.002	✓	5882	65	-.2614	55.345	1338				

AVERAGE "C" FOR ALL RUNS: 55.347



33

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Mt. Leona	17 Oct 81	0810	0075			
1) EXAMINER (SIGNATURE) <i>John G. Clark</i>	PROCEDURE No. IX-ME-101-Z	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SCRI 2034			
2) EXAMINER (SIGNATURE) <i>J. K. Ritter</i>	PRESSURE TRANSDUCER Setra 37620	INSTRUMENT (DIGIT VOLT M.) EVI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aersted, 01266141			
TEST PIPE IDENTIFICATION 26-OHBC-53 - Turned Service Water Sta.		AVERAGE °C 55.347	CALIBRATION SHEET No. 0074				
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
156 A	1.7	.8156	51	.8156	0	0809	Sided weld DATUM
156 D		.8138	51	.8138	.100	0820	" "
157 A		.8138	51	.8138	.100	0821	" "
B		.8069	51	.8069	.482	0921	2" PIPE
C		.7995	51	.7995	.891	0822	
D		.7937	51	.7937	1.212	0823	
158 A		.7925	51	.7925	1.279	0824	
B		.7874	51	.7874	1.561	0825	
C		.7857	51	.7857	1.655	0826	
D		.7875	51	.7875	1.555	0827	
159 A		.7882	51	.7882	1.517	0828	90° Elbow Start
B		.7952	52	.7951	1.135	0829	" "
C		.7981	52	.7980	.774	0830	" "
160 A		.7973	52	.7972	1.018	0831	
B		.8044	52	.8043	.625	0832	
160 C		.8098	52	.8097	.327	0833	
160 D		.8139	52	.8138	.100	0834	
161 A		.8143	53	.8141	.083	0835	
B		.8140	53	.8138	.100	0836	
C		.8138	53	.8136	.111	0837	
162 A		.8138	53	.8136	.111	0838	



34

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6512-003	Midford	17 Oct 91	0839	0076			
1) EXAMINER (SIGNATURE) <i>Stuart O. Pitt</i>	PROCEDURE No. IX-106-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRC 2034			
2) EXAMINER <i>J. E. Ritten</i>	PRESSURE TRANSDUCER S.D. 37620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aorster 01155101			
TEST PIPE IDENTIFICATION <b>26-0 HBC-53</b>			AVERAGE °C 55.347	CALIBRATION SHEET No. 0074			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
162 B	1.7	.8129	53	.8127	.161 ✓	0839	
C		.8091	53	.8089	.371 ✓	0840	
D		.8050	53	.8048	.598 ✓	0841	
163 A		.8056	53	.8054	.565 ✓	0842	
B		.8050	53	.8048	.598 ✓	0843	
C		.8048	53	.8046	.609 ✓	0844	
164 A		.8036	53	.8034	.675 ✓	0845	
B		.7959	53	.7957	1.101 ✓	0846	
C		.7900	54	.7897	1.433 ✓	0847	
D		.7905	54	.7902	1.406 ✓	0848	
165 A		.7907	54	.7904	1.395 ✓	0849	
B		.7902	54	.7899	1.422 ✓	0850	
C		.7903	54	.7900	1.417 ✓	0851	
D		.7907	54	.7904	1.395 ✓	0852	
166 A		.7903	54	.7900	1.417 ✓	0853	
B		.7870	54	.7867	1.600 ✓	0854	
C		.7869	55	.7865	1.611 ✓	0855	
D		.7826	55	.7822	1.849 ✓	0856	
167 A		.7830	55	.7826	1.826 ✓	0857	X
B		.7784	55	.7880	1.528 ✓	0858	
C		.7768	55	.7764	2.170 ✓	0859	



55)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	11054 31	1/10/81	0857	0077			
1) EXAMINER (SIGNATURE) <i>Olga G. O. A.</i>	PROCEDURE No. IX-NIE-131-2	INSTRUMENT (WTR COL. MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRI 2834			
2) EXAMINER <i>J. E. Little</i>	PRESSURE TRANSDUCER SWRI 39620	INSTRUMENT (DIGIT VOLT M.) ENV	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec C-266141			
TEST PIPE IDENTIFICATION <b>26-0HBC-53</b>			AVERAGE °C 65.347	CALIBRATION SHEET No. 0074			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
167 D	1.7	.7755	55	.7757	2.242 ✓	0800 0806	
167 A		.7773	55	.7769	2.142 ✓	0901	
B		.7799	56	.7794	2.004 ✓	0902	
C		.7885	56	.7880	1.518 ✓	0903	
D		.7969	56	.7964	1.063 ✓	0904	
169 A		.7985	56	.7980	.974 ✓	0905	
B		.8112	56	.8107	.271 ✓	0906	
C		.8263	56	.8258	-.565 ✓	0907	
D		.8376	56	.8371	-1.190 ✓	0908	
170 A		.8397	56	.8392	-1.306 ✓	0909	
B		.8534	56	.8529	-2.064 ✓	0910	
C		.8642	56	.8637	-2.662 ✓	0911	
D		.8740	56	.8735	-3.205 ✓	0912	
171 A		.8748	56	.8743	-3.249 ✓	0913	
B		.8814	57	.8808	-3.609 ✓	0914	
C		.8851	57	.8845	-3.813 ✓	0915	
D		.8825	57	.8829	-3.725 ✓	0916	
172 A		.8825	57	.8819	-3.670 ✓	0912	
B		.8785	57	.8779	-3.448 ✓	0929	
C		.8690	57	.8684	-2.922 ✓	0929	
D		.8569	57	.8563	-2.253 ✓	0931	

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. <i>17-6542-003</i>		SITE <i>Midland</i>		DATE (DAY-MO-YR) <i>17 Oct 81</i>		TIME (24 HR CLOCK) <i>0932</i>		SHEET No. <i>0078</i>	
1) EXAMINER (SIGNATURE) <i>[Signature]</i>		PROCEDURE No. <i>IX-1112-10-2</i>		INSTRUMENT (WTR COL MON) <i>Wortel</i>		SERIAL No. <i>131-D-317</i>		WATER COLUMN TRANSDUCER <i>SWRI 2034</i>	
2) EXAMINER <i>J. E. Ritter</i>		PRESSURE TRANSDUCER <i>Sofra 39620</i>		INSTRUMENT (DIGIT VOLT M.) <i>ENI</i>		SERIAL No. <i>38521</i>		THICKNESS TRANSDUCER No. <i>Aerotec 0260111</i>	
TEST PIPE IDENTIFICATION <i>26 - OHBC - 53</i>						AVERAGE "C" <i>55.347</i>		CALIBRATION SHEET No. <i>0074</i>	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
173 A	1.7	.8563	58 <sup>---6</sup>	.8557	-2.219 ✓	0933			
B		.8367	59 <sup>---7</sup>	.8360	-1.129 ✓	0934	X		
C		.8154	59	.8147	.050 ✓	0935			
D		.7997	59	.7990	.919 ✓	0937			
174 A		.7996	59	.7989	.924 ✓	0938			
B		.7878	59	.7871	1.577 ✓	0940			
C		.7810	59	.7803	1.954 ✓	0942			
D		.7788	59	.7781	2.076 ✓	0943			
175 A		.7797	59	.7790	2.026 ✓	0944	X		
B		.7781	59	.7774	2.114 ✓	0945			
C		.7749	59	.7742	2.291 ✓	0946			
D		.7723	59	.7716	2.435 ✓	0947			
176 A		.7721	59	.7714	2.446 ✓	0948			
B		.7725	60 <sup>---8</sup>	.7717	2.430 ✓	0950			
C		.7787	60	.7779	2.087 ✓	0951	X		
D		.7821	60	.7813	1.878 ✓	0953			
177 A	.7824	60	.7816	1.882 ✓	0954				
B	.7875	60	.7867	1.560 ✓	0955	X			
C	.7849	60	.7841	1.743 ✓	0956				
D	.7785	60	.7777	2.098 ✓	0957				
178 A	.7791	60	.7786	2.048 ✓	0959				

# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-00	SITE Midland	DATE (DAY-MO-YR) 11 Oct 81	TIME (24 HR CLOCK) 0960 1000	SHEET No. 0079
1) EXAMINER (SIGNATURE) <i>Grant O. D. A.</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Mortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER Scout 2936
2) EXAMINER <i>F. E. Hatten</i>	PRESSURE TRANSDUCER Setra 37620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotax (11-2-65-100)
TEST PIPE IDENTIFICATION 26-OHBC-53			AVERAGE "C" 55.347	CALIBRATION SHEET No. 0074

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
178 B	1.1	.7728	60	.7730	2.358 v	1001	
178 C		.7706	60	.7698	2.535 v	1004	
178 D		.7658	61	.7649	2.806 v	1007	
179 A		.7689	61	.7680	2.635 v	1009	
179 B		.7745	61	.7736	2.325 v	1012	
179 C		.7834	61	.7825	1.832 v	1013	
179 D		.7932	61	.7923	1.290 v	1015	
180 A		.7933	61	.7924	1.284 v	1016	
180 B		.8086	61	.8077	.437 v	1017	
180 C		.8249	61	.8240	-.465 v	1020	
180 D		.8392	61	.8383	-1.256 v	1022	
181 A		.8409	61	.8400	-1.350 v	1023	45° Elbow
181 B		.8414	61	.8405	-1.378 v	1024	"
181 C		.8438	61	.8429	-1.511 v	1025	"
182 A		.8439	61	.8430	-1.517 v	1026	
182 B		.8494	61	.8485	-1.821 v	1027	
182 C		.8534	61	.8525	-2.042 v	1028	
183 A		.8555	61	.8546	-2.159 v	1029	
183 B		.8595	61	.8586	-2.380 v	1030	
183 C		.8651	61	.8642	-2.690 v	1031	
184 A		.8652	61	.8643	-2.695 v	1032	



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-032	SITE Middle	DATE (DAY-MO-YR) 17 OCT 51	TIME (24 HR CLOCK) 1033	SHEET No. 0080			
1) EXAMINER (SIGNATURE) G. J. O'Dea	PROCEDURE No. IX-WE-10A-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 13-0317	WATER COLUMN TRANSDUCER SWRT 2034			
2) EXAMINER J. E. Litten	PRESSURE TRANSDUCER Sutra 35620	INSTRUMENT (DIGIT VOLT M.) EMI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aristar 02661-11			
TEST PIPE IDENTIFICATION 26-OHBC-53		AVERAGE °C 55.347	CALIBRATION SHEET No. 0074				
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
184 B	1.7	.8749	61	.8740	-3.232 v	1034	
C		.8868	61	.8859	-3.891 v	1035	
185 A		.8858	61	.8849	-3.836 v	1036	
B		.8940	61	.8931	-4.289 v	1037	
C		.9014	61	.9009	-4.887 v	1038	
D		.9141	61	.9132	-5.402 v	1039	
186 A		.9154	61	.9145	-5.474 v	1040	
B		.9180	61	.9171	-5.618 v	1041	
C		.9158	61	.9149	-5.496 v	1042	
D		.9187	61	.9118	-5.324 v	1043	
187 A		.9112	61	.9103	-5.241 v	1044	side of well
B		.9039	61	.9030	-4.837 v	1045	" "
C		.8943	61	.8934	-4.306 v	1046	" "
D		.8866	61	.8857	-3.880 v	1047	" "
188 A		.8871	61	.8862	-3.907 v	1050	Edge Pipe
B		.8820	62	.8810	-3.620 v	1051	
C		.8808	62	.8798	-3.553 v	1055	
D		.8870	62	.8850	-3.896 v	1056	
189 A		.8816	62	.8766	-3.376 v	1058	
B		.8939	62	.8929	-4.278 v	1059	
C		.8972	62	.8982	-4.572 v	1100	



32)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003		SITE midland		DATE 17-oct-81		TIME (24 HR CLOCK) 1100		SHEET No. 5081	
1) EXAMINER (SIGNATURE) D. H. [Signature]		PROCEDURE No. 1A-12E-101-2		INSTRUMENT (WTR COL MON) Inverted		SERIAL No. 131-D-57		WATER COLUMN TRANSDUCER SWRI-2034	
2) EXAMINER J. Elster		PRESSURE TRANSDUCER Set. a 39620		INSTRUMENT (DIGIT VOLT M.) LNF		SERIAL No. 38521		THICKNESS TRANSDUCER No. Acosta 0.26614	
TEST PIPE IDENTIFICATION 26 - 0 HBC - 53						AVERAGE °C 55.347		CALIBRATION SHEET No. 0074	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
187D	1.7	.9043	62	.9033	-4.854 ✓	1102			
190A		.9051	62	.9041	-4.898 ✓	1103			
B		.9118	62	.9108	-5.269 ✓	1104			
C		.9210	62	.9200	-5.778 ✓	1105			
D		.9302	62	.9292	-6.287 ✓	1106			
191A		.9316	62	.9306	-6.365 ✓	1107			
B		.9420	62	.9410	-6.941 ✓	1108			
C		.9504	62	.9494	-7.405 ✓	1109			
D		.9556	62	.9546	-7.693 ✓	1110			
192A		.9574	62	.9564	-7.793	1111			
B		.9638	62	.9628	-8.147 ✓	1112			
C		.9665	62	.9655	-8.297 ✓	1115			
D		.9667	62	.9657	-8.308 ✓	1117			
193A		.9708	62	.9698	-8.535 ✓	1118			
B		.9715	62	.9705	-8.573 ✓	1119			
C		.9701	62	.9691	-8.496 ✓	1121			
D		.9666	62	.9656	-8.302 ✓	1122			
194A		.9591	62	.9581	-7.887 ✓	1123			
B		.9505	62	.9495	-7.411 ✓	1124			
C		.9495	62	.9485	-7.356 ✓	1125			
D		.9394	62	.9384	-6.797 ✓	1126			

10

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.		SITE		DATE (DAY - MO - YR)		TIME (24 HR CLOCK)		SHEET No.	
17-6542-003		Midland		12 09 81		1128		0082	
1) EXAMINER (SIGNATURE)		PROCEDURE No.		INSTRUMENT (WTR COL MON)		SERIAL No.		WATER COLUMN TRANSDUCER	
D. J. Ritter		1X-MF-101-2		Nortec		131-D-317		SWRI 5030	
2) EXAMINER		PRESSURE TRANSDUCER		INSTRUMENT (DIGIT VOLT M.)		SERIAL No.		THICKNESS TRANSDUCER No.	
J. E. Ritter		5-STA 35620		ENI		38521		Armed 1266114	
TEST PIPE IDENTIFICATION		DIGITAL VOLTMETER (VOLTS)		P.V.M. CORR. FOR TEMP. (VOLTS)		CHANGE IN ELEVATION (IN.)		AVERAGE °C	
26-OHPC-53								55.347	
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS		
195 C	1.7	9266	62	.9256	-6.088 v	1129			
D		9011	62	.9101	-5.230 v	1130			
196 A		9101	62	.9091	-5.175 v	1132			
B		8969	62	.8969	-4.444 v	1133			
C		8825	62	.8815	-3.647 v	1134			
D		8692	62	.8682	-2.911 v	1135	X		
197 A		8716	62	.8706	-3.044 v	1136			
B		8639	62	.8629	-2.618 v	1137			
C		8539	62	.8549	-2.175 v	1138			
D		8505	62	.8495	-1.876 v	1139	END OF		
360 A		8499	62	.8489	-1.843 v	1141	45° Elbow		
360 B		7696	62	.7686	2.601 v	1142	" "		
360 C		6325	62	.6315	10.189 v	1143	" "		
361 A		5682	62	.5672	13.748 v	1146	90° Elbow		
B		2939	62	.2929	28.930 v	1178	" "		
361 C		1436	62	.1426	37.249 v	1147			
362 A		1408	62	.1398	37.404 v	1151			
B		1522	62	.1512	36.773 v	1153			
C		1645	62	.1635	36.092 v	1156			
D		1783	62	.1773	35.328 v	1157			
363 A		1829	62	.1819	35.073 v	1158	start of 90° E/60° W		

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Miller	DATE (DAY-MO-YR) 17 Oct 81	TIME (24 HR CLOCK) 1159	SHEET No. 0083
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER Sstra 39620	INSTRUMENT (DIGIT VOLT M.) EMT	SERIAL No. 38521	THICKNESS TRANSDUCER No. Acrotex 01266141
TEST PIPE IDENTIFICATION 26-04BC-53      Toward Water Pump Sta.			AVERAGE "C" 55.347	CALIBRATION SHEET No. 0074

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
363 B	1.7	.1905	62 <sup>0.015</sup>	.1895 <sup>v</sup>	34.653 <sup>v</sup>	1159	
C		.1872	62	.1862 <sup>v</sup>	34.835 <sup>v</sup>	1200	
364 A		.1849	62	.1839	34.963 <sup>v</sup>	1201	
B		.1820	62	.1810	35.123 <sup>v</sup>	1202	
C		.1785	62	.1775	35.317 <sup>v</sup>	1203	END of Pipe
196 C		.8825	61 <sup>-.0004</sup>	.8816	-3.653	1238	3.657 8825
193 B		.9715	61	.9706	-8.579	1239	8.573 9715
186 D		.9130	62 <sup>-.0010</sup>	.9120	-5.335	1242	5.324 9127
185 B		.8964	62	.8954	-4.417	1245	4.418 8940
180 B		.8000	63 <sup>-.0011</sup>	.8089	.371	1252	.437 9086
178 B		.7754	63	.7743	2.286	1258	2.374 178 B 7738
177 B		.7886	63	.7870	1.583	1305	1.560 7875
173 B		.8375	63	.8364	-1.151	1308	-1.129 8367
170 A		.8401	63	.8390	-1.295	1312	-1.276 8397
166 D		.7830	63	.7819	1.865	1315	1.844 7826
160 A		.7972	63	.7961	1.079	1320	1.018
156 A		.8164	63	.8153	.016	1328	0 DATUM

END

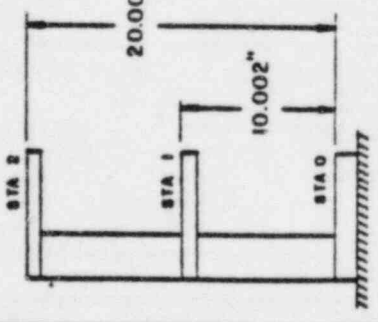


42

### SWRI CALIBRATION RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.						
17-6542-003	1111/land	18 Oct 81	0739	0084						
1) EXAMINER (SIGNATURE) <i>John C. ...</i>	PROCEDURE No. 1X-ME-10-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-517	WATER COLUMN TRANSDUCER SWRI 2051						
2) EXAMINER (SIGNATURE) <i>John C. ...</i>	PRESSURE TRANSDUCER Set 2 29620	INSTRUMENT (DIGIT VOLT M.) EMC	SERIAL No. 38531	THICKNESS TRANSDUCER No. Approved 0-266141						
HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSUCER TEMP. (°F)	D.Y.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	9500	62	.180	55.259	0742	1.001	2.001	0739	26-0H8c-54
10.002		7690	62	.181	55.249	0743	1.001	2.002	0810	
20.002		5880	62	.362	55.254	0744	1.000	2.001	820	
0		9501	62	.180	55.259	0746	999	2.000	900	
10.002		7691	62	.181	55.249	0747	999	2.000	930	
20.002		5881	62	.362	55.254	0748	1.000	2.002	955	
					Avg. 55.254		1.000	2.001	1028	
0	1.7	9489	58	.181	55.269	1312	1.001	2.001	1046	
10.002		7679	58	.1807	55.340	1314	1.000	2.001	1115	
20.002		5872	58	.3617	55.299	1315	1.002	2.002	1140	
0		9487	58	.1809	55.290	1317	1.002	2.002	1210	
10.002		7678	58	.1807	55.340	1318	1.001	2.001	1238	
20.002		5871	58	.3616	55.315	1319	1.002	2.002	1252	
AVERAGE "C" FOR ALL RUNS							1.002	2.002	1315	
55.281							1.002	2.002	1320	

ELEVATION HEIGHT REFERENCE CALIBRATION BLOCK No. D-6224-069



WATER COLUMN MONITOR HEIGHT REFERENCE CALIBRATION BLOCK No. C-6224-068



### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-013	SITE Midland	DATE (DAY-MO-YR) 18 Oct 61	TIME (24 HR CLOCK) 0748	SHEET No. 0265
1) EXAMINER (SIGNATURE) [Signature]	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER J E Ritter	PRESSURE TRANSDUCER Setra 39(20)	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. A-2-520 01266141
TEST PIPE IDENTIFICATION 26-01BC-54			AVERAGE "C" 55.281	CALIBRATION SHEET No. 0084

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
206 A	1.7	.8498	60	.8498	0	805	DATUM
206 B		.8512	1	.8512	-.077	806	
C		.8532	60	.8532	-.188	807	
D		.8541	1	.8541	-.238	808	
207 A		.8531	1	.8531	-.182	809	
B		.8522	60	.8522	-.133	811	
C		.8531	1	.8531	-.182	812	
D		.8579	1	.8579	-.448	813	
208 A		.8594	60	.8594	-.531	814	START of 90° elbow
B		.8589	60	.8589	-.503	815	
C		.8632	1	.8632	-.741	816	
209 A		.8639	60	.8639	-.779	817	
B		.8650	60	.8650	-.840	818	
C		.8643	1	.8643	-.802	819	
D		.8630	1	.8630	-.730	820	
210 A		.8640	60	.8640	-.785	821	
B		.8520	60	.8520	-.122	822	
C		.8409	1	.8409	.492	823	
D		.8325	1	.8325	.956	824	
211 A		.8330	1	.8330	.929	825	
B		.8246	60	.8246	1.393	827	

24)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 19 04 81	TIME (24 HR CLOCK) 0928	SHEET No. 0086
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Norton	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SwRI 2034
2) EXAMINER J Elitter	PRESSURE TRANSDUCER Slic 39620	INSTRUMENT (DIGIT VOLT M.) ENI	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerotec 0266141
TEST PIPE IDENTIFICATION 26-OHBC-54			AVERAGE "C" 53.281	CALIBRATION SHEET No. 0084

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
211 C	1.7	.8180	60	.8180	1.758	829	
D		.8106		.8106	2.167	830	
212 A		.8112		.8112	2.134	0831	
212 B		.8092		.8092	2.244	832	
C		.8072		.8072	2.355	833	
D		.8046	60	.8046	2.499	834	
213 A		.8045		.8045	2.504	835	
B		.8010	60	.8010	2.665	836	
214 A		.8010		.8010	2.698	837	
B		.7984	60	.7984	2.841	838	
214 C		.7948		.7948	3.040	839	
D		.7874		.7874	3.450	841	
215 A		.7889	60	.7889	3.367	843	
B		.7864		.7864	3.505	844	
C		.7859	60	.7859	3.532	845	
D		.7866	60	.7866	3.494	847	
216 A		.7876	60	.7879	3.422	848	
B		.7885	60	.7885	3.389	849	
C		.7926	59	.7927	3.157	850	
D		.7979	59	.7980	2.864	852	
217 A	✓	.8002	59	.8003	2.736	0853	

6159

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-002	Midland	1 Nov 81	0854	0087			
1) EXAMINER (SIGNATURE) <i>John D. ...</i>	PROCEDURE No. 1X-W-E-1X-2	INSTRUMENT (WTR COL MON) NORTEL	SERIAL No. 131-0-317	WATER COLUMN TRANSDUCER SQRZ 2143			
2) EXAMINER <i>John ...</i>	PRESSURE TRANSDUCER SQRZ 39620	INSTRUMENT (DIGIT VOLT M.) E-M	SERIAL No. 38521	THICKNESS TRANSDUCER No. A-101 212-101			
TEST PIPE IDENTIFICATION 26-OHBC-54		AVERAGE °C 55.281		CALIBRATION SHEET No. 0084			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
217 B	1.7	.8057	59	.8058	2.432	0855	
C		.8121	59	.8122	2.079	0856	
D		.8162		.8163	1.852	0858	
218 A		.8170		.8171	1.808	0859	
B		.8244	59	.8245	1.399	0859	
C		.8328		.8329	.734	0102	
D		.8388	59	.8389	.603	0904	
219 A		.8383		.8384	.630	0105	
B		.8448	59	.8449	.271	0908	
C		.8544		.8545	-.094	0910	
D		.8559	59	.8560	-.343	0912	
220 A		.8566		.8567	-.381	0913	
B		.8576		.8577	-.437	0914	
C		.8575	59	.8576	-.431	0915	
D		.8495		.8496	.011	0916	
221 A		.8492		.8493	.028	0918	
221 B		.8351	59	.8352	.807	1120	
C		.8167		.8168	1.824	0422	
D		.8021	59	.8022	2.631	0923	
222 A		.8012	59	.8013	2.681	0925	
B		.7878		.7879	3.311	0926	



16)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Midland	18 Oct 81	0927	0088			
1) EXAMINER (SIGNATURE)	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
<i>P. H. G. R. T.</i>	17-ME-WI-2	Nortec	31-0-317	SWRI 2034			
2) EXAMINER (SIGNATURE)	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
<i>J. E. Ritter</i>	Setra 39620	ENI	38521	Approved 012661M			
TEST PIPE IDENTIFICATION		AVERAGE °C		CALIBRATION SHEET No.			
26-04BC-54		55.281		0084			
PIPE POSITION (F.T.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSUCER TEMP (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
222-C	1.7	.7875	60	.7875	3.444	0928	
D		.7871	60	.7871	3.466	0929	
223-A		.7894	60	.7894	3.339	0930	
B		.7832	60	.7832	3.682	0932	
C		.7806	60	.7806	3.825	0933	
D		.7777	60	.7777	3.586	0935	
224-A		.7795	60	.7795	3.886	0936	
B		.7856	60	.7856	3.549	0938	
C		.7960	60	.7960	2.974	0941	
D		.8085	60	.8085	2.283	0942	
225-A		.8085	60	.8085	2.283	0943	
B		.8160	60	.8160	1.868	0944	
C		.8165	60	.8165	1.841	0945	
D		.8136	60	.8136	2.000	0946	
226-A		.8130	60	.8130	2.034	0947	
B		.8074	60	.8074	2.344	0950	
C		.7999	60	.7999	2.759	0951	
D		.7945	60	.7945	3.057	0952	
227-A		.7933	60	.7933	3.123	0953	side of weld
B		.7953	60	.7953	3.013	0954	
C		.7985	60	.7985	2.836	0955	



41)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
1) 6542-003	hildred	18 Oct 81	0958	089			
EXAMINER (SIGNATURE) D. G. O'X	PROCEDURE No. IX-NIE-101-2	INSTRUMENT (WTR COL MON) Nortox	SERIAL No. 171-D-317	WATER COLUMN TRANSDUCER Scal J 2031			
EXAMINER J. E. Ritter	PRESSURE TRANSDUCER Setia 39620	INSTRUMENT (DIGIT VOLT M.) C.I.E.	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aerostat 012661 01			
TEST PIPE IDENTIFICATION 26-OHBC-54			AVERAGE °C 53.281	CALIBRATION SHEET No. 0084			
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
227 A	1.7	.8130	60	.8030	2.587	1000	
228 A		.8034		.8038	2.543	1001	
B		.8056		.8056	2.443	1003	
C		.8074		.8094	2.233	1005	
D		.8130		.8130	2.034	1006	
229 A		.8153		.8153	1.907	1008	Start @ 45' Elevation
B		.8157		.8157	1.885	1009	" "
C		.8147		.8147	1.940	1012	" "
230 A		.8135		.8135	2.007	1014	
B		.8196		.8196	1.669	1015	
C		.8255		.8255	1.343	1017	
D		.8309		.8309	1.045	1018	
231 A		.8305		.8305	1.067	1020	
B		.8335		.8335	.901	1022	
C		.8375		.8375	.680	1023	
232 A		.8370		.8370	.708	1024	
B		.8375	(58)	.8377	.669	1024	
C		.8405	58	.8407	.503	1056	
233 A		.8424		.8426	.398	1059	
B		.8420		.8422	.420	1059	
C		.8457		.8459	.216	1106	

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No. 17-6542-003	SITE Midland	DATE (DAY-MO-YR) 18 Oct 81	TIME (24 HR CLOCK) 1100	SHEET No. 0090
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-ME-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER SWRI 2034
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER C-ETR-39620	INSTRUMENT (DIGIT VOLT M.) F.M.I.	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aersted 012661M
TEST PIPE IDENTIFICATION 26-OHBC-54			AVERAGE "C" 55.281	CALIBRATION SHEET No. 0084

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLT METER (VOLTS)	TRANSDUCER TEMP (°F)	D. V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
233 D	1.7	.8505	58 <sup>1.0001</sup>	.8507	-.050	1101	
234 A		.8506		.8508	-.055	1102	
B		.8507		.8509	-.061	1103	
C		.8486	58	.8488	.055	1105	
D		.8440	58	.8442	.310	1106	
235 A		.8439	L	.8441	.315	1107	
B		.8366	58	.8368	.719	1109	
C		.8265	59 <sup>1.0001</sup>	.8266	1.283	1112	
D		.8198	59	.8199	1.653 ✓	1113	
236 A		.8203	59	.8204	1.625	1114	
B		.8165	59	.8166	1.835	1115	
C		.8170	✓	.8171	1.808	1116	
D		.8236	59	.8237	1.443	1117	
237 A		.8246	59	.8247	1.388	1118	
B		.8319	59	.8319	.790	1120	
C		.8419	59	.8420	.431	1121	
D		.8462	59	.8463	.193	1123	
238 A		.8466	59	.8467	.171	1124	
B		.8488		.8489	.050	1126	
C		.8573		.8574	-.420	1128	
D		.8661		.8668	-.940	1129	

119)

### SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT NO. 11-6542-003	SITE MILL 28	DATE (DAY-MO-YR) 180.8.81	TIME (24 HR CLOCK) 1130	SHEET NO. 0091
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. 1X-ME-101-2	INSTRUMENT (WTR COL MON) Nortac	SERIAL No. 131-D-317	WATER COLUMN TRANSDUCER
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER Set. 2 39620	INSTRUMENT (DIGIT VOLT M.) EMT	SERIAL No. 38521	THICKNESS TRANSDUCER No. Anodize 0126 p/4
TEST PIPE IDENTIFICATION 26-0HBC-54		AVERAGE °C 53.281	CALIBRATION SHEET No. 0084	

PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
239 A	1.7	.8686	59	.8687	-1.045	1131	
B		.8780	^	.8781	-1.564	1133	
C		.8905		.8906	-2.255	1134	
D	1.7	.89012		.9013	-2.847	1135	
240 A		.9034		.9035	-2.967	1137	
B		.9117		.9118	-3.427	1138	
C		.9204		.9205	-3.908	1140	
D		.9252		.9253	-4.174	1142	
241 A		.9281		.9282	-4.334	1143	
B		.9321		.9322	-4.610	1146	
C		.9330		.9331	-4.605	1148	
D		.9319		.9320	-4.544	1150	
242 A		.9321		.9322	-4.555	1151	
B		.9305		.9306	-4.467	1153	
C		.9247		.9248	-4.146	1155	✓
D		.9119		.9120	-3.438	1156	
243 A		.9126		.9127	-3.477	1157	X
B		.8985		.8986	-2.698	1159	
C		.8962		.8863	-2.018	1201	
D		.8749		.8750	-1.393	1202	
244 A		.8750		.8751	-1.399	1203	



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6547-003	Milland	18 Oct 81	1209	0092			
1) EXAMINER (SIGNATURE) <i>Robert C. ...</i>	PROCEDURE No.	INSTRUMENT (WTR COL MON)	SERIAL No.	WATER COLUMN TRANSDUCER			
2) EXAMINER (SIGNATURE) <i>J. ...</i>	1X-11E-101-2	North	131-D-317	Suck F 2031			
TEST PIPE IDENTIFICATION	PRESSURE TRANSDUCER	INSTRUMENT (DIGIT VOLT M.)	SERIAL No.	THICKNESS TRANSDUCER No.			
26-04BC-54	Setra 39620	ENV	38521	Acc. 179.0126. 111			
			AVERAGE °C	CALIBRATION SHEET No.			
			55.281	0084			
PIPE POSITION (FT.)	WATER COL. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
244B	1.7	.8665	59	.8666	-.929	1205	
C		.8595		.8596	-.542	1206	
D		.8542	59	.8543	-.249	1207	
245A		.8534		.8535	-.205	1208	
B		.8468	59	.8465	.182	1210	
C		.8399		.8400	.542	1212	
D		.8282	59	.8283	1.189	1214	END OF PIPE
							36" PIPE T "
248AA		.2155	59	.2156	35.069	1222	} Ready from old P.I. (PIPE 36-048C-16)
248BB		.2198		.2199	34.822	1225	
248CC		.2230		.2231	34.645	1227	
248DD		.2174	59	.2195	34.844	1208	
243A		.9124		.9125	-3.466	1233	
239A		.8686		.8689	-1.056	1235	
235B		.8368		.8369	.713	1240	
232A		.8368		.8369	.713	1240	
224B		.7849		.7850	3.582	1260	
220B		.7887		.7888	3.372	1300	
201A		.6571	58	.8533	-1.138	1305	
2064		.8487	58	.8489	.050	1307	DATUM

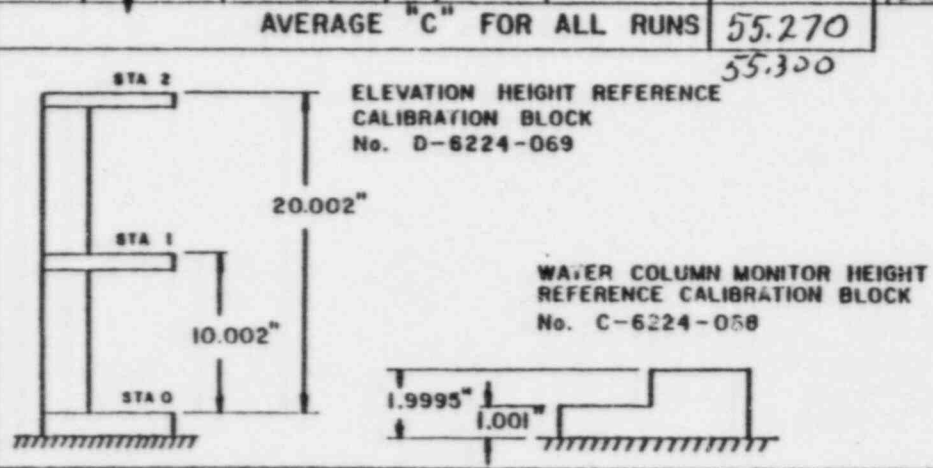
.011  
.011  
.006  
.005  
.033  
.061  
.044  
0.00



## SWRI CALIBRATION RECORD

PROJECT No. <i>17-6542-003</i>	SITE <i>midland</i>	DATE (DAY-MO-YR) <i>19 Oct 81</i>	TIME (24 HR CLOCK) <i>0838</i>	SHEET No. <i>0093</i>
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. <i>IX-ME-101-2</i>	INSTRUMENT (WTR COL MON) <i>Nortec</i>	SERIAL No. <i>1310-317</i>	WATER COLUMN TRANSDUCER <i>SWRI 2034</i>
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER <i>Stra 29620</i>	INSTRUMENT (DIGIT VOLT M.) <i>ENT</i>	SERIAL No. <i>38521</i>	THICKNESS TRANSDUCER No. <i>Aerotec 01266171</i>

HEIGHT (IN.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP. (°F)	D.V.M. CORR. FOR TEMP. (VOLTS)	CONVERSION CONSTANT "C" INCHES-VOLT	TIME	WATER COL. MON. 1" THICK	WATER COL. MON. 2" THICK	TIME	REMARKS
0	1.7	.7278	55	.1809	65.290	845	1.001	2.001	840	
10.002		5469		.1812	55.188	846	1.002	2.002	915	
20.002		3657		.3621	55.239	847	1.001	2.001	940	
0		.7279		.1809	55.290	850	1.002	2.002	108	
10.002		5470		.1812	55.188	851	1.001	2.003	1038	
20.002		3658	55	.3621	55.239	852	1.002	2.002	1105	
Avg. 55.239										
0	1.7	.7291	56	.1806	55.382	1103				
10.002		5475	1	.1811	55.218	1104				
20.002		3664	56	.3617	55.300	1105				
0		.7279		.1809	55.290	1101				
10.002		5470		.1807	55.310	1102				
20.002		3662	56		55.300	1103				
AVERAGE "C" FOR ALL RUNS						55.270				
						55.300				



# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET No.			
17-6542-003	Midland	19 Oct 81	0853	0094			
1) EXAMINER (SIGNATURE) <i>[Signature]</i>	PROCEDURE No. IX-101-101-2	INSTRUMENT (WTR COL MON) Nortec	SERIAL No. 13FD-317	WATER COLUMN TRANSDUCER SWRI 2011			
2) EXAMINER <i>[Signature]</i>	PRESSURE TRANSDUCER Sotr2 39620	INSTRUMENT (DIGIT VOLT M.) ENT	SERIAL No. 38521	THICKNESS TRANSDUCER No. Aortec 01266141			
TEST PIPE IDENTIFICATION 26-OHBC-15	TIE IN WITH 26-OHBC-03		AVERAGE °C 55.270	CALIBRATION SHEET No. 0093			
PIPE POSITION (F.T.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V.M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
331 D	1.7	8899	55	.8899	0	0854	Datum (AT PIPE ENTRY)
327 B	1.7	9200	54.1001	.9201	-1.670	0857	
322 C	1.7	7765	54.52	.7468	7.909	0901	
318 B	1.7	6816	53.003	.6818	11.502	0909	
313 C	1.7	6940	54	.6942	10.816	0912	
308 D	1.7	7576	54	.7518	7.633	0915	
306 C	1.7	7375	54	.7377	8.633	0917	
306 B		7246	54	.7248	9.125	0918	
303 A		7123	54	.7125	9.805	0920	
307 B		7239	54.55	.7239	9.175	0922	Reducers
307 A		7730	55	.7730	6.461	0924	11
306 C		7966	55	.7966	5.157	0925	26" PIPE 36"-OHBC-15
306 B		7908	55	.7908	5.477	0926	
306 A		7645	54.56	.7844	5.831	0927	
305 D		7889	56	.7888	5.588	0928	
305 C		7724	56	.7723	6.500	0930	
305 B		7553	56	.7552	7.445	0931	
305 A		7423	56	.7422	8.163	0933	
364 C		7073	56	.7042	10.214	0935	26" PIPE 26"-OHBC-53
364 B		7079	56	.7077	10.070	0937	
364 A		7104	56	.7103	9.926	0938	





# SWRI PIPE ELEVATION PROFILE DATA RECORD

PROJECT No.	DATE (DAY-MO-YR.)	TIME (24 HR CLOCK)	SHEET No.				
17-6542-003	11 Oct 81	1010	0096				
1) EXAMINER (SIGNATURE) D. J. Ritter	SITE midland	INSTRUMENT (WTR COL MON) WATER	WATER COLUMN TRANSDUCER Sexto 2034				
2) EXAMINER (SIGNATURE) D. J. Ritter	PROCEDURE No. 1X-ME-101-2	SERIAL No. 171-D-10	THICKNESS TRANSDUCER No. Aerlog 01201 III				
TEST PIPE IDENTIFICATION 26-OHAB-16 TIE IN WITH 26-OHBC-54	INSTRUMENT (DIGIT VOLT M.) ENT	SERIAL No. 38521	CALIBRATION SHEET No. 0093				
	AVG. TEMP. °C 55.270						
PIPE POSITION (FT.)	WATER COL. MON. (IN.)	DIGITAL VOLTMETER (VOLTS)	TRANSDUCER TEMP (°F)	P.V. M. CORR. FOR TEMP. (VOLTS)	CHANGE IN ELEVATION (IN.)	TIME	REMARKS
247A	1.7	9030	56	.9029	2.542	1011	Datum (First Point in Pipe)
247A	1.7	8570	56	.8569	2.542	1013	
246A	1.7	7202	56	.7201	10.103	1016	
247B	1.7	6727	58	.6724	12.740	1023	
247A	1.7	6655	58	.6652	13.138	1025	
250C	1.7	6656	58	.6652	13.138	1027	
260B	1.7	6635	58	.6632	13.248	1028	
250A	1.7	6596	58	.6593	13.464	1030	End of 20"
247B	1.7	6760	58	.6757	12.557	1032	Reduced
247A	1.7	7293	58	.7250	9.611	1033	36-OHBC = 16' Datum
248D	1.7	7416	58	.7463	8.655	1034	Start of T
248C	1.7	7490	58	.7487	8.512	1035	
246B	1.7	7484	58	.7481	8.556	1036	
248A	1.7	7424	58	.7421	8.887	1037	End of T
247D	1.7	7458	58	.7455	8.699	1038	
247C	1.7	7398	58	.7395	9.031	1039	
247B	1.7	7308	58	.7305	9.528	1040	
245D	1.7	6356	58	1.3558	-25.031	1042	26" Pipe Top (26-OHBC-54)
245C	1.7	6366	58	1.3659	-25.590	1043	
245B	1.7	6329	58	1.3726	-25.960	1045	
245A	1.7	6380	61	1.3803	-26.386	1046	
275A	1.7	9025	56	.9024	1.0276	1056	



APPENDIX C

PIPE CALIBRATION AND OUT-OF-ROUNDNESS DATA RECORDS

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 16 OCT 81	TIME (24-HR CLOCK) 1012	SHEET No. 057
EXAMINER R.A. RIES	EXAMINER J.E. Sill	INSTRUMENT SWRI	PROCEDURE IX-ME-102-0	

SET DISTANCE * D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
27	68.5	27	<del>27</del> 69.5	27	68.5
25	N/A	25	N/A	25	N/A
23½ <sup>RAO</sup> 25	N/A	23½	<del>23½</del> <sup>RAO</sup> 23½	23½	N/A

POSITION	AZIMUTH
1	3°
2	182°
3	271°
4	91°

\* Set Distance measured with steel TAPE (RAO)

The Reference Calibration block for the Set distance was not available for this calibration. JEL.

FIGURE 2

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 17-OCT-1981	TIME (24-HR CLOCK) 0826	SHEET NO. 058
EXAMINER R. ARIES	EXAMINER J. E. Sill	INSTRUMENT S. W. R. I.	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 7/8"	68.5	26 7/8"	68.5	26 7/8"	68.5
24 7/8"	63.4	24 7/8"	63.4	24 7/8"	63.4
23 1/4"	59.1	23 1/4"	59.1	23 1/4"	59.1

POSITION	AZIMUTH
1	300°
2	178°
3	90°
4	270°

FIGURE 2

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 18 Oct 81	TIME (24-HR CLOCK) 0920	SHEET No. 059
EXAMINER R.A. RIES	EXAMINER J.F. S. II	INSTRUMENT SWRI	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 3/8		26 3/8		26 3/8	
24 3/8		24 3/8		24 3/8	
23 3/8		23 3/8		23 3/8	59.4

POSITION	AZIMUTH
1	0°
2	178°
3	90°
4	270°

IX-ME-102-0  
 September 1981  
 Page 8 of 9

FIGURE 2



# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-004	SITE Midland	DATE (DAY-MO-YR) 19 Oct 81	TIME (24-HR CLOCK) 0750	SHEET NO. 060
EXAMINER R.A. RIES	EXAMINER <del>R</del> J.E. Sill	INSTRUMENT SWRI	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 3/8"		26 3/8"		26 3/8	
24 3/8		24 3/8		24 3/8	
23 3/8		23 3/8		23 3/8	

POSITION	AZIMUTH
1	3°
2	178°
3	90°
4	270°

Delay Because of Gas in pipe, and lack of labor support. (RAR)

Elbow

# SwRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 20 Oct 81	TIME (24-HR CLOCK) 1115	SHEET NO. 061
EXAMINER R.A. RIES	EXAMINER T.E. RITTER	INSTRUMENT SwRI	PROCEDURE Change 1 IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 3/8		26 3/8		N/A	
24 3/8		24 3/8			
23 3/8		24 3/8			

POSITION	AZIMUTH
1	N/A
2	↓
3	
4	

Calibration checked 1532 EJR

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DRY-MO-YR) 21 OCT. 81	TIME (24-HR CLOCK) 1102	SHEET NO. 062
EXAMINER RAVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 $\frac{7}{8}$	—	26 $\frac{7}{8}$	—	26 $\frac{7}{8}$	—
24 $\frac{7}{8}$	—	24 $\frac{7}{8}$	—	24 $\frac{7}{8}$	—
23 $\frac{3}{8}$	—	23 $\frac{3}{8}$	—	23 $\frac{3}{8}$	—

POSITION	AZIMUTH
1	N/A
2	
3	
4	N/A

# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DRY-MO-YR) 21 OCT 81	TIME (24-HR CLOCK) 1630	SHEET No. 063
EXAMINER J. DELGADO	EXAMINER R. AVALON	INSTRUMENT SWRI	PROCEDURE IX-ME-102-0	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 $\frac{7}{8}$	—	26 $\frac{7}{8}$	—	26 $\frac{7}{8}$	—
24 $\frac{7}{8}$	—	24 $\frac{7}{8}$	—	24 $\frac{7}{8}$	—
23 $\frac{3}{8}$	—	23 $\frac{3}{8}$	—	23 $\frac{3}{8}$	—

POSITION	AZIMUTH
1	N/A
2	
3	
4	
	N/A

Note: Entered pipe 26-OHBC-15 (toward Aux Bldg)  
 Safe Air Protector Meeter went off, pulled out of  
 pipe - before any data recorded. RA



# SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Mid land	DATE (DRY-MO-YR) 21 Oct 81	TIME (24-HR CLOCK) 1750	SHEET NO. 064
EXAMINER J Delgado	EXAMINER R. Avalon	INSTRUMENT SwRI	PROCEDURE IX-ME 102-D	

SET DISTANCE D		INDICATED DISTANCE - SCALES			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
37.0		27.0*	—	27.0	—
34.0		24.0	—	24.0	—
					RE

This calibration  
made for measuring  
36" Dia. pipes.

POSITION	AZIMUTH
1	0°
2	180°
3	90°
4	270°

\* Actual Distance (D) is plus 10"

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DRY-MO-YR) 22 Oct '81	TIME (24-HR CLOCK) 0800	SHEET NO. 065
EXAMINER J. Delgado	EXAMINER R. Avalón	INSTRUMENT SWRT	PROCEDURE IX-ME-102-D	

SET DISTANCE D		INDICATED DISTANCE - SCALES			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
37.0	N/A	27.0 *	N/A	N/A	N/A
35.0		25.0			
N/A		N/A			

This Calibration  
Made for Measuring  
36" Dia. Pipes.

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

\* Actual Distance (D) is plus 10"

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT 81	TIME (24-HR CLOCK) 1005	SHEET NO. 066
EXAMINER P. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE IX-ME-102-D <small>CH. 1</small>	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 7/8	N/A	26 7/8	N/A	26 7/8	N/A
24 7/8		24 7/8		24 7/8	
23 3/8		23 3/8		23 3/8	

PIPE #  
96-CHBC-53

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

FIGURE 2

## SWRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DRY-MO-YR) 23 Oct 81	TIME (24-HR CLOCK) 0753	SHEET NO. 067
EXAMINER J. Delgado	EXAMINER R. Avalón	INSTRUMENT SWRI	PROCEDURE IX-ME-102-D	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 <sup>7</sup> / <sub>8</sub>	N/A	26 <sup>7</sup> / <sub>8</sub>	N/A	26 <sup>7</sup> / <sub>8</sub>	N/A
24 <sup>7</sup> / <sub>8</sub>		24 <sup>7</sup> / <sub>8</sub>		24 <sup>7</sup> / <sub>8</sub>	
23 <sup>3</sup> / <sub>8</sub>		23 <sup>3</sup> / <sub>8</sub>		23 <sup>3</sup> / <sub>8</sub>	

POSITION	AZIMUTH
1	0°
2	90°
3	180°
4	270°

FIGURE 2

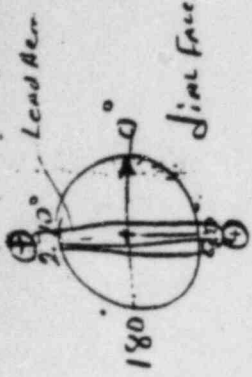


## SwRI CALIBRATION RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 24 Oct 81	TIME (24-HR CLOCK) 0741	SHEET NO. 068
EXAMINER J. Delgado	EXAMINER R. Avalon	INSTRUMENT SwRI	PROCEDURE IX-ME-102-D	

SET DISTANCE D		INDICATED DISTANCE			
		MAXIMUM		MINIMUM	
INCHES	CENTIMETERS	INCHES	CENTIMETERS	INCHES	CENTIMETERS
26 <sup>7</sup> / <sub>8</sub>	N/A	26 <sup>7</sup> / <sub>8</sub>	N/A	26 <sup>7</sup> / <sub>8</sub>	N/A
24 <sup>7</sup> / <sub>8</sub>		24 <sup>7</sup> / <sub>8</sub>		24 <sup>7</sup> / <sub>8</sub>	
23 <sup>3</sup> / <sub>8</sub>		23 <sup>3</sup> / <sub>8</sub>		23 <sup>3</sup> / <sub>8</sub>	

POSITION	AZIMUTH
1	N/A
2	
3	
4	



70% Ovalness = 100 Digits - Dm11  
Do  
64.135cm

## SwRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-006	MIDLAND	16 OCT 81	10 25	058			
EXAMINER		INSTRUMENT	PROCEDURE No.				
R.A. RIES	JE. 5111	SwRI	IX-ME-102-0				
TEST IDENTIFICATION							
26 - OHBC-16 TOWARD SOBRIE WATER PUMP STA.							
PIPE POSITION	MAX. DIA. (CM.)	MIN. DIA. (CM.)	AZIMUTH MAX./MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	% OVALNESS
273A	64	63.5	160°/70°	162°	1027	ELEVATION DMEUM	.78
274D	64	63.5	160°/90°	185°	1031		.78
274C	64.3	63.3	20°/130°	180°	1056		1.52
274B	64.1	63.4	15°/125°	180°	1101		.31
274A	63.9	63.4	175°/70°	180°	1105		.78
273D	64	63.5	53°/175°	220°	1107		.79
273C	64.2	63.5	75°/175°	220°	1110		1.09
273B	64	63.5	75°/40°	220°	1114		.78
273A	64.1	63.5	190°/95°	220°	1117		.93
272D	64.4	63.5	35°/125°	195°	1120		1.40
272C	64.3	63.5	115°/72°	195°	1124		1.25
272B	64.4	63.5	30°/70°	195°	1127		1.40
272A	64.2	63.5	105°/85°	195°	1131		1.09
271D	64.3	63.5	165°/90°	180°	1135		1.25
271C	64.3	63.6	170°/50°	180°	1138		1.09
271B	64.2	63.7	150°/55°	180°	1141		.78
271A	64	63.5	155°/60°	180°	1144		.78
270D	64	63.6	105°/180°	255°	1147		.62
270C	64.2	63.6	96°/200°	255°	1152		.94

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (DAY-MO-YR) 16 OCT 81	TIME (24 HR CLOCK) 1155	SHEET NO. 059
EXAMINER R.A. RIES	EXAMINER J.E. Sill	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-04BC-16			CALIBRATION SHEET NO. 057	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OUT-OF-ROUNDNESS
270B	64	63.4	110° / 190°	255°	1156		.94
270A	64	63.6	84° / 190°	255°	1200		.62
269D						90° TURN	-
269C						"	-
269B						"	-
269A						"	-
268D						"	-
268C	64.1	63.5	255° / 10°	230°	1421		.94
268B	64.2	63.5	30° / 275°	230°	1423		1.09
268A	64.1	63.5	260° / 0°	230°	1425		.94
267D	64	63.5	280° / 335°	205°	1429		.78
267C	64.3	63.3	205° / 335°	205°	1444		1.06
267B	64.3	63.5	30° / 335°	205°	1446		1.25
267A	64	63.3	235° / 355°	205°	1453		1.09
266D	64.2	63.5	290° / 190°	190°	1454		1.09
266C	64.4	63.5	270° / 325°	190°	1457		1.40
266B	64.3	63.5	28° / 315°	190°	1500		1.25
266A	64.3	63.5	270° / 340°	190°	1502		1.25
265D	64.2	63.4	220° / 320°	195°	1504		1.25



# SwRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-006	Midland	16 Oct 81	1505	060			
EXAMINER	EXAMINER	INSTRUMENT	PROCEDURE NO.				
R.A. RIES	J.E. SILL	SwRI	IX-ME				
TEST IDENTIFICATION	CALIBRATION SHEET NO.						
26-OHBC-16	057						
PIPE POSITION	MAX DIA. (IN.)	MIN. DIA. (IN.)	MAX. / MIN. AZIMUTH	AZIMUTH SEAM WELD	TIME	REMARKS	Ø/INCHES
265C	64.2	63.5	270° / 330°	196°	1506		1.09
265B	64.2	63.6	275° / 315°	195°	1510		.94
265A	64	63.7	280° / 336°	195	1512		.47
264D	64.2	63.7	104° / 175°	75°	1539		.78
264C	64.4	63.5	90° / 209°	75°	1543		1.40
264B	64.3	63.6	110° / 190°	75°	1545		1.09
264A	64	63.4	135° / 195°	77°	1551		.94
263D	64	63.5	130° / 195°	65°	1553		.78
263C	64.3	63.6	120° / 215°	65°	1555		1.09
263B	64.4	63.5	125° / 210°	66°	1559		1.40
263A	64.2	63.6	100° / 210°	70°	1602	Incomplete weld penetration at vert cert weld junction	1.09
262D	64	63.2	110° / 190°	110°	1605		1.25
262C	64.3	63.5	105° / 195°	45°	1607		1.25
262B	64.6	63.4	95° / 190°	45°	1609		1.47
262A	64.5	63.3	95° / 185°	45°	1612		1.87
261D	64.5	63.1	265° / 0°	255°	1614		2.18
261C	64.4	63.4	275° / 5°	255°	1617		1.56
261B	64.2	63.7	270° / 10°	255°	1619		.78
261A	64.3	63.2	50° / 270°	255°	1623	45° TURN start	1.72

45° TURN start  
115° TURN



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6542-006		Midland		16 OCT 81		1625		061	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE NO.			
R.A. RIES		J.E. Sill		S&AI		IX-ME-102-D			
TEST IDENTIFICATION						CALIBRATION		SHEET NO.	
26-OHBC-16								057	
PIPE POSITION	MAX. DIA. IN. CM.	MIN. DIA. IN. CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	070 DIMENESS		
26723C	64.2	63.6	310 / 200°	3150	1629		.94		
259A	64.1	63.7	295° / 190°	3150	1631		.62		
259A	64	63.5	160° / 200°	3170	1645		.78		
258D	64.3	63.6	150° / 190°	3000	1656		1.09		
258C	64.5	63.3	140° / 240°	3000	1658		1.87		
258B	64.5	63.4	295° / 245°	3000	1701		1.72		
258A	64	63.6	305° / 180°	3000	1704		.62		
257D	64.3	63.5	120° / 205°	2850	1706		1.25		
257C	64.4	63.4	125° / 160°	2850	1708		1.56		
257B	64.3	63.6	125° / 160°	2850	1712		1.09		
257A	64.3	63.5	130° / 190°	2850	1713		1.25		
256D	64.2	63.7	305° / 205°	1800	1721		.78		
256C	64.3	63.7	0° / 225°	1800	1723		.94		
256B	64.1	63.7	310° / 205°	1800	1728		.62		
256A	64.2	63.8	185° / 260°	1800	1730		.62		
255D	64.1	63.8	300° / 265°	1650	1732		.47		
255C	64.2	63.8	300° / 195°	1650	1735		.62		
255A	64.3	63.8	300° / 175°	1650	1738		.78		
255A	64.2	63.7	295° / 235°	1650	1750		.78		

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE MIOIANO	DATE (DAY-MO-YR) 16 Oct 81	TIME (24 Hr Clock) 1751	SHEET NO. 062
EXAMINER R.A. RIES	EXAMINER R.A. RIES	INSTRUMENT SWRT	PROCEDURE NO. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-16		CALIBRATION SHEET NO. 057		

PIPE POSITION	MAX. DIA. (CM.)	MIN. DIA. (CM.)	AZIMUTH MAX./MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
2540	64.4	63.6	240°/295°	145°	1752		1.25
254C	64.3	63.1	305°/285°	145°	1753		1.87
254B	64.3	63.7	300°/205°	145°	1756		.94
254A	64.3	63.6	300°/195°	145°	1758		1.09
253D	64.3	63.6	75°/355°	280°	1759		1.09
253C	64.3	63.4	290°/350°	280°	1802		1.40
253B	64.2	63.5	285°/250°	280°	1805		1.09
253A	64.3	63.5	65°/340°	280°	1808		1.25
252D	64.5	63.6	270°/355°	255°	1810		1.40
252C	64.5	63.6	265°/25°	255°	1813		1.40
252B	64.5	63.7	265°/25°	255°	1815		1.25
252A	64.4	63.5	315°/45°	255°	1818		1.40
251D	64.4	63.3	310°/35°	240°	1820		1.72
251C	64.3	63.3	325°/15°	240°	1822		1.56
251B	64.1	63.6	50°/145°	240°	1827		.78
251A	64.4	63.3	40°/325°	240°	1830		1.72
250C	64.3	63.5	65°/170°	45°	1835		1.25
250A	64.1	63.6	310°/355°	45°	1838		1.40
250A	64.1	63.2	245°/35°	45°	1840	EN of 26" Exam 1813/140	1.40

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6542-006		Midland		17-Oct-1981		0923		063	
EXAMINER		EXAMINER (IN PIPE)		INSTRUMENT		PROCEDURE No.			
J. S. 11		R. RIES		S. W. R. I.		IX-ME-192-0			
TEST IDENTIFICATION						CALIBRATION SHEET NO.			
26-OHBC-X <sup>95</sup> 15						058			
PIPE POSITION	MAX DIA. IN / CM.	MIN DIA. IN / CM.	AZIMUTH MAX / MIN	AZIMUTH SEAM WELD	TIME	REMARKS	% OVALNESS		
308A	64.1	63.5	15° / 85°	135°	0924	AT SEAM WTR. BLDG.	.94		
308B	64.1	63.7	50° / 0°	135°	0928		.62		
308C	64.3	63.3	65° / 345°	135°	0930		1.56		
308D	63.9	63.4	40° / 30°	135°	0933		.78		
309A	64.0	63.5	75° / 355°	155°	0935		.78		
309B	64.3	63.6	140° / 25°	155°	0938		1.09		
309C	64.3	63.6	120° / 30°	155°	0940		1.09		
309D	64.0	63.6	0° / 35°	155°	0942		.62		
310A	64.0	63.4	125° / 40°	175°	0943		.94		
310B	64.2	63.5	0° / 55°	175°	0945		1.09		
310C	64.3	63.6	165° / 50°	175°	0948		1.09		
310D	64.0	63.7	125° / 160°	170°*	0950	* Insufficient setting on circ.	.47		
311A	64.2	63.6	150° / 120°	335°	0958		.94		
311B	64.2	63.7	225° / 305°	335°	1225		.78		
311C	64	63.5	230° / 160°	335°	1230		.78		
311D	64	63.5	230° / 315°	335°	1232		.78		
312A	64.1	63.5	250° / 215°	355°	1234		.94		
312B	63.364.3	63.4	200° / 305°	355°	1236		1.40		
312C	64.5	63.5	185° / 295°	355°	1238		1.56		

FIGURE 3



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6542-006		M. of Land		17 Oct. 1981		1240		064	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE No.			
J. E. Sill		R. RIES		S. W. R. I.		IX-MF-107-0			
TEST IDENTIFICATION						CALIBRATION SHEET No.			
26-9HBC-15						958			
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN	AZIMUTH SEAM WELD	TIME	REMARKS	THICKNESS		
312 D	64	63.4	250° / 215°	355°	1241		.94		
313 A	64.2	63.7	285° / 330°	15°	1242		.78		
313 B	64.1	63.6	205° / 240°	15°	1244		.78		
313 C	64.1	63.7	210° / 245°	15°	1246		.62		
313 D	64.2	63.6	225° / 335°	15°	1248		.94		
314 A	64.1	63.7	270° / 340°	50°	1249		.62		
314 B	64.1	63.5	260° / 355°	50°	1251		.94		
314 C	64.3	63.4	250° / 350°	50°	1252		1.40		
314 D	64.3	63.4	260° / 0°	50°	1255		1.40		
315 A	64.3	63.5	270° / 355°	65°	1256		1.25		
315 B	64.3	63.6	265° / 20°	65°	1258		1.09		
315 C	64.3	63.6	270° / 20°	65°	1300		1.09		
315 D	64.2	63.7	270° / 25°	65°	1302		.78		
316 A	64.2	63.7	280° / 210°	0°	1303		.78		
316 B	64.2	63.6	195° / 210°	0°	1305		.94		
316 C				0°	1307	45° Turn			
317 A									
317 B									
317 C									



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 17 Oct 81	TIME (24 HR CLOCK) 1308	SHEET NO. 063
EXAMINER R. A. RIES	EXAMINER (IN PIPE) J. E. S:11	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-15			CALIBRATION SHEET NO. 58	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	0° OVALNESS
318 A							
318 B	64.3	63.4	255°/315°	350°	1309		1.40
318 C	64.1	63.7	255°/220°	350°	1311		.62
318 D	64	63	230°/315°	350°	1313		1.56
319 A	64.1	63.5	205°/310°	5°	1314		.94
319 B	64.2	63.3	270°/330°	5°	1316		1.40
319 C	64.3	63.1	350°/230°	5°	1318		1.87
319 D	64.2	63.5	325°/235°	5°	1321		1.09
320 A	64.4	63.5	350°/240°	20°	1330		1.40
320 B	64.2	63.7	270°/335°	20°	1331		.78
320 C	64.1	63.6	240°/340°	20°	1333		.78
320 D	64.1	63.7	290°/230°	20°	1335		.62
320 A	64.3	63.5	280°/5°	75°	1338		1.25
321 B	64.3	63.5	240°/355°	75°	1340		1.25
321 C	64.2	63.6	285°/30°	75°	1341		.94
321 D	64.3	63.6	275°/340°	75°	1343		1.09
322 A	64.3	63.5	290°/350°	90°	1344		1.25
322 B	64.5	63.5	70°/335°	90°	1345		1.76
322 C	64.4	63.5	65°/20°	90°	1346		1.40

SWRI DATA RECORD (OUT-OF-ROUNDNESS)										
PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.						
17-6542-006	Midland	17 Oct 81	13 47	066						
EXAMINER	EXAMINER	INSTRUMENT	PROCEDURE No.							
R.A. RIES	J.E. Sill	SuPT	IX-ME-102-0							
TEST IDENTIFICATION										
26-OHBC-15										
PIPE POSITION	MAX. DIA. (CAL) / CM.	MIN. DIA. (CAL) / CM.	AZIMUTH MAX. / MIN.	SEAM WELD AZIMUTH	TIME	REMARKS	% OUT-OF-ROUNDNESS			
322 D	64.1	63.7	350° / 350°	900	13 48		.62			
323 A	64.1	63.6	270° / 220°	3550	13 49		.78			
323 A	64.3	63.5	350° / 305°	3550	13 51		1.25			
323 C	64.3	63.5	185° / 305°	3550	13 52		1.25			
323 P	64.2	63.6	260° / 205°	3550	13 54		.94			
324 A	64.3	63.5	260° / 350°	150	13 55		1.25			
324 A	64.5	63.3	275° / 100°	150	13 56		1.87			
324 C	64.6	63.4	270° / 330°	150	13 58		1.87			
324 D	64.9	63.4	285° / 200°	150	13 59		.78			
325 A	64.3	63.4	150° / 335°	300	14 01		1.40			
325 B	64.8	63.2	250° / 330°	300	14 04		2.34			
325 C	64.7	63.3	300° / 330°	300	14 05		2.18			
325 O						90°				
326 A										
326 B										
326 C										
327 A										
327 B	64.0	63.5	310° / 245°	205°	14 07		.78			
327 C	64.2	63.4	210° / 255°	205°	14 09		1.25			

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006		SITE Midland		DATE (DAY-MO-YR) 17 Oct 81		TIME (24 HR CLOCK) 1409		SHEET NO. 067	
EXAMINER R.A. RIES		EXAMINER J.E. Sill		INSTRUMENT SWRT		PROCEDURE No. FX-ME-102-0			
TEST IDENTIFICATION 26-OHBC-15						CALIBRATION SHEET NO. 058			
PIPE POSITION	MAX. DIA. (OD) / CM.	MIN. DIA. (ID) / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS		
328 D	64.1	63.4	225°/330°	205°	1410		1.09		
328 A	64.2	63.5	200°/310°	0°	1411		1.09		
328 B	64.3	63.5	260°/305°	0°	1413		1.25		
328 C	64.2	63.7	275°/230°	0°	1414		.78		
328 D	64.0	63.5	295°/235°	0°	1415		.78		
329 A	64.2	63.5	240°/305°	5°	1416		1.09		
329 B	64.2	63.4	295°/235°	5°	1417		1.25		
329 C	64.2	63.4	315°/225°	5°	1418		1.25		
329 D	64.2	63.3	205°/270°	5°	1419		1.40		
330 A	64.	63.7	290°/250°	20°	1420		.47		
330 B	64.1	63.8	0°/270°	20°	1422		.47		
330 C	64.2	63.7	235°/340°	20°	1423		.78		
330 D	64	63.5	230°/300°	20°	1424		.78		
331 A	64.2	63.8	270°/300°	30°	1425		.62		
331 B	64.3	63.8	235°/310°	30°	1426		.78		
331 C	64.3	63.6	370°/265°	30°	1427		1.09		
331 D	64.1	63.6	30°/70°	30°			.78		
END	E X A M	1330 hrs	NA						

IX-ME-102-0  
 September 1981  
 Page 9 of 9



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE <del>SWRI</del> MIDLAND	DATE (DAY-MO-YR) 18 OCT 81	TIME (24 HR CLOCK) 0925	SHEET NO. 018
EXAMINER R.A. RIES	EXAMINER (IN PIPE) J.E. SILL	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-15			CALIBRATION SHEET NO. 059	

PIPE POSITION	MAX. DIA. / CM.	MIN. DIA. / CM.	AZIMUTH MAX./MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	0%
							OUT-OF-ROUNDNESS
359 C	64.2	63.5	230°/240°	130°	0943	AT AUT. BLDG. Scale 1/4" thick on	1.09
359 B	64.4	64.2	240°/170°	130°	0945		.31
359 A						90° TURN	-
358 C							-
358 B							-
358 A							-
357 C	64.3	63.7	285°/190°	355°	0948		.94
357 B	64.3	63.8	200°/265°	355°	0949		.78
357 A	64.3	63.6	210°/275°	355°	0951		1.09
356 D	64.4	63.6	225°/280°	355°	0952		1.25
356 C	64.3	63.5	200°/290°	355°	0955		1.25
356 B	64.3	63.7	350°/275°	355°	0956		.94
356 A	64.3	63.8	330°/275°	355°	0957		.78
355 D	64.2	63.5	340°/245°	15°	0959		1.09
355 C	64.7	63.3	350°/250°	15°	1001		2.18
355 B	64.8	63.3	355°/250°	15°	1002		2.34
355 A	64.4	63.7	0°/255°	15°	1003		1.09
354 D	64.3	63.7	40°/300°	40°	1005		.94
354 C	64.5	63.7	35°/260°	40°	1007		1.25



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 18 Oct 81	TIME (24HR CLOCK) 1008	SHEET NO. 069
EXAMINER R.A. RIES	EXAMINER J.E. Sill	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-16 <sup>POA</sup> 15			CALIBRATION SHEET NO. 059	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	Ø (VALVES)
354 B	64.8	63.7	40° / 275°	40°	1009		1.72
354 A	64.3	63.3	15° / 300°	40°	1010		1.56
353 D	64.2	63.5	235° / 265°	130°	1012		1.09
353 C	64.1	63.6	220° / 265°	130°	1013		.78
353 B	64.2	63.6	205° / 265°	130°	1014		.94
353 A	64.2	63.7	240° / 275°	130°	1015		.78
352 D	64.3	63.7	180° / 260°	150°	1017		.94
352 C	64.3	63.7	215° / 280°	150°	1018		.94
352 A	64.4	63.8	170° / 205°	150°	1019		.94
352 A						45° Turn	-
351 C							-
351 B							-
351 A							-
350 C	64.7	63.5	210° / 310°	195°	1023		1.87
350 B	64.6	63.7	220° / 320°	195°	1024		1.40
350 A				195°	1025	45° Turn	-
349 A							-
348 A							-
348 B							-

# SwRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17#6542-006		Midland		18 Oct 81		1027		070	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE No.			
R. A. RIES		J. E. Sill		SwRI		IX-ME-102-0			
TEST IDENTIFICATION						CALIBRATION SHEET No.			
26-OHBC-15						059			
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	QUALIFIED		
348 A							-		
347 D	64.4	63.7	270° / 205°	345°	1028		1.09		
347 C	64.3	63.4	275° / 180°	345°	1038		.62		
347 B	64.3	63.8	275° / 310°	345°	1039		.78		
347 A	64.3	63.8	285° / 335°	345°	1040		.78		
346 D	64.4	63.8	275° / 225°	5°	1042		.94		
346 C	64.6	63.8	265° / 215°	5°	1044		.94		
346 B	64.6	63.7	255° / 340°	5°	1045		1.25		
346 A	64.5	63.8	265° / 230°	5°	1046		1.40		
345 D	64.5	63.4	270° / 355°	20°	1050		1.09		
345 C	64.4	63.8	290° / 240°	20°	1051		.94		
345 B	64.3	63.8	285° / 245°	20°	1053		.78		
345 A	64.4	63.6	335° / 255°	20°	1054		1.25		
344 D	64.4	63.6	15° / 270°	230°	1056		1.25		
344 C	64.4	63.7	25° / 290°	230°	1057		1.09		
344 B	64.3	63.5	35° / 285°	230°	1059		1.25		
344 A				230°		90° TURN	-		
343 C							-		
343 B							-		

# Sv. RI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6542-006		Midland		18 Oct 81		1101		071	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE No.			
R.A. RIES		J.E. SILL		Sv. RI		IX-ME-102-0			
TEST IDENTIFICATION						CALIBRATION SHEET No.			
26-OHBC-15						059			
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAS WELD	TIME	REMARKS	OUT-OF-ROUNDNESS		
3437									
342C									
342B									
342A									
341C									
341A									
341A									
340C					1108 (M)				
340B	64.4	63.2	260°/50	50° (M)	1109		2.34		
340A	64.4	63.2	260°/100	55°	1111		1.87		
339D	64.3	63.1	270°/170°	115°	1122		1.87		
339C	64.3	63.3	275°/170°	115°	1123		1.56		
339B	64.4	63.6	275°/180°	115°	1125		1.25		
339A	64.3	63.9	50°/345°	115°	1126		.62		
338D	64.3	63.4	275°/180°	135°	1127		1.40		
338C	64.5	63.2	285°/190°	135°	1128		2.03		
338B	64.5	63.1	290°/190°	135°	1129		2.18		
338A	64.6	63.4	285°/190°	135°	1130		1.87		
337D	64.5	63.4	285°/200°	155°	1132		1.72		

FIGURE 2



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6642-006	Midland	18 Oct 81	1133	072			
EXAMINER	EXAMINER	INSTRUMENT	PROCEDURE NO.				
R. B. RIES	J. E. Sill	SWRI	IX-ME-102-0				
TEST IDENTIFICATION							
26-O.H.B.C.-15							
PIPE POSITION	MAX. DIA. (OD) / CM.	MIN. DIA. (ID) / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
337C	64.9	63.3	250° / 195°	155°	1134		2.34
337B	64.9	63.3	255° / 200°	155°	1135		2.34
337A	64.7	63.6	260° / 170°	155°	1136		1.72
336D	64.5	63.7	240° / 930°	345°	1137		1.25
336C	64.5	63.8	250° / 320°	345°	1138		1.09
336A	64.7	63.7	208° / 230°	345°	1139		1.56
336A	64.4	63.8	220° / 295°	345°	1140		.94
335D	64.4	63.5	210° / 315°	10°	1141		1.40
335C	64.5	63.8	345° / 225°	10°	1142		1.09
335B	64.4	63.4	345° / 245°	10°	1143		1.52
335A	64.5	63.6	210° / 230°	10°	1144		1.40
334D	64.4	63.7	250° / 260°	25°	1145		1.09
334C	64.8	63.7	310° / 225°	25°	1147		1.72
334B	64.8	63.6	290° / 220°	25°	1148		1.87
334A	64.3	63.6	310° / 260°	25°	1149		1.09
333D	64.4	64.63 (OD)	100° / 60°	300°	1150		.62
333C	64.4	64.63 (OD)	95° / 65°	300°	1152		.62
333B	64.5	63.2	90° / 350°	300°	1153		1.03
333A	64.3	63.3	95° / 80°	300°	1154		1.56





# SURI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-006	M. d. land	19 OCT 81	1257	074			
EXAMINER	J.E. Sill	INSTRUMENT	PROCEDURE No.				
R.A. RIES	SURI		IX-ME-102-0				
TEST IDENTIFICATION			CALIBRATION SHEET No.				
	26-OHBC-16		060				
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OUTLINE DUMPLING
303C	63.8	63.2	270° / 290°	550	1259	AT AXIAL R.D.G.	0.78
303B	64.1	63.5	260° / 00	550	1259	Scale starts at	0.74
303A						303C marker in pipe	
302C						Scale at 303B is	
302B	64	63.5	60° / 290°	2450	1302	at maximum thickness	
302A						is .13"	
301C						Scale is on bottom	
301B	64	63.5	60° / 290°	2450	1302	half of pipe only	0.78
301A	64.1	63.5	35° / 305°	2450	1303	Heavy Scale Ends	0.98
300D	64.1	63.7	50° / 300°	2500	1304		.62
300C	64	63.3	40° / 300°	2500	1306		
300B	64.2	63.5	40° / 310°	2500	1307		1.09
300A	64.2	63.3	260° / 315°	2500	1308		1.09
299D	64.4	63.7	70° / 315°	2600	1310		1.40
299C	64.4	63.6	55° / 305°	2600	1311		1.09
299B	64.3	63.5	65° / 300°	2600	1312		1.25
299A	64.2	63.5	280° / 0°	2600	1314		1.25
298D	64.4	63.2	215° / 345°	2600	1316		1.09
298C	64.5	63.4	275° / 50°	2600	1318		1.87
							1.72

900 Floor

# SwRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-006	Midland	19 Oct 81	1319	075			
EXAMINER R.A. RIES	EXAMINER J.E. SILL	INSTRUMENT SwRI	PROCEDURE No. IX-ME-102-0				
TEST IDENTIFICATION 26-0HBC-16							
CALIBRATION SHEET NO. 060							
PIPE POSITION	MAX. DIA. (RAD) / CM.	MIN. DIA. (POE) / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	DIV. / MEAS.
298B	64	63.5	280° / 335°	280°	1320		.78
298A	64	63.6	300° / 10°	280°	1321		.62
297D	63.9	63.7	270° / 195°	340°	1322		.16
297C	64	63.4	320° / 210°	340°	1324		.94
297B	64.4	63.4	330° / 220°	340°	1330		1.06
297A	64.3	63.4	325° / 225°	340°	1331		1.40
296D	64	63.6	205° / 295°	10°	1333		.62
296C	64.4	63.5	0° / 315°	10°	1334		1.40
296B	64.3	63.4	205° / 310°	10°	1335		1.40
296A					777	45° E/60W	-
295C							
295B							
295A							
294C							
294B							
294A							
293C							
293B							
293A							



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.	SITE	DATE (DAY-MO-YR)	TIME (24 HR CLOCK)	SHEET NO.			
17-6542-006	M.D. Land	19 Oct 81	1339	076			
EXAMINER	EXAMINER	PROCEDURE No.					
R.A. RIES	J.E.S:11	IX-ME-102-0					
TEST IDENTIFICATION							
26-OHBC-16							
CALIBRATION SHEET No. 060							
PIPE POSITION	MAX. DIA. (RAD) / CM.	MIN. DIA. (RAD) / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
292D	64.1	63.5	240°/325°	330°	1340	45° (160°) END	.94
292C	64.3	63.4	245°/165°	330°	1341		1.40
292A	64.3	63.4	255°/190°	330°	1342		1.40
291D	64.1	63.7	290°/210°	355°	1344		.62
291C	64.2	63.5	280°/215°	355°	1345		1.09
291B	64.1	63.4	255°/215°	355°	1347		1.09
291A	64.3	63.3	270°/220°	355°	1348		1.56
290D	64.5	63.1	270°/0°	10°	1349		2.18
290C	64.4	63.3	280°/355°	10°	1350		1.72
290B	64	63.3	275°/240°	10°	1352		1.09
290A	64	63.2	330°/230°	10°	1353		1.25
289D	64.3	63.5	165°/260°	325°	1355		1.25
289C	64.3	63.7	160°/220°	325°	1356		.94
289B	64.1	63.6	245°/190°	325°	1357		.78
289A					1358	90° (160°)	-
288B							-
288A							-
288							-



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midlund	DATE (DAY-MO-YR) 19 Oct 81	TIME (24 HR CLOCK) 1400	SHEET NO. 077
EXAMINER R.A. RIES	EXAMINER J.E. Sill	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-16			CALIBRATION SHEET No. 060	

PIPE POSITION	MAX. DIA. <small>(PP)</small> / CM.	MIN. DIA. <small>(PP)</small> / CM.	AZIMUTH MAX./MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	57° VALUES
287C						90° Elbow	-
287B							-
286C							-
286B							-
286A							-
285C							-
285B							-
285A							-
284C							-
284B	64.2	63.4	105°/355°	305°	1412		1.25
284A	64.1	63.3	320°/5°	305°	1413		1.25
283D	64.1	63.6	280°/330°	200°	1414		.78
283C	64.3	63	240°/330°	200°	1415		2.03
283B	64.4	62.9	220°/330°	200°	1416		2.34
283A	64	63.3	290°/355°	200°	1418		1.09
282D	64	63.5	295°/0°	215°	1419		.78
282C	64.5	63.2	295°/0°	215°	1420		2.03
282B	64.4	63.2	300°/5°	215°	1421		1.87
282A	64.3	63.3	305°/15°	215°	1422		1.56

# S<sub>w</sub>RI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6452-006		Midland		19 Oct 81		14 23		078	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE No.			
R.A. RIES		J.E. Sill		S <sub>w</sub> RI		IX-ME-102-0			
TEST IDENTIFICATION									
26-OHBC-16									
PIPE POSITION		MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.		AZIMUTH SEAM WELD	TIME	REMARKS	VALUES
281D	64.3	63.2	290° / 15°	245°	1424	Device jammed, sent out for repair	.72		
281C	64.4	63.5	45° / 5°	245°	1455		1.40		
281B	64.5	63.3	250° / 0°	245°	1456		1.87		
281A	64.1	63.7	255° / 20°	245°	1457		.62		
280D	64.1	63.7	20° / 330°	310°	1458		.62		
280C	64.3	63.5	40° / 80°	310°	1459		1.25		
280B	64.2	63.6	45° / 310°	310°	1500		.94		
280A	64.2	63.5	325° / 85°	310°	1501		1.09		
279D	64.4	63.5	300° / 245°	320°	1502		1.40		
279C	64.1	63.5	290° / 90°	320°	1503		.94		
279A	64	63.7	290° / 200°	320°	1504		.47		
278D	64	63.7	170° / 235°	320°	1505		.47		
278C	64.5	63.6	160° / 195°	335°	1506		.62		
278B	64.5	63.6	315° / 205°	335°	1508		1.40		
278A	64.2	63.6	315° / 200°	335°	1509		1.40		
277D	64.1	63.5	320° / 265°	335°	1511		1.09		
277C	64.1	63.5	170° / 275°	150°	1512		.94		
277B	64	63.6	165° / 275°	150°	1513		.78		
277A	64	63.4	250° / 205°	150°	1514		.94		

CALIBRATION SHEET NO.  
060





SWRI DATA RECORD (OUT OF ROUNDNESS - ELBOWS)

PROJECT NO.	17-6542-006	SITE	Midland
EXAMINER	T.E. Ritter	EXAMINER	R.A. Ries
DATE (DAY-MO-YR)	20 Oct 81	INSTRUMENT	SWRI
PROCEDURE NO.	IX-ME-102-0	CALIBRATION SHEET NO.	061
SHEET NO.	080	TIME (24 HR CLOCK)	1425

PIPE POSITION	DIAMETER MEASUREMENTS IN/CH				AZIMUTH	MAX/MIN	TIME	REMARKS
	0-0	1-1	2-2	3-3				
269D	64.2	64.1	64.1	64.1	64.3	N/A	start of 90° Elbow	
269C	64	64	64.1	64.3	64	1433		
269B	64.2	64.2	64.2	64.2	64.3	1437		
269A	63.9	63.9	64.2	64.3	64	1440		
268D	63.5	63.6	64	63.7	63.6	1442	End 90° Elbow	
261A	64.2	63.7	63.4	63	63.6	1500	start 45° Elbow	
260C	64.6	64.1	63.6	63.7	63.8	1504		
260B	64.6	64.1	63.6	63.7	63.9	1507		
260A	64.2	63.8	63.7	63.7	64.1	1509	End 45° Elbow	
259D	64	63.7	63.6	63.6	64.1	1512		

070  
OVERS



# SWRI DATA RECORD (OUT OF ROUNDNESS - ELBOWS)

PROJECT NO. 17-6542-006		SITE MIDLAND	
EXAMINER T.F. Ritter		EXAMINER R.A. RIES	
TEST IDENTIFICATION 261		TEST IDENTIFICATION 261	
CALIBRATION SHEET NO. 061		CALIBRATION SHEET NO. 061	
PROCEDURE NO. Change #1	IX-ME-102-0	INSTRUMENT SWRI	SWRI
SHEET NO. 081	TIME (24 HR CLOCK) SHEET NO. 1540	DATE (DAY-MO-YR) 20 OCT 81	DATE (DAY-MO-YR) 20 OCT 81

PIPE POSITION	DIAMETER MEASUREMENTS							AZIMUTH	TIME	REMARKS	BURNERS
	0-0	1-1	2-2	3-3	4-4	5-5	MM/CM				
327A	63.7	63.8	63.8	64	63.9	63.6	N/A	1547	Start 90° Elbow	.62	
326C	63.9	64	64.2	64.2	64.1	63.8		1548		.62	
326B	64	64.1	64.1	64.3	64.2	64.1		1551		.47	
326A	63.8	63.7	64.2	64.3	64.2	64		1554	End 90° Elbow	.94	
3250	63.9	64.1	64	63.7	63.9	63.8		1556		.62	
318A	63.7	63.7	63.9	64	64	64.1		1607	Start 45° Elbow	.62	
317C	64.1	64.1	64.2	64.2	64.2	64.1		1609		.14	
317B	64.2	64.3	64.2	64.2	64.3	64.2		1610		.16	
317A	64.3	64.1	63.9	63.9	64	64.1		1613		.62	
316C	64.2	64	63.7	63.9	64.1	64.1				-	
316S	64.9	64.2	64.2	64	64.2	64.2		1616	End 45° Elbow	1.72	

# SWRI DATA RECORD (OUT OF ROUNDNESS - ELBOWS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 20 Oct 81	TIME (24 HR CLOCK) 1704	SHEET NO. 082					
EXAMINER T. E. Pitter	EXAMINER R. A. RIES	INSTRUMENT SURTI	PROCEDURE NO. CHANGE 1						
TEST IDENTIFICATION 26-OHBC-54		CALIBRATION SHEET NO. 061							
PIPE POSITION	DIAMETER MEASUREMENTS					AZIMUTH MAX/MIN.	TIME	REMARKS	OVERLAP
	0-0	1-1	2-2	3-3	4-4				
245D	63.4	64.7	65	64.1	63.3	63.2	1714	Elbow from 26" to 26"	2.81
245DA	63.2	64.3	65.5	64.8	63.5	63.2	1720	Last reading in 26" pipe	3.59
245AB	63.2	64.2	65.1	64.9	63.3	62.7	1725	Start of Elbow	3.74
245BC	63.4	64.1	65	65.2	63.9	63.2	1731	Very	2.12
24500	63.2	63.3	64.1	63.9	64.3	64.3	1738	15" pipe between 32" & 26"	1.72
* Very difficult to measure due to compounded angle of joint/elbow									

\* Reading taken at center of 15" pipe

# SwRI DATA RECORD (OUT OF ROUNDNESS - ELBOWS)

PROJECT NO. 17-654Z-006	SITE Midland	DATE (MO-YR) 20 Oct 81	TIME (24 HR CLOCK) 1759	SHEET NO. 083
EXAMINER T.E. Ritter	EXAMINER R.A. RIES	INSTRUMENT SwRI	PROCEDURE NO. Change 1	
TEST IDENTIFICATION 25-0148C-75		CALIBRATION SHEET NO. 061		

PIPE POSITION	DIAMETER MEASUREMENTS								AZIMUTH MAX/MIN.	TIME	REMARKS	OVALNET
	0-0	1-1	2-2	3-3	4-4	5-5	6-6	7-7				
360A	63.8	63.8	64	63.8	63.4	63.7	63.8	63.7	N/A	1804		.47
360B	63.8	63.8	63.7	63.6	63.8	63.9	63.8	63.7		1805	45° Elbow	.47
360C	63.8	63.8	64.1	64	63.7	63.7	63.8	63.7		1808	45° Elbow	.16
361A	64	64.2	64.2	64.2	64.3	64	64.3	64		1813		.62
361B	64.5	64.1	64	64	64.3	64.3	64.3	64.3		1815	90° Elbow	.47
361C	64	63.9	64	64	64.4	64.3	64.3	64.3		1818		.78
362A	63.3	63.4	63.4	63.5	63.3	63.8	63.8	63.8		1820		.78
362D	63.7	63.7	63.6	63.7	64	64	64	64		1822	straight p.p.e.	.78
362Q	63.5	63.1	63.4	63.3	63.2	63.8	63.8	63.8		1830	RRA	1.09
363A	63.8	63.5	63.8	64.2	64.3	64.3	64.3	64.3		1832	45° Elbow	900 1.25
363B	64.3	63.6	63.7	64	64.4	64.6	64.6	64.6		1835		1.56
363C	63.9	63.8	63.9	64.1	64.5	64.4	64.4	64.4		1837		1.09
364A	63.3	63	63.4	63.8	63.8	63.7	63.7	63.7		1839		1.25



# SWRI DATA RECORD (OUT OF ROUNDNESS - ELBOWS)

PROJECT NO. 17-6542-006	SITE MIDLAND	DATE (MO-YR) 21-22 OCT 81	TIME (24 HR CLOCK) 1130	SHEET NO. 084
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE NO. CHANGE 1 IX-ME-102-0	
TEST IDENTIFICATION 26-OHBC-16			CALIBRATION SHEET NO. 062	

PIPE POSITION	DIAMETER MEASUREMENTS IN/CM					AZIMUTH MAX/MIN.	TIME	REMARKS	OVALNESS
	0-0	1-1	2-2	3-3	4-4				
303A	65.0	63.8	64.3	64.1	64.0	64.0	1210		1.87
302C	63.7	63.3	63.3	64.0	64.3	63.4	1212		1.56
302B	64.7	64.4	63.5	64.5	64.2	63.6	1215		1.25
302A	64.0	64.2	64.4	63.7	63.0	63.0	1217		2.18
301C	64.3	64.4	64.1	63.9	64.3	64.5	1219		.94
296A	63.8	63.9	63.8	63.9	63.9	63.8	1222		.16
295C	64.0	64.0	64.1	64.3	64.2	64.0	1226		.47
295B	64.1	64.1	64.1	63.9	64.1	64.2	1230		.47
295A	64.0	63.5	64.0	64.0	64.0	64.0	1233		.78
294C	63.9	63.9	64.0	64.0	63.8	64.5	1234		1.09
294A	64.0	63.8	63.5	63.7	63.7	63.8	1236		.78
293C	64.0	64.0	64.0	63.8	63.6	63.5	1239	45°	.78
293B	63.8	64.5	64.3	63.8	63.7	63.8	1241		1.25
293A	63.5	64.0	64.0	63.8	63.7	63.4	1242		.94
292	64.0	63.8	64.0	63.5	63.8	63.9	1245		.78
289A	64.3	64.4	64.3	63.9	63.8	64.0	1253	90°	.94
288B	63.8	63.9	63.9	63.9	63.6	63.6	1254		.47
288A	63.7	63.9	63.9	63.9	63.5	63.7	1256		.62
287C	64.2	64.3	64.4	64.6	64.0	63.9	1258	45°	1.09











# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-0070	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT. 81	TIME (24 HR CLOCK) 1035	SHEET NO. 088
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA.	MIN. DIA.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
	IN. / CM.	IN. / CM.	MAX. / MIN.					
156A	64.1	63.4	310°	275°	182°	1036		1.09
156B	62.9	62.7	306°	341°	185°	1037		.81
157A	63.4	62.3	226°	340°	200°	1040		1.72
157B	63.4	62.4	<del>342</del> 230°	345°	208°	1041		1.56
157C	63.5	62.3	236°	346°	210°	1045		2.03
157D	63.2	62.3	326°	54°	212°	1047		1.40
158A	64.2	63.3	49°	141°	220°	1050		1.40
158B	64.3	63.0	232°	346°	211°	1052		2.03
158C	64.3	63.2	235°	350°	219°	1055		1.72
158D							} 90° ELbow	
159A								
159B								
159C								
160A	64.1	63.6	40°	10°	246°	1058		.78
160B	64.3	63.2	259°	10°	245°	1059		1.72
160C	64.3	63.3	262°	4°	244°	1102		1.56
160D	64.2	63.5	244°	11°	247°	1105		1.09
161A	64.3	63.5	90°	10°	275°	1107		1.25
161B	64.2	63.6	93°	10°	275°	1108		.94



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT 81	TIME (24 HR CLOCK) <del>1014</del> 1114	SHEET NO. 089
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET No. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		TIME	REMARKS	% DUALNESS
			MAX. / MIN.	SEAM WELD			
161C	64.2	63.7	91°	411°	274°	1110	.78
162A	64.3	63.4	95°	9°	295°	1112	1.40
162B	64.3	63.6	99°	60°	295°	1114	1.09
162C	64.2	63.6	94°	114°	291°	1121	.94
162D	64.3	63.6	109°	347°	303°	1122	1.09
163A	64.2	63.8	110°	90°	303°	1124	.62
163B	64.2	63.9	120°	346°	312°	1125	.47
163C	64.3	63.7	115°	345°	315°	1126	.94
164A	64.0	63.5	275°	180°	115°	1127	.78
164B	64.4	63.3	275°	165°	114°	1128	1.40
164C	64.5	63.1	26°	164°	110°	1313	2.18
164D	64.4	63.5	25°	211°	114°	1314	1.40
165A	64.3	63.6	134°	227°	137°	1315	1.09
165B	64.3	63.6	285°	183°	134°	1317	1.09
165C	64.3	63.6	284°	182°	130°	1319	1.09
165D	64.3	63.4	242°	178°	134°	1321	1.40
166A	64.3	63.4	65°	172°	148°	1323	1.40
166B	64.8	62.9	77°	154°	45°	1324	2.96
166C	64.4	63.5	69°	73°	54°	1325	1.40

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT 81	TIME (24 HR CLOCK) 1327	SHEET NO. 2090
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET No. 066	

PIPE POSITION	MAX. DIA.	MIN. DIA.	AZIMUTH	AZIMUTH	TIME	REMARKS	% OVALNESS
	IN. / CM.	IN. / CM.	MAX. / MIN.	SEAM WELD			
166D	64.3	63.4	66°/160°	44°	1328		1.40
167A	64.4	63.3	69°/62°	65°	1329		1.72
167B	<del>64.3</del> 64.3	63.5	82°/197°	65°	1330		1.25
167C	64.3	63.6	80°/196°	64°	1332		1.09
167D	64.2	63.5	166°/168°	63°	1335		1.09
168A	64.1	63.4	230°/198°	85°	1338		1.09
168B	64.3	63.5	100°/206°	84°	1340		1.25
168C	<del>64.2</del> 64.1	<del>63.6</del> 63.6	100°/184°	85°	1341		.78
168D	64.3	63.6	84°/175°	85°	1344		1.09
169A	64.2	63.5	150°/81°	9°	1346		1.09
169B	64.3	63.3	86°/171°	9°	1348		1.56
169C	64.3	63.5	82°/3°	11°	1351		1.25
169D	64.4	63.1	96°/179°	11°	1353		2.03
170A	64.4	63.2	97°/177°	30°	1354		1.87
170B	64.5	63.4	106°/174°	27°	1356		1.40
170C	64.5	63.6	114°/195°	29°	1357		1.40
170D	64.1	63.6	119°/175°	24°	1358		.78
171A	64.3	63.5	115°/181°	49°	1400		1.25
171B	64.3	63.7	155°/216°	46°	1402		.94

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT. 81	TIME (24 HR CLOCK) 1403	SHEET NO. 091
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWPI	PROCEDURE No. IX-ME-1020	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	% OVALNESS
171C	64.2	63.7	129°/214°	49°	1404		.78
171D	64.4	63.5	89°/206°	46°	1410		1.40
172A	64.3	63.3	279°/181°	126°	1411		1.56
172B	64.3	63.4	279°/176°	126°	1413		1.40
172C	64.2	63.5	284°/189°	127°	1415		1.09
172D	64.0	63.5	271°/180°	129°	1416		.78
173A	64.0	63.5	250°/199°	150°	1417		.78
173B	64.2	63.5	259°/190°	149°	1418		1.09
173C	64.3	63.6	250°/191°	148°	1419		1.09
173D	64.1	62.8	286°/192°	146°	1421		.47
174A	64.0	63.6	315°/203°	162°	1422		.62
174B	64.3	63.5	260°/210°	167°	1424		1.25
174C	64.3	63.4	259°/207°	163°	1425		1.40
174D	64.0	63.6	269°/208°	163°	1426		.62
175A	64.2	63.7	352°/82°	345°	1434		.78
175B	64.1	63.2	158°/108°	344°	1436		.78
175C	64.3	63.4	155°/19°	340°	1438		1.40
175D	64.0	63.5	82°/11°	339°	1440		.78
176A	64.1	63.6	70°/4°	359°	1441		.78



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT. 81	TIME (24 HR CLOCK) 1442	SHEET NO. 092
EXAMINER R. AVALLON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26 OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
			MAX. / MIN.					
176B	64.2	63.7	83°	359°	356°	1444		.78
176C	64.4	63.6	65°	130°	359°	1446		1.25
176D	64.3	63.6	246°	319°	350°	1450		1.09
177A	64.3	63.4	171°	157°	17°	1453		1.40
177B	64.3	63.4	80°	148°	17°	1455		1.40
177C	64.3	63.5	39°	154°	17°	1457		1.25
177D	64.1	63.4	250°	323°	13°	1458		1.09
178A	64.0	63.5	80°	155°	350°	1459		.78
178B	64.6	63.5	73°	155°	350°	1501		1.72
178C	64.7	63.4	77°	156°	350°	1502		2.03
178D	64.3	63.2	87°	354°	349°	1504		1.72
179A	64.4	63.3	95°	178°	9°	1506		1.72
179B	64.4	63.4	110°	149°	5°	1508		1.56
179C	64.3	63.5	85°	37°	7°	1510		1.25
179D	64.4	63.0	85°	150°	5°	1512		2.18
180A	64.3	63.1	74°	160°	27°	1514		1.87
180B	64.5	63.4	40°	156°	25°	1515		1.72
180C	64.3	63.4	38°	152°	24°	1518	45° ELBOW NEW	1.40
182B	64.3	63.6	105°	35°	30°	1621		1.09

IX-ME-102-D  
 September 1981  
 Page 9 of 9



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT 81	TIME (24 HR CLOCK) 1622	SHEET NO. 093
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26 OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	90 OVALNESS
182C	64.3	<del>64.0</del> 63.4	99° 358°	306°	1623		1.40
183A	64.3	63.5	128° 2°	326°	1624		1.25
183B	64.3	63.6	125° 11°	325°	1626		1.09
183C	64.3	63.5	117° 10°	325°	1628		1.25
184A	64.4	63.3	88° 15°	293°	1630		1.72
184B	64.6	63.5	94° 353°	293°	1631		1.72
184C	64.8	63.4	93° 0°	294°	1632		2.18
185A	64.4	63.3	108° 355°	323°	1633		1.72
185B	64.1	63.5	290° 193°	143°	1635		.94
185C	64.1	63.6	231° 281°	139°	1636		.78
185D	64.1	63.5	220° 300°	139°	1639		.94
186A	63.9	63.4	259° 279°	164°	1641		.78
186B	64.0	63.6	261° 203°	165°	1643		.62
186C	64.0	63.6	258° 253°	165°	1645		.62
186D	64.3	63.4	250° 340°	165°	1646		1.40
187A	64.0	63.5	255° 325°	190°	1647		.78
187B	64.1	63.5	214° 303°	186°	1649		.94
187C	64.1	63.5	249° 350°	185°	1651		.94
187D	64.0	63.6	226° 294°	184°	1652		.62

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22. OCT 81	TIME (24 HR CLOCK) 1653	SHEET NO. 094
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	90° OVALNESS
			MAX. / MIN.					
188A	64.0	63.6	245°	119°	90°	1654		.62
188B	64.3	63.8	115°	210°	89°	1655		.78
188C	64.3	63.3	85°	191°	85°	1657		1.56
188D	64.0	63.3	99°	165°	84°	1658		1.09
189A	64.1	63.5	264°	170°	108°	1659		.94
189B	64.0	63.6	199°	240°	106°	1701		.62
189C	64.0	63.6	203°	275°	106°	1702		.62
189D	64.0	63.6	260°	159°	106°	1703		.62
190A	63.9	63.3	282°	282°	127°	1704		.94
190B	64.1	63.6	287°	185°	126°	1705		.94
190C	64.3	63.7	285°	209°	126°	1707		.94
190D	64.0	63.5	235°	183°	127°	1708		.78
191A	64.3	63.3	104°	342°	306°	1709		1.56
191B	64.3	63.5	122°	35°	306°	1711	1/4" SOIL ON-BOTTOM PIPE	1.25
191C	64.3	63.4	119°	25°	304°	1712		1.40
191D	64.3	63.4	110°	346°	304°	1714		1.40
192A	64.3	63.4	108°	27°	320°	1715		1.40
192B	64.3	63.6	123°	27°	320°	1716		1.09

IX-ME-102-0  
 September 1981  
 Page 9 of 9

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT 81	TIME (24 HR CLOCK) 1717	SHEET NO. 095
EXAMINER R. AVALON	EXAMINER J. DELGADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
			MAX.	MIN.				
192C	64.3	63.7	190°	0°	320°	1718		.94
192D	64.3	63.6	126°	10°	323°	1719		1.09
193A	*	*	*	*	*		*NO LONGITUDINAL WELD	
193B	*	*	*	*	*			
194A	64.2	<del>63.7</del> 63.7	142°	116°	340°	1724		.78
194B	64.3	63.7	140°	93°	345°	1725		.94
194C	64.3	63.7	0°	95°	344°	1726		.94
194D	64.1	63.7	67°	142°	345°	1727		.62
195A	64.3	63.7	70°	192°	66°	1728		.94
195B	64.8	63.4	79°	170°	65°	1730		2.18
195C	64.8	63.4	69°	183°	65°	1731		2.18
195D	64.7	63.2	74°	150°	65°	1732		2.34
196A	64.8	63.2	250°	162°	86°	1734	HEAVY SCALE ALONG	2.50
-	-	-	-	-	-	-	LONGITUDINAL WELD	
196B	64.6	63.2	85°	142°	85°	1736		2.18
196C	64.4	63.3	90°	135°	82°	1739		1.72
196D	64.3	63.4	80°	140°	80°	1739		1.40
197A	64.1	63.2	113°	335°	94°	1740		1.40

IX-ME-102-0  
 September 1981  
 Page 9 of 9



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 22 OCT. 81	TIME (24 HR CLOCK) 1741	SHEET NO. 096
EXAMINER R. AVALON	EXAMINER J. DELCADO	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-CHBC-53			CALIBRATION SHEET NO. 066	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
			MAX. / MIN.					
197B	64.4	64.3	105°	143°	100°	1742		1.72
197C	64.8	63.3	105°	214°	100°	1744		2.34
362B	63.5	63.3	121°	84°	*	1759	* NO LONG. WELD	1.87
362C	63.5	63.4	60°	100°	*	1800	MEASUREMENTS TAKEN AT 0°	1.72
364A	64.3	62.9	315°	197°	159°	1804		2.18
364B	64.3	63.2	265°	226°	157°	1805		1.72
153C	64.3	63.5	100°	45°	300°	1841		1.25
153B	64.4	63.8	105°	353°	305°	1844		.94
153A	64.1	64.0	105°	0°	305°	1846		.78
152D	64.2	63.6	95°	330°	306°	1847		.94
152C	64.4	63.7	97°	9°	307°	1848		1.09
152B	64.4	63.9	100°	5°	305°	1850		.78
152A	64.2	63.7	96°	308°	305°	1851		.78
151D	64.0	63.5	120°	345°	305°	1852		.78
151C	64.3	63.5	122°	355°	326°	1853		1.25
151B	64.5	63.4	125°	3°	325°	1855		1.40
151A	64.5	63.6	135°	163°	329°	1856		1.40
150D	64.8	63.5	150°	43°	325°	1856		2.03

FIGURE 3





# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 0818	SHEET NO. <del>097</del> 098
EXAMINER J. Delgado	EXAMINER K. Avalón	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26"-OHBC-54			CALIBRATION SHEET NO. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
			MAX. / MIN.					
206A	64.1	63.4	340°	280°	170°	0823		1.09
206B	64.0	63.6	250°	215°	170°	0826		.62
206C	64.1	63.6	220°	304°	169°	0830		1.09
206D	64.0	63.6	248°	310°	168°	0832		.62
207A	64.1	63.5	280°	325°	192°	0834		.94
207B	64.4	63.2	265°	320°	193°	0835		1.87
207C	63.9	63.1	271°	331°	195°	0836		1.25
207D		See Remarks					Begin 90° elbow	-
208A		"					"	-
208B		"					"	-
208C		"					"	-
209A	64.5	63.2	106°	176°	97°	0840		2.03
209B	64.6	63.4	101°	155°	96°	0842		1.87
209C	185.	63.5	106°	180°	96°	0844		1.56
209D	64.3	63.6	104°	226°	95°	0845		1.09
210A	65.6 64.8	63.6	310°	46°	300°	0851		1.87
210B	64.7	63.3	103°	355°	300°	0854		2.18
210C	64.8	63.3	100°	358°	299°	0856		2.34
210D	64.9	63.2	104°	32°	300°	0857		2.50

FIGURE 3

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6742-006	SITE MIDLAND	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 0858	SHEET NO. 099
EXAMINER J. Delgado	EXAMINER R. Avalón	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26-OHBC-54			CALIBRATION SHEET No. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	7° OVALNESS
			MAX. / MIN.					
211A	64.3	63.4	291°	215°	136°	0859		1.40
211B	64.4	63.6	295°	251°	136°	0900		1.25
211C	64.3	63.5	310°	200°	136°	0901		1.25
211D	64.7	63.1	272°	184°	135°	0903		2.50
212A	64.6	63.6	262°	171°	155°	0904		1.56
212B	64.1	63.4	257°	209°	154°	0906		1.09
212C	64.0	63.4	255°	325°	155°	0910		.94
212D	64.0	63.5	264°	330°	155°	0912		.78
213A	64.1	63.4	261°	350°	180°	0913		1.09
213B	64.4	63.2	282°	205°	172°	0914		1.87
214A	64.3	63.2	260°	180°	105°	0916		1.72
214B	64.7	63.4	255°	168°	155°	0918		2.03
214C	64.3	63.5	236°	156°	98°	0920		1.25
214D	64.4	63.5	200°	110°	99°	0922		1.40
215A	64.5	63.4	276°	189°	122°	0924		1.72
215B	64.2	63.6	292°	200°	122°	0926		.94
215C	64.3	63.4	292°	290°	121°	0927		1.40
215D	64.1	63.4	220°	295°	121°	0929		1.09



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 0929	SHEET NO. <del>99</del> 100
EXAMINER J. Delgado	EXAMINER R. Avalón	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26'-OHBC-54			CALIBRATION SHEET No. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
			MAX. / MIN.					
216A	64.1	63.4	226°	306°	140°	0929		1.09
216B	64.4	63.5	231°	315°	140°	0931		1.40
216C	64.4	63.5	231°	316°	140°	0934		1.40
216D	64.0	63.6	246°	160°	140°	0938		.62
217A	64.3	63.4	90°	0°	273°	0940		1.40
217B	64.3	63.7	116°	215°	270° 98°	0941		.94
217C	64.7	63.5	90°	0°	271° 94°	0944		1.87
217D	64.5	63.3	87°	359°	271°	0945		1.87
218A	64.5	63.4	85°	352°	290°	0946		1.72
218B	64.5	63.3	105°	356°	289°	0948		1.87
218C	64.5	63.4	104°	356°	288°	0949		1.72
218D	64.6	63.2	84°	354°	285°	0950		2.18
219A	64.4	63.2	92°	345°	244° 304°	0952		1.87
219B	64.3	63.4	95°	341°	305°	0954		1.40
219C	64.5	63.3	104°	345°	306°	0955		1.87
219D	64.5	63.4	100°	359°	310°	1001		1.72
220A	64.3	63.3	291°	190°	145°	1003		1.56
220B	64.2	63.4	251°	189°	144°	1004		1.25
220C	64.3	63.4	250°	320°	143°	1006		1.40

IX-ME-102-D  
 September 1981  
 Page 9 of 9



# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO.		SITE		DATE (DAY-MO-YR)		TIME (24 HR CLOCK)		SHEET NO.	
17-6542-006		Midland		23 Oct 81		1007		1010 <sup>th</sup>	
EXAMINER		EXAMINER		INSTRUMENT		PROCEDURE No.			
J. Delgado		R. Avalon		SWRI		IX-ME-102-D			
TEST IDENTIFICATION						CALIBRATION SHEET NO.			
26"-OHBC-54						067			
PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS		
220D	64.4	63.1	256° 180°	143°	1008		2.03		
221A	64.4	63.1	250° 187° 220°	160°	1010		2.03		
221B	64.4	63.5	260° 191°	160°	1016		1.40		
221C	64.1	63.6	273° 196°	168°	1018		.78		
221D	64.4	63.5	276° 198°	168°	1020		1.40		
222A	64.3	63.4	270° 210°	178°	1021		1.40		
222B	64.3	63.4	259° 189°	176°	1024		1.40		
222C	64.1	63.4	265° 341°	176°	1025		1.09		
222D	64.0	63.4	265° 330°	172°	1027		.94		
223A	64.1	63.5	78° 354°	335°	1030		.94		
223B	64.3	63.3	69° 359°	335°	1031		.94		
223C	64.4	63.5	69° 0°	328°	1033		1.40		
223D	64.2	63.3	116° 1°	332°	1035		1.40		
224A	64.2	63.5	125° 30°	350°	1037		1.09		
224B	64.4	63.2	265° 206°	342°	1040		1.87		
224C	64.3	63.6	79° 154°	345°	1043		1.09		
224D	64.1	63.4	150° 150°	345°	1045		1.09		
225A	64.3	63.4	295° 194°	10°	1050	Excessive amount of scale	1.40		
225B	64.2	63.4	268° 196°	9°	1053	excessive scale	1.25		

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 1054	SHEET NO. 10102
EXAMINER J. Delgado	EXAMINER R. Avalon	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26"-OHBC-54			CALIBRATION SHEET NO. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	% OVALNESS
225C	64.2	63.4	263° 327°	8°	1055	Excessive scale	1.25
225D	64.1	63.4	212° 326°	9°	1056		1.09
226A	64.3	63.6	240° 220°	166°	1058		1.09
226B	64.4	63.3	344° 220°	170°	1100		1.72
226C	64.4	63.2	345° 221°	170°	1101		1.87
226D	64.1	63.6	227° 230°	169°	1103		.78
227A	64.1	63.3	270° 355°	189°	1104		1.25
227B	64.1	63.5	301° 224°	189°	1106		.94
227C	64.1	63.6	281° 251°	185°	1109		.78
227D	64.2	63.5	282° 252°	184°	1111		1.09
228A	64.1	63.4	280° 336°	203°	1112		1.09
228B	64.2	63.4	282° 331°	203°	1115		1.25
228C	64.1	63.4	286° 6°	205°	1116		1.09
228D*		See Remarks				Elbow begins 229A,B,C	
230A*	64.7	63.1	105° 0°	313°	1323		2.50
230B	64.4	63.4	105° 349°	314°	1324		1.56
230C	64.3	63.7	104° 0°	312°	1327		.94
230D	64.5	63.3	107° 25°	311°	1330		1.87
230							—

# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 1331	SHEET NO. 103 <sup>102</sup>
EXAMINER J. Delgado	EXAMINER R. Avallón	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26" - CHBC - 54			CALIBRATION SHEET NO. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH MAX. / MIN.	AZIMUTH SEAM WELD	TIME	REMARKS	OVALNESS
231 A	64.4	63.3	126° 19°	334°	1333		1.72
231 B	64.5	63.3	116° 20°	334°	1334		1.87
231 C	64.5	63.3	120° 19°	334°	1335		1.87
232 A	64.3	63.4	109° 207°	70°	1338		1.40
232 B	64.3	63.5	130° 201°	71°	1339		1.25
232 C	64.2	63.7	100° 211°	70°	1340		.78
233 A	64.2	63.7	106° 237°	93°	1346		.78
233 B	64.4	63.7	96° 151°	95°	1350		1.09
233 C	64.3	63.8	99° 161°	94°	1351		.78
233 D	64.3	63.7	171° 241°	94°	1352		.94
234 A	64.1	63.6	15° 286°	232°	1356		.78
234 B	64.3	63.6	31° 302°	232°	1358		1.09
234 C	64.2	63.7	36° 302°	236°	1359		.78
234 D	64.2	63.7	50° 315°	230°	1400		.78
235 A	64.2	63.6	64° 309°	258°	1401		.94
235 B	64.4	63.2	64° 304°	256°	1404		1.87
235 C	64.6	63.1	65° 304°	254°	1405		2.34
235 D	64.2	63.4	65° 301°	251°	1406		1.25
236 A	64.1	63.5	22° 304°	271°	1407		.94



















# SWRI DATA RECORD (OUT-OF-ROUNDNESS)

PROJECT NO. 17-6542-006	SITE Midland	DATE (DAY-MO-YR) 23 Oct 81	TIME (24 HR CLOCK) 1408	SHEET NO. <del>102</del> 104
EXAMINER J. Delgado	EXAMINER R. Avalon	INSTRUMENT SWRI	PROCEDURE No. IX-ME-102-D	
TEST IDENTIFICATION 26"-OHBC-54			CALIBRATION SHEET NO. 067	

PIPE POSITION	MAX. DIA. IN. / CM.	MIN. DIA. IN. / CM.	AZIMUTH		AZIMUTH SEAM WELD	TIME	REMARKS	% OVALNESS
			MAX. / MIN.					
236B	64.2	63.7	66°	331°	272°	1408		.78
236C	64.2	63.7	68°	324°	272°	1409		.78
236D	64.3	63.5	66°	221°	273°	1410		1.25
237A	64.1	63.6	245°	155°	112°	1411		.78
237B	64.3	63.5	220°	126°	112°	1412		1.25
237C	64.3	63.5	221°	117°	113°	1414		1.25
237D	64.3	63.4	221°	146°	113°	1415		1.40
238A	64.3	63.4	226°	304°	136°	1417		1.40
238B	63.8	63.4	246°	186°	135°	1419		2.18
238C	63.8	63.4	215°	309°	133°	1420		2.18
238D	64.0	63.5	225°	292°	132°	1421		.78
239A	64.1	63.4	163°	284°	146°	1423		1.09
239B	64.3	63.4	171°	276°	146°	1424		1.40
239C	64.3	63.5	161°	276°	145°	1425		1.25
239D	64.1	63.6	320°	257°	146°	1426		.78
240A	64.0	63.6	310°	46°	295°	1427		.62
240B	64.0	63.7	81°	340°	294°	1430		.47
240C	64.1	63.7	82°	345°	294°	1431		.62
240D	64.2	63.6	318°	351°	292°	1432		.94
245C	64.2	63.5	100°	351°	301°	1504		1.09

APPENDIX D

TABULATION OF PERCENT OVALNESS CALCULATIONS

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26/36"-OHBC-15

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

Pipe Position	% Ovalness	Pipe Position	% Ovalness	Pipe Position	% Ovalness	
36" Pipe	304A*	2.12	314A	0.62	323A	0.78
	304B	1.23	314B	0.94	323B	1.25
	304C	1.01	314C	1.40	323C	1.25
	305A	1.23	314D	1.40	323D	0.94
	305B	0.45	315A	1.25	324A	1.25
	305C	0.45	315B	1.09	324B	1.87
	305D	0.78	315C	1.09	324C	1.87
	306A	1.17	315D	0.78	324D	0.78
	306B	Tee	316A	0.78	325A	1.40
	306C	1.23	316B	0.94	325B	2.34
	306D	---	316C	1.72	325C	2.18
	307A	Reducer			325D	0.62
	307B	Reducer	317A(45° Ell)	0.62	326A(90° Ell)	0.94
	308A	0.94	317B(45° Ell)	0.16	326B(90° Ell)	0.47
	308B	0.62	317C(45° Ell)	0.16	326C(90° Ell)	0.62
	308C	1.56	318A	0.62	327A	0.62
	308D	0.78	318B	1.40	327B	0.78
	309A	0.78	318C	0.62	327C	1.25
	309B	1.09	318D	1.56	327D	1.09
	309C	1.09	319A	0.94	328A	1.09
	309D	0.62	319B	1.40	328B	1.25
	310A	0.94	319C	1.87	328C	0.78
	310B	1.09	319D	1.09	328D	0.78
	310C	1.09	320A	1.40	329A	1.09
	310D	0.47	320B	0.78	329B	1.25
	311A	0.94	320C	0.78	329C	1.25
	311B	0.78	320D	0.62	329D	1.40
	311C	0.78	321A	1.25	330A	0.47
	311D	0.78	321B	1.25	330B	0.47
	312A	0.94	321C	0.94	330C	0.78
	312B	1.40	321D	1.09	330D	0.78
	312C	1.56	322A	1.25	331A	0.62
	312D	0.94	322B	1.56	331B	0.78
313A	0.78	322C	1.40	331C	1.09	
313B	0.78	322D	0.62	331D	0.78	
313C	0.62					
313D	0.94					

\*At Service Water Pump Structure.

OUT OF ROUNDNESS

$$Z = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26/36"-OHBC-15

$D_o$  = Average I.D. = 25.25"

$D_o$  = 64.135cm

$D_{MAX}$  = Maximum I.D.

$D_{MIN}$  = Minimum I.D.

$D_o = 35.25 = 89.535\text{cm}$

<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>
332A	1.25	342A	1.87	353A	0.78
332B	1.09	342B	1.25	353B	0.94
332C	1.09	342C	0.78	353C	0.78
332D	1.09	343A(90° E11)	0.78	353D	1.09
333A	1.56	343B(90° E11)	1.40	354A	1.56
333B	2.03	343C(90° E11)	1.56	354B	1.72
333C	0.62	344A	1.72	354C	1.25
333D	0.62	344B	1.25	354D	0.94
334A	1.09	344C	1.09	355A	1.09
334B	1.87	344D	1.25	355B	2.34
334C	1.72	345A	1.25	355C	2.18
334D	1.09	345B	0.78	355D	1.09
335A	1.40	345C	0.94	356A	0.78
335B	1.56	345D	0.94	356B	0.94
335C	1.09	346A	1.09	356C	1.25
335D	1.40	346B	1.40	356D	1.25
336A	0.94	346C	1.25	357A	1.09
336B	1.56	346D	0.94	357B	0.78
336C	1.09	347A	0.78	357C	0.94
336D	1.25	347B	0.78	358A(90° E11)	0.78
337A	1.72	347C	0.62	358B(90° E11)	0.62
337B	2.34	347D	1.09	358C(90° E11)	1.72
337C	2.34	348A(45° E11)	0.94	359A	1.09
337D	1.72	348B(45° E11)	0.47	359B	0.31
338A	1.87	348C(45° E11)	0.78	359C**	1.09
338B	2.18	349A	0.47		
338C	2.03	350A	0.62		
338D	1.40	350B	1.40		
339A	0.62	350C	1.87		
339B	1.25	351A(45° E11)	0.78		
339C	1.56	351B(45° E11)	1.09		
339D	1.87	351C(45° E11)	1.25		
340A	1.87	352A	0.31		
340B	2.34	352B	0.94		
340C	2.34	352C	0.94		
341A(90° ELL)	2.65	352D	0.94		
341B(90° ELL)	2.34				
341C(90° ELL)	2.81				

\*\* At Aux Bldg.



OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26/36"-OHBC-16

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	
36" Pipe {	246A*	0.33	255A	0.78	264A	0.94
	246B	0.22	255B	0.78	264B	1.09
	246C	1.17	255C	0.62	264C	1.40
	246D	0.33	255D	0.47	264D	0.78
	247A	0.33	256A	0.62	265A	0.47
	247B	0.33	256B	0.62	265B	0.94
	247C	1.17	256C	0.94	265C	1.09
	247D	0.12	256D	0.78	265D	1.25
	248A	Tee	257A	1.25	266A	1.25
	248B	Tee	257B	1.09	266B	1.25
	248C	Tee	257C	1.56	266C	1.40
	248D	Tee	257D	1.25	266D	1.09
	249A	Reducer	258A	0.62	267A	1.09
	249B	Reducer	258B	1.72	267B	1.25
	250A	1.40	258C	1.87	267C	1.56
	250B	0.78	258D	1.09	267D	0.78
	250C	1.25	259A	0.78	268A	0.94
	251A	1.72	259B	0.62	268B	1.09
	251B	0.78	259C	0.94	268C	0.94
	251C	1.56	259D	0.78	268D	0.78
	251D	1.72	260A (45° Ell)	1.25	269A (90° Ell)	0.62
	252A	1.40	260B (45° Ell)	1.56	269B (90° Ell)	0.31
	252B	1.25	260C (45° Ell)	1.56	269C (90° Ell)	0.62
	252C	1.40	261A	1.72	269D	0.31
	252D	1.40	261B	0.78	270A	0.62
	253A	1.25	261C	1.56	270B	0.94
	253B	1.09	261D	2.18	270C	0.94
	253C	1.40	262A	1.87	270D	0.62
253D	1.09	262B	1.87	271A	0.78	
254A	1.09	262C	1.25	271B	0.78	
254B	0.94	262D	1.25	271C	1.09	
254C	1.87	263A	1.09	271D	1.25	
254D	1.25	263B	1.40	272A	1.09	
		263C	1.09	272B	1.40	
		263D	0.78	272C	1.25	
				272D	1.40	

\*At Service Water Pump Structure.

OUT OF ROUNDNESS

$$Z = 100 \frac{DMAX - DMIN}{Do}$$

PIPELINE: 26/36"-OHBC-16

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>
273A	0.93	283A	1.09	294A	0.78
273B	0.78	283B	2.34	294B	-----
273C	1.09	283C	2.03	294C	1.09
273D	0.78	283D	0.78	295A(45° Ell)	0.78
274A	0.78	284A	1.25	295B(45° Ell)	0.47
274B	0.31	284B	1.25	295C(45° Ell)	0.47
274C	1.56	284C	2.34	296A	0.16
274D	0.78	285A(90° Ell)	1.72	296B	1.40
275A	0.78	285B(90° Ell)	2.34	296C	1.40
Opening	-----	285C(90° Ell)	0.78	296D	0.62
276A	0.62	286A	1.40	297A	1.40
276B	1.25	286B	-----	297B	1.56
276C	0.94	286C	1.56	297C	0.94
276D	0.94	287A(90° Ell)	1.25	297D	0.16
277A	1.25	287B(90° Ell)	0.78	298A	0.62
277B	0.94	287C(90° Ell)	1.09	278B	0.78
277C	0.78	288A	0.62	298C	1.72
277D	0.94	288B	0.47	298D	1.87
278A	1.09	289A	0.94	299A	1.09
278B	1.40	289B	0.78	299B	1.25
278C	1.40	289C	0.94	299C	1.25
278D	0.62	289D	1.25	299D	1.09
279A	0.47	290A	1.25	300A	1.40
279B	0.47	290B	1.09	300B	1.09
379C	0.94	290C	1.72	300C	1.09
279D	1.40	290D	2.18	300D	0.62
280A	1.09	291A	1.56	301A	0.94
280B	0.94	291B	1.09	301B	0.78
280C	1.25	291C	1.09	301C	0.94
280D	0.62	291D	0.62	302A(90° Ell)	2.18
281A	0.62	292A	1.40	302B(90° Ell)	1.25
281B	1.87	292B	1.40	302C(90° Ell)	1.56
281C	1.40	292C	0.94	303A	1.87
281D	1.72	292D	0.78	303B	0.94
282A	1.56	293A(45° Ell)	0.94	303C**	0.78
282B	1.87	293B(45° Ell)	1.25		
282C	2.03	293C(45° Ell)	0.78		
282D	0.78				

\*\*At Aux Bldg.

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26"-OHBC-53

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>
Opening	---	165A	1.09	173A	0.78
156A*	1.09	165B	1.09	173B	1.09
156B	0.31	165C	1.09	173C	1.09
157A	1.72	165D	1.40	173D	0.47
157B	1.56	166A	1.40	174A	0.62
157C	2.03	166B	2.96	174B	1.25
157D	1.40	166C	1.40	174C	1.40
158A	1.40	166D	1.40	174D	0.62
158B	2.03	167A	1.72	175A	0.78
158C	1.72	167B	1.25	175B	0.78
158D	0.94	167C	1.09	175C	1.40
159A(90° Ell)	1.25	167D	1.09	175D	0.78
159B(90° Ell)	1.25	168A	1.09	176A	0.78
159C(90° Ell)	0.78	168B	1.25	176B	0.78
160A	0.78	168C	0.78	176C	1.25
160B	1.72	168D	1.09	176D	1.09
160C	1.56	169A	1.09	177A	1.40
160D	1.09	169B	1.56	177B	1.40
161A	1.25	169C	1.25	177C	1.25
161B	0.94	169D	2.03	177D	1.09
161C	0.78	170A	1.87	178A	0.78
162A	1.40	170B	1.40	178B	1.72
162B	1.09	170C	1.40	178C	2.03
162C	0.94	170D	0.78	178D	1.72
162D	1.09	171A	1.25	179A	1.72
163A	0.62	171B	0.94	179B	1.56
163B	0.47	171C	0.78	179C	1.25
163C	0.94	171D	1.40	179D	2.18
164A	0.78	172A	1.56	180A	1.87
164B	1.40	172B	1.40	180B	1.72
164C	2.18	172C	1.09	180C	1.40
164D	1.40	172D	0.78	180D	0.78

\*At Valve Pit.

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26" - OHBC-53

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>
181A(45° Ell)	0.94	190A	0.94	361A(90° Ell)	0.47
181B(45° Ell)	1.56	190B	0.94	361B(90° Ell)	0.78
181C(45° Ell)	1.56	190C	0.94	361C(90° Ell)	0.78
182A	---	190D	0.78	362A	0.78
182B	1.09	191A	1.56	362B	1.87
182C	1.40	191B	1.25	362C	1.72
183A	1.25	191C	1.40	362D	1.09
183B	1.09	191D	1.40	363A(90° Ell)	1.25
183C	1.25	192A	1.40	363B(90° Ell)	1.56
184A	1.72	192B	1.09	363C(90° Ell)	1.09
184B	1.72	192C	0.94	364A	2.18
184C	2.18	192D	1.09	364B	1.72
185A	1.72	193A	---	364C**	---
185B	0.94	193B	---		
185C	0.78	194A	0.78		
185D	0.94	194B	0.94		
186A	0.78	194C	0.94		
186B	0.62	194D	0.62		
186C	0.62	195A	0.94		
186D	1.40	195B	2.18		
187A	0.78	195C	2.18		
187B	0.94	195D	2.34		
187C	0.94	196A	2.50		
187D	0.62	196B	2.18		
188A	0.62	196C	1.72		
188B	0.78	196D	1.40		
188C	1.56	197A	1.40		
188D	1.09	197B	1.72		
189A	0.94	197C	2.34		
189B	0.62	197D	0.47		
189C	0.62	360A(45° Ell)	0.47		
189D	0.62	360B(45° Ell)	0.16		

\*\*At Service Water Pump Structure.



OUT OF ROUNDNESS

$$Z = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

PIPELINE: 26"-OHBC-54

Do = Average I.D. = 25.25"  
 Do = 64.135cm  
 DMAX = Maximum I.D.  
 DMIN = Minimum I.D.  
 Do = 35.25 = 89.535cm

<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>	<u>Pipe Position</u>	<u>Z Ovalness</u>
Opening	—	215A	1.72	224A	1.09
206A*	1.09	215B	0.94	224B	1.87
206B	0.62	215C	1.40	224C	1.09
206C	1.09	215D	1.09	224D	1.09
206D	0.62	216A	1.09	225A	1.40
207A	0.94	216B	1.40	225B	1.25
207B	1.87	216C	1.40	225C	1.25
207C	1.25	216D	0.52	225D	1.09
207D	1.40	217A	1.40	226A	1.09
208A(90° Ell)	1.40	217B	0.94	226B	1.72
208B(90° Ell)	1.87	217C	1.87	226C	1.87
208C(90° Ell)	2.03	217D	1.87	226D	0.78
209A	2.03	218A	1.72	227A	1.25
209B	1.87	218B	1.87	227B	0.94
209C	1.56	218C	1.72	227C	0.78
209D	1.09	218D	2.18	227D	1.09
210A	1.87	219A	1.87	228A	1.09
210B	2.18	219B	1.40	228B	1.25
210C	2.34	219C	1.87	228C	1.09
210D	2.50	219D	1.72	228D	0.94
211A	1.40	220A	1.56	229A(45° Ell)	1.09
211B	1.25	220B	1.25	229B(45° Ell)	1.56
211C	1.25	220C	1.40	229C(45° Ell)	1.72
211D	2.50	220D	2.03	230A	2.50
212A	1.56	221A	2.03	230B	1.56
212B	1.09	221B	1.40	230C	0.94
212C	0.94	221C	0.78	230D	1.87
212D	0.78	221D	1.40	231A	1.72
213A	1.09	222A	1.40	231B	1.87
213B	1.87	222B	1.40	231C	1.87
214A	1.72	222C	1.09	232A	1.40
214B	2.03	222D	0.94	232B	1.25
214C	1.25	223A	0.94	232C	0.78
214D	1.40	223B	0.94		
		223C	1.40		
		223D	1.40		

\*At Valve Pit.

OUT OF ROUNDNESS

$$\% = 100 \frac{D_{MAX} - D_{MIN}}{D_o}$$

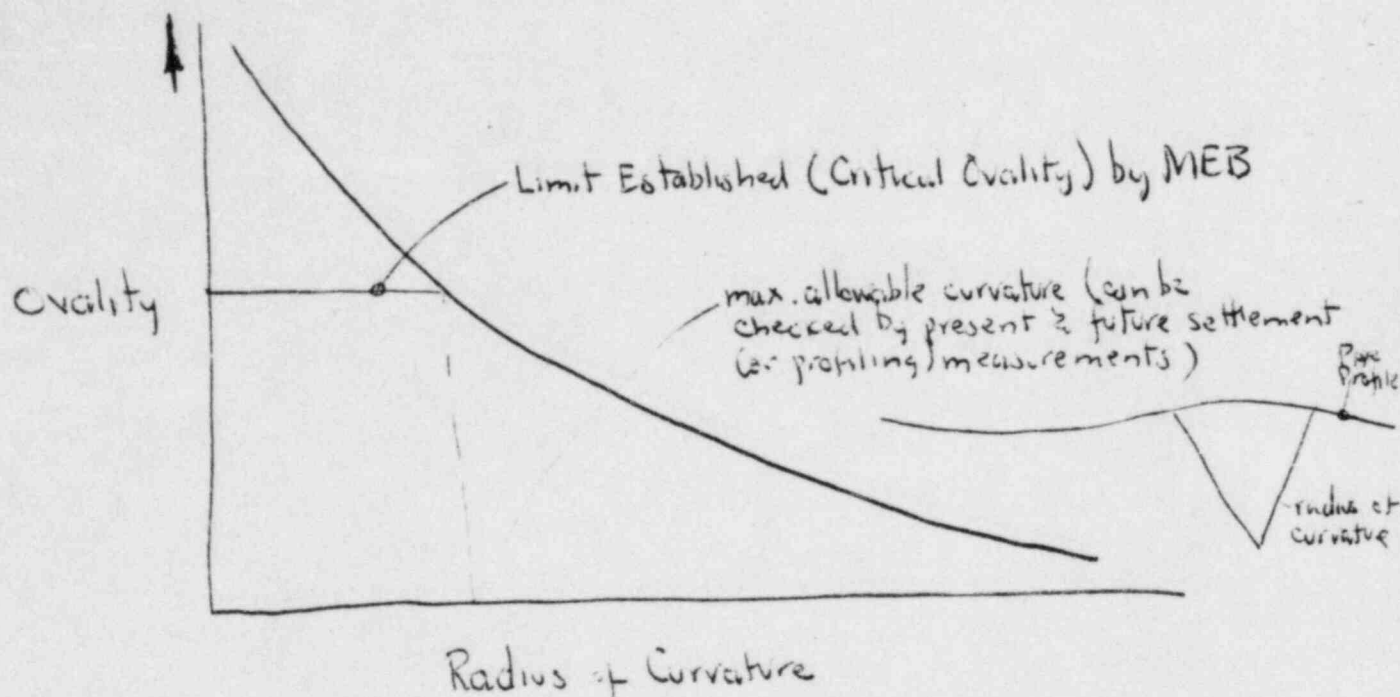
PIPELINE: 26"-OHBC-54

D<sub>o</sub> = Average I.D. = 25.25"  
D<sub>o</sub> = 64.135cm  
D<sub>MAX</sub> = Maximum I.D.  
D<sub>MIN</sub> = Minimum I.D.  
D<sub>o</sub> = 35.25 = 89.535

<u>Pipe Position</u>	<u>% Ovalness</u>	<u>Pipe Position</u>	<u>% Ovalness</u>
233A	0.78	242A	0.94
233B	1.09	242B	1.87
233C	0.78	242C	2.18
233D	0.94	242D	1.09
234A	0.78	243A	0.94
234B	1.09	243B	0.62
234C	0.78	243C	0.94
234D	0.78	243D	0.62
235A	0.94	244A	1.87
235B	1.87	244B	2.18
235C	2.34	244C	2.18
235D	1.25	244D	1.25
236A	0.78	245A	0.47
236B	0.78	245B	1.25
236C	0.78	245C	1.09
236D	1.25	245D**	-----
237A	0.78		
237B	1.25		
237C	1.25		
237D	1.40		
238A	1.40		
238B	2.18		
238C	2.18		
238D	0.78		
239A	1.09		
239B	1.40		
239C	1.25		
239D	0.78		
240A	0.62		
240B	0.47		
240C	0.62		
240D	0.94		
241A	0.78		
241B	0.78		
241C	0.62		
241D	1.25		

\*\*At Service Water Pump Structure.

Based on discussions w/ L. Heller on 1/27/82



1. Must determine if relationship between radius of curvature & ovality is developed (or can be developed) from existing experimental studies
2. If relationship does exist - compare profiling of pipe results @ Midland to see if there are any pipe lengths which are near or above critical ovality

MIDLAND - UNDERGROUND PIPING

J Kane  
Rec'd 12/20/83



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

November 2, 1983

Charles Bechhoefer, Esq.  
Administrative Judge  
Atomic Safety and Licensing Board  
U.S. Nuclear Regulatory Commission  
Washington, D. C. 20555

Dr. Jerry Harbour  
Administrative Judge  
Atomic Safety and Licensing Board  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Dr. Frederick P. Cowan  
Administrative Judge  
6152 N. Verde Trail  
Apt. B-125  
Boca Raton, Florida 33433

In the Matter of  
CONSUMERS POWER COMPANY  
(Midland Plant, Units 1 and 2)  
Docket Nos. 50-329 OM & OL and 50-330 OM & OL

Dear Administrative Judges:

At the hearing session held on November 17, 1982, Consumers Power Company (CPC) was granted permission to submit an affidavit explaining how certain piping, although analyzed to a seismic criteria of .12g, meets current criteria. The Staff stated that, after reviewing the affidavit, it would notify the Board of its agreement with it. (Tr. 9041-9044). By letter to the Licensing Board from Mr. Steptoe, dated February 3, 1983, CPC submitted an affidavit by Dr. Thiruvengadam. Enclosed is an affidavit by Dr. W. P. Chen indicating concurrence with Dr. Thiruvengadam's affidavit.

Sincerely,

Michael N. Wilcove  
Counsel for NRC Staff

Enclosure: As stated

~~8312050381 831102~~  
~~PDR ADOCK 05000329~~  
G PDR

DESIGNATED ORIGINAL

Certified By \_\_\_\_\_

~~8312050381~~

//





UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20545

*Kone*

APR 21 1981

*G. Lear*

Docket Nos.: 50-329/330 OM, OL

MEMORANDUM FOR: Ellen Brown, Attorney, Office of the Executive Legal Director  
FROM: Earl Hood, Project Manager, Licensing Branch, No. 3, DL  
SUBJECT: RESPONSE TO A. FARNELL'S LETTER OF MARCH 20, 1981

Mr. A. Farnell's letter of March 20, 1981 requests clarification and/or additional response to some of the NRC Staff's Answers to Interrogatories Filed by Consumers Power Company. A reply to each of Mr. Farnell's concerns follows:

One concern expressed by Mr. Farnell is the use of the word "primarily" at page 9. The answer to Interrogatory 6, page 9, states that the means by which the staff communicated its position as to the inadequacy of the licensee's response was "primarily" by the issuance of additional questions on the same subject. Additional means by which the staff communicated its position was by handouts and discussions at meetings. The only case for use of meeting handouts to this end is identified by footnote number 1 to Table 6-1 of the answer to Interrogatory 6. Except for the seismic input matter discussed below, where meeting discussions were used to communicate staff positions as to the inadequacy of the applicants response with respect to criteria, these discussions were followed up by issuance of additional questions identified in the staffs answer.

The followup communications to the staffs seismic input requests<sup>1/</sup> prior to December 6, 1979 were communicated as "Open Items Associated with Staff Review of Midland Plants, Units 1 & 2 FSAR" (S. Varga letter of March 30, 1979, Enclosure 1, item 1 under "Geology and Seismology,"), and then orally during meetings with Consumers as documented in Enclosure 4 (Item 1 under "Geology/ Seismology Branch") to "Summary of April 10-11, 1979 Meetings on Open Items Regarding FSAR Review", dated April 25, 1979, and in "Summary of July 19, 1979 Meeting on Site Geology and Seismicity" dated October 16, 1979. Relevant staff communications after December 6, 1979 were identified in the answer to Interrogatory 11.

<sup>1/</sup> Staff Requests 361.4 and 361.5 from enclosure 1 to S. Varga's letter of June 20, 1978, and followup Request 361.7 from enclosure 1 to S. Varga's letter of February 14, 1979.

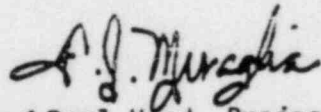
~~814422580~~ 200.

APR 24 1981

The word "essentially" on page 35 (second paragraph of answer) and on page 36 (occurring twice in the first paragraph of answer) may be deleted, except that the answers also identify the Staffs need for information with respect to (1) seismic input and (2) underground piping and associated components.

The word "essentially" in the second paragraph on page 42 may be deleted, except that the preceding two paragraphs of the answer refer to the difficulties attributed to the on-going aspects of the review, and the need for resolution of seismological input, and except that the subsequent paragraph of the answer (page 43) identifies information needed with regard to underground piping.

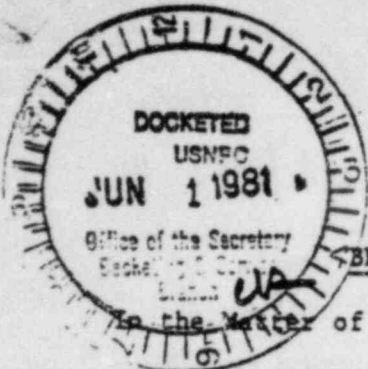
With respect to Mr. Farnell's requests regarding Interrogatory 11 and Table 6-1, meetings have been scheduled to discuss Staff review of Amendment 85 containing responses to requests 39-53 and are being scheduled to discuss Consumers plans and findings with respect to cracking of the concrete foundation of the Borated Water Storage Tank, errors in the seismic analyses for the Control Tower, the emerging concept of a bin wall support concept for the Service Water Intake Structure, and other remedial items. We will endeavor during the conclusion of these meetings to identify any resolutions which may be achieved and any needs for further information.

*for*   
Darl Hood, Project Manager  
Licensing Branch No. 3  
Division of Licensing

5/27/81

RELATED CORRESPONDENCE

J. Kane  
Rec'd 6/9/81



UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of

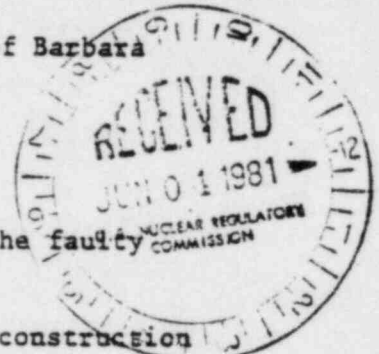
CONSUMERS POWER COMPANY

(Midland Plant, Units 1 and 2)

Docket Nos. 50-329-OM  
50-330-OM  
50-329-OL  
50-330-OL

RESPONSES TO STAMIRIS' DISCOVERY REQUESTS  
PURSUANT TO BOARD ORDER OF MAY 8, 1981

Pursuant to the Order of the ASLB dated May 8, 1981, Consumers Power Company hereby provides the following responses to interrogatories of Barbara Stamiris:



Questions 5(b) - 5(e) (January 26, 1981 Request)

5(b) On what basis was the decision to remove and replace the faulty fill under the administration building made?

The basis for the decision was the status of building construction in this area at the time the problem was discovered. No construction above the grade beam and footings had been completed. The most economical approach was to remove and replace the grade beam and the supporting fill.

5(c) Who made this 5(b) decision?

The decision was made by the Bechtel<sup>™</sup> Project Superintendent. (Joel Newgen)

5(d) When was this (5b) decision made?

The decision was made in September, 1977.

5(e) Describe and explain any alternative corrective actions ever considered and rejected for the Administration Building, if such considerations were made.

No alternative corrective actions were considered.

DS03  
5  
0/1

~~8106050-480~~  
3pp.

G



Question 13 (April 27, 1981 Request

Response

During the period of December 6, 1979 through April 30, 1980, concrete work on the Diesel Generator Building included placement of the following: removable roof plugs for bays 2, 3 and 4, mud mats and base slabs for the stairtowers and north entries, stairs and slabs for the north entryways and the parapet wall for the west stairtower.

Dates for the concrete pours were as follows:

December 6, 1979 - removable roof plug bay 2

December 10, 1979 - removable roof plug bays 3 and 4

January 30, 1980 - mud mats for stairtowers

February 13, 1980 - base slabs for stairtowers

February 13, 1980 - mud mats, north entries bays 2 and 3

February 26, 1980 - stairs and slabs for all north entryways

February 26, 1980 - parapet wall for west stairtower

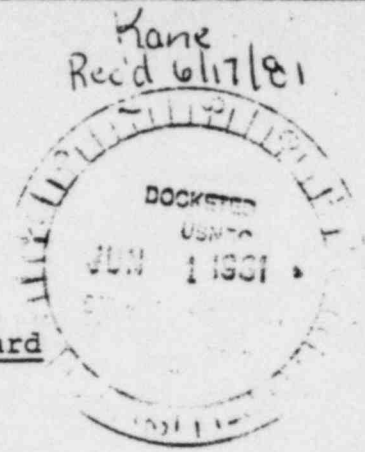
No work was performed by way of excavation or sealing of cracks during this period.

The "grade slabs" mentioned (in Applicant's Response dated March 30, 1981) refer to the concrete slabs at elevation 634'-6" in all four bays of the building. Concrete work on these slabs includes mud mats, structural slabs, and underlying ductbanks. The curbs referenced are the pads for motor control centers in all four bays.

The NRC was advised of Applicant's intent to resume construction on the diesel generator building in MCR 24, Interim Report #7, p. 14, attached to a letter from Stephen Howell to James Keppler dated September 5, 1979,

and in MCAR 24, Interim Report #8, p. 3, attached to a letter from Howell to Keppler dated November 2, 1979. In addition, the NRC had a full time inspector assigned to the Midland site during the time period in question.

No work related directly or indirectly to soils or soil settlement was performed during the time period in question.



UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

Before the Atomic Safety and Licensing Board

In the Matter of	)	
	)	
CONSUMERS POWER COMPANY	)	Docket Nos. 50-329-OM
	)	50-330-OM
(Midland Plant, Units 1 and 2)	)	50-329-OL
	)	50-330-OL
	)	

CONSUMERS POWER COMPANY RESPONSE TO INTERVENOR  
RESPONSE TO 5/8/81 MEMORANDUM & ORDER OF THE  
BOARD, AND APPLICANT'S 5/6/81 RESPONSE AND MOTIONS  
FOR PROTECTIVE ORDER

On reading Ms. Stamiris' latest pleading captioned "Intervenor Response to 5/8/81 Memorandum and Order of the Board, and Applicant's 5/6/81 Response and Motions for Protective Order" one cannot escape a feeling of <sup>already seen</sup> *deja vu*: present, once again, is the same unusual and highly confusing mixture of comments on previous discovery interspersed with apparent motions to compel. A new twist is the addition of comments on the Board's ruling.

Ms. Stamiris' comments on Consumers Power's responses to her "discovery questions" about which she accurately and candidly states "the quality of my discovery questions has been lacking at times" (page 5) appear to be little more than mere gratuitous shiping which hardly warrants response.

The two items she has requested the Board to rule on are:

~~8106110290~~

8 pp.

G

DS03  
50/1

1. A "direct ruling" on Request #10 of Ms. Stamiris' 3/27/81 Request which she claims was never mentioned in the Board Order, and

2. A motion to compel Consumers Power to supplement its response to #5 document request of the 1/14/81 Follow-up series page 3 of the 4/28/81 summary", pursuant to 2.740(e).

An analysis of these requests demonstrates why Consumers Power deemed it necessary to apply for a protective order.

I. Factual Background

The long and tortuous history of Ms. Stamiris' discovery requests is well known to the Board. This latest request is merely the latest and most flagrant example of the seemingly unending succession of Stamiris filings.

In order to clear up all discovery disputes the Board issued an order on 5/8/81 dealing with all pending discovery requests. The only issue left open by the Board was the motion with regard to a protective order on future discovery.

II. The Board's Order Permitted Ms. Stamiris to Respond to the Motion Concerning Future Discovery but not to Rehash Old Discovery Requests

The Board stated on page 5 of the order that Ms. Stamiris had until May 21st to respond to the motion with respect to future discovery. In doing so it noted at page six that "we consider discovery to be essentially closed and that we will be most reluctant to permit any further discovery, except as specifically required by this ruling or by 10 CFR



§2.740(e)." At page 2 of the order the Board noted the reasons for this reluctance towards any future discovery: that discovery had been in progress for nearly six months, that Consumers Power had supplied a large amount of discovery to Ms. Stamiris, that prepared testimony is due to be filed soon, and that the hearing was about to begin.

It should be emphasized that the Board ruled on all of Ms. Stamiris' then pending discovery requests. Therefore any discovery request submitted prior to that time was denied to the extent it was not specifically granted in the order.

III. The Alleged Future Discovery Requests are Merely Old Requests Which Ms. Stamiris Seeks to Relitigate Not Future Discovery or Supplementation of Past Responses

A. Request #5 to Ms. Stamiris' 1/14/81 "Followup Requests"

Ms. Stamiris seeks a supplementation to Consumers Power's response to the first paragraph of her Request #5 which reads:

5. The reports provided were numbered SB 13752- SB 13956 although not in that sequence and with many pages missing. It appears that these Bechtel reports stemming from the Administration Building settlement problem have to do with plant area fill soils and as such are important to this proceeding. Please provide these file pages: SB 13770, 13771, 13790-13794, 13816, 13817, 13818, 13829-13854, 13867-13912, 13920-13953, 13955 and any beyond SB 13956 in this series on soils.

This request was dealt with at pages 16-17 of "Consumers Power Company Response to 4/28/81 Summary of Intervenor Outstanding Discovery Requests and to Ms. Stamiris' Motions to Compel; Consumers Power Company Motion for Protective

Order on Certain Pending and All Future Discovery by Stamiris" and Appendix B, Question 5. The Board ruled on this request at page 4 of #5 Order.

In seeking to relitigate this issue Ms. Stamiris has conveniently sought through procrustean logic to torture her attempted relitigation of an issue she lost into the category of 10 CFR § 2.740(e) "Supplementation of Responses". It is interesting to note that this is the only regulation mentioned by the Board and the only one Ms. Stamaris uses.

The only new ground for this purported duty to supplement is the alleged statement by Mr. James Brunner, Consumers Power attorney, that she had been given Bechtel's "whole file" on the Administration Building. Mr. Brunner's recollection of the phone call is that he never told her that every single document having reference to the Administration Building had been provided in response to her discovery request.\* Indeed, had she made such a broad discovery request, Consumers Power would not have responded as it would not have satisfied the "reasonable particularity" standard required by 10 CFR §2.741. Consumers Power is aware of 10 CFR 2.740(e) (2) and submits that it has complied with this regulation. At the top of page 10 of her May 20, 1981 pleading, Ms. Stamaris sets forth a new request which is, as usual, much broader than the original request. Now she is seeking any documents referring or relating to a certain SB numbered

---

\*The substance of this phone call was documented in a letter from Mr. Brunner to Ms. Stamiris. Ms. Stamiris later confirmed its accuracy.

document. This is not a request for supplementation of a past response but rather a purported clarification of a past discovery request which is in fact a new, broader discovery request.

The most egregious portion of her pleading are her "new requests" which are set forth at the bottom of page 10. These requests are "new" and are clearly not a supplementation of a past document production as no document production was made on this subject since the Board determined that the request was improper. Moreover, the requests, even if filed timely and not already denied by the Board are objectionable on the grounds of being overbroad.

B. Request #10 of Stamiris' 3/27/81 Request

This request was included in Ms. Stamiris' 4/28/81 Summary, was dealt with in paragraph 10 to Appendix B of Consumers Power response and was denied by the Board at page 6 when it stated that "...Applicant's motions for protective orders with respect to outstanding discovery are granted" (emphasis in original). Ms. Stamiris motion is really for reconsideration of a Board decision and hence had to be made within the ten day period. Therefore it is untimely. Furthermore no additional information is set forth which was not before the Board earlier.

IV. Conclusion

For the reasons set forth in this response, the Board then must deny Ms. Stamiris' latest discovery request and enter and enforce the Protective Order.

Respectfully submitted,

By Alan S. Farnell  
Alan S. Farnell  
Attorney for Consumers <sup>by JFB</sup>  
Power Company

ISHAM, LINCOLN & BEALE  
One First National Plaza  
Suite 4200  
Chicago, Illinois 60603  
(312) 558-7500

DATED: June 3, 1981





SERVICE LIST

Frank J. Kelley, Esq.  
Attorney General of the  
State of Michigan  
Stewart H. Freeman, Esq.  
Assistant Attorney General  
Gregory T. Taylor, Esq.  
Assistant Attorney General  
Environmental Protection Div.  
720 Law Building  
Lansing, Michigan 48913

Myron M. Cherry, Esq.  
One IBM Plaza  
Suite 4501  
Chicago, Illinois 60611

Mr. Wendell H. Marshall  
RFD 10  
Midland, Michigan 48640

Charles Bechhoefer, Esq.  
Atomic Safety & Licensing Bd. Pnl.  
U.S. Nuclear Regulatory Com.  
Washington, D.C. 20555

Dr. Frederick P. Cowan  
6152 N. Verde Trail  
Apt. B-125  
Boca Raton, Florida 33433

Admin. Judge Ralph S. Decker  
Route No. 4, box 190D  
Cambridge, Maryland 21613

Carroll E. Mahaney  
Babcock & Wilcox  
P. O. Box 1260  
Lynchburg, Virginia 24505

James E. Brunner, Esq.  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Steve Galdler, Esq.  
2120 Carter Avenue  
St. Paul, Minnesota 55108

Atomic Safety & Licensing Appeal Pnl.  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Mr. C. R. Stephens  
Chief, Docketing & Service Section  
Office of the Secretary  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Ms. Mary Sinclair  
5711 Summerset Street  
Midland, Michigan 48640

William D. Paton, Esq.  
Counsel for the NRC Staff  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Atomic Safety & Licensing Bd. Panel  
U.S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Barbara Stamiris  
5795 North River Road  
Route 3  
Freeland, Michigan 48623

NRC Interrogatories (2nd) asked of CPCo  
(Includes questions of Cappucci, Gonzalez & Hood) 01/02/81

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
CONSUMERS POWER COMPANY ) Docket Nos. 50-329-OM & OL  
(Midland Plant, Units 1 and 2) ) 50-330-OM & OL

NRC STAFF INTERROGATORIES TO CONSUMERS POWER COMPANY

Pursuant to 10 C.F.R. § 2.740(b), the NRC Staff serves the following interrogatories on Consumers Power Company. In several interrogatories we have included requests for documents. The requests are made in the event you will respond absent a formal Motion to Produce these Documents.

INSTRUCTIONS AND DEFINITIONS

1. Information sought in these Interrogatories shall include information within the knowledge, possession, control or access of any agents, employees and independent contractors of Consumers Power Company.
2. As used herein, "documents" includes, but is not limited to, subsurface investigation and foundation reports, geotechnical engineering calculations, geotechnical evaluations and special study reports, construction plans and specifications, papers, photographs, criteria, standards of review, recordings, memoranda, books, records, writings, letters, telegrams, mailgrams, correspondence, notes and minutes of meetings or of

~~810105073~~ 12 pp.

conversations or of phone calls, interoffice, intra-agency or interagency memoranda or written communications of any nature, recordings of conversations either in writing or upon any mechanical or electronic or electrical recording devices, notes, exhibits, appraisals, work papers, reports, studies, opinions, surveys, evaluations, projections, hypotheses, formulas, designs, drawings, manuals, notebooks, worksheets, contracts, agreements, letter agreements, diaries, desk calendars, charts, schedules, appointment books, punchcards and computer printout sheets, computer data, telecopier transmissions, directives, proposals, and all drafts, revisions, and differing versions (whether formal or informal) of any of the foregoing, and also all copies of any of the foregoing which differ in any way (including handwritten notations or other written or printed matter of any nature) from the original.

Interrogatory 1

Your response to Question 17 in "Responses to NRC Requests Regarding Plant Fill" regarding piping founded in the plant area fill, states: "When two pipelines were parallel and in the same proximity, only one was profiled."

- (a) Define "same proximity" as used in the above quotation.
- (b) In view of the random nature and varying properties of the fill, what assurance exists that the settlement of the profiled pipelines is similar to pipelines not profiled?
- (c) What assurance exists that future settlement of the profiled pipelines will be similar to pipelines not profiled?



Interrogatory 2

Your response to Question 17 in "Responses to NRC Requests Regarding Plant Fill" includes a Figure 17-1 showing the locations of some, but not all, of the piping listed in Table 17-1 of that response. Do you have sketches like that of Figure 17-1 identifying the location of the remaining piping listed in Table 17-1? If yes, please provide copies.

Interrogatory 3

The legend for Figure 17-1 of your response to Question 17 in "Response to NRC Requests Regarding Plant Fill" makes reference to a Note #1 and a Note #2. Neither note is shown. State the contents of these two notes, if they exist.

Interrogatory 4

Figure 17-2 of your response to Question 17 in "Responses to NRC Requests Regarding Plant Fill" regarding piping founded in the plant area fill shows some differences between profiles of a given pipe taken on different dates. Specifically, the profiles for pipeline 20" - 1HCD-169 between stations 3+00 and 4+30 show a decrease in slope changes (i.e., a smoothing out) and relocation of certain peaks when the March/April 1979 profile is compared to the July 1979 profile. How do you explain the difference of these two profiles?

Interrogatory 5

Figure 19-1 of your response to Question 19 in "Responses to NRC Requests Regarding Plant Fill" regarding piping founded in the plant area fill shows some differences between profiles of a given pipe taken on different dates. Specifically, the profile for pipeline 10" - OHBC-27 taken September 1979 is at a higher elevation than the profile of that same line taken in January 1979. How do you reconcile these differences?

Interrogatory 6

Figure 19-1 of your response to Question 19 in "Responses to NRC Requests Regarding Plant Fill" regarding piping founded in the plant area fill shows some differences between profiles of a given pipe as taken on different dates. Specifically, the profile for pipeline 8" - 1HBC-81 measured in September 1979 is at a deeper elevation than the profile of this pipeline taken in January 1979 and the change in slope for the September 1979 profile is not as great as for the January 1979 profile. How do you reconcile this behavior?

Interrogatory 7

Have any underground pipelines other than those for which the profiled results are reported in your responses to Questions 17 and 19 of "Responses to NRC Requests Regarding Plant Fill", and which are not provided in response to Interrogatory 2 herein, been measured for profile? As to any affirmative reply, please describe the results and any sketches of profile results.

Interrogatory 8

State the principal architectural and engineering criteria provided pursuant to 10 C.F.R. § 50.35 to which each of the following structures and components were designed (or were to have been designed) with respect to soil properties, foundation support and performance during severe natural phenomena:

- (1) Diesel Generator Building
- (2) Auxiliary Building
- (3) Service Water Intake Structure and integral retaining walls
- (4) Feedwater Isolation Valve Pits
- (5) Underground seismic Category I piping and conducts
- (6) Underground piping other than seismic Category I piping, located beneath or near seismic Category I structures and components
- (7) Borated water storage tanks and ring support
- (8) Underground diesel fuel oil storage tanks and fuel oil lines
- (9) Cooling pond dikes

Interrogatory 9

Identify all principal architectural and engineering criteria identified in your answer to Interrogatory 8 which will not be met unless the remedial actions proposed or completed for the soils placed and compacted at the Midland site are implemented.

Interrogatory 10

Midland PSAR Section 2.8.4.1, as last amended on May 28, 1969, states the following design criterion for fill and backfill: "All fill and backfill materials are adequately compacted to insure stability of the fill and to provide adequate support for structures founded on this fill without excessive settlements."

- (a) With respect to this criterion, define "excessive settlements".
- (b) With respect to this criterion, define "adequately compacted".
- (c) Was this design criterion met for the fills and backfills as originally placed and compacted (i.e., prior to the surcharge program) beneath or adjacent to the Diesel Generator Building?
- (d) Has this design criterion been met for the fills and backfills which were subjected to the Diesel Generator Building surcharge program?
- (e) Was this design criterion met for the fills and backfills as originally placed and compacted beneath or adjacent to the Auxiliary Building?
- (f) Will this design criterion be met once the proposed remedial action for the Auxiliary Building has been completed?
- (g) If the answer to Interrogatory 10(f) is no, what design criterion will be met?
- (h) Was the design criterion quoted above met for the fills and backfills as originally placed and compacted beneath or adjacent to the Service Water Intake Structures?
- (i) Will the design criterion quoted above be met once the proposed remedial action for the Service Water Intake Structure has been completed?
- (j) If the answer to Interrogatory 10(i) is no, what design criterion will be met?
- (k) Did the original fill and backfills placed inside and beneath the ring supports of the Borated Water Storage Tanks meet the quoted design criterion?
- (l) Do the existing fills and backfills placed inside and beneath the ring supports of the Borated Water Storage Tanks meet the quoted design criterion?
- (m) If the answer to Interrogatory 10(l) is no, what design criterion is met?



- (n) Was the quoted design criterion met for the fills and backfills placed and compacted in the vicinity of the Diesel Fuel Oil Storage Tanks?
- (o) Was all of the fill for the Diesel Fuel Oil Storage Tanks placed originally to the requirements of Zone 2 materials?
- (p) If the answer to 10(o) is no, what areas were not placed to Zone 2 requirements; on what basis was this material accepted?
- (q) Was the design criterion quoted above met for the fills and backfills as originally placed and compacted beneath and adjacent to the Feedwater Isolation Valve Pits?
- (r) Will the design criterion quoted above be met once the proposed remedial action for the Feedwater Isolation Valve Pits has been completed?
- (s) If the answer to Interrogatory 10(r) is no, what design criterion will be met?
- (t) Has the design criterion quoted above been met for the cooling pond dikes? If yes, state how this was determined. If no, what design criterion was met?

#### Interrogatory 11

For all structures and components listed in Interrogatory 8, list all design bases (as design basis is defined in 10 C.F.R. § 50.2(u)) of significance to safety which depend upon adequate foundation support or soil related properties and which would not be met unless remedial actions are implemented.

#### Interrogatory 12

When, if ever, was your intent to include lean concrete as a Zone 2 material first conveyed to the NRC? To whom and by what means of communication was this intent conveyed to NRC?

Interrogatory 13

Have you performed, or do you know of the existence of, any studies of the consequences of failure of the Midland cooling pond dike? If yes, provide copies of or a reference to these studies. If no, what is the justification for not performing such studies?

Interrogatory 14

Have you performed, or do you know of the existence of, any studies of the probability of failure of the Midland cooling pond dike? If yes, provide copies of or references to these studies. If no, what is the justification for not performing such studies?

Interrogatory 15

In your responses to NRC requests 24b and 51 concerning permanent dewatering, you used a specific yield coefficient of 14 percent for determining the volume of ground water to be removed from storage within the plant dikes. In determining average permeability, you used a value of 30 percent for effective porosity. Under water table conditions such as exist at Midland, "specific yield" means the same as "effective porosity". Provide justification for using two different percentages.

Interrogatory 16

In your response to request 24 concerning permanent dewatering, you used an error function equation to define water level rise. This equation is as follows:

$$h = H \left[ 1 - \operatorname{erf} \frac{x}{\sqrt{\frac{4Kht}{n_e}}} \right]$$

In applying this equation you used 0.1 foot for  $h$ , 1.6 feet for  $H$  and 20 feet for  $\bar{h}$ .

In request 49, we asked for additional information on why 20 feet had been used for  $\bar{h}$  when  $\bar{h}$  is defined as the average depth of water. Your response to request 49 was that the values of  $h$  and  $H$  are much smaller because they represent the changes in head above the original potentiometric surface while the value of  $\bar{h}$  is the thickness of natural sands through which the seepage from the cooling pond is assumed to flow.

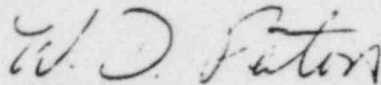
The equation that you used to model groundwater flow, from Bear 1972, assumes a horizontal impervious bottom as a datum from which the terms  $h$ ,  $H$  and  $\bar{h}$  are measured. It is not clear why you are using one datum, i.e., the original potentiometric surface (approximately 622 feet) to measure  $h$  and  $H$  and another lower datum (approximately elevation 607) to measure  $\bar{h}$ .

Have you performed any studies or do you know of the existence of any studies done using a single datum from which to measure  $h$ ,  $H$  and  $\bar{h}$ ? If yes,

- (a) identify these studies,
- (b) do these studies justify your use of two different datums, and
- (c) if the answer to (b) is affirmative, please state the justification provided in these studies.

Provide your justification for using two different datums and show that your resultant groundwater rebound time is at least as conservative as the rebound time would be if computed using a single datum as in Bear, 1972.

Respectfully submitted,



William D. Paton  
Counsel for NRC Staff

Dated at Bethesda, Maryland  
this 2nd day of January, 1981





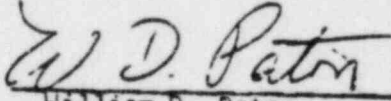
James E. Brunner, Esq.  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Ms. Barbara Stamiris  
5795 N. River  
Freeland, Michigan 48623

Mr. Steve Gadler  
2120 Carter Avenue  
St. Paul, Minnesota 55108

Wendell H. Marshall, Vice President  
Midwest Environmental Protection  
Associates  
RFD 10  
Midland, Michigan 48640

Ms. Sharon K. Warren  
636 Hillcrest  
Midland, Michigan 48640

  
William D. Paton  
Counsel for NRC Staff



review, recordings, memoranda, books, records, writings, letters, telegrams, mailgrams, correspondence, notes and minutes of meetings or of conversations or of phone calls, interoffice, intra-agency or interagency memoranda or written communications of any nature, recordings of conversations either in writing or upon any mechanical or electronic or electrical recording devices, notes, exhibits, appraisals, work papers, reports, studies, opinions, surveys, evaluations, projections, hypotheses, formulas, designs, drawings, manuals, notebooks, worksheets, contracts, agreements, letter agreements, diaries, desk calendars, charts, schedules, appointment books, punchcards and computer printout sheets, computer data, telecopier transmissions, directives, proposals, and all drafts, revisions, and differing versions (whether formal or informal) of any of the foregoing, and also all copies of any of the foregoing which differ in any way (including handwritten notations or other written or printed matter of any nature) from the original.

Interrogatory 1

As a result of settlement and inadequate compaction in the fill area, you have proposed remedial actions and you have agreed to re-analyze the seismic/structural analyses of the Category I structures located in this area.

- (a) Have you verified and evaluated any changes in the design safety margins available for any Category I structures by performing structural re-analysis? *Re-analysis completed (used spring constant by Geot. Engr.)*
- (b) If the answer to (a) is yes, please provide documents related to any structural re-analysis performed.



- (c) If the answer to (a) is no, please state the reasons for not performing that re-analysis.
- (d) If the answer to (a) is no, but you plan to make such re-analysis, please state when you plan to do so.
- (e) Have you factored into any re-analysis information contained in, or resulting from, a letter from Robert Tedesco to Vice President J. Cook, dated October 14, 1980, concerning seismological input data acceptable to the Staff?
- (f) If the answer to (e) is yes, please provide copies of all documents relating to that re-analysis.
- (g) If the answer to (e) is no, please state if you plan to make an analysis incorporating that data, which structures you plan to re-analyze, and when you plan to do so.
- (h) If you believe re-analysis is not required for any such Category I structure, please state for each structure why such re-analysis is not required.
- (i) Was the floor response spectra for the diesel generator building generated on the assumption that the shear wave velocity would not be lower than 500 feet per second? *Yes*
- (j) If the answer to Question (i) is negative, please state the assumption used with respect to shear wave velocity.
- (k) How have you assured yourself that the soil shear wave velocity will not be less than 500 feet per second for the life of the plant?  
*That does not know*

#### Interrogatory 2

The fill material under the northern wing of the service water pump structure has been found to provide inadequate support. While the portion of the structure over the fill material is being supported by the main structure founded on natural material, through cantilever action, it is stated in Management Corrective Action Report No. 24, Interim Report 6, issued September 7, 1978, that the total design loads cannot be supported by the main structure. Your proposed remedial action will utilize corbels attached to

the side of the structural wall by bolts. The corbels are to be supported by pilings placed underneath them.

Yes - Remove & replace - Rejected because of perceived deteriorating problem  
Strengthen structure - Rejected because of feasibility concerns  
= practical considerations

- (a) What alternative corrective actions did you consider for supporting the cantilevered portion of the Service Water Pump Structure?
- (b) Was one of the alternatives considered to provide a stable solid foundation support of the cantilever portion of the structure down to the glacial till rather than the concentrated support design eventually chosen?
- (c) What structural analyses for each of these alternatives did you perform?
- (d) Please provide copies of documents relating to any analysis described in 2(c) above.
- (e) Did you factor into any analysis identified in 2(c) above the information contained in a letter from Robert Tedesco to Vice President J. Cook, dated October 14, 1980, concerning seismological input data acceptable to the Staff?
- (f) Explain why each of the alternatives identified in 2(a) above was rejected or accepted.
- (g) For those alternatives that were rejected, but for which no analysis was identified in 2(c) above, give the reasons for not considering those alternatives.
- (h) What analyses have you done to assure yourselves that the long longitudinal bolts which will be used in the remedial action will withstand the force produced in the bending mode?
- (i) Please provide copies of documents relating to any analysis identified in 2(h).
- (j) If no such analysis has been performed do you plan to do an analysis and if so when?
- (k) Do you have a plan for pre-service and in-service inspection of the integrity of the bolts during the life of the plant?
- (l) If the answer to 2(k) is yes, provide a copy or description of that plan.
- (m) If the answer to 2(k) is no, state the reasons that such a plan is not necessary.

- (n) What type of bracing (if any) will be provided to assure that the vertical piling will resist horizontal forces?
- (o) What analysis have you done to assure the adequacy of any horizontal braces identified in 2(n).
- (p) Please provide a copy of any analysis identified in 2(o).
- (q) What analyses have you done to assure yourselves that the piling under the service water pump structure will provide adequate vertical support after the occurrence of a postulated earthquake (OBE)?
- (r) What analyses have you done to assure yourselves that the piling under the service water pump structure will provide adequate vertical support after the occurrence of a postulated earthquake (SSE)?
- (s) Please provide a copy of any analysis identified in 2(q) and 2(r).
- (t) Did you factor into any analysis identified in 2(r) above the information contained in a letter from Robert Tedesco to Vice President J. Cook, dated October 14, 1980, concerning seismological input data acceptable to the Staff?

### Interrogatory 3

The following questions refer to the remedial actions at the service water pump structure.

- (a) Is the corbel design such that it depends upon a friction-fit with the service water pump structure's north wall resulting from the pre-tensioning of the long longitudinal bolts.
- (b) How have you assured yourselves that this friction-fit will be maintained under all the design loads for the building?
- (c) If the answer to 3(b) is based on tests or other analysis please identify and provide copies of the analysis or test results.
- (d) How have you assured yourself that the concrete at the interface between the corbel and the Service Water Pump Structure can adequately resist bearing pressures developed as a result of pre-tensioning of the bolts.
- (e) If the answer to 3(d) is based on tests or other analysis please identify and provide copies of the analysis or test results.

Interrogatory 4

In the response to Question 15 of the NRC request, regarding plant fill, it is stated that, "differential settlement primarily induces additional strain, which is a self-limiting effect and does not affect the ultimate strength of the structural members." Additional clarification of this statement is needed.

- (a) Why do you classify the resulting strains as self-limiting in nature?
- (b) How do you reconcile your statement quoted above with your statement concerning the Service Water Pump Structure in the Management Corrective Action Report No. 24, Interim Report 6, issued September 7, 1978 that the total design loads cannot be supported by the main structure.

Interrogatory 5

Your responses to Questions 14, 28, and 29 of the NRC request regarding the causes of cracks due to settlement, the significance of the extent of cracks, and the consequences of cracking, addressed only the existing condition of the Category I structures.

- (a) Have you performed analyses which provide tension field data under the design load combinations at any crack locations for each Category I structure.
- (b) Provide documents relating to data or analysis described in Part (a).
- (c) If the answer to (a) is no, state why it is not necessary to perform that analysis.
- (d) Have you performed any analyses to show the limiting tension field conditions in which a crack will not propagate.
- (e) Provide documents relating to data or analysis described in Part (d).
- (f) If the answer to (d) is no, state why you do not believe it is necessary to perform that analysis.



- (g) What analyses have you performed prior to loading or surcharging of any structures or tanks to assure that existing cracks will not further propagate?

Interrogatory 6

Since the fill was replaced by other material, such as lean concrete, in the vicinity of the auxiliary building and of the feedwater valve pits, the soil properties of the foundation material have been changed.

- (a) Have you performed new seismic/structural analyses that utilizes the new soil properties, (e.g. damping valves and shear modules).
- (b) If the answer to (a) is yes, please provide documents relating to such seismic/ structural analysis.
- (c) If the answer to (a) is no, please state the reasons for not performing such new seismic/structural analysis.
- (d) If the answer to (a) is no, please state your basis for concluding that these structures will comply with current NRC criteria.
- (e) If the answer to (a) is yes, have you performed a new soils structural interaction analysis for the auxiliary building and the feedwater isolation valve pits.
- (f) If the answer to (e) is yes, please provide documents relating to that analysis.

Interrogatory 7

Your replies to date indicate that the effectiveness of the proposed ground water well system has not yet been established. These wells will be needed to control the ground water level and prevent soil-liquifaction.

- (a) Will the permanent dewatering system be designed to withstand the safe shutdown earthquake (SSE)?

- (b) If no, will the permanent dewatering system be designed to withstand any lesser ground vibratory motion?
- (c) If the answer to (a) is no, have you evaluated the impact of soil liquification on any soil supported Category I structure.
- (d) If no, why not?
- (e) If the answer to (b) is yes, what ground vibratory motion has been considered?
- (f) If the answer to (a) is yes, have you performed any analysis based upon information contained in or resulting from a letter from Robert Tedesco to Vice President J. Cook dated October 14, 1980 concerning seismological input data acceptable to the Staff?
- (g) If the answer to (f) is yes, what changes in the dewatering system design and ground water drawdown levels were determined to be needed.

Interrogatory 8

In connection with your seismic analysis of the service water pump structure and the diesel generator building have you developed: (1) Lump mass models (2) Stiffness value for each member (3) Mass at each nodes point (4) Spring constants used in the analysis ( $K_o$ ,  $C_o$ ,  $K_x$ ,  $C_x$ ,  $K_y$ ,  $C_y$ ) and (5) Seismic inputs of the modified Taft N21E 1952 record used in this analysis. As to any affirmative answer, please provide copies.

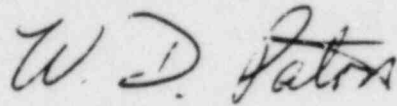
Interrogatory 9

With respect to the seismic Category I valve pits located in the fill adjacent of the east and west side of the diesel generator building:

- (a) What changes, if any, occurred to these pits during the diesel generator surcharge program?

- (b) Do any cracks exist in these pits?
- (c) What changes, if any, occurred in the rattle space for the piping during the diesel generator building surcharge program?

Respectfully submitted,



William D. Paton  
Counsel for NRC Staff

Dated at Bethesda, Maryland  
this 26th day of November, 1980.

UNITED STATES OF AMERICA  
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of )  
CONSUMERS POWER COMPANY ) Docket Nos. 50-329-OM & OL  
(Midland Plant, Units 1 and 2) ) 50-330-OM & OL

CERTIFICATE OF SERVICE

I hereby certify that copies of "NRC STAFF INTERROGATORIES TO CONSUMERS POWER COMPANY" in the above-captioned proceeding have been served on the following by deposit in the United States mail, first class, or as indicated by an asterisk, through deposit in the Nuclear Regulatory Commission's internal mail system, this 26th day of November, 1980:

\*Charles Bechhoefer, Esq.  
Atomic Safety and Licensing Board  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Ms. Mary Sinclair  
5711 Summerset Street  
Midland, Michigan 48640

\*Mr. Gustave A. Linenberger  
Atomic Safety and Licensing Board  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Michael I. Miller, Esq.  
Ronald G. Zamarin, Esq.  
Alan S. Farnell, Esq.  
Isham, Lincoln & Beale  
One First National Plaza  
42nd Floor  
Chicago, Illinois 60603

Dr. Frederick P. Cowan  
6152 N. Verde Trail  
Apt. B-125  
Boca Raton, Florida 33433

\*Atomic Safety and Licensing  
Board Panel  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Frank J. Kelley  
Attorney General of the State  
of Michigan  
Steward H. Freeman  
Assistant Attorney General  
Gregory T. Taylor  
Assistant Attorney General  
Environmental Protection Division  
720 Law Building  
Lansing, Michigan 48913

\*Atomic Safety and Licensing  
Appeal Board Panel  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555

Myron M. Cherry, Esq.  
1 IBM Plaza  
Chicago, Illinois 60611

\*Docketing and Service Section  
Office of the Secretary  
U. S. Nuclear Regulatory Commission  
Washington, D.C. 20555



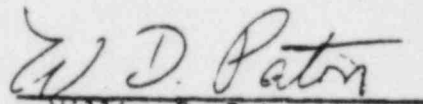
James E. Brunner, Esq.  
Consumers Power Company  
212 West Michigan Avenue  
Jackson, Michigan 49201

Ms. Barbara Stamis  
5795 N. River  
Freeland, Michigan 48623

Mr. Steve Gadler  
2120 Carter Avenue  
St. Paul, Minnesota 55108

Wendell H. Marshall, Vice President  
Midwest Environmental Protection  
Associates  
RFD 10  
Midland, Michigan 48640

Ms. Sharon K. Warren  
636 Hillcrest  
Midland, Michigan 48640

  
\_\_\_\_\_  
William D. Paton  
Counsel for NRC Staff

Copy forwarded to COE on 11/7/80

J Kane  
Rec'd. 11/7/80  
from L. Heller



# MEB Interrogatories

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D. C. 20555

NOV 6 1980

MEMORANDUM FOR: F. J. Miraglia, Acting Chief, Licensing Branch #3, DL  
FROM: R. J. Bosnak, Chief, Mechanical Engineering Branch, DE  
SUBJECT: INTERROGERATORIES FOR UNDERGROUND PIPING IN THE RANDOM  
FILL AREA AT THE MIDLAND NUCLEAR PLANT

Please find enclosed pages 1 and 2 of the Enclosure to ETEC letter 80ETEC-DRF-4465 transmitting interogatories for Consumer's Power Company. These questions are submitted in connection with the discovery period related to the upcoming hearings on the "Order Modifying Construction Permits CPPR-81 and 82". We will require a rapid response to these questions so that an evaluation can be made prior to the hearings.

R. J. Bosnak, Chief  
Mechanical Engineering Branch  
Division of Engineering

Enclosure: As stated

cc: J. P. Knight, DE  
H. L. Brammer, DE  
F. C. Cherny, DE  
D. Hood, DL  
W. Paton, ELD  
J. Kane, DE  
L. Heller, DE  
F. Rinaldi, DE  
R. Gonzales, DE

Contact: A. Cappucci, DE:MEB, x29476

8011240220

11/30/80

QUESTIONS FOR CONSUMERS POWER COMPANY CONCERNING  
THE DEFORMATIONS OF BURIED PIPING DUE TO  
DIFFERENTIAL SOIL SETTLEMENT AT MIDLAND PLANT UNITS 1 AND 2

Reference Responses to the NRC 10 CFR 50.54(f) Request Regarding  
Plant Fill for Midland Plant Units 1 and 2, Consumers  
Power Company, Docket Numbers 50-329 and 50-330.

- 1) What were the criteria for determining which of the Category I buried lines were to be profiled and what was the justification for these criteria?
- 2) It appears that in some sections of the profiled lines the stresses are considerably higher than those listed in the reference. What is the method used to calculate the stresses in these lines due to the differential soil settlement?
- 3) There are sections of the profiled lines where the slope changes rather rapidly. This would indicate high local bearing loads. What are the magnitudes of these loads, type of load and their probable cause?
- 4) The sections of line where the slope changes rapidly could have high bearing loads and also high bending stresses. What assurance is there that local buckling will not occur in these areas?
- 5) What action is contemplated for buried pipes if the stresses due to the ground settlement are greater than the Code allowable for  $3 S_c$ ?
- 6) What assurance is there that the deformed lines do not induce high nozzle or component loads? Some of the profiled lines have considerable slope at attachment points to other pipes, tanks etc., and at building penetrations. If these lines were forced into position to make the final closure weld or the settlement occurred mainly after the final closure welds were made, high stresses could be induced into the piping, components, and supports.

pipes close  
only profile one  
SW piping  
typified all other

- 7) Have methods for measuring in situ stresses in the deformed piping been investigated or tried? If not, why not? This may be the only method of determining the stresses in some areas where the final closure welds have been made before the major portion of the settlement occurred or where there is a concentrated load due to some unknown phenomenon.
- 8) If the stresses in the profiled lines exceed code allowables, how will this be related to the non-profiled lines? Does Bill Paton have problems asking new work?
- 9) Current profiles reflect present settlement only. How do you plan to account for the additional settlement that occurs over the life of the plant? Establish Monitoring Requirements?
- 10) What are the criteria for the minimum rattle space of Category I piping at building penetrations and do all the Category I piping penetrations meet these criteria? If not, what corrective action is proposed?
- 11) Due to the slope of some of the lines at building penetrations it appears that there could be clearance on one side of the penetration and contact on the other. What assurance is there that there is sufficient clearance over the length of the penetration to accommodate the differential settlement between the pipe and the building and the expected seismic excitations?
- 12) The accuracy (and reliability) of the method used to profile the pipes should be clarified. More about Aqueduct

Do you know if the