SACRAMENTO MUNCIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

UNIT NO. 1

CONTAINMENT STRUCTURAL INTEGRITY TEST REPORT

Prepared by:
Bechtel Corporation
San Francisco, California
March 1974

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1. INTRODUCTION

The Unit 1 Containment Structural Integrity Test was conducted in conjunction with the initial Integrated Leak Rate Test during the time period 2-9, Feb. 1974. The primary purpose of the structural integrity test was to verify the design and the structural integrity of the containment by imposing an internal pressure of 115 percent design pressure for a period of not less than one hour.

In order to accomplish the intended test purpose, specialized measuring devices were employed on and in the containment to provide the data needed to evaluate structural response during pressurization and depressurization. The test was conducted in accordance with a written procedure detailing test requirements and instructions for acquiring test data.

2. SUMMARY AND CONCLUSIONS

The structural integrity test consisted of (1) proof of containment ability to contain 115 percent of design pressure and (2) measurement of structural response to changes in internal pressure. Test measurements included gross structural deformations and concrete crack growth. Measurement points were located along typical sections of the structure, at thickened sections and at discontinuties. Test measurements were recorded at specified stages during the pressurization cycle.

The containment withstood 115 percent of design pressure with no observable indications of structural distress. All measured deformations were less than allowable values.

Concrete cracks observed in the various surveillance areas did not change in measured width by more than .01 inches. This is considered to be within reasonable expectations based on the results of previous tests (Reference 2) and does not adversely affect the structural integrity of the containment.

The results of the structural integrity test provide direct experimental evidence that the containment can contain the design internal pressure with a sufficient margin of safety and that the gross response to pressure is predictable. Further, the test measurements indicate that structural behavior near discontinuities is reasonable.

The initial tendon end anchorage and liner surveillances were carried out concurrently with the structural integrity test. An interim report on surveillance findings is contained in Appendix 2.

3. CONTAINMENT STRUCTURE AND PRESSURIZATION

The containment is a reinforced and post-tensioned concrete structure designed to contain any accidental release of radioactivity from the reactor coolant system as defined in the Final Safety Analysis Report (Reference 1).

The structure consists of a post-tensioned, reinforced concrete cylinder and dome connected to and supported by a massive reinforced concrete foundation slab as shown in Figure 3-1. The cylinder wall thickness is increased at three equally spaced locations to form vertical buttresses for prestressing tendon end anchorage. Reinforced openings in the cylinder wall are provided for equipment and personnel access as well as for electrical and mechanical system feed through. The entire interior surface of the structure is lined with a 1/4 inch thick welded ASTM 285 steel plate which serves as a leak tight membrane.

Principal dimensions of the containment are:

Inside Diameter	150 ft.
Inside Height (Including Dome)	185 ft.
Vertical Wall Thickness	3 ft. 9 in.
Dome Thickness	3 ft. 6 in.
Foundation Slab Thickness	8 ft.

The containment was pressurized pneumatically to verify the required structural integrity and leak tightness. The pressure cycle is shown in Figure 3-2. The proof pressure of 68 psig, equal to 1.15 times design pressure (Reference 1), was specified to assure that

the containment has sufficient reserve strength. Proof pressure was held for a period of 16 hours to record structural data.

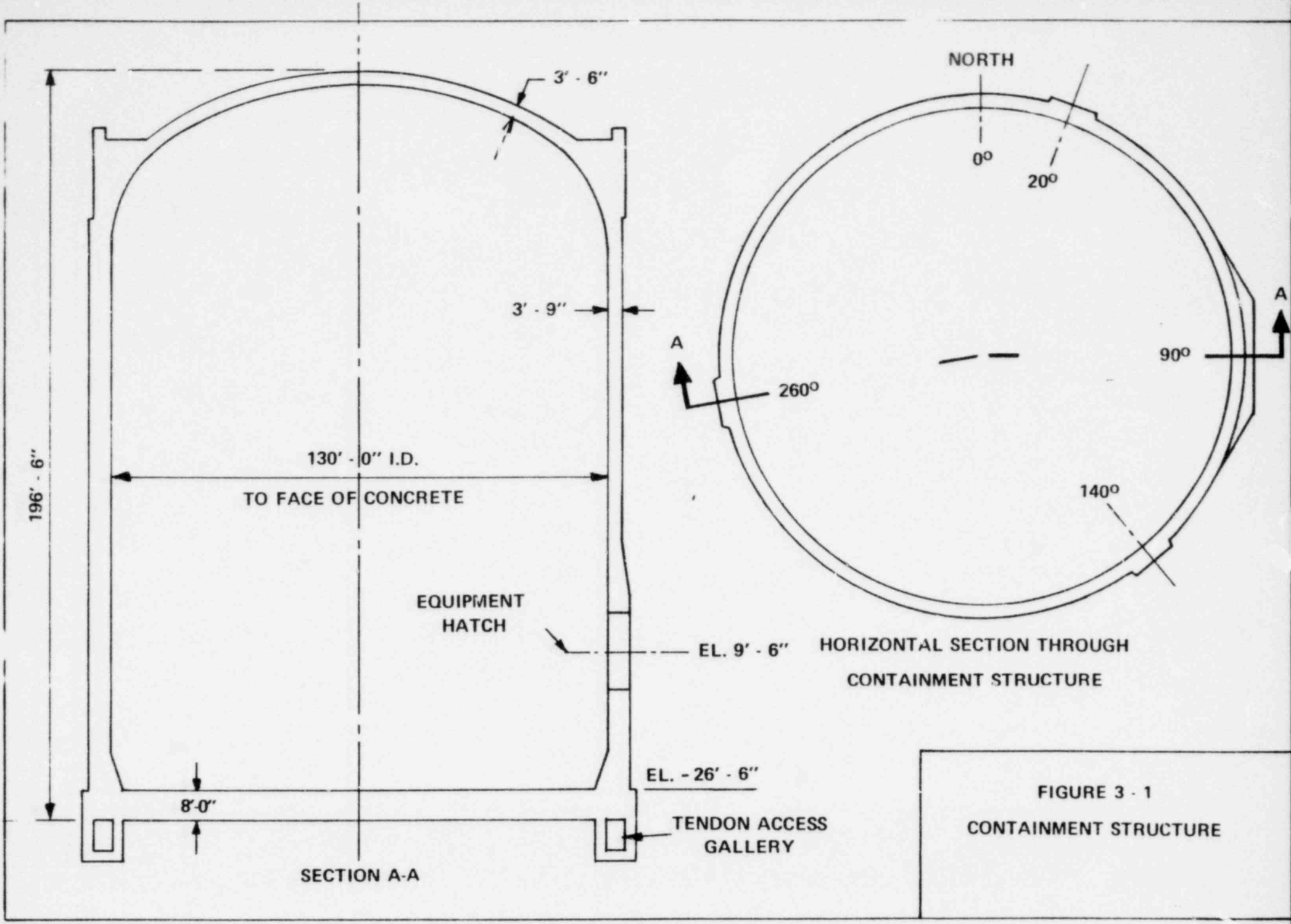


FIGURE 3 - 1

CONTAINMENT STRUCTURE

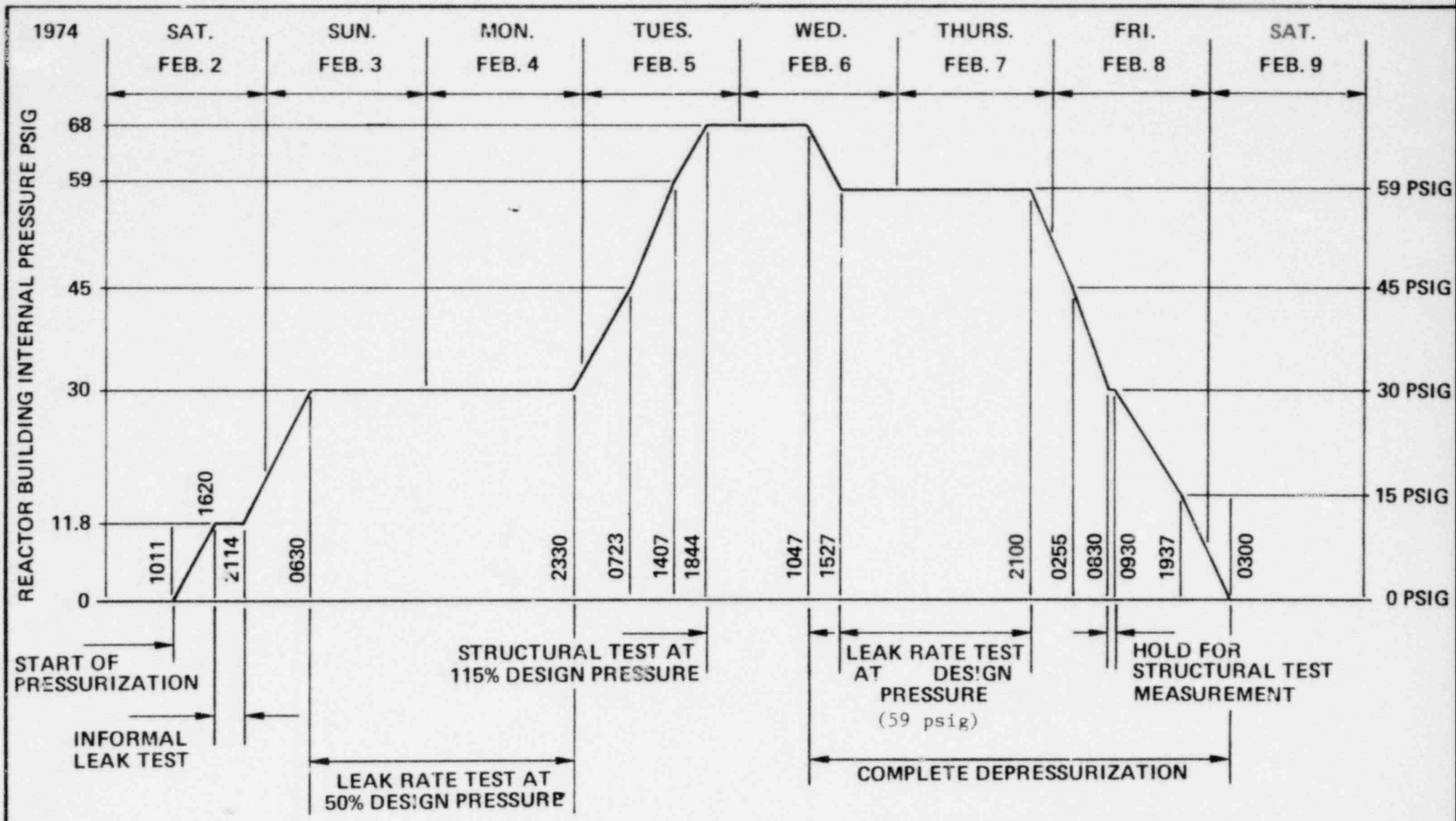


FIGURE 3-2

STRUCTURAL INTEGRITY AND INTEGRATED LEAK RATE TESTS CONTAINMENT PRESSURE CYCLE

4. TEST PLAN AND PROCEDURES

Test measurements were made at points on the containment which represented both the regular areas and the regions of discontinuity to provide data on structural deformations, and concrete crack growth.

Gross structural deformations were measured by taut wire extensometers which spanned opposite points at the same elevations on the cylinder and between other measurement points and fixed points within the building. The extensometers were located to measure radial displacements along typical wall sections, buttress sections and around the equipment hatch and vertical displacements along typical wall sections and over the dome. The layout of the extensometer system is shown in Figures 4-1 through 4-4. Descriptions of the extensometer system and calibration procedures are included in Appendix 1. The deformation measuring devices were wired to a scanning digital data acquisition system located adjacent to the containment.

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 the areas were recorded at specified pressure levels.

The structural integrity test was conducted in accordance with the procedures in Appendix 3.

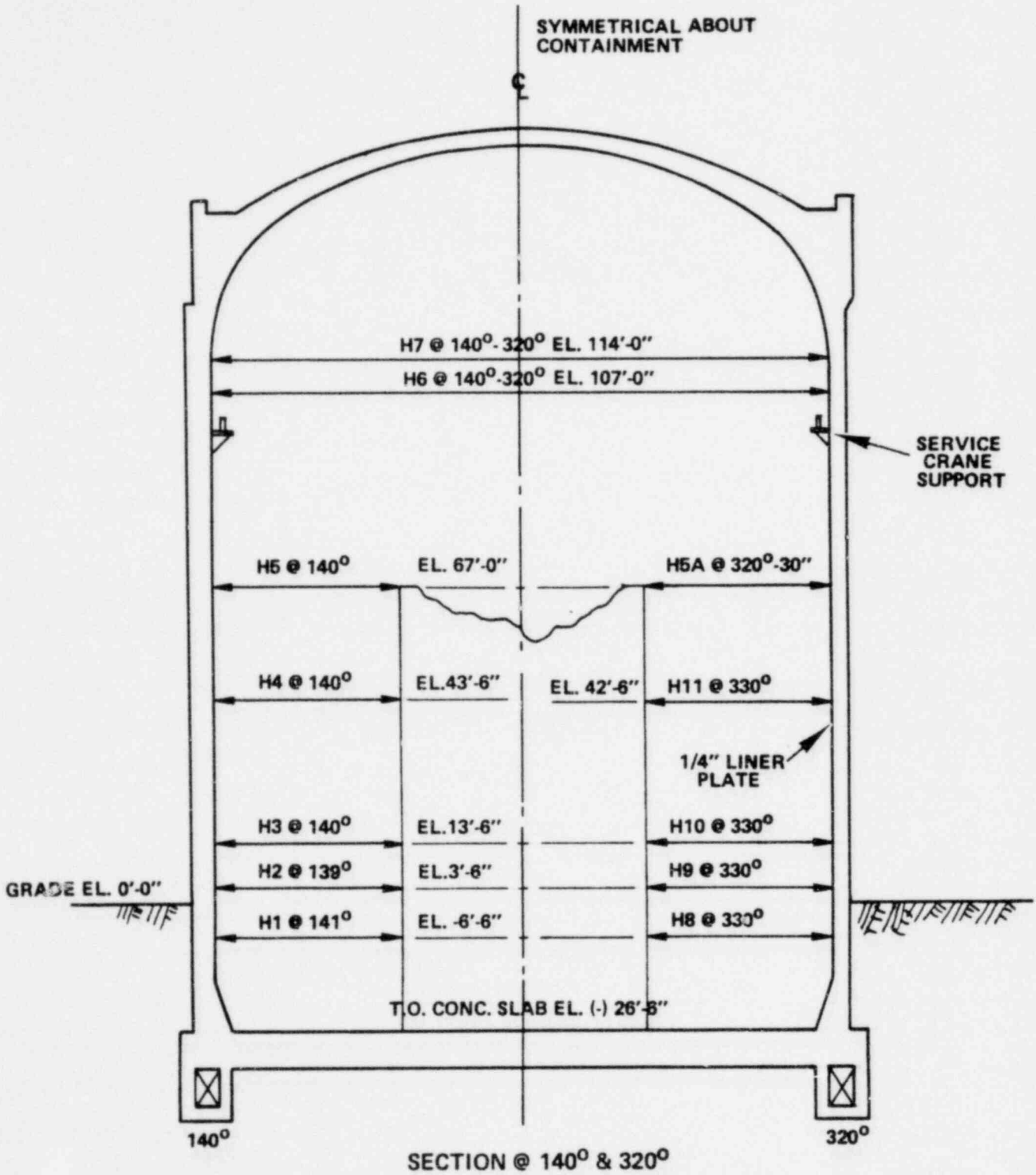


FIGURE 4-1

TAUT WIRE EXTENSOMETER LOCATIONS

RADIAL UNITS AT 14°-320°

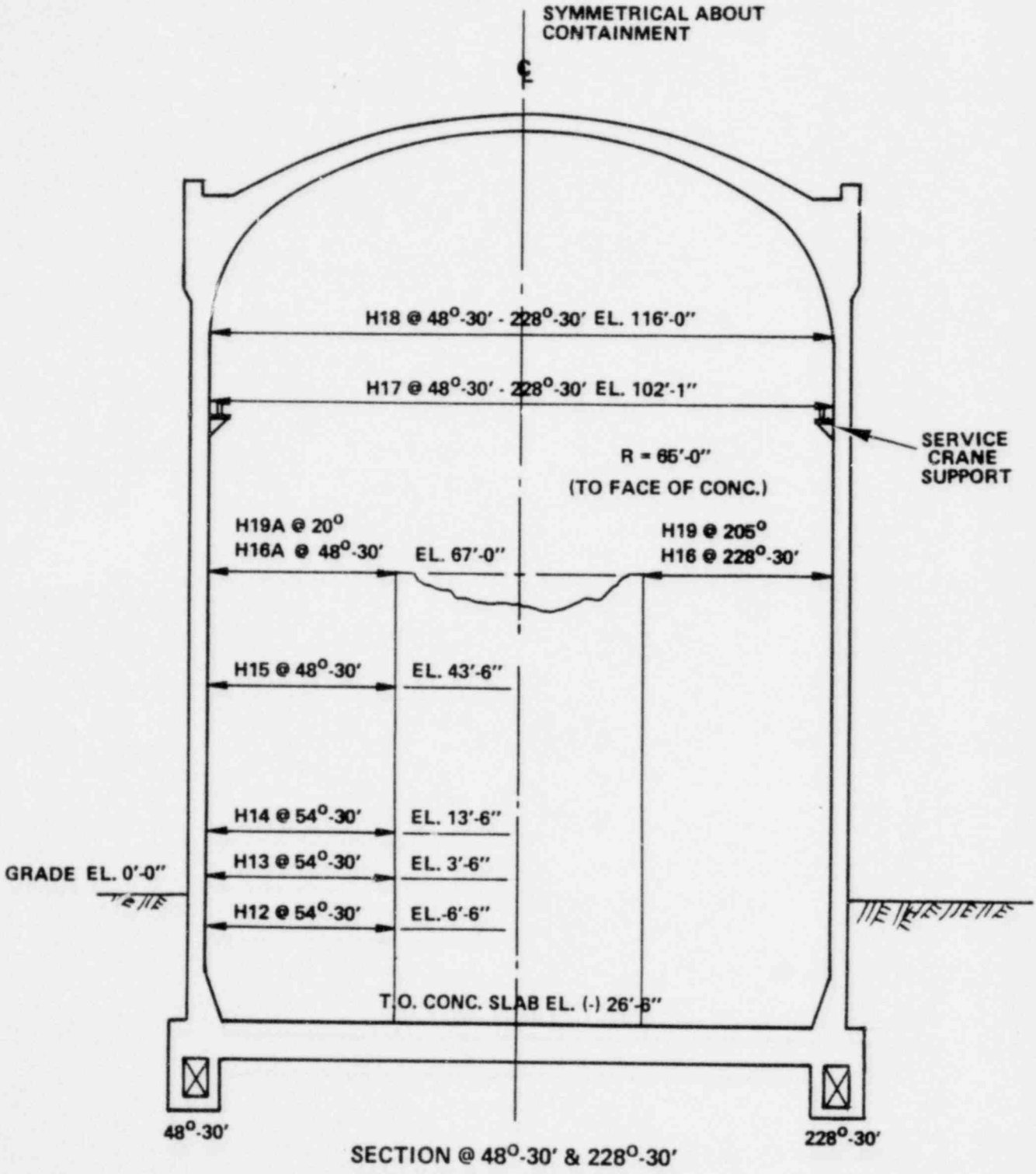
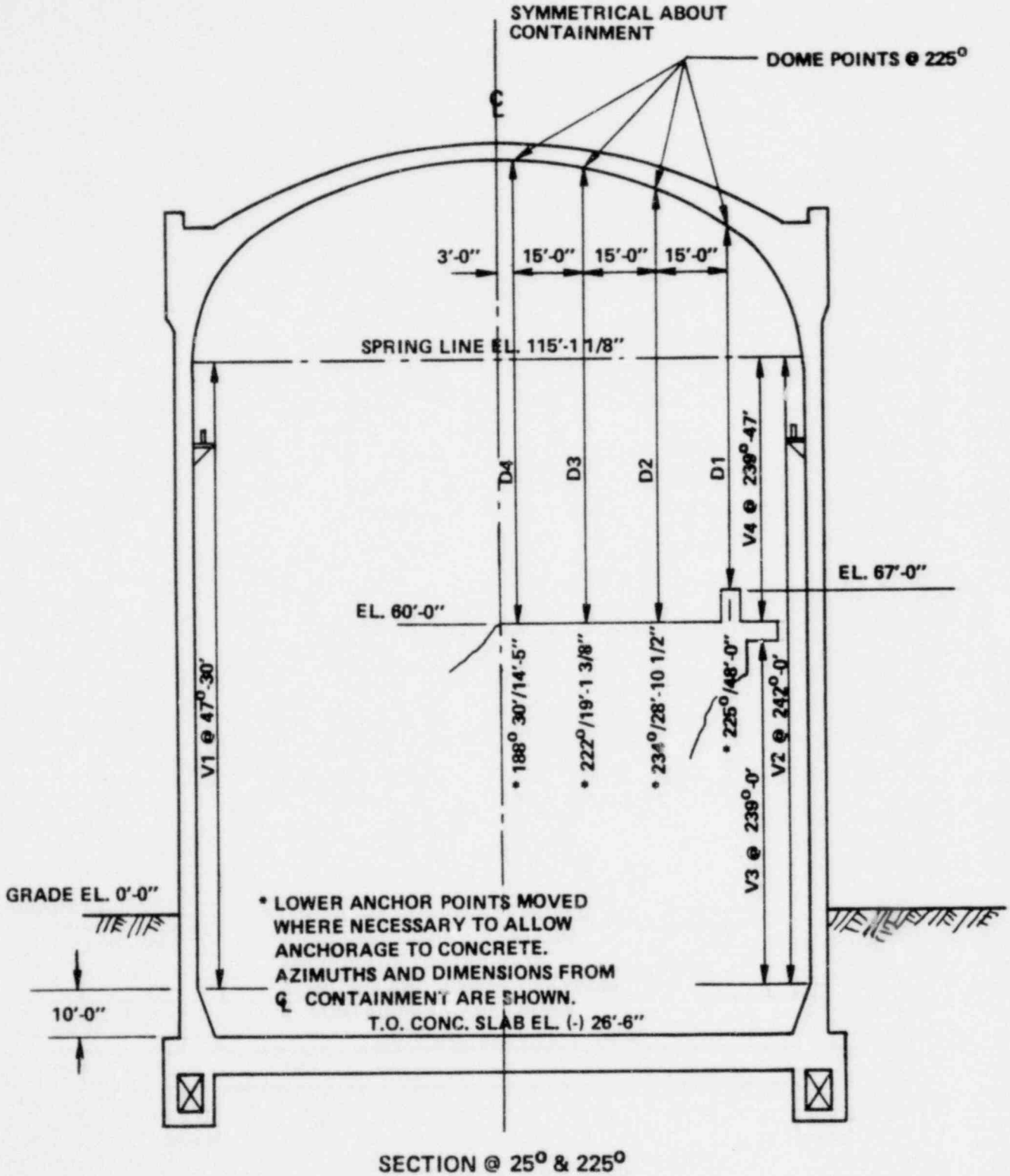


FIGURE 4-2

TAUT WIRE EXTENSOMETER LOCATIONS

RADIAL UNITS AT 48°30'-228°30'



SECTION @ 25° & 225°

FIGURE 4-3

TAUT WIRE EXTENSOMETER LOCATIONS

VERTICAL UNITS

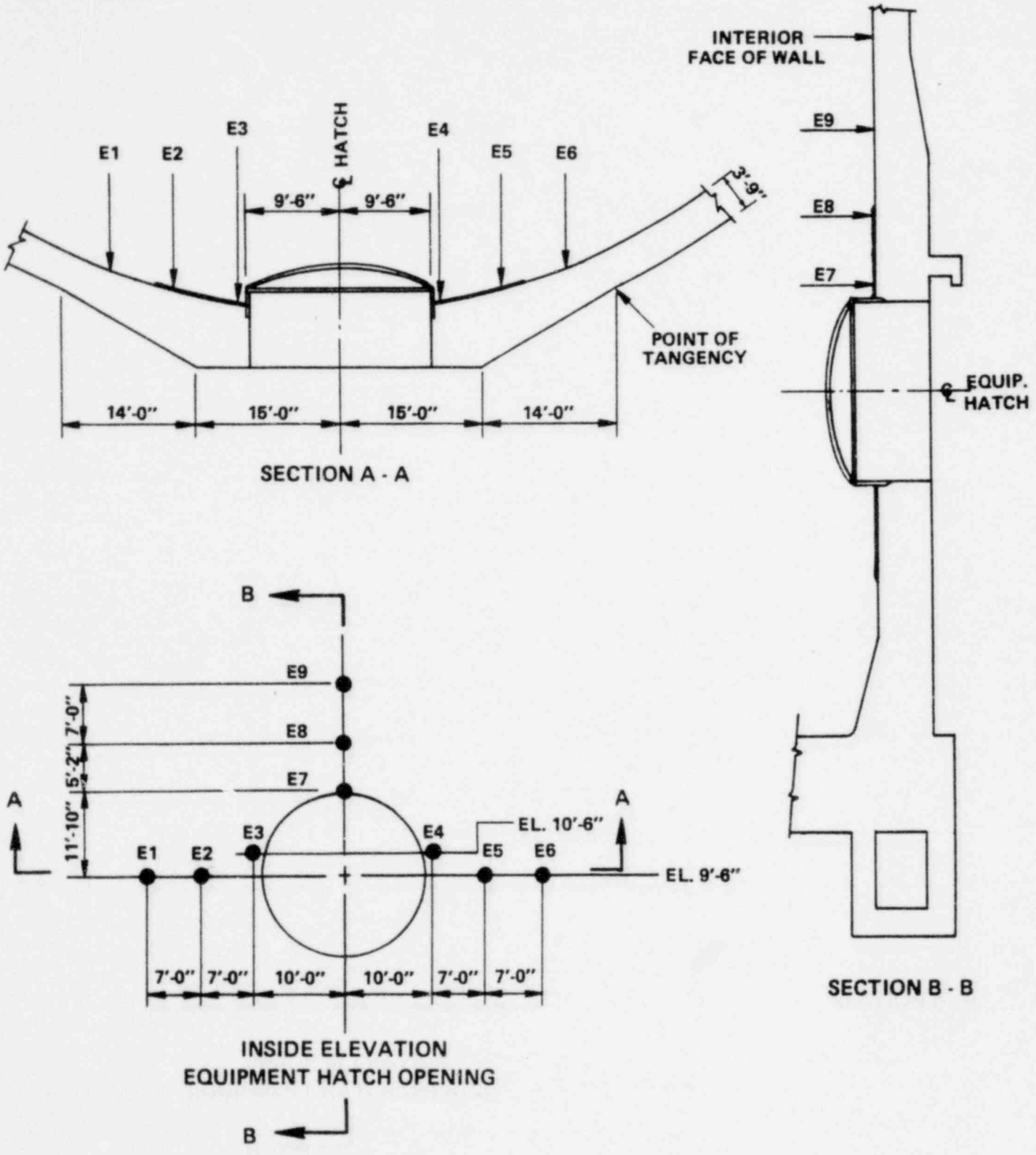
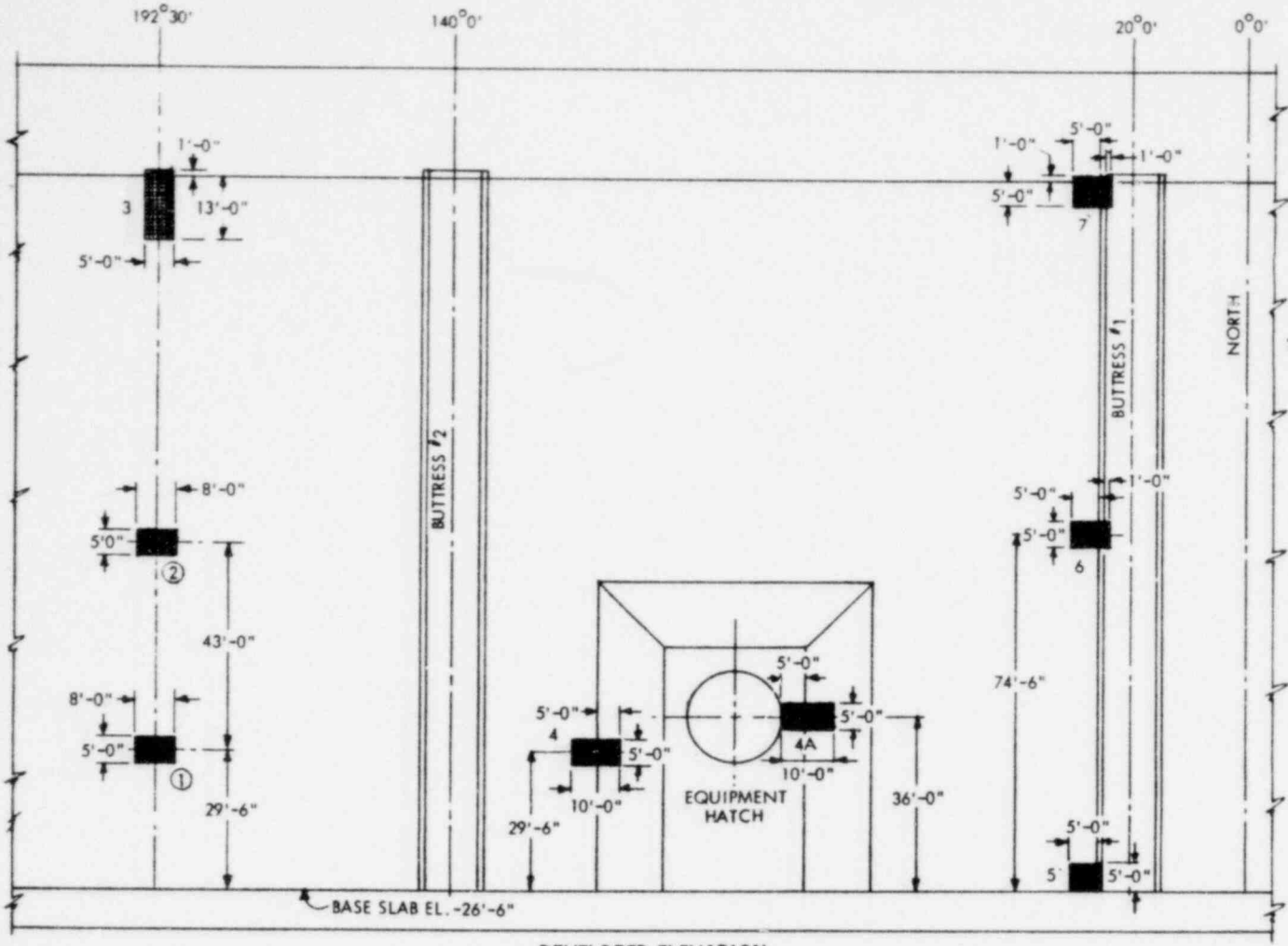


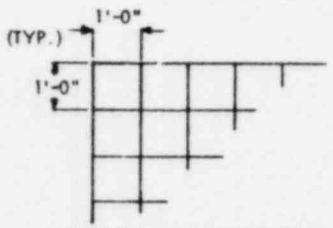
FIGURE 4-4

TAUT WIRE EXTENSOMETER LOCATIONS
EQUIPMENT HATCH

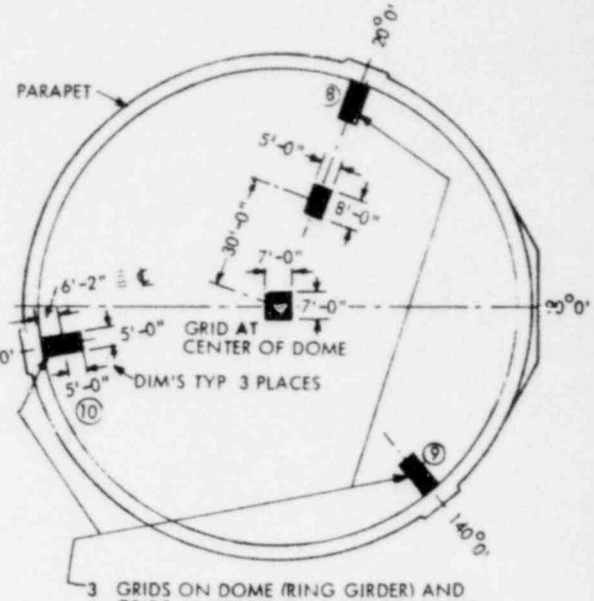


DEVELOPED ELEVATION

OUTSIDE OF CONTAINMENT STRUCTURE WALL

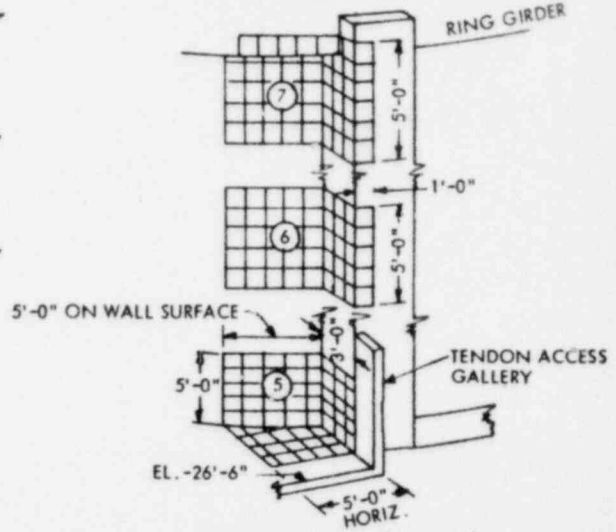


TYPICAL GRID PATTERN



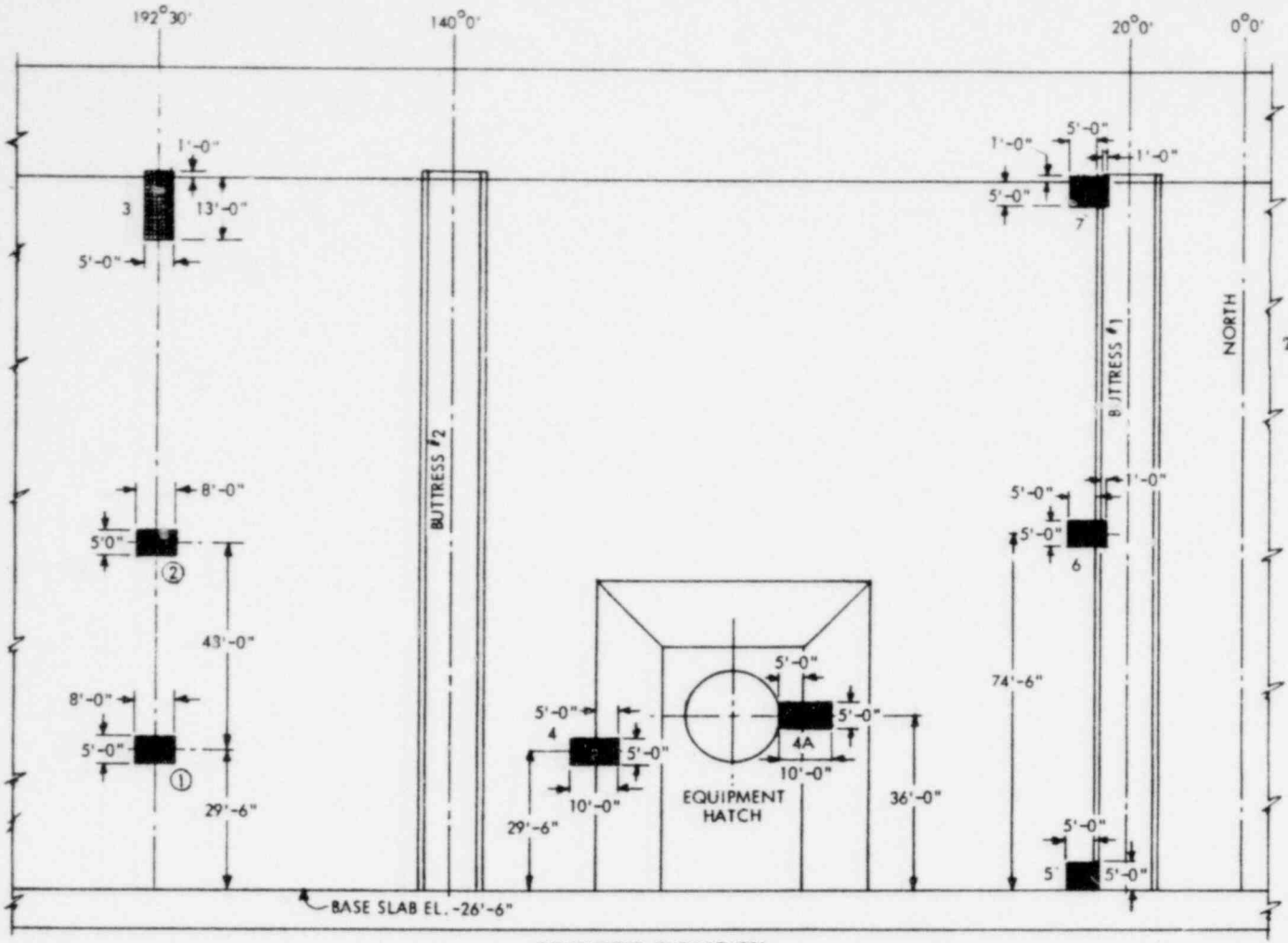
3 GRIDS ON DOME (RING GIRDER) AND
3 GRIDS AT CORRESPONDING POINTS ON
CEILING OF TENDON GALLERY (EL. -34'-6")
NUMBERED G8 G9 G10

PLAN OF DOME

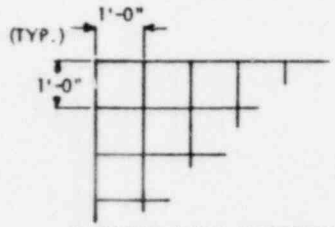


DETAIL AT BUTTRESS #1 (N.T.S.)

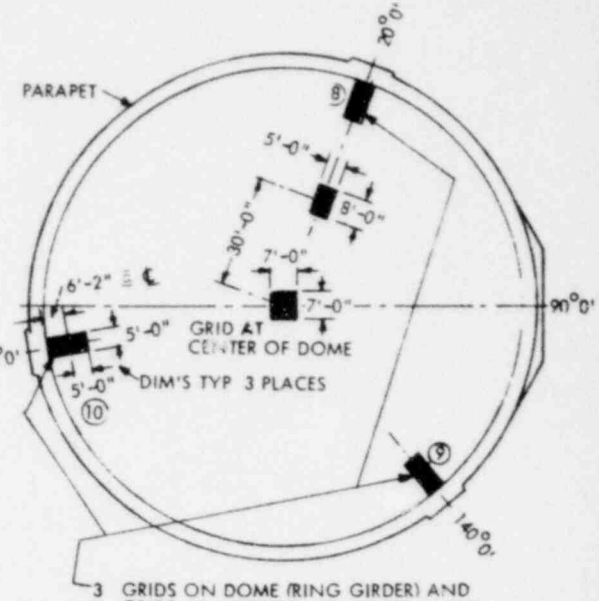
FIGURE 4-5
CONCRETE CRACK MAPPING AREAS



DEVELOPED ELEVATION
OUTSIDE OF CONTAINMENT STRUCTURE WALL

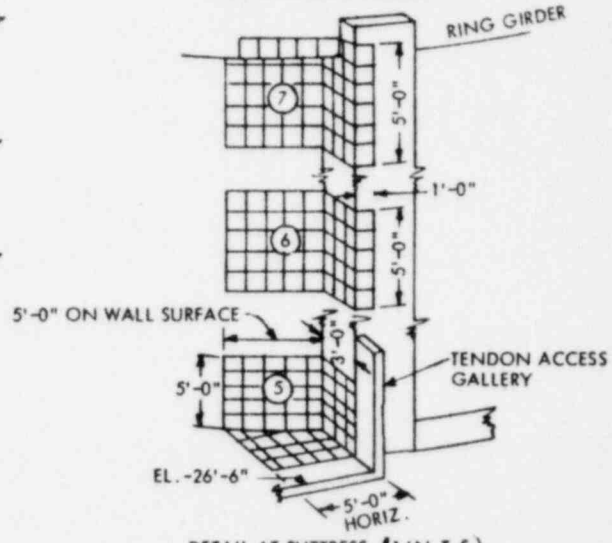


TYPICAL GRID PATTERN



3 GRIDS ON DOME (RING GIRDER) AND
3 GRIDS AT CORRESPONDING POINTS ON
CEILING OF TENDON GALLERY (EL. -34'-6")
NUMBERED G8 G9 G10

PLAN OF DOME



DETAIL AT BUTTRESS #1 (N.T.S.)

FIGURE 4-5
CONCRETE CRACK MAPPING AREAS

5. TEST RESULTS

The intent of the basic design criteria, as stated in Reference 1, is to provide a containment structure of unquestionable integrity that will meet the postulated design loading with a predictable elastic response.

The results of the structural containment integrity test provide direct experimental evidence that the containment can withstand 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 deformations. These conclusions are derived from an evaluated comparison of the predicted and measured structural response for the Rancho Seco Unit 1 containment and previously tested containments (Reference 2).

5.1 Containment Building Deformations

The 68 psig measured and predicted outward deformations of the containment dome, wall and buttress are shown in Figure 5-1. Predicted and measured values for dome deformation are in good agreement is expected for a doubly curved surface which exhibits little tendancy to round out the small deviations from true axisymmetry.

The measured deformations of the wall and buttress exhibit some scatter. This behavior is typical (see Reference 2) and reflects the

tendancy of the singly curved surface to round out the minor deviations from a true cylindrical shape. The measured buttress deformations shown are actual single data points for the 140° azimuth. The measured values shown for the wall section are averages of measurements at 50° and 330°.

Measured outward deformations in the equipment hatch area are shown in Figure 5-2. The measurements confirm expected behavior showing that the thickened, stiff central portion of the hatch area moves less than the adjacent more flexible part of the wall.

All measured deformations are less than the allowable values stipulated in Appendix 3.

Figures 5-3 through 5-7 show typical time histories of deformation over the pressure cycle. Measured deformations are essentially linear functions of pressure. Deviations from linearity are due to both thermal growth of the containment and a small hysteresis effect in the measuring devices as is discussed in Appendix 1.

5.2 Surface Concrete Cracks

The patterns of surface concrete cracks on the wall of the containment at various internal pressure are shown in Figures 5-8 through 5-23. Most of the observed cracks were present prior to the start of pressurization and result from thermal and shrinkage stresses at the concrete surface. Increases in crack width during pressurization did not exceed .01 inches and were, for the most part, .005 in. or less.

Figure 5-17 indicates a .020 in. closure of a crack observed at the edge of the dome. This area was sandblasted to remove a mastic

coating and expose the concrete for crack observations. The sand-blasting produced very pronounced rounded edges at existing hairline cracks; a condition which made accurate width measurement difficult. Since adjacent cracks indicate no measurable change in width, it is concluded that the recorded .020 in. closure represents an error in measurement.

In no case did crack width increase exceed the allowable value stipulated in Appendix 3.

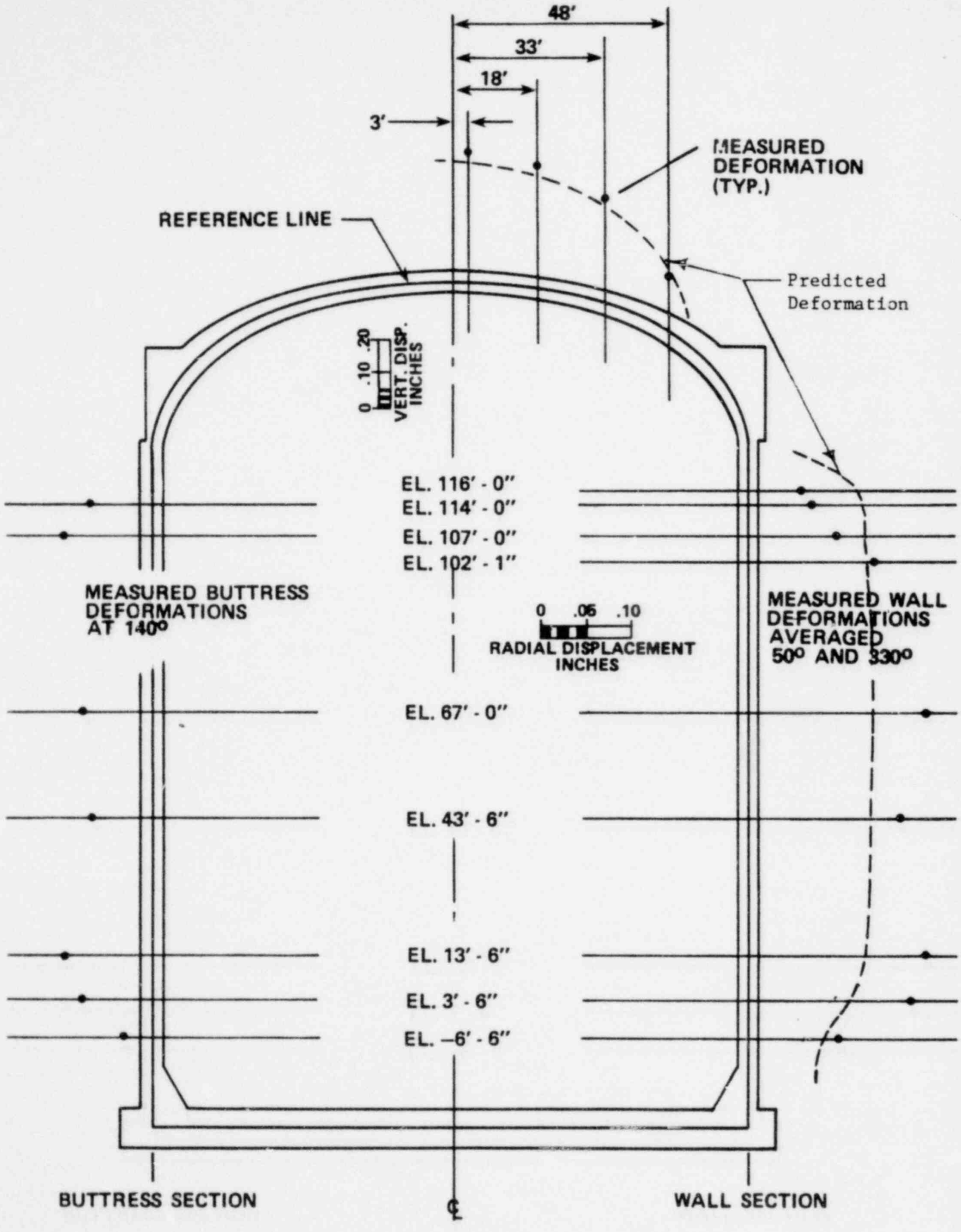


FIGURE 5 - 1
CONTAINMENT STRUCTURE DEFORMATIONS AT 68 PSIG
WALL, BUTTRESS, DOME

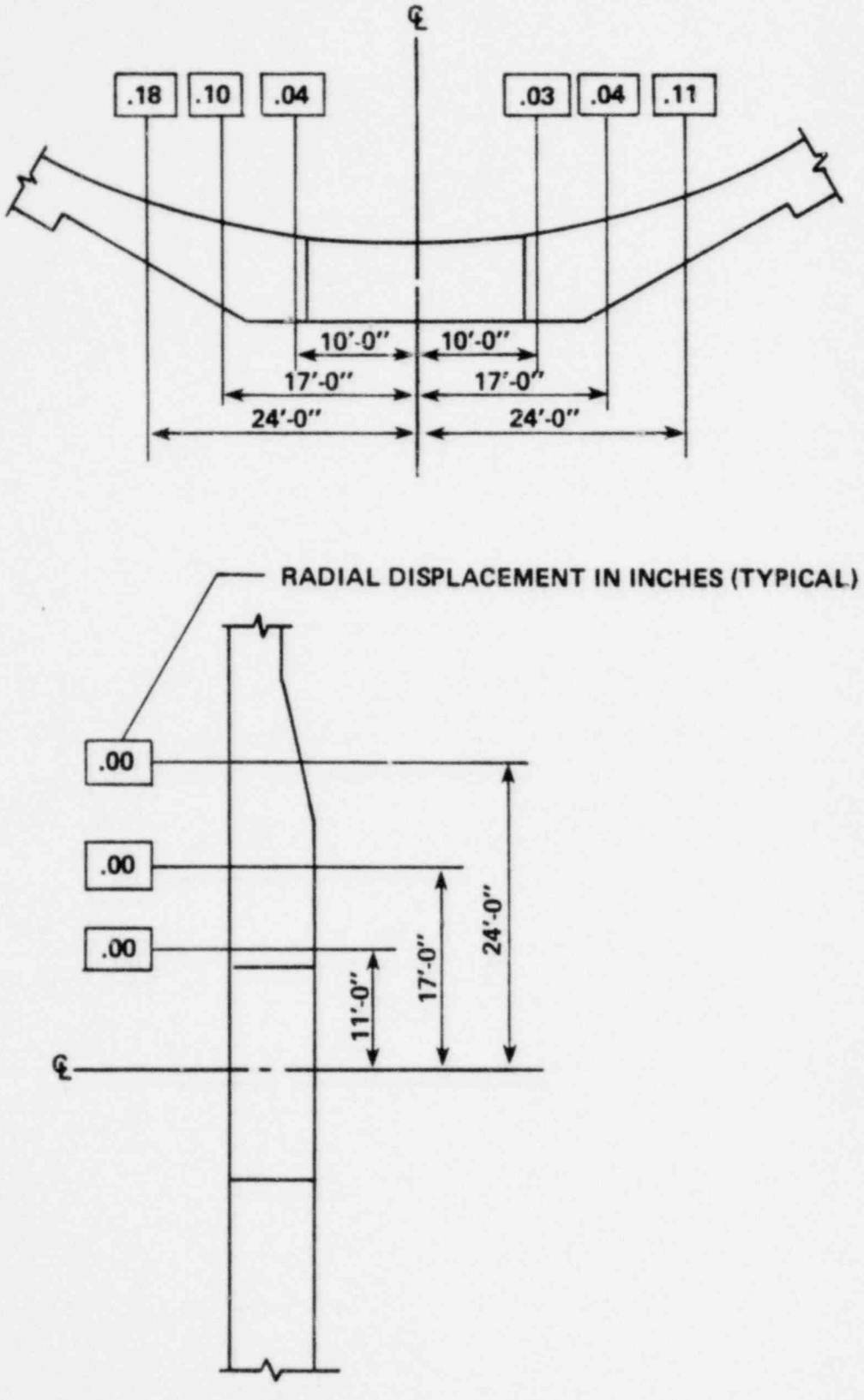


FIGURE 5 - 2
CONTAINMENT DEFORMATIONS AT 68 PSIG
EQUIPMENT HATCH

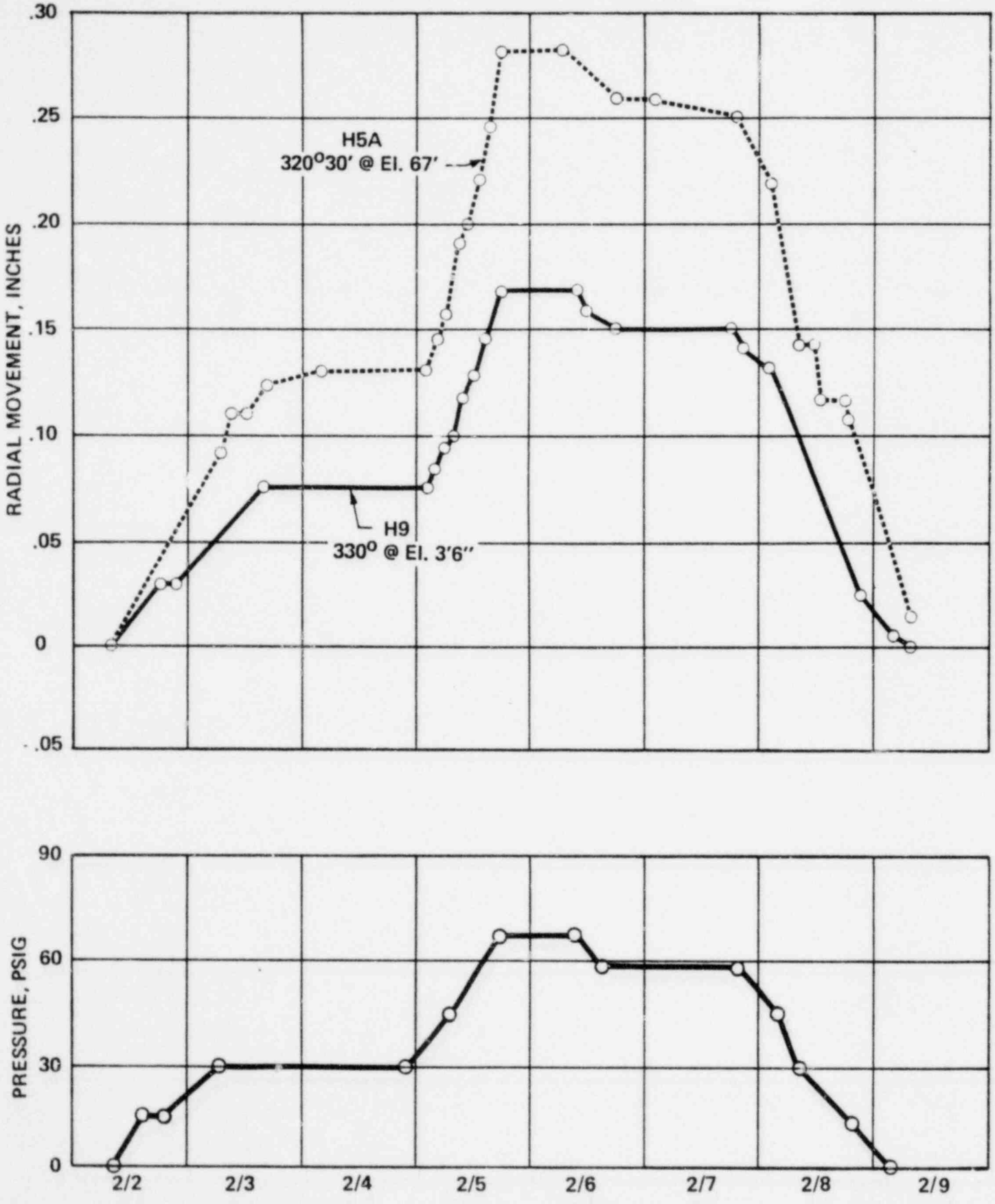


FIGURE 5 - 3
TYPICAL DEFORMATION/PRESSURE HISTORY WALL

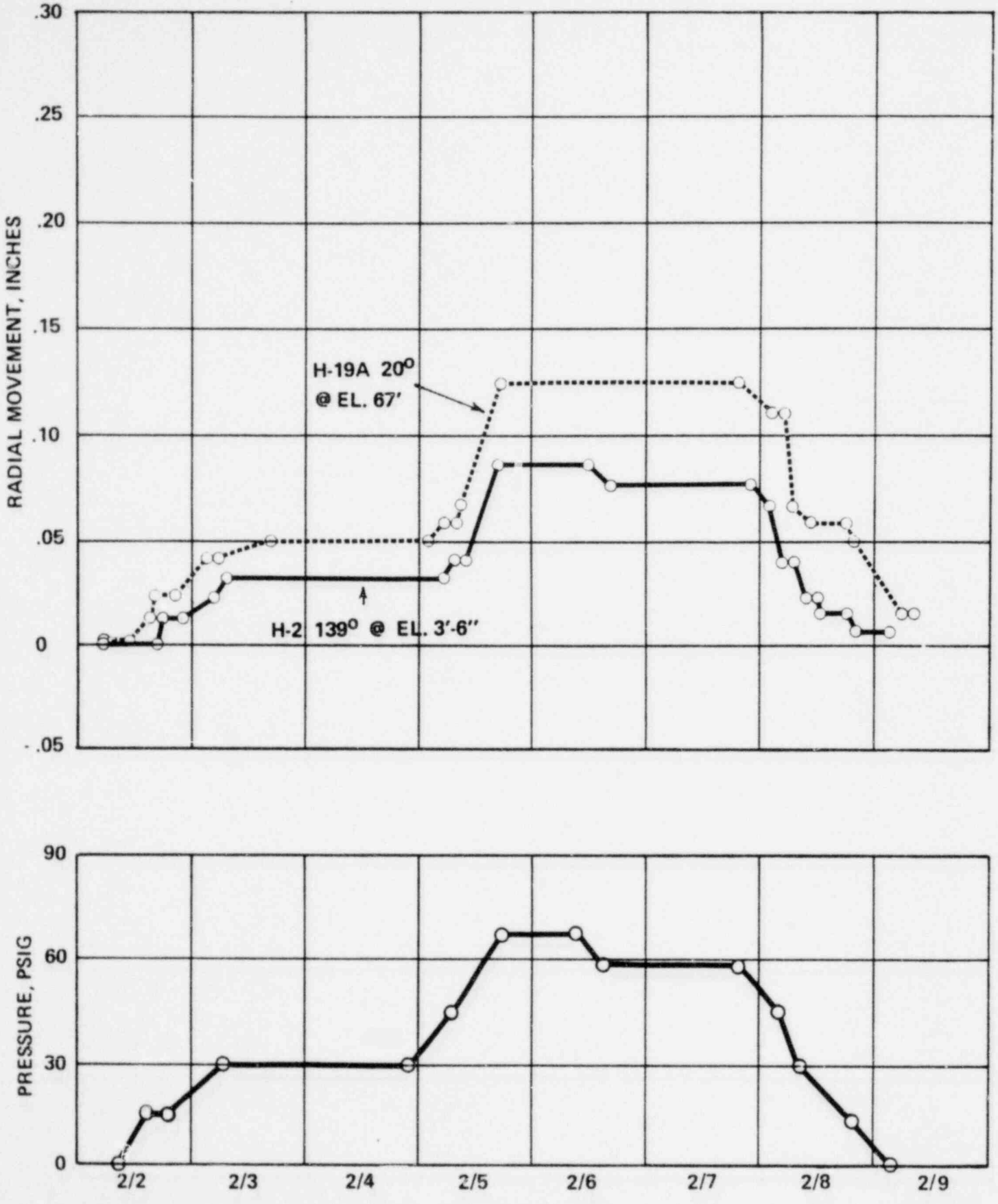


FIGURE 5 - 4

TYPICAL DEFORMATION/PRESSURE HISTORY BUTTRESS

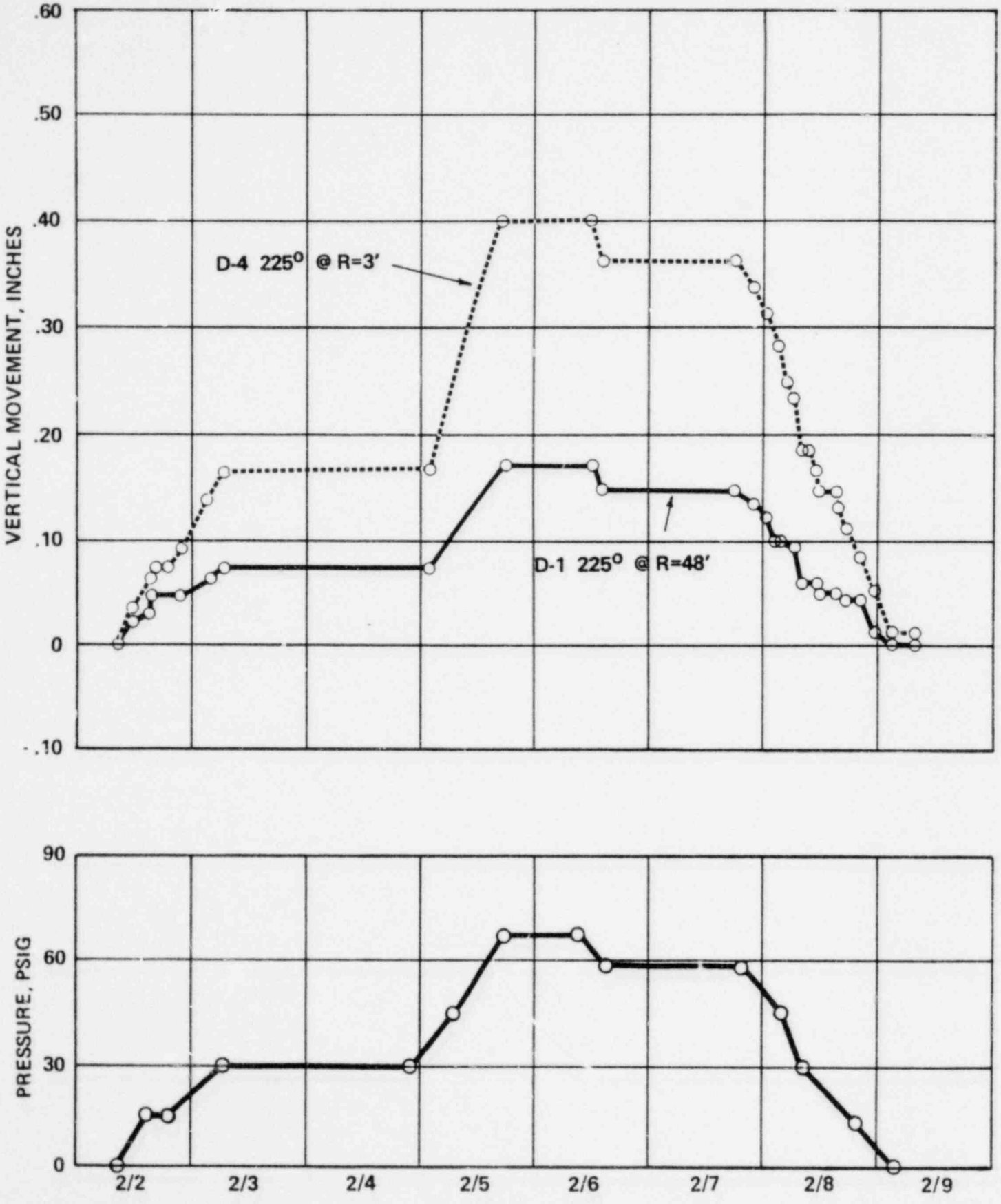


FIGURE 5-5
TYPICAL DEFORMATION/PRESSURE
HISTORY DOME

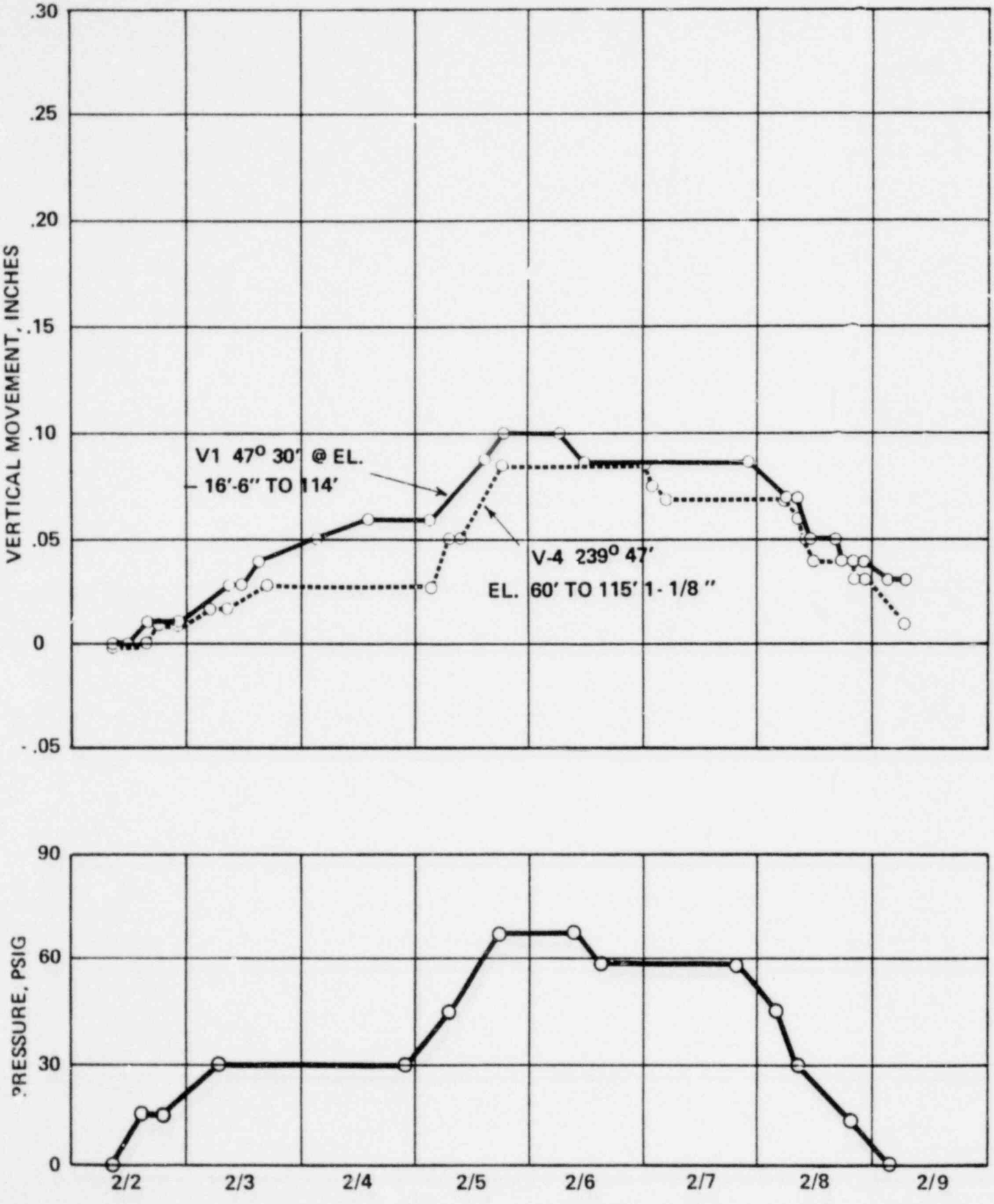


FIGURE 5-6
TYPICAL DEFORMATION PRESSURE HISTORY VERTICAL

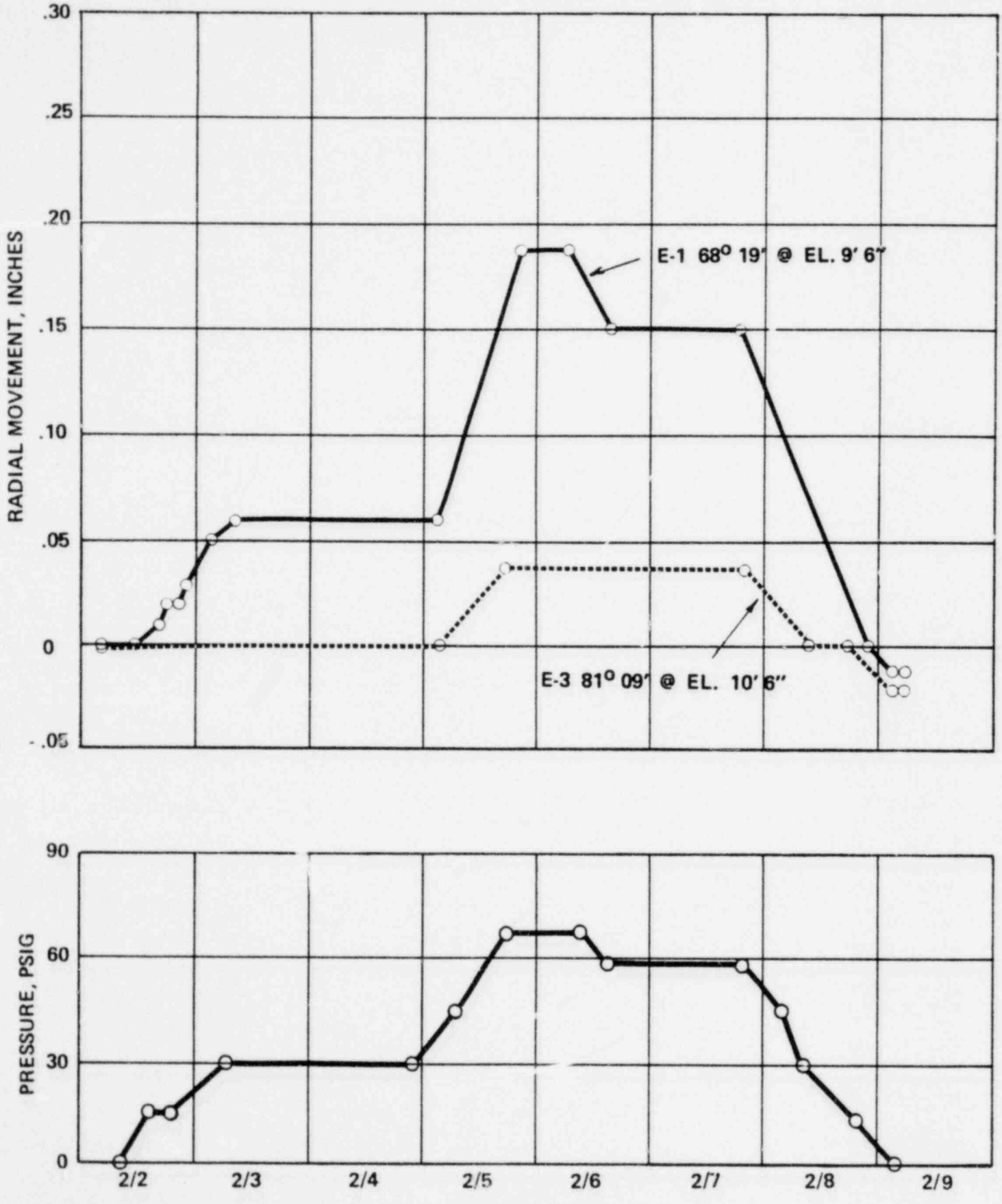
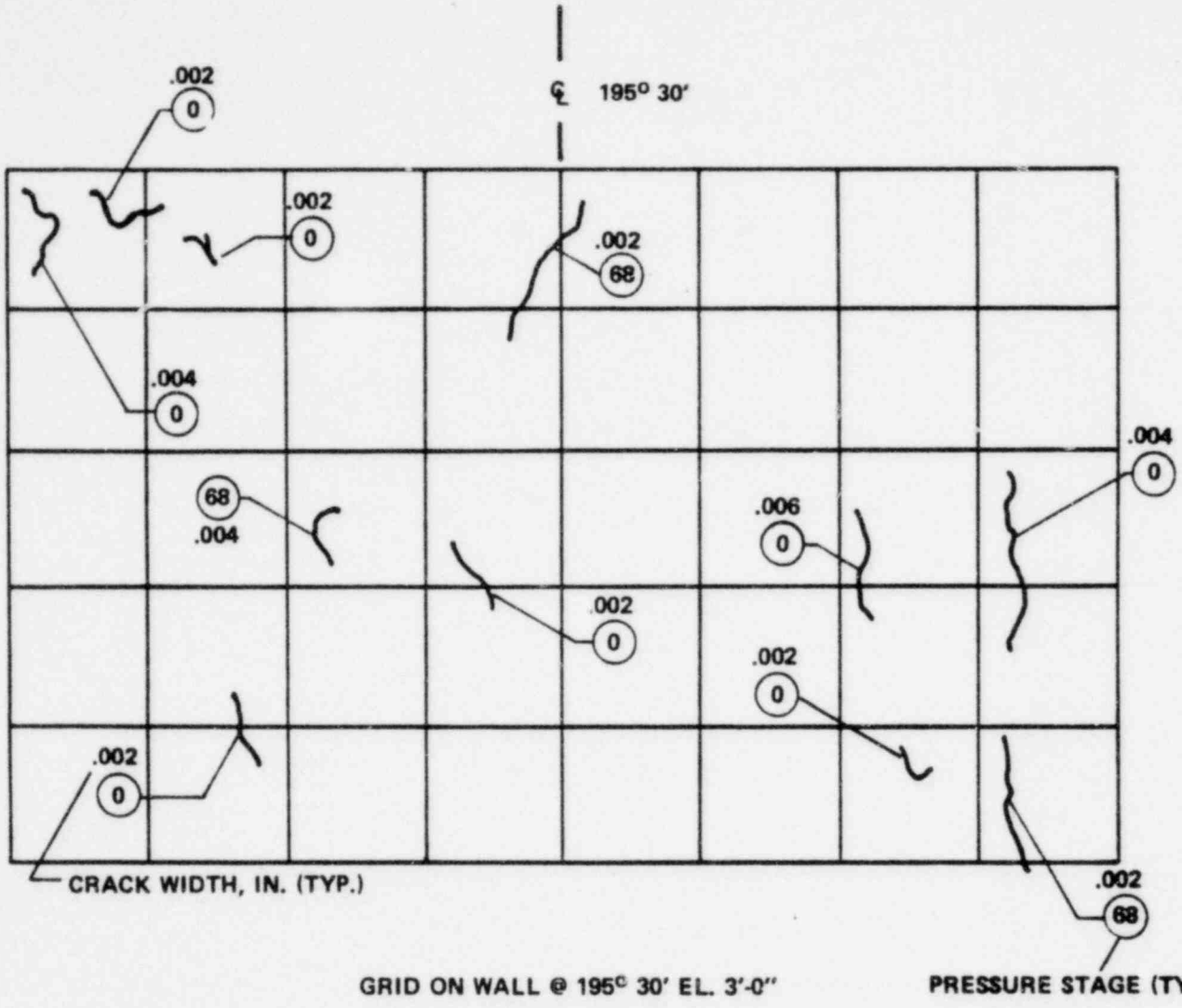


FIGURE 5 - 7
TYPICAL DEFORMATION/PRESSURE HISTORY
EQUIPMENT HATCH



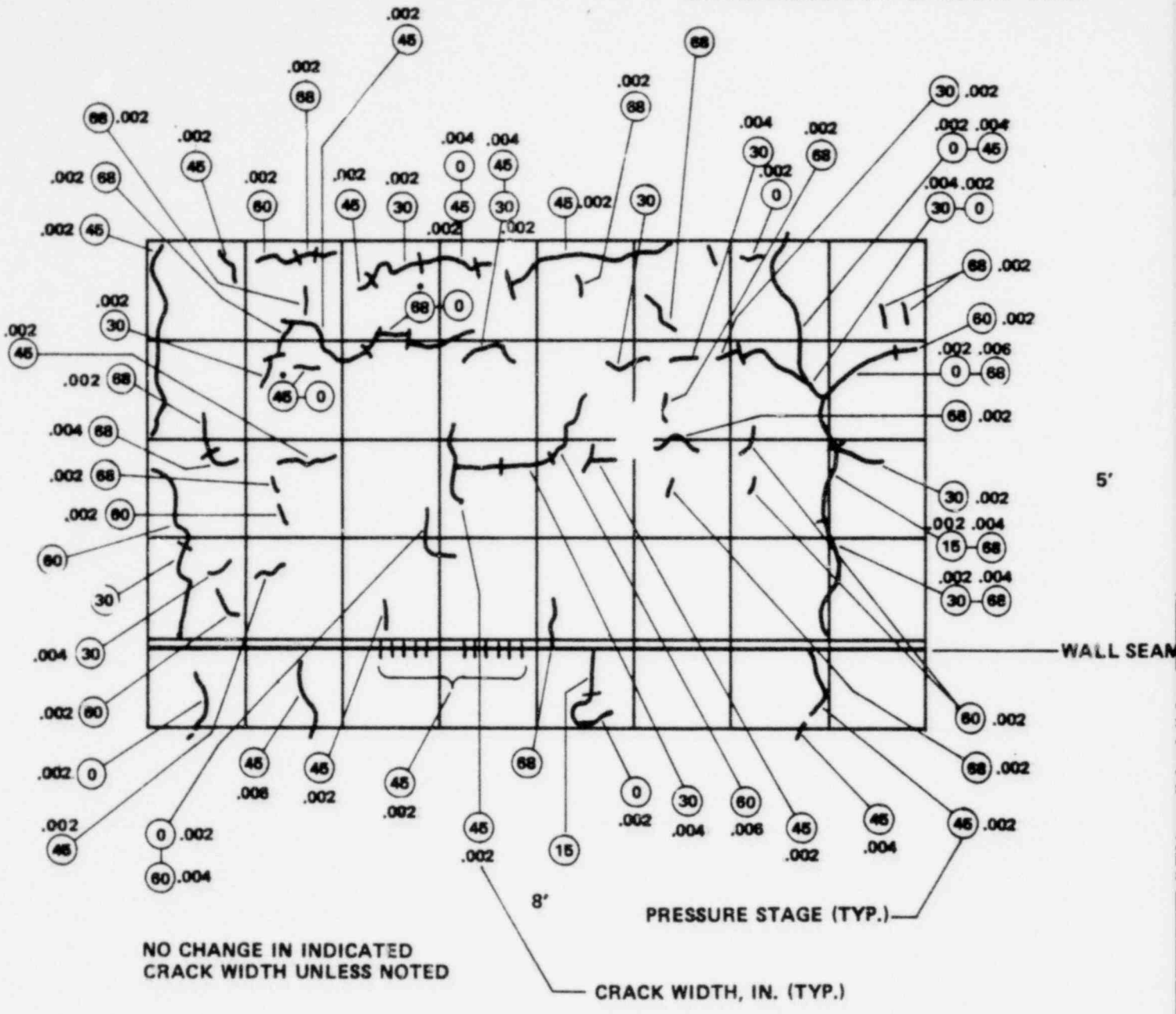
GRID ON WALL @ 195° 30' EL. 3'-0"

SCALE 1½" = 2'

NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

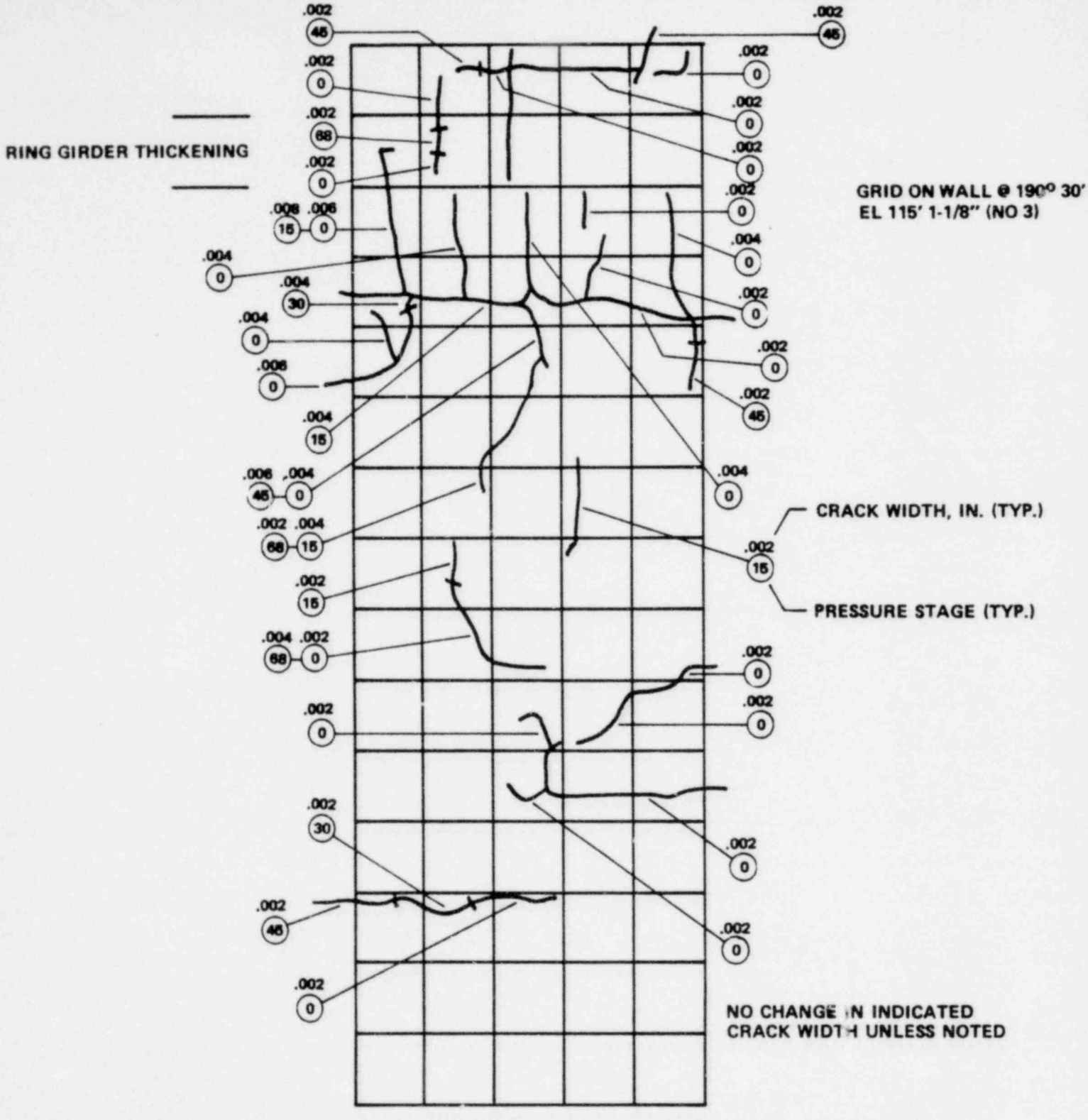
INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS IN HG / HUM., %	INT. HUM., %
			INT.	EXT.			
0	2/1/74	9:30 AM	77	49	SAJ	30 / 83	43
15	2/2/74	10:30 PM	80	49	SAJ	30 / 86	43
30	2/3/74	7:40 AM	82	45	SAJ	30 / 93	47
45	2/5/74	7:12 AM	81	40	SAJ	30 / 94	57
60	2/5/74	1:50 PM	84	54	SAJ	30 / 77	53
68	2/5/74	8:10 PM	83	48	SAJ	30 / 71	55
0	2/9/74	8:10 AM	78	41	SAJ	30 / 100	28

FIGURE 5 - 8
CONCRETE CRACK PATTERNS
LOCATION 1



INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	5:00 PM	80	55	RLE	30 / 90	39
15	2/2/74	11:40 PM	80	40	RLE	30 / 89	43
30	2/3/74	7:30 AM	83	44	RLE	30 / 94	45
45	2/5/74	8:45 AM	83	40	RLE	30 / 92	53
60	2/5/74	2:30 PM	82	54	RLE	30 / 77	57
68	2/5/74	9:20 PM	81	48	RLE	30 / 67	59
0	2/9/74	10:25 AM	77	54	RLE	30 / 67	29

FIGURE 5 - 9
CONCRETE CRACK PATTERNS
LOCATION 2



INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
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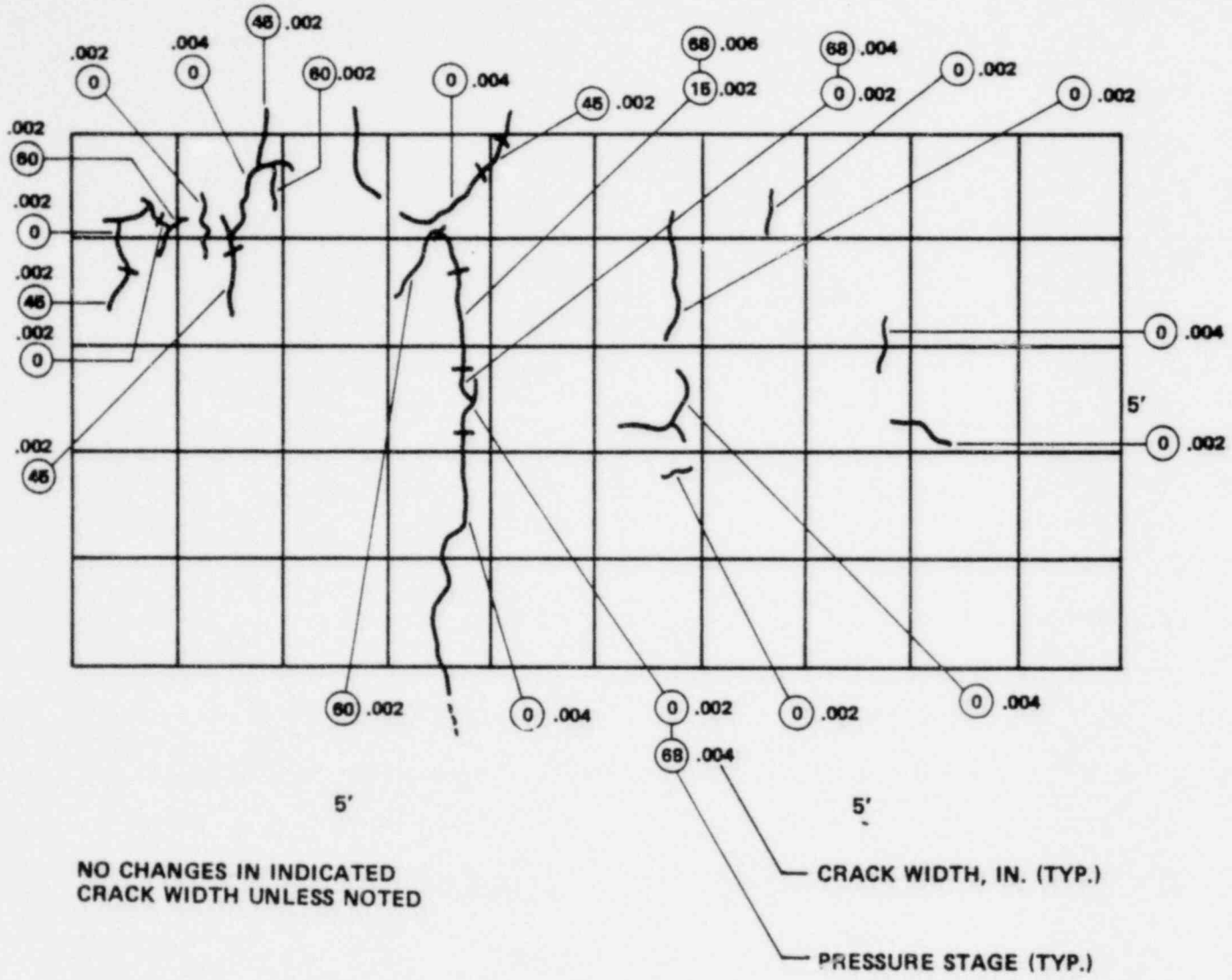
15	2/2/74	11:25 PM	79	49	CMT	30 / 89	43
30	2/3/74	8:45 AM	83	45	CMT	30 / 94	47
45	2/5/74	7:35 AM	81	40	CMT	30 / 92	57
60	*						
68	2/6/74	10:05 AM	79	42	KS	30 / 91	61
0	2/9/74	11:50 AM	80	54	CMT	30 / 69	29

*CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 10
CONCRETE CRACK PATTERNS
LOCATION 3

GRID ON WALL @ EQUIPMENT HATCH EL 3'0" (NO. 4)



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			INT	EXT			
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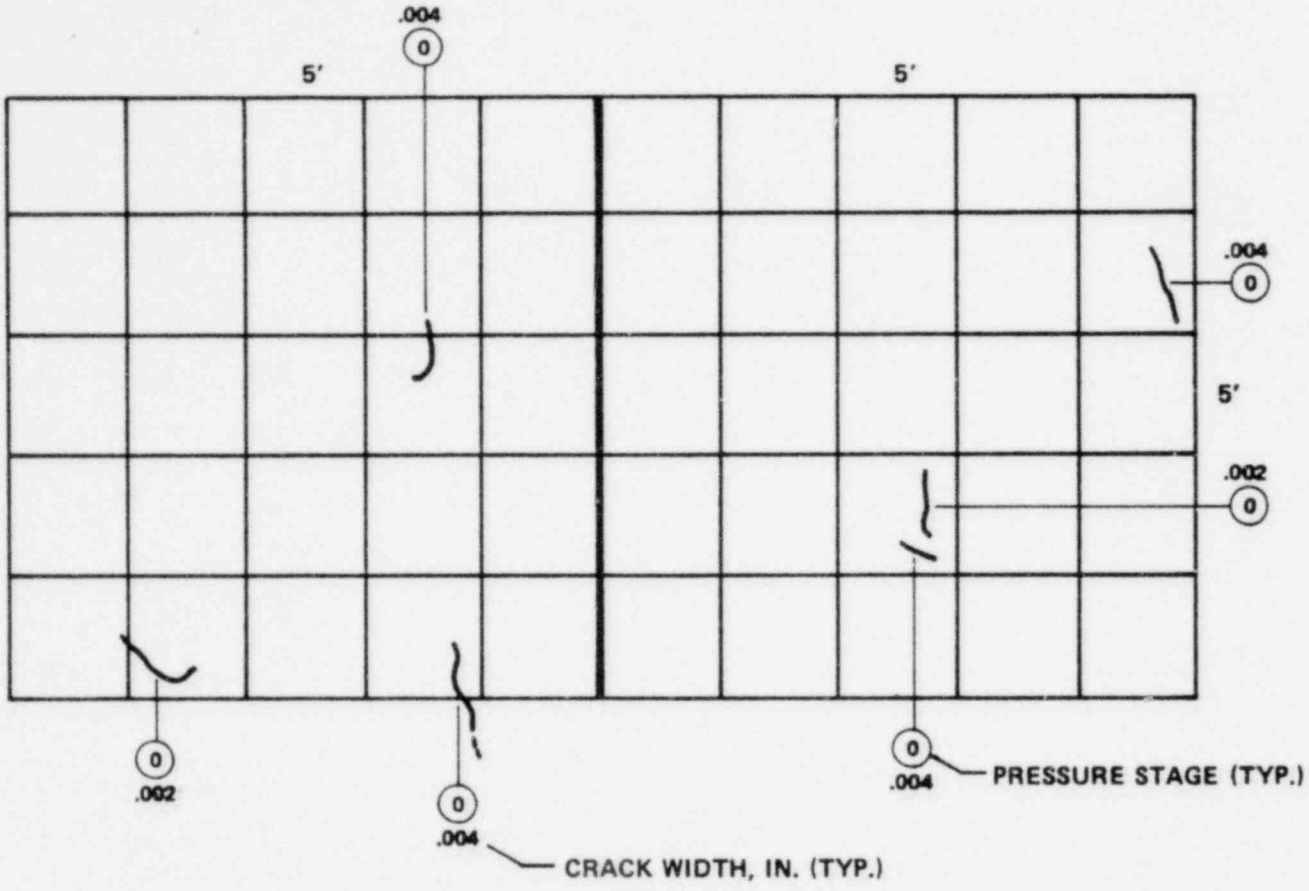
15	2/2/74	11:00 AM	80	49	SAJ	30 / 86	43
30	2/3/74	8:00 AM	82	45	SAJ	30 / 93	47
45	2/5/74	7:45 AM	81	40	SAJ	30 / 94	57
60	2/5/74	2:25 PM	84	54	SAJ	30 / 77	53
68	2/5/74	8:45 PM	83	48	SAJ	30 / 86	55
0	2/9/74	8:25 PM	78	41	SAJ	30 / 100	28

FIGURE 5 - 11
CONCRETE CRACK PATTERNS
LOCATION 4

GRID ON WALL @ EQUIPMENT HATCH EL 9'6" (NO 4A)



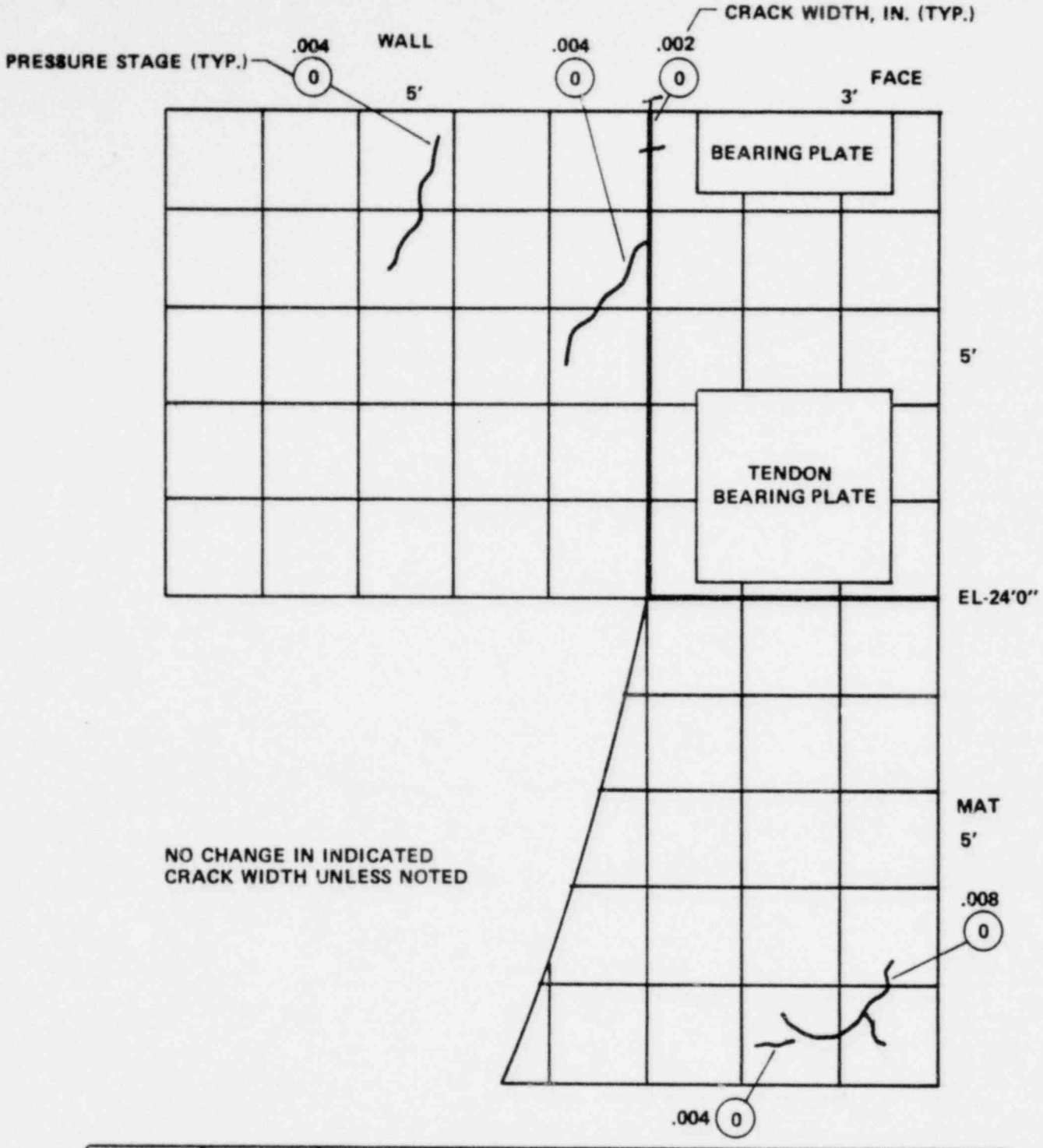
NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	10:15 AM	77	49	SAJ	30 / 83	43
15	2/2/74	11:15 PM	81	49	SAJ	30 / 86	43
30	2/3/74	8:15 AM	82	45	SAJ	30 / 93	47
45	2/5/74	8:00 AM	81	40	SAJ	30 / 94	57
60	2/5/74	2:35 AM	84	54	SAJ	30 / 77	53
68	2/5/74	9:00 AM	83	48	SAJ	30 / 86	55
0	2/9/74	8:30 AM	78	41	SAJ	30 / 100	28

FIGURE 5 - 12

CONCRETE CRACK PATTERNS

LOCATION 4A



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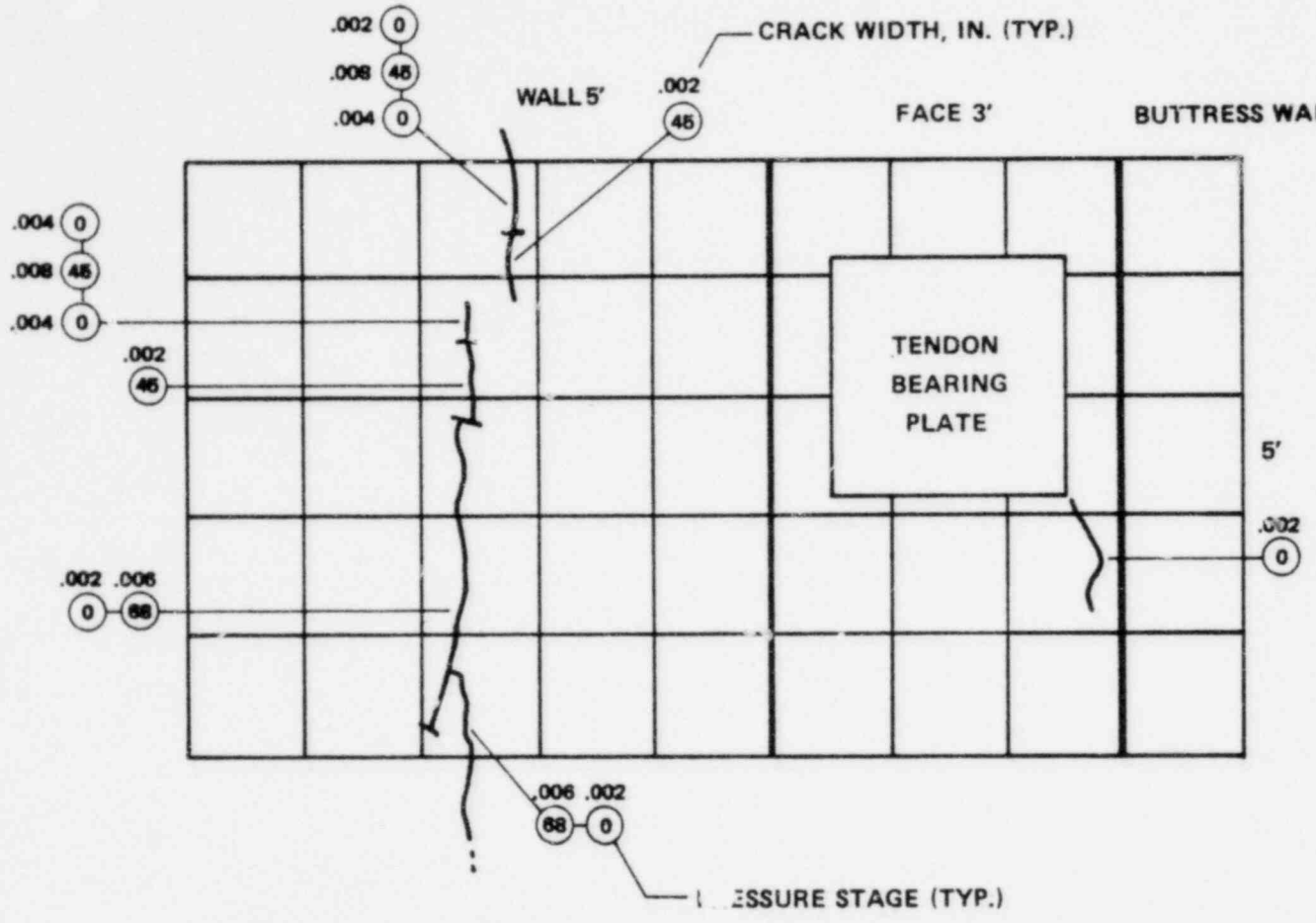
15	2/2/74	11:30 PM	78	51	SAJ	30 / 88	46
30	2/3/74	8:25 AM	82	45	SAJ	30 / 93	47
45	2/5/74	8:17 AM	81	40	SAJ	30 / 94	57
60	2/5/74	2:50 PM	85	54	SAJ	30 / 77	53
68	2/5/74	8:10 PM	83	48	SAJ	30 / 86	55
0	2/9/74	11:00 AM	77	56	SAJ	30 / 72	29

FIGURE 5 - 13
CONCRETE CRACK PATTERNS
LOCATION 5

GRID ON WALL @ BUTTRESS NO 1 EL 48'0" (NO 6)



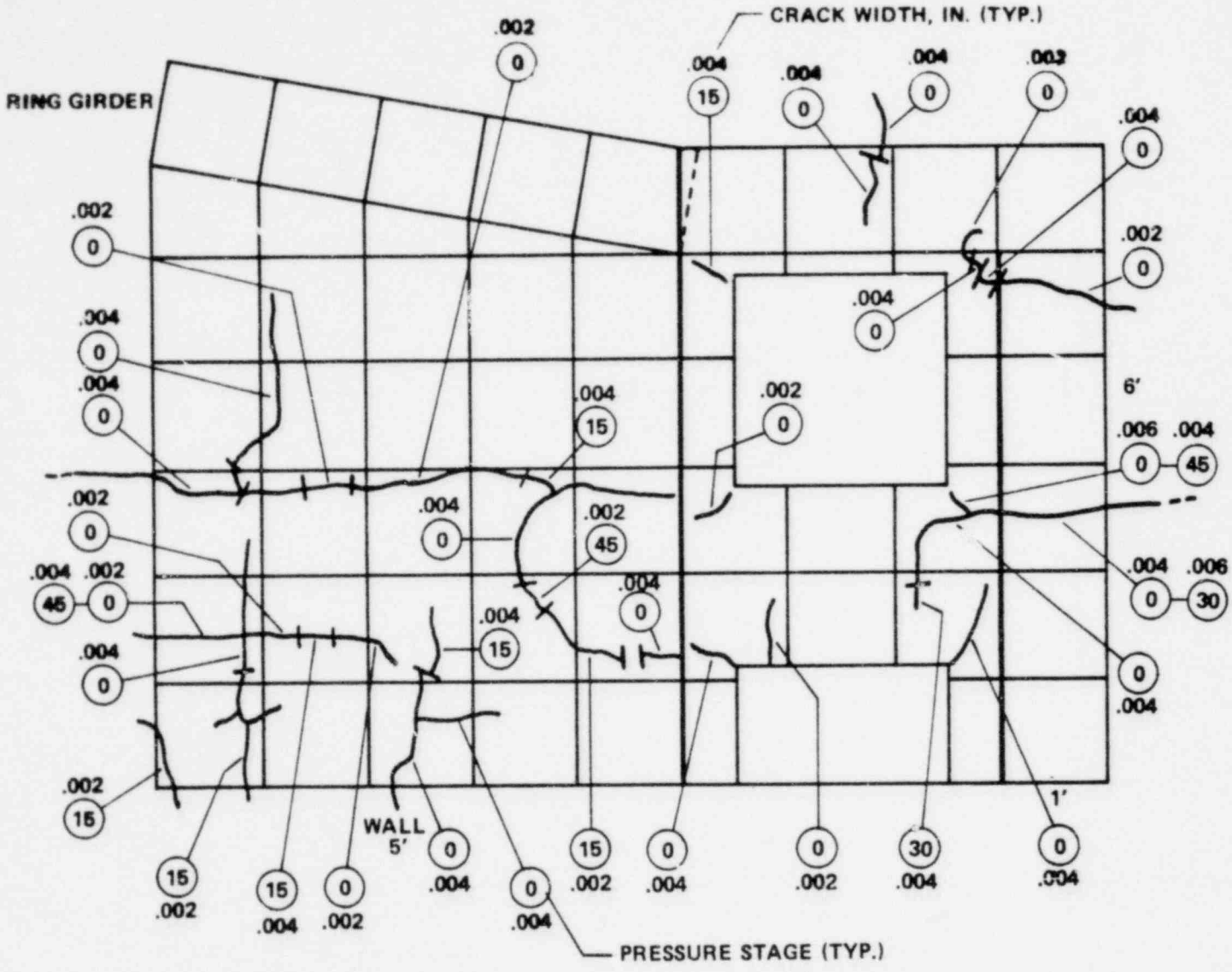
NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	3:30 PM	80	56	CMT	30 / 87	39
15	2/2/74	11:08 PM	80	49	CMT	30 / 86	43
30	2/3/74	8:30 AM	82	45	CMT	30 / 93	47
45	2/5/74	7:25 AM	81	40	CMT	30 / 94	57
60	*						
68	2/6/74	10:15 AM	80	42	KS	30 / 91	61
0	2/9/74	12:10 PM	77		CMT	30 / 77	29

* CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 14
CONCRETE CRACK PATTERNS
LOCATION 6

GRID ON WALL @ BUTTRESS NO. 1
EL 120' 7-1/8" (NO.7)



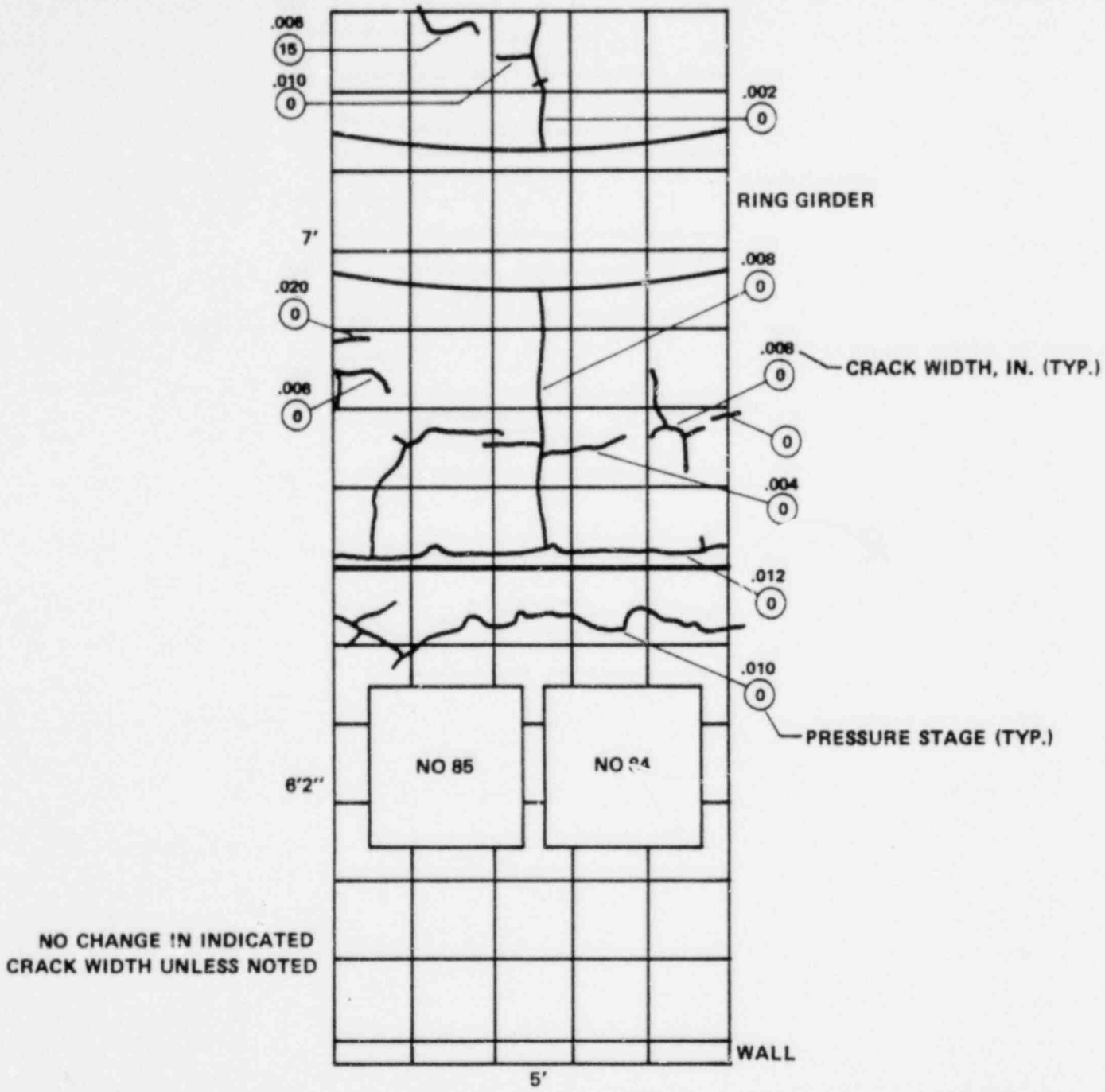
NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	4:00 PM	80	56	CMT	30 / 90	39
15	2/2/74	10:30 PM	80	49	CMT	30 / 86	43
30	2/3/74	8:35 AM	82	45	CMT	30 / 93	47
45	2/5/74	7:15 AM	81	40	CMT	30 / 94	57
60	*						
68	2/6/74	8:50 AM	80	37	KS	30 / 100	61
0	2/9/74	10:40 AM	78	55	CMT	30 / 69	28

*CANCELLED DUE TO WIND CONDITIONS

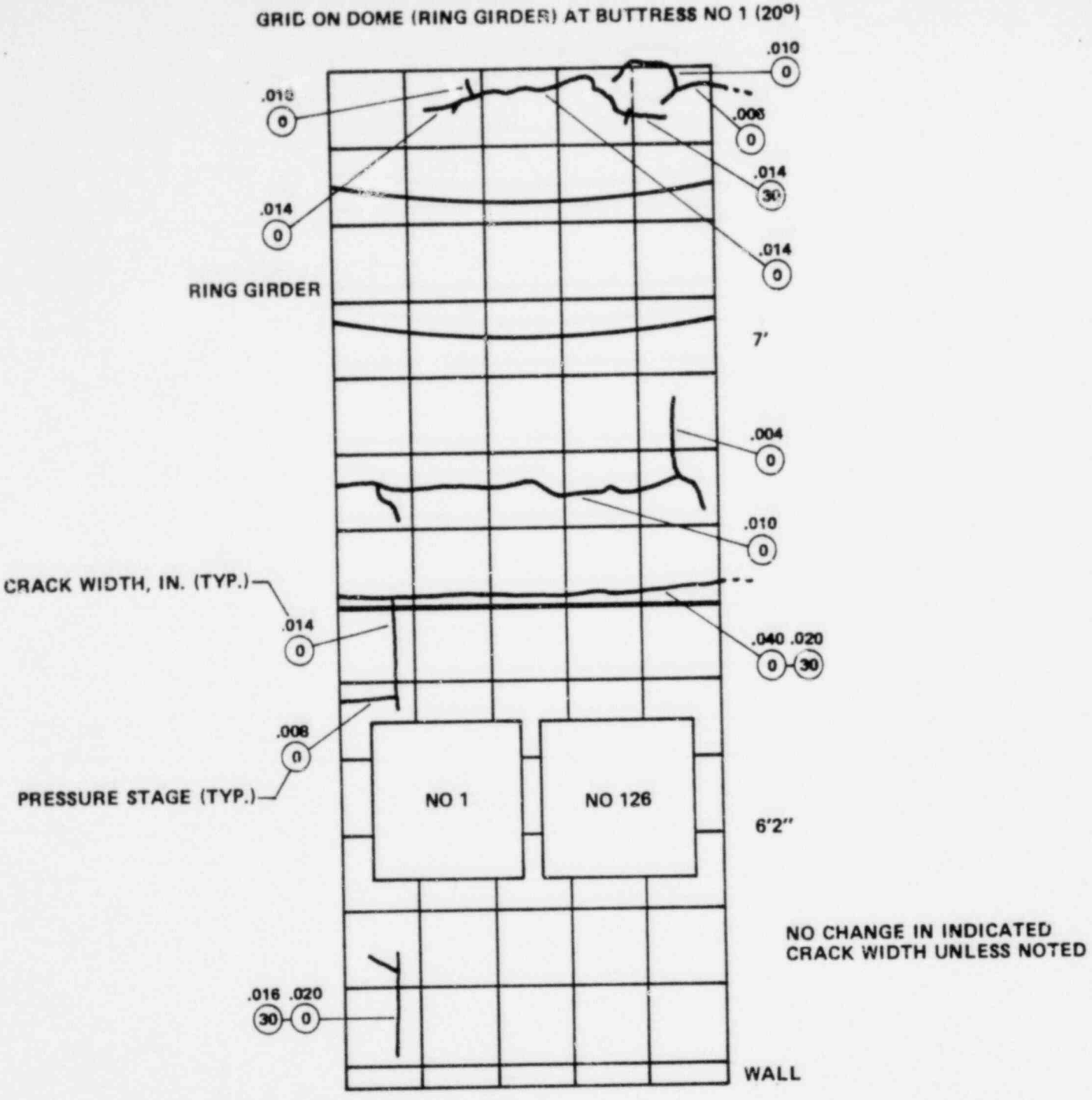
FIGURE 5 - 15
CONCRETE CRACK PATTERNS
LOCATION 7

GRID ON DOME (RING GIRDER) AT BUTTRESS NO 3 (260°)



INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	3:20 PM	80	56	RLE	30 / 87	39
15	2/2/74	11:00 PM	80	49	RLE	30 / 86	43
30	2/3/74	8:10 AM	82	45	RLE	30 / 93	47
45	2/5/74	7:55 AM	81	40	RLE	30 / 94	57
60	2/5/74	2:15 AM	84	54	RLE	30 / 77	53
68	2/5/74	8:05 PM	83	48	RLE	30 / 86	56
0	2/9/74	9:40 AM	80	43	RLE	30 / 100	28

FIGURE 5 - 16
CONCRETE CRACK PATTERNS
LOCATION 8

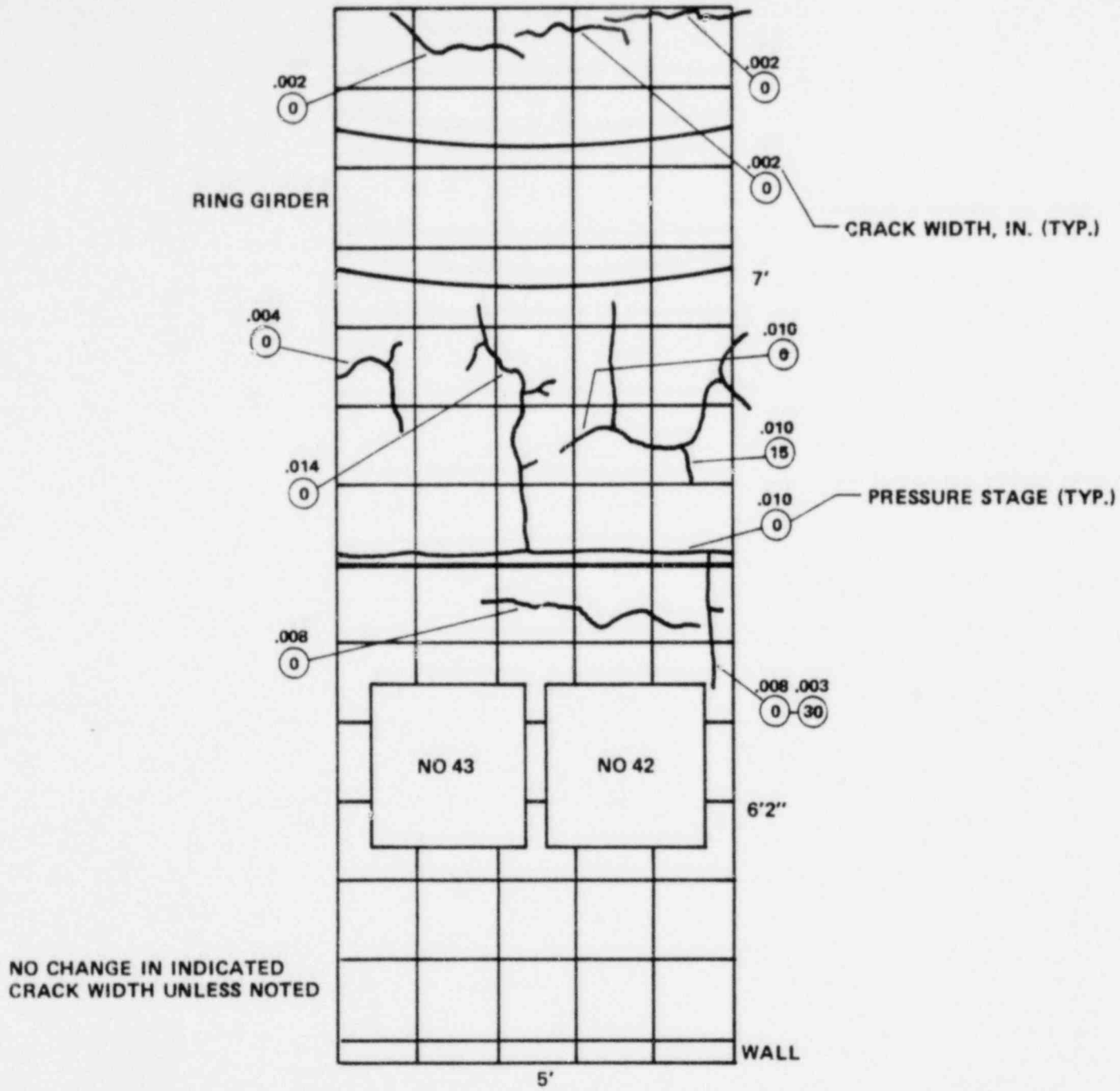


INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	2:45 PM	80	56	RLE	30 / 87	39
15	2/2/74	10:35 PM	80	49	RLE	30 / 86	43
30	2/3/74	7:55AM	82	45	RLE	30 / 93	47
45	2/5/74	7:55 AM	81	40	RLE	30 / 94	57
60	*						
68	2/5/74	8:15 PM	83	48	RLE	30 / 71	55
0	2/9/74	9:06 AM	78	41	RLE	30 / 100	28

* CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 17
CONCRETE CRACK PATTERNS
LOCATION 9

GRID ON DOME (RING GIRDER) AT BUTTRESS (140°)

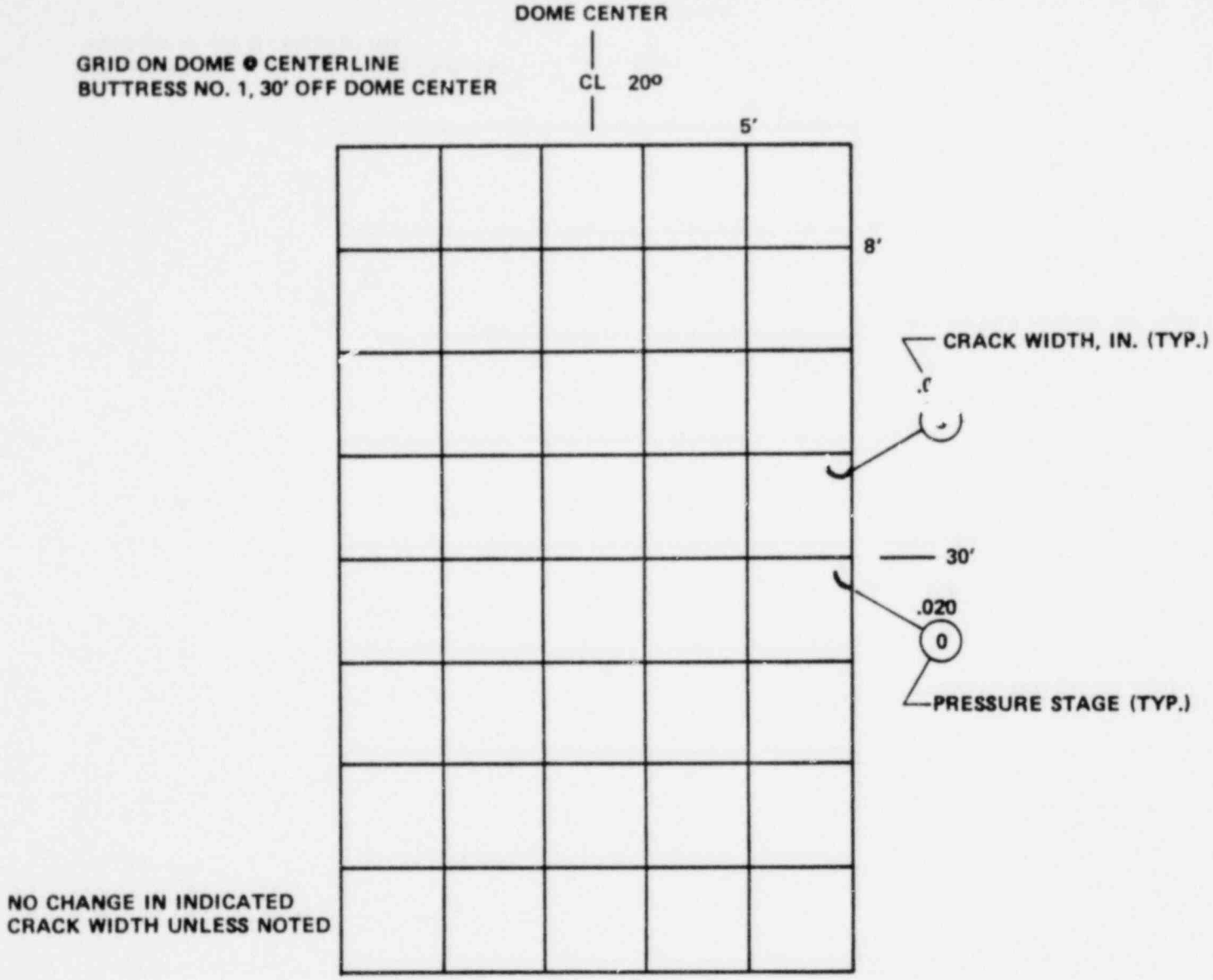


INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	4:00 PM	80	55	RLE	30 / 90	39
15	2/2/74	11:15 PM	80	49	RLE	30 / 86	43
30	2/3/74	8:20 AM	82	45	RLE	30 / 93	47
45	2/5/74	7:20 AM	81	40	RLE	30 / 94	57
60	*						
68	2/5/74	8:35 PM	83	48	RLE	30 / 71	55
0	2/9/74	9:20 AM	79	42	RLE	30 / 100	28

* CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 18

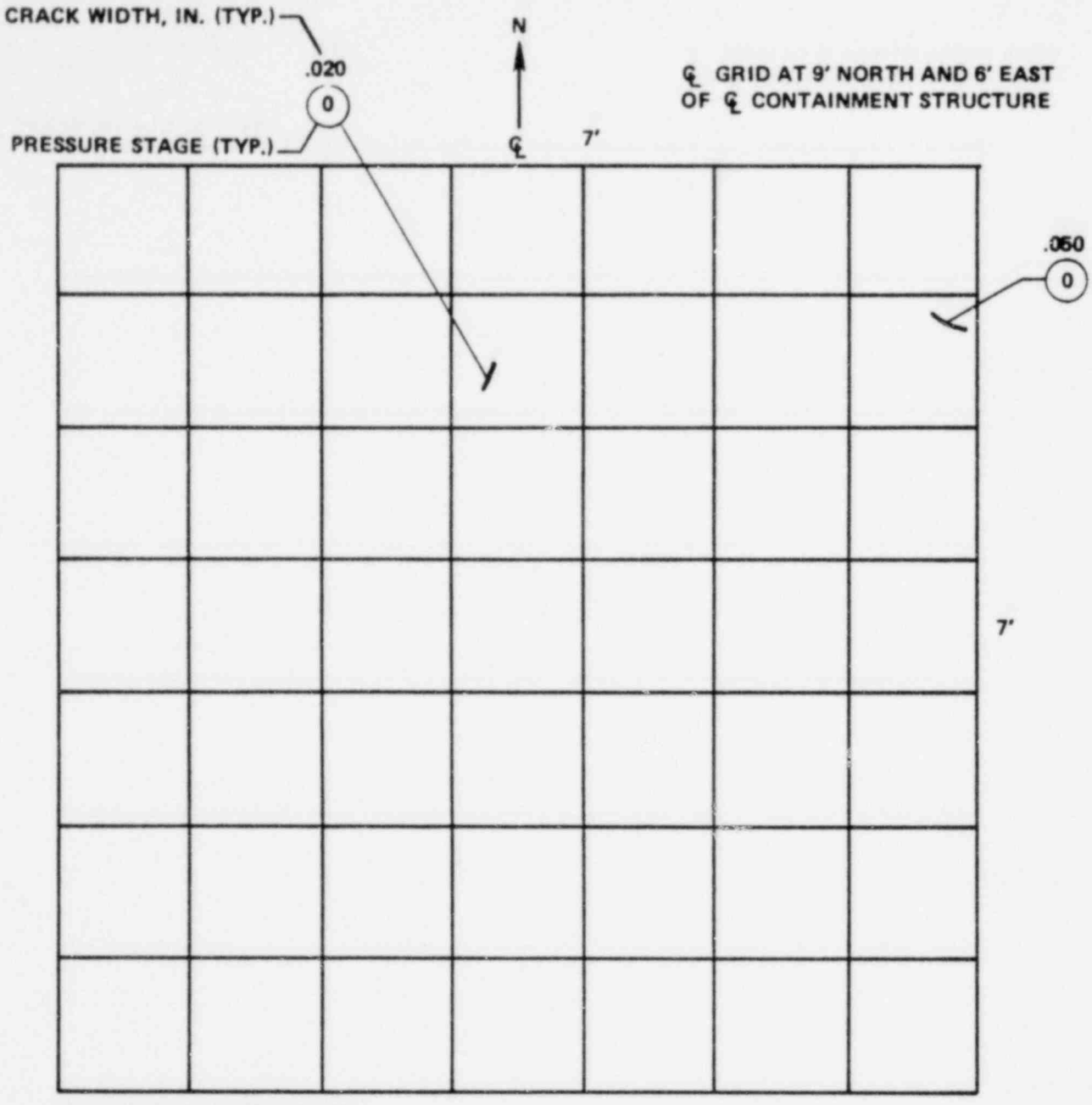
CONCRETE CRACK PATTERNS



INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	2:15 PM	80	56	RLE	30 / 85	39
15	2/2/74	11:30 PM	79	48	RLE	30 / 86	43
30	2/3/74	8:00 AM	82	45	RLE	30 / 93	47
45	2/5/74	7:40 AM	81	40	RLE	30 / 94	57
60	*						
68	2/5/74	8:20 PM	83	48	RLE	30 / 86	55
0	2/9/74	8:50 AM	78	41	RLE	30 / 100	28

* CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 19
CONCRETE CRACK PATTERNS
LOCATION 11



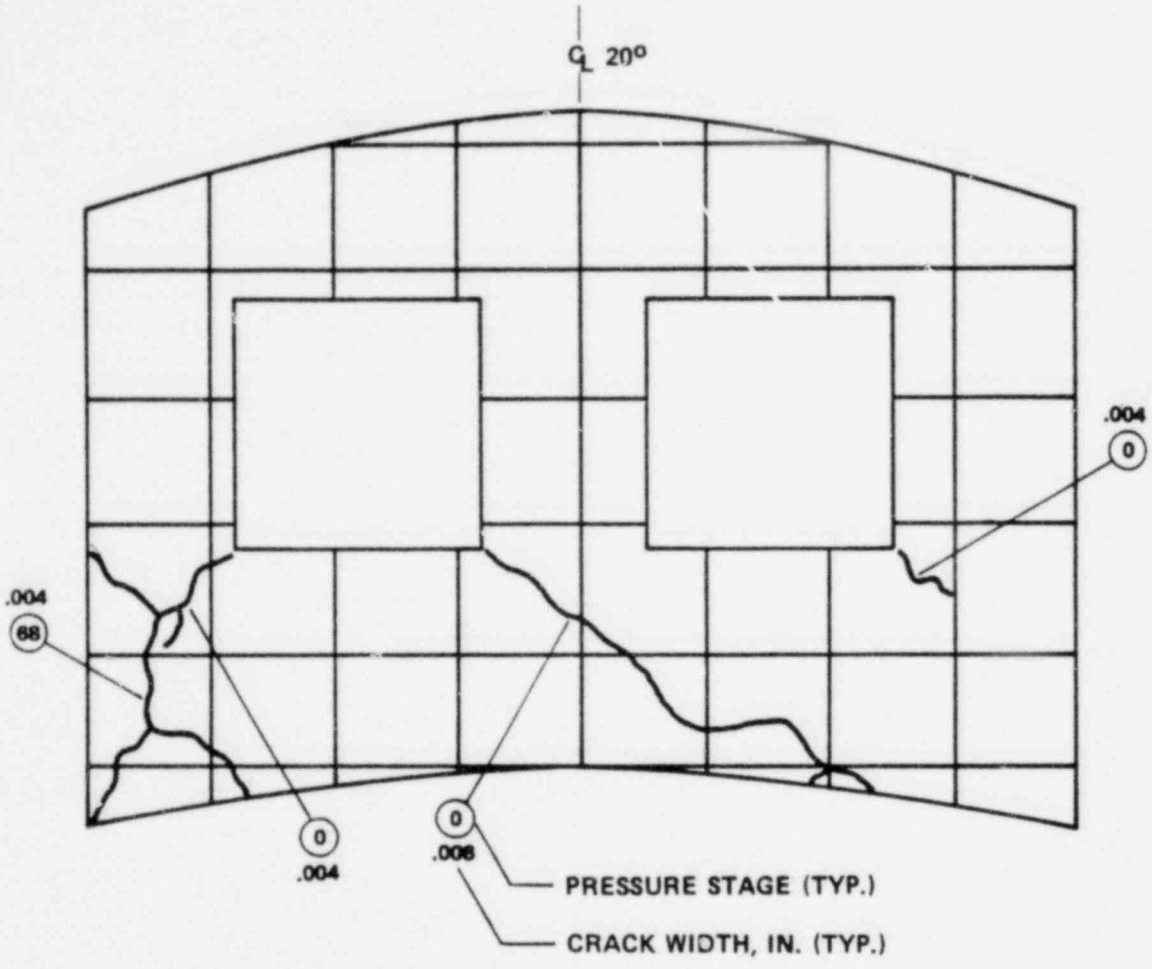
NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	2:20 PM	80	56	RLE	30 / 85	39
15	2/2/74	11:35 PM	79	49	RLE	30 / 86	43
30	2/3/74	8:05 AM	82	45	RLE	30 / 93	47
45	2/5/74	7:45 AM	81	40	RLE	30 / 94	57
60	*						
68	2/5/74	8:25 PM	83	48	RLE	30 / 86	55
0	2/9/74	8:45 AM	78	41	RLE	30 / 100	28

* CANCELLED DUE TO WIND CONDITIONS

FIGURE 5 - 20
CONCRETE CRACK PATTERNS
LOCATION 12

GRID ABOVE TENDON ACCESS GALLERY @ 20° (G-8)

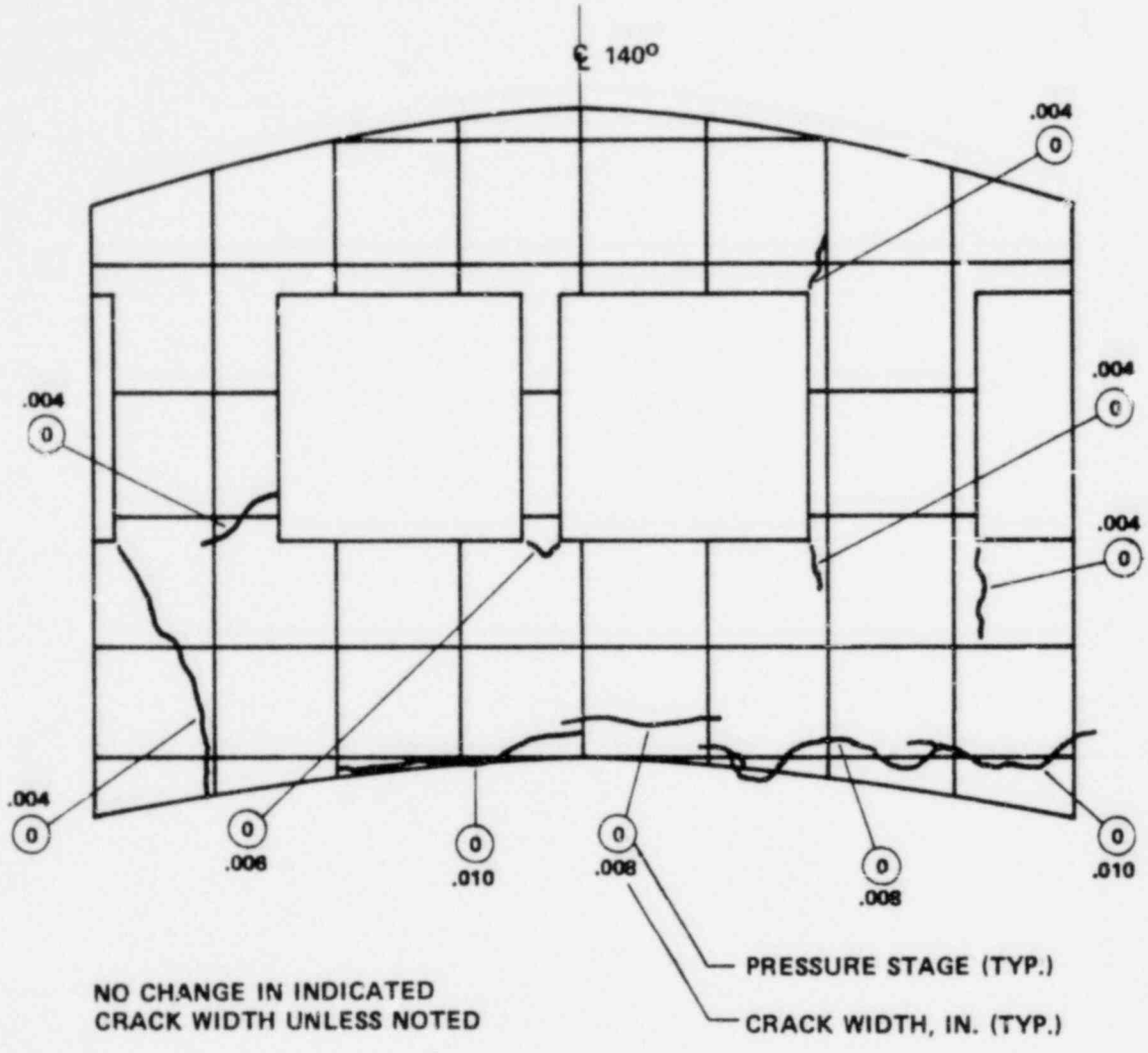


NO CHANGE IN INDICATED
CRACK WIDTH UNLESS NOTED

INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	11:45	79	51	SAJ	30 / 87	40
15	2/2/74	12:00 PM	80	50	SAJ	30 / 89	43
30	2/3/74	9:00 AM	82	42	SAJ	30 / 100	47
45	2/5/74	8:38 AM	83	40	SAJ	30 / 92	53
60	2/5/74	3:18 PM	83	54	SAJ	30 / 75	55
68	2/5/74	9:35 PM	83	53	SAJ	30 / 71	55
0	2/9/74	11:25 AM	77	57	SAJ	30 / 75	29

FIGURE 5 - 21
CONCRETE CRACK PATTERNS
LOCATION G8

GRID ABOVE TENDON ACCESS GALLERY @ 140°



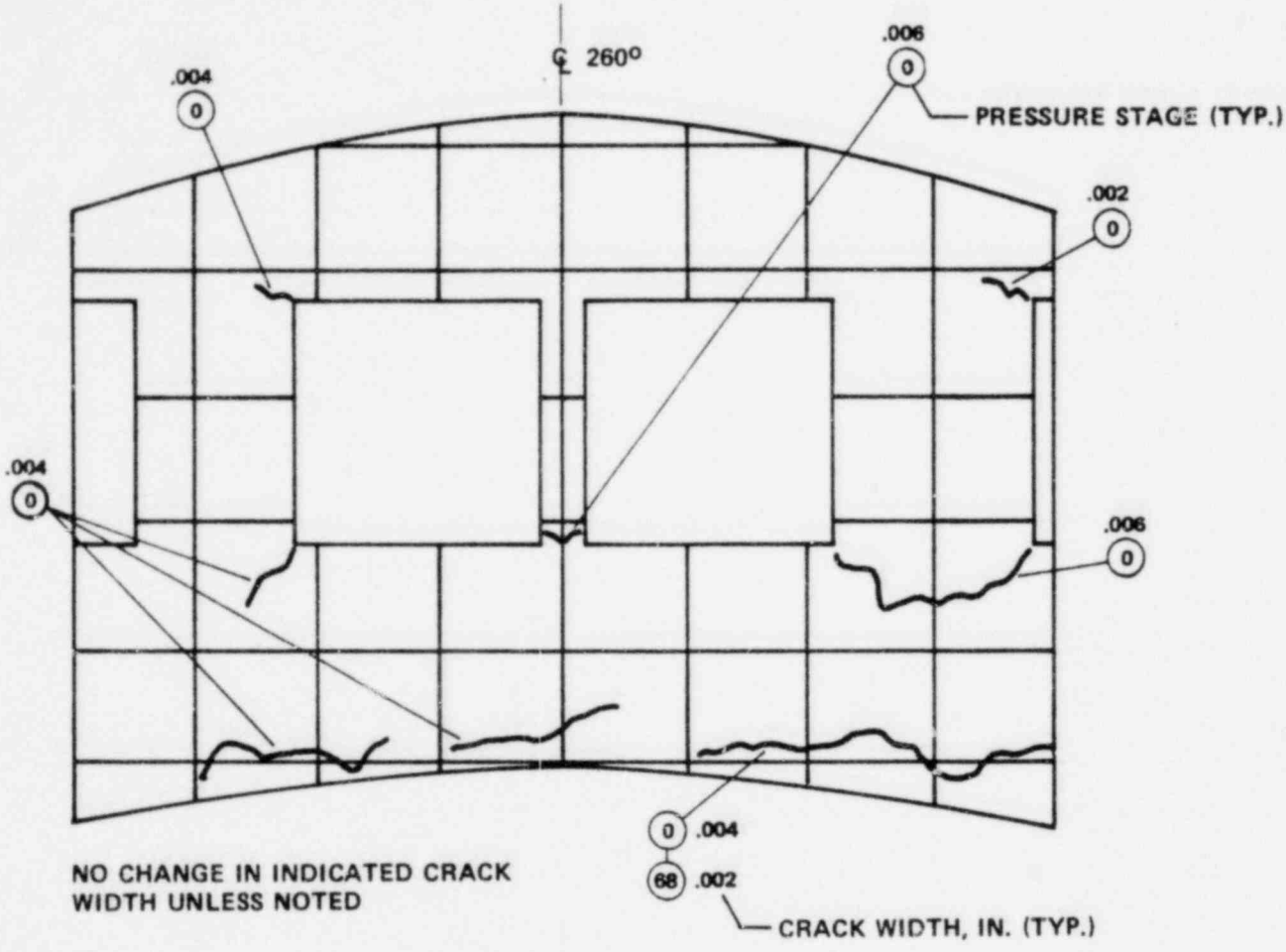
PSI	DATE	TIME	TEMP		INIT	EXT PRESS/ HUM	INT HUM
			INT	EXT			
0	2/1/74	3:40 PM	80	56	SAJ	30 / 87	39
15	2/2/74	12:20 AM	79	55	SAJ	30 / 73	45
30	2/3/74	9:20 AM	83	43	SAJ	30 / 100	45
45	2/5/74	8:25 AM	83	40	SAJ	30 / 92	53
60	2/5/74	3:35 PM	83	53	SAJ	30 / 74	55
68	2/5/74	8:25 PM	83	48	SAJ	30 / 72	55
0	2/9/74	11:40 AM	78	57	SAJ	30 / 76	28

FIGURE 5 - 22

CONCRETE CRACK PATTERNS

LOCATION G9

GRID ABOVE TENDON ACCESS GALLERY @ 260°



INT. PRESS., PSIG	DATE	TIME	TEMP., °F		INITIALS	EXT. PRESS. IN HG / HUM., %	INT. HUM., %
			INT	EXT			
0	2/1/74	2:30 PM	80	56	SAJ	30 / 85	39
15	2/2/74	11:50 PM	80	50	SAJ	30 / 89	43
30	2/3/74	8:45 AM	82	43	SAJ	30 / 100	47
45	2/5/74	8:55 AM	83	40	SAJ	30 / 92	53
60	2/5/74	3:10 PM	83	54	SAJ	30 / 75	55
68	2/5/74	9:43 PM	84	43	SAJ	30 / 93	54
0	2/9/74	11:20 AM	78	57	SAJ	30 / 74	28

FIGURE 5 - 2?
CONCRETE CRACK PATTERNS
LOCATION G10

6. REFERENCES

1. Rancho Seco Nuclear Generating Station, Unit No. 1, Final Safety Analysis Report.

2. Duke Power Company,Oconee Nuclear Station, Unit 2 Docket No. 50-270, Structural Integrity Test Report of the Reactor Containment Building.

APPENDIX 1

Report Submitted by Wiss, Janney, Elstner and Associates, "Deformation Measurements During Containment Pressure Test of the Rancho Seco Nuclear Generating Station Unit No. 1."

Wiss, Janney, Elstner and Associates

DEFORMATION MEASUREMENTS DURING CONTAINMENT PRESSURE TEST OF THE RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1 SACREMENTO MUNICIPAL UTILITY DISTRICT

FOR

BECHTEL POWER CORPORATION

WJE JOB NO. 73502

FEBRUARY 28, 1974

Wiss, Janney, Elstner and Associates

DEFORMATION MEASUREMENTS DURING CONTAINMENT PRESSURE TEST OF THE RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1 SACREMENTO MUNICIPAL UTILITY DISTRICT FOR BECHTEL POWER CORPORATION

February 28, 1974

Invar wire extensometers were used for measurement of displacements of the secondary containment structure during the air pressure test. The same type of instrumentation had been used previously on eleven containment structures under conditions comparable to those of Rancho Seco Unit One. The measuring instruments were located entirely inside the structure, and were connected to an external power supply and read-out equipment by wiring extending through penetrations in the cylinder wall. Each extensometer consisted of an invar wire spanning between selected points, with one end (the "dead" end) fixed in position and the "live" end attached to a spring-loaded frame incorporating a linear potentiometer, the entire system spanning the distance to be measured.

The springs used were the so-called "Negator" type that apply an essentially constant force independent of extension. The springs selected applied a force of approximately 15 lbs. each, and they used in matched pairs with a back-to-back mounting to avoid eccentricity. The invar wire diameter was .088 in. and the corresponding stress in the wire was about 5,000 psi.

The dead end of each wire was secured to a U-bolt fitted into a small steel plate that was rigidly secured either by welding or by concrete anchor bolts. The live end, containing the springs and instrumentation, was fitted with a swivel to allow directional adjustment, and was likewise secured by welding or other means. The swivel was tightened against movement after alignment, but the frame contained a rod-end bearing (in effect another swivel) to avoid eccentric force on the potentiometer. The wire was attached to the frame through a turnbuckle that was adjusted to position the potentiometer at the desired zero setting.

The potentiometers were the infinite resolution type with a total travel of about 1.3 in. The turnbuckles on each frame were adjusted to provide for about 0.3 in. of shortening and the remainder of the range for elongation. Current was supplied to the potentiometers by a constant-voltage power supply delivering 1.332 volts through No. 18 2/c cable. The output from the potentiometers was through a separate circuit of No. 22 3/c cable and this output was monitored by a Digitec data acquisition system, incorporating a digital display millivoltmeter and a printing millivolt recorder. In some of the previous installations, readings were taken on both resistance arms of the potentiometers, that is, from the wiper to each of the two ends. These readings invariably showed that the sum of the two voltages is constant within a few millivolts. In other words, the reading of a single arm may be accepted as accurate within a few thousandths of an inch, so the single-arm procedure was adopted in the present case.

Each instrument was calibrated in the laboratory against a pair of 0.001-in. dial gages, using an input voltage to the potentiometers of approximately 1.25-volts. Circuitry in the field installation permitted continuous monitoring of the supply voltage and the initial voltage at each potentiometer. Calibration factors, corrected from those in the laboratory, were then developed. The data have been reduced on the basis of 0.001 in. per millivolt, which is within a few per cent of the best-fit data established from the calibration records.

Prior to the structural integrity test and immediately upon completing the test, instrumentation at F2, H4 and H13 was field checked. Calibration of the three instruments consisted of comparing the measurements obtained on a pair of dial gages with measurements read at the data acquisition panel. Movement of the potentiometer was obtained by placing shims between the front and rear aluminum channels of the frames. The results of the calibration are presented below.

FIELD CALIBRATIONS

Pre-Test Calibration

Location	Dial Gage Readings (At Frame) Inches	DAS Readings Inches	Diff.
F2	0.309	0.298	0.011
H4	0.228	0.221	0.007
H13	0.307	0.305	0.002

Post Test Calibration

F2	0.296	0.292	0.004
H4	0.214	0.213	0.001
H13	0.316	0.318	0.002

Each recording consisted of a print-out by the recording millivoltmeter for each instrument, which required less than two minutes. Such

readings were repeated at each data collection time and repetitive print-outs and manual readings agreed within one or two millivolts. During hold periods, only a single set of readings were obtained at each data collection time.

LOCATION OF INSTRUMENTS

Instrument locations conformed in general with those indicated on Bechtel Drawing No. 6292 SKC-210, Sheets 1, 2, 3 and 4. Some minor deviations were necessary because of interference of piping or other equipment. The actual locations are noted in the text and in Tables I through VI which record the measured displacements.

Gages H1, H2, H3, H4, H5 (140° Azimuth) and H19A (20° Azimuth) spanned from the buttress to the internal concrete structure, with wire lengths of 6 to 32 feet.

Gages H8, H9, H10, H11, H5A (320° Azimuth), H16 (228°-30'), H19 (205° Azimuth) also spanned from the cylinder wall to the internal concrete structure, with invar wire lengths of 5 to 36 feet.

Gages H6, H7 (Azimuth 140°/320°), H17, H18 (Azimuth 48°-30'/228°-30') spanned the full diameter between buttresses and walls. Due to equipment interference, it was necessary to relocate some gages. The actual location of these gages are shown in Table I through II. The uppermost gages in each case, H7 and H18, were approximately at the spring line. In all cases the measurements reported represent charges in radius rather than in diameter.

Four vertical gage lines were installed as follows:

V1 - Cylinder wall at elev. 114'-0" (Spring line) to elev. -16'-6" Azimuth 47°-30'.

V2 - Cylinder wall at elev. 115'- 1 1/8" to elev. -16'-4" Azimuth 242°

V3 - Operating floor elev. 59'-4" to Cylinder wall elev. -16'-4" Azimuth 239°

V4 - Cylinder wall elev. 115'-1 1/8" to Operating floor elev. 60'-0" Azimuth 239°-47'

The data from Gage No. V2 was used to convert the dome displacements from the measured values to a reference at the spring line elevation.

Dome displacements were measured at Azimuth 225° at four locations, spaced at equal horizontal increments of 15 feet. Gage D4 was located 3'-0" from the apex of the dome. The invar wires terminated at the operating floor (Elev. 69 0") at distances of 0'-0" (Plumb) to 12'-1 1/2" right or left of the dome attachments. Angular corrections have been applied to convert the measurements to vertical displacements at the point of measurement on the dome. The total vertical displacements were then reduced by the vertical wall movement shown by Gage No. V2, so that the reported values are vertical displacements of the dome referenced to the spring line.

The equipment hatch gages, No. E2 through E9 spanned from the cylinder wall to rigid internal members of the vessel or to the shield wall. Invar wire lengths were 2 to 43 feet. Because of obstructions Gage E1 spanned from the cylinder wall to the floor (Elev. 1'-6"). Angular corrections have been applied to Gage E1 and the reported displacements are radial movements.

Two gage lines (Nos. F1 and F2) were installed on the Floor.

Th purpose was to investigate possible effects of pressure and temperature on the measuring instrumentation. In addition, these gages provided an overall check on the entire measuring and recording system so that corrections could be made, if necessary, to the data from the major installation. The maximum change recorded for those control gages during the entire test was 0.010 in. Because of the small magnitude of these changes, the data have not been tabulated and have not been used as correction factors.

DISCUSSION OF INSTRUMENTATION

As mentioned earlier, the intent was to maintain the invar wires under a constant tension by the use of a flat-coil spring known as a "negator". Laboratory tests show that the negator spring does indeed exert an essentially constant force regardless of amount of elongation. However, in earlier previous installations these springs showed hysteresis when the direction of movement changed from elongation to retraction. Several extensometers were tested under different load-displacement arrangements, some of which reproduced actual field measurements, with a true time scale of seven days of continuous monitoring introduced in one test. It was found that the change of load in changing from elongation to retraction, or the reverse, was 1.9 lbs. It was also noted that when elongation was resumed following retraction (or the reverse), the original force was again indicated. As noted previously, diameter of the invar was 0.088. Corresponding hysteresis correction for a force change of 1.9 lbs was 0.019 in. per 100 ft. of wire length.

This hysteresis, although of minor magnitude and subject to reasonable correction factors, has been a troublesome factor in previous

installations. In consequence, in May of 1973, all potentiometer frames were remodeled to reduce hysteresis and to minimize friction effects. All frames were completely dismantled and all of the negator springs were individually calibrated and were then matched in pairs to provide uniform pull on each side of the potentiometer frame. The negator springs were then pinned to the rear drum to avoid any coiling or uncoiling at that drum. The rollers that supported the front drum were removed and the previously used roller bearings were replaced by stainless steel ball bearings located at both top and bottom of the drum. The guide rod holes in the front channel were enlarged and teflon bushings were pressed into the guide holes. Along with this, the guide rods were cut off at the front channel, and cap screws having a teflon sleeve were installed. Each extensometer frame was then calibrated in a lathe bed against a pair of 0.001-in. dial gages.

The input voltage for the field instruments was selected so that the "best fit" ratio was one-to-one between voltage change and displacement; that is, 1 millivolt equals 0.001 in. The laboratory calibrations showed that hysteresis had been reduced very substantially, and individual plots of the response of all field instruments indicated that this effect could be neglected without significant loss in accuracy. Consequently, the data recorded in Tables 1 through VI do not include a hysteresis adjustment.

TEST RESULTS

Overall, the pressure test involved pressurization from 0 to 68.2 psig and down to 0 psig. The integrated leak rate was performed at 30 psig

during pressurization and at 58 psig during depressurization. In addition to the major hold periods required to conduct the integrated lead rate test, a major hold period of 16 hours was required at 68.2 psig (peak pressure). The extended hold period at peak pressure resulted when high winds prevented test personnel from performing crack surveillance and tendon inspections.

Measured data are presented in the following tables:

TABLE I Radial Displacement 20° and 140° Azimuths

TABLE II Radial Displacement 320° Azimuth

TABLE III Radial Displacement 48°-30'/228°-30' Azimuth

TABLE IV Vertical Displacements

Table V Dome Displacement - Referenced to Springline Elevation 115'-1 1/8"

TABLE VI Radial Displacement - Equipment Hatch

Respectfully submitted,

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TABLE I

BUTTRESS SECTION - RADIAL DISPLACEMENT (INCHES)

ON AZIMUTHS 20° and 140°

GAGE NO. ELEVATION AZIMUTH			H1 -6'-6" 141°	H2 3'-6" 139°	H3 13'-6" 140°	H4 43'-6" 140°	H5 67'-0" 140°	H19A 67'-0" 20°	H6 107'-0" 140°	H7 114'-0" 140°
DATE	TIME	PSIG								
2/2/74	1011	0	.00	.00	.00	.00	.00	.00	.00	.00
	1234	5	.00	.00	.00	.00	.00	.00	.00	.00
	1515	10	.00	.00	.00	.01	.00	.01	.01	.00
	1620	12	.00	.01	.01	.01	.00	.02	.01	.00
	2114*	12	.00	.01	.01	.01	.00	.02	.01	.00
	2310	15	.00	.01	.01	.01	.00	.02	.01	.00
2/3/74	0330	25	.01	.02	.02	.01	.01	.04	.02	.01
	0630	30	.01	.03	.03	.02	.01	.04	.03	.01
	0730	30	.01	.03	.03	.02	.01	.04	.03	.01
	1730	30	.01	.03	.03	.02	.03	.05	.04	.02
2/4/74	0330	30	.01	.03	.03	.02	.03	.05	.04	.02
	1530	30	.01	.03	.03	.03	.04	.05	.05	.03
2/5/74	0130*	30	.01	.03	.03	.03	.04	.05	.05	.03

TABLE I
(Continued)

BUTTRESS SECTION - RADIAL DISPLACEMENT (INCHES)

ON AZIMUTHS 20° and 140°

GAGE NO.			H1	H2	H3	H4	H5	H19A	H6	H7
ELEVATION			-6'-6"	3'-6"	13'-6"	43'-6"	67'-0"	67'-0"	107'-0"	114'-0"
AZIMUTH			141°	139°	140°	140°	140°	20°	140°	140°
DATE	TIME	PSIG								
2/5/74	0250**	35(34.2)	.01	.03	.03	.03	.04	.06	.05	.03
	0500**	40(39.1)	.01	.03	.04	.03	.04	.06	.05	.03
	0723**	45(44.1)	.01	.04	.05	.04	.04	.07	.06	.04
	0934**	50(48.9)	.02	.04	.06	.04	.05	.08	.07	.04
	1156**	55(53.8)	.02	.05	.07	.05	.06	.09	.08	.05
	1407	60	.03	.06	.07	.06	.07	.10	.09	.05
	1706	65	.03	.07	.09	.07	.08	.11	.10	.06
	1844	68.2	.03	.08	.10	.07	.08	.12	.10	.07
	1944	68.2	.03	.08	.10	.07	.08	.12	.10	.07
2/6/74	0344	68.2	.03	.08	.10	.07	.08	.12	.10	.07
	1047*	68.2	.03	.08	.10	.07	.08	.12	.10	.07
	1216	65	.03	.08	.09	.07	.08	.12	.10	.07
	1444	60	.03	.07	.08	.07	.08	.12	.10	.07
	1527	59.2	.03	.07	.08	.07	.08	.12	.10	.07
	1630	59.2	.03	.07	.08	.07	.08	.12	.10	.07

TABLE I
(Continued)

BUTTRESS SECTION - RADIAL DISPLACEMENT (INCHES)

ON AZIMUTHS 20° and 140°

GAGE NO. ELEVATION AZIMUTH			H1 -6'-6" 141°	H2 3'-6" 139°	H3 13'-6" 140°	H4 43'-6" 140°	H5 67'-0" 140°	H19A 67'-0" 20°	H6 107'-0" 140°	H7 114'-0" 140°
DATE	TIME	PSIG								
2/7/74	0030	59.2	.03	.07	.08	.07	.08	.12	.10	.07
	0630	59.2	.03	.07	.08	.06	.08	.12	.10	.07
	1430	59.2	.03	.07	.08	.06	.08	.12	.10	.07
	2100*	59.2	.03	.07	.08	.06	.08	.12	.10	.07
	2304	55	.03	.07	.08	.06	.08	.11	.10	.07
2/8/74	0105	50	.02	.06	.07	.05	.08	.10	.10	.07
	0255	45	.02	.05	.06	.05	.07	.10	.09	.07
	0445	40	.02	.04	.05	.04	.06	.09	.09	.07
	0630	35	.01	.04	.04	.03	.06	.08	.08	.06
	0830	30	.01	.03	.03	.03	.05	.07	.07	.05
	0930*	30	.01	.03	.03	.03	.05	.07	.07	.05
	1124	25	.00	.02	.03	.03	.05	.06	.06	.05
	1206	23	.00	.02	.03	.03	.05	.06	.06	.05
	1306	23	.00	.02	.03	.03	.05	.06	.06	.05

TABLE I
(Continued)

BUTTRESS SECTION - RADIAL DISPLACEMENT (INCHES)

ON AZIMUTHS 20° and 140°

GAGE NO.			H1	H2	H3	H4	H5	H19A	H6	H7
ELEVATION			-6'-6"	3'-6"	13'-6"	43'-6"	67'-0"	67'-0"	107'-0"	114'-0"
AZIMUTH			141°	139°	140°	140°	140°	20°	140	140°
DATE	TIME	PSIG								
2/8/74	1659*	23	.00	.02	.03	.03	.05	.06	.06	.05
	1757	20	.00	.01	.02	.02	.05	.06	.06	.05
	1937	15	.00	.01	.02	.02	.04	.05	.06	.05
	2130	10	-.01	.00	.01	.02	.04	.04	.05	.04
	2323	5	-.01	-.01	.00	.01	.03	.03	.04	.03
2/9/74	0300	0	-.02	-.01	-.01	.01	.03	.02	.03	.03
	0800	0	-.02	-.01	-.01	.00	.02	.02	.03	.02

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

TABLE 11

320° AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO. / ELEVATION / AZIMUTH			H8 -6'-6" 330°	H9 3'-6" 330°	H10 13'-6" 330°	H11 42'-6" 330°	H5A 67'-0" 320°-30'	H6*** 107'-0"	H7*** 114'-0"
DATE	TIME	PSIG							
2/2/74	1011	0	.00	.00	.00	.00	.00		
	1234	5	.00	.01	.01	.01	.02		
	1515	10	.01	.02	.02	.02	.04		
	1620	12	.01	.02	.03	.03	.05		
	2114*	12	.01	.03	.03	.03	.05		
	2310	15	.01	.03	.03	.03	.06		
2/3/74	0330	25	.03	.05	.06	.05	.09		
	0630	30	.04	.06	.07	.07	.11		
	0730	30	.04	.06	.07	.07	.11		
	1730	30	.04	.07	.07	.07	.12		
2/4/74	0330	30	.04	.07	.07	.07	.13		
	1530	30	.04	.07	.07	.08	.13		
2/5/74	0130*	30	.04	.07	.08	.08	.13		
	0250**	35(34.2)	.05	.08	.09	.09	.14		
	0500**	40(39.1)	.06	.09	.10	.10	.16		

TABLE II
(Continued)

320° AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO.			H8	H9	H10	H11	H5A	H6***	H7***
ELEVATION			-6'-6"	3'-6"	13'-6"	42'-6"	67'-0"	107'-0"	114°-0"
AZIMUTH			330°	330°	330°	330°	320°-30'		
DATE	TIME	PSIG							
2/5/74	0723**	45(44.1)	.06	.10	.11	.11	.18		
	0934**	50(48.9)	.07	.1[illegible]	.12	.12	.20		
	1156**	55(53.8)	.08	.13	.13	.14	.22		
	1407	60	.09	.14	.15	.15	.24		
	1706	65	.10	.16	.17	.17	.27		
	1844	68.2	.11	.17	.18	.18	.28		
	1944	68.2	.11	.17	.18	.18	.28		
2/6/74	0344	68.2	.11	.17	.18	.18	.28		
	1047*	68.2	.11	.17	.18	.18	.28		
	1216	65	.11	.16	.18	.18	.27		
	1444	60	.10	.15	.17	.17	.26		
	1527	59.2	.10	.15	.16	.17	.26		
	1630	59.2	.10	.15	.16	.17	.26		
2/7/74	0030	59.2	.10	.15	.16	.17	.26		

TABLE II
(Continued)

320° AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO. ELEVATION AZIMUTH			H8 -6'-6" 330°	H9 3'-6" 330°	H10 13'-6" 330°	H11 42'-6" 330°	H5A 67'-0" 320°-30'	H6*** 107'-0"	H7 *** 114'-0"
DATE	TIME	PSIG							
2/7/74	0630	59.2	.10	.15	.16	.16	.25		
	1430	59.2	.10	.15	.16	.16	.25		
	2100*	59.2	.10	.15	.16	.16	.25		
	2304	55	.09	.14	.16	.15	.24		
2/8/74	0105	50	.08	.13	.14	.14	.22		
	0255	45	.08	.12	.13	.13	.20		
	0445	40	.07	.11	.12	.12	.18		
	0630	35	.06	.09	.10	.10	.16		
	0830	30	.05	.08	.09	.09	.14		
	0930*	30	.05	.08	.09	.09	.14		
	1124	25	.05	.07	.08	.08	.13		
	1206	23	.04	.07	.07	.07	.12		
	1306	23	.04	.06	.07	.07	.12		
	1659*	23	.04	.06	.07	.07	.12		
	1757	20	.04	.06	.07	.07	.11		

(Continued)

320° AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO. ELEVATION AZIMUTH			H8 -6'-6" 330°	H9 3'-6" 330°	H10 13'-6" 330°	H11 42'-6" 330°	H5A 67'-0" 320°-30'	H6*** 107'-0"	H7*** 114'-0"
DATE	TIME	PSIG							
2/8/74	1937	15	.03	.05	.06	.06	.09		
	2130	10	.02	.04	.04	.04	.07		
	2323	5	.01	.03	.03	.03	.05		
2/9/74	0300	0	.01	.01	.01	.01	.03		
	0800	0	.00	.00	.01	.01	.02		

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

*** REPORTED ON TABLE I

48°-30'/228°-30' AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO.			H12	H13	H14	H15	H16	H16A	H19	H17	H18
ELEVATION			-6'-6"	3'-6"	13'-6"	43'-6"	67'-0"	67'-0"	67'-0"	102'-1"	116'-0"
AZIMUTH			54°-30'	54°-30'	54°-30'	48°-20'	228°-30'	48°-30'	205°	48°-30'	to 228°-30'
DATE	TIME	PSIG									
2/2/74	1011	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
	1234	5	.00	.01	.00	.00	.01	.00	.01	.00	.00
	1515	10	.01	.02	.02	.01	.04	.01	.03	.00	.00
	1620	12	.01	.03	.02	.02	.05	.02	.06	.01	.01
	2114*	12*	.01	.03	.03	.02	.06	.02	.06	.01	.01
	2310	15	.02	.04	.04	.03	.07	.03	.07	.01	.02
2/3/74	0330	25	.03	.06	.06	.05	.11	.05	.11	.03	.03
	0630	30	.04	.07	.08	.06	.14	.06	.13	.04	.03
	0730	30	.04	.07	.08	.06	.14	.06	.13	.04	.03
	1730	30	.04	.07	.08	.06	.16	.06	.16	.06	.03
2/4/74	0330	30	.04	.07	.08	.07	.16	.06	.16	.06	.03
	1530	30	.03	.07	.09	.07	.17	.07	.16	.06	.04
2/5/74	0130*	30	.03	.07	.09	.07	.17	.07	.17	.07	.04
	0250**	35(34.2)	.04	.08	.10	.08	.18	.07	.17	.07	.04
	0500**	40(39.1)	.05	.10	.12	.09	.20	.08	.19	.08	.04

TABLE III
(Continued)
48°-30'/228°-30' AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO. ELEVATION AZIMUTH			H12 -6'-6" 54°-30'	H13 3'-6" 54°-30'	H14 13'-6" 54°-30'	H15 43'-6" 48°-30'	H16 67'-0" 228°-30'	H16A 67'-0" 48°-30'	H19 67'-0" 205°	H17 102'-1" 48°-30' to	H18 116'-0" 228°-30'
DATE	TIME	PSIG									
2/5/74	0723**	45(44.1)	.05	.11	.13	.10	.22	.09	.20	.08	.04
	0934**	50(48.9)	.06	.12	.15	.11	.24	.10	.22	.10	.04
	1156**	55(53.8)	.06	.14	.16	.12	.27	.10	.24	.11	.04
	1407	60	.07	.15	.18	.13	.29	.11	.27	.12	.04
	1706	65	.08	.17	.20	.15	.33	.12	.30	.13	.06
	1844	68.2	.09	.19	.22	.16	.35	.13	.32	.14	.06
	1944	68.2	.09	.19	.22	.16	.35	.13	.32	.14	.06
2/6/74	0344	68.2	.09	.19	.22	.16	.35	.13	.32	.14	.06
	1047*	68.2	.09	.19	.22	.16	.35	.13	.32	.14	.06
	1216	65	.09	.18	.22	.15	.35	.12	.32	.14	.06
	1444	60	.08	.17	.20	.14	.32	.11	.31	.14	.06
	1527	59.2	.08	.16	.20	.14	.32	.11	.31	.14	.06
	1630	59.2	.08	.16	.20	.14	.32	.11	.31	.14	.06
2/7/74	0030	59.2	.08	.16	.20	.14	.32	.11	.31	.14	.06
	0630	59.2	.08	.16	.20	.14	.32	.11	.30	.14	.06
	1430	59.2	.08	.16	.19	.14	.32	.11	.30	.14	.06

TABLE III
(Continued)

48°-30'/228°-30' AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO.			H12	H13	H14	H15	H16	H16A	H19	H17	H18
ELEVATION			-6'-6"	3'-6"	13'-6"	43'-6"	67'-0"	67'-0"	67'-0"	102'-1"	116'-0"
AZIMUTH			54°-30'	54°-30'	54°-30'	48°-30'	228°-30'	48°-30'	205°	48°-30'	to 228°-30'
DATE	TIME	PSIG									
2/7/74	2100*	59.2	.08	.16	.19	.14	.32	.11	.30	.14	.06
	2304	55	.07	.15	.18	.13	.32	.10	.29	.13	.06
2/8/74	0105	50	.06	.14	.17	.12	.29	.10	.27	.12	.06
	0255	45	.06	.12	.15	.11	.27	.09	.25	.11	.06
	0445	40	.05	.11	.13	.10	.24	.08	.23	.10	.05
	0630	35	.04	.09	.12	.08	.22	.07	.21	.10	.05
	0830	30	.03	.08	.10	.07	.19	.06	.18	.08	.04
	0930*	30	.03	.08	.10	.07	.19	.06	.18	.08	.04
	1124	25	.02	.06	.08	.05	.17	.05	.16	.07	.04
	1206	23	.02	.05	.07	.05	.16	.04	.15		.04
	1306	23	.02	.05	.07	.05	.16	.04	.15		.04
	1659*	23	.02	.05	.07	.05	.16	.04	.15		.04
	1757	20	.02	.05	.06	.04	.16	.04	.15		.03
	1937	15	.01	.03	.05	.03	.14	.03	.14	.05	.03
	2130	10	.00	.02	.04	.02	.11	.03	.11	.04	.03

TABLE III
(Continued)

48°-30'/228°-30' AZIMUTH - RADIAL DISPLACEMENT (INCHES)

WALL SECTION

GAGE NO.			H12	H13	H14	H15	H16	H16A	H19	H17	H18
ELEVATION			-6'-6"	3'-6"	13'-6"	43'-6"	67'-0"	67'-0"	67'-0"	102'-1"	116'-0"
AZIMUTH			54°-30'	54°-30'	54°-30'	48°-30'	228°-30'	48°-30'	205°	48°-30' to 228°-30'	
DATE	TIME	PSIG									
2/8/74	2323	5	-.01	.01	.02	.01	.08	.02	.09	.03	.02
2/9/74	0300	0	-.01	-.01	.00	.00	.06	.01	.06	.02	.02
	0800	0	-.01	-.01	.00	.00	.05	.01	.05	.01	.01

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

TABLE IV

VERTICAL WALL GAGES - DISPLACEMENT (INCHES)

GAGE NO.			V1	V2	V3	V4
ELEVATION TOP			114'-0"	115'-1 1/8"	59'-4"	115'-1 1/8"
ELEVATION BOTTOM			-16'-6"	-16'-4"	-16'-4"	60'-0"
AZIMUTH			47°-30'	242°	239°	239°-47'
DATE	TIME	PSIG				
2/2/74	1011	0	.00	.00	.00	.00
	1234	5	.00	.00	.00	.00
	1515	10	.01	.01	.00	.00
	1620	12	.01	.01	.00	.01
	2114*	12	.01	.01	.00	.01
	2310	15	.01	.01	.00	.01
2/3/74	0330	25	.02	.03	.01	.02
	0630	30	.03	.03	.01	.02
	0730	30	.03	.03	.01	.02
	1730	30	.04	.04	.02	.03
2/4/74	0330	30	.05	.05	.02	.03
	1530	30	.06	.05	.03	.03
2/5/74	0130*	30	.06	.06	.03	.03
	0250**	35(34.2)	.06	.06	.03	.03
	0500**	40(39.1)	.06	.06	.03	.04
	0723**	45(44.1)	.07	.07	.03	.04
	0934**	50(48.9)	.07	.07	.03	.05
	1156**	55(53.8)	.08	.08	.03	.05
	1407	60	.08	.08	.03	.06
	1706	65	.09	.09	.03	.07

TABLE IV
(Continued)

VERTICAL WALL GAGES - DISPLACEMENT (INCHES)

GAGE NO.			V1	V2	V3	V4
ELEVATION TOP			114'-0"	115'-1 1/8"	59'-4"	115'-1 1/8"
ELEVATION BOTTOM			-16'-6"	-16'-4"	-16'-4"	60'-0"
AZIMUTH			47°-30'	242°	239°	239°-47'
DATE	TIME	PSIG				
2/5/74	1844	68.2	.10	.10	.03	.08
	1944	68.2	.10	.10	.03	.08
2/6/74	0344	68.2	.10	.10	.03	.08
	1047*	68.2	.10	.10	.03	.08
	1216	65	.09	.09	.02	.08
	1444	60	.09	.09	.02	.08
	1527	59.2	.09	.09	.02	.08
	1630	59.2	.09	.09	.02	.08
2/7/74	0030	59.2	.09	.09	.02	.08
	0630	59.2	.09	.09	.02	.07
	1430	59.2	.09	.09	.02	.07
	2100*	59.2	.09	.09	.02	.07
	2304	55	.09	.09	.02	.07
2/8/74	0105	50	.08	.08	.02	.07
	0255	45	.07	.08	.02	.07
	0445	40	.07	.07	.02	.06
	0630	35	.06	.06	.02	.06
	0830	30	.05	.06	.01	.05
	0930*	30	.05	.06	.01	.05
	1124	25	.05	.05	.01	.04
	1206	23	.05	.05	.01	.04

TABLE IV
(Continued)

VERTICAL WALL GAGES - DISPLACEMENT (INCHES)

GAGE NO.			V1	V2	V3	V4
ELEVATION TOP			114'-0"	115'-1 1/8"	59'-4"	115'-1 1/8"
ELEVATION BOTTOM			-16'-6"	-16'-4"	-16'-4"	60'-0"
AZIMUTH			47°-30'	242°	239°	239°-47'
DATE	TIME	PSIG				
2/8/74	1306	23	.05	.05	.01	.04
	1659*	23	.05	.05	.01	.04
	1757	20	.05	.05	.01	.04
	1937	15	.04	.04	.01	.04
	2130	10	.04	.04	.01	.03
	2323	5	.03	.03	.01	.03
2/9/74	0300	0	.03	.03	.01	.02
	0800	0	.03	.02	.01	.01

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

TABLE V

DOME GAGES - VERTICAL DISPLACEMENT (INCHES)

REFERENCES AT AZIMUTH 225° TO ELEVATION 115'-1 1/8"

GAGE NO.			D1	D2	D3	D4
ELEVATION			144'-3 5/8"	152'-3 3/4"	156'-7 7/8"	157'-11 3/4"
DIST. FROM APEX			48'-0"	33'-0"	18'-0"	3'-0"
DATE	TIME	PSIG				
2/2/74	1011	0	.00	.00	.00	.00
	1234	5	.02	.01	.02	.03
	1515	10	.03	.04	.05	.06
	1620	12	.04	.05	.06	.07
	2114*	12	.04	.05	.06	.07
	2310	15	.04	.06	.08	.09
2/3/74	0330	25	.06	.10	.12	.14
	0630	30	.07	.12	.16	.17
	0730	30	.07	.12	.16	.17
	1730	30	.07	.13	.16	.17
2/4/74	0330	30	.07	.13	.16	.17
	1530	30	.07	.13	.16	.17
2/5/74	0130*	30	.07	.13	.16	.17
	0250**	35(34.2)	.07	.14	.18	.19
	0500**	40(39.1)	.08	.17	.21	.23
	0723**	45(44.1)	.09	.19	.23	.25
	0934**	50(48.9)	.11	.21	.26	.28
	1156**	55(53.8)	.12	.23	.29	.31
	1407	60	.14	.26	.33	.34
	1706	65	.16	.29	.36	.38
	1844	68.2	.17	.31	.38	.40
	1944	68.2	.17	.31	.38	.40

TABLE V
(Continued)

DOME GAGES - VERTICAL DISPLACEMENT (INCHES)

REFERENCES AT AZIMUTH 225° TO ELEVATION 115'-1 1/8"

GAGE NO. / ELEVATION / DIST. FROM APEX			D1 144'-3 5/8" 48'-0"	D2 152'-3 3/4" 33'-0"	D3 156'-7 7/8" 18'-0"	D4 157'-11 3/4" 3'-0"
DATE	TIME	PSIG				
2/6/74	0344	68.2	.17	.31	.38	.40
	1047*	68.2	.17	.31	.38	.40
	1216	65	.17	.31	.37	.40
	1444	60	.15	.29	.34	.36
	1527	59.2	.15	.29	.34	.36
	1630	59.2	.15	.29	.34	.36
2/7/74	0030	59.2	.15	.29	.34	.36
	0630	59.2	.15	.29	.34	.36
	1430	59.2	.15	.29	.34	.36
	2100*	59.2	.15	.29	.34	.36
	2304	55	.13	.26	.32	.33
2/8/74	0105	50	.12	.25	.29	.31
	0255	45	.10	.22	.26	.28
	0445	40	.10	.20	.24	.25
	0630	35	.09	.18	.21	.23
	0830	30	.06	.15	.17	.18
	0930*	30	.06	.15	.17	.18
	1124	25	.06	.13	.15	.16
	1206	23	.05	.12	.14	.15
	1306	23	.05	.12	.14	.15
	1659*	23	.05	.12	.14	.15

TABLE V
(Continued)

DOME GAGES - VERTICAL DISPLACEMENT (INCHES)

REFERENCES AT AZIMUTH 225° TO ELEVATION 115'-1 1/8"

GAGE NO.			D1	D2	D3	D4
ELEVATION			144'-3 5/8"	152'-3 3/4"	156'-7 7/8"	157'-11 3/4"
DIST. FROM APEX			48'-0"	33'-0"	18'-0"	3'-0"
DATE	TIME	PSIG				
2/8/74	1757	20	.04	.11	.13	.13
	1937	15	.04	.09	.11	.11
	2130	10	.02	.06	.07	.08
	2323	5	.01	.03	.05	.05
2/9/74	0300	0	.00	.01	.01	.01
	0800	0	.00	.01	.01	.01

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

TABLE VI

EQUIPMENT HATCH GAGES - RADIAL DISPLACEMENT (INCHES)

GAGE NO.			E1	E2	E3	E4	E5	E6	E7	E8	E9
ELEVATION			9'-6"	9'-6"	10'-6"	10'-6"	9'-6"	9'-6"	21'-4"	26'-6"	33'-6"
AZIMUTH			68°-19'	74°-50'	81°-09'	98°-51'	105°-10'	111°-41'	90°-0'	90°-0'	90°-0'
DATE	TIME	PSIG									
2/2/74	1011	0	.00	.00	.00	.00	.00	.00	.00	.00	.00
	1234	5	.00	.00	.00	.00	.01	.02	.00	.00	.00
	1515	10	.01	.01	.00	.00	.01	.03	.00	.00	.00
	1620	12	.02	.01	.00	.00	.01	.03	.00	.00	.00
	2114*	12	.02	.01	.00	.00	.01	.03	.00	.00	.00
	2310	15	.03	.02	.00	.00	.01	.03	.00	.00	.00
2/3/74	0330	25	.05	.03	.00	.00	.01	.04	.00	.00	.00
	0630	30	.06	.04	.00	.01	.01	.05	.00	.00	.00
	0730	30	.06	.04	.00	.01	.01	.05	.00	.00	.00
	1730	30	.06	.04	.00	.01	.02	.05	.00	.00	.01
2/4/74	0330	30	.06	.04	.00	.01	.01	.05	.00	.01	.01
	1530	30	.06	.04	.00	.01	.01	.05	.00	.01	.01
2/5/74	0130*	30	.06	.04	.00	.01	.01	.05	.00	.01	.01
	0250**	35(34.2)	.07	.04	.00	.01	.01	.05	.00	.01	.01
	0500**	40(39.1)	.08	.05	.01	.01	.01	.06	.00	.01	.01

TABLE VI
(Continued)

EQUIPMENT HATCH GAGES - RADIAL DISPLACEMENT (INCHES)

GAGE NO.			E1	E2	E3	E4	E5	E6	E7	E8	E9
ELEVATION			9'-6"	9'-6"	10'-6"	10'-6"	9'-6"	9'-6"	21'-4"	26'-6"	33'-6"
AZIMUTH			68°-19'	74°-50'	81°-09'	98°-51'	105°-10'	111°-41'	90°-0'	90°-0'	90°-0'
DATE	TIME	PSIG									
2/5/74	0723**	45(44.1)	.09	.06	.01	.01	.01	.06	.00	.01	.01
	0934**	50(48.9)	.11	.07	.01	.02	.01	.07	.00	.01	.01
	1156**	55(53.8)	.12	.07	.02	.02	.02	.08	.00	.01	.01
	1407	60	.14	.08	.02	.03	.03	.09	.00	.01	.00
	1706	65	.16	.10	.03	.03	.03	.10	.00	.00	.00
	1844	68.2	.18	.10	.04	.03	.04	.11	.00	.00	.00
	1944	68.2	.18	.10	.04	.03	.04	.11	.00	.00	.00
2/6/74	0344	68.2	.18	.10	.04	.03	.04	.11	.00	.00	.00
	1047*	68.2	.18	.10	.04	.03	.04	.11	.00	-.01	-.01
	1216	65	.17	.10	.04	.03	.04	.11	.00	-.01	-.01
	1444	60	.16	.09	.04	.03	.04	.11	.00	-.01	-.01
	1527	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01
	1630	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01
2/7/74	0030	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01
	0630	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01
	1430	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01

TABLE VI
(Continued)

EQUIPMENT HATCH GAGES - RADIAL DISPLACEMENT (INCHES)

GAGE NO. / ELEVATION / AZIMUTH			E1 9'-6" 68°-19'	E2 9'-6" 74°-50'	E3 10'-6" 81°-09'	E4 10'-6" 98°-51'	E5 9'-6" 105°-10'	E6 9'-6" 111°-41'	E7 21'-4" 90°-0'	E8 26'-6" 90°-0'	E9 33'-6" 90°-0'
DATE	TIME	PSIG									
2/7/74	2100*	59.2	.15	.09	.04	.03	.03	.10	.00	-.01	-.01
	2304	55	.14	.08	.04	.03	.03	.09	.00	-.01	-.01
2/8/74	0105	50	.13	.07	.03	.02	.02	.08	.00	-.01	-.01
	0255	45	.11	.06	.03	.02	.02	.07	-.01	-.01	-.01
	0445	40	.10	.05	.02	.01	.01	.06	-.01	-.01	-.01
	0630	35	.09	.04	.02	.01	.00	.05	-.01	-.01	-.01
	0830	30	.07	.04	.01	.00	.00	.04	-.01	-.01	-.01
	0930	30	.07	.04	.01	.00	.00	.04	-.01	-.01	-.01
	1124	25	.05	.03	.00	.00	.00	.04	-.01	-.01	-.01
	1206	23	.05	.02	.00	.00	.00	.04	-.01	-.01	-.01
	1306	23	.05	.02	.00	.00	.00	.04	-.01	-.01	-.01
	1659*	23	.05	.02	.00	.00	.00	.04	-.01	-.01	-.01
	1757	20	.04	.02	.00	.00	.00	.03	-.01	-.01	-.01
	1937	15	.03	.01	.00	.00	-.01	.02	-.01	-.01	.00
	2130	10	.02	.01	-.01	.00	-.01	.01	-.01	-.01	.00
	2323	5	.00	.00	-.01	-.01	-.02	.00	-.01	-.01	.00

TABLE VI
(Continued)

EQUIPMENT HATCH GAGES - RADIAL DISPLACEMENT (INCHES)

GAGE NO. ELEVATION AZIMUTH			E1 9'-6" 68°-19'	E2 9'-6" 74°-50'	E3 10'-6" 81°-09'	E4 10'-6" 98°-51'	E5 9'-6" 105°-10'	E6 9'-6" 111°-41'	E7 21'-4" 90°-0'	E8 26'-6" 90°-0'	E9 33'-6" 90°-0'
DATE	TIME	PSIG									
2/9/74	0300	0	-.01	-.01	-.02	-.02	-.02	-.01	-.01	-.01	.00
	0800	0	-.01	-.01	-.02	-.02	-.02	-.01	-.01	-.01	.00

* END OF HOLD PERIOD

** ACTUAL PRESSURE SHOWN IN PARENTHESIS

APPENDIX 2

Interim Report

Tendon End Anchorage Surveillance

Liner Plate Surveillance

Interim Report

Tendon End Anchorage Surveillance
Liner Plate Surveillance

Tendon end anchorage and liner plate surveillance are continuing programs prescribed in the Final Safety Analysis Report. The results of the initial phase of these programs, conducted during the containment structural integrity test, are reported below.

1. Tendon End Anchorage Surveillance

Tendon end anchorage surveillance comprises the measurement of bearing plate movement and the mapping of concrete cracks in the anchorage zones at both ends of nine tendons. The hoop, dome and vertical groups each contain three anchorage surveillance tendons. These are: H29, H53, H112, D18 D30, D74, V14, V60 and V100.

Offsets between three prong frames (illustrated in Figure A 2-1) anchored into concrete and the tendon bearing plates were measured with a dial depth gage prior to the start of containment pressurization, at 115% of design pressure and following the completion of depressurization. Concrete crack patterns in the anchorage zones were mapped at the same pressure levels. Test procedure details are given in Appendix 3.

Table A 2-1 lists the indicated movements at all measurement points for the 68 psig and 0 psig (following depressurization) pressure stages. The net (average of the three measurements) movements of the bearing plates at 68 psig are distributed between -.006 in. and +.005 in. and average approximately -.001 in.

Since the negative figures, which represent outward movement of the bearing plate, are inconsistent with structural loading conditions, it is concluded that the measured values represent primarily a combination of thermal effects on the measuring system and measurement error. Actual movements of the bearing plates are probably small compared to the measured values and, in any case, are well below the .050 in. stipulated in the acceptance criteria (see Appendix 3). The same conclusions apply to bearing plate movement measured at 0 psig following containment depressurization.

Concrete cracks observed in the anchorage zones are illustrated in Figures A 2-2 through A 2-4. The observed cracks generally radiate from the corners of the bearing plates as is expected for cracks which result from shrinkage and/or surface thermal stresses in the concrete. No significant changes in the original mapped crack patterns were noted at 115% design pressure or following the completion of depressurization.

2. Liner Plate Surveillance

Liner plate surveillance comprises observation for strain concentrations and measurement of offsets between the liner and fixed chords. Observations and measurements were made prior to containment pressurization and following the completion of depressurization. The surveillance locations are:

--Observation Only

- o 3 ft. above and below the horizontal center line extending 10 ft. east of the east edge of the personnel lock.
- o 2 ft. radius around electrical penetration No. 7.
- o Upper half of mechanical penetration No. 40 (main steam) extending from edge of penetration to 6 ft. out from edge.
- o 2 ft. radius about mechanical penetration No. 20 (HP injection).

--Offset Measurement

- Horizontal chords centered at:
  - El. 18'6" / Az. 187°30'
  - El. 65'6" / Az. 351°30'
  - El. 65'0" / Az. 225°10'
- Vertical chords centered at:
  - El. 3'6" / Az. 23°30'
  - El. 63'6" / Az. 355°0'
- Chord centered at apex of dome.

The configuration of the fixed chords is illustrated in Figure A 2-5. Offsets to the liner are measured with a dial depth gages as described in Appendix 3.

The four observation areas showed no evidence of strain concentration before or after pressurization.

Changes in chord offsets at the completion of depressurization are listed in Table A 2-2. All changes except one are .009 in. or less. Point 7 on the chord at 65ft/225°10' shows an offset change of -.121 in. (movement away from the concrete). This movement is the result of a shift in the location of a known liner bulge as is illustrated in Figure A 2-6. Since this measurement represents an elastic readjustment of a liner irregularity rather than an inelastic permanent set, it is, not governed by the .050 in acceptance criterion stipulated in Appendix 3. All other measured changes are well below the acceptance value.

Tendon/ End	RB Internal Pressure PSIG	Indicated Movement In.			Average 68 PSIG	Average 0 PSIG
		Left	Middle	Right		
H29 W	68	.004	.001	.003	.003	
	0	.004	.000	.001		.002
H29 S	68	-.005	-.005	-.003	-.004	
	0	-.004	-.006	-.001		-.004
H53 W	68	-.002	0	-.002	-.001	
	0	-.003	-.001	-.004		-.003
H53 SW	68	0	0	-.003	-.001	
	0	-.003	.001	-.001		-.001
H112 N	68	.001	-.003	-.006	-.003	
	0	.004	.001	.001		.002
H112 SE	68	0	.004	.002	.002	
	0	.001	.003	0		.001
D18 S	68	-.001	.001	-.002	-.001	
	0	.008	.004	.002		.005
D18 N	68	.004	-.002	-.001	0	
	0	.003	0	.001		.001
D30 NW	68	-.002	.001	-.002	-.001	
	0	.001	.007	.001		.003
D30 S	68	.004	.007	.005	.005	
	0	.004	.007	.003		.005
D74 NE	68	-.008	.004	.001	-.001	
	0	-.006	.005	.002		0
D74 W	68	-.003	.002	.004	.001	
	0	-.001	.001	.004		.001
V14 B	68	-.001	-.001	-.003	-.002	
	0	-.001	-.002	-.002		-.002
V14 T	68	.004	.002	-.001	.002	
	0	.002	.003	-.001		.001
V60 B	68	-.003	-.003	-.005	-.004	
	0	-.004	-.002	-.004		-.003
V60 T	68	-.006	-.003	-.009	-.006	
	0	-.006	-.004	-.009		-.006
V100 B	68	-.003	-.004	-.004	-.004	
	0	-.004	-.004	-.004		-.004
V100 T	68	-.001	0	-.001	-.001	
	0	-.006	.001	-.003		-.003

(Positive values indicate movement of bearing plate into concrete.)

TABLE A 2-1

TENDON END ANCHORAGE MOVEMENT

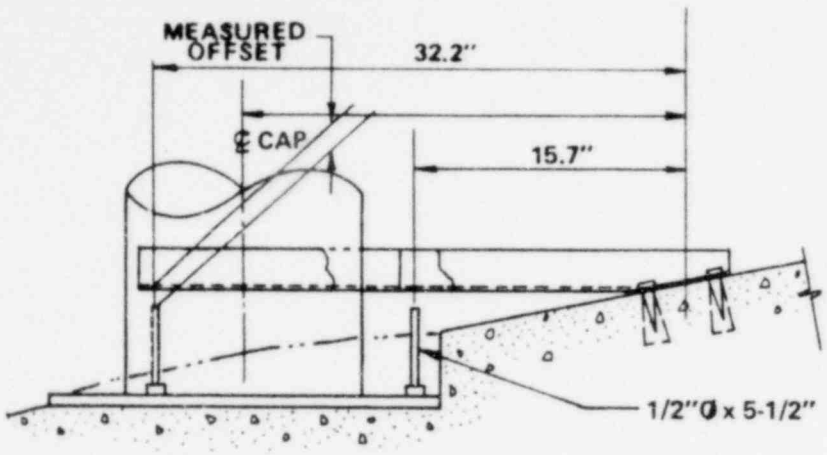
(CHANGES IN CHORD OFFSETS)

Point	Chord Elevation/Azimuth					
	18'6"/ 187°30'	65'6" 351°30'	65'0"/ 225°0'	Dome Apex	3'6" 23°30'	63'6" 355°0'
1	.005	.002	.009	0	.002	.003
2	.004	.001	0	0	.003	.001
3	.003	.005	0	0	.003	.002
4	.005	.005	.004	.001	.003	.002
5	.003	.002	.001	-.001	.004	.002
6	.004	.002	-.001	-.001	.005	.003
7	.003	.004	-.115	-.001	.006	.004
8	.005			-.003	.004	.004
9	.002	7 Point Chord	7 Point Chord	0	.005	.004
10	.006			-.001	.004	.004
11	.005			0	.005	.002
12	.002			-.001	.003	.003
13	.004			.002	.001	.003

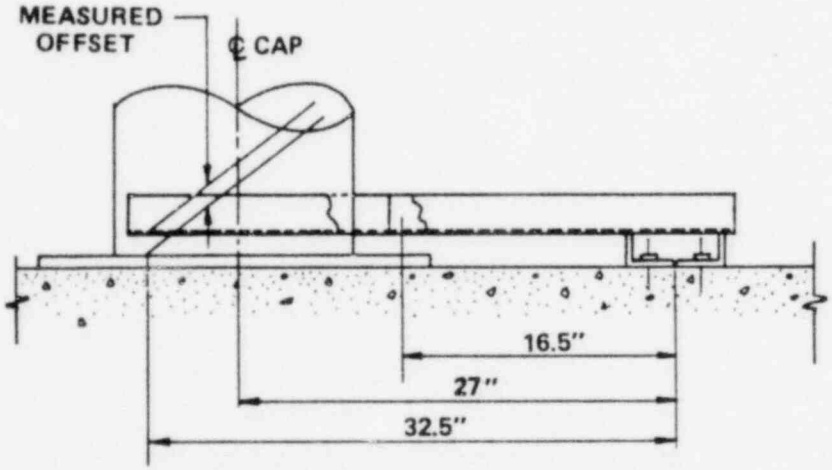
(All values in inches - positive values indicate movement of liner into concrete ends).

TABLE A 2-2

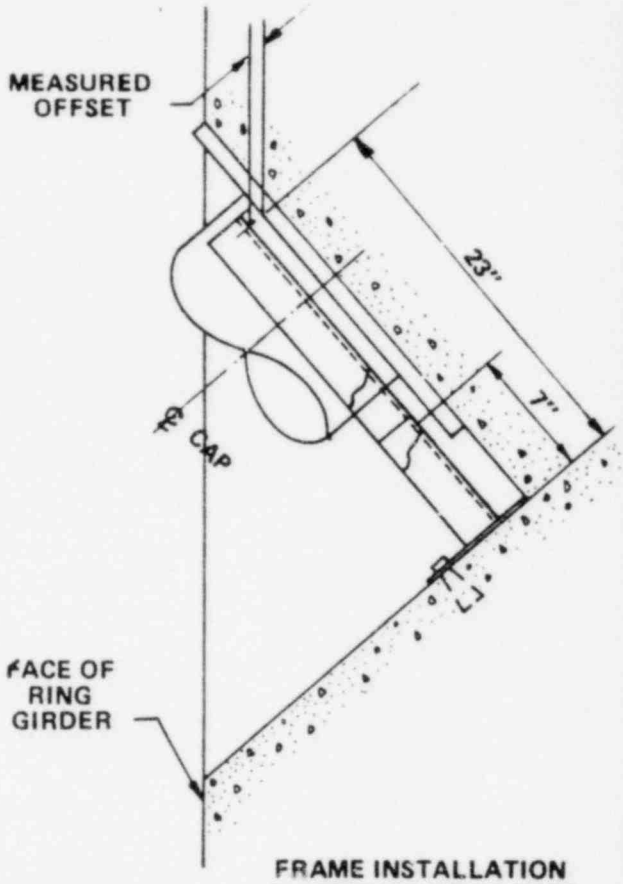
Liner Plate Deformations



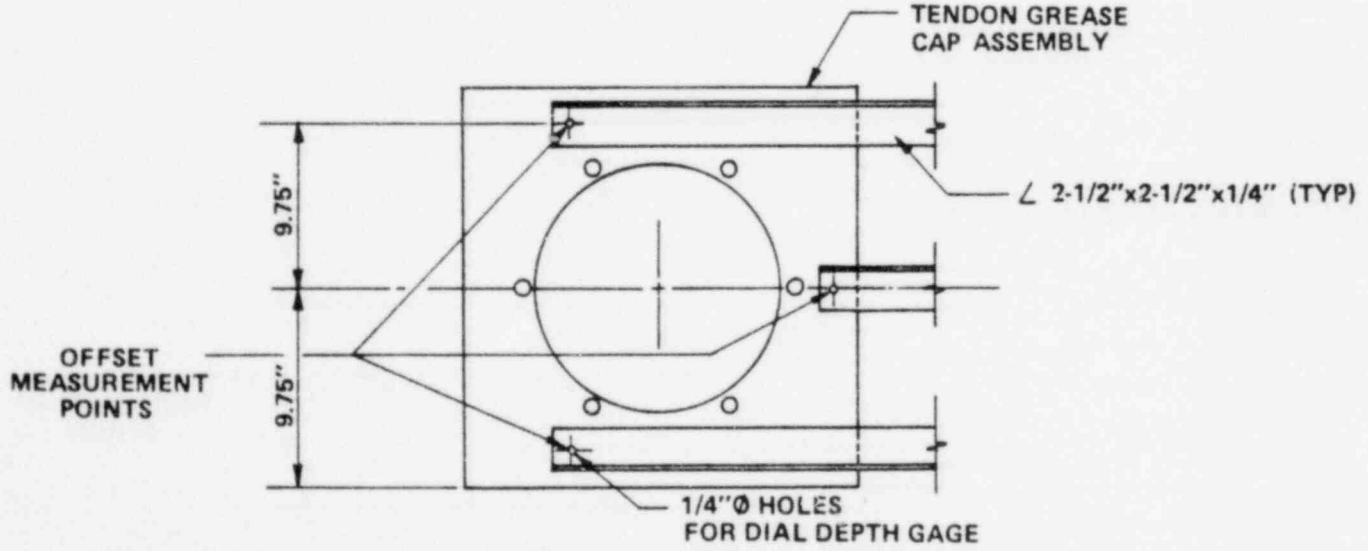
FRAME INSTALLATION ON VERTICAL TENDON UPPER ENDS



FRAME INSTALLATION ON HOOP TENDON ENDS AND VERTICAL TENDON LOWER ENDS



FRAME INSTALLATION ON DOME TENDON ENDS



TYPICAL PLAN OF 3 PRONG FRAME AT TENDON END ANCHORAGES

FIGURE A2 - 1 TENDON END ANCHORAGE MOVEMENT MEASUREMENT FRAME ASSEMBLY

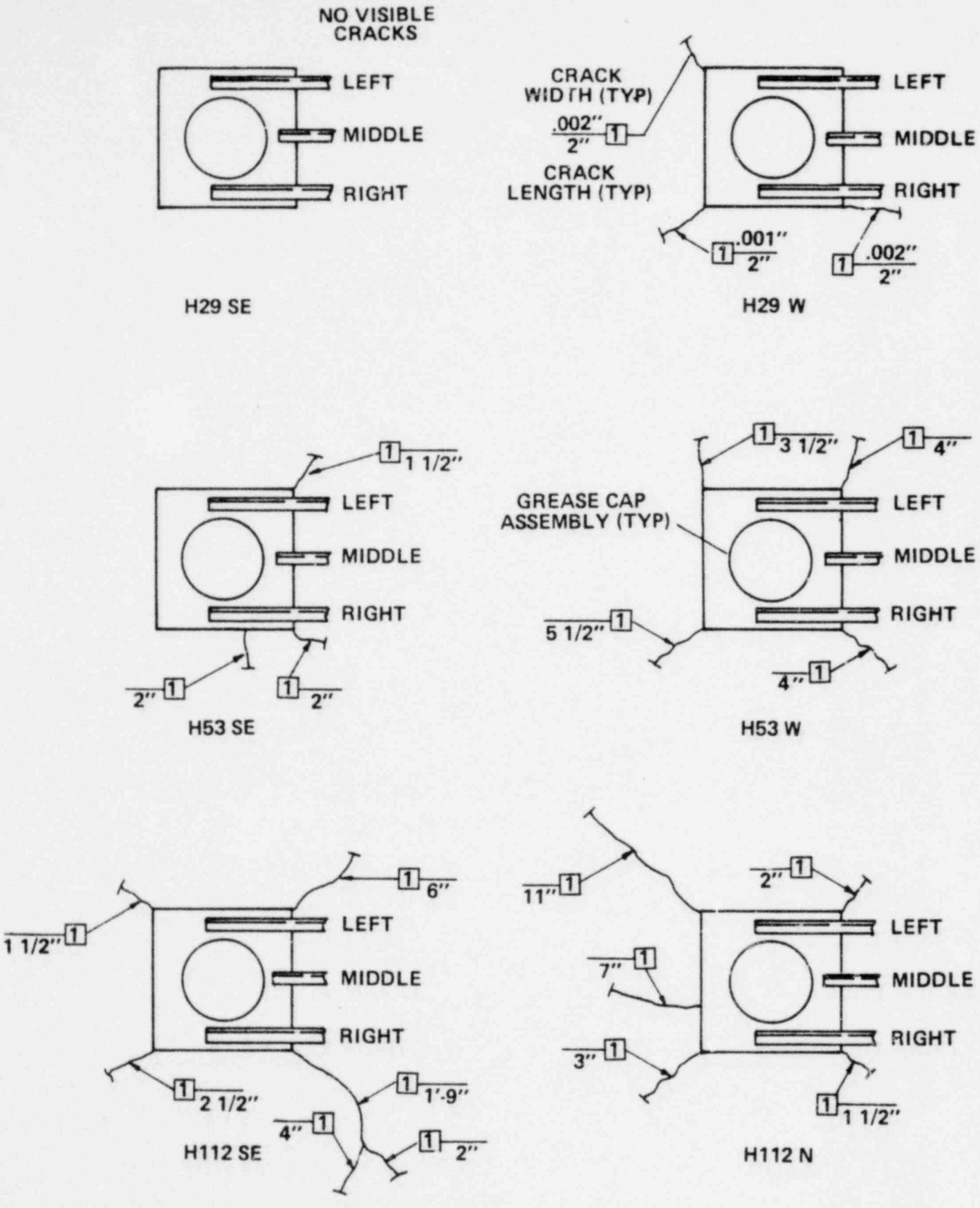
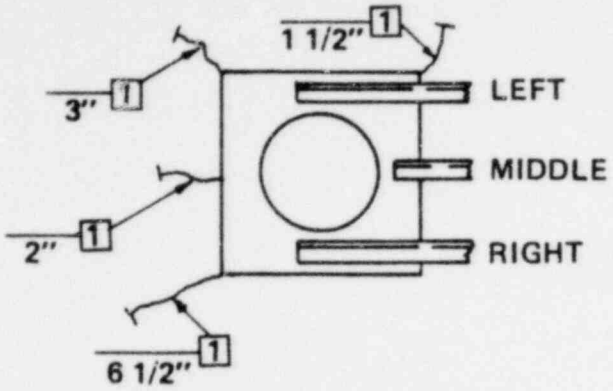
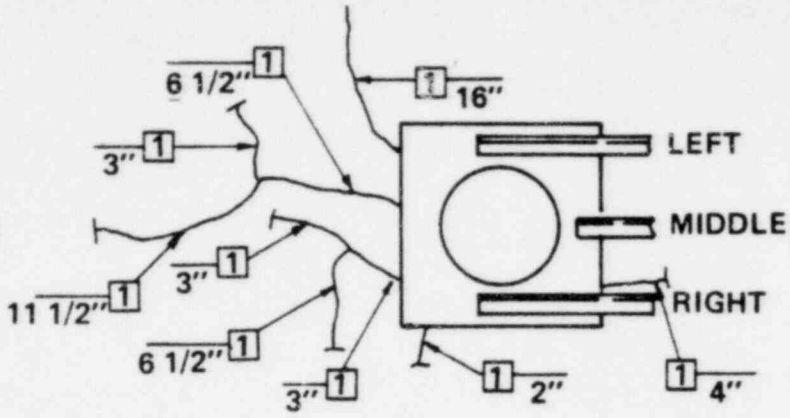


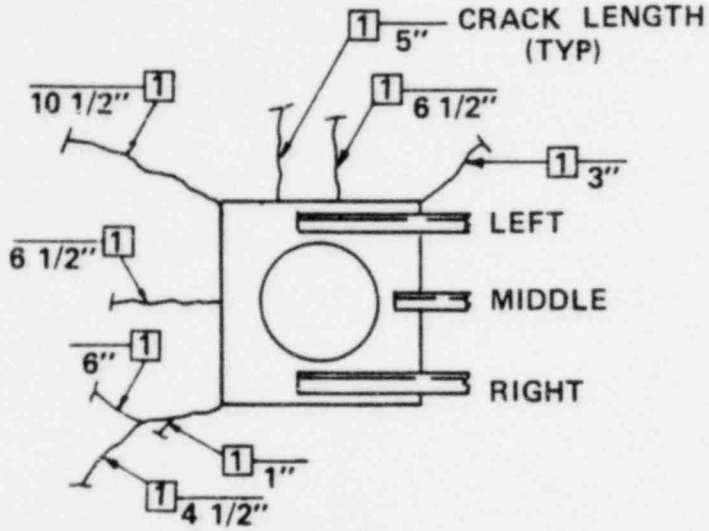
FIGURE A2 - 2
HOOP TENDON END ANCHORAGE CRACK PATTERNS



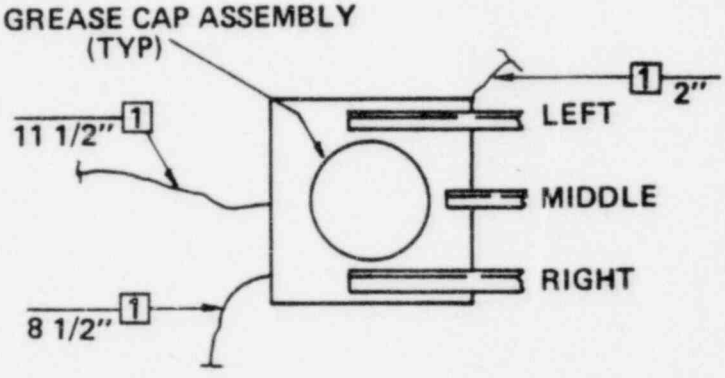
D18 N



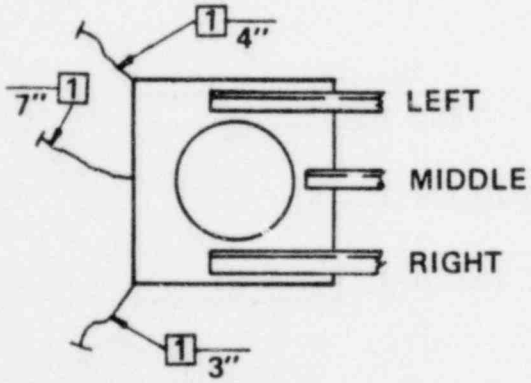
D18 S



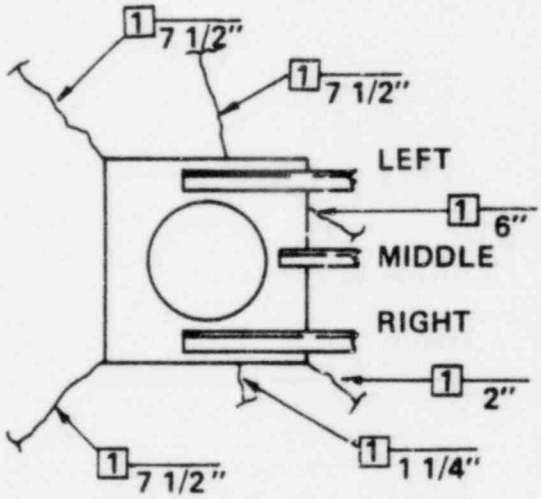
D30 NW



D30 S



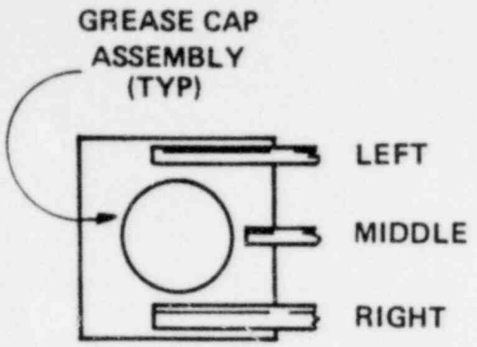
D74 NE



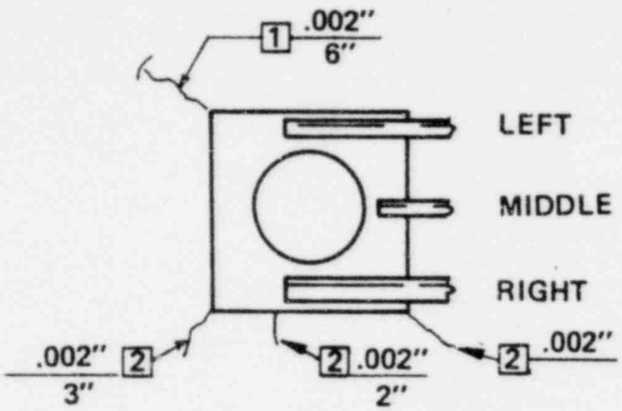
D74 W

STAGE [1] PRIOR TO PRESSURIZATION
[2] 115% DESIGN PRESSURE
[3] FOLLOWING DEPRESSURIZATION

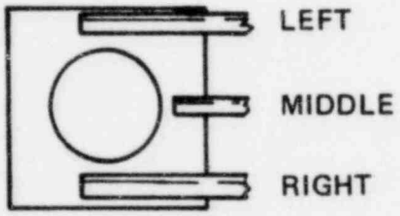
FIGURE A2 - 3
DOME TENDON END ANCHORAGE CRACK PATTERNS



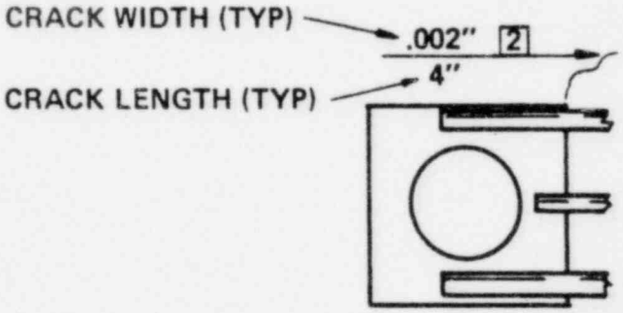
V14 TOP
NO CRACKS VISIBLE-AREA COVERED
WITH MEMBRANE COATING



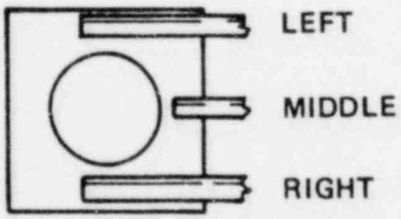
V14 BOTTOM
NOTE: CRACKS OBSERVED AT STAGE [2]
ASSUMED PRESENT AT STAGE [1] . LIGHTING
CONDITIONS MADE OBSERVATION DIFFICULT



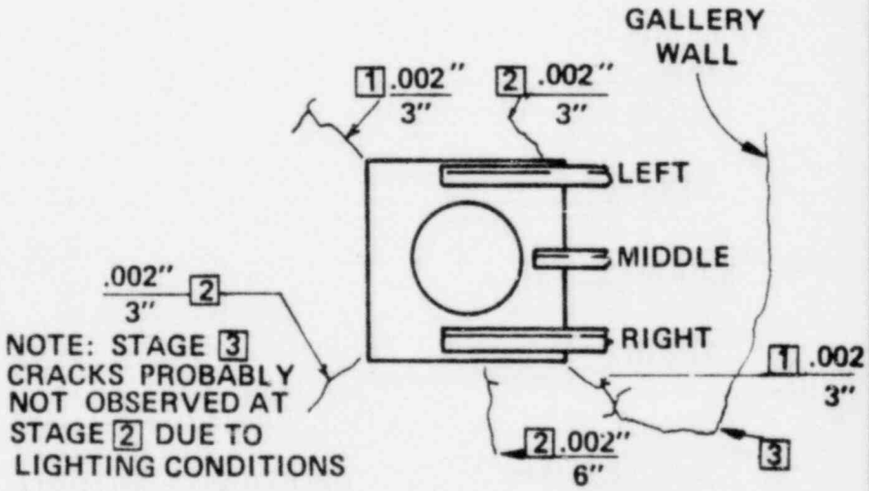
V60 TOP
NO CRACKS VISIBLE-AREA COVERED
WITH MEMBRANE COATING



V60 BOTTOM



V 100 TOP
NO CRACKS VISIBLE-AREA COVERED
WITH MEMBRANE COATING



V100 BOTTOM
STAGE [1] PRIOR TO PRESSURIZATION
[2] 115% DESIGN PRESSURE
[3] FOLLOWING DEPRESSURIZATION

FIGURE A2 - 4
VERTICAL TENDON END ANCHORAGE CRACK PATTERNS

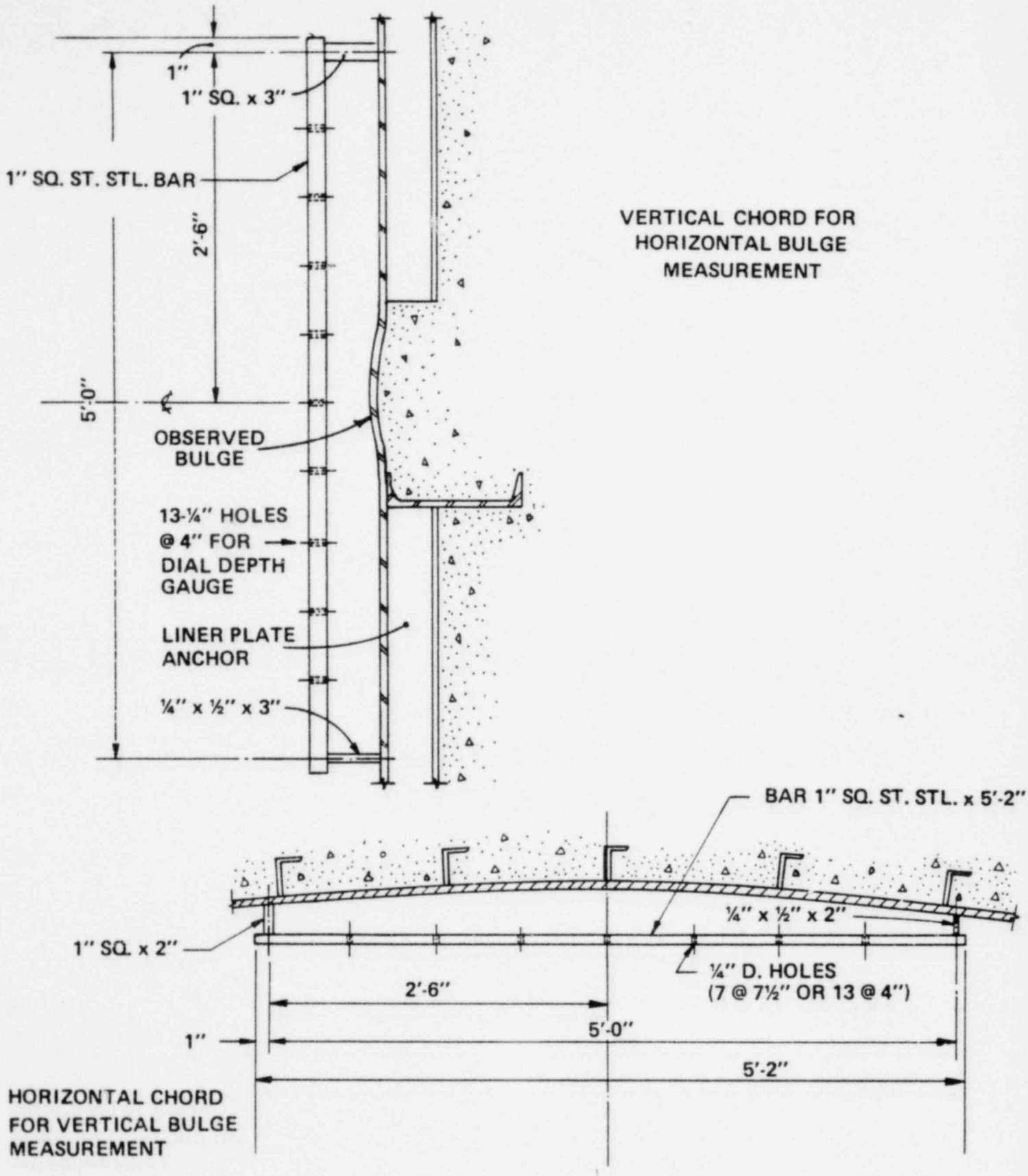


FIGURE A2 - 5 FIXED CHORD FOR LINER DEFORMATION MEASUREMENT

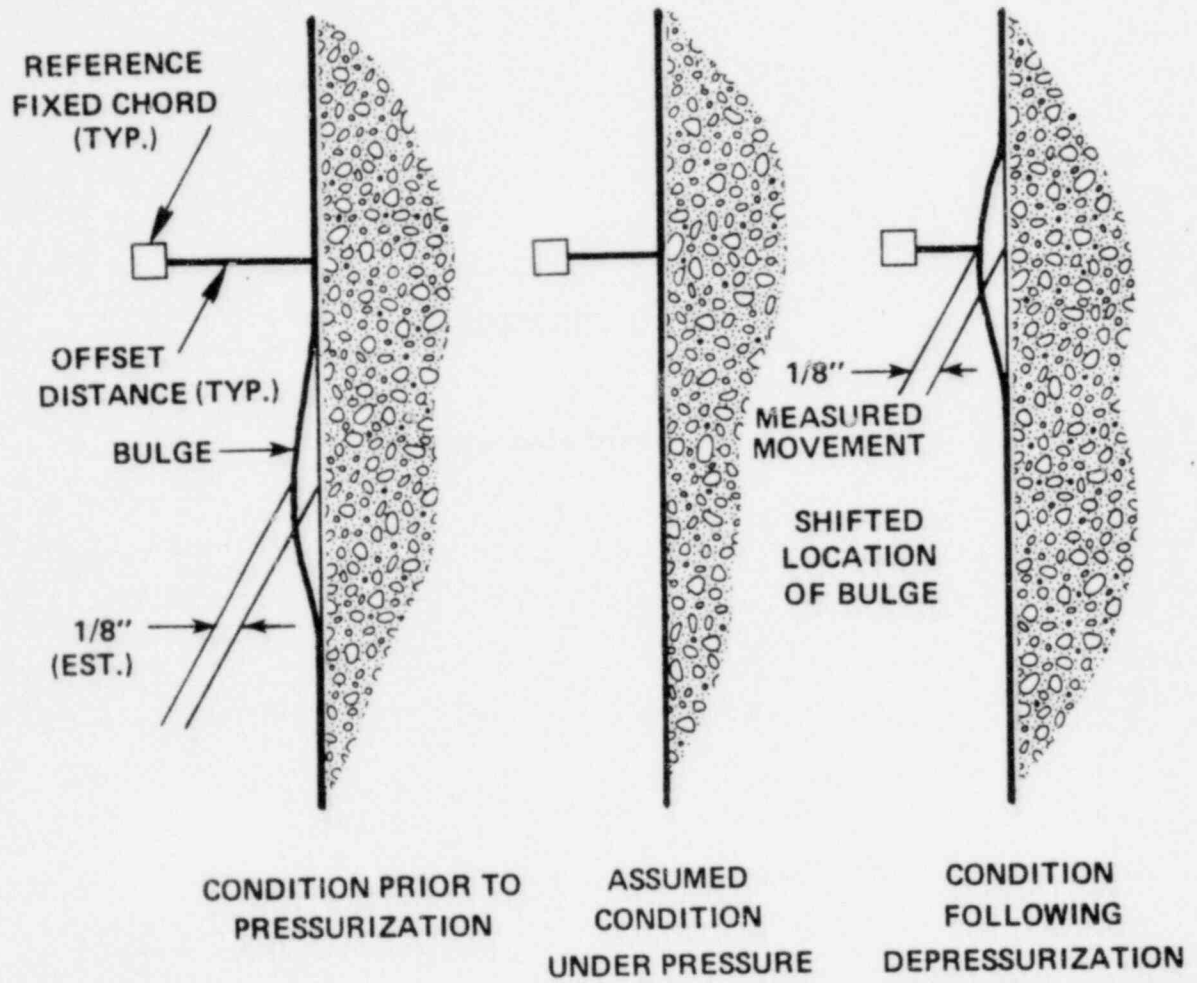


FIGURE A2 - 6

SHIFT IN LINER BULGE

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 006 Rev 1

Title Structural Integrity Test

Originator George Drew Date ~~1-25-74~~ 2-1-74

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Provide limit on rate of Depressurization to insure structure and deformation readings consistant by adding ~~permissible~~ the following to note pg 5A = Depressurization rate to be limited to 3 psi per hour maximum

Reason for Change Insure accurate correlation between pressure and structural response

Approved Ronald W. Colombo Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved J. V. Parrish Date 2-27-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed _____ Date _____
Management Safety Review Committee

SMUD RGT-2 1/73

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE APPROVAL FORM

Procedure Number STP-006

Title STRUCTURAL INTEGRITY TEST

Originator George E Drew Date 1-25-74

Approved [signature] Date 1-25-74
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [✓] No [ ]

Approved [signature] Date 1-28-74
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved [signature] Date 1/30/74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [—]

Reviewed _____ Date _____
Management Safety Review Committee

S.U.
SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 006 Rev 9 4 [illegible]

Title Structural Integrity Test

Originator George Drew GAD DAB Date 2-9-74

Approved ______________ Date ______________
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Pg 5A add to Note: Also, depressurization shall be halted for one hour at 30 psig. ~~Deformations shall be halted for one hour at 30 psig.~~ GD Deformations shall be recorded at the beginning and end of the hold periods.

Reason for Change AEC request to add controls for missing the holds

Approved [signature] Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved [signature] Date 2-18-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed ______________ Date ______________
Management Safety Review Committee

4 GD
2-4-74

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 005 Rev 5

Title Structural Integrity Test

Originator George Oliver gco DMB Date 2-4-73

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Pg 5A Refer to "plate" Fast Line between "at" and "least" — The beginning and end of all hold periods and

Reason for Change AEC Request to add controls for missing 1 hr holds

Approved Ronald V Colombo Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved J. V. McCue Date 2-21-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed _____ Date _____
Management Safety Review Committee

5 of 10
2-4-74

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 006 Rev 6

Title Structural Integrity Test

Originator George Drew Date 2-4-74

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Add paragraph 8.3 "Data Evaluation"
.1 Deformation data will be evaluated at the end of the 12 psig hold period if there is a trend to creep as evidenced by a change in recorded deformations exceeding .01" during the hold additional holds of one hour will be required at 95 and 100 psig (Rev 7)

Reason for Change AEC request to add control for missing 1 hr holds

Approved Ronald W Colombo Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved _____ Date 2-25-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed _____ Date _____
Management Safety Review Committee

6 pm
2-4-74

SMUD RST-2 1/73

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 006 Rev 7

Title Structural Integrity Test

Originator George Drew Date 2-5-74

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Pg 1 F2 4.0 b) add " Any one crack inspection may be deleted, if weather conditions demand except for 0 & 68 psig Test Pg 5 A add to Note " Crack inspection at any one pressure level except 0 or 68 psig may be deleted if weather demands

Reason for Change High winds at 60 psig pressure level made crack inspection from Crane and on dome dangerous. Crack grids numbered 3, 6, 7, 8, 9, 10, 11, & 12 deleted from 60 psi test

Approved Ronald W Colombo Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved John V. McKibben Date 2-22-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

7 gdd
2-5-77

Reviewed _____ Date _____
Management Safety Review Committee

STP-006

SPECIAL TEST PROCEDURE

FOR
STRUCTURAL INTEGRITY TEST

FOR
RANCHO SECO NUCLEAR GENERATING STATION

UNIT 1
SACRAMENTO MUNICIPAL UTILITY DISTRICT

1.0 Purpose

To verify the structural integrity of the Containment Structure under 115% of the design pressure. This will be accomplished by:

.1 Detecting, measuring and documenting exterior concrete cracks in the containment structure at various pressures up to 115% of the design pressure.

.2 Measuring containment structure deformations at various pressures up to 115% of the design pressure.

.3 Detecting and measuring concrete cracking or end anchor movement of tendon anchorages (surveillance).

.4 Measuring liner plate and liner plate anchor movement and possible strain concentration.

2.0 Reference

.1 Administrative Procedure AP 302

.2 Technical Specifications (4.4.2)

.3 AEC Regulatory Guide 1.18

3.0 Procedure: See attachments

Titles as follows:

.1 Procedure for Inspecting, Measuring and documenting Exterior Concrete Cracks During the Structural Integrity Test.

.2 Procedure for Measurement of Containment Structure Deformations During the structural Integrity Test.

.3 Procedure for Post-tensioning System End Anchor Concrete Surveillance.

.4 Procedure for Liner Plate Surveillance.

4.0 PREREQUISITES — INITIAL

.1 Prerequisites for concrete crack inspection

.1 Crack inspection grids layed out (survey crew) Dome coating must be removed and grids layed out.

.2 Sketch forms prepared for mapping

.3 Optical comparators, rules and crayons available for inspectors (3)

.4 Inspectors assigned, scheduled and briefed

.5 Lighting rigged for night observation

.6 Access to grids provided

.7 Conduct base line inspection and document all grids one to three days prior to test (all inspectors)

.2 Prerequisites for Containment Deformation Measurement

.1 Layout locations for attachments (extensometers)

.2 Install attachments (extensometers)

.3 Run instrumentation wiring

.1 From SWGR Room to penetration

.2 Make connections at penetrations

.3 From R.B. interior to instrument location

.4 Makeup interior connection at penetrations

.4 Install Data Acquisition System

.5 Install extensometers and taut wires

.6 Connect control wire to extensometers

.7 Checkout system operation

.8 Calibrate extensometers

George E Drew

HOWARD T. HILL

INITIAL

.3 Prerequisites for Post Tensioning System End Anchor Surveillance

.1 Fabricate measurement frames

.2 Locate frame attachment points

.3 Install frames

.4 Dial depth gage available for inspection

.5 Inspection date form prepared

.6 Access to measurement frames provided

.7 Conduct baseline inspection one to three days prior to test

.4 Prerequisites for Liner Plate Surveillance

.1 Fabricate measurement frames

.2 Locate frame attachment points

.3 Inspection data forms prepared

.4 Locate areas for strain surveillance and clean

.5 Dial Depth Gage available for inspection

.6 Conduct baseline inspection for liner

5.0 Test Plan During Pressurization

.1 During pressurization data is to be collected for the concrete crack surveillance and the containment deformation measurement program at the following pressures.

.01 at 0 psig Deformation Measurements

.02 at 5 psig Deformation Measurements

.03 at 10 psig Deformation Measurements

.031 at 12 psig beginning & end of Hold Deformation Measurements

.04 at 15 psig

Deformation Measurements

Concrete Cracks Mapped

INITIAL

5.0 Test Plan During Pressurization (continued) -

.05 at 20 psig Deformation Measurements

.06 at 25 psig Deformation Measurements

.07 at 30 psig

Deformation Measurements

Concrete Cracks Mapped

.08 at 35 psig Deformation Measurements

.09 at 40 psig Deformation Measurements

.10 at 45 psig

Deformation Measurements

Concrete Cracks Mapped

.11 at 50 psig Deformation Measurements

.12 at 55 psig Deformation Measurements

.13 at 60 psig

Deformation Measurements

Concrete Cracks Mapped (Partial See Row 7)

.14 at 65 psig Deformation Measurements

.15 at 68 psig

Verify this pressure held minimum 1-hour

Deformation Measurements

Concrete Cracks Mapped

Tendon End Anchorage Surveillance

NOTE: Deformation Measurements are to be taken at the beginning and end of all hold periods and ~~least~~ one hour after initiating pressure hold periods and on two hour intervals throughout pressure hold period, and at 65 psi and succeeding 5 psi increments during depressurization. Depressurization rate to be limited to 3 psi per hour maximum. Also depressurization shall be halted for crack inspection at any one pressure level (except 0 or 68 psig) and hold at 30 psig one hour must be deleted

INITIAL

6.0 Test Completion After Depressurization

.1 Requirements to complete crack inspections

.1 Make final crack inspection within one day of depressurization _____

.2 Complete report detailing crack inspection results within one month of test completion _____

.2 Requirements to complete Containment Deformation Measurements

.1 Make a final calibration check on extensometers _____

.2 Complete report on data and results within one month of test completion _____

.3 Requirements to complete Post-Tensioning System End Anchor Concrete Surveillance

.1 Conduct surveillance one to three days after the structural integrity test _____

.2 Complete report within one month of test completion _____

NOTE: This inspection is included in the Surveillance Program.

.4 Requirements to complete liner plate surveillance

.1 Conduct surveillance one to three days after the structural integrity test _____

.2 Complete report within one month of test completion _____

NOTE: Follow-up liner plate inspections must be made 6 months after test completion and 1 year after initial Start-Up.

7.0 Acceptance Criteria

.1 Exterior Concrete Crack width shall not increase more than 60 mils throughout the building pressurization.

.2 Deformation measurements shall indicate radial building growth less than 500 mils and vertical growth less than 1000 mils.

.3 Tendon End Anchor movement shall in no case exceed 50 mils.

.4 Liner Plate movement shall in no case exceed 50 mils.

8.0 Limits and Precautions

.1 Criteria

.1 All limits and precautions of TP150-1 shall apply to this procedure.

.2 Limit of crack width increase shall not exceed 60 mils.

.3 Deformation measurements shall not exceed 500 mils in radial growth or 1000 mils in vertical growth.

.2 Necessary Action

.1 Stop pressurization if any of above criteria are exceeded.

.2 Depressurize using normal depressurization piping if any of the above criteria continue to be exceeded after pressurization is stopped.

.3 Do not conduct test under conditions of extreme cold, heavy rains or strong winds.

.4 If test pressure drops to or below the next lower pressure level the entire sequence must be repeated. All conditions must be documented.

.3 Data Evaluation .1 Deformation data will be evaluated at the end of the 12 psig hold period. If there is a trend to creep as evidenced by a change in recent deformations exceeding .01" over the hold additional holds of one hour will be required at 45 & 60 psig (continued below) during pressurization 60, 45, and 30 psig during depressurization. Any change in recorded data shall be evaluated as creep unless instrument error can be demonstrated.

9.0 Retest Criteria

.1 If any significant modifications or repairs are made to the containment following this test the structural test must be repeated.

8.3 continued .2 Deformation data will be evaluated at the end of the 30 psig hold period. If there is evidence of creep, as defined in 8.3 above, the additional holds listed in 8.3.1 will be required.

.3 If additional holds are required per 8.3.1 or 8.3.2, data recorded at the beginning and end of the Hold will be evaluated prior to proceeding to the higher

Bechtel Corporation

Interoffice Memorandum

To SIT File

Date January 30, 1974

Subject Exception to Containment Pressurization Requirements per AEC Regulatory Guide 1.18

From SIT Director

Of SD

Copies to

At 50/21/B13

Exception is taken to the regulatory position, stated in Regulatory Guide 1.18, stipulating that containment pressure be held for one hour prior to recording deformation data. This exception is based on the results of prior containment tests which show that no change in measurable deformation can be expected over a one hour period.

The Rancho Seco test procedure requires deformation measurements at 5 psig increments, at the beginning and end of all hold periods and at two hour intervals during hold periods. This requirement greatly exceeds the minimum requirement outlined in Regulatory Guide 1.18. The writer concludes that the validity of the structural test data cannot be increased by pressure hold periods in addition to those currently specified for leak rate determination and structural integrity verification at 115 percent of design pressure.

2 QCO 2-1-74

H. T. Hill
SIT Director

HTH:cmg

SMUD Concurrence

By John Haley
Supervising Civil Engineer

0600 (10-72)

SACRAMENTO MUNICIPAL UTILITY DISTRICT
RANCHO SECO NUCLEAR GENERATING STATION #1
REACTOR BUILDING

1. REGISTERED PROFESSIONAL ENGINEER CERTIFICATION

The Sacramento Municipal Utility District has constructed the reinforced concrete reactor building in accordance with the District specification C1.1.

Construction inspection has been performed routinely during the construction to insure that the work meets all the specified requirements. Sign off forms are available for audit in the Quality Assurance Vault.

J. P. Hiltz

Certified by J. P. Hiltz

State of California # 17738

Date- 2/11/74

2. STRUCTURAL INTEGRITY TEST
AUTHORIZED CODE INSPECTION - PNEUMATIC TEST CERTIFICATION

I have witnessed the non-Asme Pressure Test of Rancho Seco #1 Reactor Containment Building. My certification covers only that the R.B. Pressure was brought to 68 psig and held for one hour to demonstrate the structural integrity of the building.

C. E. Pemberton

Witnessed by C. Pemberton

D. I. S. # [redacted]-353

George E Drew

George Drew
SMUD Test Coordinator

Professional Engr.-California
20681

Date- 2-6-74

10.0 Data Forms for Concrete Crack Inspection

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO .CO UNIT 1

Page of

SUBJECT

STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

DATE

DEPT. Generation Engineering

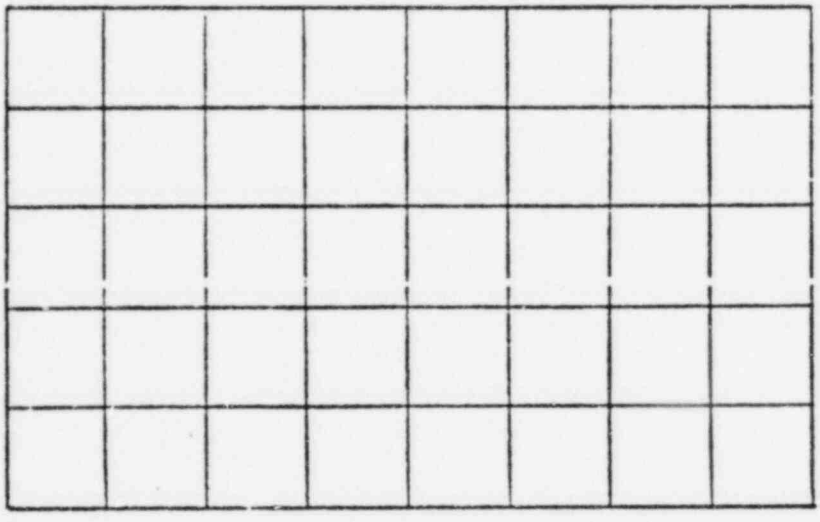
BY

REFERENCE STP 006

GRID ON WALL @ 195° 30' E1 3'0" (#1)

℄ 195°30'

8'



5'

PSI	DATE / TIME	TEMP INT	TEMP EXT	INIT	EXT PRESS/Hum.	INT HUM
0						
15						
30						
45						
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68						

SCALE 1" = 2'

RANC SECO UNIT 1

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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SUBJECT

STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

DATE

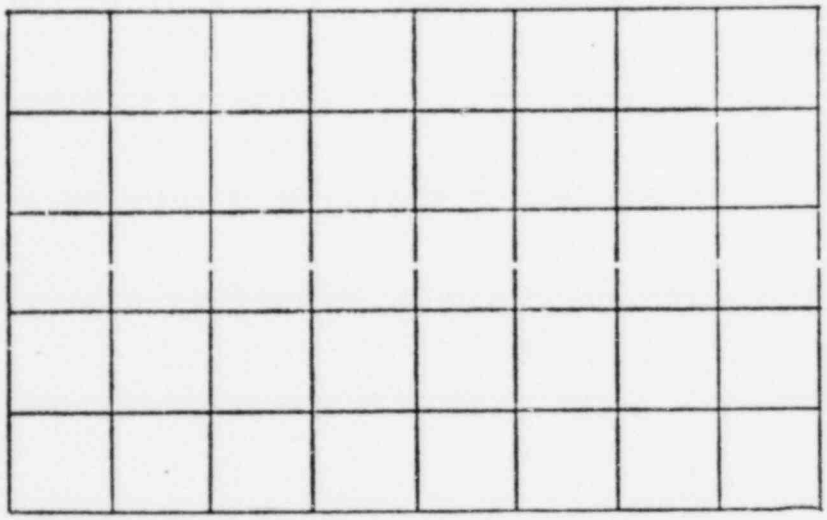
DEPT. Generation Engineering

BY

REFERENCE

GRID ON WALL @ 192° 30' El 65'0"(#2) | ℄ 192° 30'

8'



5'

PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT	EXT PRESS/ HUM.	INT. HUM
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68						

SCALE 1"=2'

SUBJECT: STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

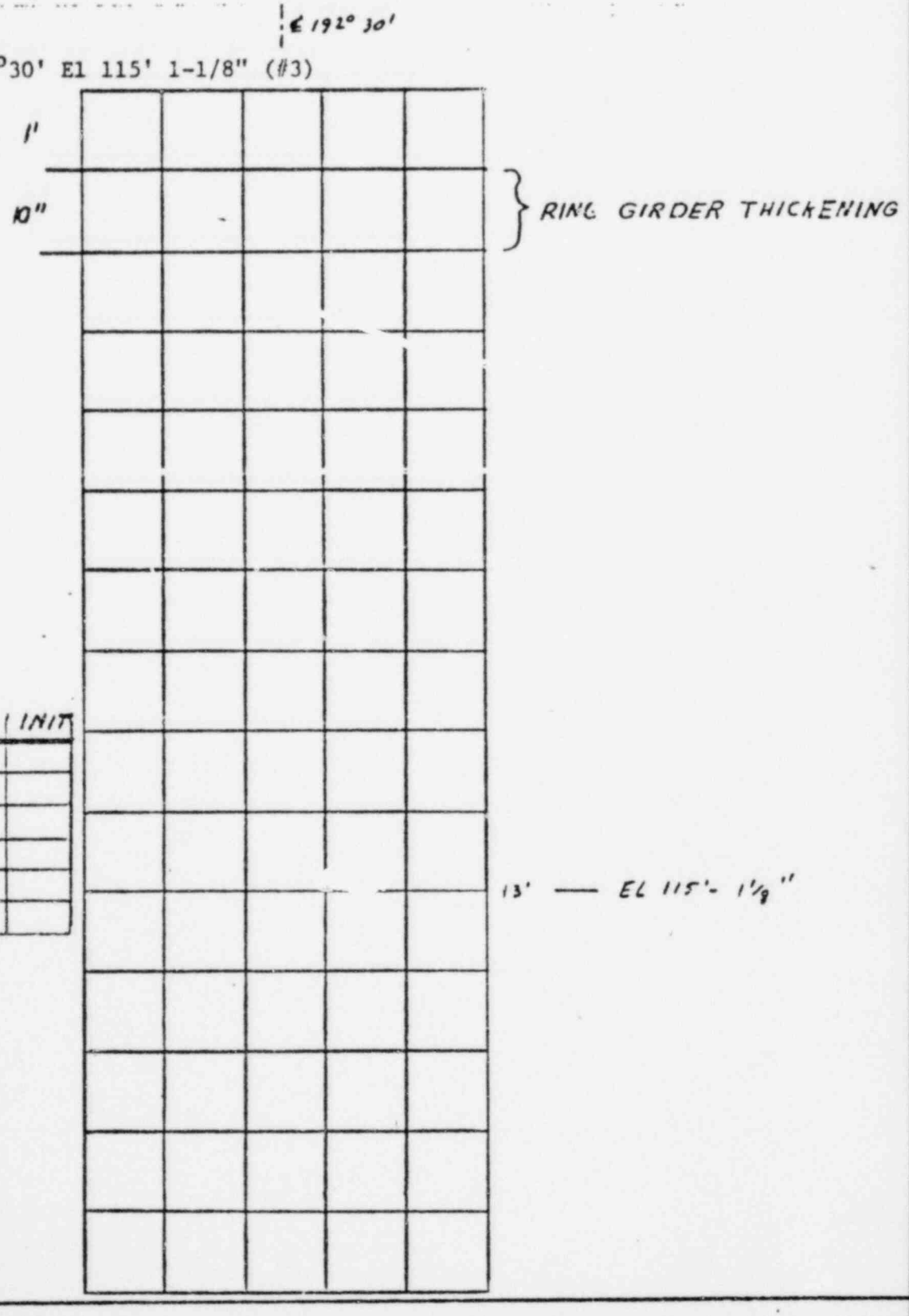
DATE:

DEPT.: Generation Engineeri

BY:

REFERENCE: STP 006

GRID ON WALL @ 192°30' El 115' 1-1/8" (#3)



DATE/TIME	TEMP. F° INT.	EXT.	INIT

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SCALE 1"=2'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO :CO UNIT 1

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SUBJECT: STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

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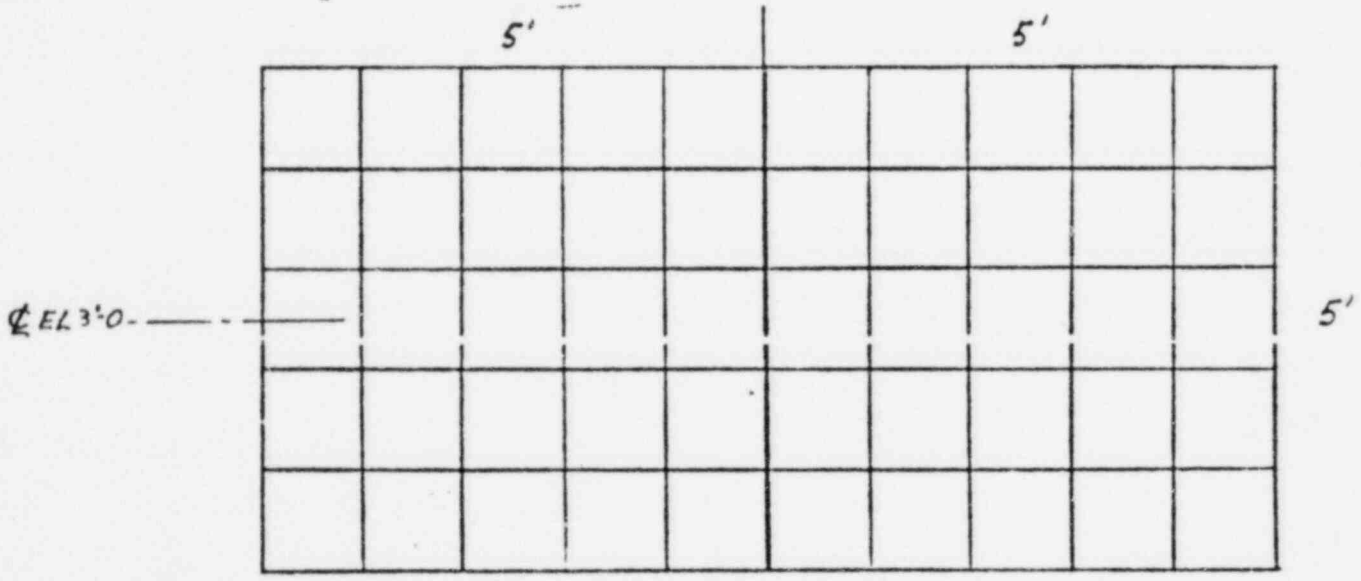
BY:

REFERENCE: STP 006

GRID ON WALL @ EQUIPMENT HATCH EL 3'0" (#4)



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SCALE 1"=1'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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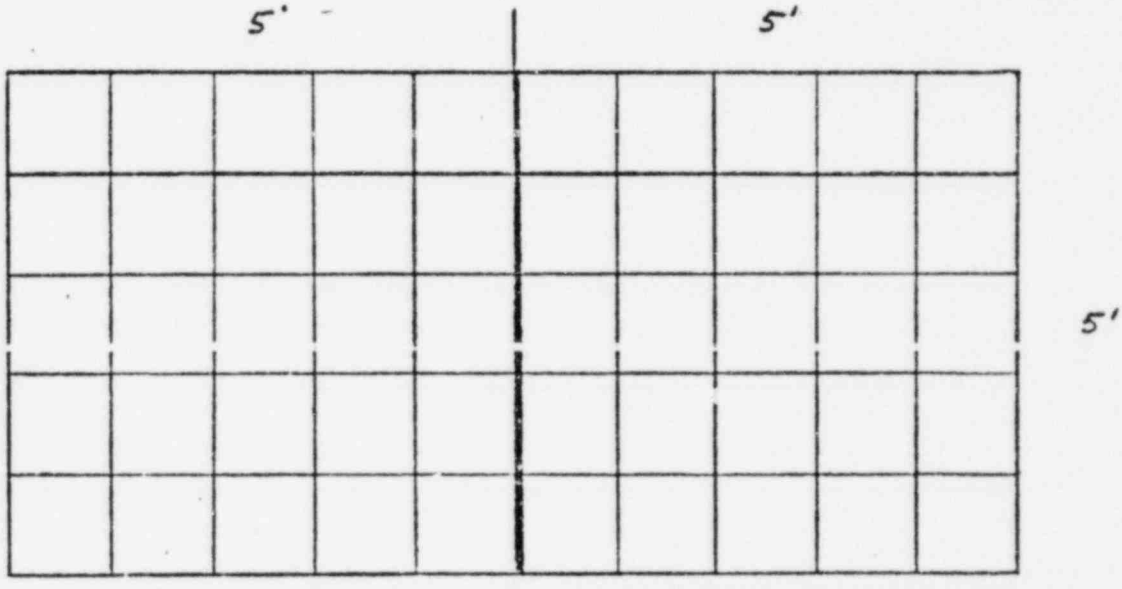
GRID ON WALL @ EQUIPMENT HATCH EL 9'6" (Ø4A)



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SCALE 1" = 2'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO U 1

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STRUCTURAL INTEGRITY TEST CONCRETE CRACK SURVEY	
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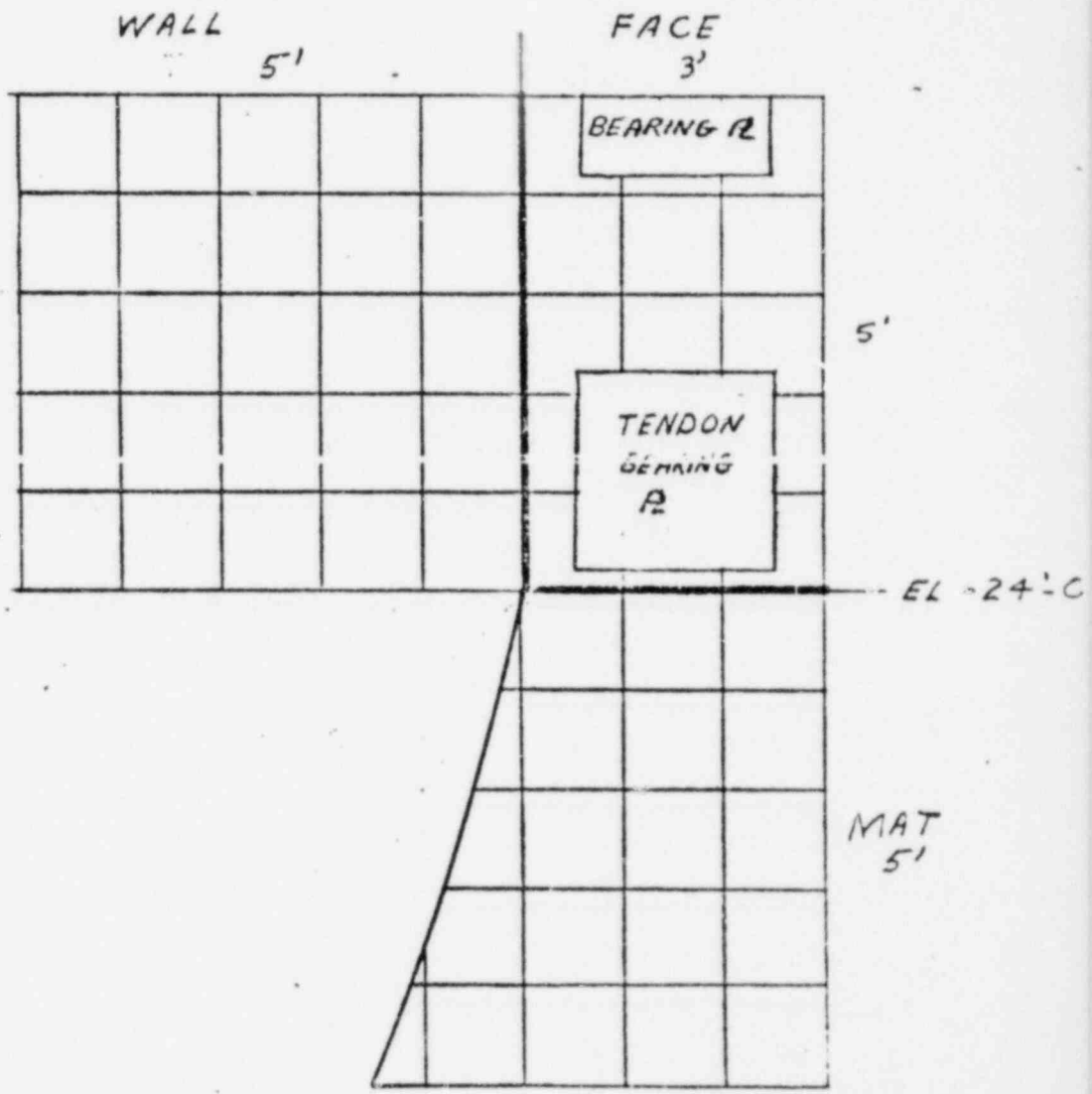
BY	REFERENCE STP 006

GRID ON WALL @ BUTTRESS #1 EL-24'0" (#5)



PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT.	EXT PRESS/HUM.	INT HUM
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SCALE 1"=2'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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CONCRETE CRACK SURVEY

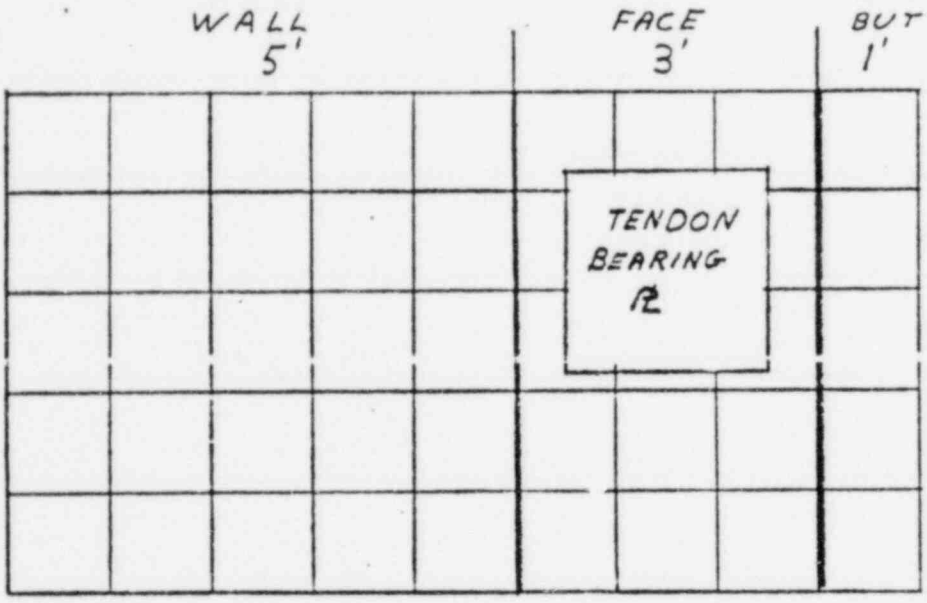
DATE

DEPT.
Generation Engineering

BY

REFERENCE
STP 006

GRID ON WALL @ BUTTRESS #1 EL 48'0" (#6)



PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT	EXT PRESS/HUM	INT HUM
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45						
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SCALE 1"=2'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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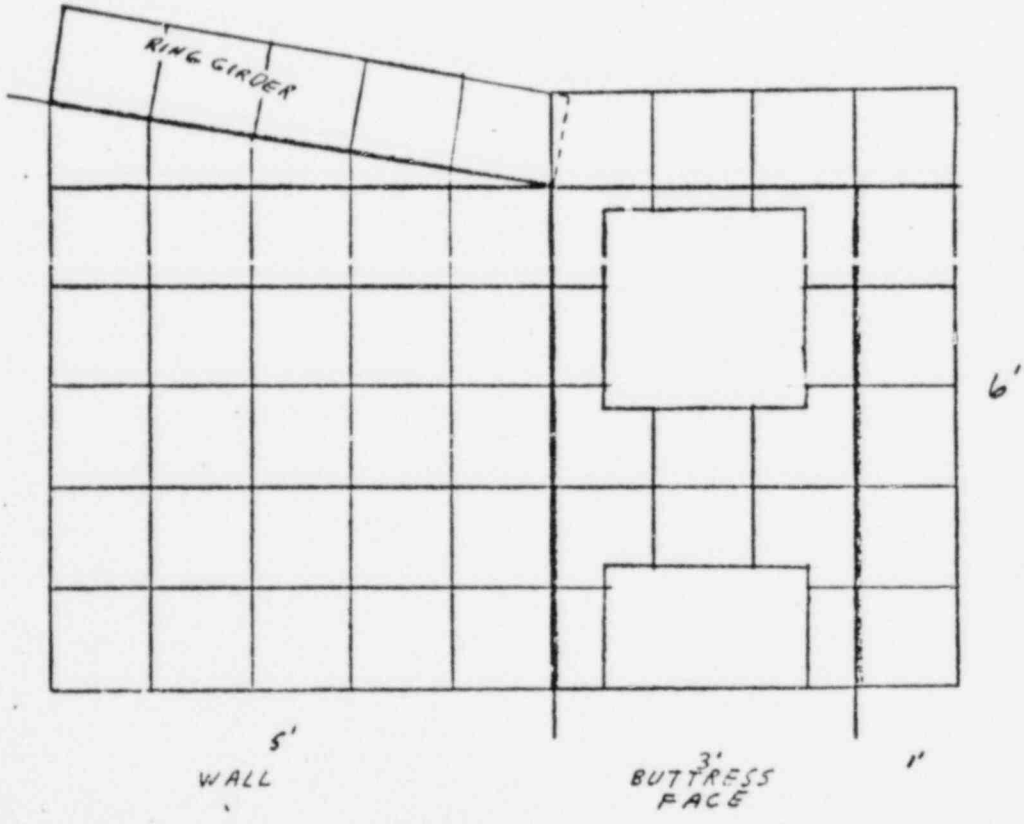
GRID ON WALL @ BUTTRESS #1 EL 120' 7-1/8" (#7)



PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT	EXT PRESS/HUM.	INT. HUM.
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SCALE 1"=2'

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SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO UNIT 1

SUBJECT: STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

DATE:

DEPT. Generation Engineering

BY:

REFERENCE: STP 006

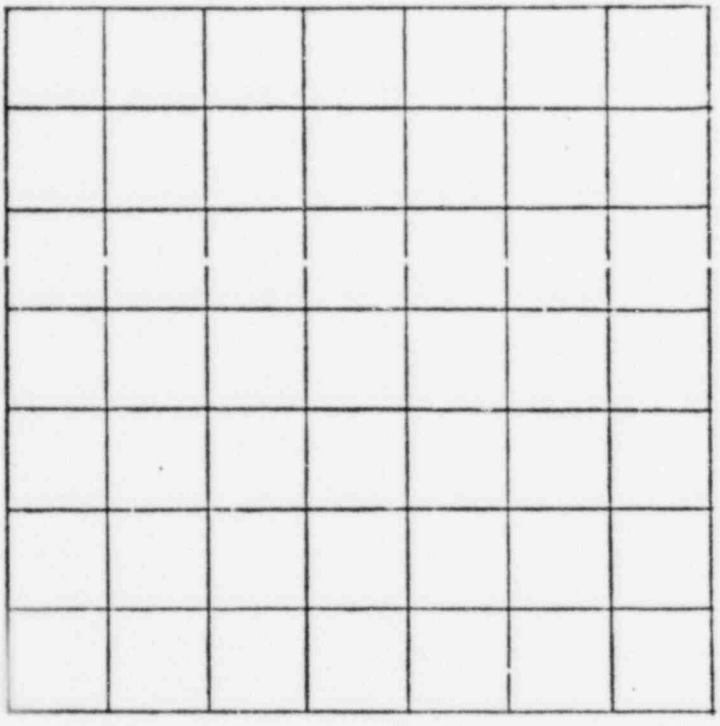
GRID NEAR CENTER OF DOME

N

℄

7'

℄ GRID AT 9 FEET NORTH
AND 6 FEET EAST
OF ℄ CONTAINMENT STRUCTURE



7'

PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT	EXT. PRESS/HUM	INT. HUM
0						
15						
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SCALE 1"=1'

RANCHO SECO UT 1

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

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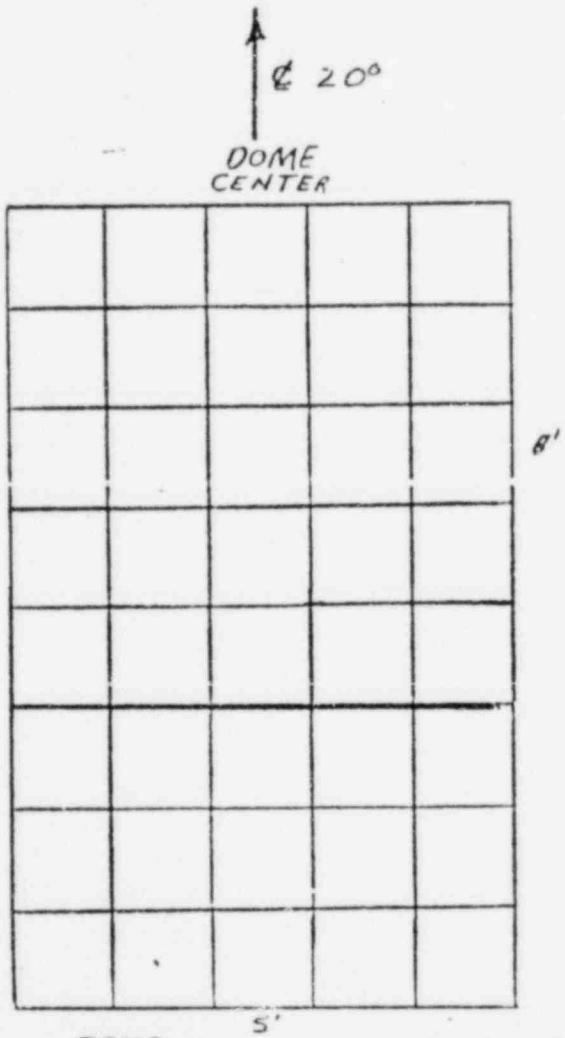
REFERENCE STP 006

GRID ON DOME @ CENTERLINE BUTTRESS #1, 30' off DOME CENTER



PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT	EXT. PRESS/HUM	INT HUM.

SCALE 1" = 2'

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

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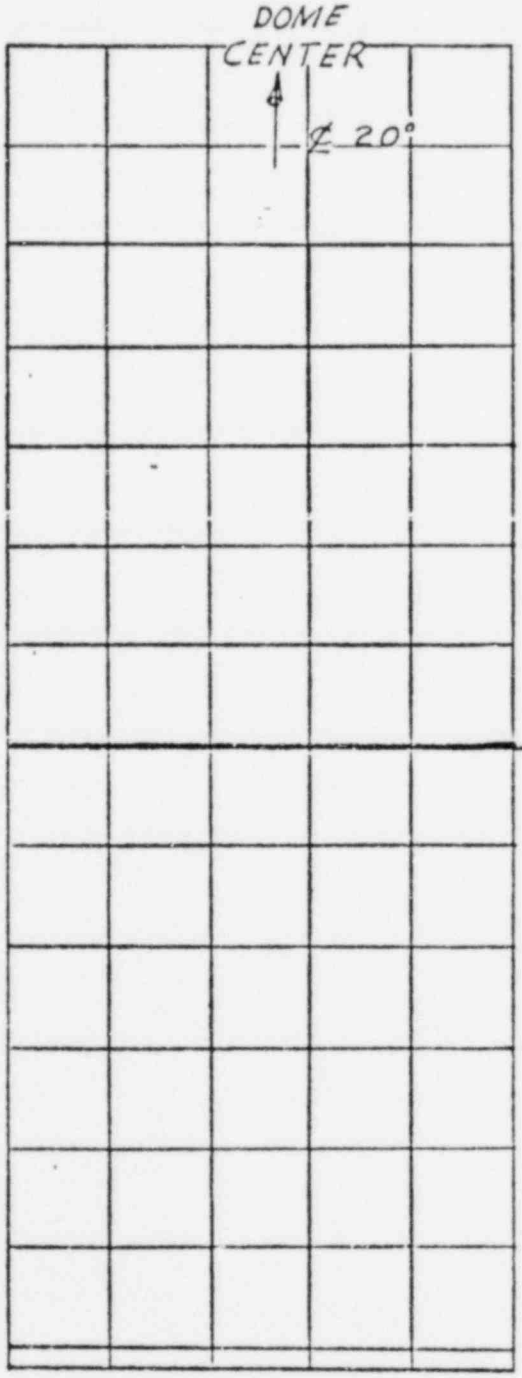
	DEPT. Generation Engineerin
BY	REFERENCE STP 006

GRID ON DOME (RING GIRDER) AT BUTTRESS #1 (20°)



DATE/TIME	TEMP INT	TEMP EXT	INIT

EXT PRESS ____
" HUM ____
INT HUM ____

SCALE 1" = 2'

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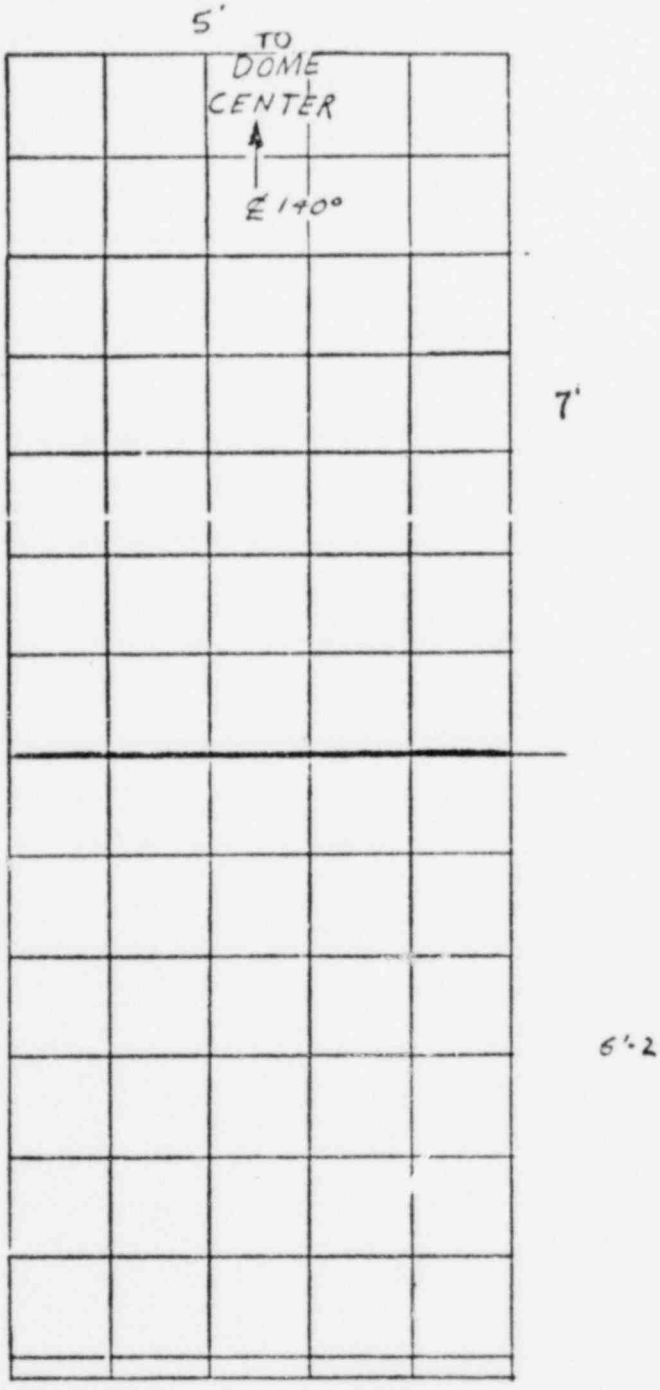
GRID ON DOME (RING GIRDER) AT BUTTRESS #2 (140°)



DATE/TIME	TEMP INT	TEMP EXT	INIT

EXT PRESS
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INT HUM

SCALE 1" = 2'

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SACRAMENTO MUNICIPAL UTILITY DISTRICT

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DATE:

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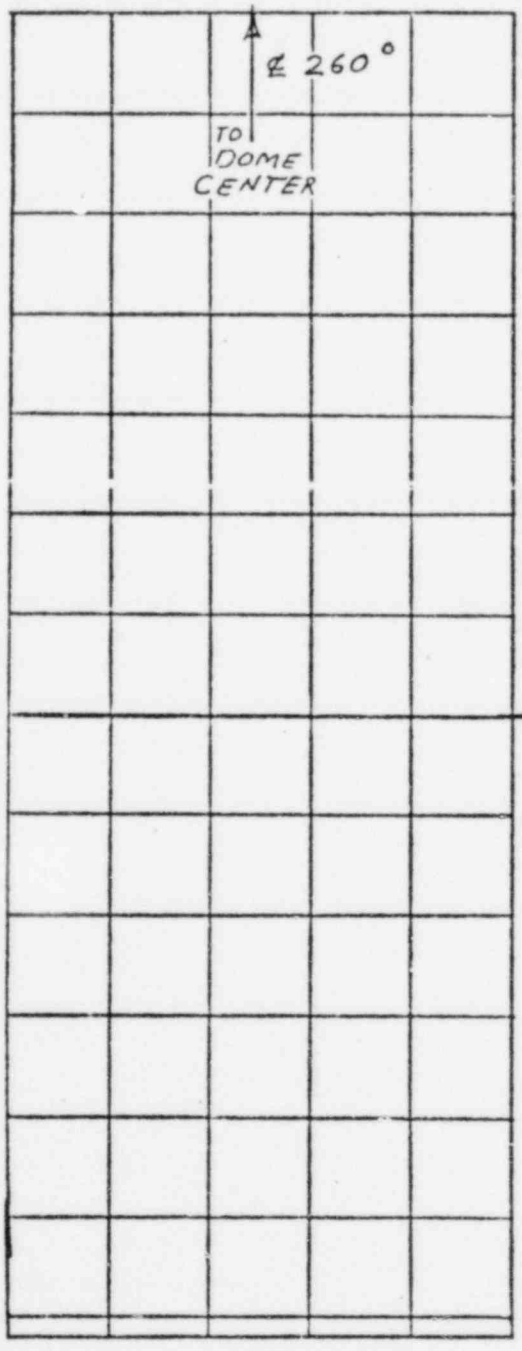
BY:

REFERENCE: STP 006

GRID ON DOME (RING GIRDER) AT BUTTRESS #3(260°)



DATE/TIME	TEMP INT	TEMP EXT	INIT

EXT PRESS.
EXT HUM.
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SCALE 1"=2'

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SACRAMENTO MUNICIPAL UTILITY DISTRICT

SUBJECT: STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

DATE:

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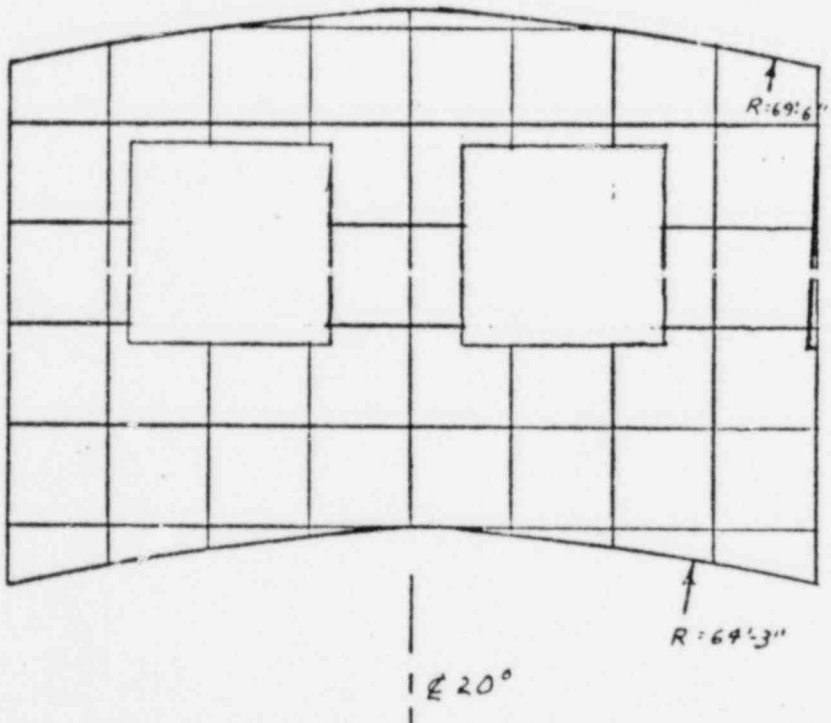
BY:

REFERENCE: STP 006

GRID ABOVE TENDON ACCESS GALLERY @ 20° (G-8)



PSI	DATE/TIME	TEMP INT.	TEMP EXT	INIT	EXT PRESS / HUM	INT HUM
0						
15						
30						
45						
60						
68						

SCALE 1"= 2'

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SACRAMENTO MUNICIPAL UTILITY DISTRICT

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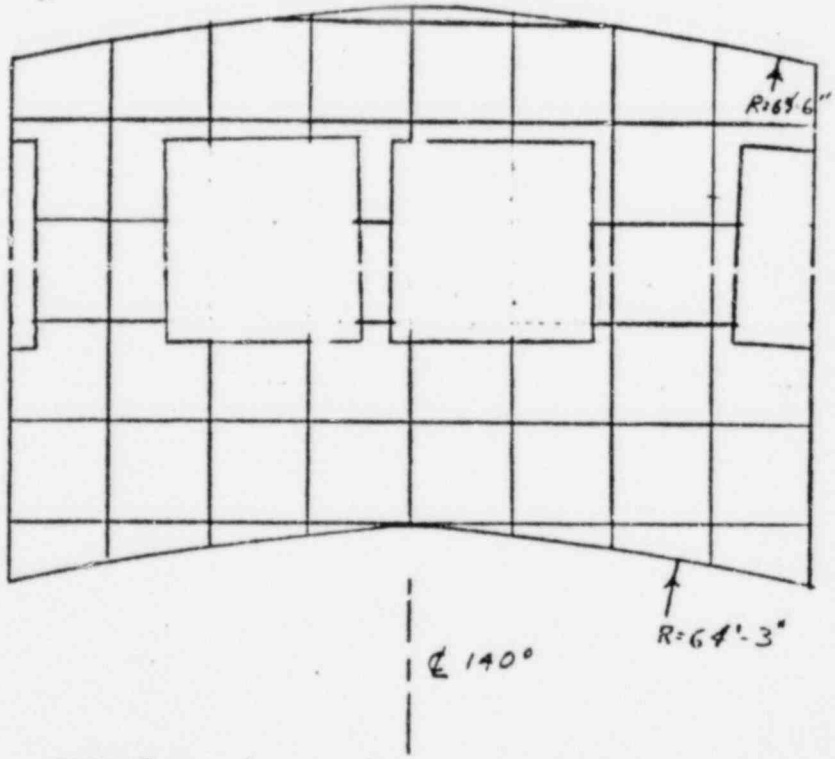
GRID ABOVE TENDON ACCESS GALLERY @ 140° (G-9)



PSI	DATE/TIME	TEMP INT	TEMP EXT	INIT.	EXT. PRESS/HUM	INT HUM
0						
15						
30						
45						
60						
68						

SCALE 1"=2'

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

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SUBJECT: STRUCTURAL INTEGRITY TEST
CONCRETE CRACK SURVEY

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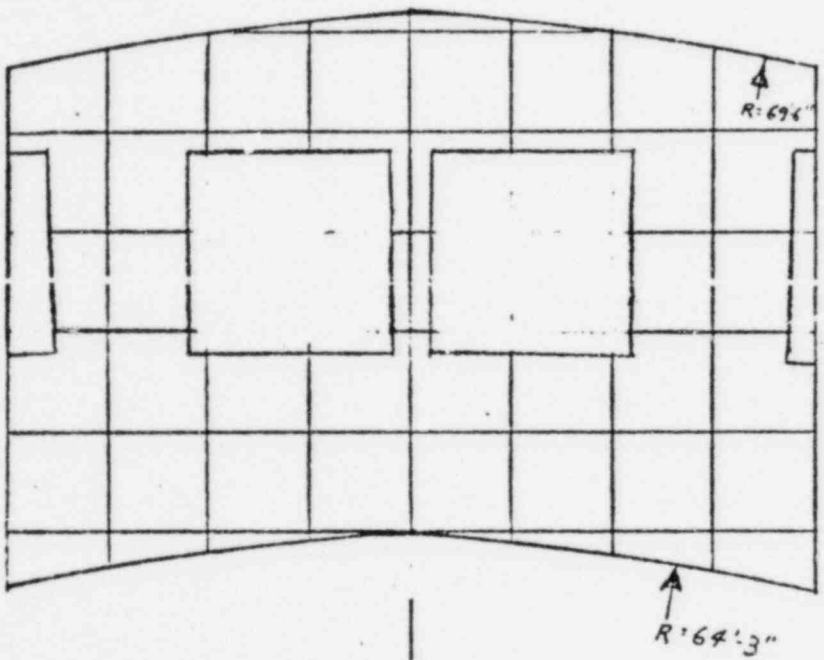
GRID ABOVE TENDON ACCESS GALLERY @ 260° (G-10)



℄ 260°

PSI	DATE/TIME	TEMP. INT.	TEMP. EXT.	INIT	EXT PRESS/HUM	INT HUM

SCALE 1"=2'

11.0 Data Form For End Anchor Surveillance

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

SUBJECT
STRUCTURAL INTEGRITY TEST
End Anchor Surveillance

DATE

DEPT.
Generation Engineering

BY

REFERENCE
STP 006

TENDON TYPE
Horizontal
Vertical
Dome

Tendon No._____

OBSERVED CRACKS

1. Baseline inspection Date_____
2. Peak pressure inspection Date_____
3. One to three days after structure test Date_____
4. Surveillance Date _____

1 Time_____Exterior Concrete Temp_____Interior Temp_____

2 Time_____Exterior Concrete Temp_____Interior Temp_____

3 Time_____Exterior Concrete Temp_____Interior Temp_____

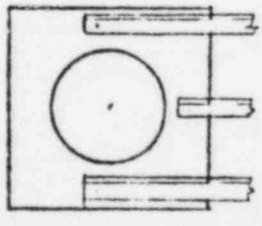
4 Time_____Exterior Concrete Temp_____Interior TEmp_____

All Reference Bar Measurements Taken According to Sketch

REFERENCE BAR MEASUREMENTS

	Left	Middle	Right
1 Base Line			
2 Peak Pressure			
3 1 to 3 days after S.T.			
4 Surveillance			

Crack Sketch



12.0 Data Forms For Liner Plate Surveillance

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO UN.. 1

Page of

SUBJECT: STRUCTURAL INTEGRITY TEST
Liner Plate Surveillance

DATE:

DEPT.: Generation Engineering

BY:

REFERENCE: STP 006

Fixed Cord Displacement Measurement

LOCATION:

TYPE:

TE	TEST	TIME	1	2	3	4	5	6	7	8	9	TEMP. INT.	EXT
	Baseline												
	1 day after S.T.												
	6 Mo. after S.T.												
	1 Yr after initial Oper.												

NOTE: Cord length numbered from left to right, or from top to bottom depending on orientation of fixed cord

COMMENTS

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO UNIT 1

Page of

SUBJECT	DATE
STRUCTURAL INTEGRITY TEST Liner Plate Surveillance	
	DEPT. Generation Engineering
BY	REFERENCE STP 006

SURVEY FOR STRAIN CONCENTRATION

LOCATION:

Sketch & Comment as Appropriate

BASELINE

1 day after S.T.

6 months after S.T.

1 year after initial operation

ATTACHMENTS

PROCEDURE FOR

INSPECTING, MEASURING AND DOCUMENTING

EXTERIOR CONCRETE CRACKS

DURING THE

STRUCTURAL INTEGRITY TEST

FOR

THE SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

UNIT NO. 1

1.0 SCOPE

This procedure specifies the items to be performed and the equipment necessary to visually detect, measure and document concrete cracks during the structural integrity test.

2.0 METHOD

At various pressure levels during the structural integrity test, several selected locations on the exterior of the containment structure shall be visually inspected for cracks. If cracks are found, their length and typical width shall be measured. Only typical cracks and the largest cracks will be recorded.

2.1 Sketches: Sketches shall be made of each location inspected. These sketches shall indicate:

2.1.1 Date and hour of inspection.

2.1.2 Pressure level stage with respect to the structural integrity test.

2.1.3 Location of cracks.

2.1.4 Width and length of cracks.

2.1.5 Estimated total number of cracks if only typical cracks have been shown.

2.1.6 Initials of person making observations.

2.1.7 General observations.

These sketches shall be made on forms previously prepared and including a reduced scale grid of the area observed and a table for data entry.

3.0 LOCATIONS OF INSPECTION

The selected locations and their respective dimensions are shown in Figure 1.

4.0 SCHEDULE OF INSPECTIONS

The selected locations shall be inspected at the following times:

a) One to three days before the structural integrity test.

b) During pressurization at approximately 15 psig, 30 psig, 45 psig, and 60 psig. Pressurization need not be stopped for concrete crack inspection. Any one crack inspection may be deleted if weather conditions demand except for 0 & 60 psig inspections. 7 gkb 2-5-74

c) At the peak pressure.

d) Within one day after depressurization is completed.

5.0 REPORTS

Sketches shall be completed during each inspection; they shall be available for inspection and use by the test director at all times during the structural integrity test.

A final report shall be submitted to The Sacramento Utility District within one month of completion of the initial integrated leak rate test and containment pressure test.

6.0 EQUIPMENT

The following equipment and supplies are required:

a) Scaffolding as required for access to inspection locations.

b) Two Peak Model No. 5 optical comparators or other suitable devices for measuring crack width.

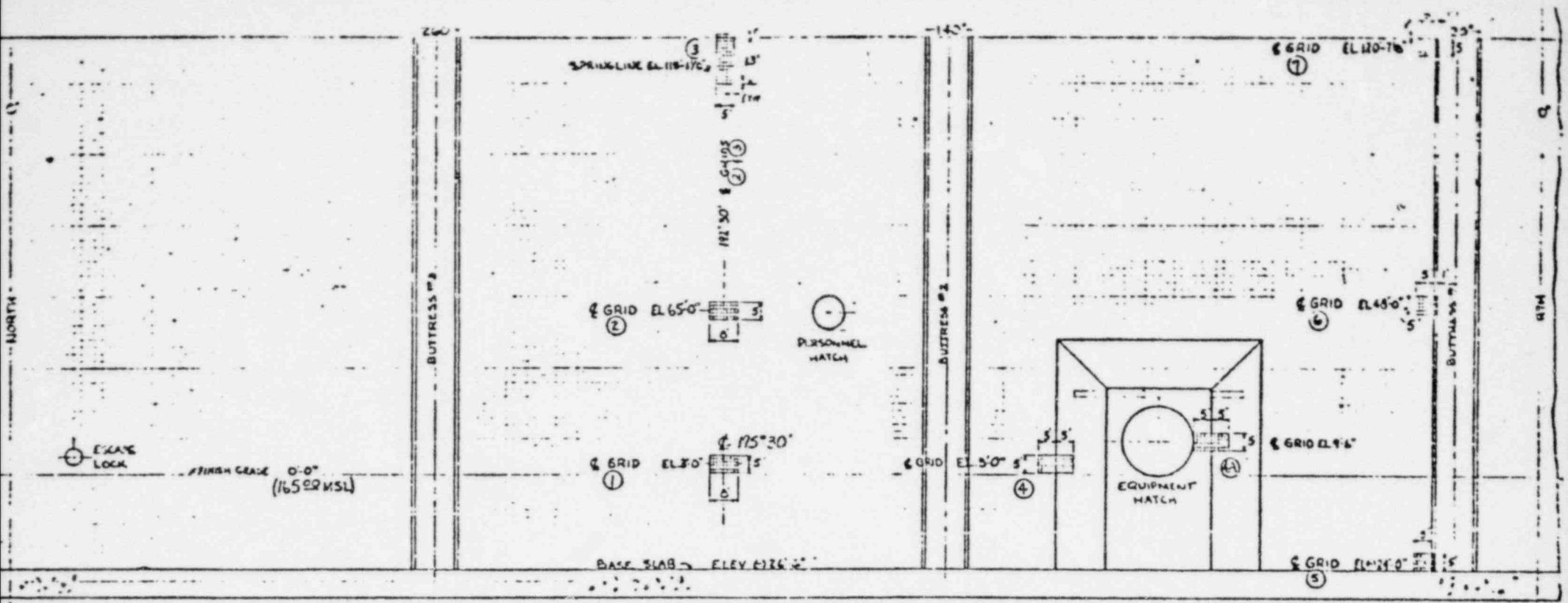
c) Lighting equipment as required for night observations.

d) One yellow, one blue and one red crayon for marking cracks and grids on the containment.

e) Two rules for use as a straightedge and to determine crack length.

7.0 INSPECTORS

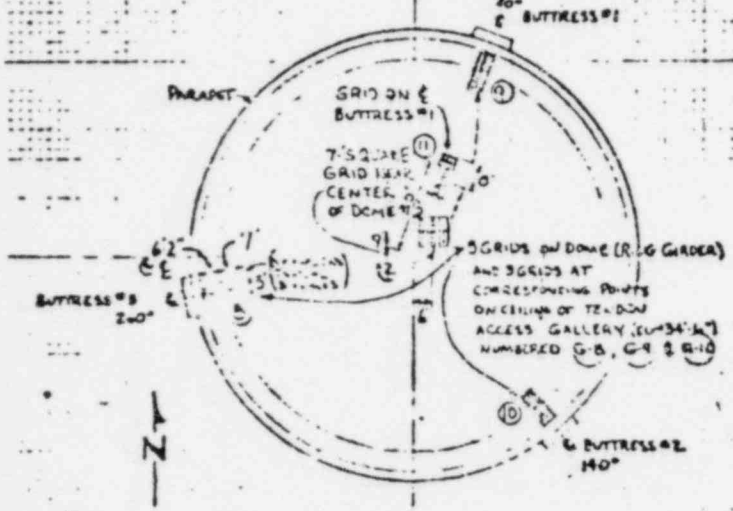
Two inspectors will be required during each concrete inspection period.



DEVELOPED ELEVATION

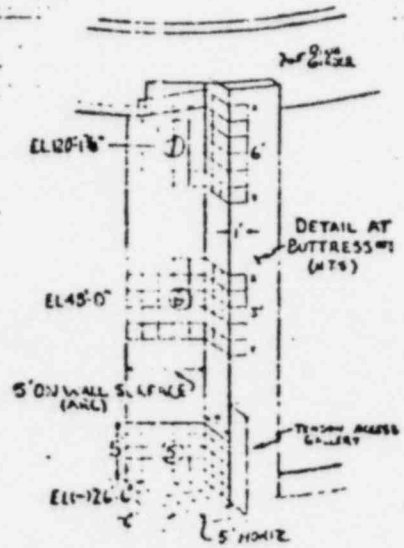
OUTSIDE OF REACTOR CONTAINMENT WALL

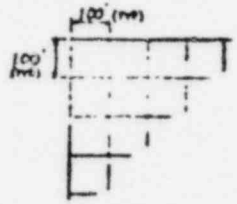
(N.T.S)



PLAN OF DOME

(N.T.S)





TYPICAL GRID PATTERN

RANCHO SECO

NUCLEAR GENERATING STATION

REACTOR CONTAINMENT STRUCTURE

PRESSURIZATION MONITORING

GRID LOCATIONS & DETAILS

Cont'd — ELEV 10-23-72

6292-SK-C-187

PROCEDURE FOR

MEASUREMENT OF CONTAINMENT STRUCTURE

DEFORMATIONS DURING THE STRUCTURAL INTEGRITY TEST

FOR

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

UNIT NO. 1

1.0 SCOPE

This procedure specifies the items to be performed and the equipment and labor necessary to determine radial and vertical deformations of selected locations inside the containment structure during the structural integrity test.

2.0 METHOD

Deformations shall be determined using taut wire extensometers attached to the liner plate at liner plate anchors and either the internal concrete structure or another location on the liner plate. Deformation measurements shall be corrected for the effects of temperature. The signals from the taut wire extensometers shall be monitored at a location outside the containment; the location shall permit audible communication with the pressurization control panel.

2.1 Calibration: Each extensometer shall be calibrated prior to the structural integrity test. Calibration shall include:

2.1.1 Determine relationship by applying known displacements and observing resulting potentiometer voltage changes.

2.1.2 The potentiometer measured displacements differ from those applied by no more than 0.025 inches in 1/2 inch of movement.

2.1.3 The forces exerted by the negator spring during extension and contraction differ by no more than 0.20 pounds.

2.1.4 Determining effect of extensometer hysteresis.

2.1.5 Determining repeatability of measurements.

2.1.6 A final calibration check shall be conducted at the end of the test.

The results of extensometer calibration shall be included in the test report. These results shall include raw data, calculations and reduced data.

3.0 LOCATIONS OF MEASUREMENT

Deformations shall be measured as indicated in Figures 1 to 4. The location of deformation measurements shall be changed only with the approval of the test director.

4.0 SCHEDULE OF MEASUREMENT

Deformations shall be measured at the following pressures, during both pressurization and depressurization:

0 psig	30 psig
5 psig	35 psig
10 psig	40 psig
15 psig	45 psig
20 psig	50 psig
25 psig	55 psig
	60 psig
	65 psig
	68 psig

In addition, deformations shall be measured at the start, end and at 2 hour intervals during all pressure hold periods.

5.0 REPORTS

All deformation data shall be tabulated, analyzed and graphed on a preliminary basis within one hour after being taken. The graphs of data shall be available for inspection and use by the test director at all times during the structural integrity test.

An original certified final report and twelve (12) additional copies shall be submitted to the Sacramento Municipal Utility District one month after completion of the Structural Integrity Test. The report shall include test procedures, raw data, sample data, data reduction calculations, reduced data, pertinent graphs and calibration results.

6.0 EQUIPMENT AND LABOR

The following equipment and supplies are required:

a) 36 taut wire extensometers.

b) Equipment and supplies required to install extensometers and connect to a data acquisition system near the pressurization control panel.

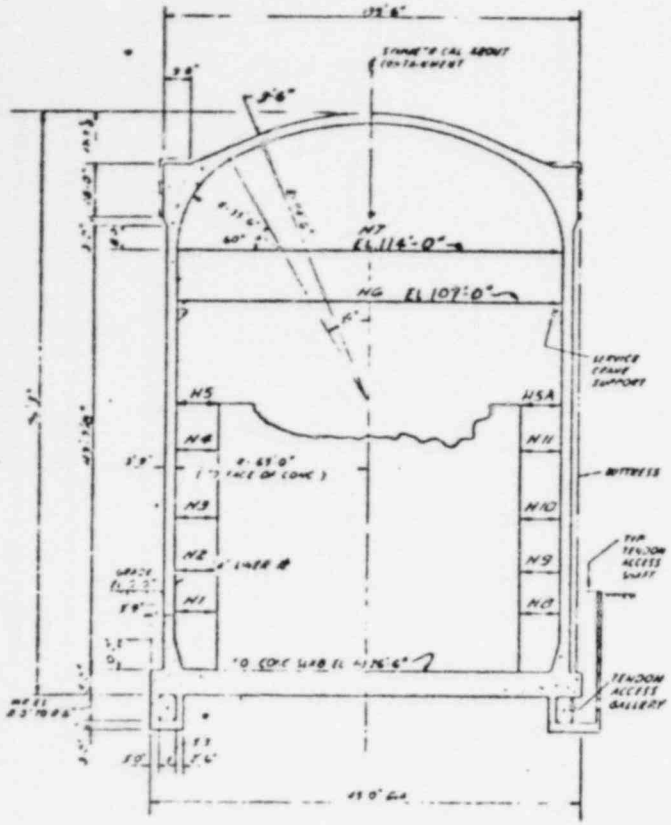
c) Data acquisition system suitable for recording all deformation readings within 5 minutes.

d) Supervision of Equipment installation, technician for data acquisition system operation and data recording.

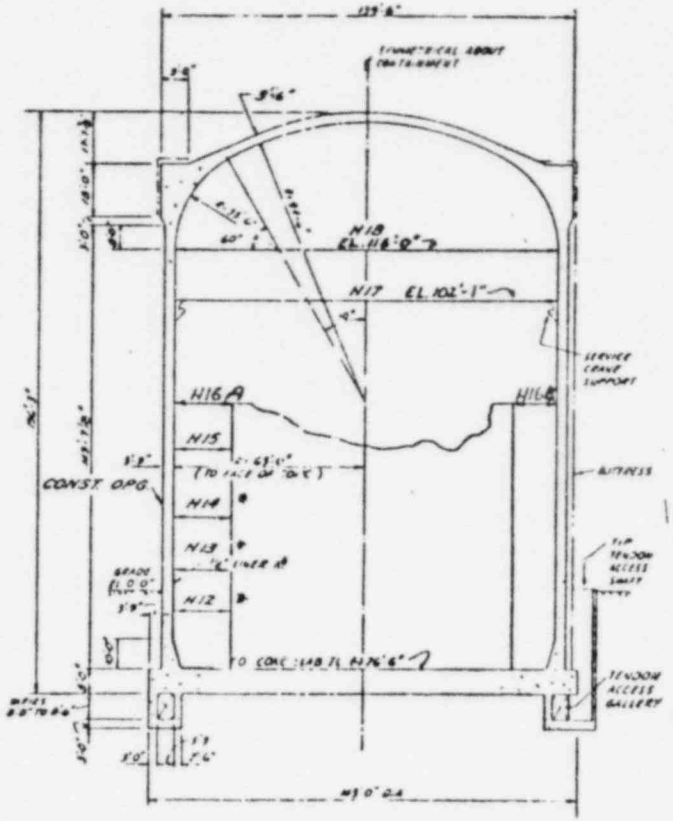
e) Technician for data reduction and analysis during test.

7.0 LABOR NOT INCLUDED

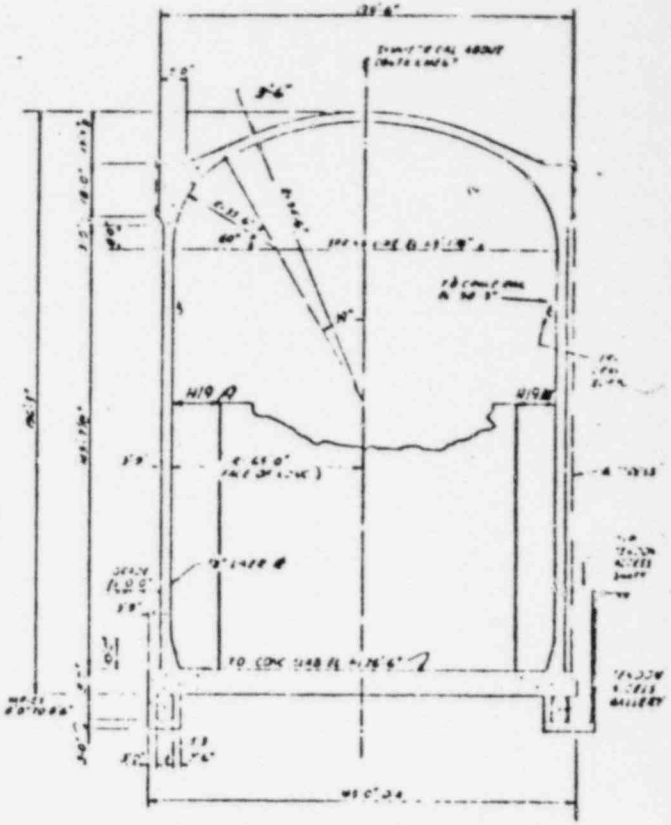
Craft labor required for installation and maintenance of equipment shall not be provided by the equipment supplier.



SECTION @ ABOUT 140° & 320°



SECTION @ 18°30' & 228°30'
& H12, 13, 14 @ 54°30'



SECTION @ 20° & 205°

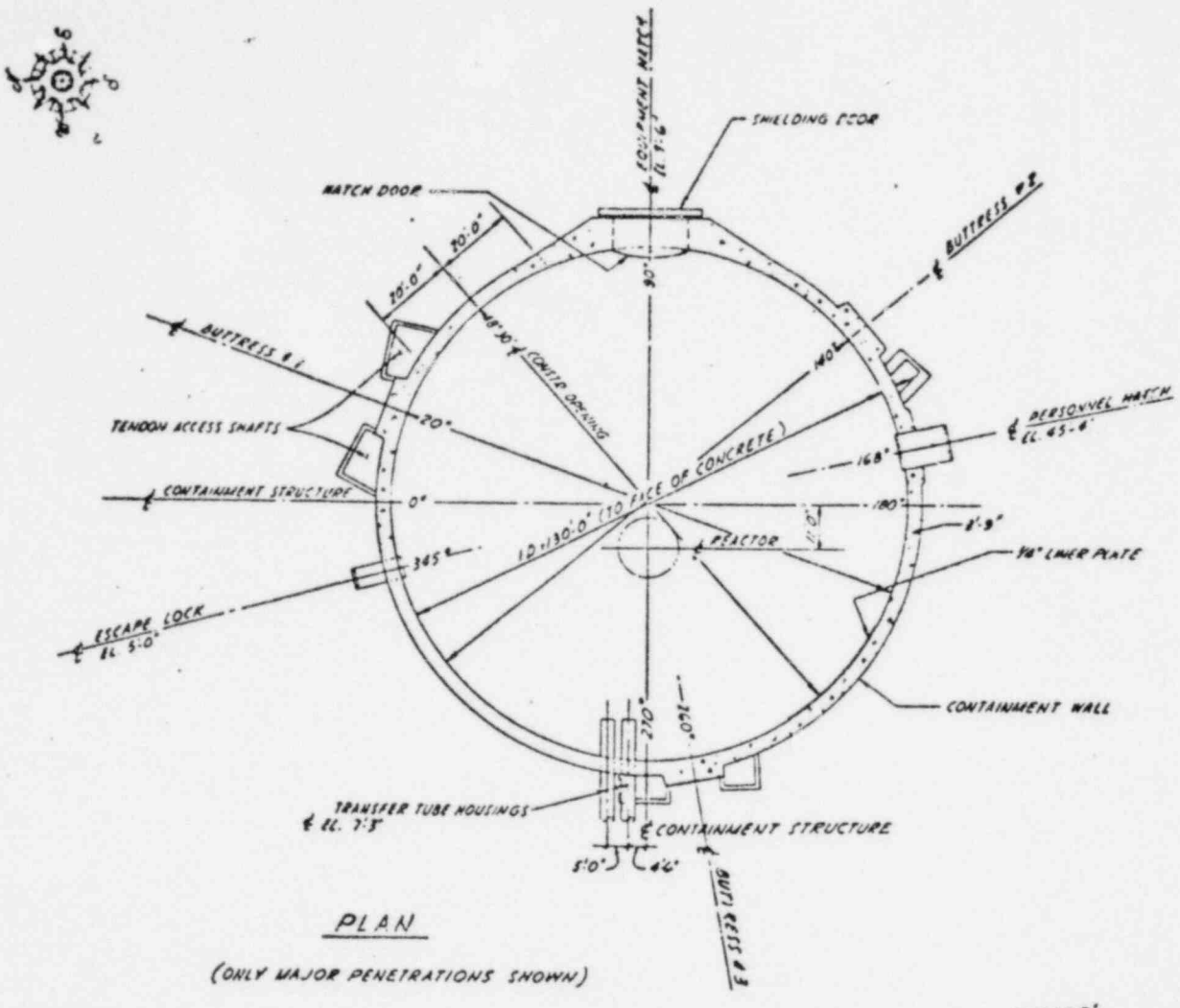
AZIMUTHS :

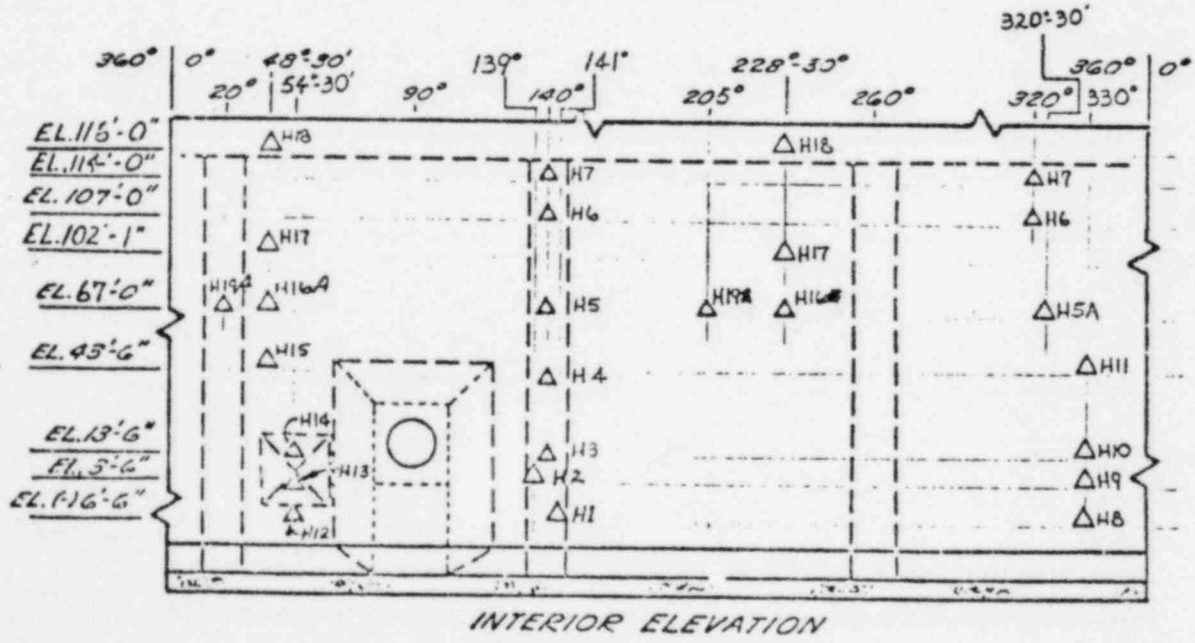
H1 @ 141°
H2 @ 139°
H3, 4, 5, 6 & 7 @ 140° & 320°
H5A @ 320°-30'
H8, 9, 10 & 11 @ 330°

SEE DEVELOPED INTERIOR ELEVATIONS
FOR ELEVATION OF MEASUREMENT POINTS

FIGURE 1
LOCATION OF CYLINDER RADIAL
MEASUREMENT DURING STRUCTURAL
INTEGRITY TEST
SECTIONS

6292-SK-C-210 1 OF 4





△ INDICATES MEASUREMENT POINT

FIGURE 2
LOCATION OF CYLINDER RADIAL MEASUREMENT DURING STRUCTURAL INTEGRITY TEST DEVELOPED INTERIOR ELEVATION AND PLAN

6292-SK-C-210 2 OF 4
1-17-74

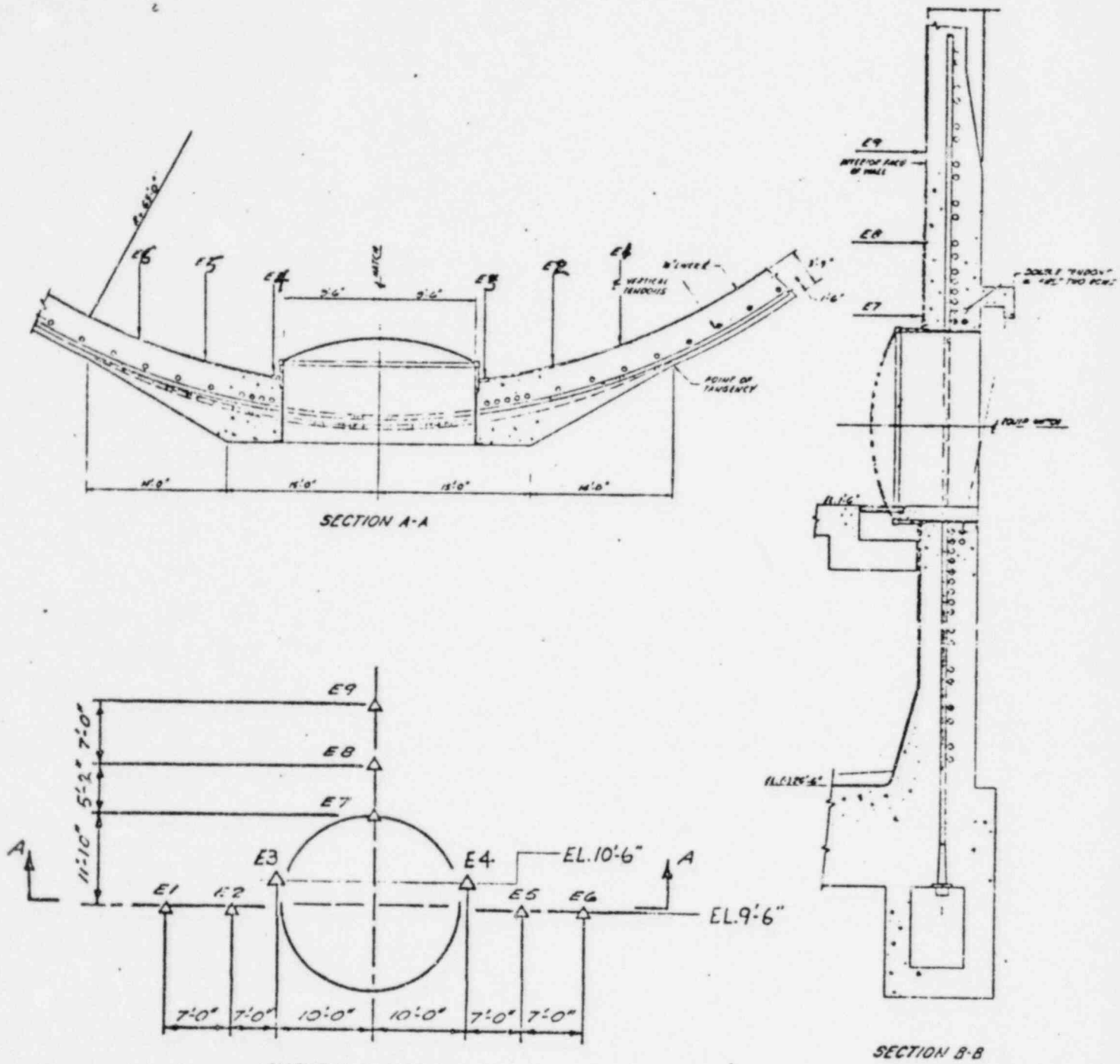
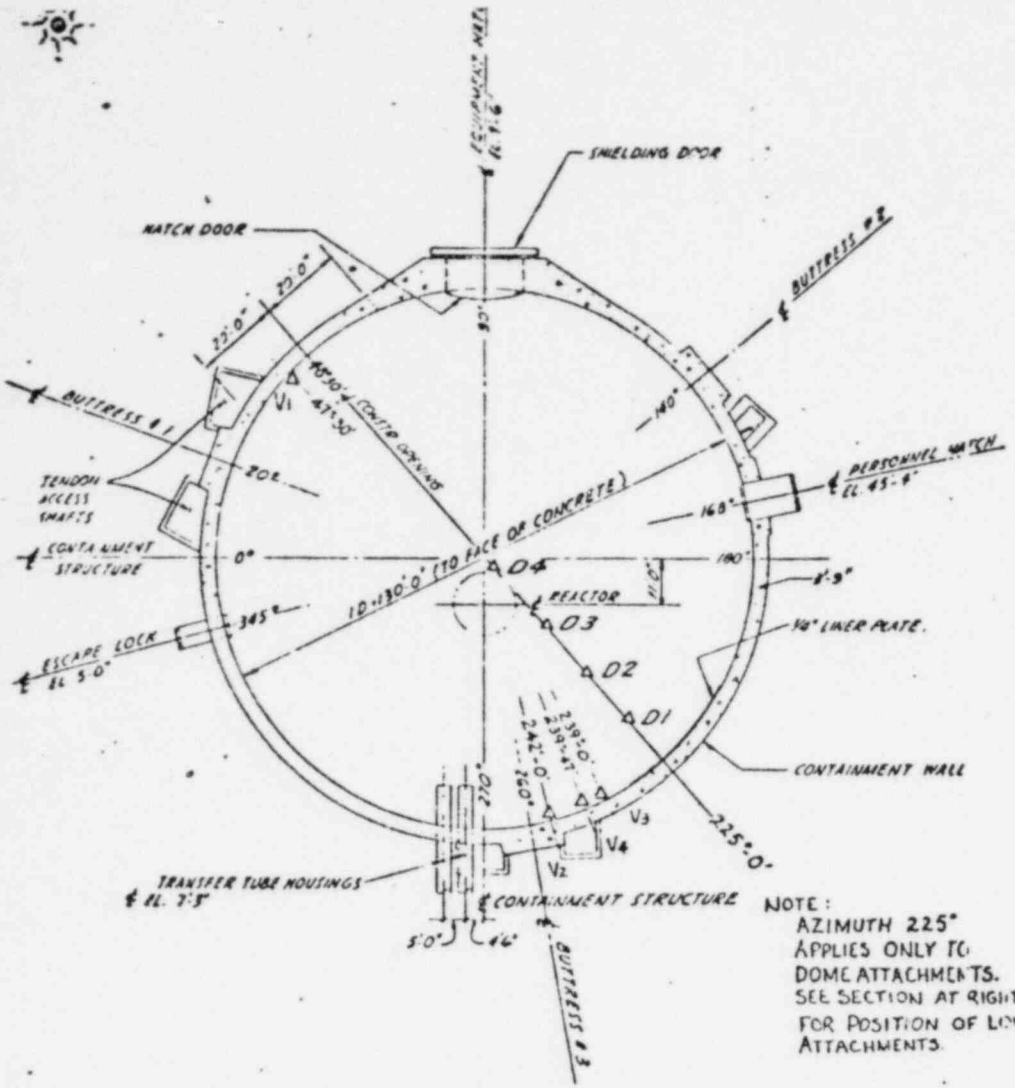


FIGURE 3
LOCATION OF EQUIPMENT HATCH
RADIAL MEASUREMENT DURING
STRUCTURAL INTEGRITY TEST
ELEVATION AND SECTIONS

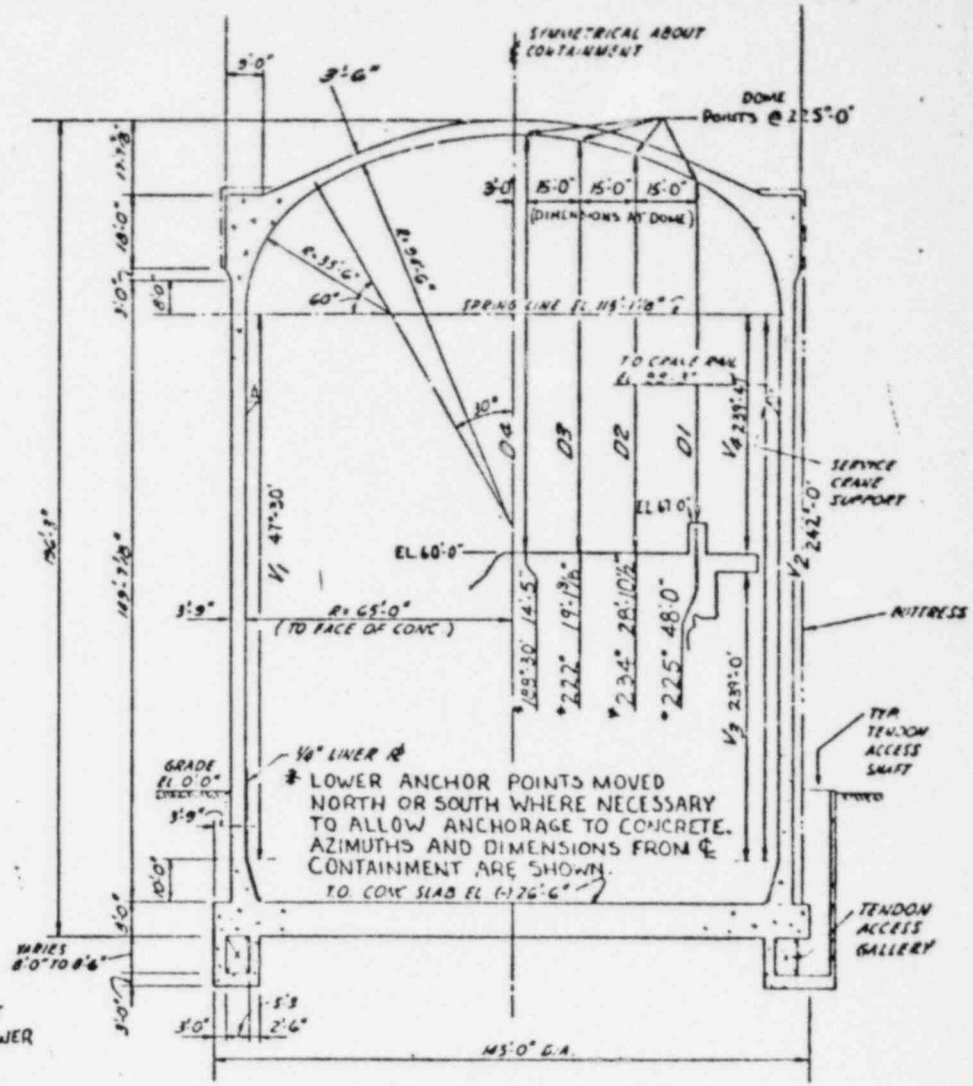
6292-SK-C-210 3 OF 4



PLAN

(ONLY MAJOR PENETRATIONS SHOWN)

NOTE:
AZIMUTH 225° APPLIES ONLY TO DOME ATTACHMENTS. SEE SECTION AT RIGHT FOR POSITION OF LOWER ATTACHMENTS.



SECTION @ ABOUT 25° & 225°

FIGURE 4
LOCATION OF CYLINDER DOME AND VERTICAL MEASUREMENT DURING STRUCTURAL INTEGRITY TEST
PLAN AND SECTION

6292-SK-C-210 4 of 4
1-17-74

RANCHO SECO

REACTOR BUILDING STRUCTURAL INTEGRITY TEST

EXTENSOMETER ANCHOR POINT LOCATIONS

(Extensometer Connected to Stud)

EASURE-ENT OINT NO	TYPE OF ANCHOR	ANCHORED TO	AZIMUTH	DISTANCE FROM ℄ CONTAINMENT	ELEVATION	STRAIGHTLINE DISTANCE BETWEEN POINTS	REMARKS
H1	Stud	Liner	141°	65'	(-)6'-6"		
H1	Eye	Stair Housing	141°	58'-8"	3'-6"	6'-4"	
H2	Stud	Liner ℄	139°	65'	3'-6"		
H2	Eye	Stair Housing	139°	59'	3'-6"	6'-0"	
H3	Stud	Liner ℄	140°	65'	13'-6"		
H3	Eye	Stair Housing	140°	55' 9-3/8"	13'-6"	9' 2-5/8"	
H4	Stud	Liner ℄	140°	65'	43'-6"		
H4	Eye	Stair Housing	140°	55' 9-3/8"	43'-6"	9' 2-5/8"	
H5	Stud	Liner ℄	140°	65'	67'-0"		
(	Eye	Secondary Shield	140°	32' 11-3/8"	67'-0"	32 0-5/8"	
H5A	Stud	Liner ℄	320°30'	65'	67'-0"		
H5A	Eye	Secondary Shield	320°30'	48'-11"	67'-0"	16'-1"	
H6	Stud	Liner ℄	140°	65'	107'-0"	130'-0"	
H6	Eye	Liner ℄	320°	65'	107'-0"	(Computed)	
H7	Stud	Liner ℄	140°	65'	114'-0"	130'-0"	
H7	Eye	Liner ℄	320°	65'	114'-0"	(Computed)	
H8	Stud	Liner ℄	330°	65'	(-)6'-6"	4'9-7/8"	
H8	Eye	Steel Column	330°	60'2-1/8	(-)6'-6"		
H9	Stud	Liner ℄	330°	65'	3'-6"		
H9	Eye	Steel Column	330°	60'1-1/4"	3'-6"	4'10-3/4"	
H10	Stud	Liner ℄	330°	65'	13'-6"	4'9-7/8"	
H10	Eye	Steel Column	330°	60'2-1/8"	13'-6"		
H11	Stud	Liner ℄	330°	65'	42'-6"		
H11	Eye	Steel Column	330°	60'2-3/8"	42'6"	4'9-5/8"	
H12	Stud	Liner Plate	54°30'	65'	(-)6'-6"	14'1-3/8"	
H12	Eye	Secondary Shield	54°30'	50'10-5/8"	(-)6'-6"		
	Stud	Liner Plate	54°30'	65'	3'-6"		
H13	Eye	Steel Column	54°30'	49'3-5/8"	3'-6"	15'8 3/8"	
H14	Stud	Liner	54°30'	65'	13'-6"		
H14	Eye	Steel Column	54°30'	49'3-5/8"	13'-6"	15'8-3/8"	

RANCHO SECO

REACTOR BUILDING STRUCTURAL INTEGRITY TEST

EXTENSOMETER ANCHOR POINT LOCATIONS

(Extensometer Connected to Stud)

ASURE-IT NT No.	TYPE OF ANCHOR	ANCHORED TO	AZIMUTH	DISTANCE FROM ℄ CONTAINMENT	ELEVATION	STRAIGHTLINE DISTANCE BETWEEN POINTS	REMARKS
5	Stud	Liner Plate	48°30'	65'	43'6"		
5	Eye	Secondary Shield	48°30'	29'7-1/4"	43'6"	35'4-3/4"	
6A	Stud	Liner	48°30'	65'	67'0"		
6A	Eye	Secondary Shield	48°30'	28'2-3/8"	67'0"	36'9-5/8"	
6	Stud	Liner Plate	228°30'	65'	67'0"	18'0-1/4"	
6	Eye	Secondary Shield	228°30'	46'11-3/4"	67'0"		
7	Stud	Liner Plate	48°30'	65'	102'1"	130'0"	
7	Eye	Liner Plate	228°30	65'	102'1"		
8	Stud	Liner Plate	48°30'	65'	116'0"	130'0"	
8	Eye	Liner Plate	228°30'	65'	116'0"		
9A	Stud	Liner Plate	20°	65'	67'0"	21'3-5/8"	
9A (see below)	Eye	Secondary Shield	20°	43'8-3/8"	67'0"		
	Eye	Dome Liner	225°	48'0"	144'3-5/8"	77'3-5/8"	Vertical
	Stud	Top of Secondary Shield Wall	225°	48'0"	67'0"		
	Eye	Dome Liner ℄	225°	33'0"	152'3-3/4"	92'6-3/8"	6'4"
	Stud	Concrete Deck	233°55'	28'10-1/2"	60'0"		Out of Plumb
	Eye	Dome Liner ℄	225°	18'0"	156'7-7/8"		1'6-1/4"
	Stud	Concrete Deck	221°47'	19'1-3/8"	60'0"	96'8"	Out of Plumb
	Eye	Dome Liner	225°	3'0"	157'11-3/4"		12'1-1/2"
	Stud	Concrete Deck	188°-28'	14'4-7/8"	60'0"	98'8-3/4"	Out of Plumb
	Eye	Liner Plate	47°30'	64'6"	114'0"		
	Stud	Liner Plate	47°30'	64'6"	(-)16'6"	130'6"	
	Eye	Liner Plate	242°	64'7"	115'1-1/8"	131'7-1/8"	
	Stud	Liner Plate	242°	64'7"	(-)16'6"		
	Eye	Bottom of Concrete Deck	239°	64'7"	59'4"		
	Stud	Liner Plate	239°	64'7"	(-)16'6"	75'10"	
	Eye	Liner Plate	239°47'	64'6"	115'1-1/8"		
	Stud	Top of Concrete Deck	239°47'	64'6"	60'0"	55'1-1/8"	
	Stud	Liner Plate	205°	65'	67'0"	14'2-5/8"	
	Eye	Secondary Shield Wall	205°	50'9-3/8"	67'0"		

RANCHO SECO

REACTOR BUILDING STRUCTURAL INTEGRITY TEST

EXTENSOMETER ANCHOR POINT LOCATIONS

(Extensometer Connected to Stud)

ASURE-NT INT No	TYPE of ANCHOR	ANCHORED TO	AZIMUTH	DISTANCE FROM ℄ CONTAINMENT	ELEVATION	STRAIGHTLINE DISTANCE BETWEEN POINTS	REMARKS
1	Stud	Liner Plate	68°19'	65'	9'6"		
1	Eye	Concrete Deck	68°19'	41'	1'7-3/4"	25'2"	Horizontal Distance = 24
2	Stud	Liner Plate	74°50'	65'	9'6"	23'10-3/4"	
2	Eye	Steel Column	74°50"	41'1-1/4"	9'6"		
3	Stud	Liner Plate	81°09'	65'	10'6"		
3	Eye	Steel Column	81°09'	58'9-1/4"	10'6"	6'2-3/4"	
4	Stud	Liner Plate	98°51'	65'	10'6"	6'2-3/4"	
4	Eye	Steel Column	98°51'	58'9-1/4"	10'6"		
	Stud	Liner Plate	105°10'	65'	9'6"		
5	Eye	ELEVATOR Housing	105°10'	62'8-5/8"	9'6"	2'3-3/8"	
5	Stud	Liner Plate	111°41'	65'	9'6"		
5	Eye	Elevator Housing	111°41'	60'8-1/2"	9'6"	4'3-1/2"	
6	Stud	Liner Plate	90°0'	65'	21'4"	43'	
6	Eye	Secondary Shield	90°0'	22'	21'4"		
7	Stud	Liner Plate	90°0'	65'	26'6"	43'	
7	Eye	Secondary Shield	90°0'	22'	26'6"		
8	Stud	Liner Plate	90°0'	65'	33'6"	43'	
8	Eye	Secondary Shield	90°0'	22'	33'6"		

PROCEDURE FOR

POST-TENSIONING SYSTEM END ANCHOR CONCRETE

SURVEILLANCE

FOR

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

UNIT NO. 1

1.0 SCOPE

This procedure specifies the items to be performed and the equipment necessary to detect and measure any concrete cracking or end anchor movement at the surveillance tendon end anchorages.

2.0 METHOD

The surveillance tendon end anchorages and adjacent concrete surface shall be inspected at five year intervals.

2.1 Inspection: Each inspection shall include the following:

2.1.1 Visual inspection of the end anchorage concrete exterior surfaces.

2.1.2 Measurement of interior and exterior concrete temperature.

2.1.3 Sketching each location inspected. These sketches shall include:

a) Date and hour of inspection

b) Location of cracks

c) Width and length of cracks

d) Estimated total number of cracks if only typical cracks are shown

e) Initials of person making observations

f) Distance from reference bars to bearing plate (See Section 2.2)

2.2 End Anchor Movements: End anchor movements shall be measured using reference bars and a dial depth gage. The reference bars are shown on sketch SK-6292-188 sheets 1 thru 4.

3.0 SURVEILLANCE TENDONS

The surveillance tendons shall be as follows:

a) The two end anchorages of 9 tendons immediately adjacent to lift-off surveillance tendons shall be inspected. The tendons involved are:

Horizontal	29, 53, 112
Vertical	14, 60, 100
Dome	18, 74, 30

4.0 SCHEDULE OF SURVEILLANCE

The end anchorages shall be surveyed at the following times:

a) One to three days before the structural integrity test.

b) At peak pressure during the structural integrity test.

c) One to three days after the structural integrity test.

d) At five year intervals subsequent to the structural integrity test.

e) Before removal of frames and after their replacement as required for tendon surveillance, bearing plate movement measurements shall be made.

5.0 REPORTS

A surveillance report shall be submitted after the structural integrity test and all subsequent surveillances.

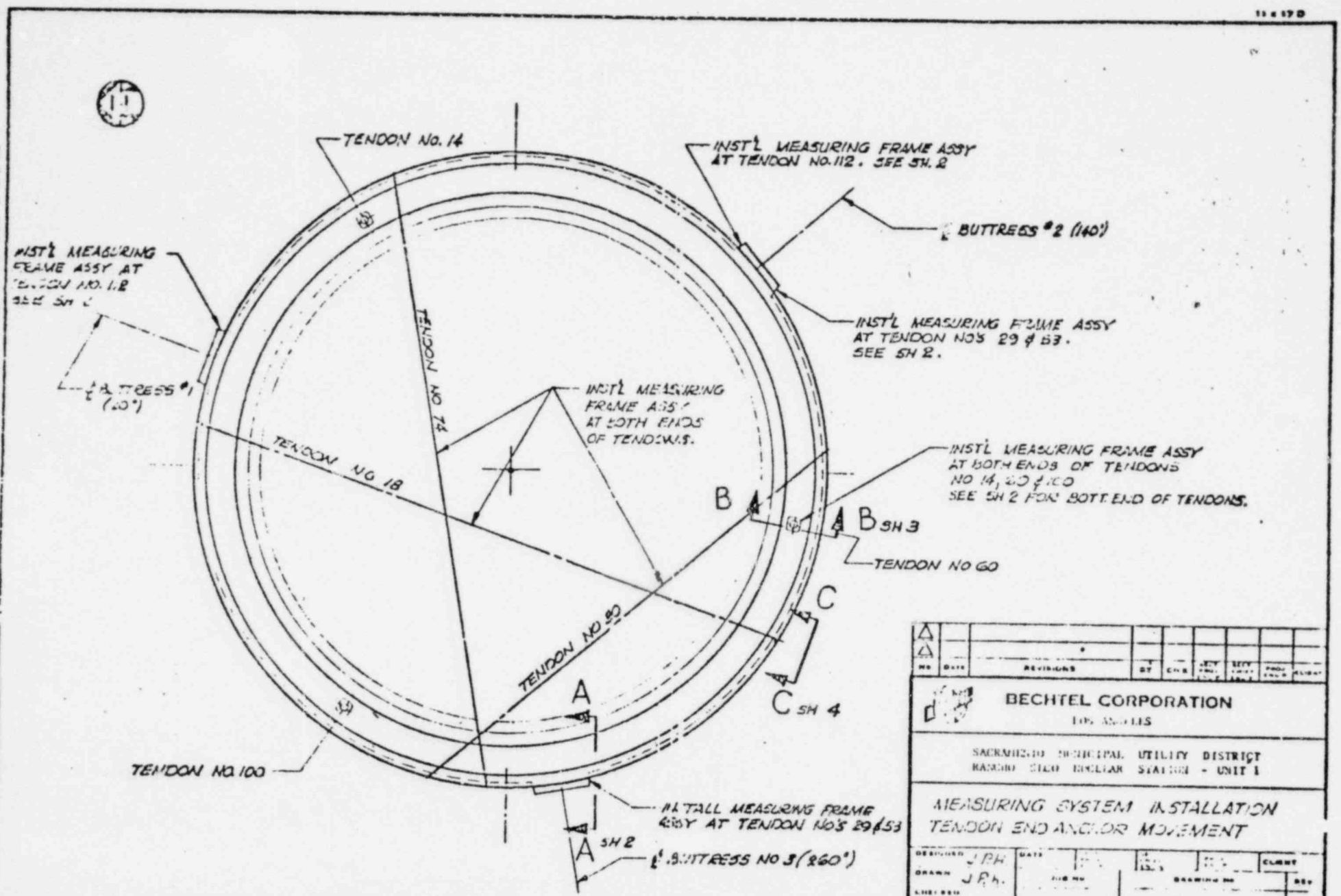
6.0 EQUIPMENT

The following equipment and supplies are required:

a) Two frames for each surveillance tendon (18 total).

b) One dial depth gage range 0" to 6" (Mitutoyo Mfg. Co. Ltd. Code No. 7217 or equal).

c) Scaffolding for access to surveillance tendons.



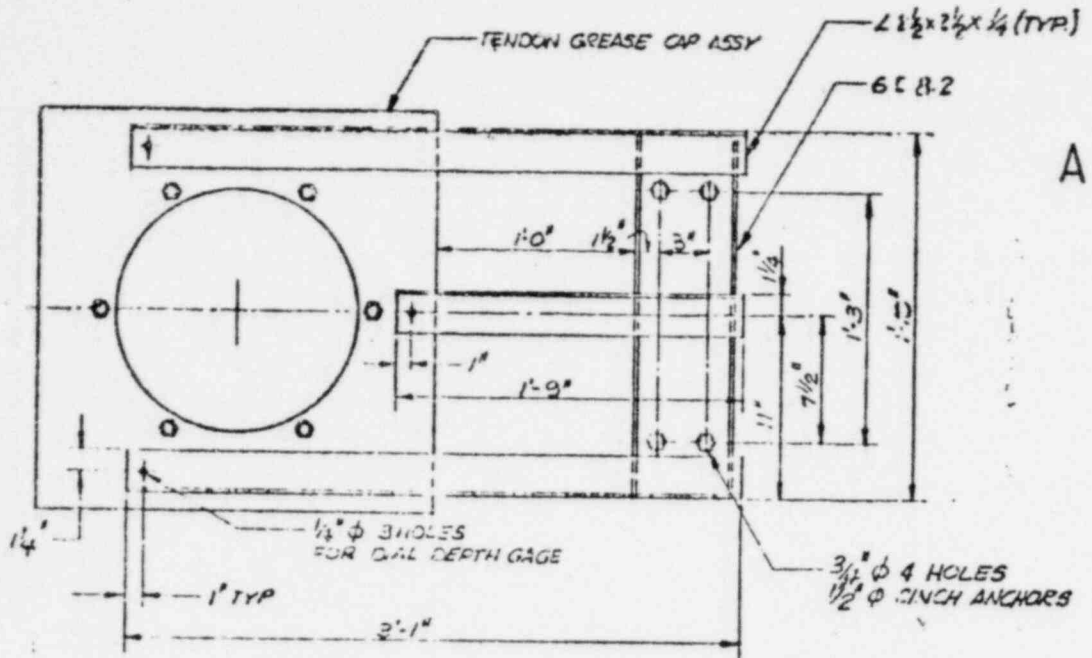
NO	DATE	REVISIONS	BY	CHK	ENGR	ENGR	PROJ ENGR	APPROVED

BECHTEL CORPORATION
LOS ANGELES

SACRAMENTO MUNICIPAL UTILITY DISTRICT
RANCHO SECO NUCLEAR STATION - UNIT 1

MEASURING SYSTEM INSTALLATION
TENDON END ANCHOR MOVEMENT

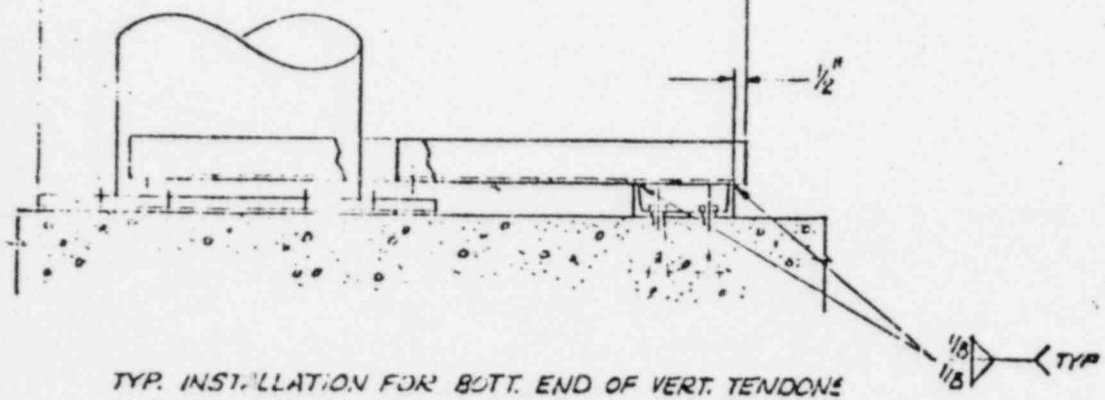
DESIGNED	DATE			CLIENT
DRAWN J.P.H.	JOB NO		DRAWING NO	REV
CHECKED	SCALE		SK-6292-1113	0



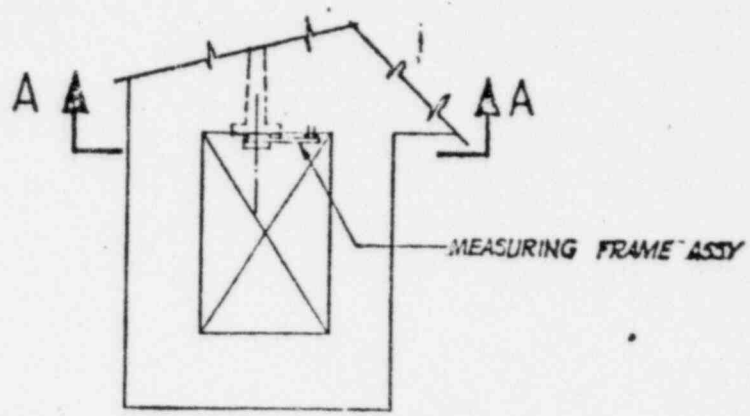
SECTION A-A

SCALE 1½" = 1'-0"

MAKE 5 MEASURING FRAME ASSY'S AS SHOWN.



TYP. INSTALLATION FOR BOTT. END OF VERT. TENDONS AND ALL HORIZONTAL TENDONS.



SECTION THRU TENDON ACCESS GALLERY

SCALE 3/16" = 1'-0"

@ TENDON NO'S 14, 60, & 100

NOTE:

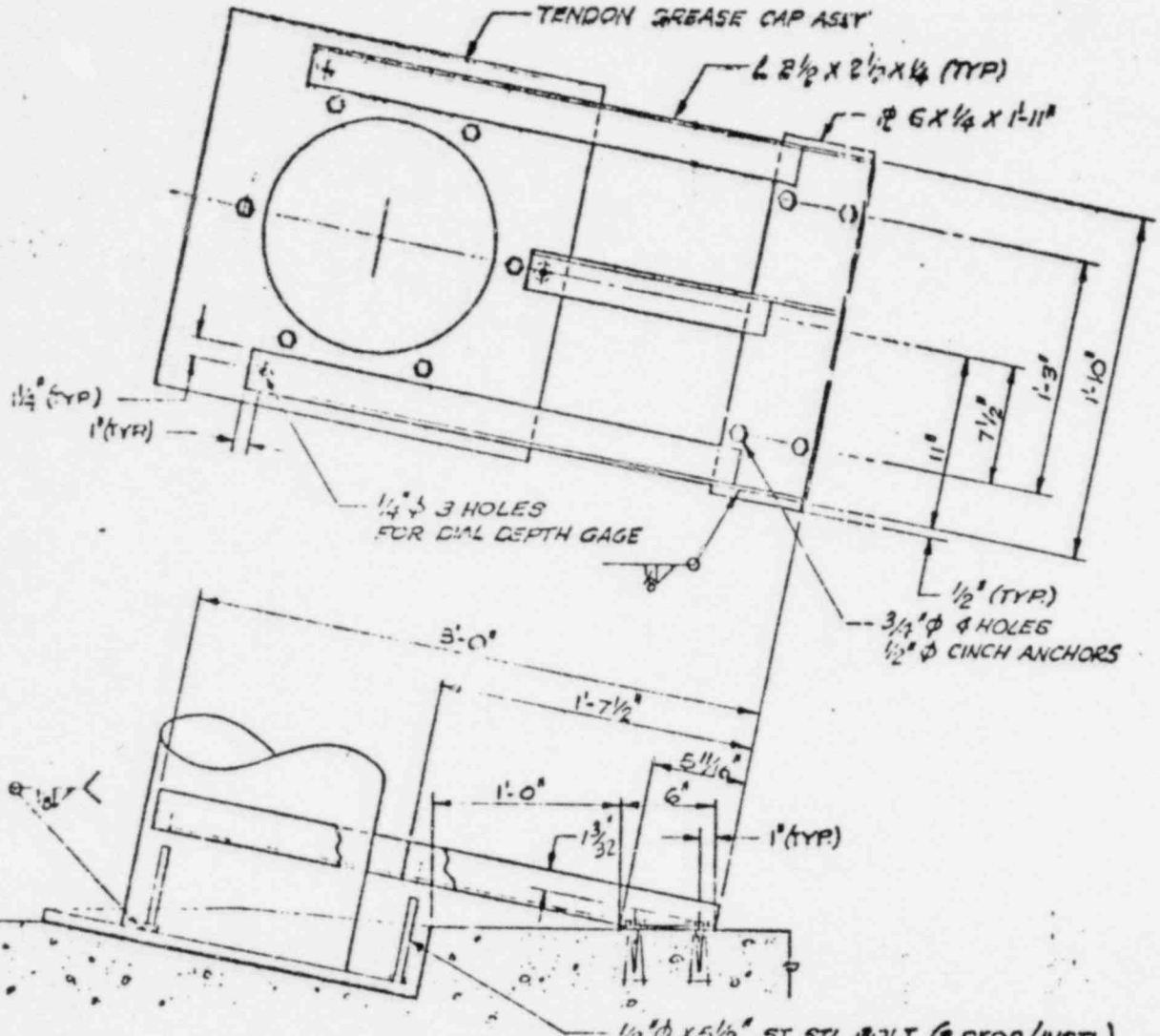
HOT DIP GALVANIZE FRAME ASSY AFTER WELDING.

BECHTEL CORPORATION

SACRAMENTO MUNICIPAL UTILITY DISTRICT
RANCHO SECO NUCLEAR STATION - UNIT 1

MEASURING SYSTEM INSTALLATION, TENDON END ANCHOR MOVEMENT

DESIGNED JPH	DATE		CLIENT
DRAWN JPH	JOB NO.	DRAWING NO.	REV
CHECKED		SK-6293-103	0
SCALE NTS			



SECTION B-B
SCALE 1½"=1'-0"

MAKE 3 MEASURING FRAME ASSY'S AS SHOWN

NOTE:
HOT DIP GALVANIZE FRAME ASSY AFTER WELDING

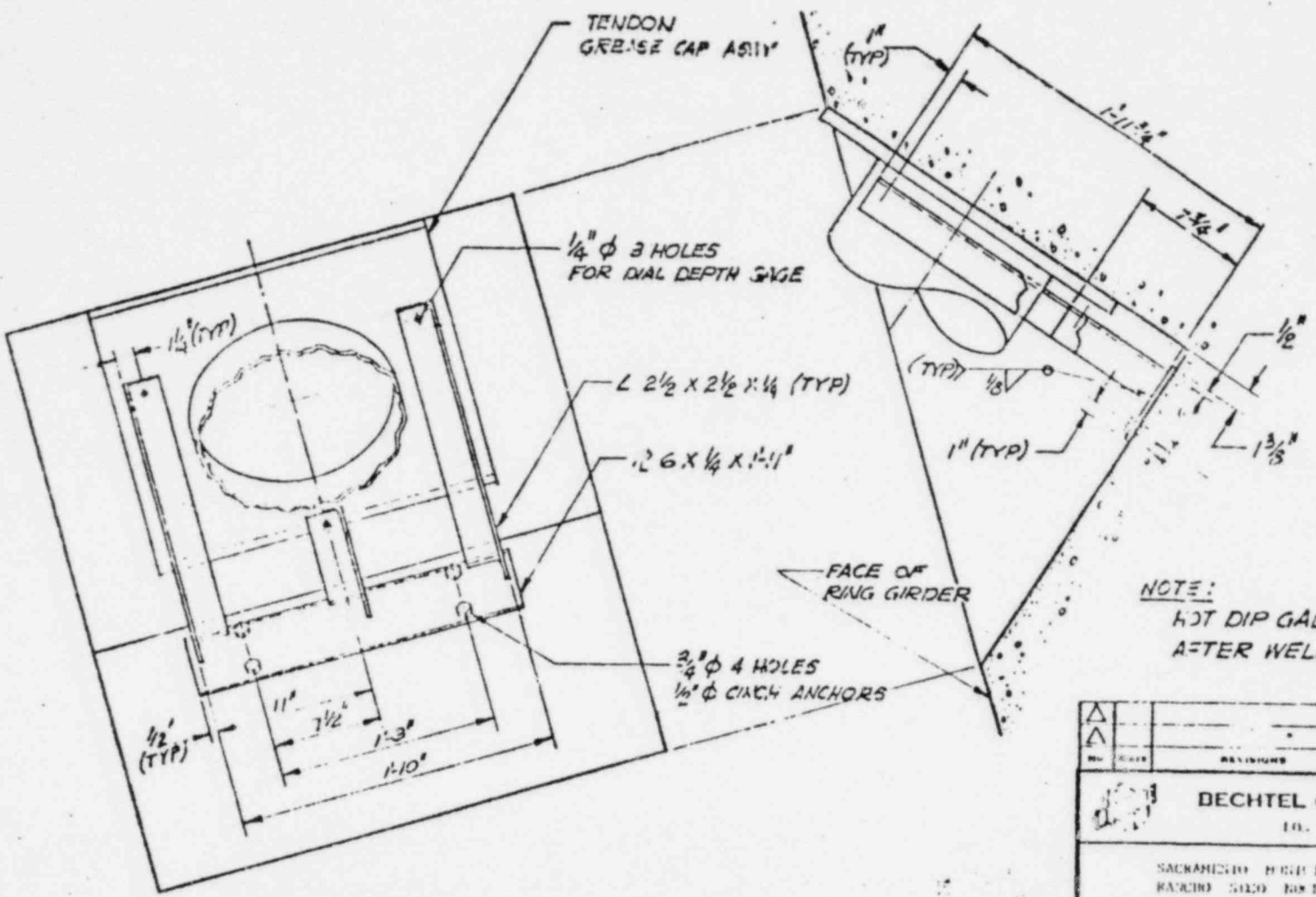
NO	DATE	REVISIONS	BY	CHK	APP'D

BECHTEL CORPORATION
LOS ANGELES

SACRAMENTO MUNICIPAL UTILITY DISTRICT
RANCHO SECO NUCLEAR STATION - UNIT 1

MEASURING SYSTEM INSTALLATION, TENDON END ANCHOR MOVEMENT

DESIGNED J.P.K.	DATE	CLASS
DRAWN J.P.	JOB NO.	DRAWING NO. 5K-62L-383 REV 3
TRACED		
CHECKED		



NOTE:
HOT DIP GALVANIZE FRAME ASSY AFTER WELDING

SECTION C-C

SCALE 1 1/2" = 1'-0"
MAKE 6 MEASURING FRAME ASSY'S AS SHOWN.

REVISIONS	BY	CHK	APPD	DATE	CLIENT

DECHTEL CORPORATION
LOS ANGELES

SACRAMENTO MUNICIPAL UTILITY DISTRICT
RANCHO SECO NUCLEAR GENERATING STATION - UNIT 1

MEASURING SYSTEM INSTALLATION, TENDON END ANCHOR MOVEMENT

DESIGNED	JPH	DATE		CLIENT
DRAWN	JPH	JOB NO.	DRAWING NO.	REV
CHECKED			SK-6292-188	0
SCALE	NTS	APPD		

PROCEDURE FOR

LINER PLATE SURVEILLANCE

FOR

SACRAMENTO MUNICIPAL UTILITY DISTRICT

RANCHO SECO NUCLEAR GENERATING STATION

UNIT NO. 1

1.0 SCOPE

This procedure specifies the items to be performed and the equipment necessary to observe liner plate and liner plate anchor movements at various selected locations and possible strain concentrations at other selected locations.

2.0 METHOD

2.1 Displacement: Liner plate and liner plate anchor movements shall be measured with a dial depth gage and a short fixed chord at four locations on the liner plate. The fixed chord shall be approximately 5 feet long and span four anchor spaces at each location. Measurements shall be made and recorded as follows:

2.1.1 Select the locations for measurement and permanently mark them.

2.1.2 Install the fixed chord.

2.1.3 Record time, date and exterior and interior temperature when measurements are made.

2.1.4 Record all dial depth gage readings.

The fixed chord and dial depth gage measurement system is shown in Figure 1 and Figure 2.

2.2 Strain: Four locations shall be surveyed for any indication of strain concentrations. Surveillance consists of removing any grease or foreign material and determining if any evidence of strain concentrations are present. Strain concentrations will be indicated by large deformations, liner cracking and possibly paint cracking. Any indication of strain concentration shall be shown on a sketch of the area surveyed.

3.0 LOCATIONS OF SURVEILLANCE

This procedure involves the survey of ten areas on the liner plate: six for displacement and four for strain. These areas shall be selected at the jobsite based on the as-built configuration of the liner plate and ease of accessibility.

Four of the areas for displacement measurement shall have an initial inward curvature between the liner anchors (i.e. two horizontal and two vertical) while the other two shall have a typical outward curvature.

The four areas for strain concentration survey shall be where discontinuities occur such as the penetration reinforcing plates and nozzle to reinforcing plate connections.

4.0 SCHEDULE OF SURVEILLANCE

The selected locations shall be surveyed at the following times.

a) One to three days before the structural integrity test.

b) Within one day after depressurization is completed.

c) Six months after completion of the structural integrity test.

d) Approximately one year after initial start-up.

Surveillance of the liner plate shall not continue beyond one year after initial start-up provided evidence of strains exceeding design limits is not found.

5.0 REPORTS

All findings shall be documented in reports and submitted to The Sacramento Municipal Utility District as follows:

a) After completion of the integrated leak rate test.

b) After completion of periodic surveillances.

The report prepared after the last scheduled surveillance shall document all findings and recommend a schedule for future surveys, if any.

6.0 EQUIPMENT

The following equipment and supplies are required:

a) Four short fixed chord measurement devices as shown in Figure 1.

b) Two short fixed chord measurement devices as shown in Figure 2.

c) One dial depth gage range 0" to 6" (Mitutoyo Mfg. Co. Ltd. Code No. 7212 or equal).

d) Lighting equipment as required.

e) Supplies and equipment to permanently mark the location measured by the dial depth gage.

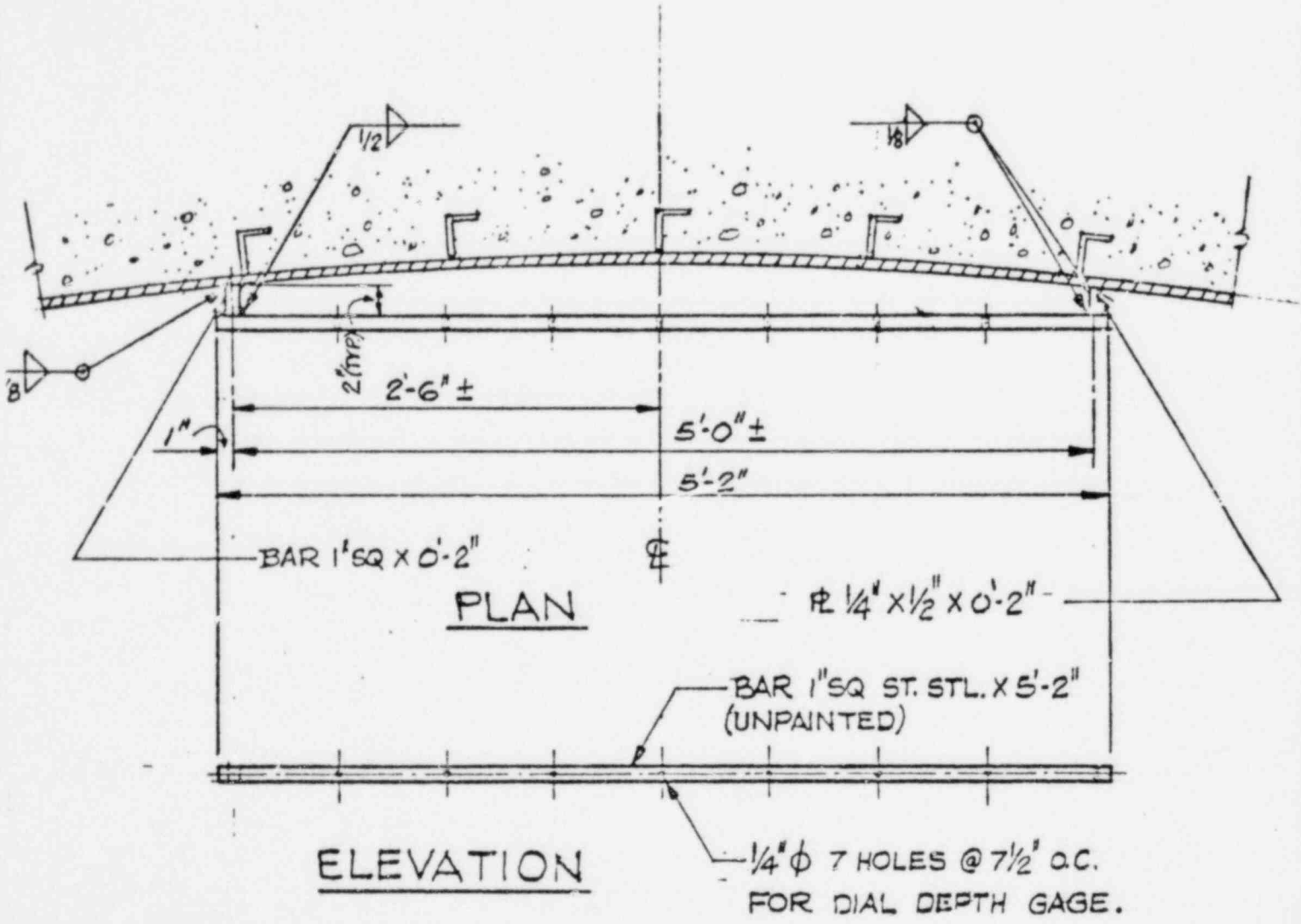
CALCULATION SHEET

DATE

ESIGN BY DATE CHECKED BY SHEET NO

PROJECT JOB NO

JBJECT FILE NO

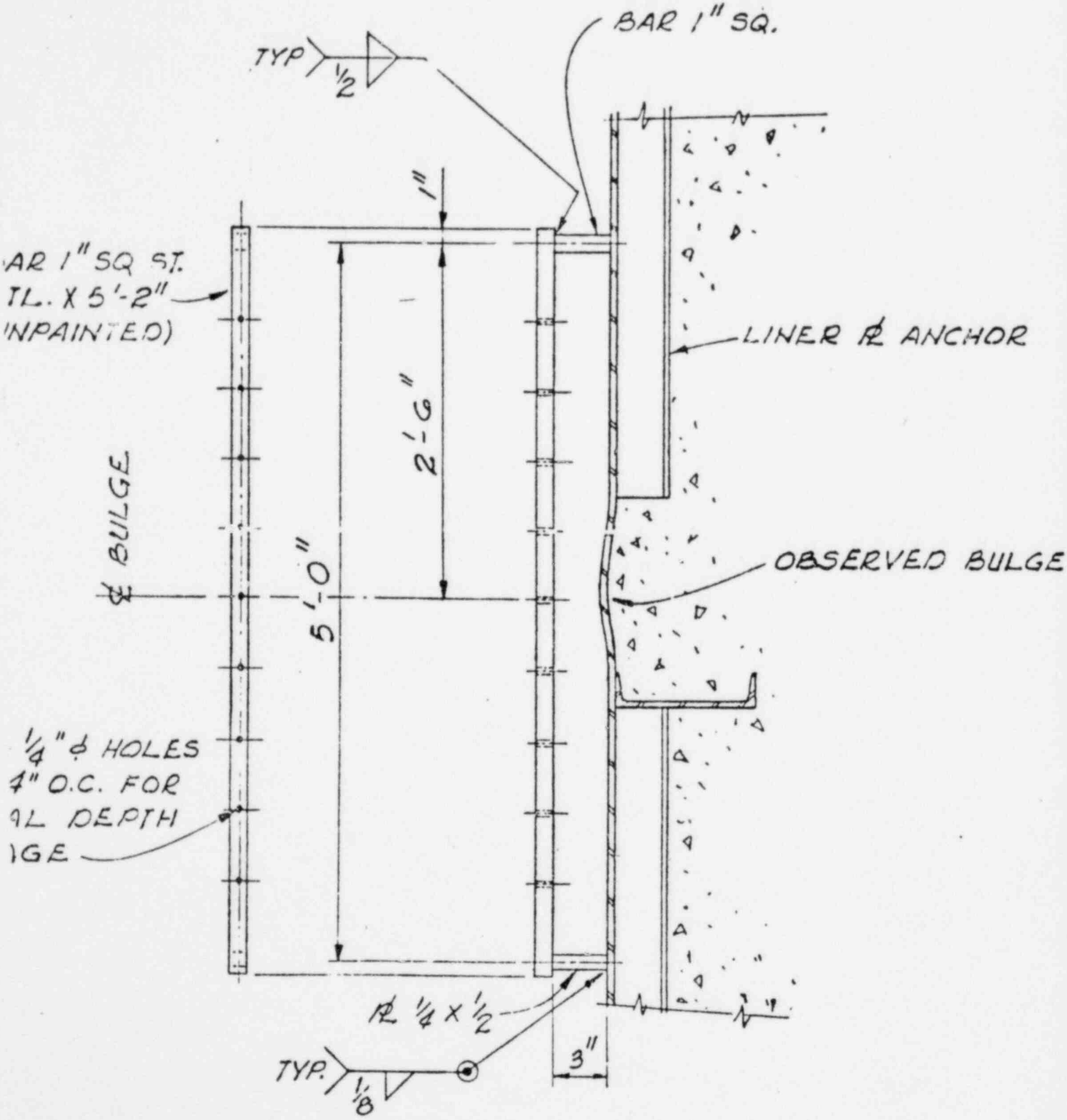


NOTES :

1. PLATE & BAR SUPPORTS SHALL BE ATTACHED TO THE LINER PLATE AT ANGLE ANCHOR LOCATIONS AS SHOWN.
2. THE MEASUREMENT POINT ON THE LINER SHALL BE MARKED.

LINER PLATE MEASUREING SYS.

FIGURE 1



HORIZONTAL BULGE MEASUREMENT DEVICE

FIGURE 2

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT

Page of

SUBJECT: STRUCTURAL INTEGRITY TEST LINER PLATE SURVEILLANCE

DATE:

DEPT.: GENERATION ENGR

BY: GEORGE DREW

REFERENCE:

LOCATIONS FOR DISPLACEMENT MEASUREMENT

'ICE O	DEVICE TYPE	CENTERLINE AZIMUTH	CENTER LINE ELEVATION	REMARKS
V	FIGURE 1	181° 30'	18'-6"	MAX. BULGE ANALIZED
V	" "	151° 30'	65'-6"	
V	" "	225° 10'	65'-0"	TYP. OUTWARD CURVATURE (NO BULGE
D	" "	ON DOME 3' NORTH OF CENTER		ORIENTED EAST - WEST
H	FIGURE 2	23° 30'	3'-6"	
H	" "	355° 0'	63'-6"	

LOCATIONS FOR STRAIN OBSERVATION

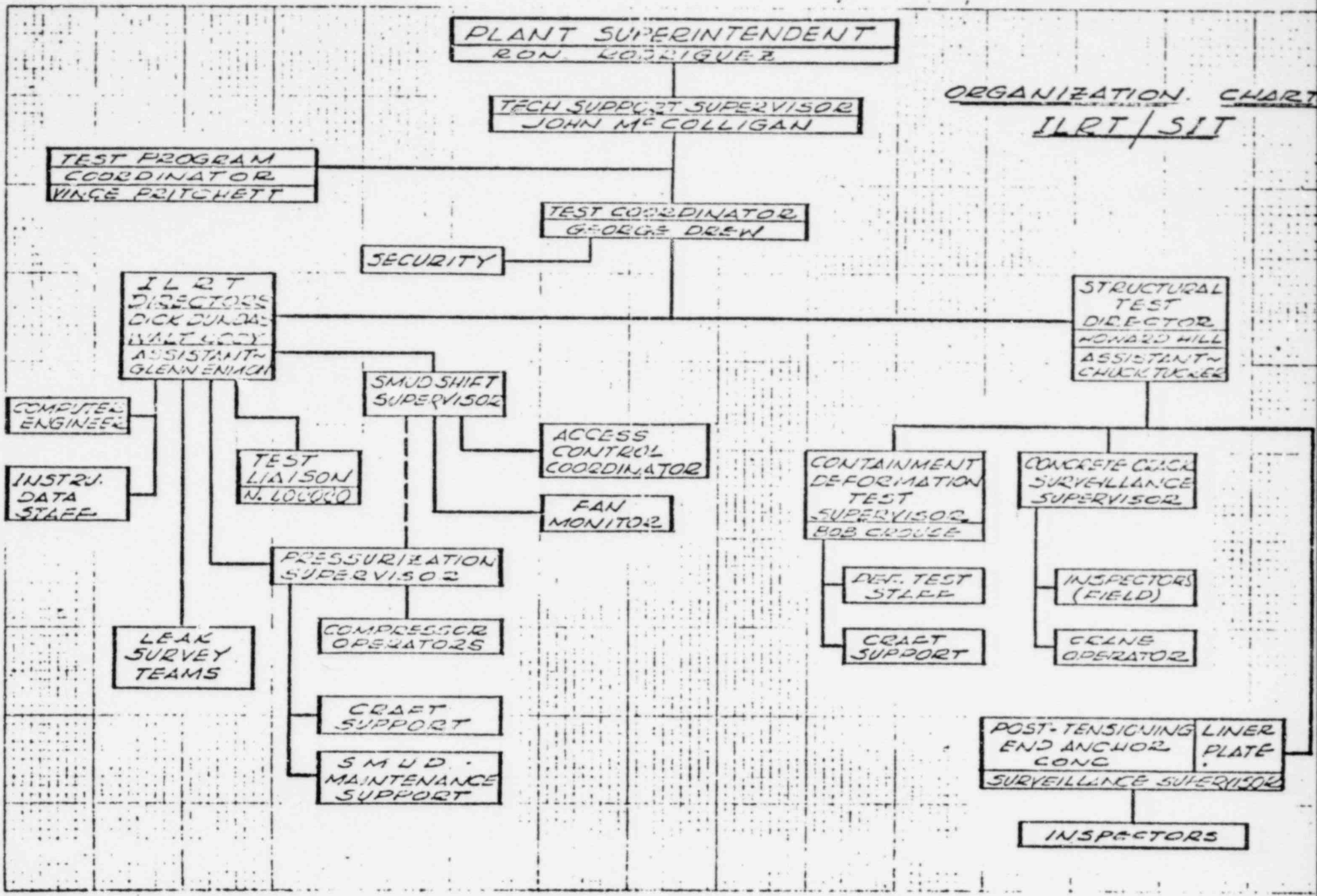
PERSONNEL HATCH : 3' ABOVE AND BELOW HORIZONTAL & EXTENDING FROM EAST EDGE OF HATCH 10' TOWARD EAST

ELECTRICAL PENETRATION #7 : 2' RADIUS AROUND PENETRATION

MECHANICAL PENETRATION # 40 (MAIN STEAM) : UPPER HALF OF PENETRATION 6' OUT FROM JUNCTION WITH LINER PLATE

MECHANICAL PENETRATION # 20 (H.P. INJECTION) : 2' RADIUS AROUND PENETRATION

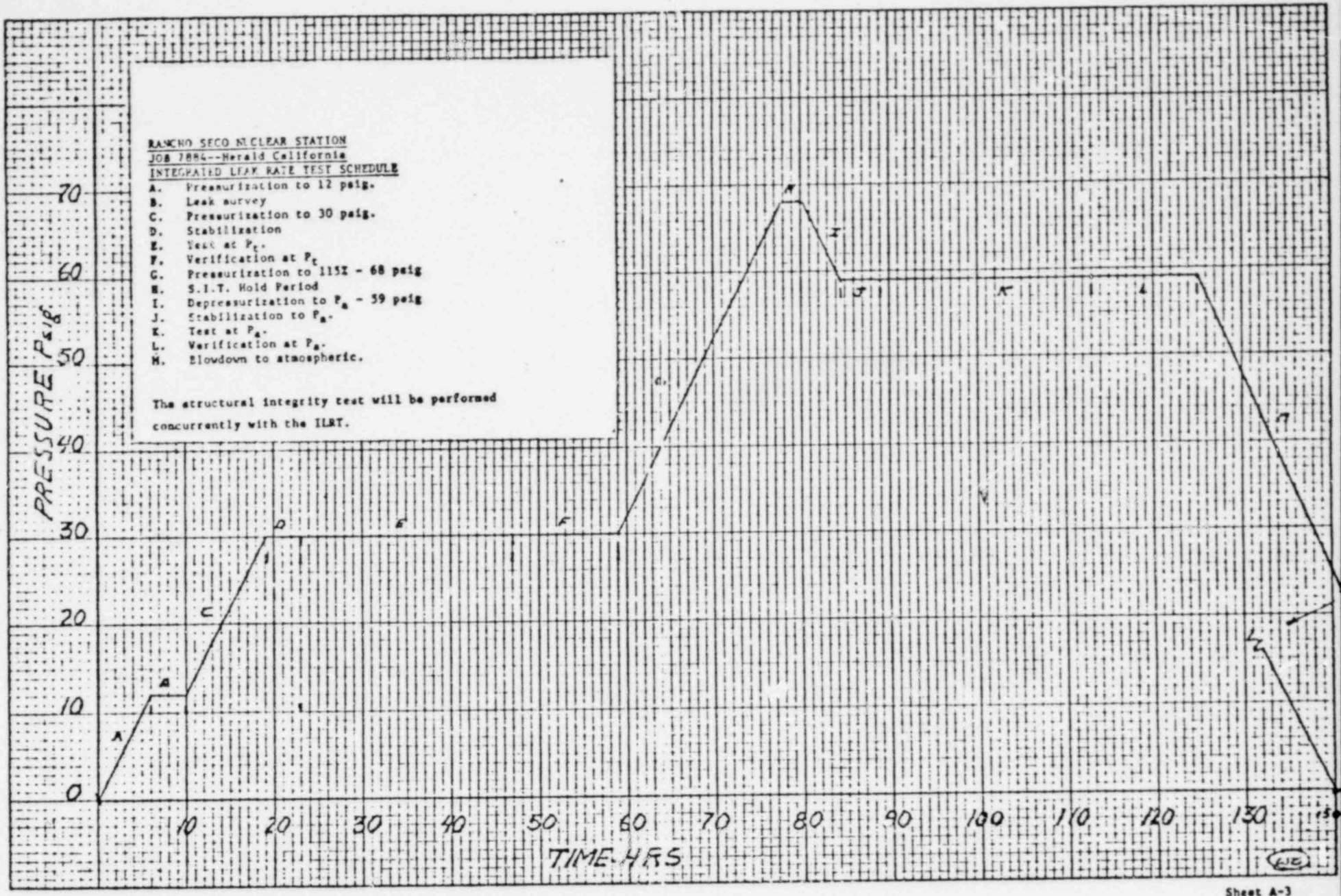
ORGANIZATION CHART
ILRT / SIT



RANCHO SECO NUCLEAR STATION
JOB 7884--Herald California
INTEGRATED LEAK RATE TEST SCHEDULE

A. Pressurization to 12 psig.
B. Leak survey
C. Pressurization to 30 psig.
D. Stabilization
E. Test at P_t.
F. Verification at P_t
G. Pressurization to 115% - 68 psig
H. S.I.T. Hold Period
I. Depressurization to P_a - 59 psig
J. Stabilization to P_a.
K. Test at P_a.
L. Verification at P_a.
M. Blowdown to atmospheric.

The structural integrity test will be performed concurrently with the ILRT.



Sheet A-3

RANCHO SECO

NONCONFORMING REPORT

Q Class 1

NO. 6568

I. Drawing/Installation No. Rancho Seco Unit No. 1
Drawing/Installation Name ILRT
P. O./Contract No. Special
Supplier/Contractor Name Bechtel

Inspector John Jewett
Location Rancho Seco
Date Feb. 1, 1974

II. Description of Nonconformance

Model 269 Multimeter Digital Gage Serial No. 57185 is presently installed for use in the Data Acquisition System. No calibration data is available on this item.

NOTE: A certification is available for gage S/N 59185.

III. DISPOSITION
(Check One) Accept _____ Reject _____ Repair _____ Rework /

IV. Disposition Instructions and Technical Justification

Verify S/N inconsistency is typo. Cotain Certification of Colibration for S/N 57185.

FINAL RESULT
CORRECTED CERTIFICATION
HAS BEEN RECEIVED 2/11/74

G E Drew
Field Engineer

V. ENGINEERING REVIEW BOARD (Required on all accept/repair dispositions)

N/A

Bechtel QAE DATE | Bechtel PE DATE | ~~G E Drew 2-11-74~~ SMUD PE DATE

VI. Repair/Rework Complete and Acceptable 2/11/74 SMUD 49 G E Drew 2-11-74
Inspector/Engineer Date

VII. Cause and Corrective Action

Typo error in coping S/N. Contractor cationed to observe greater care.

DISTRIBUTION

echtel Field (4)
echtel Norwalk (5)
MUD (2)
echtel QAE (1/Orig.)

This change ~~must~~ will not affect functional test.

If Electrical, give function of circuit changed _____

Change incorporated in test procedure and retested, when required.

Test Coordinator

1001 EAST TOUHY AVENUE, DES PLAINES, ILLINOIS 60018

MIDWEST REGIONAL OFFICE

Certificate of Calibration

We certify that the instrument listed below was duly tested and inspected prior to shipment and that it met all of the published physical and operating specifications for this instrument.

Electro Rent's primary and secondary standards are traceable to the National Bureau of Standards to the extent allowed by the Bureau's calibration facilities.

James A. Fox

ELECTRO RENT 1/10/74

Quantity	Mfg.	Description	Serial No.	Report No.
1	DIG Model 269	A/N 57185	S/N 1123	CHO 338
1	DIG Model 662B	A/N 57151	S/N 5165	CHO 338
1	DIG Model 691	A/N 54149	S/N 1569	CHO 338
1	DIG Model 636	A/N 54145	S/N 636	CHO 338

"CORRECTED COPY"

SMUD

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP 006 Rev 3

Title STRUCTURAL INTEGRITY TEST

Originator George Drew GAD 2-9-74 Date 2-9-74

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Add to pg 4A paragraph 5.1.03.f — at 12 PSIG beginning & end of hold Deformation measurements

Reason for Change AEC Request to Add controls for missing 1 hr holds

Approved Ronald W Colombo Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved J.C.V. Miller Date 2-22-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed _____ Date _____
Management Safety Review Committee

SMUD RST 2 1/72

3 pgs

S M D

SACRAMENTO MUNICIPAL UTILITY DISTRICT ☐ 6201 S Street, Box 15830, Sacramento, California 95813; (916) 452-3211

RANCHO SECO NUCLEAR GENERATING STATION UNIT NO. 1

PROCEDURE CHANGE APPROVAL FORM

Procedure Number STP006 Rev 2

Title STRUCTURAL INTEGRITY TEST

Originator George Drewry GD Date 2-1-74

Approved _____ Date _____
Group Supervisor

Recommend Approval by Plant Review Committee: Yes [ ] No [ ]

Requested Change Add pg 8A - Explanation of deformation measurement increments.

Add pg 2B - Authorized Code Inspection Pneumatic Test certification

~~Add pg 2A~~ Registered Professional Engineer Certification

Reason for Change 1. Provide discription of difference in test procedure and AEC Guide 1.18 and justify use data points

2. Provide Sign off for State inspection

3. Provide Sign off for Professional Engr.

Approved [signature] Date Feb. 14, 1974
Plant Review Committee

Recommend Review by Management Safety Review Committee: Yes [ ] No [X]

Approved [signature] Date 2-27-74
Plant Superintendent

Forward to Management Safety Review Committee: Yes [ ] No [X]

Reviewed _____ Date _____
Management Safety Review Committee

SMUD RST-2 1/72

2