MISSISSIPPI POWER & LIGHT COMPANY

GRAND GULF NUCLEAR STATION
UNIT 1

PRIMARY REACTOR CONTAINMENT
STRUCTURAL INTEGRITY TEST

FINAL REPORT

JANUARY 1982

MISSISSIPPI POWER AND LIGHT COMPANY

GRAND GULF NUCLEAR STATION
UNIT 1

PRIMARY CONTAINMENT
STRUCTURAL INTEGRITY TEST REPORT

Bechtel Power Corporation
San Francisco, California
January 1982

CONTENTS

FIGURES

1. INTRODUCTION

The Unit 1 Containment Structural Integrity Test was conducted during the time period December 31, 1981 to January 2, 1982. The primary purpose of the structural integrity test was to verify the design and structural integrity of the containment structure by imposing one hundred and fifteen percent of the design pressure for a period of not less than one hour.

In order to accomplish the intended test purpose, specialized measuring devices were installed in the containment structure to provide the data needed to evaluate structural response during pressurization and depressurization. The tests were conducted in accordance with written procedure Q1M61-W-11302WXA (Reference 2), detailing test requirements and instructions for acquiring test data. This procedure is a part of the permanent plant records at the Grand Gulf Nuclear Station.

2. SUMMARY AND CONCLUSIONS

The containment structural integrity test provided proof of the structure's ability to contain the internal design pressure and provided measurement of structural response to changes in internal pressure. Test measurements for the containment included gross structural deformations and concrete crack growth. Measurement points were located at typical sections of the structure with measurements obtained at specified stages during the pressurization cycle. The structure withstood the internal pressure with no observable indications of structural distress. All measured structural deformations were less than the design allowable values. All dome and vertical measurement points recovered more than 70 percent of their maximum deflection. Radial deflections at the elevation of maximum average deflection recovered more than 70 percent of their maximum deflection, also.

Changes in concrete cracks observed in the various surveillance areas did not change in measured width by more than 0.010 inches. This is considered to be within reasonable expectations based on the results of previous tests and does not adversely affect the integrity of the structure. Prior to the start of pressurization, no cracks with widths equal to or exceeding 0.010 inches were observed in the inspection areas. Cracks developed in two of the six mapping areas during pressurization and closed to below measurable values at zero pressure.

The results of the structural integrity test provide direct experimental evidence that the containment structure can contain the internal design pressure with a sufficient margin of safety and that the gross response to pressure is predictable.

3. STRUCTURE AND PRESSURIZATION

The containment is a reinforced concrete structure designed to act as a pressure barrier during postulated loss-of-coolant accidents as defined in the Final Safety Analysis Report (Reference 1). The structure consists of a reinforced concrete cylinder and hemispherical dome connected to and supported by a massive reinforced concrete base slab as shown in Figure 3-1. Reinforced openings in the cylinder are provided for equipment and personnel access as well as for electrical and mechanical feed through.

Principal dimensions for the containment structure are:

o Inside diameter	124 ft.
o Inside height	206 ft. 8-1/2 in.
o Vertical wall thickness	3 ft. 6 in.
o Dome thickness	2 ft. 6 in.
o Foundation slab thickness	9 ft. 6 in.

The containment structure was pressurized pneumatically to verify the required structural integrity. The internal peak pressure of 17.25 psig was held for a period of two hours to record structural data. For details of the pressure cycle see Figure 3-2.

The suppression pool and upper containment pool were both filled with water to their normal level for plant operation to provide the proper load on the containment and basemat.

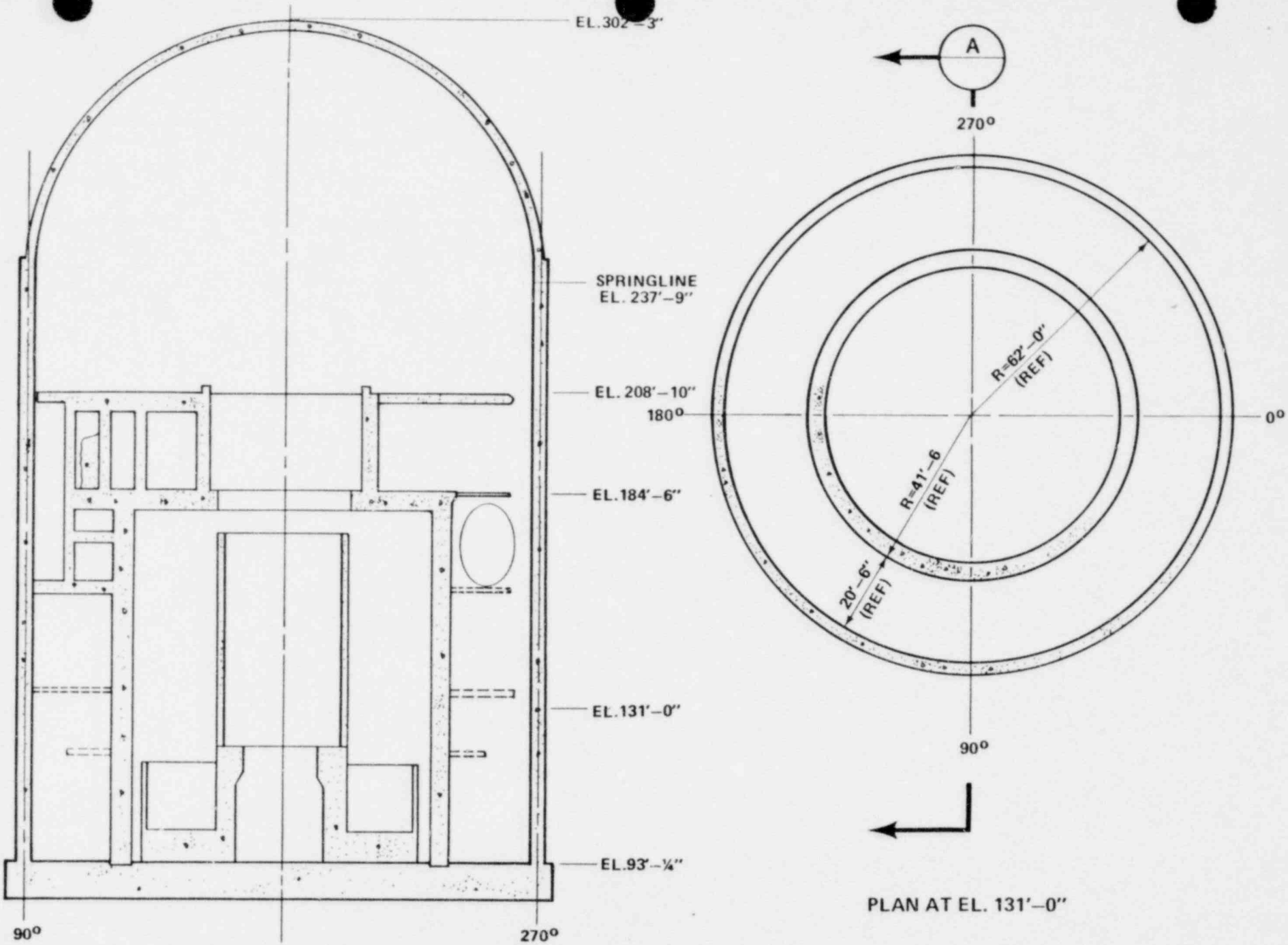


FIGURE 3-1 CONTAINMENT STRUCTURE

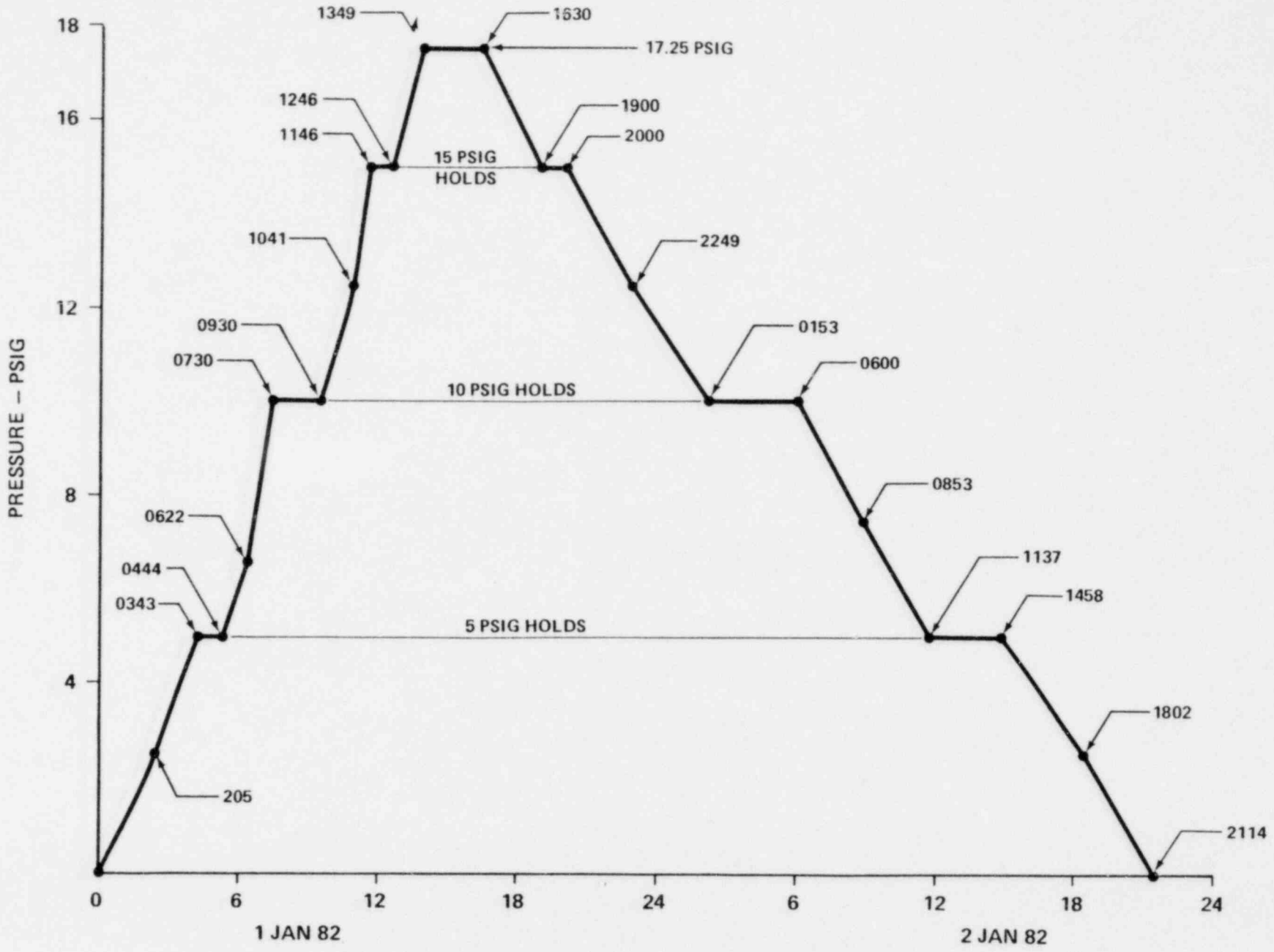


FIGURE 3-2 SIT PRESSURE CYCLE

4. TEST PLAN AND PROCEDURES

Test measurements were made at points on the containment structure which represented typical areas to provide data on structural behavior during the pressure test. The measured parameters consisted of gross structural deformation and concrete crack growth.

Gross structural deformations were measured using taut wire extensometers which spanned between points on the containment wall, dome, and springline and fixed points within and outside the structure. The extensometers were located to measure radial displacements along typical wall sections and around the lower equipment hatch, vertical displacement of the dome relative to the operating floor, and vertical displacement of the springline relative to the foundation slab. The layout of the extensometer system is shown in Figures 4-1 through 4-3 and exact locations are listed in Table 4-1.

The extensometers, illustrated in Figure 4-4, consist of displacement transducer assemblies and low expansion alloy (invar) taut wires. A movement between opposing points on the containment shell or between a point on the containment shell and a fixed reference structure results in an almost equal movement between the core and body of the linear variable differential transformer (LVDT) which is housed in the transducer assembly. The LVDT output is a voltage which is proportional to the position of the core within the body. The spring in the transducer assembly maintains a nominal 20 lb tension on the wire to reduce sag and eliminate slack at threaded and swivel connections.

The extensometers are calibrated to establish the displacement - voltage characteristics and spring constant (nominally 2 lb/in). Spring constant is used to correct for the small changes in wire length which result from transducer displacement. The transducers were calibrated prior to shipment to the Grand Gulf Nuclear Station and again at the station. The two sets of calibration data agreed to within the required limits of accuracy.

The transducer's swivels and opposing taut wire ends were secured to fittings which were welded to the containment liner and other metal structures and epoxy bonded or expansion anchored to concrete. Following initial attachment, the transducers were aligned with the wires to eliminate LVDT core side loading and the core positions adjusted to provide the desired travel.

The LVDT's were wired to excitation power supplies and a scanning data acquisition system which converted LVDT output voltage to a digital format for register display, printed record, and direct entry into a microcomputer. The computer was programmed with extensometer calibration constants and a routine which converted raw voltage data into displacement units.

During the structural integrity test the deformation data were recorded at 2.5 psig pressure increments and decrements, at the beginning and end of all constant pressure holds, and at regular intervals during extended holds. Additional data were recorded following depressurization to monitor post-test structural recovery and during the subsequent integrated leakage rate test. At each data acquisition point all voltages were recorded three times in rapid succession to provide a 2 out of 3 basis for identifying spurious values caused by electrical transients. The recording of 3 complete records required about 2 minutes.

Concrete crack patterns were mapped in the areas shown in Figure 4-5. The lengths and widths (measured by optical comparator) of all visible cracks within these areas were recorded prior to the start of pressurization, at 10 psig during pressurization, at peak test pressure, and following the completion of depressurization.

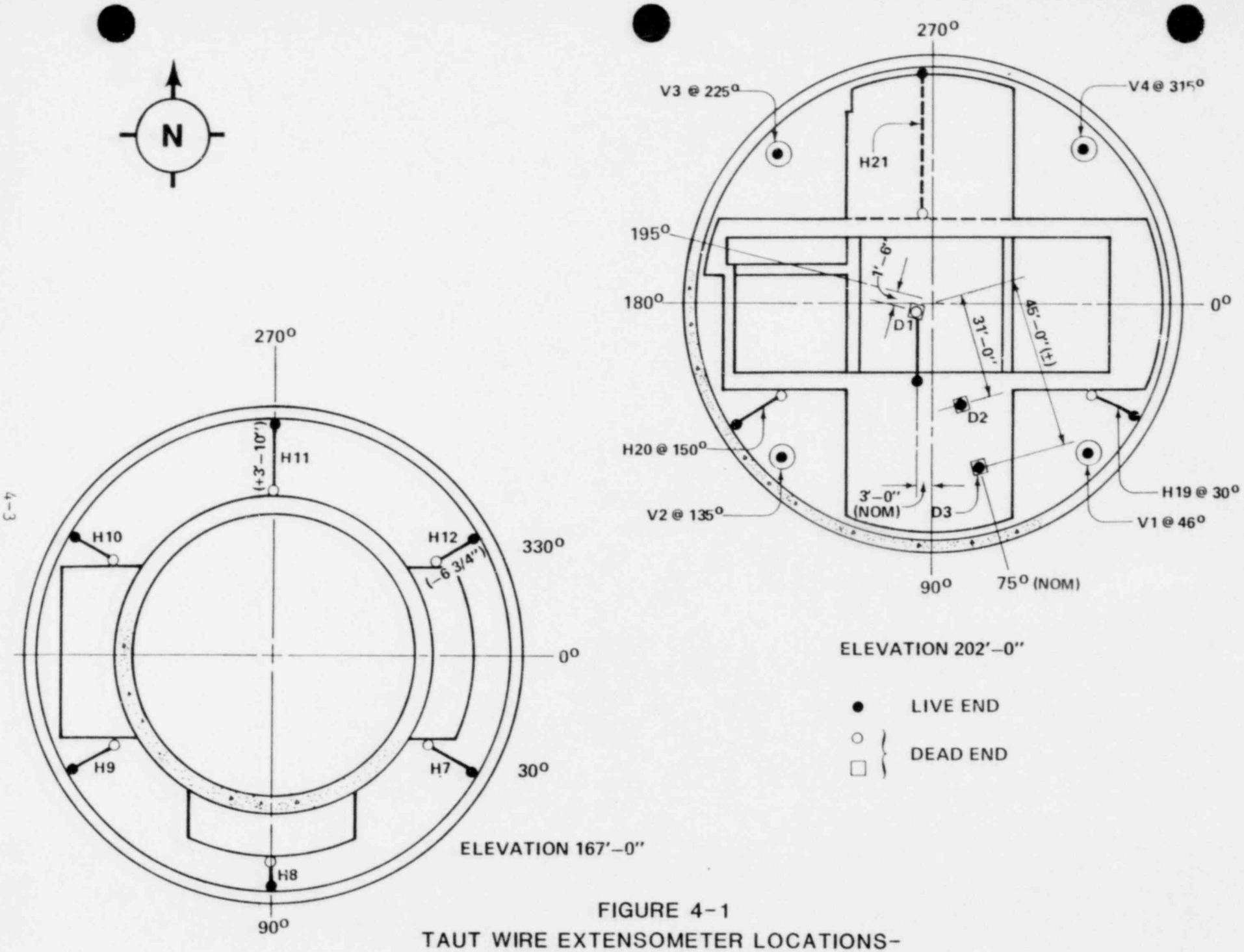
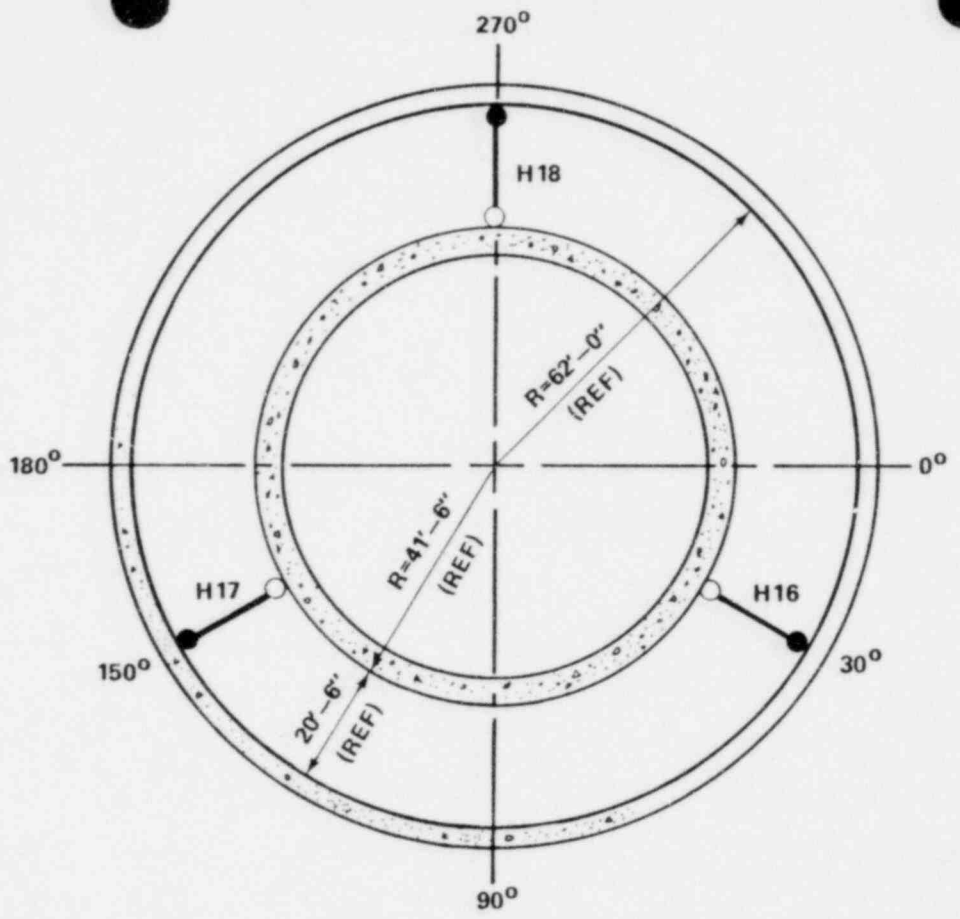
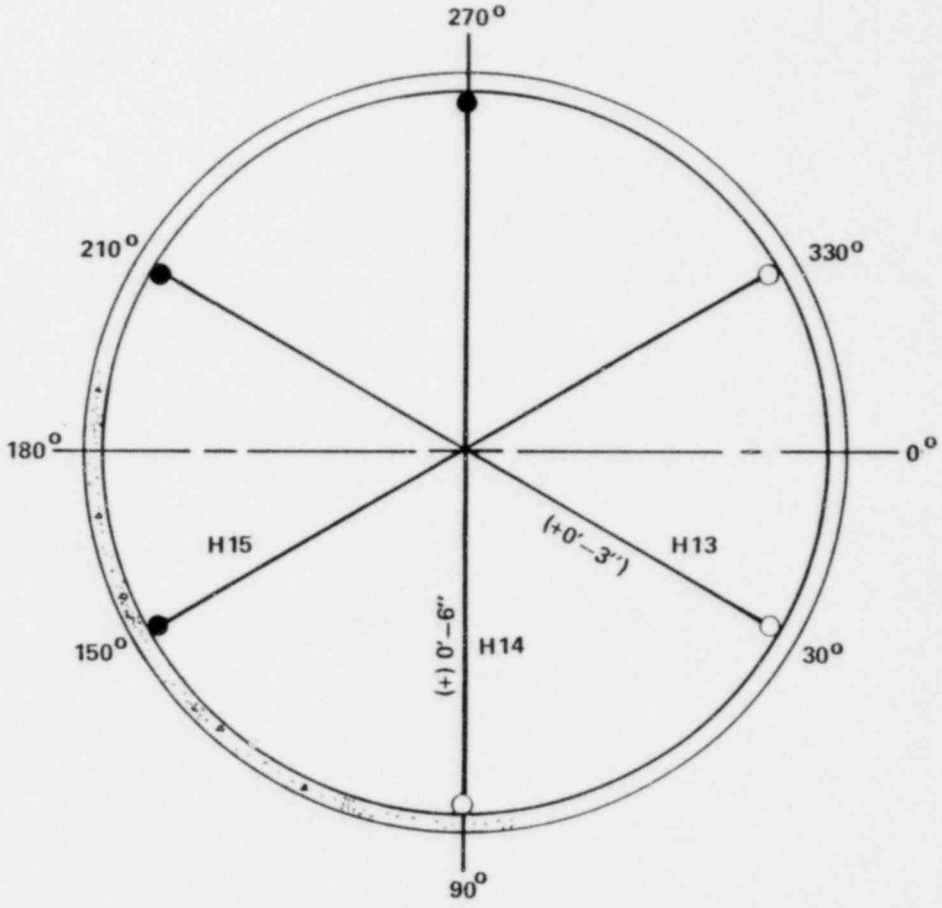


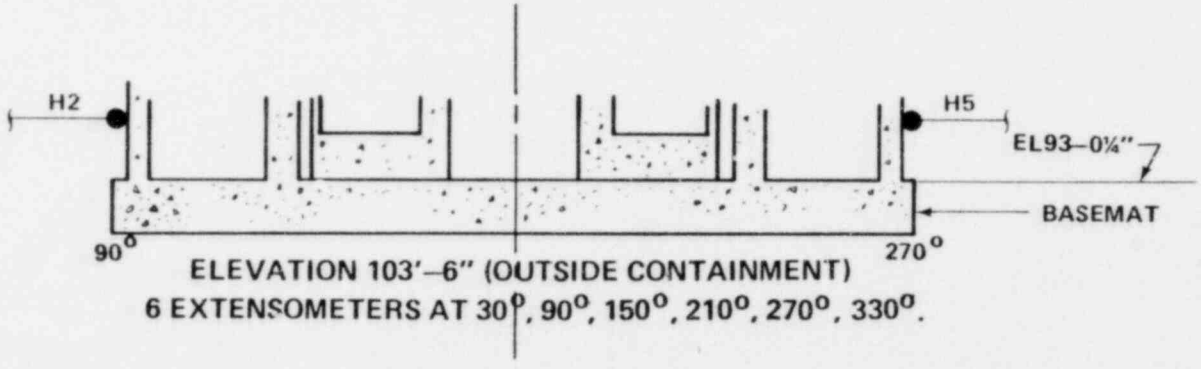
FIGURE 4-1
TAUT WIRE EXTENSOMETER LOCATIONS-
RADIALS AT ELEVATIONS 167' AND 202', DOMES, AND VERTICALS



ELEVATION 131'-0"



ELEVATION 230'-0"



ELEVATION 103'-6" (OUTSIDE CONTAINMENT)
6 EXTENSOMETERS AT 30°, 90°, 150°, 210°, 270°, 330°.

FIGURE 4-2 TAUT WIRE EXTENSOMETER LOCATIONS - RADIALS AT ELEVATIONS 103'-6", 131', AND 230'

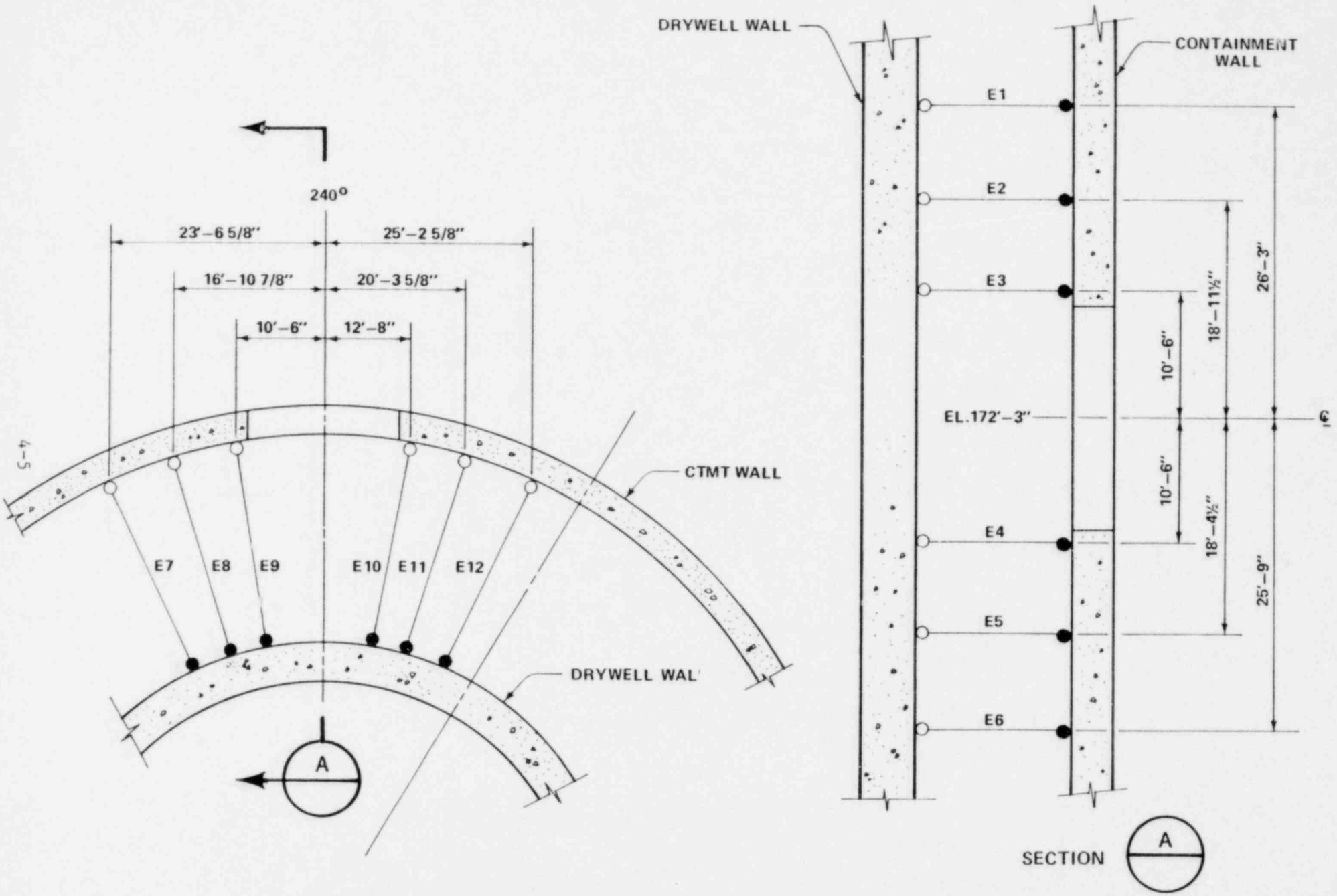


FIGURE 4-3 TAUT WIRE EXTENSOMETER LOCATIONS - EQUIPMENT HATCH

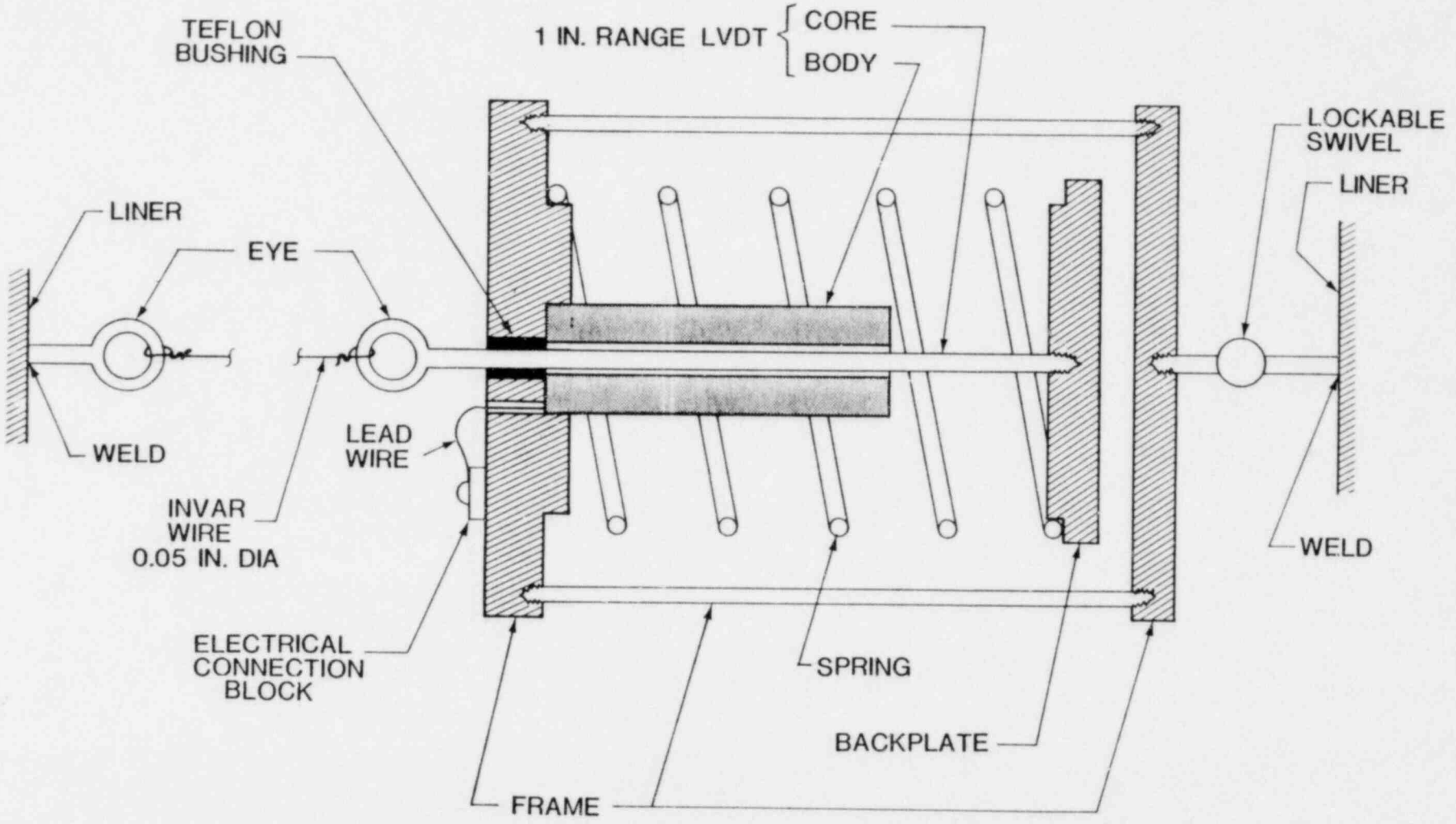


FIGURE 4-4
SCHEMATIC REPRESENTATION OF TAUT WIRE EXTENSOMETER

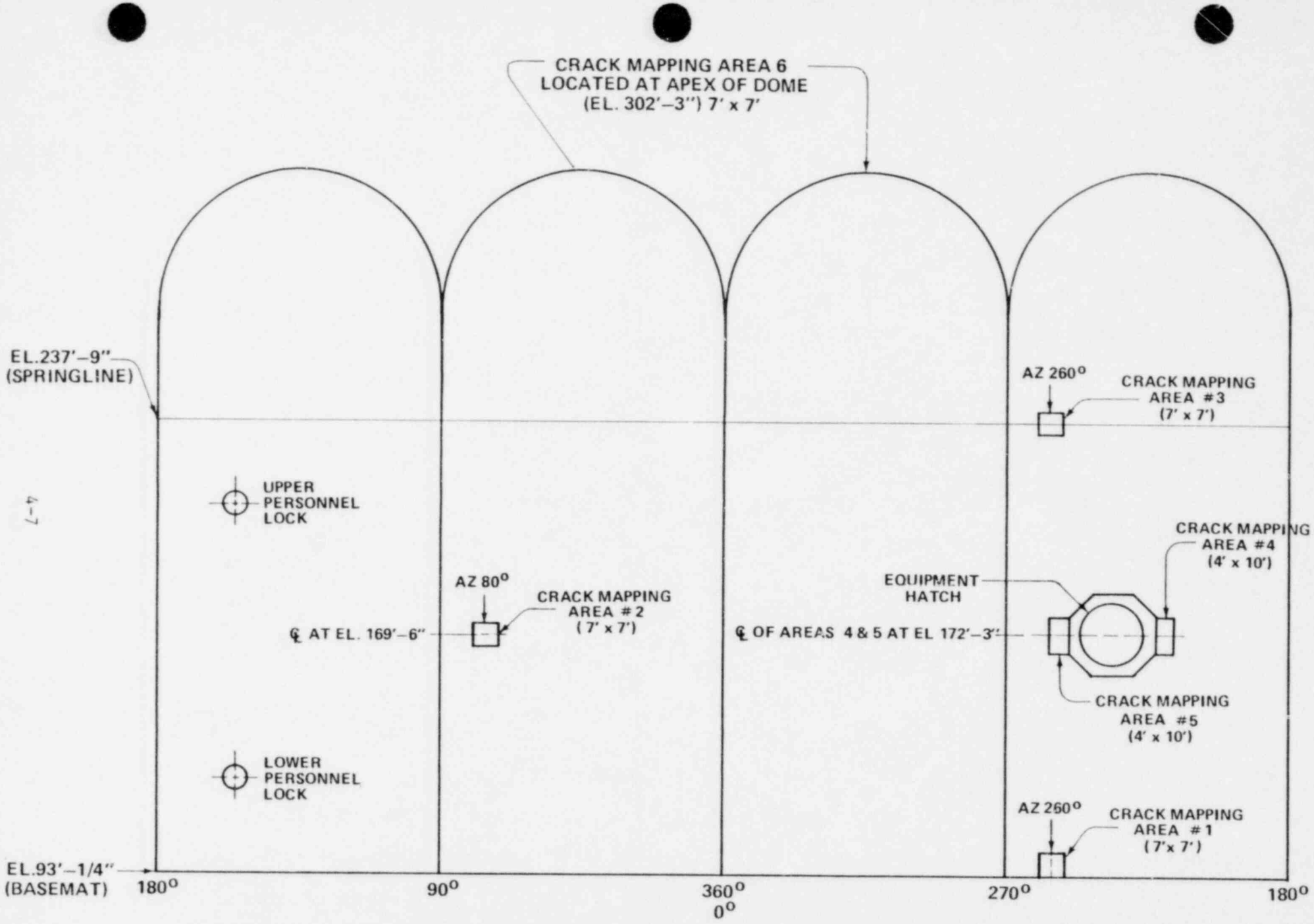


FIGURE 4-5 CONCRETE CRACK MAPPING AREAS

TABLE 4-1
EXTENSOMETER LOCATIONS

Table	Extensometer	Elevation Radials (H) and Hatch (E) or Radius Verticals (V) and Dome (D)	Azimuth
A-2	H-1	EL. 103'-0"	30°
A-3	H-2	EL. 103'-0"	90°
A-4	H-3	EL. 103'-0"	150°
A-5	H-4	EL. 103'-0"	210°
A-6	H-5	EL. 103'-0"	270°
A-7	H-6	EL. 103'-0"	330°
A-8	H-7	EL. 167'-0"	30°
A-9	H-8	EL. 167'-0"	90°
A-10	H-9	EL. 167'-0"	150°
A-11	H-10	EL. 167'-0"	211°-08'
A-12	H-11	EL. 167'-0"	270°
A-13	H-12	EL. 167'-0"	330°
A-14	H-13	EL. 230'-0"	210°
A-15	H-14	EL. 230'-0"	270°
A-16	H-15	EL. 230'-0"	150°
A-17	H-16	EL. 131'-0"	30°
A-18	H-17	EL. 131'-0"	150°
A-19	H-18	EL. 131'-0"	270°
A-20	H-19	EL. 202'-0"	30°
A-21	H-20	EL. 202'-0"	150°
A-22	H-21	EL. 202'-0"	270°
A-23	D-1	R 3'-1"	165°-30'
A-24	D-2	R 31'-0"	75°
A-25	D-3	R 45'-0"	75°
A-26	V-1	R 61'-8"	46°
A-27	V-3	R 61'-8"	225°
A-28	V-4	R 61'-8"	315°
A-29	E-1	EL. 198'-6"	240°
A-30	E-2	EL. 191'-2-1/2"	240°
A-31	E-3	EL. 182'-9"	240°
A-32	E-4	EL. 161'-9"	240°
A-33	E-5	EL. 153'-10-1/2"	240°
A-34	E-6	EL. 146'-6"	240°
A-35	E-7	EL. 172'-6"	217°-47'
A-36	E-8	EL. 172'-3"	223°-14'
A-37	E-9	EL. 172'-6"	230°-14'
A-38	E-10	EL. 168'-2"	247°-07'
A-39	E-11	EL. 172'-7-1/4"	259°
A-40	E-12	EL. 172'-0"	264°

5. TEST RESULTS

The results of the structural integrity test provide direct experimental evidence that the containment structure can contain the design internal pressure with an ample margin of safety. Further, the test data confirm the validity of the analytical methods employed to determine the structural effects of loading combinations and to predict the resulting deflections.

5.1 CONTAINMENT STRUCTURE DEFLECTIONS

The response of the containment to the maximum test pressure of 17.3 psig is illustrated in Figures 5-1 and 5-2. Figure 5-1 shows the measured radial and vertical growth of the cylinder wall and the measured vertical growth of the dome as well as the predicted growth based on both elastic and cracked section analyses. The measured vertical growth of the dome and wall is less than the elastic case prediction. This demonstrates that the stress in the dome and the vertical stress in the wall were not sufficient to cause extensive tensile cracking. It further demonstrates that the actual elastic modulus of the concrete is higher than that used in the computations. The radial growth of the wall is between the elastic and cracked wall section case predictions. This demonstrates that hoop stress caused tensile cracking but did not develop the complete cracked section used as a model in the cracked section analysis.

The wall radial deflections listed and plotted in Figure 5-1 are averages of the measurements made on several azimuths at each elevation. The individual measurements made at each elevation show a variation from azimuth to azimuth which is attributed to round out of minor irregularities in the cylinder wall. This behavior is typical for concrete containments and is expected for any singly curved structural element which does not have a perfectly true radius. In contrast the measured dome deflections show a smooth trend which is typical for a doubly curved surface. The measured wall vertical deflection listed in the figure is the average of the measurements at extensometers V1, V3, and V4 (V2 malfunctioned). Here the individual measurements are tightly grouped as is expected for the uncurved direction on the wall.

Figure 5-2 shows the measured radial growth of the wall in the vicinity of the equipment opening. The deflections measured along the horizontal center plane of the hatch are approximately symmetrical about the vertical center line. Measurements along the vertical center plane of the hatch show that the outward movement in the vicinity of the hatch increased with elevation. This behavior is typical for a large opening located close to the containment base mat.

Deflection/pressure histories at various points on the containment are illustrated in Figures 5-3 through 5-6 and all measured deflections are listed in Tables 5-1 through 5-39. The plotted deflection/pressure histories all show essentially linear response during the initial

stages of pressurization and throughout depressurization. Deviations from linearity are the deflection lags at the start of pressurization/depressurization, creep response at constant pressure hold periods, and the increase in slope at higher pressures during pressurization.

The lag results from friction between moving parts of the extensometer and is normally not evident at the start of the test since the extensometer is initially set for motion in the proper direction. Where lag does occur at the start of the test, it is generally due to the extensometer being disturbed after being set. Lag at the start of depressurization is always evident, except for extensometers with very short wires. This lag results from a reversal of friction forces in the extensometer and a consequent shortening of the wire. Lag effects are corrected for where required by extrapolating the linear part of the plot through 0 psig (initial lag) or 17.3 psig (depressurization lag) and calculating the deflection on the extrapolated line at this pressure. The difference between the deflection on the extrapolated line and the measured deflection at the same pressure is added to (initial lag) or subtracted from (depressurization lag) subsequent measurements to provide corrected values. The correction procedure is illustrated in Figures 5-3 and 5-5.

Creep response of the concrete is generally evident at the constant pressure hold periods, particularly at higher pressures. This is expected and typical for reinforced concrete structures.

All extensometers show on essentially linear deflection/pressure characteristic at low pressures which demonstrates initial elastic behavior of the containment. The characteristics for the dome and wall vertical extensometers remain linear through peak test pressure thus verifying the previously stated conclusion that the stresses in the dome and in the vertical direction in the wall are not sufficient to cause extensive tensile cracking and consequent departure from elastic response. The wall radial and equipment opening extensometers show significant changes in the deflection/pressure slope at varying levels of higher pressure. The point where the slope breaks represents initial tensile cracking. If the initial slopes of the wall radial extensometers are extrapolated to 17.3 psig and corrected for initial lag as required (see Figure 5-3), the displacements on the extrapolated lines at peak test pressure are quite close to the displacement predicted using the elastic case. This further verifies the validity of the constants and techniques used in containment analysis.

The recovery of containment deflections following the completion of depressurization was at least the required 70 percent at the points of maximum deflection. All dome and the three functioning vertical extensometers recovered over 70 percent of their maximum displacements. Radial extensometers at elevation 167'-0", the maximum expected deflection location, recovered 74 percent (after correcting for lag) of the average deflection of 0.178 inches. The two extensometers which measured the largest deflections at that elevation recovered over 80 percent of the deflected value. The largest average measured deflection occurred at elevation 202'-0", where three extensometers were located.

The average maximum deflection at that elevation was 0.226 inches. The extensometers recovered 72.1 percent of the maximum value. The radial extensometer recovery data are based on readings taken after the ILRT, with readings ending at noon, January 5, 1982. Final deflection values for all extensometers are listed in Tables 5-1 through 5-39. Final values are adjusted for extensometer lag where noted on the tables.

5.2 CONTAINMENT CONCRETE CRACKING

The patterns of surface concrete cracks on the containment wall at specified internal pressures are shown in Figures 5-7 through 5-12. A variety of surface cracks were mapped immediately prior to pressurization, and a minimum number showed increases in length or width during the pressurization cycle. This is consistent with the low deflections recorded. The observed crack patterns are typical of those found on reinforced concrete containment structures.

During the subsequent ILRT pressure cycle to 12.5 psig, cracks which appeared in Crack Mapping Area 2 were monitored. Those cracks enlarged slightly from the zero pressure recovery value, and returned to hairline width which was not accurately measurable with the optical comparators. Growth during the ILRT pressure cycle was estimated at 0.002 inches at the locations observed.

5.3 ESTIMATED ACCURACY OF MEASUREMENT

The accuracy of measurement is based on the following items:

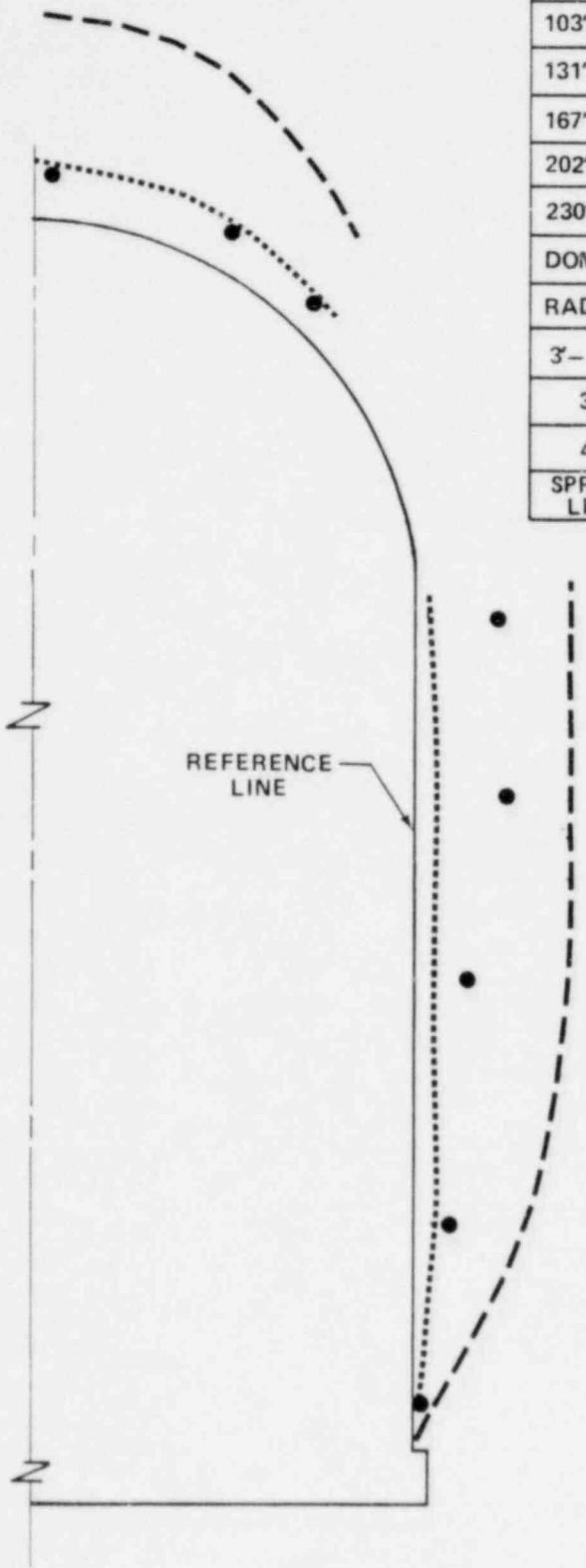
- Calibration of instrumentation
- Laboratory testing as in the case of invar wire
- Human factor, i.e., judgement of the reader

Displacements in the containment structure were measured using taut wire extensometers. Accuracy of the extensometer is $\pm$ 0.002 inches so long as wire tension remains constant. When the direction of pressurization changes, extensometer response lags due to friction in the mechanism. Typical lag is 0.02 inches for a 100-foot long wire.

The crack patterns were measured using optical comparators calibrated to measure crack width of 0.001 inches and wider. However, since most cracks observed on the containment were irregular traces on coarse textured concrete surfaces, it was not generally possible to estimate true crack width to better than approximately 0.003 inches. For this reason, reported crack widths are considered to be accurate to within $\pm$ 0.003 inches.

DEFLECTIONS (INCHES)

WALL					
EL	MIN	MAX	AVG	PRED [1]	PRED [2]
103'–6"	.024	.044	.034	.08	.01
131'–0"	.056	.082	.071	.38	.05
167'–0"	.084	.283	.178	.42	.05
202'–0"	.201	.271	.226	.42	.05
230'–0"	.184	.249	.214	.39	.04
DOME					
RADIUS	–	–	DEFL	PRED [1]	PRED [2]
3'–1"	–	–	.114	.54	.15
31'	–	–	.112	.51	.15
45'	–	–	.107	.46	.14
SPRING LINE	.027	.034	.031	.20	.08



0 .20 .40 .60

SCALE – INCHES

CRACKED ANALYSIS DISPLACEMENT

ELASTIC ANALYSIS DISPLACEMENT

MEASURED VALUE

NOTES:

1. PREDICTED DISPLACEMENT FROM CRACKED ANALYSIS
2. PREDICTED DISPLACEMENT FROM ELASTIC ANALYSIS

FIGURE 5-1 CONTAINMENT STRUCTURE AVERAGE DEFLECTIONS AT 17.25 PSIG -WALL AND DOME

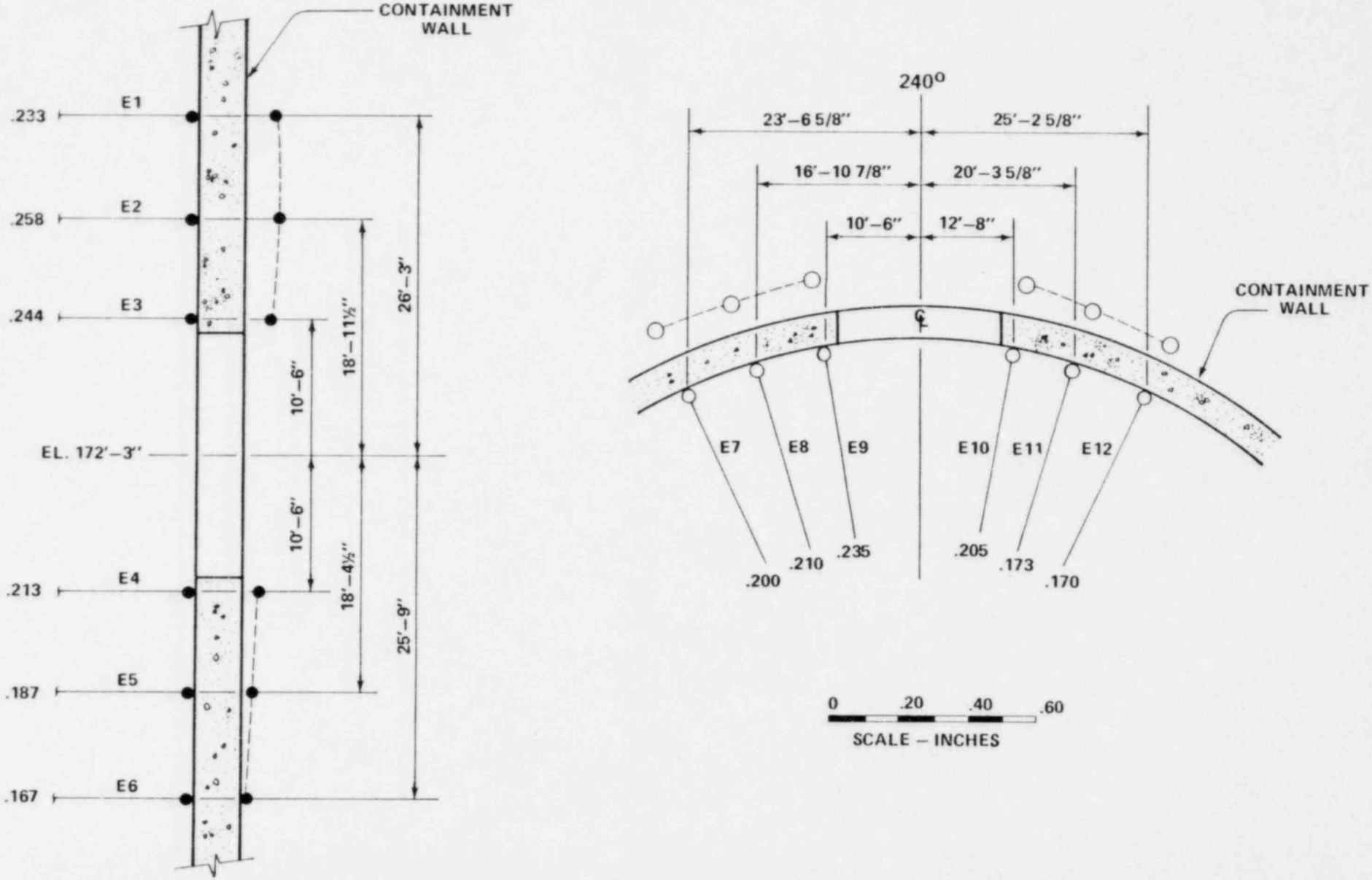


FIGURE 5-2
CONTAINMENT STRUCTURE DEFLECTIONS AT 17.25 PSIG-EQUIPMENT HATCH RADIAL

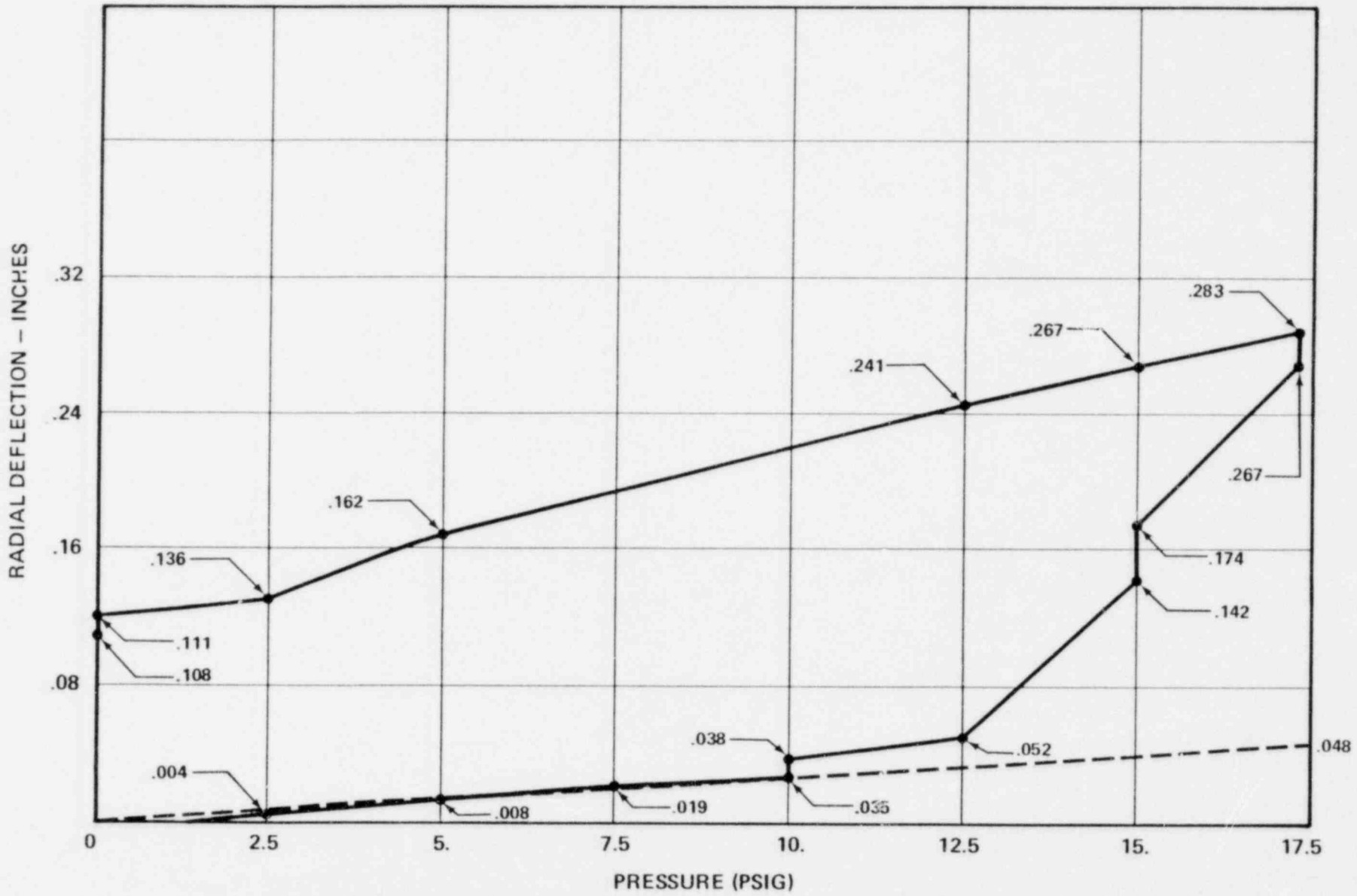


FIGURE 5-3 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT WALL-H8

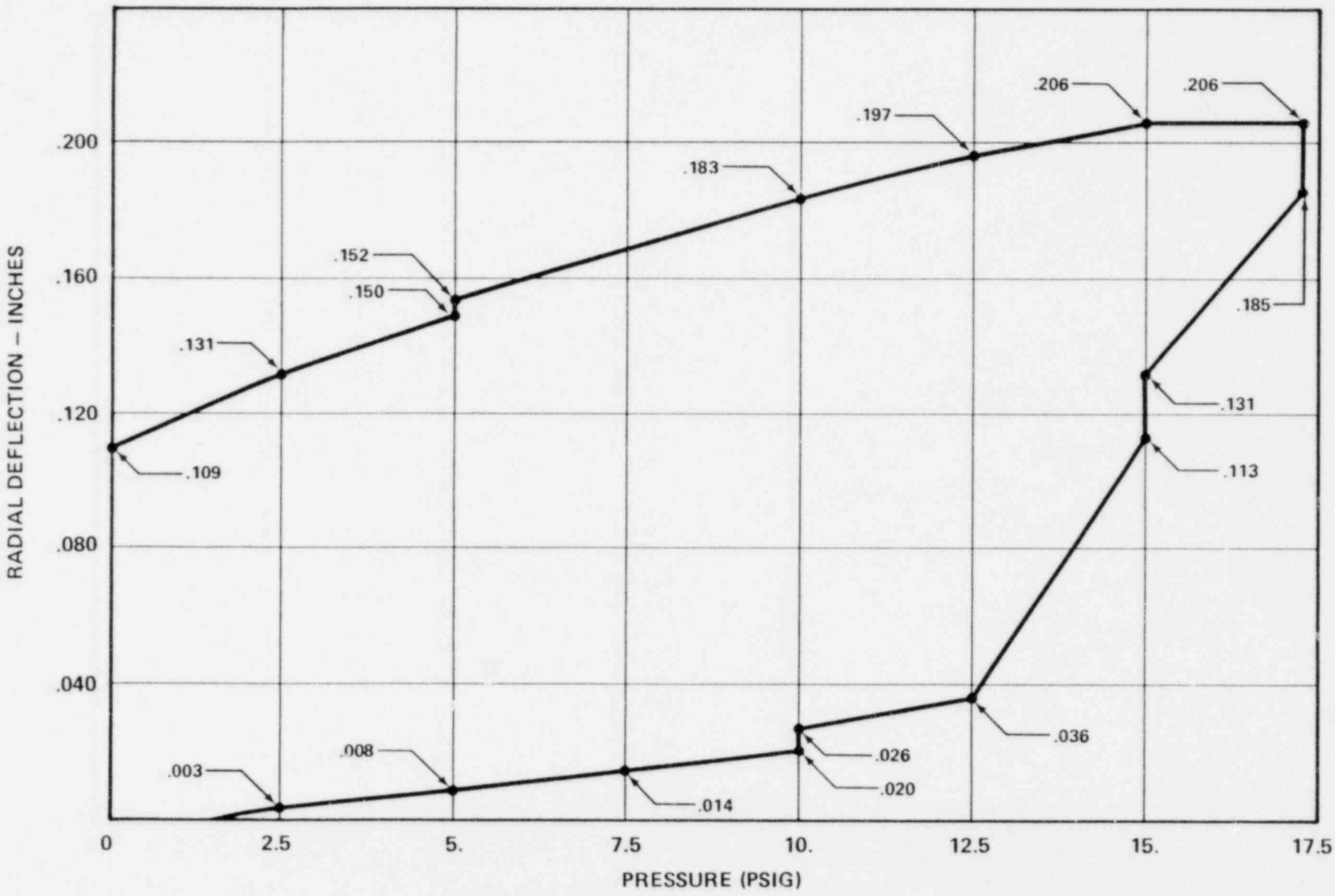


FIGURE 5-4 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT WALL-H21

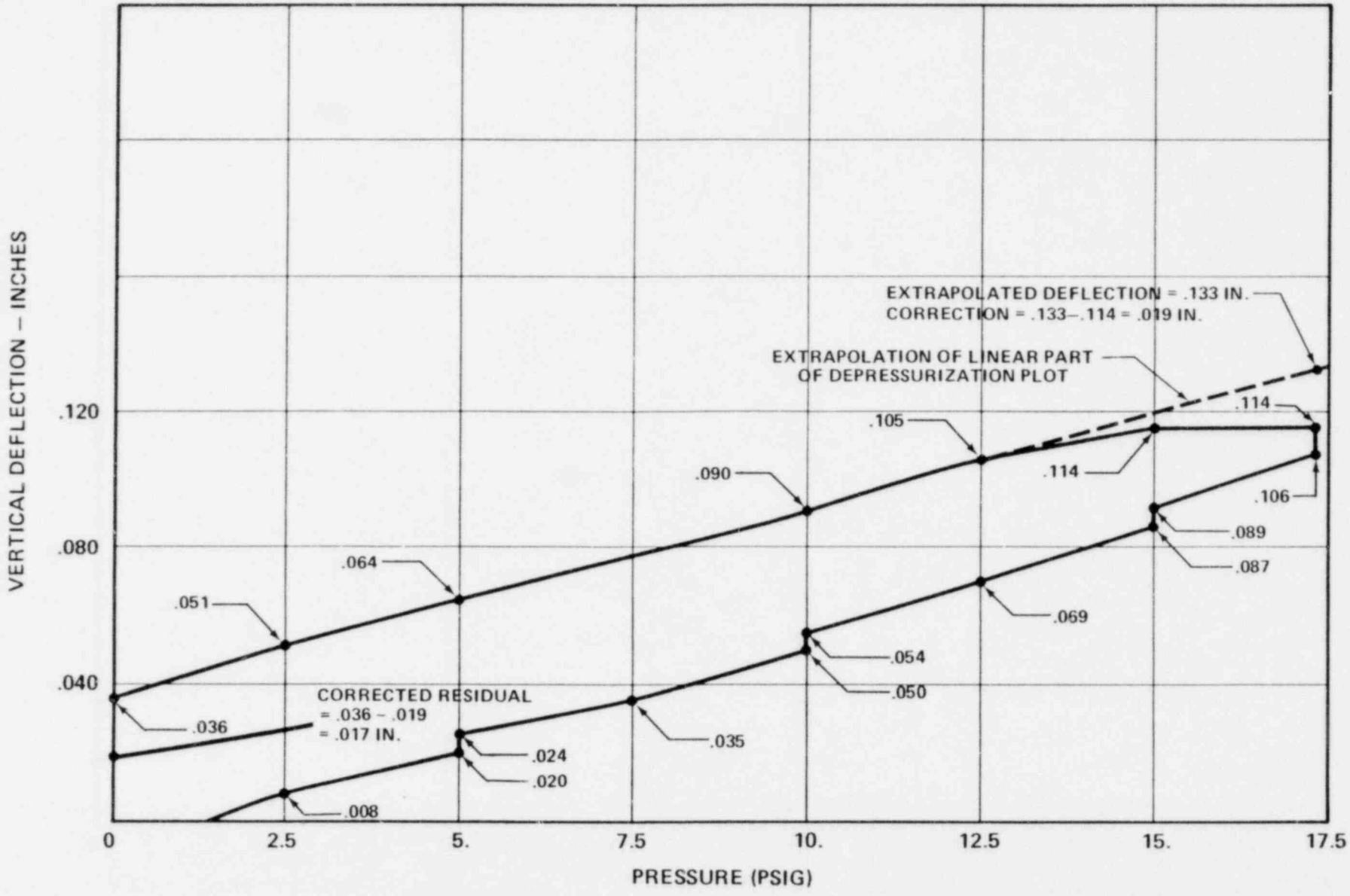


FIGURE 5-5 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT DOME-D1

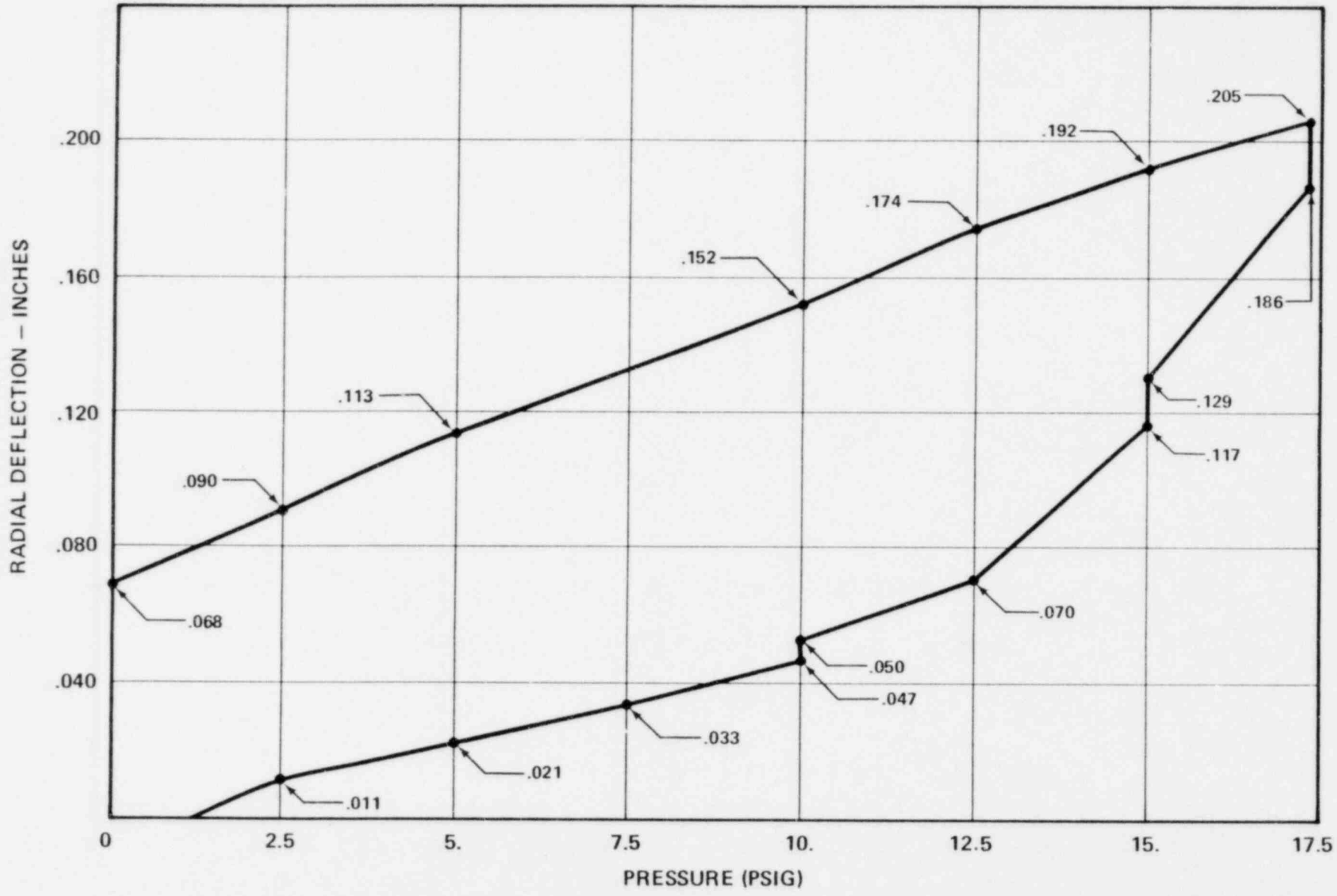
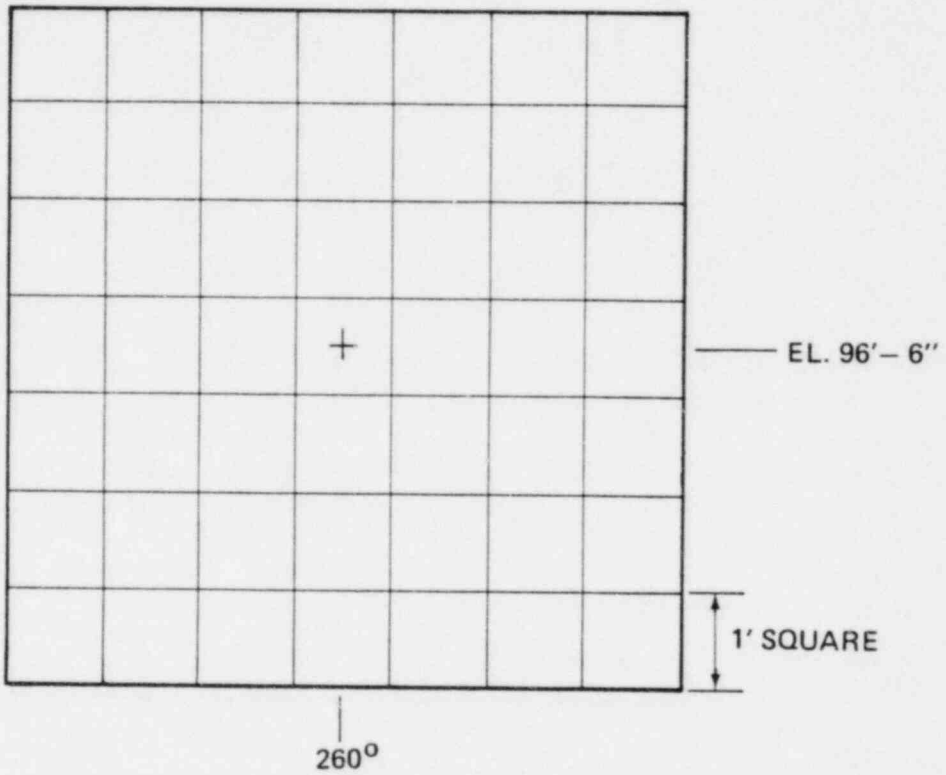
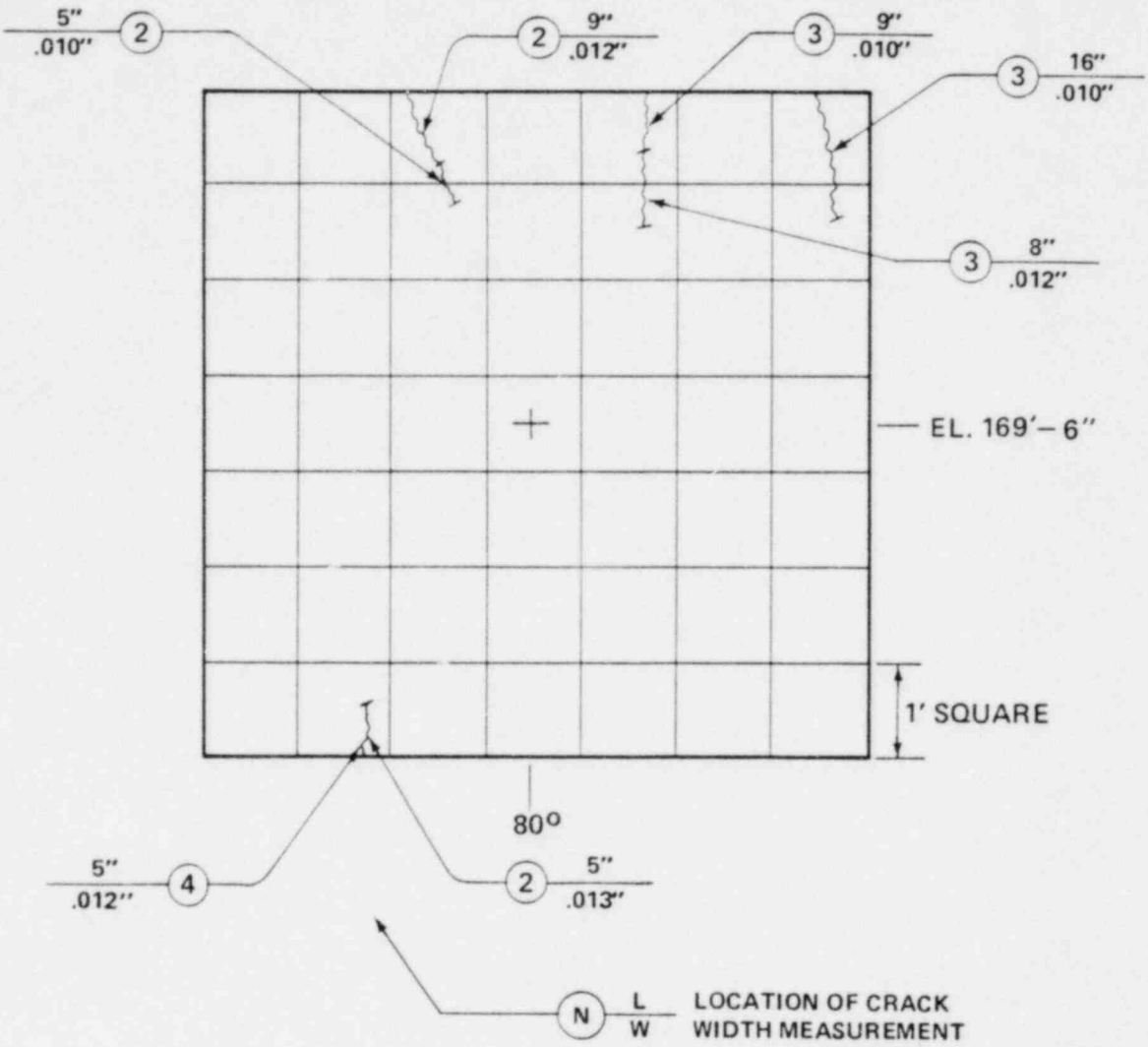


FIGURE 5-6 TYPICAL DEFLECTION/PRESSURE HISTORY-EQUIPMENT HATCH-E10



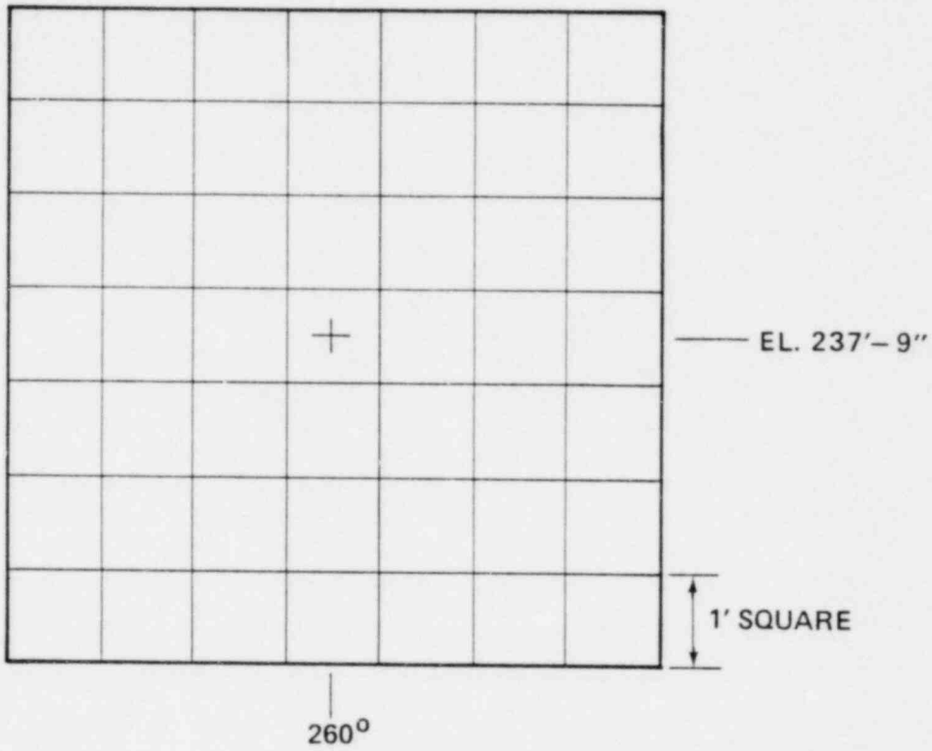
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1203	69.80	64	1	0	
1/1	0800	76.7	66	2	10	NO CRACKS > 3 THOUS.
1/1	1407	78.2	65	3	17.30	NO CRACKS > 5 THOUS.
1/2	2124	67.4	64	4	0	NO CRACKS > 5 THOUS.

FIGURE 5-7 CONCRETE CRACK MAPPING
AREA 1



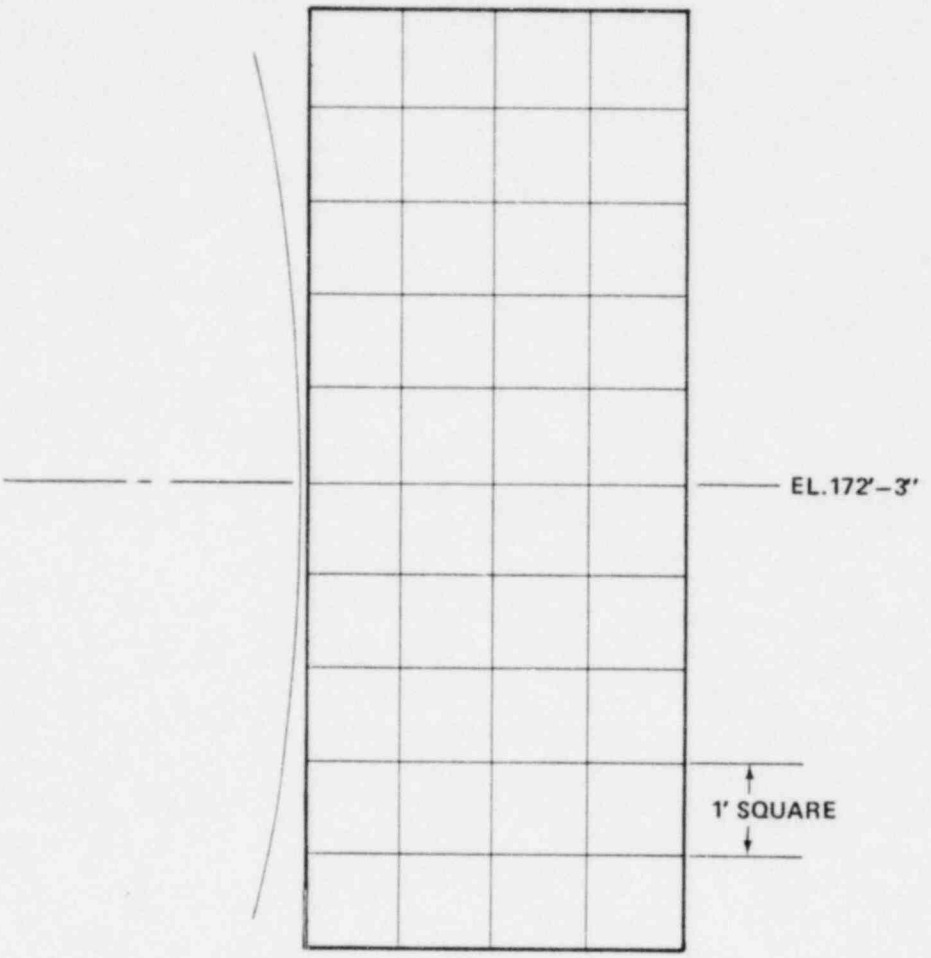
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1210	75.37	72	1	0	
1/1/82	830	76.7	61	2	10	ONLY TWO CRACKS OVER .01" WERE OBSERVED. NO OTHER CRACKS OBSERVED GREATER THAN .008".
1/1/82	14:19	78.2	61	3	17.25	NO OTHER CRACKS GREATER THAN .008" OBSERVED.
1/2/82	21:30	69	69	4	0	NO OTHER CRACKS OBSERVED.

FIGURE 5-8 CONCRETE CRACK MAPPING
AREA 2



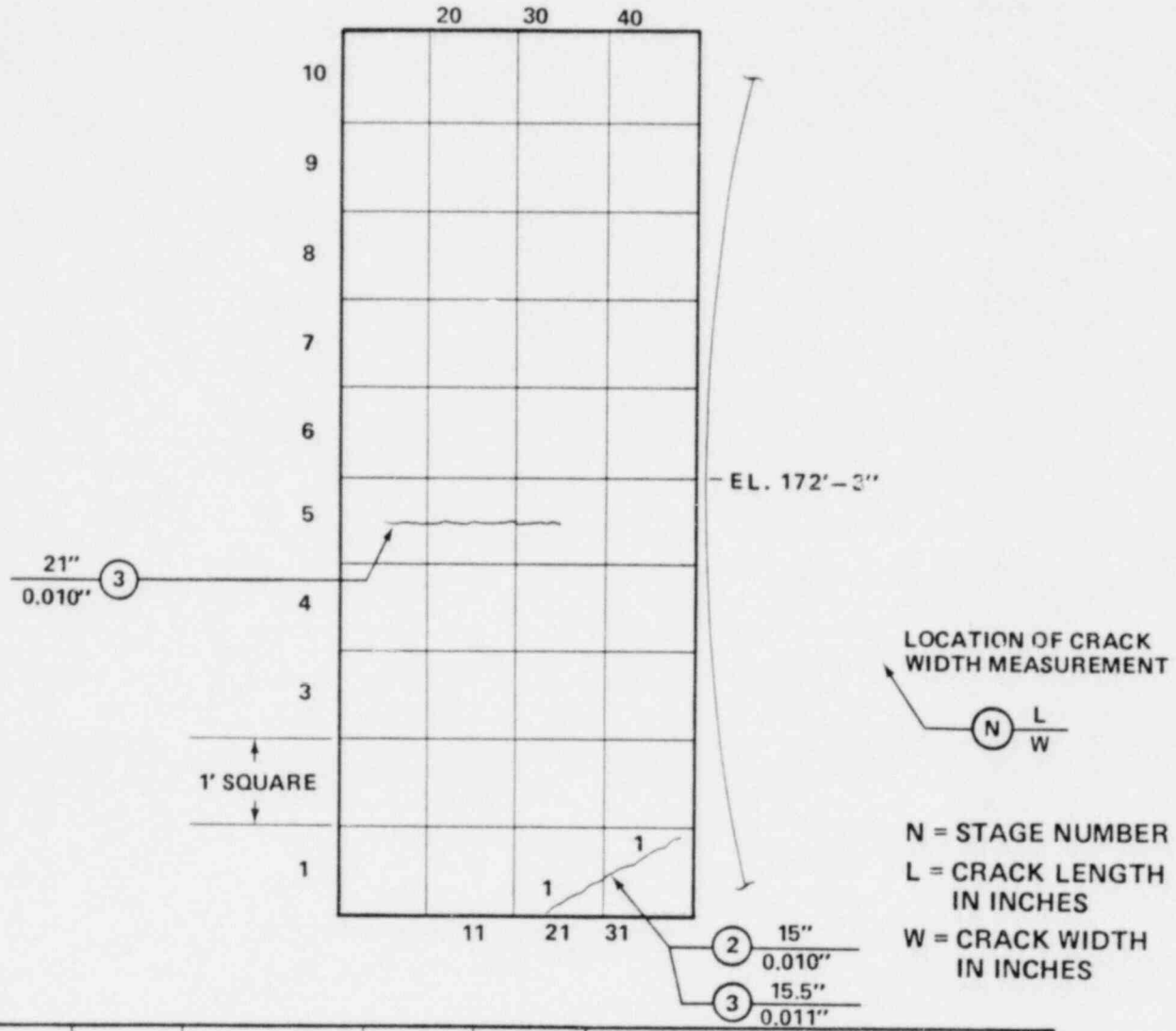
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1230	76.98	68	1	0	
1/1/82	8:05 AM	76.7	61	2	10	NOTHING OBSERVED OVER 0.005"
1/1/82	2:20 PM	78.2	62	3	17.25	NOTHING OBSERVED OVER 0.005", THESE CRACKS EXTENDED IN LENGTH ONLY, NO NEW CRACKS.
1/2/82	9:28 PM	74.3	68	4	0	NOTHING OBSERVED OVER .003 CRACKS DECREASED IN WIDTH

FIGURE 5-9 CONCRETE CRACK MAPPING
AREA 3



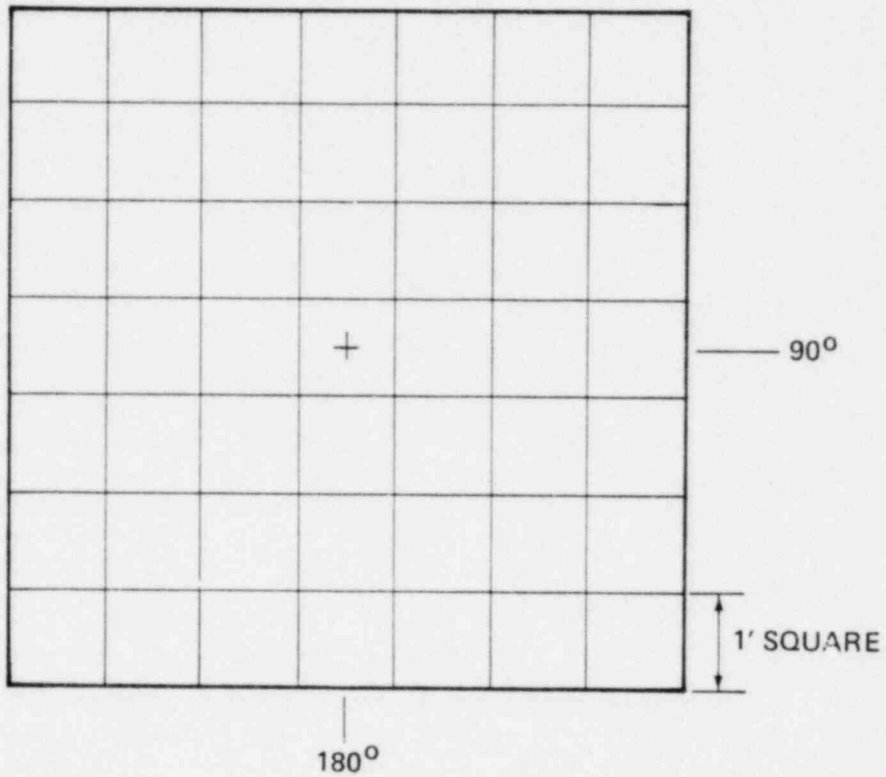
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12:17	75.38	66	1	0	
1/1/82	07:45	76.7	55	2	10	NO CRACKS LARGER THAN 0.005" OBSERVED
1/1/82	14:00	78.2	58	3	17.3	NO CRACKS LARGER THAN 0.007" OBSERVED
1/2/81	21:40	72	69	4	0	NO OTHER CRACKS OBSERVED

FIGURE 5-10 CONCRETE CRACK MAPPING
AREA 4



DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12:20	15.38	66	1	0	
1/1	8:30	76.7	63	2	10	BLOCKS 6 & 7 HAD NEW CRACKS NO GREATER THAN 0.003
1/1	14:10	74.2	55	3	17.30	NEW CRACK 13" BLOCK 33. NEW CRACK BLOCK 37
1/2	21:34	72	64	4	0	NO CRACKS > .004"

FIGURE 5-11 CONCRETE CRACK MAPPING
AREA 5



+ DENOTES APEX OF DOME

DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12/25	77.31	67	1	0	
1/1/82	8:27 AM	76.7	65	2	10	NOTHING OBSERVED OVER. 008
1/1/82	2:53 PM	78.2	68	3	17:25	NOTHING OBSERVED OVER .008 SLIGHT EXTENSION IN LENGTH OF EXISTING CRACKS ONLY
1/2/82	9:36 PM	74.7	67	4	0	NOTHING OBSERVED OVER .008 CRACKS DECREASED IN WIDTH

FIGURE 5-12 CONCRETE CRACK MAPPING
AREA 6

TABLE 5-1
SUMMARY OF DATA FOR TRANSDUCER H-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.002
1/1	0622	7.5	0.004
1/1	0930	10.0	0.006
1/1	1041	12.6	0.009
1/1	1246	15.0	0.024
1/1	1349	17.3	0.027
1/1	1630	17.3	0.029
1/1	2000	15.1	0.029
1/1	2249	12.5	0.028
1/2	0153	9.8	0.026
1/2	1458	5.1	0.021
1/2	1802	2.5	0.019
1/2	2114	0	0.015

TABLE 5-2
SUMMARY OF DATA FOR TRANSDUCER H-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.002
1/1	0622	7.5	0.004
1/1	0930	10.0	0.007
1/1	1041	12.6	0.010
1/1	1246	15.0	0.025
1/1	1349	17.3	0.028
1/1	1630	17.3	0.031
1/1	2000	15.1	0.031
1/1	2249	12.5	0.029
1/2	0153	9.8	0.026
1/2	1458	5.1	0.022
1/2	1802	2.5	0.020
1/2	2114	0	0.017

TABLE 5-3
SUMMARY OF DATA FOR TRANSDUCER H-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.000
1/1	0930	10.0	0.000
1/1	1041	12.6	0.012
1/1	1246	15.0	0.020
1/1	1349	17.3	0.023
1/1	1630	17.3	0.024
1/1	2000	15.1	0.024
1/1	2249	12.5	0.024
1/2	0153	9.8	0.024
1/2	1458	5.1	0.021
1/2	1802	2.5	0.019
1/2	2114	0	0.017

TABLE 5-4
SUMMARY OF DATA FOR TRANSDUCER H-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.001
1/1	0622	7.5	0.003
1/1	0930	10.0	0.006
1/1	1041	12.6	0.009
1/1	1246	15.0	0.030
1/1	1349	17.3	0.036
1/1	1630	17.3	0.039
1/1	2000	15.1	0.039
1/1	2249	12.5	0.038
1/2	0153	9.8	0.035
1/2	1458	5.1	0.029
1/2	1802	2.5	0.026
1/2	2114	0	0.023

TABLE 5-5
SUMMARY OF DATA FOR TRANSDUCER H-5

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.002
1/1	0343	5.0	0.004
1/1	0622	7.5	0.006
1/1	0930	10.0	0.009
1/1	1041	12.6	0.011
1/1	1246	15.0	0.029
1/1	1349	17.3	0.034
1/1	1630	17.3	0.036
1/1	2000	15.1	0.035
1/1	2249	12.5	0.033
1/2	0153	9.8	0.030
1/2	1458	5.1	0.026
1/2	1802	2.5	0.024
1/2	2114	0	0.022

TABLE 5-6
SUMMARY OF DATA FOR TRANSDUCER H-6

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.001
1/1	0343	5.0	0.004
1/1	0622	7.5	0.007
1/1	0930	10.0	0.011
1/1	1041	12.6	0.015
1/1	1246	15.0	0.036
1/1	1349	17.3	0.041
1/1	1630	17.3	0.044
1/1	2000	15.1	0.044
1/1	2249	12.5	0.042
1/2	0153	9.8	0.038
1/2	1458	5.1	0.032
1/2	1802	2.5	0.029
1/2	2114	0	0.025

TABLE 5-7
SUMMARY OF DATA FOR TRANSDUCER H-7

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.007
1/1	0622	7.5	0.011
1/1	0930	10.0	0.019
1/1	1041	12.6	0.025
1/1	1246	15.0	0.057
1/1	1349	17.3	0.089
1/1	1630	17.3	0.101
1/1	2000	15.1	0.099
1/1	2249	12.5	0.093
1/2	0153	9.8	0.086
1/2	1458	5.1	0.068
1/2	1802	2.5	0.056
1/2	2114	0	0.043

Final Adjusted Recovery Value: 0.043

TABLE 5-8
SUMMARY OF DATA FOR TRANSDUCER H-8

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.008
1/1	0622	7.5	0.019
1/1	0930	10.0	0.038
1/1	1041	12.6	0.052
1/1	1246	15.0	0.174
1/1	1349	17.3	0.267
1/1	1630	17.3	0.283
1/1	2000	15.1	0.267
1/1	2249	12.5	0.241
1/2	0153	9.8	*
1/2	1458	5.1	0.161
1/2	1802	2.5	0.136
1/2	2114	0	0.111

Final Adjusted Recovery Value: 0.054

*Invalid Reading - Out of Scale

TABLE 5-9
SUMMARY OF DATA FOR TRANSDUCER H-9

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.002
1/1	0343	5.0	0.008
1/1	0622	7.5	0.016
1/1	0930	10.0	0.028
1/1	1041	12.6	0.056
1/1	1246	15.0	0.185
1/1	1349	17.3	0.246
1/1	1630	17.3	0.263
1/1	2000	15.1	0.257
1/1	2249	12.5	0.233
1/2	0153	9.8	0.204
1/2	1458	5.1	0.153
1/2	1802	2.5	0.127
1/2	2114	0	0.102

Final Adjusted Recovery Value: 0.037

TABLE 5-10
SUMMARY OF DATA FOR TRANSDUCER H-10

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.018
1/1	0930	10.0	0.030
1/1	1041	12.6	0.049
1/1	1246	15.0	0.107
1/1	1349	17.3	0.145
1/1	1630	17.3	0.166
1/1	2000	15.1	0.163
1/1	2249	12.5	0.150
1/2	0153	9.8	0.134
1/2	1458	5.1	0.108
1/2	1802	2.5	0.094
1/2	2114	0	0.079

Final Adjusted Recovery Value: 0.077

TABLE 5-11
SUMMARY OF DATA FOR TRANSDUCER H-11

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.015
1/1	0930	10.0	0.025
1/1	1041	12.6	0.041
1/1	1246	15.0	0.109
1/1	1349	17.3	0.152
1/1	1630	17.3	0.168
1/1	2000	15.1	0.164
1/1	2249	12.5	0.156
1/2	0153	9.8	0.144
1/2	1458	5.1	0.122
1/2	1802	2.5	0.108
1/2	2114	0	0.093

Final Adjusted Recovery Value: 0.090

TABLE 5-12
SUMMARY OF DATA FOR TRANSDUCER H-12

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.009
1/1	0622	7.5	0.015
1/1	0930	10.0	0.023
1/1	1041	12.6	0.029
1/1	1246	15.0	0.060
1/1	1349	17.3	0.078
1/1	1630	17.3	0.084
1/1	2000	15.1	0.084
1/1	2249	12.5	0.080
1/2	0153	9.8	0.074
1/2	1458	5.1	0.063
1/2	1802	2.5	0.057
1/2	2114	0	0.049

Final Adjusted Recovery Value: 0.050

TABLE 5-13
SUMMARY OF DATA FOR TRANSDUCER H-13

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.011
1/1	0930	10.0	0.026
1/1	1041	12.6	0.043
1/1	1246	15.0	0.125
1/1	1349	17.3	0.185
1/1	1630	17.3	0.210
1/1	2000	15.1	0.210
1/1	2249	12.5	0.198
1/2	0153	9.8	0.173
1/2	1458	5.1	0.130
1/2	1802	2.5	0.110
1/2	2114	0	0.088

TABLE 5-14
SUMMARY OF DATA FOR TRANSDUCER H-14

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.006
1/1	0343	5.0	0.013
1/1	0622	7.5	0.023
1/1	0930	10.0	0.039
1/1	1041	12.6	0.057
1/1	1246	15.0	0.154
1/1	1349	17.3	*
1/1	1630	17.3	0.249
1/1	2000	15.1	0.244
1/1	2249	12.5	*
1/2	0153	9.8	0.197
1/2	1458	5.1	0.147
1/2	1802	2.5	0.124
1/2	2114	0	0.102

*Invalid Reading - Out of Scale

TABLE 5-15
SUMMARY OF DATA FOR TRANSDUCER H-15

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.009
1/1	0622	7.5	0.017
1/1	0930	10.0	0.029
1/1	1041	12.6	0.040
1/1	1246	15.0	0.108
1/1	1349	17.3	0.165
1/1	1630	17.3	0.184
1/1	2000	15.1	0.184
1/1	2249	12.5	0.171
1/2	0153	9.8	0.150
1/2	1458	5.1	0.112
1/2	1802	2.5	0.097
1/2	2114	0	0.080

TABLE 5-16
SUMMARY OF DATA FOR TRANSDUCER H-16

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.009
1/1	0622	7.5	0.014
1/1	0930	10.0	0.019
1/1	1041	12.6	0.024
1/1	1246	15.0	0.044
1/1	1349	17.3	0.051
1/1	1630	17.3	0.056
1/1	2000	15.1	0.055
1/1	2249	12.5	0.051
1/2	0153	9.8	0.046
1/2	1458	5.1	0.037
1/2	1802	2.5	0.032
1/2	2114	0	0.026

TABLE 5-17
SUMMARY OF DATA FOR TRANSDUCER H-17

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.015
1/1	0930	10.0	0.021
1/1	1041	12.6	0.027
1/1	1246	15.0	0.060
1/1	1349	17.3	0.075
1/1	1630	17.3	0.082
1/1	2000	15.1	0.081
1/1	2249	12.5	0.075
1/2	0153	9.8	0.067
1/2	1458	5.1	0.054
1/2	1802	2.5	0.047
1/2	2114	0	0.039

TABLE 5-18
SUMMARY OF DATA FOR TRANSDUCER H-18

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.006
1/1	0622	7.5	0.009
1/1	0930	10.0	0.013
1/1	1041	12.6	0.016
1/1	1246	15.0	0.038
1/1	1349	17.3	0.058
1/1	1630	17.3	0.074
1/1	2000	15.1	0.072
1/1	2249	12.5	0.068
1/2	0153	9.8	0.064
1/2	1458	5.1	0.056
1/2	1802	2.5	0.051
1/2	2114	0	0.046

TABLE 5-19
SUMMARY OF DATA FOR TRANSDUCER H-19

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.008
1/1	0622	7.5	0.013
1/1	0930	10.0	0.025
1/1	1041	12.6	0.041
1/1	1246	15.0	0.123
1/1	1349	17.3	0.182
1/1	1630	17.3	0.201
1/1	2000	15.1	0.193
1/1	2249	12.5	0.177
1/2	0153	9.8	0.157
1/2	1458	5.1	0.118
1/2	1802	2.5	0.096
1/2	2114	0	0.074

Final Adjusted Recovery Value: 0.068

TABLE 5-20
SUMMARY OF DATA FOR TRANSDUCER H-20

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.008
1/1	0622	7.5	0.013
1/1	0930	10.0	0.021
1/1	1041	12.6	0.042
1/1	1246	15.0	0.176
1/1	1349	17.3	0.255
1/1	1630	17.3	0.271
1/1	2000	15.1	0.258
1/1	2249	12.5	0.231
1/2	0153	9.8	*
1/2	1458	5.1	0.144
1/2	1802	2.5	0.117
1/2	2114	0	0.091

Final Adjusted Recovery Value: 0.100

*Invalid Reading - Out of Scale

TABLE 5-21
SUMMARY OF DATA FOR TRANSDUCER H-21

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.008
1/1	0622	7.5	0.014
1/1	0930	10.0	0.026
1/1	1041	12.6	0.036
1/1	1246	15.0	0.131
1/1	1349	17.3	0.185
1/1	1630	17.3	0.206
1/1	2000	15.1	0.206
1/1	2249	12.5	0.197
1/2	0153	9.8	0.183
1/2	1458	5.1	0.150
1/2	1802	2.5	0.131
1/2	2114	0	0.109

Final Adjusted Recovery Value: 0.020

TABLE 5-22
SUMMARY OF DATA FOR TRANSDUCER D-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.008
1/1	0343	5.0	0.020
1/1	0622	7.5	0.035
1/1	0930	10.0	0.054
1/1	1041	12.6	0.069
1/1	1246	15.0	0.089
1/1	1349	17.3	0.106
1/1	1630	17.3	0.114
1/1	2000	15.1	0.114
1/1	2249	12.5	0.105
1/2	0153	9.8	0.090
1/2	1458	5.1	0.064
1/2	1802	2.5	0.051
1/2	2114	0	0.036

Final Adjusted Recovery Value: 0.017

TABLE 5-23
SUMMARY OF DATA FOR TRANSDUCER D-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.015
1/1	0343	5.0	0.026
1/1	0622	7.5	0.040
1/1	0930	10.0	0.056
1/1	1041	12.6	0.069
1/1	1246	15.0	0.091
1/1	1349	17.3	0.106
1/1	1630	17.3	0.112
1/1	2000	15.1	0.112
1/1	2249	12.5	0.106
1/2	0153	9.8	0.092
1/2	1458	5.1	0.067
1/2	1802	2.5	0.055
1/2	2114	0	0.043

Final Adjusted Recovery Value: 0.025

TABLE 5-24
SUMMARY OF DATA FOR TRANSDUCER D-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.012
1/1	0930	10.0	0.030
1/1	1041	12.6	0.039
1/1	1246	15.0	0.060
1/1	1349	17.3	0.073
1/1	1630	17.3	0.081
1/1	2000	15.1	0.080
1/1	2249	12.5	0.080
1/2	0153	9.8	0.073
1/2	1458	5.1	0.051
1/2	1802	2.5	0.051
1/2	2114	0	0.032

Final Adjusted Recovery Value: 0.014

TABLE 5-25
SUMMARY OF DATA FOR TRANSDUCER V-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.009
1/1	0930	10.0	0.009
1/1	1041	12.6	0.015
1/1	1246	15.0	0.023
1/1	1349	17.3	0.029
1/1	1630	17.3	0.031
1/1	2000	15.1	0.031
1/1	2249	12.5	0.031
1/2	0153	9.8	0.031
1/2	1458	5.1	0.027
1/2	1802	2.5	0.022
1/2	2114	0	0.017

Final Adjusted Recovery Value: 0.007

TABLE 5-26
SUMMARY OF DATA FOR TRANSDUCER V-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.001
1/1	0622	7.5	0.005
1/1	0930	10.0	0.011
1/1	1041	12.6	0.013
1/1	1246	15.0	0.019
1/1	1349	17.3	0.024
1/1	1630	17.3	0.027
1/1	2000	15.1	0.027
1/1	2249	12.5	0.027
1/2	0153	9.8	0.024
1/2	1458	5.1	0.014
1/2	1802	2.5	0.011
1/2	2114	0	0.007

Final Adjusted Recovery Value: 0.003

TABLE 5-27
SUMMARY OF DATA FOR TRANSDUCER V-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.004
1/1	0622	7.5	0.010
1/1	0930	10.0	0.016
1/1	1041	12.6	0.021
1/1	1246	15.0	0.027
1/1	1349	17.3	0.031
1/1	1630	17.3	0.034
1/1	2000	15.1	0.033
1/1	2249	12.5	0.033
1/2	0153	9.8	0.028
1/2	1458	5.1	0.018
1/2	1802	2.5	0.013
1/2	2114	0	0.008

Final Adjusted Recovery Value: 0.001

TABLE 5-28
SUMMARY OF DATA FOR TRANSDUCER E-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.009
1/1	0622	7.5	0.017
1/1	0930	10.0	0.031
1/1	1041	12.6	0.045
1/1	1246	15.0	0.145
1/1	1349	17.3	*
1/1	1630	17.3	0.233
1/1	2000	15.1	0.225
1/1	2249	12.5	*
1/2	0153	9.8	0.181
1/2	1458	5.1	0.137
1/2	1802	2.5	0.115
1/2	2114	0	0.093

*Invalid Reading - Out of Scale

TABLE 5-29
SUMMARY OF DATA FOR TRANSDUCER E-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.013
1/1	0622	7.5	0.022
1/1	0930	10.0	0.037
1/1	1041	12.6	0.052
1/1	1246	15.0	0.116
1/1	1349	17.3	0.213
1/1	1630	17.3	0.258
1/1	2000	15.1	0.228
1/1	2249	12.5	0.207
1/2	0153	9.8	0.183
1/2	1458	5.1	0.138
1/2	1802	2.5	0.110
1/2	2114	0	0.091

TABLE 5-30
SUMMARY OF DATA FOR TRANSDUCER E-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.011
1/1	0343	5.0	0.022
1/1	0622	7.5	0.034
1/1	0930	10.0	0.051
1/1	1041	12.6	0.068
1/1	1246	15.0	0.156
1/1	1349	17.3	0.220
1/1	1630	17.3	0.224
1/1	2000	15.1	0.232
1/1	2249	12.5	0.209
1/2	0153	9.8	0.182
1/2	1458	5.1	0.134
1/2	1802	2.5	0.110
1/2	2114	0	0.085

TABLE 5-31
SUMMARY OF DATA FOR TRANSDUCER E-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.009
1/1	0343	5.0	0.019
1/1	0622	7.5	0.031
1/1	0930	10.0	0.053
1/1	1041	12.6	0.072
1/1	1246	15.0	0.134
1/1	1349	17.3	*
1/1	1630	17.3	0.213
1/1	2000	15.1	0.207
1/1	2249	12.5	*
1/2	0153	9.8	0.163
1/2	1458	5.1	0.118
1/2	1802	2.5	0.096
1/2	2114	0	0.073

*Invalid Reading - Out of Scale

TABLE 5-32
SUMMARY OF DATA FOR TRANSDUCER E-5

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.014
1/1	0622	7.5	0.026
1/1	0930	10.0	0.040
1/1	1041	12.6	0.059
1/1	1246	15.0	0.116
1/1	1349	17.3	0.166
1/1	1630	17.3	0.187
1/1	2000	15.1	0.187
1/1	2249	12.5	0.183
1/2	0153	9.8	0.164
1/2	1458	5.1	0.128
1/2	1802	2.5	0.108
1/2	2114	0	0.088

TABLE 5-33
SUMMARY OF DATA FOR TRANSDUCER E-6

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.008
1/1	0343	5.0	0.014
1/1	0622	7.5	0.022
1/1	0930	10.0	0.036
1/1	1041	12.6	0.049
1/1	1246	15.0	0.104
1/1	1349	17.3	0.145
1/1	1630	17.3	0.167
1/1	2000	15.1	0.166
1/1	2249	12.5	0.153
1/2	0153	9.8	0.137
1/2	1458	5.1	0.106
1/2	1802	2.5	0.089
1/2	2114	0	0.072

TABLE 5-34
SUMMARY OF DATA FOR TRANSDUCER E-7

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.007
1/1	0343	5.0	0.014
1/1	0622	7.5	0.023
1/1	0930	10.0	0.037
1/1	1041	12.6	0.055
1/1	1246	15.0	0.117
1/1	1349	17.3	0.172
1/1	1630	17.3	0.200
1/1	2000	15.1	0.196
1/1	2249	12.5	0.177
1/2	0153	9.8	0.155
1/2	1458	5.1	0.116
1/2	1802	2.5	0.096
1/2	2114	0	0.076

TABLE 5-35
SUMMARY OF DATA FOR TRANSDUCER E-8

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.009
1/1	0343	5.0	0.017
1/1	0622	7.5	0.027
1/1	0930	10.0	0.044
1/1	1041	12.6	0.062
1/1	1246	15.0	0.125
1/1	1349	17.3	0.184
1/1	1630	17.3	0.210
1/1	2000	15.1	0.200
1/1	2249	12.5	0.180
1/2	0153	9.8	0.155
1/2	1458	5.1	0.112
1/2	1802	2.5	0.090
1/2	2114	0	0.068

TABLE 5-36
SUMMARY OF DATA FOR TRANSDUCER E-9

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.010
1/1	0343	5.0	0.022
1/1	0622	7.5	0.035
1/1	0930	10.0	0.055
1/1	1041	12.6	0.075
1/1	1246	15.0	0.144
1/1	1349	17.3	0.209
1/1	1630	17.3	0.235
1/1	2000	15.1	0.224
1/1	2249	12.5	0.200
1/2	0153	9.8	0.172
1/2	1458	5.1	0.121
1/2	1802	2.5	0.094
1/2	2114	0	0.068

TABLE 5-37
SUMMARY OF DATA FOR TRANSDUCER E-10

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.011
1/1	0343	5.0	0.021
1/1	0622	7.5	0.033
1/1	0930	10.0	0.050
1/1	1041	12.6	0.070
1/1	1246	15.0	0.129
1/1	1349	17.3	0.186
1/1	1630	17.3	0.205
1/1	2000	15.1	0.192
1/1	2249	12.5	0.174
1/2	0153	9.8	0.152
1/2	1458	5.1	0.112
1/2	1802	2.5	0.090
1/2	2114	0	0.068

TABLE 5-38
SUMMARY OF DATA FOR TRANSDUCER E-11

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.007
1/1	0343	5.0	0.015
1/1	0622	7.5	0.023
1/1	0930	10.0	0.033
1/1	1041	12.6	0.055
1/1	1246	15.0	0.117
1/1	1349	17.3	0.155
1/1	1630	17.3	0.173
1/1	2000	15.1	0.171
1/1	2249	12.5	0.159
1/2	0153	9.8	0.144
1/2	1458	5.1	0.116
1/2	1802	2.5	0.100
1/2	2114	0	0.082

TABLE 5-39
SUMMARY OF DATA FOR TRANSDUCER E-12

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.006
1/1	0343	5.0	0.012
1/1	0622	7.5	0.020
1/1	0930	10.0	0.030
1/1	1041	12.6	0.046
1/1	1246	15.0	0.117
1/1	1349	17.3	0.152
1/1	1630	17.3	0.170
1/1	2000	15.1	0.168
1/1	2249	12.5	0.158
1/2	0153	9.8	0.145
1/2	1458	5.1	0.120
1/2	1802	2.5	0.104
1/2	2114	0	0.087

6. REFERENCES

1. Final Safety Analysis Report, Grand Gulf Nuclear Station, Unit No. 1, Mississippi Power and Light Company.

2. Procedure Q1M61-W-11302WXA, Containment Structural Integrity Test, Grand Gulf Nuclear Station Unit 1, Mississippi Power and Light Company.

MISSISSIPPI POWER & LIGHT COMPANY

GRAND GULF NUCLEAR STATION

UNIT 1

PRIMARY REACTOR CONTAINMENT
STRUCTURAL INTEGRITY TEST

FINAL REPORT

JANUARY 1982

Dupl. of 8104110565

MISSISSIPPI POWER AND LIGHT COMPANY

GRAND GULF NUCLEAR STATION
UNIT 1

PRIMARY CONTAINMENT
STRUCTURAL INTEGRITY TEST REPORT

Bechtel Power Corporation
San Francisco, California
January 1982

CONTENTS

FIGURES

1. INTRODUCTION

The Unit 1 Containment Structural Integrity Test was conducted during the time period December 31, 1981 to January 2, 1982. The primary purpose of the structural integrity test was to verify the design and structural integrity of the containment structure by imposing one hundred and fifteen percent of the design pressure for a period of not less than one hour.

In order to accomplish the intended test purpose, specialized measuring devices were installed in the containment structure to provide the data needed to evaluate structural response during pressurization and depressurization. The tests were conducted in accordance with written procedure Q1M61-W-11302WXA (Reference 2), detailing test requirements and instructions for acquiring test data. This procedure is a part of the permanent plant records at the Grand Gulf Nuclear Station.

2. SUMMARY AND CONCLUSIONS

The containment structural integrity test provided proof of the structure's ability to contain the internal design pressure and provided measurement of structural response to changes in internal pressure. Test measurements for the containment included gross structural deformations and concrete crack growth. Measurement points were located at typical sections of the structure with measurements obtained at specified stages during the pressurization cycle. The structure withstood the internal pressure with no observable indications of structural distress. All measured structural deformations were less than the design allowable values. All dome and vertical measurement points recovered more than 70 percent of their maximum deflection. Radial deflections at the elevation of maximum average deflection recovered more than 70 percent of their maximum deflection, also.

Changes in concrete cracks observed in the various surveillance areas did not change in measured width by more than 0.010 inches. This is considered to be within reasonable expectations based on the results of previous tests and does not adversely affect the integrity of the structure. Prior to the start of pressurization, no cracks with widths equal to or exceeding 0.010 inches were observed in the inspection areas. Cracks developed in two of the six mapping areas during pressurization and closed to below measurable values at zero pressure.

The results of the structural integrity test provide direct experimental evidence that the containment structure can contain the internal design pressure with a sufficient margin of safety and that the gross response to pressure is predictable.

3. STRUCTURE AND PRESSURIZATION

The containment is a reinforced concrete structure designed to act as a pressure barrier during postulated loss-of-coolant accidents as defined in the Final Safety Analysis Report (Reference 1). The structure consists of a reinforced concrete cylinder and hemispherical dome connected to and supported by a massive reinforced concrete base slab as shown in Figure 3-1. Reinforced openings in the cylinder are provided for equipment and personnel access as well as for electrical and mechanical feed through.

Principal dimensions for the containment structure are:

o Inside diameter	124 ft.
o Inside height	206 ft. 8-1/2 in.
o Vertical wall thickness	3 ft. 6 in.
o Dome thickness	2 ft. 6 in.
o Foundation slab thickness	9 ft. 6 in.

The containment structure was pressurized pneumatically to verify the required structural integrity. The internal peak pressure of 17.25 psig was held for a period of two hours to record structural data. For details of the pressure cycle see Figure 3-2.

The suppression pool and upper containment pool were both filled with water to their normal level for plant operation to provide the proper load on the containment and basemat.

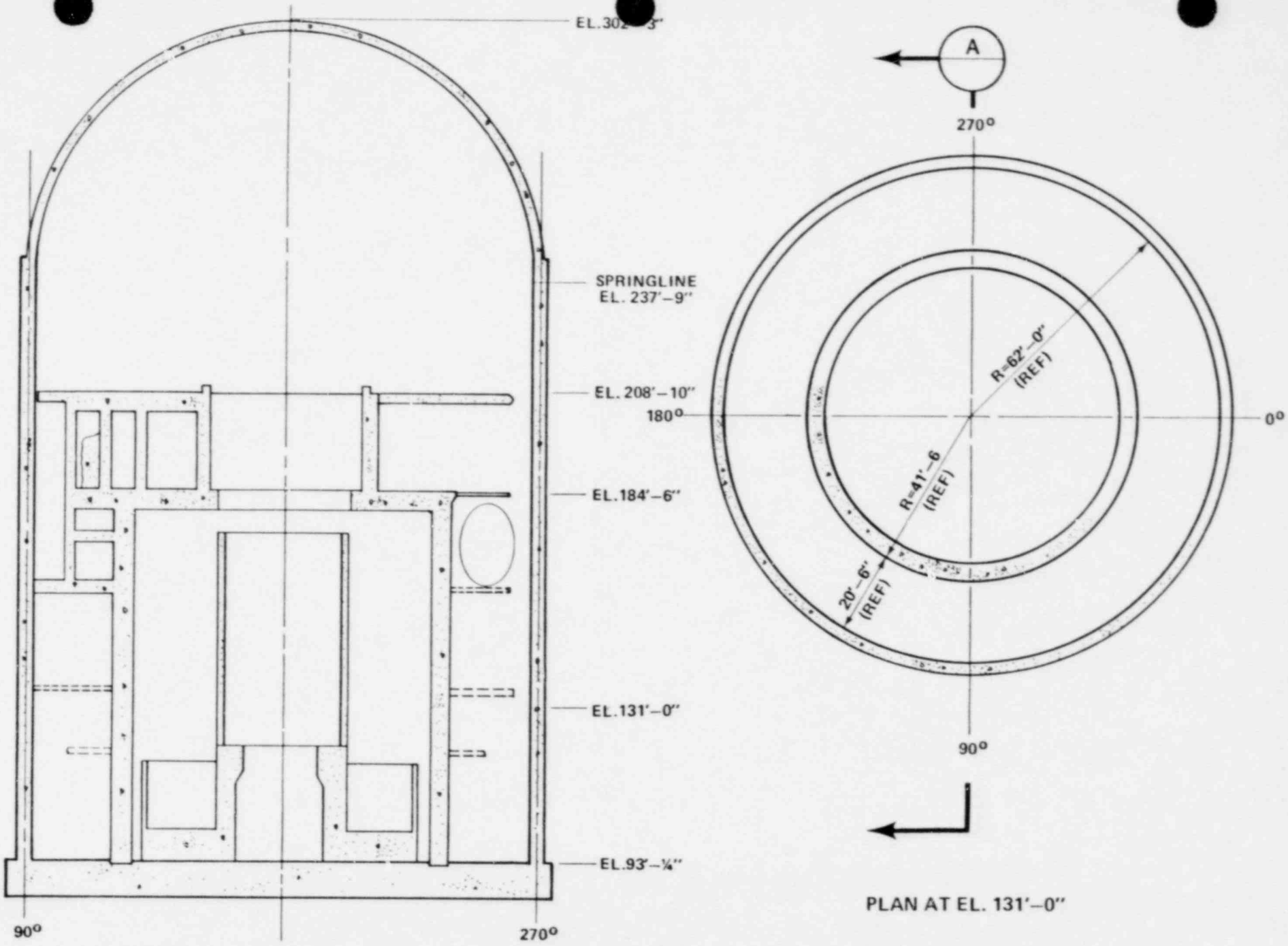


FIGURE 3-1 CONTAINMENT STRUCTURE

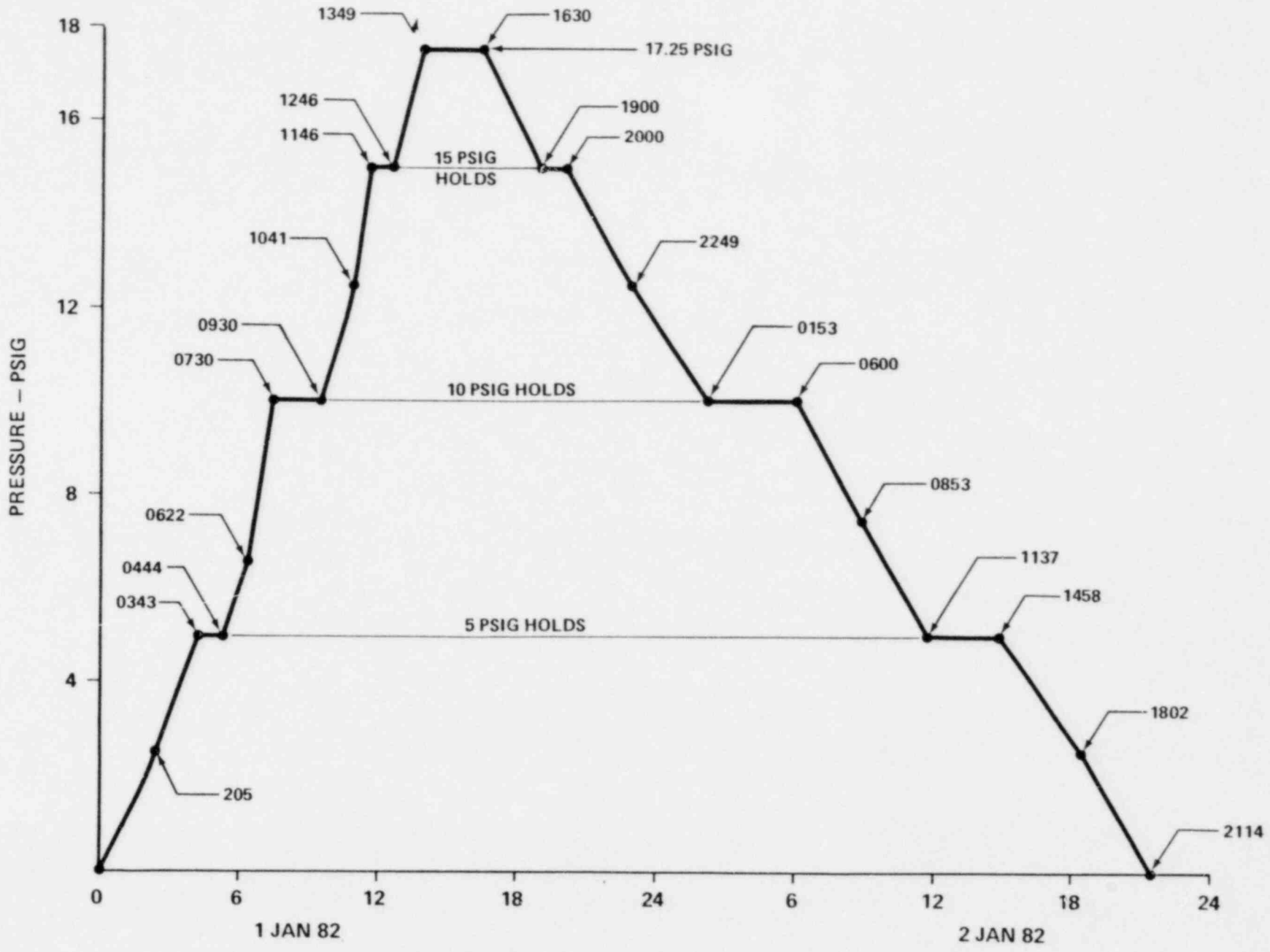


FIGURE 3-2 SIT PRESSURE CYCLE

4. TEST PLAN AND PROCEDURES

Test measurements were made at points on the containment structure which represented typical areas to provide data on structural behavior during the pressure test. The measured parameters consisted of gross structural deformation and concrete crack growth.

Gross structural deformations were measured using taut wire extensometers which spanned between points on the containment wall, dome, and springline and fixed points within and outside the structure. The extensometers were located to measure radial displacements along typical wall sections and around the lower equipment hatch, vertical displacement of the dome relative to the operating floor, and vertical displacement of the springline relative to the foundation slab. The layout of the extensometer system is shown in Figures 4-1 through 4-3 and exact locations are listed in Table 4-1.

The extensometers, illustrated in Figure 4-4, consist of displacement transducer assemblies and low expansion alloy (invar) taut wires. A movement between opposing points on the containment shell or between a point on the containment shell and a fixed reference structure results in an almost equal movement between the core and body of the linear variable differential transformer (LVDT) which is housed in the transducer assembly. The LVDT output is a voltage which is proportional to the position of the core within the body. The spring in the transducer assembly maintains a nominal 20 lb tension on the wire to reduce sag and eliminate slack at threaded and swivel connections.

The extensometers are calibrated to establish the displacement - voltage characteristics and spring constant (nominally 2 lb/in). Spring constant is used to correct for the small changes in wire length which result from transducer displacement. The transducers were calibrated prior to shipment to the Grand Gulf Nuclear Station and again at the station. The two sets of calibration data agreed to within the required limits of accuracy.

The transducer's swivels and opposing taut wire ends were secured to fittings which were welded to the containment liner and other metal structures and epoxy bonded or expansion anchored to concrete. Following initial attachment, the transducers were aligned with the wires to eliminate LVDT core side loading and the core positions adjusted to provide the desired travel.

The LVDT's were wired to excitation power supplies and a scanning data acquisition system which converted LVDT output voltage to a digital format for register display, printed record, and direct entry into a microcomputer. The computer was programmed with extensometer calibration constants and a routine which converted raw voltage data into displacement units.

During the structural integrity test the deformation data were recorded at 2.5 psig pressure increments and decrements, at the beginning and end of all constant pressure holds, and at regular intervals during extended holds. Additional data were recorded following depressurization to monitor post-test structural recovery and during the subsequent integrated leakage rate test. At each data acquisition point all voltages were recorded three times in rapid succession to provide a 2 out of 3 basis for identifying spurious values caused by electrical transients. The recording of 3 complete records required about 2 minutes.

Concrete crack patterns were mapped in the areas shown in Figure 4-5. The lengths and widths (measured by optical comparator) of all visible cracks within these areas were recorded prior to the start of pressurization, at 10 psig during pressurization, at peak test pressure, and following the completion of depressurization.

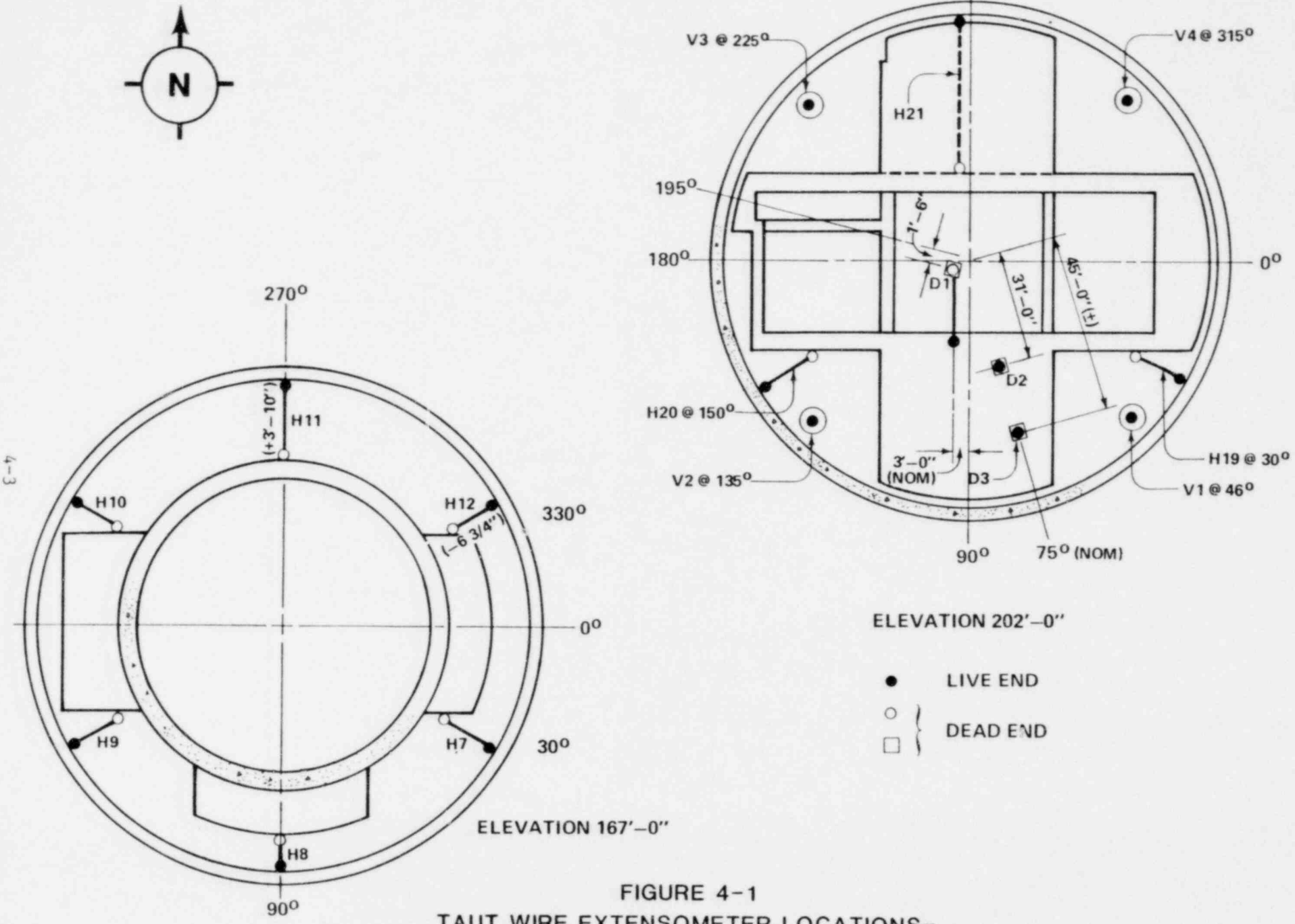
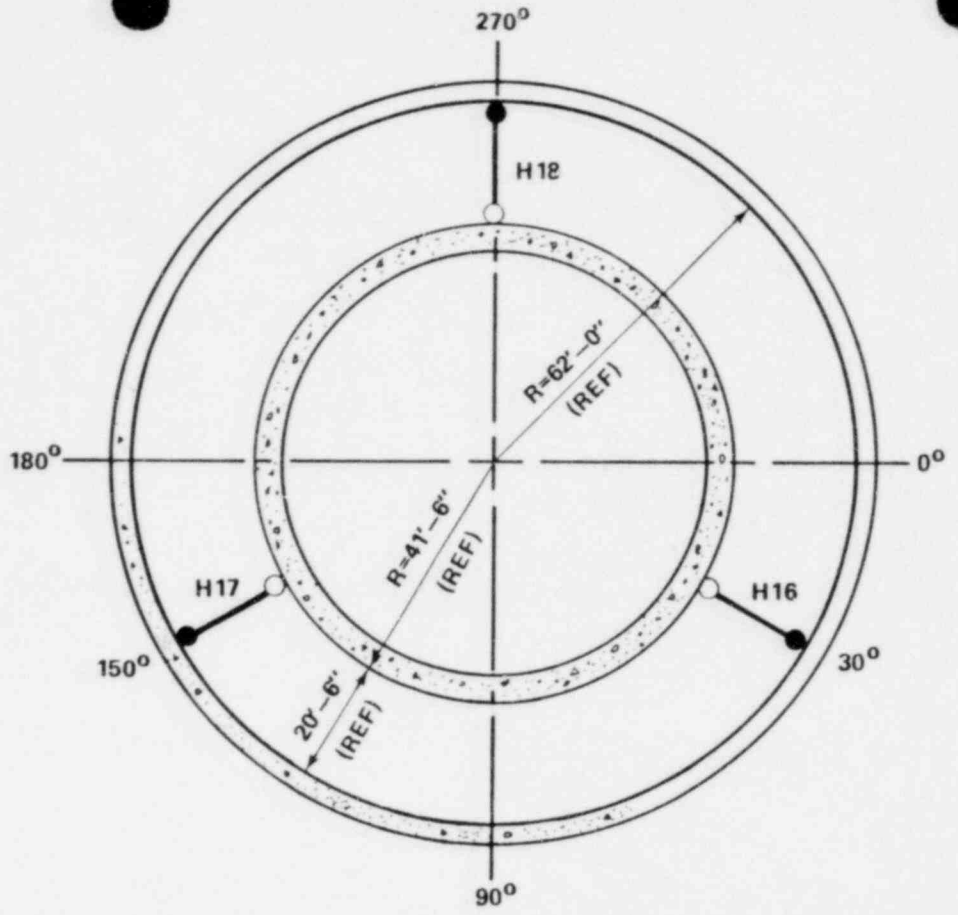
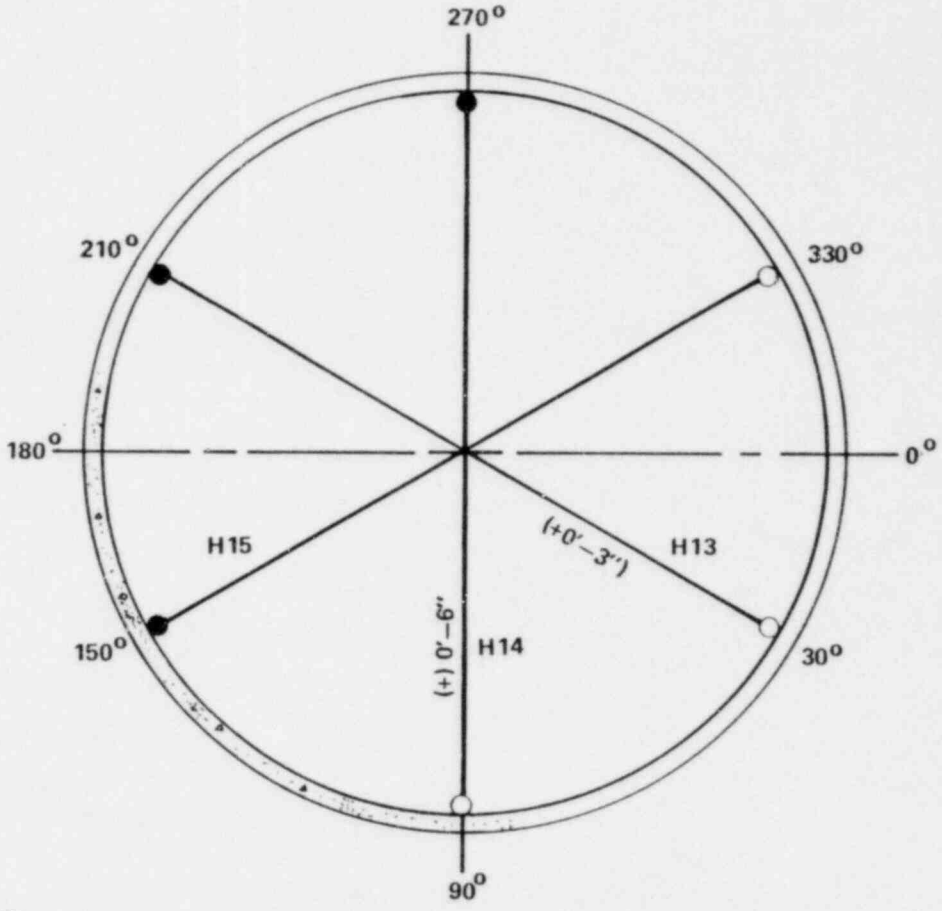


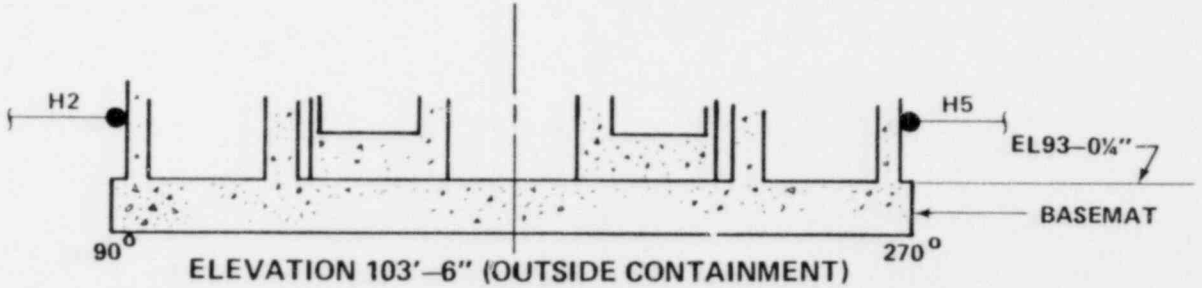
FIGURE 4-1
TAUT WIRE EXTENSOMETER LOCATIONS-
RADIALS AT ELEVATIONS 167' AND 202', DOMES, AND VERTICALS



ELEVATION 131'-0"



ELEVATION 230'-0"



ELEVATION 103'-6" (OUTSIDE CONTAINMENT)
6 EXTENSOMETERS AT 30°, 90°, 150°, 210°, 270°, 330°.

FIGURE 4-2 TAUT WIRE EXTENSOMETER LOCATIONS - RADIALS AT ELEVATIONS 103'-6", 131', AND 230'

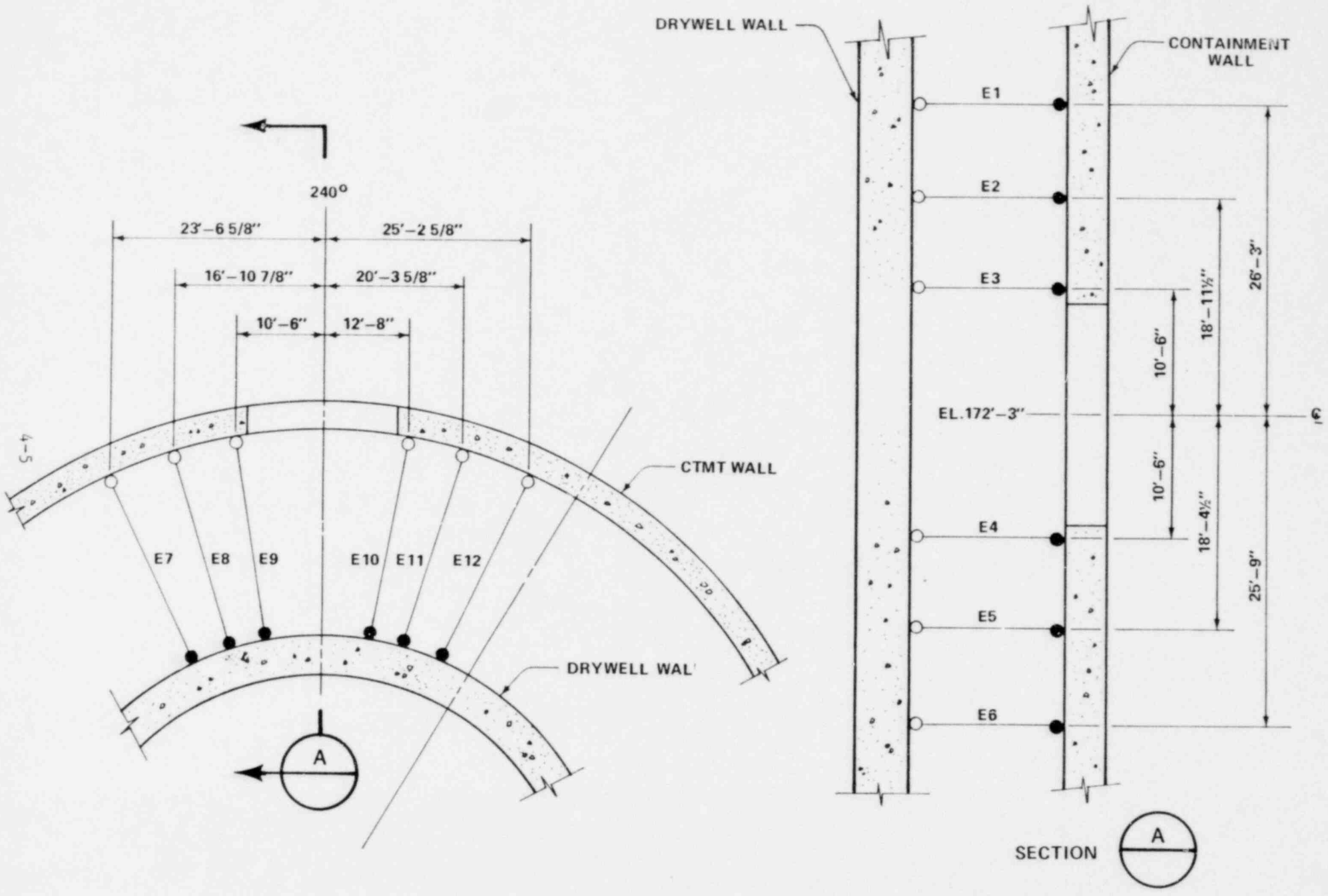


FIGURE 4-3 TAUT WIRE EXTENSOMETER LOCATIONS - EQUIPMENT HATCH

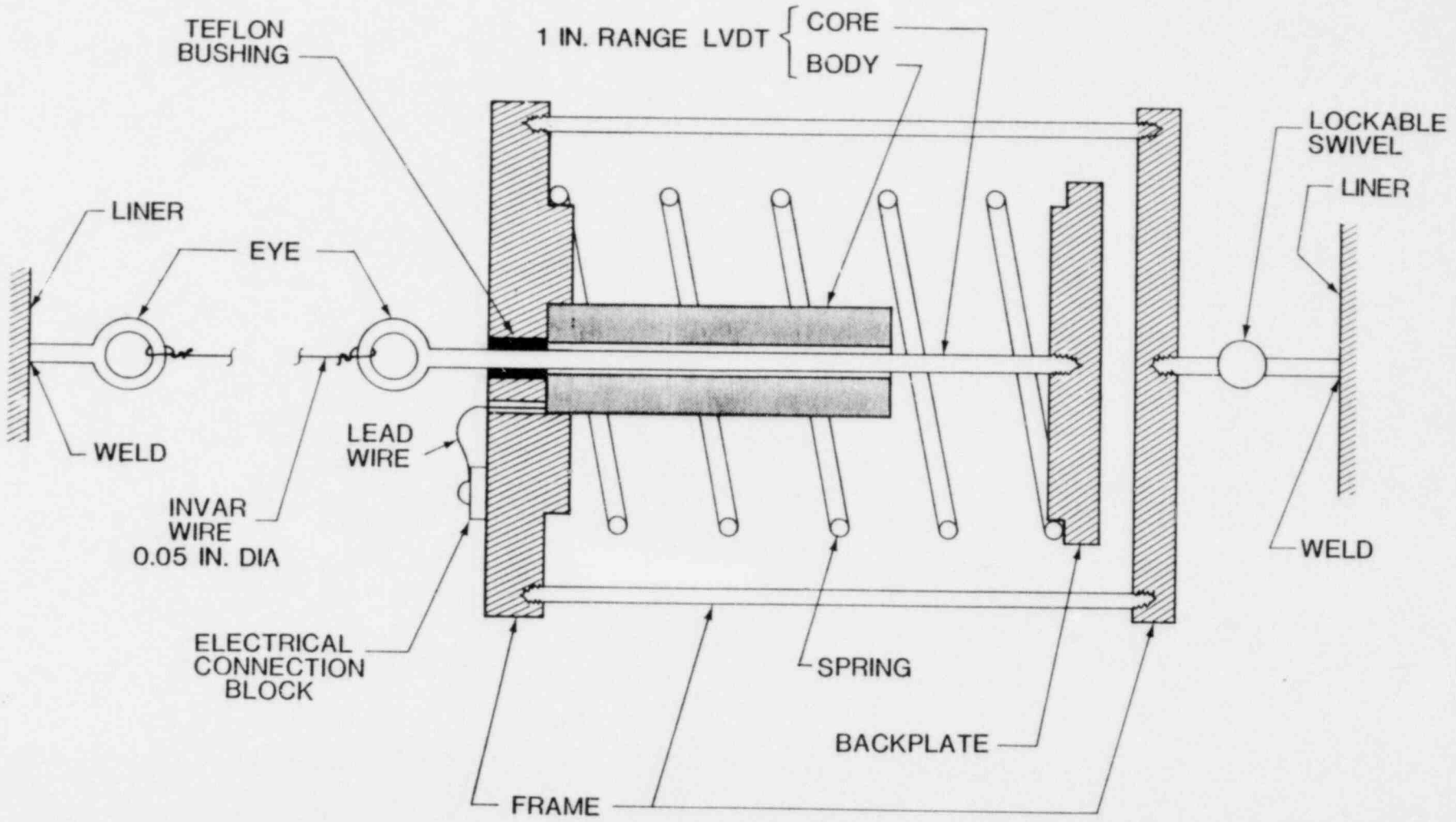


FIGURE 4-4
SCHEMATIC REPRESENTATION OF TAUT WIRE EXTENSOMETER

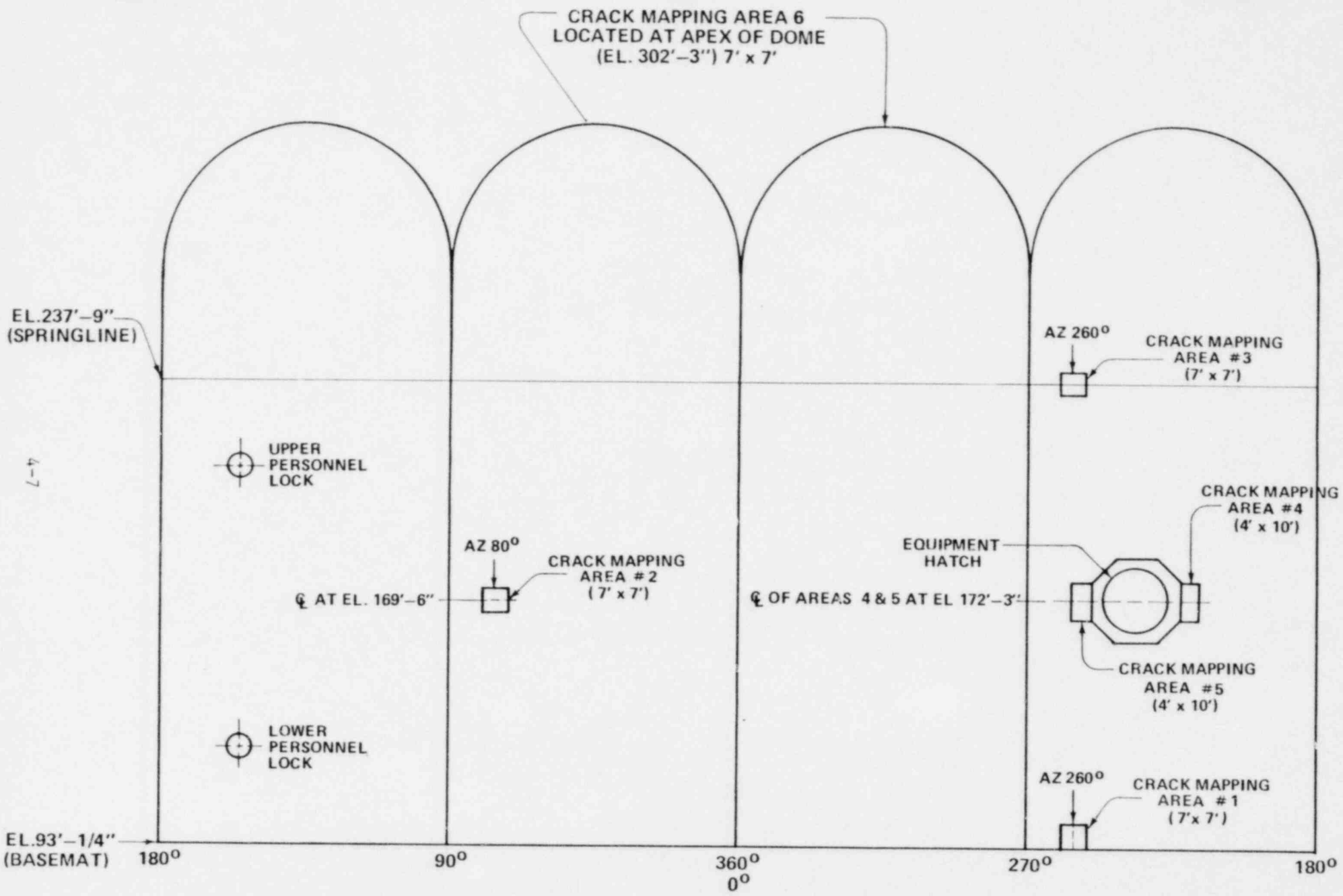


FIGURE 4-5 CONCRETE CRACK MAPPING AREAS

TABLE 4-1
EXTENSOMETER LOCATIONS

Table	Extensometer	Elevation Radials (H) and Hatch (E) or Radius Verticals (V) and Dome (D)	Azimuth
A-2	H-1	EL. 103'-0"	30°
A-3	H-2	EL. 103'-0"	90°
A-4	H-3	EL. 103'-0"	150°
A-5	H-4	EL. 103'-0"	210°
A-6	H-5	EL. 103'-0"	270°
A-7	H-6	EL. 103'-0"	330°
A-8	H-7	EL. 167'-0"	30°
A-9	H-8	EL. 167'-0"	90°
A-10	H-9	EL. 167'-0"	150°
A-11	H-10	EL. 167'-0"	211°-08'
A-12	H-11	EL. 167'-0"	270°
A-13	H-12	EL. 167'-0"	330°
A-14	H-13	EL. 230'-0"	210°
A-15	H-14	EL. 230'-0"	270°
A-16	H-15	EL. 230'-0"	150°
A-17	H-16	EL. 131'-0"	30°
A-18	H-17	EL. 131'-0"	150°
A-19	H-18	EL. 131'-0"	270°
A-20	H-19	EL. 202'-0"	30°
A-21	H-20	EL. 202'-0"	150°
A-22	H-21	EL. 202'-0"	270°
A-23	D-1	R 3'-1"	165°-30'
A-24	D-2	R 31'-0"	75°
A-25	D-3	R 45'-0"	75°
A-26	V-1	R 61'-8"	46°
A-27	V-3	R 61'-8"	225°
A-28	V-4	R 61'-8"	315°
A-29	E-1	EL. 198'-6"	240°
A-30	E-2	EL. 191'-2-1/2"	240°
A-31	E-3	EL. 182'-9"	240°
A-32	E-4	EL. 161'-9"	240°
A-33	E-5	EL. 153'-10-1/2"	240°
A-34	E-6	EL. 146'-6"	240°
A-35	E-7	EL. 172'-6"	217°-47'
A-36	E-8	EL. 172'-3"	223°-14'
A-37	E-9	EL. 172'-6"	230°-14'
A-38	E-10	EL. 168'-2"	247°-07'
A-39	E-11	EL. 172'-7-1/4"	259°
A-40	E-12	EL. 172'-0"	264°

5. TEST RESULTS

The results of the structural integrity test provide direct experimental evidence that the containment structure can contain the design internal pressure with an ample margin of safety. Further, the test data confirm the validity of the analytical methods employed to determine the structural effects of loading combinations and to predict the resulting deflections.

5.1 CONTAINMENT STRUCTURE DEFLECTIONS

The response of the containment to the maximum test pressure of 17.3 psig is illustrated in Figures 5-1 and 5-2. Figure 5-1 shows the measured radial and vertical growth of the cylinder wall and the measured vertical growth of the dome as well as the predicted growth based on both elastic and cracked section analyses. The measured vertical growth of the dome and wall is less than the elastic case prediction. This demonstrates that the stress in the dome and the vertical stress in the wall were not sufficient to cause extensive tensile cracking. It further demonstrates that the actual elastic modulus of the concrete is higher than that used in the computations. The radial growth of the wall is between the elastic and cracked wall section case predictions. This demonstrates that hoop stress caused tensile cracking but did not develop the complete cracked section used as a model in the cracked section analysis.

The wall radial deflections listed and plotted in Figure 5-1 are averages of the measurements made on several azimuths at each elevation. The individual measurements made at each elevation show a variation from azimuth to azimuth which is attributed to round out of minor irregularities in the cylinder wall. This behavior is typical for concrete containments and is expected for any singly curved structural element which does not have a perfectly true radius. In contrast the measured dome deflections show a smooth trend which is typical for a doubly curved surface. The measured wall vertical deflection listed in the figure is the average of the measurements at extensometers V1, V3, and V4 (V2 malfunctioned). Here the individual measurements are tightly grouped as is expected for the uncurved direction on the wall.

Figure 5-2 shows the measured radial growth of the wall in the vicinity of the equipment opening. The deflections measured along the horizontal center plane of the hatch are approximately symmetrical about the vertical center line. Measurements along the vertical center plane of the hatch show that the outward movement in the vicinity of the hatch increased with elevation. This behavior is typical for a large opening located close to the containment base mat.

Deflection/pressure histories at various points on the containment are illustrated in Figures 5-3 through 5-6 and all measured deflections are listed in Tables 5-1 through 5-39. The plotted deflection/pressure histories all show essentially linear response during the initial

stages of pressurization and throughout depressurization. Deviations from linearity are the deflection lags at the start of pressurization/depressurization, creep response at constant pressure hold periods, and the increase in slope at higher pressures during pressurization.

The lag results from friction between moving parts of the extensometer and is normally not evident at the start of the test since the extensometer is initially set for motion in the proper direction. Where lag does occur at the start of the test, it is generally due to the extensometer being disturbed after being set. Lag at the start of depressurization is always evident, except for extensometers with very short wires. This lag results from a reversal of friction forces in the extensometer and a consequent shortening of the wire. Lag effects are corrected for where required by extrapolating the linear part of the plot through 0 psig (initial lag) or 17.3 psig (depressurization lag) and calculating the deflection on the extrapolated line at this pressure. The difference between the deflection on the extrapolated line and the measured deflection at the same pressure is added to (initial lag) or subtracted from (depressurization lag) subsequent measurements to provide corrected values. The correction procedure is illustrated in Figures 5-3 and 5-5.

Creep response of the concrete is generally evident at the constant pressure hold periods, particularly at higher pressures. This is expected and typical for reinforced concrete structures.

All extensometers show on essentially linear deflection/pressure characteristic at low pressures which demonstrates initial elastic behavior of the containment. The characteristics for the dome and wall vertical extensometers remain linear through peak test pressure thus verifying the previously stated conclusion that the stresses in the dome and in the vertical direction in the wall are not sufficient to cause extensive tensile cracking and consequent departure from elastic response. The wall radial and equipment opening extensometers show significant changes in the deflection/pressure slope at varying levels of higher pressure. The point where the slope breaks represents initial tensile cracking. If the initial slopes of the wall radial extensometers are extrapolated to 17.3 psig and corrected for initial lag as required (see Figure 5-3), the displacements on the extrapolated lines at peak test pressure are quite close to the displacement predicted using the elastic case. This further verifies the validity of the constants and techniques used in containment analysis.

The recovery of containment deflections following the completion of depressurization was at least the required 70 percent at the points of maximum deflection. All dome and the three functioning vertical extensometers recovered over 70 percent of their maximum displacements. Radial extensometers at elevation 167'-0", the maximum expected deflection location, recovered 74 percent (after correcting for lag) of the average deflection of 0.178 inches. The two extensometers which measured the largest deflections at that elevation recovered over 80 percent of the deflected value. The largest average measured deflection occurred at elevation 202'-0", where three extensometers were located.

The average maximum deflection at that elevation was 0.226 inches. The extensometers recovered 72.1 percent of the maximum value. The radial extensometer recovery data are based on readings taken after the ILRT, with readings ending at noon, January 5, 1982. Final deflection values for all extensometers are listed in Tables 5-1 through 5-39. Final values are adjusted for extensometer lag where noted on the tables.

5.2 CONTAINMENT CONCRETE CRACKING

The patterns of surface concrete cracks on the containment wall at specified internal pressures are shown in Figures 5-7 through 5-12. A variety of surface cracks were mapped immediately prior to pressurization, and a minimum number showed increases in length or width during the pressurization cycle. This is consistent with the low deflections recorded. The observed crack patterns are typical of those found on reinforced concrete containment structures.

During the subsequent ILRT pressure cycle to 12.5 psig, cracks which appeared in Crack Mapping Area 2 were monitored. Those cracks enlarged slightly from the zero pressure recovery value, and returned to hairline width which was not accurately measurable with the optical comparators. Growth during the ILRT pressure cycle was estimated at 0.002 inches at the locations observed.

5.3 ESTIMATED ACCURACY OF MEASUREMENT

The accuracy of measurement is based on the following items:

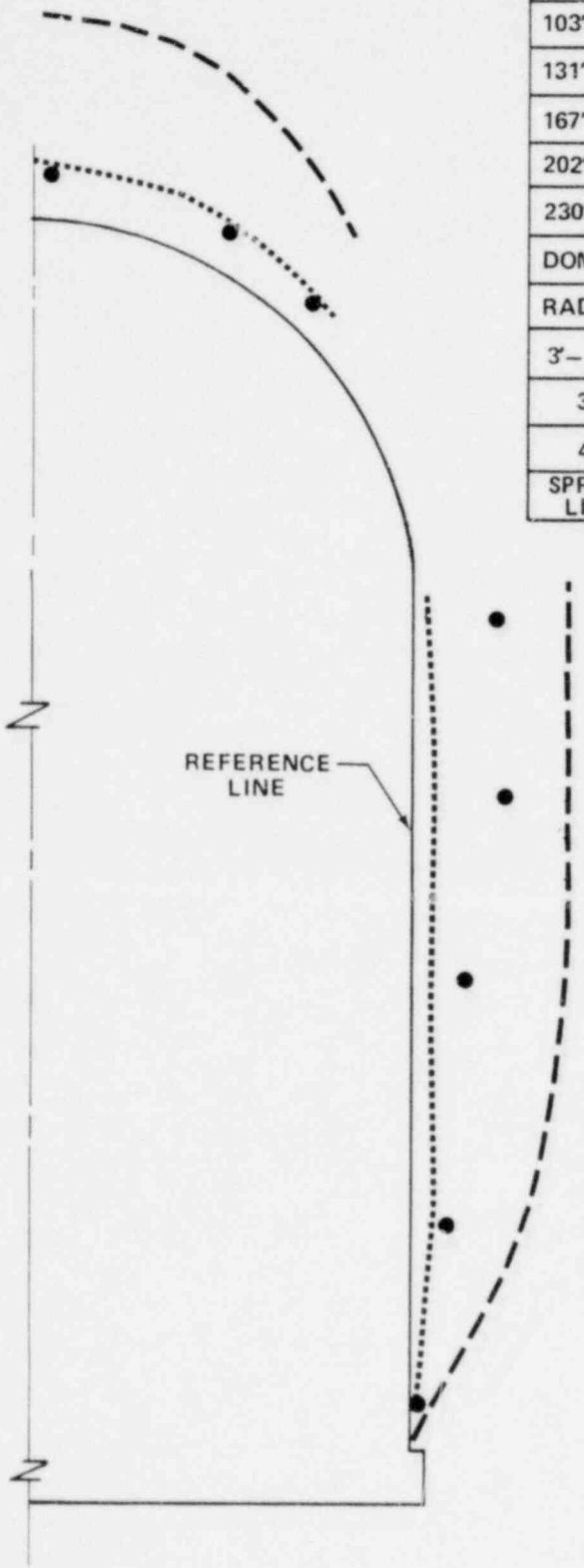
- Calibration of instrumentation
- Laboratory testing as in the case of invar wire
- Human factor, i.e., judgement of the reader

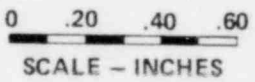
Displacements in the containment structure were measured using taut wire extensometers. Accuracy of the extensometer is $\pm$ 0.002 inches so long as wire tension remains constant. When the direction of pressurization changes, extensometer response lags due to friction in the mechanism. Typical lag is 0.02 inches for a 100-foot long wire.

The crack patterns were measured using optical comparators calibrated to measure crack width of 0.001 inches and wider. However, since most cracks observed on the containment were irregular traces on coarse textured concrete surfaces, it was not generally possible to estimate true crack width to better than approximately 0.003 inches. For this reason, reported crack widths are considered to be accurate to within $\pm$ 0.003 inches.

DEFLECTIONS (INCHES)

WALL					
EL	MIN	MAX	AVG	PRED [1]	PRED [2]
103'–6"	.024	044	.034	.08	.01
131'–0"	.056	.082	.071	.38	.05
167'–0"	.084	.283	.178	.42	.05
202'–0"	.201	.271	.226	.42	.05
230'–0"	.184	.249	.214	.39	.04
DOME					
RADIUS	–	–	DEFL	PRED [1]	PRED [2]
3'–1"	–	–	.114	.54	.15
31'	–	–	.112	.51	.15
45'	–	–	.107	.46	.14
SPRING LINE	.027	.034	.031	.20	.08





CRACKED ANALYSIS DISPLACEMENT

ELASTIC ANALYSIS DISPLACEMENT

MEASURED VALUE

NOTES:

1. PREDICTED DISPLACEMENT FROM CRACKED ANALYSIS
2. PREDICTED DISPLACEMENT FROM ELASTIC ANALYSIS

FIGURE 5-1 CONTAINMENT STRUCTURE AVERAGE DEFLECTIONS AT 17.25 PSIG -WALL AND DOME

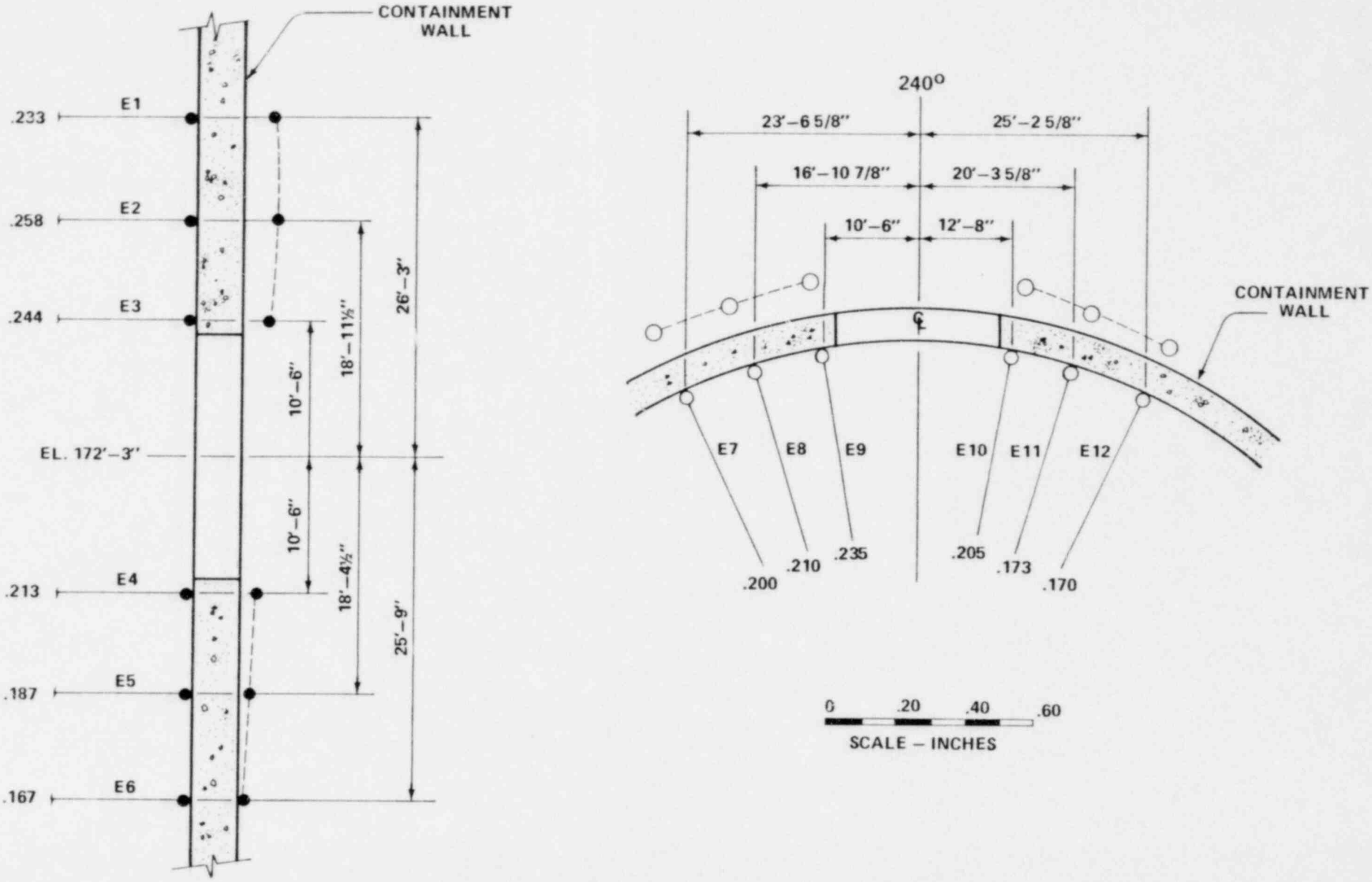


FIGURE 5-2
CONTAINMENT STRUCTURE DEFLECTIONS AT 17.25 PSIG-EQUIPMENT HATCH RADIAL

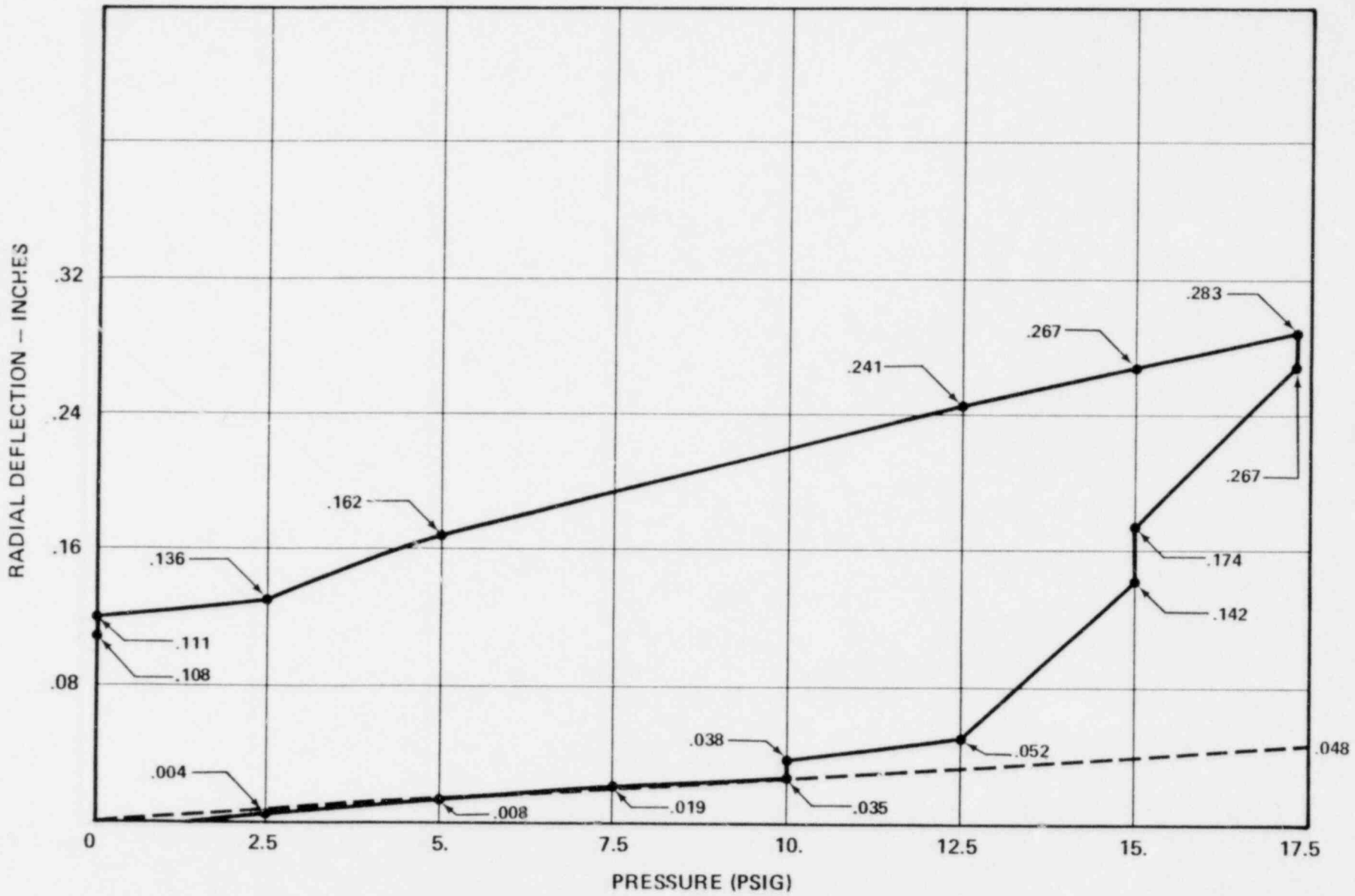


FIGURE 5-3 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT WALL-H8

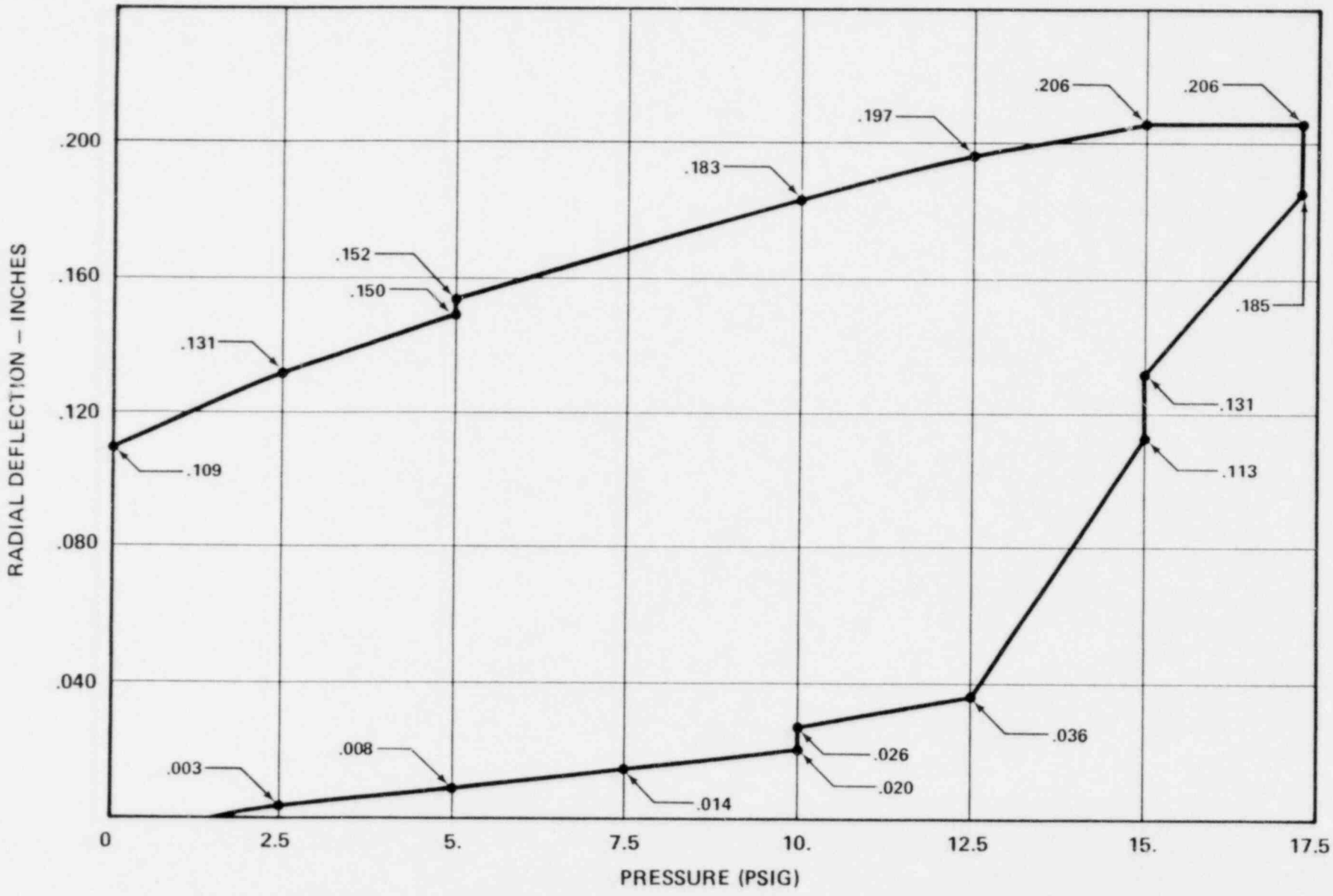


FIGURE 5-4 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT WALL-H21

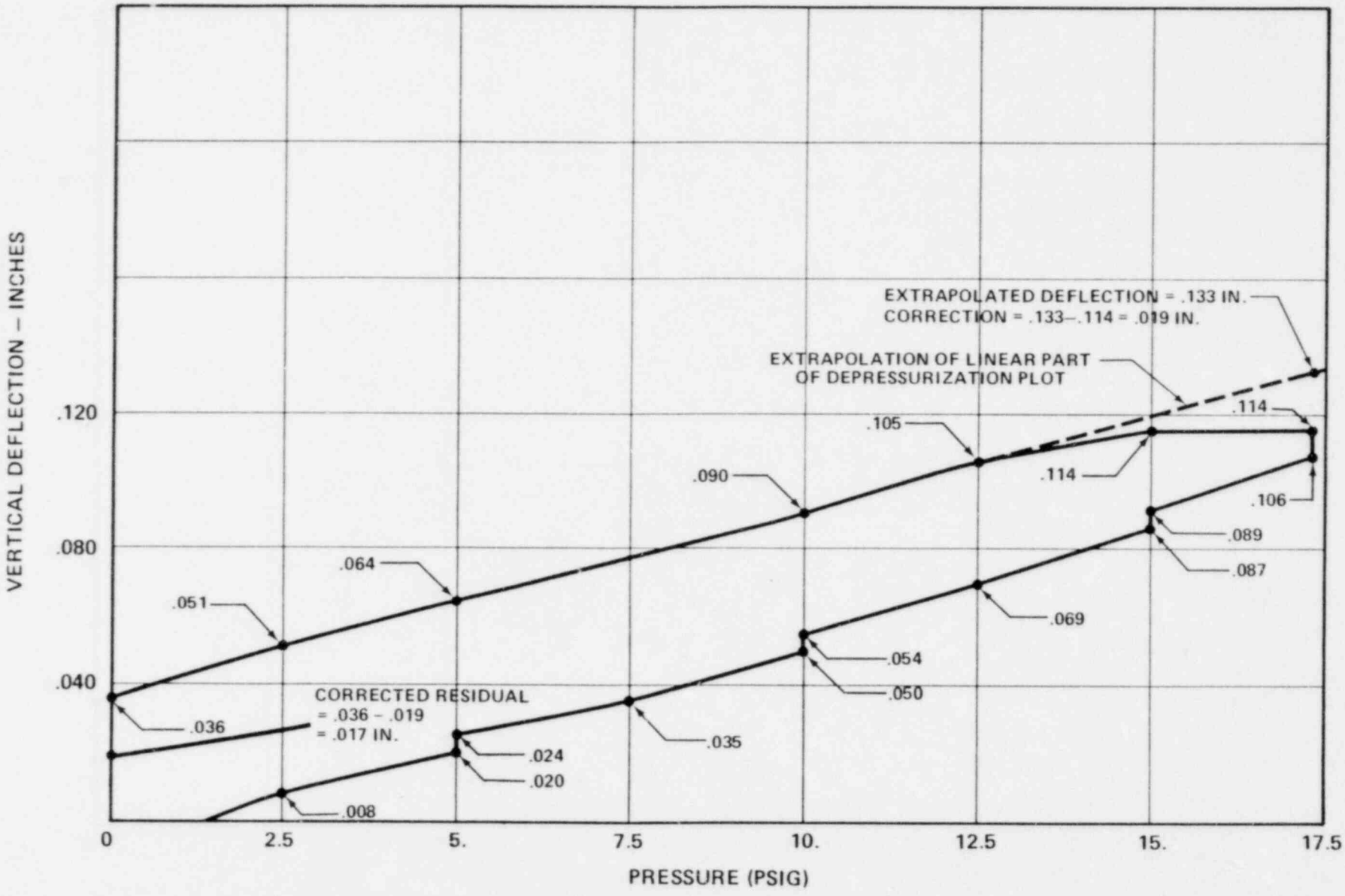


FIGURE 5-5 TYPICAL DEFLECTION/PRESSURE HISTORY-CONTAINMENT DOME-D1

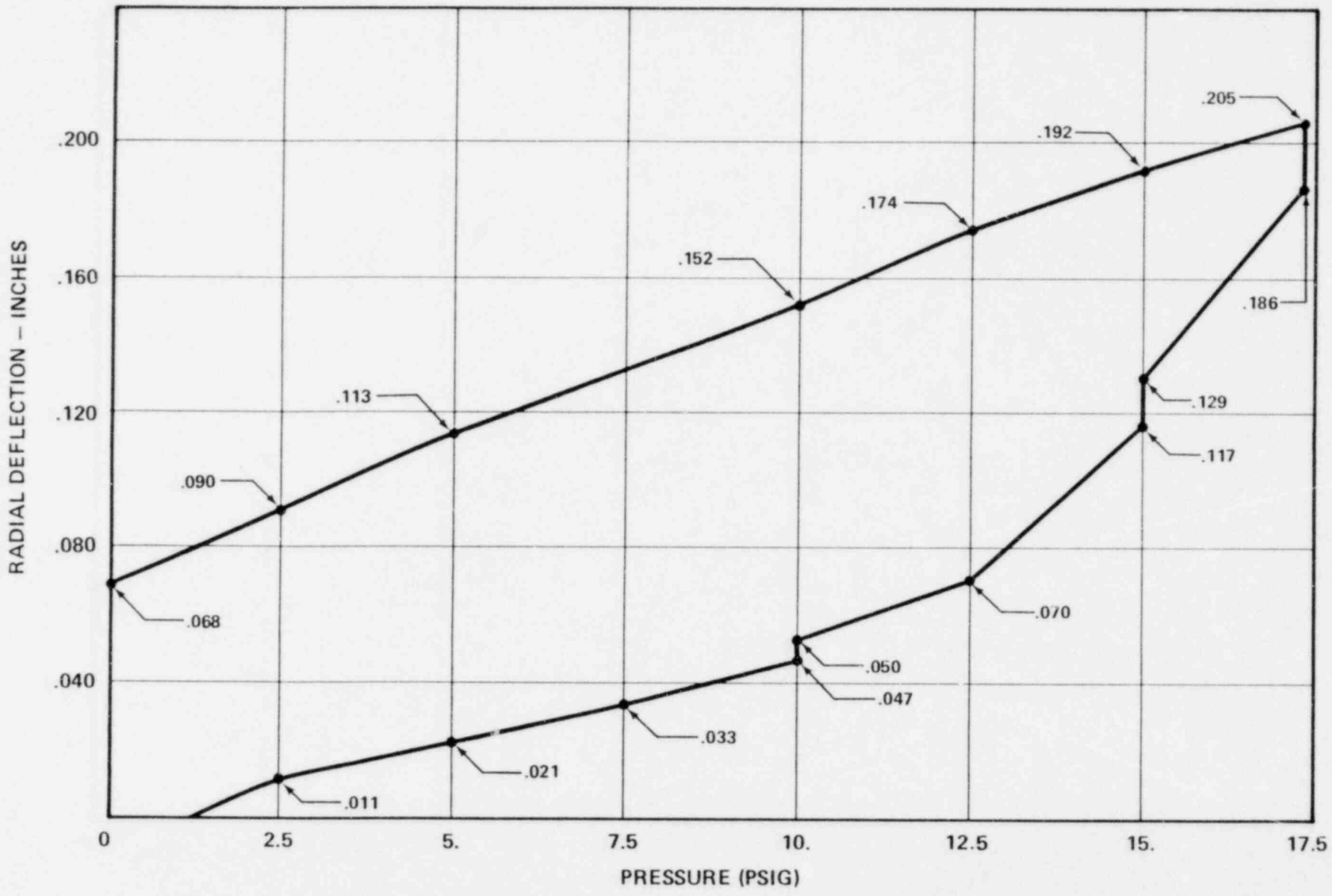
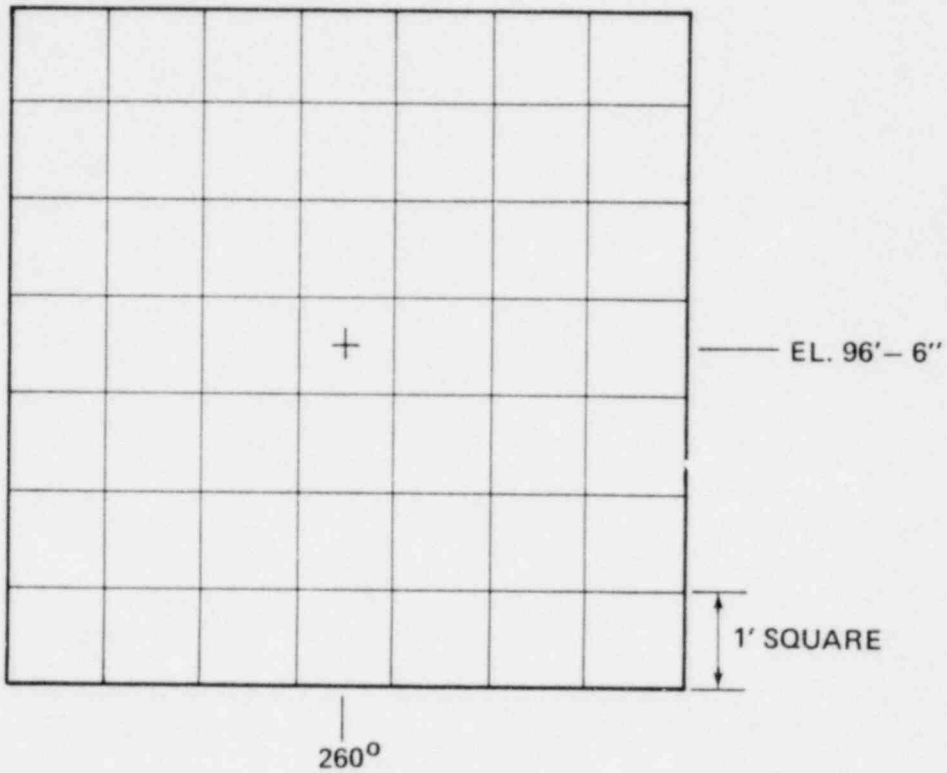
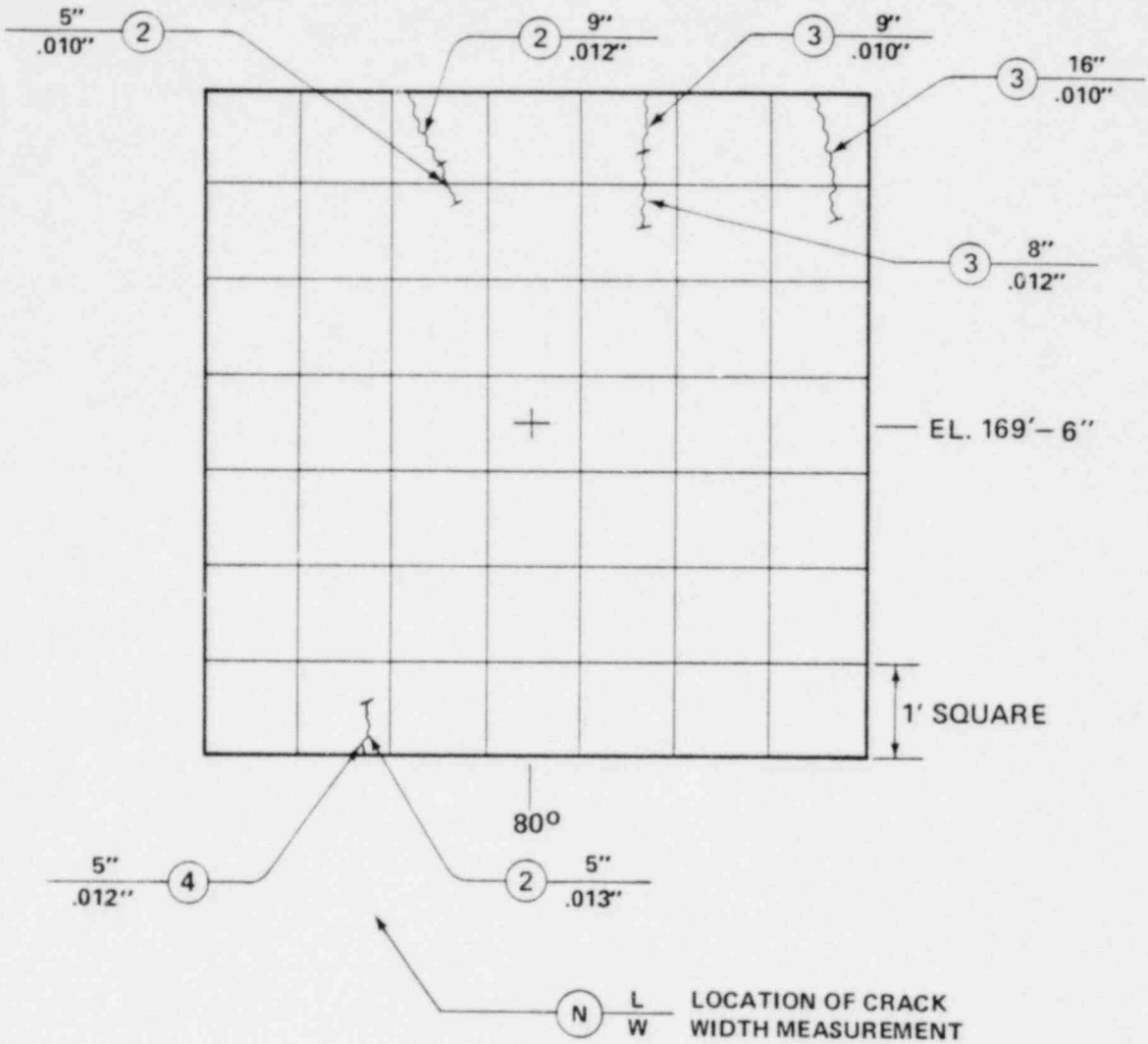


FIGURE 5-6 TYPICAL DEFLECTION/PRESSURE HISTORY-EQUIPMENT HATCH-E10



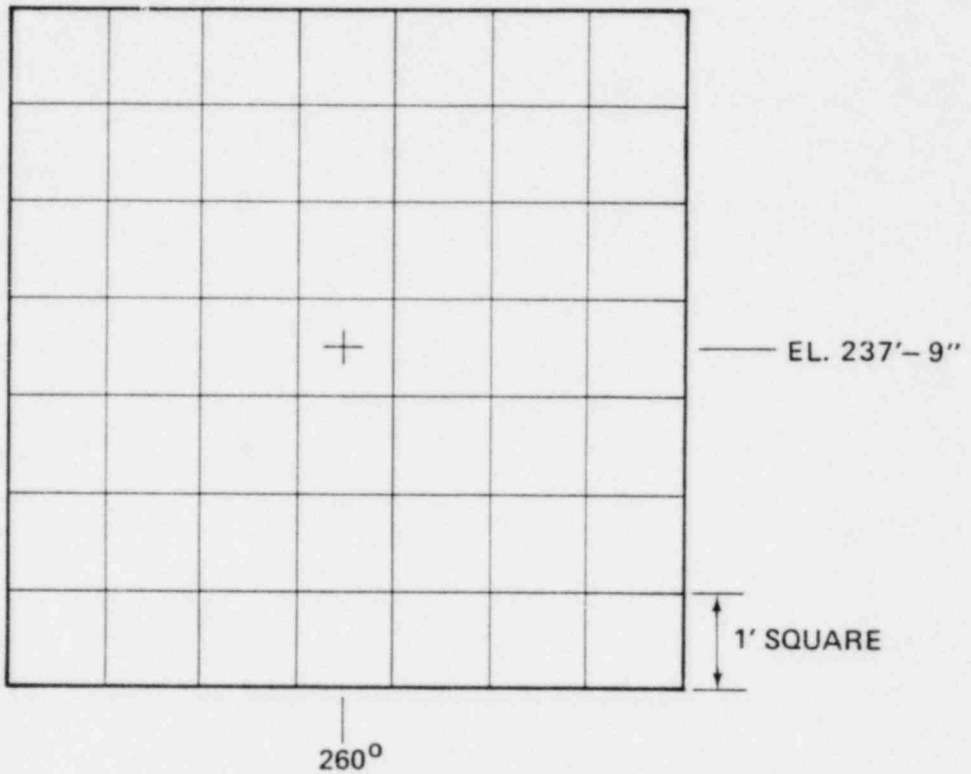
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1203	69.80	64	1	0	
1/1	0800	76.7	66	2	10	NO CRACKS > 3 THOUS.
1/1	1407	78.2	65	3	17.30	NO CRACKS > 5 THOUS.
1/2	2124	67.4	64	4	0	NO CRACKS > 5 THOUS.

FIGURE 5-7 CONCRETE CRACK MAPPING
AREA 1



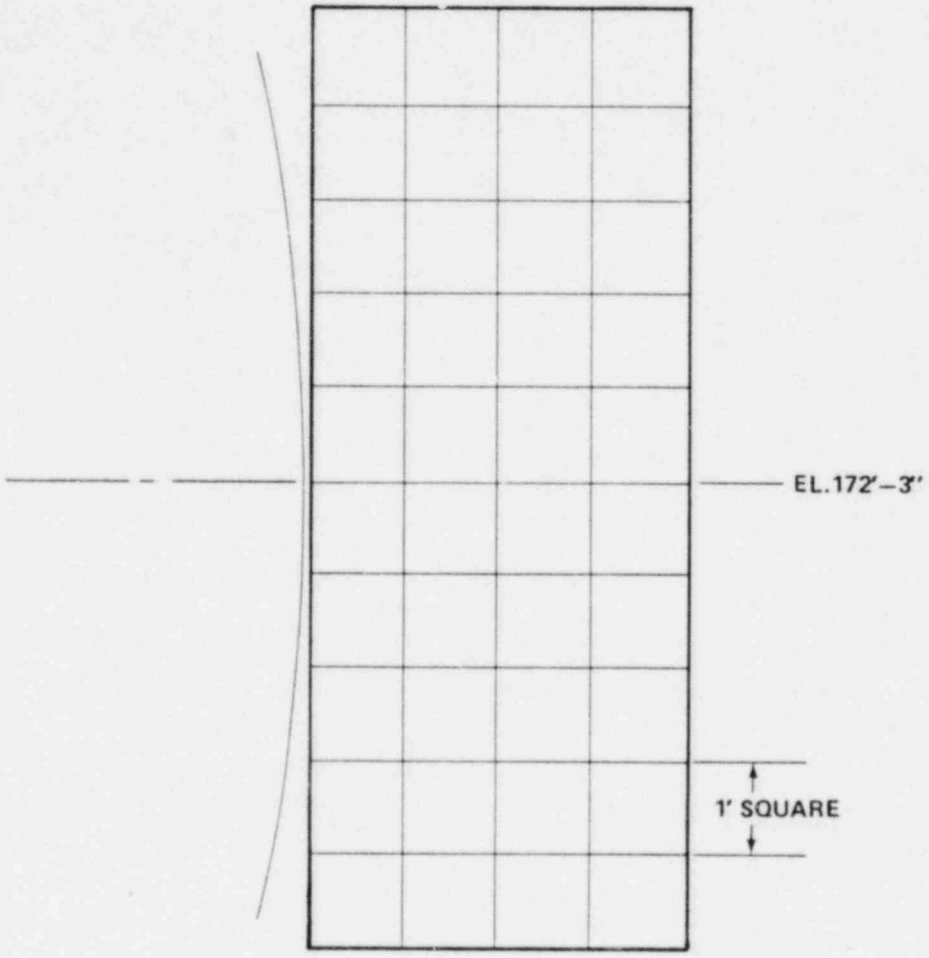
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1210	75.37	72	1	0	
1/1/82	830	76.7	61	2	10	ONLY TWO CRACKS OVER .01" WERE OBSERVED. NO OTHER CRACKS OBSERVED GREATER THAN .008".
1/1/82	14:19	78.2	61	3	17.25	NO OTHER CRACKS GREATER THAN .008" OBSERVED.
1/2/82	21:30	69	69	4	0	NO OTHER CRACKS OBSERVED.

FIGURE 5-8 CONCRETE CRACK MAPPING
AREA 2



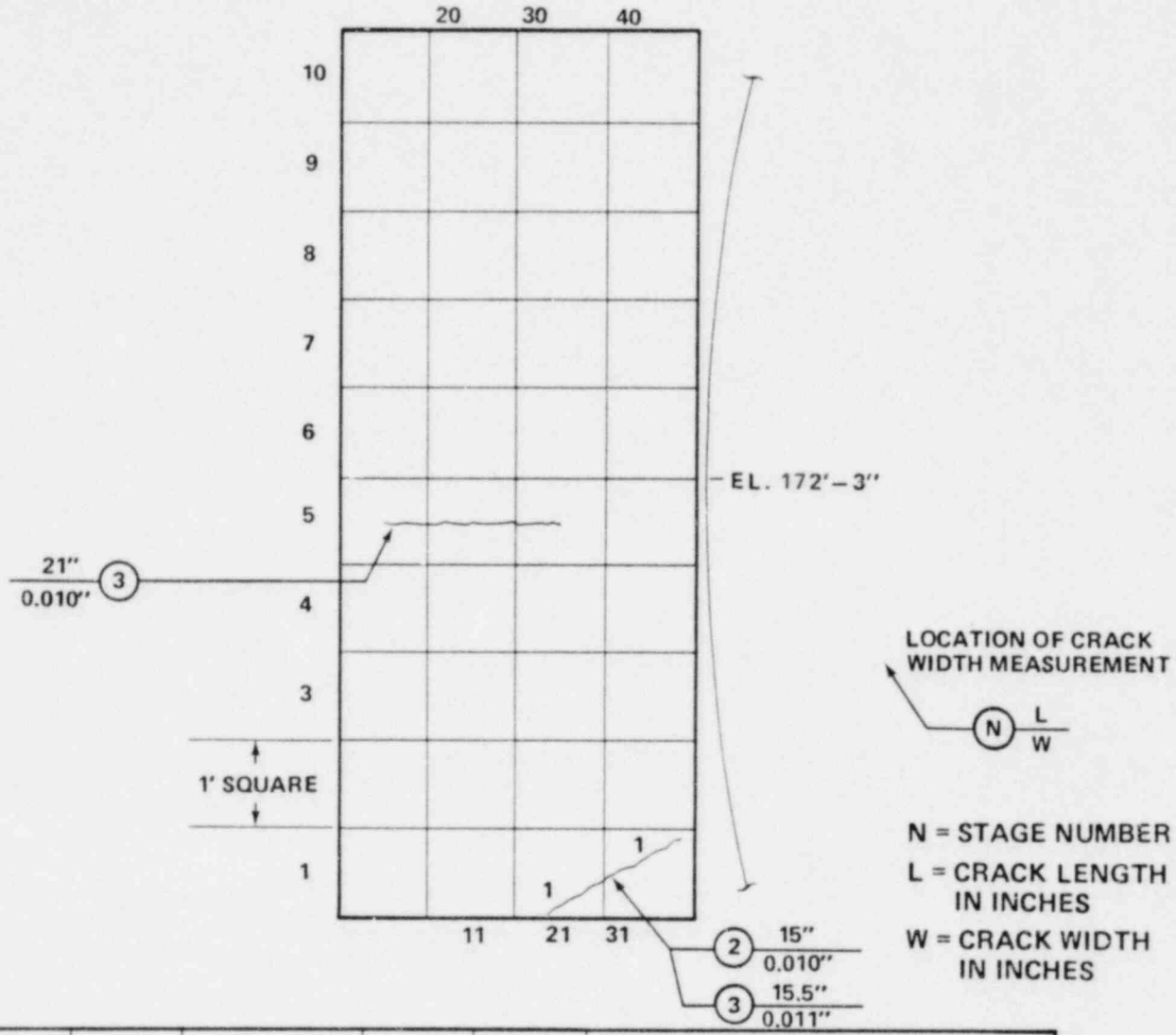
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	1230	76.98	68	1	0	
1/1/82	8:05 AM	76.7	61	2	10	NOTHING OBSERVED OVER 0.005"
1/1/82	2:20 PM	78.2	62	3	17.25	NOTHING OBSERVED OVER 0.005", THESE CRACKS EXTENDED IN LENGTH ONLY, NO NEW CRACKS.
1/2/82	9:28 PM	74.3	68	4	0	NOTHING OBSERVED OVER .003 CRACKS DECREASED IN WIDTH

FIGURE 5-9 CONCRETE CRACK MAPPING
AREA 3



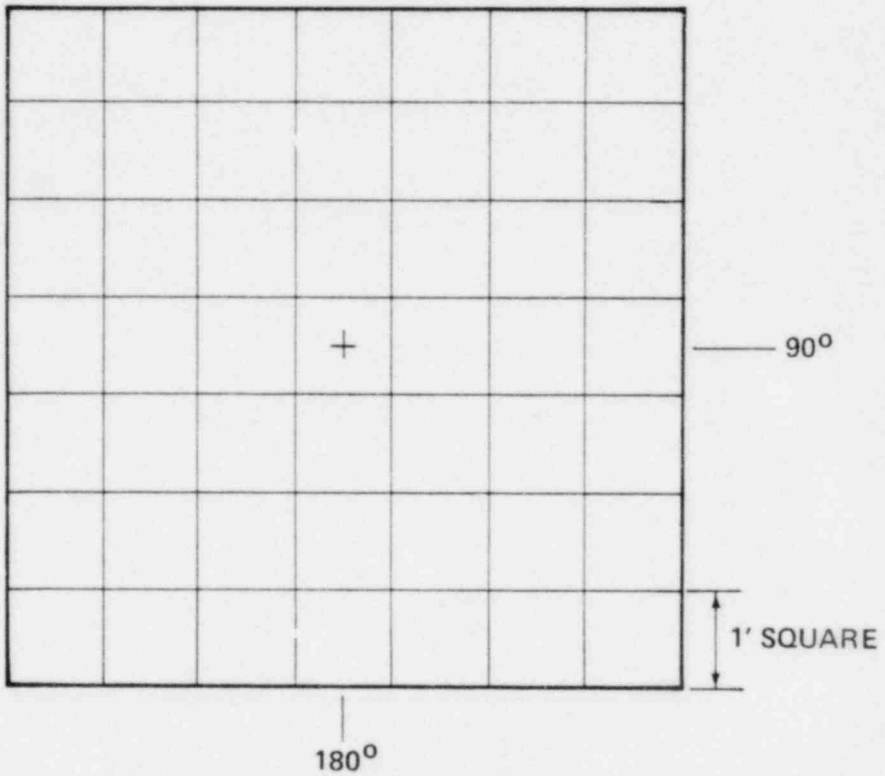
DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12:17	75.38	66	1	0	
1/1/82	07:45	76.7	55	2	10	NO CRACKS LARGER THAN 0.005" OBSERVED
1/1/82	14:00	78.2	58	3	17.3	NO CRACKS LARGER THAN 0.007" OBSERVED
1/2/81	21:40	72	69	4	0	NO OTHER CRACKS OBSERVED

FIGURE 5-10 CONCRETE CRACK MAPPING
AREA 4



DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12:20	15.38	66	1	0	
1/1	8:30	76.7	63	2	10	BLOCKS 6 & 7 HAD NEW CRACKS NO GREATER THAN 0.003
1/1	14:10	74.2	55	3	17.30	NEW CRACK 13" BLOCK 33. NEW CRACK BLOCK 37
1/2	21:34	72	64	4	0	NO CRACKS > .004"

FIGURE 5-11 CONCRETE CRACK MAPPING
AREA 5



+ DENOTES APEX OF DOME

DATE	TIME	TEMP °F		STAGE	PSIG	REMARKS
		IN	OUT			
12/31	12/25	77.31	67	1	0	
1/1/82	8:27 AM	76.7	65	2	10	NOTHING OBSERVED OVER. 008
1/1/82	2:53 PM	78.2	68	3	17:25	NOTHING OBSERVED OVER .008 SLIGHT EXTENSION IN LENGTH OF EXISTING CRACKS ONLY
1/2/82	9:36 PM	74.7	67	4	0	NOTHING OBSERVED OVER .008 CRACKS DECREASED IN WIDTH

FIGURE 5-12 CONCRETE CRACK MAPPING
AREA 6

TABLE 5-1
SUMMARY OF DATA FOR TRANSDUCER H-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.002
1/1	0622	7.5	0.004
1/1	0930	10.0	0.006
1/1	1041	12.6	0.009
1/1	1246	15.0	0.024
1/1	1349	17.3	0.027
1/1	1630	17.3	0.029
1/1	2000	15.1	0.029
1/1	2249	12.5	0.028
1/2	0153	9.8	0.026
1/2	1458	5.1	0.021
1/2	1802	2.5	0.019
1/2	2114	0	0.015

TABLE 5-2
SUMMARY OF DATA FOR TRANSDUCER H-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.002
1/1	0622	7.5	0.004
1/1	0930	10.0	0.007
1/1	1041	12.6	0.010
1/1	1246	15.0	0.025
1/1	1349	17.3	0.028
1/1	1630	17.3	0.031
1/1	2000	15.1	0.031
1/1	2249	12.5	0.029
1/2	0153	9.8	0.026
1/2	1458	5.1	0.022
1/2	1802	2.5	0.020
1/2	2114	0	0.017

TABLE 5-3
SUMMARY OF DATA FOR TRANSDUCER H-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.000
1/1	0930	10.0	0.000
1/1	1041	12.6	0.012
1/1	1246	15.0	0.020
1/1	1349	17.3	0.023
1/1	1630	17.3	0.024
1/1	2000	15.1	0.024
1/1	2249	12.5	0.024
1/2	0153	9.8	0.024
1/2	1458	5.1	0.021
1/2	1802	2.5	0.019
1/2	2114	0	0.017

TABLE 5-4
SUMMARY OF DATA FOR TRANSDUCER H-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.001
1/1	0622	7.5	0.003
1/1	0930	10.0	0.006
1/1	1041	12.6	0.009
1/1	1246	15.0	0.030
1/1	1349	17.3	0.036
1/1	1630	17.3	0.039
1/1	2000	15.1	0.039
1/1	2249	12.5	0.038
1/2	0153	9.8	0.035
1/2	1458	5.1	0.029
1/2	1802	2.5	0.026
1/2	2114	0	0.023

TABLE 5-5
SUMMARY OF DATA FOR TRANSDUCER H-5

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.002
1/1	0343	5.0	0.004
1/1	0622	7.5	0.006
1/1	0930	10.0	0.009
1/1	1041	12.6	0.011
1/1	1246	15.0	0.029
1/1	1349	17.3	0.034
1/1	1630	17.3	0.036
1/1	2000	15.1	0.035
1/1	2249	12.5	0.033
1/2	0153	9.8	0.030
1/2	1458	5.1	0.026
1/2	1802	2.5	0.024
1/2	2114	0	0.022

TABLE 5-6
SUMMARY OF DATA FOR TRANSDUCER H-6

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.001
1/1	0343	5.0	0.004
1/1	0622	7.5	0.007
1/1	0930	10.0	0.011
1/1	1041	12.6	0.015
1/1	1246	15.0	0.036
1/1	1349	17.3	0.041
1/1	1630	17.3	0.044
1/1	2000	15.1	0.044
1/1	2249	12.5	0.042
1/2	0153	9.8	0.038
1/2	1458	5.1	0.032
1/2	1802	2.5	0.029
1/2	2114	0	0.025

TABLE 5-7
SUMMARY OF DATA FOR TRANSDUCER H-7

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.007
1/1	0622	7.5	0.011
1/1	0930	10.0	0.019
1/1	1041	12.6	0.025
1/1	1246	15.0	0.057
1/1	1349	17.3	0.089
1/1	1630	17.3	0.101
1/1	2000	15.1	0.099
1/1	2249	12.5	0.093
1/2	0153	9.8	0.086
1/2	1458	5.1	0.068
1/2	1802	2.5	0.056
1/2	2114	0	0.043

Final Adjusted Recovery Value: 0.043

TABLE 5-8
SUMMARY OF DATA FOR TRANSDUCER H-8

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.008
1/1	0622	7.5	0.019
1/1	0930	10.0	0.038
1/1	1041	12.6	0.052
1/1	1246	15.0	0.174
1/1	1349	17.3	0.267
1/1	1630	17.3	0.283
1/1	2000	15.1	0.267
1/1	2249	12.5	0.241
1/2	0153	9.8	*
1/2	1458	5.1	0.161
1/2	1802	2.5	0.136
1/2	2114	0	0.111

Final Adjusted Recovery Value: 0.054

*Invalid Reading - Out of Scale

TABLE 5-9
SUMMARY OF DATA FOR TRANSDUCER H-9

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.002
1/1	0343	5.0	0.008
1/1	0622	7.5	0.016
1/1	0930	10.0	0.028
1/1	1041	12.6	0.056
1/1	1246	15.0	0.185
1/1	1349	17.3	0.246
1/1	1630	17.3	0.263
1/1	2000	15.1	0.257
1/1	2249	12.5	0.233
1/2	0153	9.8	0.204
1/2	1458	5.1	0.153
1/2	1802	2.5	0.127
1/2	2114	0	0.102

Final Adjusted Recovery Value: 0.037

TABLE 5-10
SUMMARY OF DATA FOR TRANSDUCER H-10

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.018
1/1	0930	10.0	0.030
1/1	1041	12.6	0.049
1/1	1246	15.0	0.107
1/1	1349	17.3	0.145
1/1	1630	17.3	0.166
1/1	2000	15.1	0.163
1/1	2249	12.5	0.150
1/2	0153	9.8	0.134
1/2	1458	5.1	0.108
1/2	1802	2.5	0.094
1/2	2114	0	0.079

Final Adjusted Recovery Value: 0.077

TABLE 5-11
SUMMARY OF DATA FOR TRANSDUCER H-11

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.015
1/1	0930	10.0	0.025
1/1	1041	12.6	0.041
1/1	1246	15.0	0.109
1/1	1349	17.3	0.152
1/1	1630	17.3	0.168
1/1	2000	15.1	0.164
1/1	2249	12.5	0.156
1/2	0153	9.8	0.144
1/2	1458	5.1	0.122
1/2	1802	2.5	0.108
1/2	2114	0	0.093

Final Adjusted Recovery Value: 0.090

TABLE 5-12
SUMMARY OF DATA FOR TRANSDUCER H-12

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.009
1/1	0622	7.5	0.015
1/1	0930	10.0	0.023
1/1	1041	12.6	0.029
1/1	1246	15.0	0.060
1/1	1349	17.3	0.078
1/1	1630	17.3	0.084
1/1	2000	15.1	0.084
1/1	2249	12.5	0.080
1/2	0153	9.8	0.074
1/2	1458	5.1	0.063
1/2	1802	2.5	0.057
1/2	2114	0	0.049

Final Adjusted Recovery Value: 0.050

TABLE 5-13
SUMMARY OF DATA FOR TRANSDUCER H-13

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.011
1/1	0930	10.0	0.026
1/1	1041	12.6	0.043
1/1	1246	15.0	0.125
1/1	1349	17.3	0.185
1/1	1630	17.3	0.210
1/1	2000	15.1	0.210
1/1	2249	12.5	0.198
1/2	0153	9.8	0.173
1/2	1458	5.1	0.130
1/2	1802	2.5	0.110
1/2	2114	0	0.088

TABLE 5-14
SUMMARY OF DATA FOR TRANSDUCER H-14

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.006
1/1	0343	5.0	0.013
1/1	0622	7.5	0.023
1/1	0930	10.0	0.039
1/1	1041	12.6	0.057
1/1	1246	15.0	0.154
1/1	1349	17.3	*
1/1	1630	17.3	0.249
1/1	2000	15.1	0.244
1/1	2249	12.5	*
1/2	0153	9.8	0.197
1/2	1458	5.1	0.147
1/2	1802	2.5	0.124
1/2	2114	0	0.102

*Invalid Reading - Out of Scale

TABLE 5-15
SUMMARY OF DATA FOR TRANSDUCER H-15

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.009
1/1	0622	7.5	0.017
1/1	0930	10.0	0.029
1/1	1041	12.6	0.040
1/1	1246	15.0	0.108
1/1	1349	17.3	0.165
1/1	1630	17.3	0.184
1/1	2000	15.1	0.184
1/1	2249	12.5	0.171
1/2	0153	9.8	0.150
1/2	1458	5.1	0.112
1/2	1802	2.5	0.097
1/2	2114	0	0.080

TABLE 5-16
SUMMARY OF DATA FOR TRANSDUCER H-16

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.009
1/1	0622	7.5	0.014
1/1	0930	10.0	0.019
1/1	1041	12.6	0.024
1/1	1246	15.0	0.044
1/1	1349	17.3	0.051
1/1	1630	17.3	0.056
1/1	2000	15.1	0.055
1/1	2249	12.5	0.051
1/2	0153	9.8	0.046
1/2	1458	5.1	0.037
1/2	1802	2.5	0.032
1/2	2114	0	0.026

TABLE 5-17
SUMMARY OF DATA FOR TRANSDUCER H-17

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.010
1/1	0622	7.5	0.015
1/1	0930	10.0	0.021
1/1	1041	12.6	0.027
1/1	1246	15.0	0.060
1/1	1349	17.3	0.075
1/1	1630	17.3	0.082
1/1	2000	15.1	0.081
1/1	2249	12.5	0.075
1/2	0153	9.8	0.067
1/2	1458	5.1	0.054
1/2	1802	2.5	0.047
1/2	2114	0	0.039

TABLE 5-18
SUMMARY OF DATA FOR TRANSDUCER H-18

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.006
1/1	0622	7.5	0.009
1/1	0930	10.0	0.013
1/1	1041	12.6	0.016
1/1	1246	15.0	0.038
1/1	1349	17.3	0.058
1/1	1630	17.3	0.074
1/1	2000	15.1	0.072
1/1	2249	12.5	0.068
1/2	0153	9.8	0.064
1/2	1458	5.1	0.056
1/2	1802	2.5	0.051
1/2	2114	0	0.046

TABLE 5-19
SUMMARY OF DATA FOR TRANSDUCER H-19

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.004
1/1	0343	5.0	0.008
1/1	0622	7.5	0.013
1/1	0930	10.0	0.025
1/1	1041	12.6	0.041
1/1	1246	15.0	0.123
1/1	1349	17.3	0.182
1/1	1630	17.3	0.201
1/1	2000	15.1	0.193
1/1	2249	12.5	0.177
1/2	0153	9.8	0.157
1/2	1458	5.1	0.118
1/2	1802	2.5	0.096
1/2	2114	0	0.074

Final Adjusted Recovery Value: 0.068

TABLE 5-20
SUMMARY OF DATA FOR TRANSDUCER H-20

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.008
1/1	0622	7.5	0.013
1/1	0930	10.0	0.021
1/1	1041	12.6	0.042
1/1	1246	15.0	0.176
1/1	1349	17.3	0.255
1/1	1630	17.3	0.271
1/1	2000	15.1	0.258
1/1	2249	12.5	0.231
1/2	0153	9.8	*
1/2	1458	5.1	0.144
1/2	1802	2.5	0.117
1/2	2114	0	0.091

Final Adjusted Recovery Value: 0.100

*Invalid Reading - Out of Scale

TABLE 5-21
SUMMARY OF DATA FOR TRANSDUCER H-21

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.003
1/1	0343	5.0	0.008
1/1	0622	7.5	0.014
1/1	0930	10.0	0.026
1/1	1041	12.6	0.036
1/1	1246	15.0	0.131
1/1	1349	17.3	0.185
1/1	1630	17.3	0.206
1/1	2000	15.1	0.206
1/1	2249	12.5	0.197
1/2	0153	9.8	0.183
1/2	1458	5.1	0.150
1/2	1802	2.5	0.131
1/2	2114	0	0.109

Final Adjusted Recovery Value: 0.020

TABLE 5-22
SUMMARY OF DATA FOR TRANSDUCER D-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.008
1/1	0343	5.0	0.020
1/1	0622	7.5	0.035
1/1	0930	10.0	0.054
1/1	1041	12.6	0.069
1/1	1246	15.0	0.089
1/1	1349	17.3	0.106
1/1	1630	17.3	0.114
1/1	2000	15.1	0.114
1/1	2249	12.5	0.105
1/2	0153	9.8	0.090
1/2	1458	5.1	0.064
1/2	1802	2.5	0.051
1/2	2114	0	0.036

Final Adjusted Recovery Value: 0.017

TABLE 5-23
SUMMARY OF DATA FOR TRANSDUCER D-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.015
1/1	0343	5.0	0.026
1/1	0622	7.5	0.040
1/1	0930	10.0	0.056
1/1	1041	12.6	0.069
1/1	1246	15.0	0.091
1/1	1349	17.3	0.106
1/1	1630	17.3	0.112
1/1	2000	15.1	0.112
1/1	2249	12.5	0.106
1/2	0153	9.8	0.092
1/2	1458	5.1	0.067
1/2	1802	2.5	0.055
1/2	2114	0	0.043

Final Adjusted Recovery Value: 0.025

TABLE 5-24
SUMMARY OF DATA FOR TRANSDUCER D-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.012
1/1	0930	10.0	0.030
1/1	1041	12.6	0.039
1/1	1246	15.0	0.060
1/1	1349	17.3	0.073
1/1	1630	17.3	0.081
1/1	2000	15.1	0.080
1/1	2249	12.5	0.080
1/2	0153	9.8	0.073
1/2	1458	5.1	0.051
1/2	1802	2.5	0.051
1/2	2114	0	0.032

Final Adjusted Recovery Value: 0.014

TABLE 5-25
SUMMARY OF DATA FOR TRANSDUCER V-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.000
1/1	0622	7.5	0.009
1/1	0930	10.0	0.009
1/1	1041	12.6	0.015
1/1	1246	15.0	0.023
1/1	1349	17.3	0.029
1/1	1630	17.3	0.031
1/1	2000	15.1	0.031
1/1	2249	12.5	0.031
1/2	0153	9.8	0.031
1/2	1458	5.1	0.027
1/2	1802	2.5	0.022
1/2	2114	0	0.017

Final Adjusted Recovery Value: 0.007

TABLE 5-26
SUMMARY OF DATA FOR TRANSDUCER V-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.001
1/1	0622	7.5	0.005
1/1	0930	10.0	0.011
1/1	1041	12.6	0.013
1/1	1246	15.0	0.019
1/1	1349	17.3	0.024
1/1	1630	17.3	0.027
1/1	2000	15.1	0.027
1/1	2249	12.5	0.027
1/2	0153	9.8	0.024
1/2	1458	5.1	0.014
1/2	1802	2.5	0.011
1/2	2114	0	0.007

Final Adjusted Recovery Value: 0.003

TABLE 5-27
SUMMARY OF DATA FOR TRANSDUCER V-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.004
1/1	0622	7.5	0.010
1/1	0930	10.0	0.016
1/1	1041	12.6	0.021
1/1	1246	15.0	0.027
1/1	1349	17.3	0.031
1/1	1630	17.3	0.034
1/1	2000	15.1	0.033
1/1	2249	12.5	0.033
1/2	0153	9.8	0.028
1/2	1458	5.1	0.018
1/2	1802	2.5	0.013
1/2	2114	0	0.008

Final Adjusted Recovery Value: 0.001

TABLE 5-28
SUMMARY OF DATA FOR TRANSDUCER E-1

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.009
1/1	0622	7.5	0.017
1/1	0930	10.0	0.031
1/1	1041	12.6	0.045
1/1	1246	15.0	0.145
1/1	1349	17.3	*
1/1	1630	17.3	0.233
1/1	2000	15.1	0.225
1/1	2249	12.5	*
1/2	0153	9.8	0.181
1/2	1458	5.1	0.137
1/2	1802	2.5	0.115
1/2	2114	0	0.093

*Invalid Reading - Out of Scale

TABLE 5-29
SUMMARY OF DATA FOR TRANSDUCER E-2

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.005
1/1	0343	5.0	0.013
1/1	0622	7.5	0.022
1/1	0930	10.0	0.037
1/1	1041	12.6	0.052
1/1	1246	15.0	0.116
1/1	1349	17.3	0.213
1/1	1630	17.3	0.258
1/1	2000	15.1	0.228
1/1	2249	12.5	0.207
1/2	0153	9.8	0.183
1/2	1458	5.1	0.138
1/2	1802	2.5	0.110
1/2	2114	0	0.091

TABLE 5-30
SUMMARY OF DATA FOR TRANSDUCER E-3

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.011
1/1	0343	5.0	0.022
1/1	0622	7.5	0.034
1/1	0930	10.0	0.051
1/1	1041	12.6	0.068
1/1	1246	15.0	0.156
1/1	1349	17.3	0.220
1/1	1630	17.3	0.224
1/1	2000	15.1	0.232
1/1	2249	12.5	0.209
1/2	0153	9.8	0.182
1/2	1458	5.1	0.134
1/2	1802	2.5	0.110
1/2	2114	0	0.085

TABLE 5-31
SUMMARY OF DATA FOR TRANSDUCER E-4

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.009
1/1	0343	5.0	0.019
1/1	0622	7.5	0.031
1/1	0930	10.0	0.053
1/1	1041	12.6	0.072
1/1	1246	15.0	0.134
1/1	1349	17.3	*
1/1	1630	17.3	0.213
1/1	2000	15.1	0.207
1/1	2249	12.5	*
1/2	0153	9.8	0.163
1/2	1458	5.1	0.118
1/2	1802	2.5	0.096
1/2	2114	0	0.073

*Invalid Reading - Out of Scale

TABLE 5-32
SUMMARY OF DATA FOR TRANSDUCER E-5

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.000
1/1	0343	5.0	0.014
1/1	0622	7.5	0.026
1/1	0930	10.0	0.040
1/1	1041	12.6	0.059
1/1	1246	15.0	0.116
1/1	1349	17.3	0.166
1/1	1630	17.3	0.187
1/1	2000	15.1	0.187
1/1	2249	12.5	0.183
1/2	0153	9.8	0.164
1/2	1458	5.1	0.128
1/2	1802	2.5	0.108
1/2	2114	0	0.088

TABLE 5-33
SUMMARY OF DATA FOR TRANSDUCER E-6

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.008
1/1	0343	5.0	0.014
1/1	0622	7.5	0.022
1/1	0930	10.0	0.036
1/1	1041	12.6	0.049
1/1	1246	15.0	0.104
1/1	1349	17.3	0.145
1/1	1630	17.3	0.167
1/1	2000	15.1	0.166
1/1	2249	12.5	0.153
1/2	0153	9.8	0.137
1/2	1458	5.1	0.106
1/2	1802	2.5	0.089
1/2	2114	0	0.072

TABLE 5-34
SUMMARY OF DATA FOR TRANSDUCER E-7

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.007
1/1	0343	5.0	0.014
1/1	0622	7.5	0.023
1/1	0930	10.0	0.037
1/1	1041	12.6	0.055
1/1	1246	15.0	0.117
1/1	1349	17.3	0.172
1/1	1630	17.3	0.200
1/1	2000	15.1	0.196
1/1	2249	12.5	0.177
1/2	0153	9.8	0.155
1/2	1458	5.1	0.116
1/2	1802	2.5	0.096
1/2	2114	0	0.076

TABLE 5-35
SUMMARY OF DATA FOR TRANSDUCER E-8

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.009
1/1	0343	5.0	0.017
1/1	0622	7.5	0.027
1/1	0930	10.0	0.044
1/1	1041	12.6	0.062
1/1	1246	15.0	0.125
1/1	1349	17.3	0.184
1/1	1630	17.3	0.210
1/1	2000	15.1	0.200
1/1	2249	12.5	0.180
1/2	0153	9.8	0.155
1/2	1458	5.1	0.112
1/2	1802	2.5	0.090
1/2	2114	0	0.068

TABLE 5-36
SUMMARY OF DATA FOR TRANSDUCER E-9

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.010
1/1	0343	5.0	0.022
1/1	0622	7.5	0.035
1/1	0930	10.0	0.055
1/1	1041	12.6	0.075
1/1	1246	15.0	0.144
1/1	1349	17.3	0.209
1/1	1630	17.3	0.235
1/1	2000	15.1	0.224
1/1	2249	12.5	0.200
1/2	0153	9.8	0.172
1/2	1458	5.1	0.121
1/2	1802	2.5	0.094
1/2	2114	0	0.068

TABLE 5-37
SUMMARY OF DATA FOR TRANSDUCER E-10

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.011
1/1	0343	5.0	0.021
1/1	0622	7.5	0.033
1/1	0930	10.0	0.050
1/1	1041	12.6	0.070
1/1	1246	15.0	0.129
1/1	1349	17.3	0.186
1/1	1630	17.3	0.205
1/1	2000	15.1	0.192
1/1	2249	12.5	0.174
1/2	0153	9.8	0.152
1/2	1458	5.1	0.112
1/2	1802	2.5	0.090
1/2	2114	0	0.068

TABLE 5-38
SUMMARY OF DATA FOR TRANSDUCER E-11

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.007
1/1	0343	5.0	0.015
1/1	0622	7.5	0.023
1/1	0930	10.0	0.033
1/1	1041	12.6	0.055
1/1	1246	15.0	0.117
1/1	1349	17.3	0.155
1/1	1630	17.3	0.173
1/1	2000	15.1	0.171
1/1	2249	12.5	0.159
1/2	0153	9.8	0.144
1/2	1458	5.1	0.116
1/2	1802	2.5	0.100
1/2	2114	0	0.082

TABLE 5-39
SUMMARY OF DATA FOR TRANSDUCER E-12

Date	Time	(Psig) Pressure	Displacement (inches)
1/1	0000	0	0.000
1/1	0205	2.5	0.006
1/1	0343	5.0	0.012
1/1	0622	7.5	0.020
1/1	0930	10.0	0.030
1/1	1041	12.6	0.046
1/1	1246	15.0	0.117
1/1	1349	17.3	0.152
1/1	1630	17.3	0.170
1/1	2000	15.1	0.168
1/1	2249	12.5	0.158
1/2	0153	9.8	0.145
1/2	1458	5.1	0.120
1/2	1802	2.5	0.104
1/2	2114	0	0.087

6. REFERENCES

1. Final Safety Analysis Report, Grand Gulf Nuclear Station, Unit No. 1, Mississippi Power and Light Company.

2. Procedure Q1M61-W-11302WXA, Containment Structural Integrity Test, Grand Gulf Nuclear Station Unit 1, Mississippi Power and Light Company.