FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

CONTAINMENT STRUCTURE POST-TENSIONING SYSTEM THIRD-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

July, 1975

Rev. 1
August 4, 1975

Rev. 2 (Page D10)
September 8, 1978

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Reviewed By:
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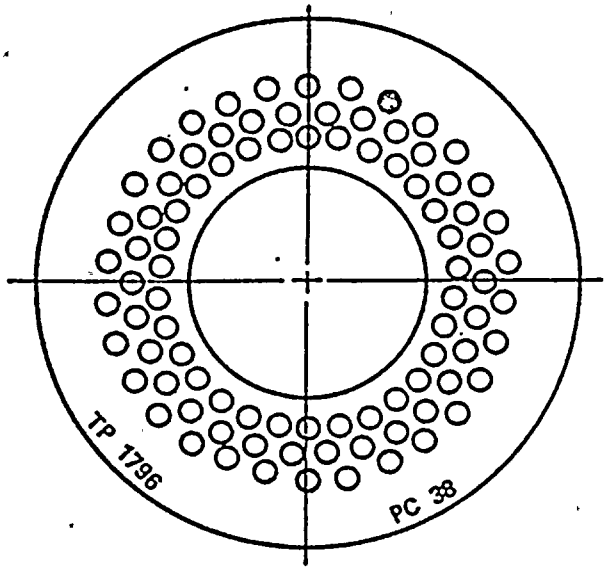
A. J. Bingaman
Chief Civil Engineer
Gaithersburg Power Division

7810170194

TENDON NO. 56V29 (



END ANCHORAGE A

(CLOSEST BUTTRESS 6T)

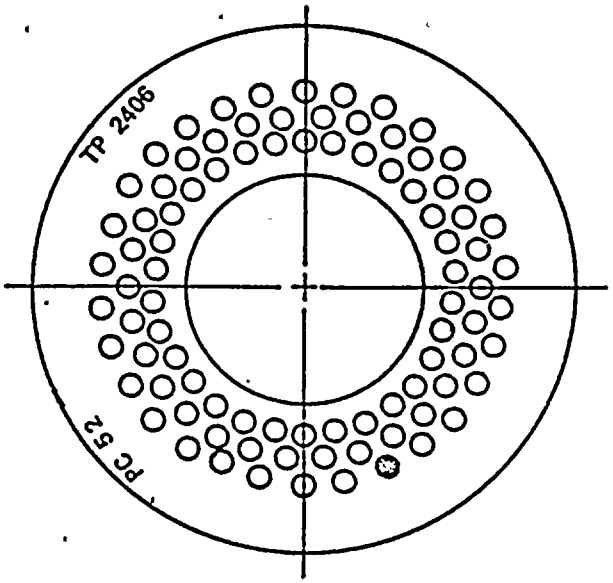
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1



END ANCHORAGE B

(CLOSEST BUTTRESS 6B)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 2

SHIMS 2

BEARING PLATE 1

2

LEGEND:

BUTTONHEADS:

- ⊕ OFF-SIZE BUTTONHEAD
- ⊕ BUTTONHEAD WITH SPLIT
- ⊗ WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊗ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A FMZ DATE 2-25-75

END ANCHORAGE B BAF DATE 2-25-75

7810170194

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
THIRD-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

FLORIDA POWER AND LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

CONTAINMENT STRUCTURE

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

July 1978
Rev. 1 (Page C-5)
September 8, 1978
CWA

By: Charles W Andrews
C. W. Andrews

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1.0 INTRODUCTION

The tendon surveillance program is a systematic means of assessing the continued quality of the post-tensioning system for the containment structure. It provides a measure of confidence in the condition and functional capability of the system, and an opportunity for timely corrective actions should adverse conditions, such as progressive corrosion, be detected.

The fifth-year tendon surveillance for the Turkey Point Nuclear Power Plant, Unit 4 Containment Structure, consisted of the physical inspection of nine tendons as described in the FSAR Technical Specification, Section 4.4.6. These tendons were: 62H38, 42H80, 64H70, 12V29, 34V29, 56V29, 1D28, 2D3, and 3D28.

2.0 SUMMARY AND CONCLUSIONS

2.1 Summary

This report covers the fifth-year tendon surveillance for the post-tensioning system of the Unit 4 containment structure at the Turkey Point Nuclear Power Plant. The surveillance was started in October 1977 and completed in November 1977.

The lift-off forces in all surveillance tendons were within the range of the predicted design values, taking into account the losses of prestress due to wire relaxation, concrete creep and shrinkage, and the initial elastic structural deformation.

The load-bearing components of the end anchorage assemblies were found to be in excellent state with no adverse conditions such as progressive corrosion and cracking.

In the mechanical testing of the specimens obtained from the removed tendon wires, no change was detected in the physical properties regarding the yield stress, ultimate strength, and percentage of elongation of the wires since the initial acceptance tests. The minimum ultimate strength requirement was met by all the specimens.

No presence of water or abnormal discoloration was observed in the tendon sheath fillers. Laboratory analysis of the filler samples, obtained from each surveillance tendon, showed that the contents of water, chlorides, nitrates, and sulfides were well within the acceptable limits.

2.2 Conclusions

Based on the inspection and tests described herein, it is concluded that the post-tensioning system in the Unit 4 Containment Structure at Turkey Point Nuclear Power Plant is performing within the limits set by design criteria and specifications.

3.0 GENERAL

The fifth-year tendon surveillance of the Turkey Point Nuclear Power Plant, Unit 4 Containment Structure Post-Tensioning System, began in October 1977, approximately 2-1/2 years after the completion of the third year surveillance in February 1975. The fifth-year tendon surveillance consisted of the following:

1. Visual and laboratory examination of sheath filler.

2. Inspecting anchorage assemblies for deleterious conditions, such as corrosion, cracking, missing wires, and split or off-size button-heads.

3. Measuring shim dimensions to determine tendon lift-off elongations.

4. Measuring tendon lift-off forces.

5. Measuring tendon elongations at 80 percent of the minimum ultimate strength of the wires.

6. Detensioning tendons and checking wire continuity by pulling each wire from one end and observing its movement at the opposite end.

7. Removing one wire from three preselected tendons for inspection and testing.

8. Retensioning tendons to lift-off forces obtained in Item 4 above, and measuring the corresponding elongations.

9. Visual inspection of removed tendon wires for corrosion, pitting, and other deleterious conditions.

10. Testing of samples obtained from removed tendon wires for yield strength, ultimate strength, and percentage of elongation at ultimate strength.

11. Evaluation of surveillance data and test results to assess the general condition of the post-tensioning system, considering the time-dependent factors such as prestress losses and corrosion.

The work was performed in accordance with the "Tendon Surveillance Procedure for Containment Structure Post-Tensioning System," dated July 22, 1977 and included in the report as Appendix A.

The locations and identifications of the dome, vertical, and horizontal surveillance tendons are shown in Figure 3-1.

4.0 SHEATH FILLER AND END ANCHORAGE ASSEMBLIES

The results of the field inspection and laboratory analysis of the sheath filler, and the visual examination of the end anchorage assemblies, are summarized in Table 4.1.

4.1 Sheath Filler

Two samples of filler were removed from each of the surveillance tendons and visually examined. All of the samples taken were dark brown in appearance, indicating the lack of water or impurities that may cause discoloration.

4.2 End Anchorage Assemblies

The end anchorage assemblies of the surveillance tendons were examined and found to be in satisfactory condition. The tendon 1D28 stressing washer, located at buttress 4, received a 120°, 9" long, 3/8" wide, 1/4" deep, tapered scrape along the side of its interior face circumference when it accidentally mated against the left side of the bearing plate during detensioning operations. The stressing washer was shown to be structurally sound when the tendon was stressed to the full effective force with no observable adverse effect. The lift-off forces were well within the acceptable limits.

The end anchorage inspection data are included in the report as Appendix C.

5.0 DETENSIONING AND WIRE INSPECTION

Data obtained during detensioning and wire inspection are shown in Table 5.1.

5.1 Tendon Lift-Off Forces

The lift-off forces obtained from the tendons during detensioning indicated that prestress losses had not exceeded the predicted design values.

The long term (40-year duration) predictions of the normalized wire lift-off forces in the surveillance tendons are shown graphically in Figures 5.1 through 5.3. These predictions had taken into account the prestress losses due to wire relaxation, and concrete creep and shrinkage. These curves provide only an estimated trend in the prestress losses, and are used as a means for comparison with the trend of the actual average prestress losses.

The minimum effective design prestress is the required average force per wire at the end of 40 years, including the effects of wire relaxation, and concrete creep and shrinkage.

Calculations for the predicted prestress losses are as follows:

1. Initial wire force (F_i) based on a wire stress of 0.70f:

$$F_i = 0.70f \times A_s$$

$$= 0.70 \times 240 \times 0.049$$

= 8.25 kips/wire

where f = ultimate strength of wire

A_s = Area of wire

2. Wire force at 40 years (F_{40}) due to wire relaxation, and concrete creep and shrinkage:

The prestress loss at the end of 40 years due to wire relaxation, and concrete creep and shrinkage, is estimated to be 34.7 ksi (see FSAR Section 5.1.4.4). This value is applicable to all dome, horizontal, and vertical tendons.

$F = 34.7 \times A_s$

$= 34.7 \times 0.049$

$= 1.70$ kips/wire

Where F_{pl} = Prestress loss @ 40 years

The minimum effective design prestress is the predicted average wire force after 40 years.

$F_{40} = F_i - F_{pl}$

$= 8.25 - 1.70$

$= 6.55$ kips/wire

In order to compare the actual average prestress losses with predicted values, it was necessary that the wire lift-off forces, from the surveillance data, be normalized to account for the initial structural deformations (which is a function of the post-tensioning sequences), the deviations of initial lift-off forces from the specified value of 0.70f, and the changes in lift-off forces resulting from tendon surveillance operations, such as reshiming and wire removal. These normalized wire lift-off forces were then superimposed on the appropriate curves shown on Figures 5.1 thru 5.3, providing a comparison between the predicted values and the actual forces at the time of tendon surveillance.

For future convenience, the normalizing factors and the normalized lift-off force for each surveillance tendon for the fifth-year tendon surveillance are listed in Table 5.2.

Formulas for calculating the normalizing factors are given in Appendix B.

5.2 Wire Inspection

The results of inspection of each tendon wire removed for inspection are shown in Appendix D.

No physical imperfections were observed on the wires removed from all tendons.

5.3 Discontinuous Wires

No discontinuous wires were found during this tendon surveillance.

6.0 RETENSIONING AND SHEATH FILLER INSTALLATION

6.1 Retensioning

The data obtained during retensioning are shown in Table 6.1.

The tendons were retensioned to approximately the same stress level indicated by the lift-off forces obtained during detensioning, with allowance made for the tendons where a wire was removed for physical examination and testing.

The retensioning data will be used as input for the next scheduled tendon surveillance.

6.2 Sheath Filler Installation

The volume of grease removed from the tendon prior to detensioning, and the volume replaced after retensioning, are indicated in Table 6.1.

7.0 WIRE TESTING AND ANALYSIS OF SHEATH FILLER

7.1 Wire Testing

7.1.1 Specimen Selection and Preparation

The locations of the specimens selected from each tendon wire for tensile testing are shown in Appendix D. In general, specimens were obtained from each end and the middle of each tendon wire removed. The specimens were cut to a length of approximately 126 inches.

After the specimens were cut from the pulled wires, they were tagged with the following information:

1. Tendon identification number.
2. Location of the specimen; i.e., middle or end section.
3. Containment unit number and the year of surveillance (1977).

These tags remained with the specimens through completion of the testing.

The remaining portions of the wires, after the specimens had been obtained, were also tagged and retained at the plant site until testing indicated that the tensile strength and elongation of all specimens were in compliance with the specification.

7.1.2 Test Procedure

Except for the gage length, the test procedure used was the same as that specified in ASTM Specification A421-65, "Standard Specification for Uncoated Stress-Relieved Wire for Prestressed Concrete." A gage length of one hundred inch (±1.0) was used instead of the ten-inch gage length as specified.

The 100-inch-gage-length specimen may indicate a lower ultimate strength and lesser ductility (elongation) than a ten-inch-gage-length specimen. Since failure will occur at the weakest point in the wire, the ultimate strength obtained is equivalent to the lowest value that would be obtained from ten 10-inch specimens. Elongation at failure will also tend to be less due to the distribution of the elongation at the neck-down area over a length of wire ten times that of the nominal ten-inch specimen.

7.1.3 Test Equipment

The apparatus used for the tensile testing of the specimens was the Tinius Olsen Super "L" Testing machine with a 1,200,000 lbs capacity, of the Pittsburgh Testing Laboratory, Pittsburgh, Pennsylvania. For machine calibration report, see Appendix I.

7.1.4 Test Results

The results of tensile testing on the one hundred-inch-gage-length wire specimens are shown in Appendix G and Table 7.1.

7.1.4.1 Yield Strength

The yield strength of all wire specimens tested exceeded the specified minimum yield strength of 192 ksi at one percent elongation.

7.1.4.2 Ultimate Strength

The ultimate strength of all wire specimens tested exceeded the specified minimum ultimate strength of 240 ksi as specified by ASTM A421-65.

7.1.4.3 Elongation

Since 100-inch-gage-length specimens were used in the tensile testing, a lesser percentage of elongation may be expected than from the testing of 10-inch-gage-length specimens of identical wire, as discussed in Paragraph 7.1.2. Previous test data [1] indicated that a wire which showed a 4 percent elongation at ultimate strength in a 10-inch-gage-length testing could be expected to exhibit a somewhat lower (no less than 3 percent) elongation at ultimate strength in a 100-inch-gage-length testing.

The percentage of elongation of all wire specimens tested met this requirement.

7.1.4.4 Fracture Characteristics

The fracture of all wire specimens was of the cusp-cone shape.

7.2 Analysis of Sheath Filler

7.2.1 Specimen Preparation

A quart-size sample of the sheath filler was obtained from each end of all surveillance tendons prior to de-tensioning. Each metal container containing the grease sample was marked with the tendon identification number. One sample from each surveillance tendon was shipped to an independent laboratory for analysis of water content and water soluble impurities, and the remaining samples were retained at the jobsite.

7.2.2 Test Procedures

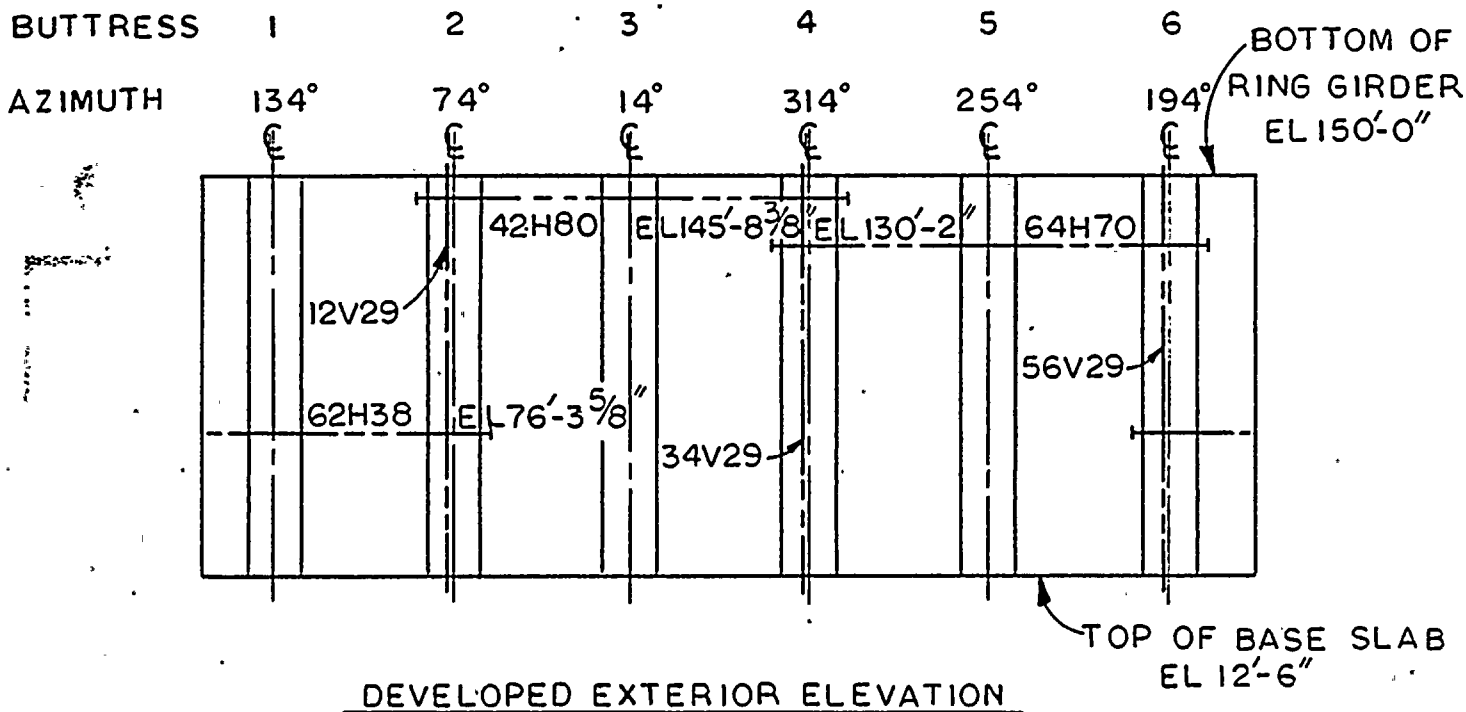
Test procedures for water content and chlorides, nitrates, and sulfides concentrations are given in Appendix F.

7.2.3 Test Results

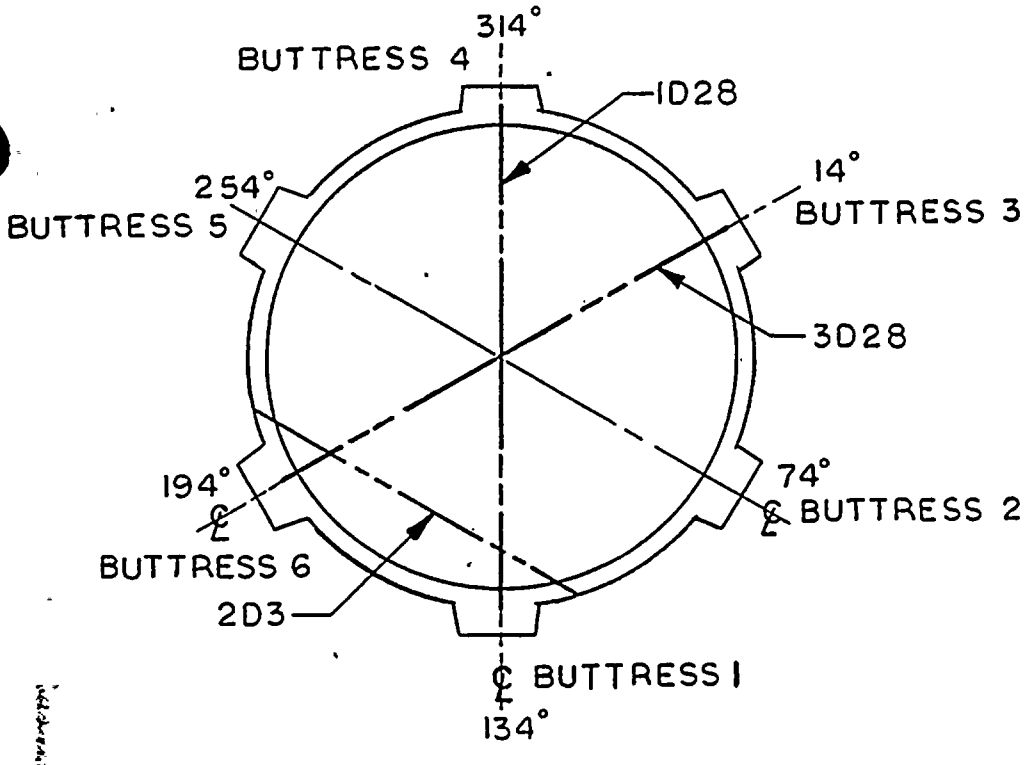
The results of laboratory analysis of the sheath filler are shown in Appendix H.

These data indicated that the contents of chlorides, nitrates, and sulfides in the grease were well within the acceptance limits, and that the amount of water present was negligible.

(1) "Containment Building Past-Tensioning System One-Year Surveillance, Palisades Plant Unit 1," Consumers Power Company, AEC Docket No. 50-255.



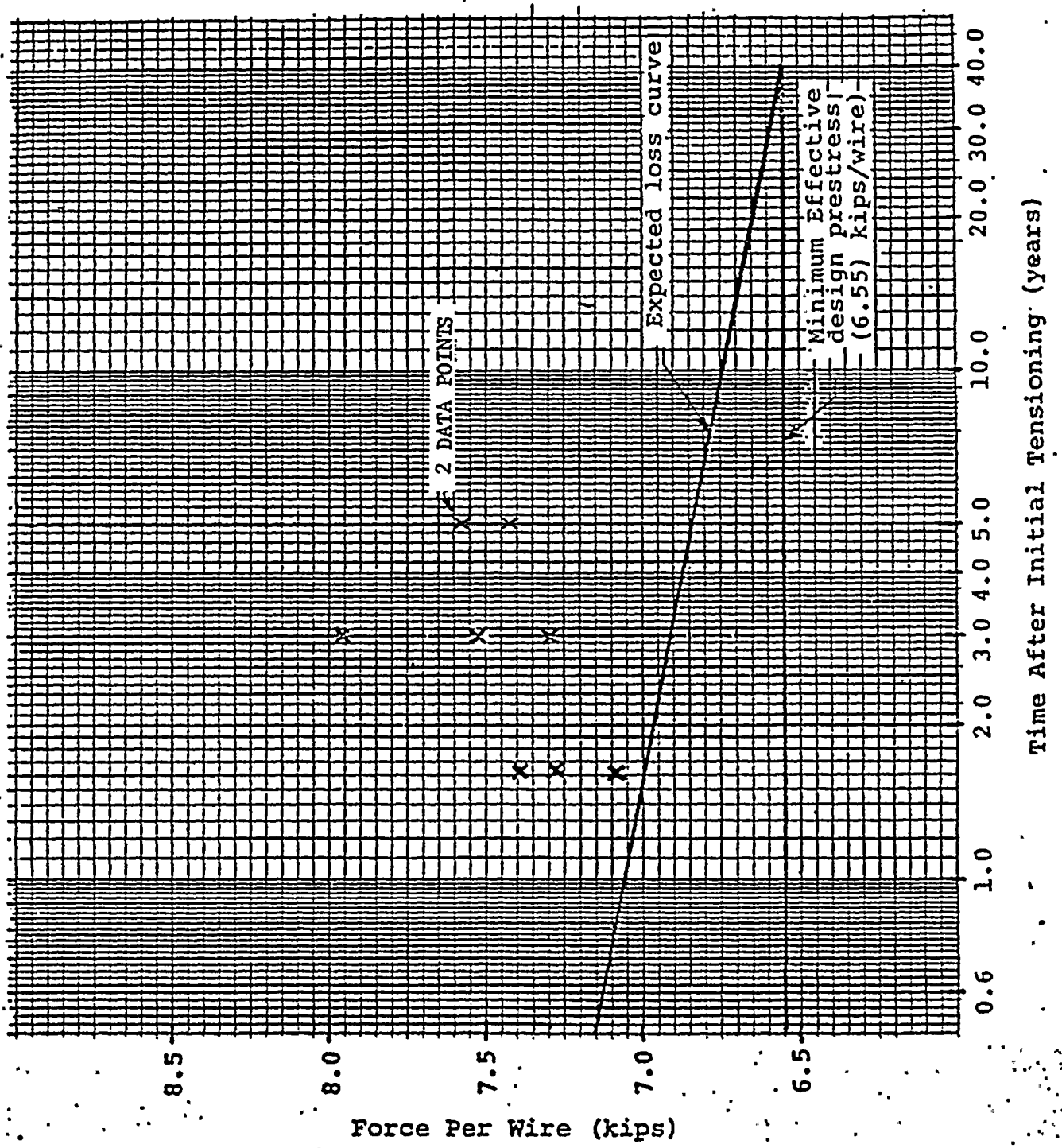
DEVELOPED EXTERIOR ELEVATION
HOOP AND VERTICAL TENDONS



PLAN
DOME TENDONS

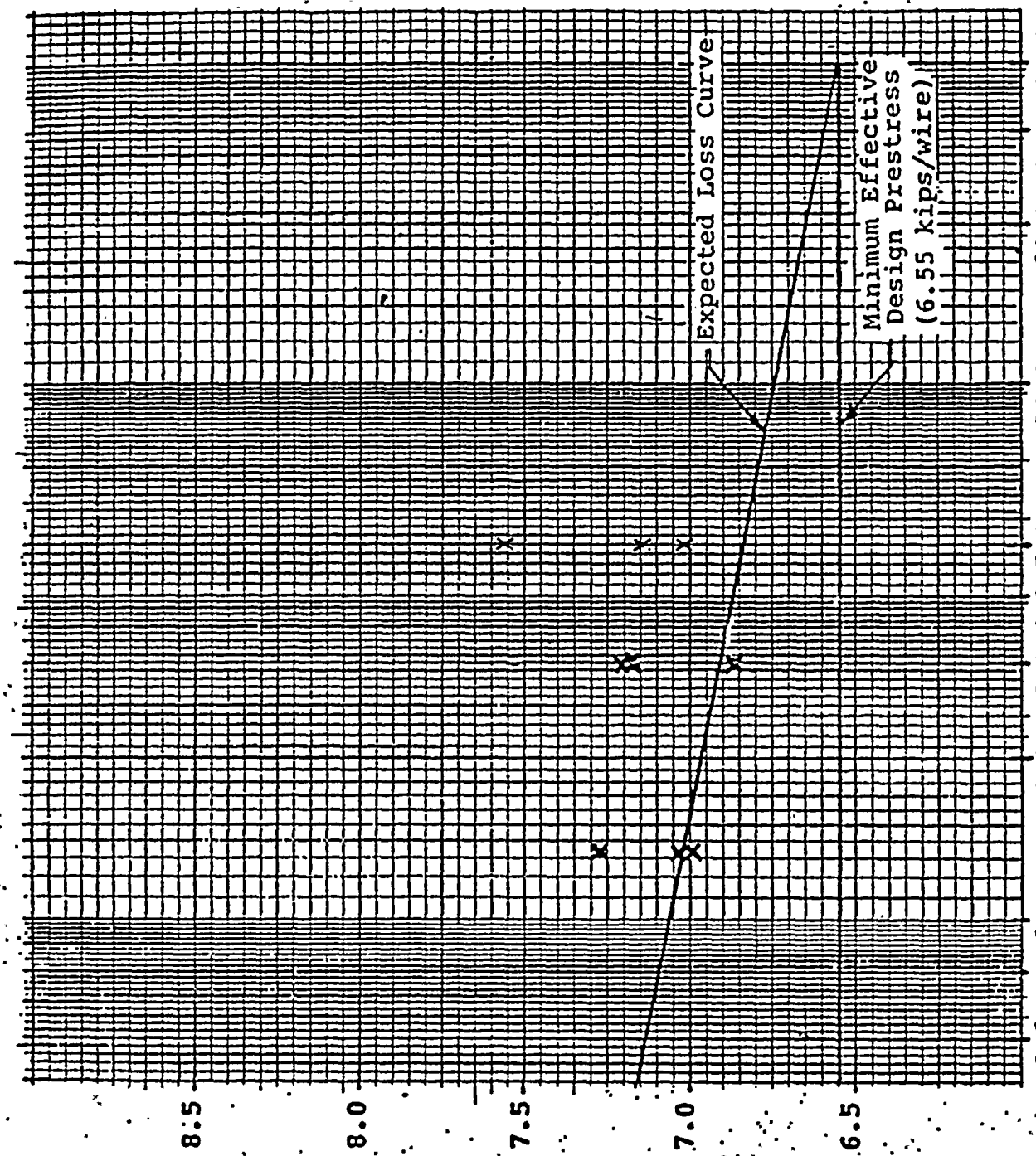
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
SURVEILLANCE TENDONS
LOCATION AND IDENTIFICATION

FIGURE 3.1



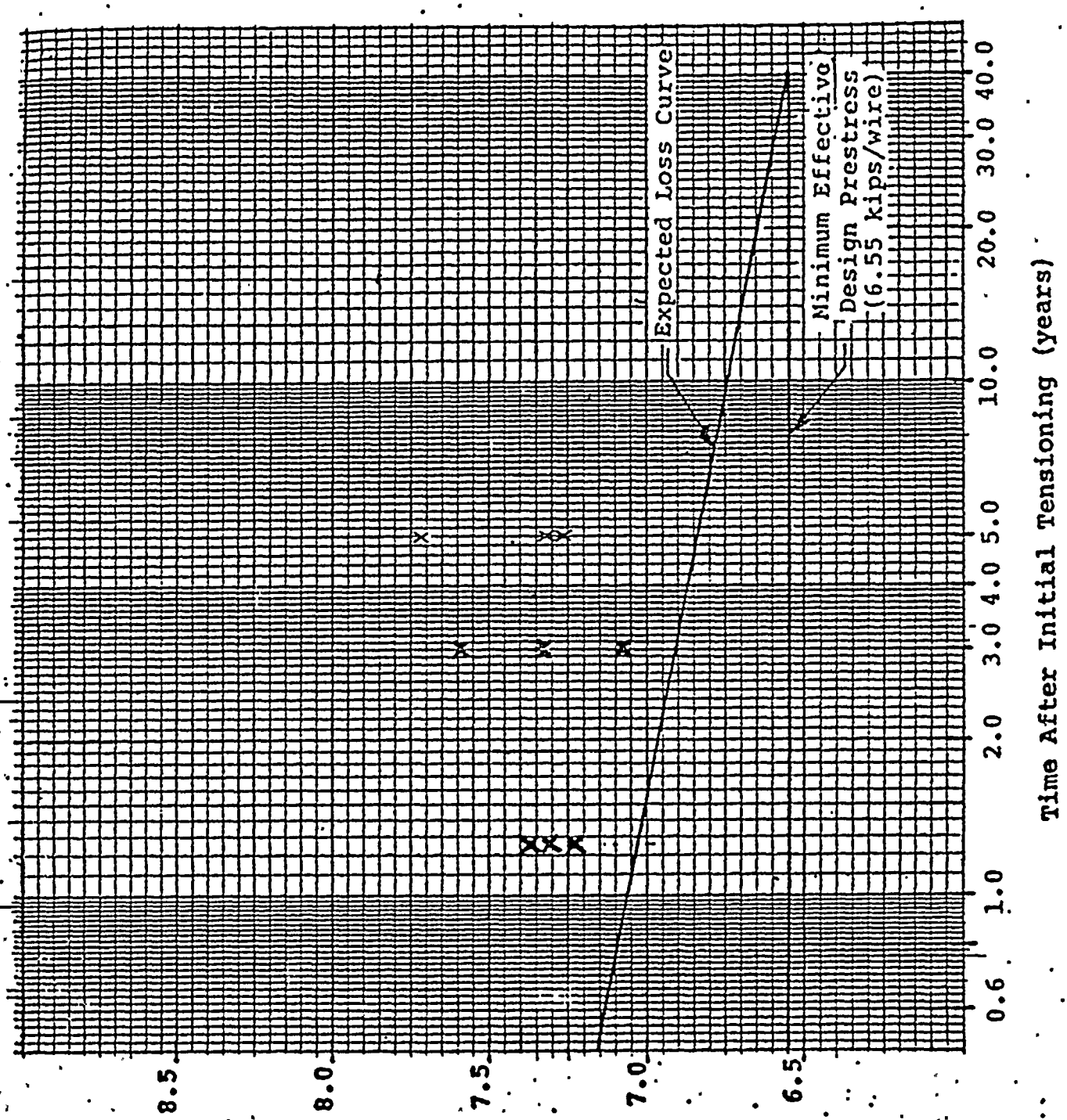
Turkey Point Power Plant Unit No. 4
Vertical Tendon Normalized Lift-Off Wire Force
Vs.
Time

Figure 5-1



Turkey Point Power Plant Unit No. 4
Horizontal Tendon Average Normalized Lift-Off Wire Force
Vs.
Time

Figure 5-2



Turkey Point Power Plant Unit No. 4
Dome Tendon Average Normalized Lift-Off Wire Force
Vs.
Time

Figure 5-3

TABLE 4-1
SUMMARY OF DATA
SHEATH FILLER AND END ANCHORAGE ASSEMBLIES

TENDON			FILLER COATING ACCEPTABLE (YES/NO)					FILLER MAT'L		ANCHORAGE COMPONENTS										TEMP. °F		DATE INSPECTED	REMARKS
										BUTTONHEADS				STRESS WASHERS		SHIMS		BEARING PLATES					
IDENT.	TYPE	LOCATION	FILLER CAP	BUTTON HEAD	STRESS WASHER	SHIMS	BEARING PLATE	COLOR CHANGE	SAMPLE NO.	NUMBER	CORROSION LEVEL	SPLITS	OFF-SIZE	CORR. OSION LEVEL	CRACKS	CORROSION LEVEL	CRACKS	CORR. OSION LEVEL	CRACKS	INTERIOR	EXTERIOR		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
56V29	VERT	6/T 6/B	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	1 2	89	1 2	NONE NONE	NONE NONE	2 2	NONE NONE	2 2	NONE NONE	1 1	NONE NONE	117	79	10-25-77	TOP STRESS WASHER HAS THE FIRST THREAD DAMAGED APPROX. 45°. THE OUTSIDE FACE IS GOUGED APPROX. 7/32" x 4" LONG.
12V29	VERT	2/T 2/B	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	3 4	88	1 1	NONE NONE	NONE 7	1 2	NONE NONE	1 2	NONE NONE	2 2	NONE NONE	117	88	10-26-77 10-27-77	THE 7 OFF-SIZE BOTTONHEADS ARE SLIGHTLY OVERSIZE.
34V29	VERT	4/T 4/B	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	5 6	89	1 1	NONE NONE	NONE 1	1 2	NONE NONE	1 2	NONE NONE	2 2	NONE NONE	117	89	10-28-77	TOP STRESS, WASHER HAS THE FIRST THREAD DAMAGED APPROX. 60°.
1D28	DOME	1 4	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	7 8	88	2 1	NONE NONE	NONE NONE	2 2	NONE NONE	2 2	NONE NONE	2 1	NONE NONE	92	86 81	11-2-77	STRESS WASHER AT BUTTRESS NO. 4 HAS A 3/8" CHAMBER 9" LONG
3D28	DOME	3 6	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	9 10	89	1,2 1	NONE NONE	NONE NONE	2 2	NONE NONE	2 2	NONE NONE	1 1	NONE NONE	98	79 79	11-4-77	20 BUTTONHEADS CORROSION LEVEL 2
2D3	DOME	1 6	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	11 12	90	1 1	NONE NONE	NONE NONE	2 2	NONE NONE	2 2	NONE NONE	1 1	NONE NONE	92	78 77	11-7-77	REPLACED 2-1/4" SHIMS (SHIMS WERE BENT)
42H60	HORIZ	2 4	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	13 14	90	2 1	NONE NONE	1 NONE	2 3	NONE NONE	2 2	NONE NONE	1 1	NONE NONE	104	78 78	11-8-77	
64H70	HORIZ	4 6	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	15 16	90	1 1	NONE NONE	NONE NONE	1 2	NONE NONE	1 2	NONE NONE	1 1	NONE NONE	106	90 66	11-11-77	
68H30	HORIZ	2 6	YES YES	YES YES	YES YES	YES YES	YES YES	NO NO	17 18	90	1 1	1 NONE	NONE NONE	2 2	NONE NONE	2 2	NONE NONE	1 1	NONE NONE	110	71 63	11-15-77	

NOTES:

1. LOCATION – INDICATES THE BUTTRESS AT WHICH THE TENDON IS ANCHORED; OR THE NEAREST BUTTRESS TO THE TENDON (FOR VERTICAL TENDONS)
   T – TOP
   B – BOTTOM

2. ANCHORAGE COMPONENTS
   A. FOR STRESSING WASHERS, THE CORROSION LEVELS INDICATE THE CONDITION OF THE SURFACE WHERE THE BUTTONHEADS ARE ANCHORED.
   B. FOR SHIMS, THE CORROSION LEVELS INDICATE THE THE CONDITION OF THE SURFACES PERPENDICULAR TO THE TENDONS.

3. CORROSION LEVELS
   LEVEL 1 – NO VISIBLE OXIDATION OR LIGHT SPOTTY OXIDATION
   LEVEL 2 – REDDISH BROWN COLOR, NO PITTING
   LEVEL 3 – 0 < PITTING ≤ 0.005" DEPTH
   LEVEL 4 – 0.005" < PITTING ≤ 0.006"
   LEVEL 5 – 0.010" < PITTING ≤ 0.010"
   LEVEL 2 IS EQUIVALENT TO LEVELS A TO E DURING INSTALLATION. CORROSION IN EXCESS OF THIS LEVEL WAS UNACCEPTABLE AT THE TIME OF INSTALLATION.

4. EACH SAMPLE WAS IDENTIFIED WITH TENDON NUMBER AND CLOSEST BUTTRESS NUMBER.

5. EXTERIOR TEMPERATURE DIFFERENCE IS DUE TO STEAM DISCHARGE WHICH WAS ADJACENT TO THE END SHOWING THE HIGHER TEMPERATURE.

TABLE 5.1
SUMMARY OF DATA-DETENSIONING AND WIRE REMOVAL

TENDON		NO. OF EFFECTIVE WIRES	DATE DETENSIONED	AIR TEMPERATURE °F		@ LIFT-OFF			@ 0.8f'_s			@ 1000 LBS/WIRE			TENSIONING EQUIPMENT		INITIAL WIRE LENGTH (FT)	WIRE REMOVAL			
						TENSION			TENSION			TENSION								CORROSION LEVEL[4]	
IDENTIFICATION	ANCHORAGE LOCATION			INT.	EXT.[7]	GAGE (PSI)	FORCE (KIPS)	ELONGATION[1] (IN)	GAGE (PSI)	FORCE[2] (KIPS)	ELONGATION[1] (IN)	GAGE (PSI)	FORCE[3] (KIPS)	ELONGATION[1] (IN)	RAM NO.	GAGE NO.		END CUT	LENGTH NOW (FT)	PREVIOUS[5]	NEW
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
56V29	6/T 6/B	89	10-25-77	117	92 "	6217 "	725 "	5 3/16 "	7150 "	840 "	7 3/16 "	725 "	86 "	-2 5/32 "	18 "	A-210 "	"	"	"	"	"
12V29	2/T 2/B	88	10-27-77	117	78 "	6117 "	715 "	7 "	7050 "	825 "	8 11/16 "	725 "	88 "	-3 "	18 "	A-210 "	"	"	"	"	"
34V29	4/T 4/B	89	10-28-77	117	98 "	6350 "	747 "	6 9/8 "	7150 "	840 "	7 11/16 "	750 "	88 "	-3 15/16 "	18 "	A-210 "	(6) N.A.	B	169.88	1	1
1D28	1 4	88	11-2-77	92	86 85	5950 5883	715 710	3 3/8 3 5/8	8900 8950	830 830	4 1/8 4 7/16	725 750	82 85	-1 1/4 5/16	0508 0408	G-109 221	"	"	"	"	"
3D28	3 6	89	11-4-77	98	83 79	5950 5867	720 700	3 7/8 2 7/8	7000 7050	835 845	4 3/4 3 3/4	775 750	90 90	0 -25/32	0408 0508	221 G-109	"	"	"	"	"
2D3	1 6	90	11-8-77	1 92	86 90	5767 5933	692 714	2 1/8 2 1/4	7100 7100	855 845	2 7/8 3 1/16	800 800	94 90	-25/32 0	0508 0408	G-109 221	(6) N.A.	1	98.37	"	1
42H00	2 4	90	*11-9-77	92	76 81	5867 5917	696 703	2 3/8 2 1/4	7050 7100	845 848	3 15/16 3 3/8	750 800	88 90	-1 9/8 -5/8	0508 0408	G-109 221	(6) N.A.	4	148.25	"	1
64H70	4 6	90	11-11-77	106	83 66	5683 5600	686 670	2 3/8 3 3/8	7100 7100	848 855	3 9/16 4 13/32	800 775	90 88	-5/16 -1 7/16	0408 0508	221 G-109	"	"	"	"	"
62H38	2 8	90	11-15-77	110	71 86	5333 5650	642 680	2 5/8 3 1/2	7100 7100	855 848	3 15/16 4 25/32	750 800	90 90	-1 1/4 1/2	0508 0408	G-109 221	"	"	"	"	"

NOTES:

(1) ELONGATION - THE CLEAR DISTANCE BETWEEN THE OUTSIDE FACE OF THE BEARING PLATE AND THE INSIDE FACE OF THE STRESSING WASHER. A NEGATIVE NUMBER IS INDICATED WHEN THE STRESSING WASHER IS INSIDE THE TRUMPET.

(2) FORCE EQUALS TO 9.43 KIPS MULTIPLIED BY THE NUMBER OF EFFECTIVE WIRES.

(3) FORCE EQUALS TO 10 KIP MULTIPLIED BY THE NUMBER OF EFFECTIVE WIRES.

T - DENOTES TOP

B - DENOTES BOTTOM

(4) CORROSION LEVELS:
1. NO VISIBLE OXIDATION
2. REDDISH BROWN COLOR; NO PITTING
3. 0.000 < PITTING ≤ 0.003"
4. 0.001 < PITTING ≤ 0.006"
5. 0.006 < PITTING ≤ 0.013"

(5) PREVIOUS SURVEILLANCE OR INITIAL CONDITION, WHICHEVER APPLIES.

(6) N.A. = NOT AVAILABLE

(7) EXTERIOR TEMPERATURE DIFFERENCE BETWEEN THE TWO ENDS IS DUE TO STEAM DISCHARGE WHICH WAS ADJACENT TO THE END SHOWING THE HIGHER TEMPERATURE

Table 5.2

NORMALIZING FACTORS AND NORMALIZED TENDON LIFT-OFF FORCES

Tendon No.	Anchorage Location	Normalizing Factor	Normalized Lift-off Force/Wire(k)	
			Each end	Average per wire
1D28	1	0.978	7.95	7.72
	4	0.929	7.50	
2D3	1-2	0.934	7.18	7.32
	5-6	0.940	7.46	
3D28	3	0.901	7.29	7.26
	6	0.909	7.23	
42H80	2	0.994	7.51	7.56
	4	0.976	7.62	
62H38	2	0.943	6.72	7.14
	6	1.000	7.56	
64H70	4	0.957	7.31	7.02
	6	0.892	6.72	
12V29	T*	0.932	7.57	7.57
34V29	T*	0.902	7.57	7.57
56V29	T*	0.911	7.42	7.42

T* denotes top

TABLE 6.1
SUMMARY OF DATA–RETENSIONING AND SHEATH FILLER INSTALLATION

TENDON		NO. OF EFFECTIVE WIRES	DATE RETENSIONED	AIR TEMPERATURE °F		@ 1000 LBS./WIRE				@ 0.8 f_s				@ LIFT-OFF				TENSIONING EQUIPMENT		SHEATH FILLER		
						TENSION		ELONGATION (IN)[1]		TENSION		ELONGATION (IN)[1]		TENSION		ELONGATION(IN)[1]				DATE FILLED	VOLUME REPLACED (GALS.)	FILLER TEMPERATURE @ OUTLET
IDENTIFICATION	ANCHORAGE LOCATION			INT.	EXT. [6]	GAGE (PSI)	FORCE[2] (KIPS)	NOW[4]	CHANGE[5]	GAGE (PSI)	FORCE[3] (KIPS)	NOW[4]	CHANGE[5]	GAGE (PSI)	FORCE (KIPS)	NOW[4]	CHANGE[5]	RAM NO.	GAGE NO.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
S6V29	6/T 6/B	89	10-26-77	117	82 "	750 "	89 "	-2 3/8 "	-19/32	7100 "	831 "	7 21/32 "	15/32	6300 "	740 "	6 3/4 "	5/8	18 "	A-216 "	10-27-77 10-28-77	95	30 GAL POURED FROM TOP (10-28-77)
12V29	2/T 2/B	88	10-27-77	117	82 "	725 "	86 "	-3 3/4 "	-3/4	7050 "	825 "	8 1/4 "	+7/16	6325 "	742 "	7 5/8 "	3/8	18 "	A-216 "	10-28-77	73	132
34V29	4/T 4/B	88	10-31-77	117	82 "	725 "	86 "	-4 "	1 1/16	7050 "	825 "	7 11/16 "	"	6483 "	758 "	6 3/4 "	1/8	18 "	A-216 "	10-31-77	100	125
1D28	1 4	88	11-3-77	92	83 86	725 750	82 85	1/4 -1 1/2	-9/16	6900 6975	830 830	5 15/32 3 1/4	5/32	5987 6058	716 730	3 5/16 3 3/4	1/16	0508 0408	G-109 221	11-3-77	23	135
3D28	3 6	89	11-7-77	98	77 83	775 750	89 88	-1 17/32	5/16	7000 7000	835 841	3 5 3/8	-1/8	6067 5956	735 710	3 5/16 3 7/16	"	0408 0508	221 G-109	11-7-77	33	148
2D3	1 6	89	11-8-77	92	86 90	800 775	92 89	-11/32 -11/16	-1/4	7000 7000	841 835	3 5/32 2 7/8	3/32	6083 5900	730 710	2 3/8 2 1/2	1/2	0508 0408	G-109 221	11-8-77	28	139
42H69	2 4	89	11-9-77	92	76 81	750 775	88 89	-1 13/32 -3/4	3/32	7000 7000	841 835	3 13/16 2 11/16	-13/16	5817 5800	700 700	2 5/8 2 1/2	1/2	0508 0408	G-109 221	11-10-7	18	120
64H70	4 6	90	11-11-77	106	70 66	800 750	92 90	-5/8 -1 1/4	-1/8	7100 7050	840 845	4 7/32 3 23/32	-1/3	5700 5600	690 675	2 3/8 2 3/16	-3/16	0408 0508	221 G-109	11-14-7	28	110
82H28	2 6	90	11-15-77	110	71 72	750 800	90 92	-5/32 -1/2	3/32	7100 7100	855 848	4 3/4 3 7/8	-3/32	5386 5717	646 691	2 3/8 3	1/4	0508 0408	G-109 221	11-16-7	12	130

NOTES:

(1) ELONGATION–THE CLEAR DISTANCE BETWEEN THE OUTSIDE FACE OF THE BEARING PLATE AND THE INSIDE FACE OF THE STRESSING WASHER. A NEGATIVE NUMBER IS INDICATED WHEN THE STRESSING WASHER IS INSIDE THE TRUMPET.

(2) FORCE EQUALS TO 1.0 KIP MULTIPLIED BY THE NUMBER OF EFFECTIVE WIRES.

(3) FORCE EQUALS TO 9.43 KIPS MULTIPLIED BY THE NUMBER OF EFFECTIVE WIRES.

T- DENOTES TOP

B-DENOTES BOTTOM

(4) NOW- DENOTES ELONGATION AT TIME OF RETENSIONING. MEASUREMENTS ARE TO THE NEAREST 1/16".

(5) CHANGE IN ELONGATION AS COMPARED TO PREVIOUS MEASUREMENT UNDER THE SPECIFIED LOAD.

(6) EXTERIOR TEMPERATURE DIFFERENCE BETWEEN THE TWO ENDS IS DUE TO STEAM DISCHARGE WHICH WAS ADJACENT TO THE END SHOWING THE HIGHER TEMPERATURE

TABLE 7.1

WIRE TEST RESULTS - 100 IN. GAGE LENGTH

Tendon No.	Sample No. (1)	Load at 1% Ext. (lbs.)	Stress at 1% Ext. (psi)	Load at Fracture (lbs.)	Stress at Fracture (psi)	Elongation at Fracture (in.)	Fracture Location Moving Head (in.)
34V29	C.E.	10,050	205,100	12,700	259,200	4.59	37.0
	B.E.	9,850	200,600	12,700	258,700	4.87	3.0
	M.S.	10,650	217,300	12,800	261,200	4.51	6.63
42H80	C.E.	10,150	206,300	12,150	246,950	4.72	3.0
	B.E.	10,150	206,300	12,200	247,950	5.42	37.5
	M.S.	10,300	209,350	12,200	247,950	5.49	AT JAW
2D3	C.E.	10,250	208,900	12,350	251,500	5.53	3.0
	B.E.	9,600	195,500	12,250	249,500	4.92	9.0
	M.S.	10,150	207,100	12,350	252,000	5.56	30.25

(1) C.E. denotes cut end of wire
B.E. denotes button head end of wire
M.S. denotes middle section of wire

APPENDIX A

TENDON SURVEILLANCE PROCEDURE

FOR

CONTAINMENT STRUCTURE

POST-TENSIONING SYSTEM

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

By Charles W Andrews
Charles W. Andrews

June, 1977

Approved: K P Buchert
K. P. Buchert
Chief Civil Engineer
Gaithersburg Power
Divison

Revision 1, July 22, 1977 CWA
Revision 2, October 11, 1977 CWA
Revision 3, December 14, 1977 CWA

1.0 PURPOSE

The purpose of this surveillance is to obtain data for assessing the continued quality and structural performance of the major components of the containment structure post-tensioning system.

2.0 SCOPE

The surveillance for each tendon shall consist of the following:

2.1 Removing and visually inspecting sheath filler, and obtaining samples for laboratory testing.

2.2 Inspecting anchorage assemblies and measuring the thickness of shims.

2.3 Obtaining tendon lift-off force and elongation.

2.4 Detensioning, removing shims, and inspecting wire continuity.

2.5 Removing wires where required, for visual examination and laboratory testing.

2.6 Retensioning, installing shims, and obtaining tendon lift-off force.

2.7 Installing sheath filler.

2.8 Testing wire samples per Attachment E. 3

2.9 Testing sheath filler per Attachment F.

2.10 Evaluating surveillance data and test results to assess the general condition of the post-tensioning system.

Temporary protection shall be provided for the tendons and anchorages during surveillance. The end anchors and wires removed shall be protected by applying a coating of Visconorust 1601, Amber over the surfaces. The elapsed time between removing and replacing sheath filler from one tendon shall not exceed 2 weeks.

Tendon surveillance may be conducted during reactor operation.

3.0 SURVEILLANCE TENDONS

Surveillance tendons for the Unit 4 containment structure shall consist of 3 dome tendons, 3 horizontal tendons, and 3 vertical tendons. The identification numbers of these tendons are listed below:

3.1 Dome tendons: 1D28, 2D3, 3D28

One wire shall be removed from Tendon 2D3.

3.2 Horizontal tendons: 62H38, 42H80, 64H70

One wire shall be removed from Tendon 42H80.

3.3 Vertical tendons: 12V29, 34V29, 56V29.

One wire shall be removed from Tendon 34V29.

4.0 INITIAL INSTALLATION RECORDS AND PREVIOUS SURVEILLANCE DATA

Original records of initial tendon installation, and of subsequent surveillances, are maintained by Florida Power & Light Company. The original installation records are in card form and contain information pertaining to tendon pulling, button-heading, tensioning, and sheath filling. The surveillance data consists of the raw data recorded during surveillances and the surveillance reports.

5.0 SURVEILLANCE PROCEDURES

5.1 Removal and Inspection of Sheath Filler

The sheath filler, Visconorust 2090P, may be liquid, gel, or solid. All states may occur at a particular tendon. Complete removal of the sheath filler is not required, provided that all filler drained or removed during the surveillance is replaced. The sheath filler shall be removed as follows:

5.1.1 Record air temperature outside the containment near the surveillance tendon and inside the containment.

5.1.2 Remove the grease caps from both ends of the tendon and allow the filler to flow into containers of known volume.

5.1.3 Obtain a one-quart sample of filler from each end of the tendon.

5.1.4 Record lack of grease coverage on end anchors, if any.

5.1.5 Record any discoloration of sheath filler on the Sheath Filler Inspection Form (Figure A-6). (The color of the filler should be dark brown.) | 3

5.1.6 Measure and record the amount of grease removed.

5.2 Inspection of Anchorage Components

5.2.1 Thoroughly clean the anchorage components with Viscosity Oil Company's Industrial Solvent No. 16 in accordance with the manufacturer's instructions. Chlorinated hydrocarbon solvents shall <u>not</u> be used.

5.2.2 Inspect and record the buttonheads for shape and size, using the Go/No-Go gage as shown in Figure A-1; cracks; | 3

 | 3

and corrosion status. Compare the number of buttonheads with the number at the previous surveillance. Identify missing buttonheads and any buttonhead defects on the end Anchorage Inspection Form as shown in Figure A-3. |3

5.2.3 Inspect and record the stressing washers for corrosion status and cracks. If any cracks are observed, show the locations and sizes on the Anchorage Inspection Form.

5.2.4 Inspect and record the shims for corrosion and cracks. If cracks are observed, prepare a sketch showing their locations.

5.2.5 Inspect and record the bearing plates at the contact surfaces with the shims for corrosion and cracks. If cracks are observed, prepare a sketch showing their locations.

5.2.6 Definitions of corrosion levels for the tendon wires and anchorage components for the surveillance are as follows:

Corrosion Level	Description
1	No visible corrosion
2	Reddish-brown color; no pitting
3	$0.000 < \text{pitting} \leq 0.003$"
4	$0.003 < \text{pitting} \leq 0.006$"
5	$0.006 < \text{pitting} \leq 0.010$"

The corrosion levels for the surveillance as compared to the criteria used during the field installation are indicated below:

Corrosion Level		Acceptability at
Surveillance	Field Installation	Installation
1	A*	Acceptable
2	B,C,D,E*	Acceptable
3,4,5	F*	Unacceptable

5.3 Detensioning and Lift-off Forces

5.3.1 Safety

All personnel on work platforms during detensioning and retensioning operations shall be familiar with, and abide by, the following safety rules:

a. Do not stand behind the jacks while they are pressurized.

b. Keep fingers away from the tendons and jacks, except when required to read lift-off forces, and remove or install shims.

*Prescon symbols identifying Corrosion Level (no longer used).

|3

5.3.2 Calibration

All gages and jacks used for the tendon surveillance shall be calibrated before use. Gages and jacks shall not be recalibrated unless damaged or repaired. Prior to use, gages shall be checked for zero deviation and damage.

5.3.3 Detensioning Tendons

5.3.3.1 Determine the number of effective wires for each tendon from the previous surveillance.

5.3.3.2 Calculate and record the jacking forces required to obtain the specified 80 percent minimum ultimate strength (0.8f's) per wire. These forces are obtained by multiplying the number of effective wires by 9.43 kips. Enter these values into the jack calibration chart to obtain the gage readings equivalent to the forces. Note that the applied jacking force for each tendon shall not exceed the value thus determined.

5.3.3.3 Attach the jack to the bearing plate. Note that if the initial stressing was done from both ends of a tendon, the surveillance shall be performed in the same manner.

5.3.3.4 Install the pressure gages to the jack and pump, and record their identification numbers. Check the gages for zero pressure reading.

5.3.3.5 Measure the depth of the existing shims.

5.3.3.6 Determine the lift-off force by tensioning the tendon until all shims are loosened. Lift-off is achieved when the sound produced by tapping on shims with a small hammer changes to indicate release from compression; also, all accessible shims can be moved by tapping with a small hammer. Repeat the operation until three measurements of the lift-off forces show a variation of $\pm$ 50 psig, or less.

5.3.3.7 Depressurize the jack until the gages read zero.

5.3.3.8 Pressurize the jack to a force so that the average wire stress is equal to 80 percent of the minimum ultimate strength of the wires, as determined in paragraph 5.3.3.2.

5.3.3.9 Record on the Detensioning/Retensioning Form (Figure A-4) the gage reading and the corresponding tendon elongation. |3

|3

5.3.3.10 Remove the shims.

5.3.3.11 Depressurize the jack until the gages read zero.

5.3.3.12 Pressurize the jack to a force equivalent to 1,000 lbs per wire.

5.3.3.13 Record on the Detensioning/Retensioning Form the gage reading and the corresponding tendon elongations.

5.3.3.14 Depressurize the jack until the gages read zero. Detach the gages from the jack.

5.3.3.15 Remove the jack.

5.4 Wire Inspection

5.4.1 Inspect each tendon wire for continuity by pulling from one end, one wire at a time, and observing the movement of the buttonhead at the opposite end. The tool for pulling the individual wires is shown in Figure A-2. Prior to inspecting the wires, it is necessary to move the stressing washer away from the buttonheads approximately 3 inches This may be accomplished by using a hammer and a wood buffer block. |3

Record any discontinuous wires on the Anchorage Inspection Form. All discontinuous wires shall be removed and examined to determine the cause of breakage. Discontinuous wires shall not be used for surveillance wire test samples.

5.4.2 Remove one test wire from each of the following tendons:

Dome Tendon: 2D3

Horizontal tendon: 42H80

Vertical tendon: 34V29

The locations of the buttonheads of the wires to be removed, shall be recorded on the end Anchorage Inspection Form.

5.4.3 Pull the test wire at the end to be cut away from the stressing washer and notch approximately 2 inches from the end. Record the end that is cut, and the distance from the notch to the outside of the buttonhead within ± 0.02 inches.

5.4.4 Cut the wire between the buttonhead and the notch. Remove the remaining portion of the wire and clean it with solvent, (Viscosity Oil Co. Industrial Solvent No. 16).

5.4.5 Inspect the wire and record on the Wire Inspection Form (Figure A-5) the locations of any damages, corrosion, and corrosion levels. |3.

5.4.6 Compare the corrosion levels with those of the previous surveillance. If the corrosion has progressed one or more levels, remove one additional wire at approximately 120° from the first wire, repeating paragraph 5.4.3, 5.4.4, and 5.4.5.

If the second wire has progressed one or more levels, repeat this procedure for a third wire selected at approximately 120° from the first two. Do not remove more than three wires from any one tendon during one surveillance period.

5.5 Retensioning and Lift-off Forces

5.5.1 Safety

The safety rules as specified in paragraph 5.3.1 shall apply.

5.5.2 Retensioning Tendons

Retensioning shall be performed in a similar manner as detensioning; that is, if detensioning is done from both ends of a tendon, retensioning shall be performed accordingly.

5.5.2.1 Determine the number of effective wires in the tendon for retensioning. Deduct any discontinuous or surveillance test wires removed and recalculate the new jacking forces as outlined in paragraph 5.3.3.2.

5.5.2.2 Attach the jack to the bearing plate.

5.5.2.3 Install the pressure gages to the jack and pump, and record their identification numbers. Check the gages for zero pressure reading.

5.5.2.4 Pressurize the jack to a force equivalent to 1,000 lbs per wire. Record the gage reading and the corresponding tendon elongation.

5.5.2.5 Increase the tensioning force so that the average wire stress is equal to 80 percent of the minimum ultimate strength of the wires, as

|3

determined in paragraph 5.5.2.1. Record the gage reading and the corresponding tendon elongation.

5.5.2.6 Reduce the jacking force from the equivalent of 80 percent of the minimum ultimate strength of the wires, to the initial lift-off reading as obtained in paragraph 5.3.3.6.

For any discontinuous or test wires removed, deduct 50 psi from the initial lift-off readings. Measure the distance from the bottom of the stressing washer to the bearing plate and subtract one-eighth inch. This distance is defined as full shim depth and is the depth of the new shims to be installed.

5.5.2.7 Install shims to the nearest one-eighth inch of the full shim depth.

5.5.2.8 Obtain new lift-off force. The reading should be equal to or greater than the initial lift-off force. If not, repeat the procedures as stated in paragraphs 5.5.2.5 and 5.5.2.6. Install shims and obtain new lift-off force.

5.5.2.9 Measure and record new shim depth.

5.5.2.10 Detach the jack and apply a coating of Viscosity Oil Co. 2090P or 1601 Amber to the tendon end anchorages.

5.6 Installing Sheath Filler

5.6.1 Reinstall tendon filler caps using new gaskets, copper washers, and teflon nuts as used in the initial installation.

5.6.2 Refill the tendon sheathing with Viscosity Oil Co. Viscorust 2090P, 2090P-2, or 2090P-4 sheath filler. The temperature of the filler at the filler pump shall be approximately 120°F. Do not reuse filler that has been removed from the tendons. Pumping shall continue from one end of the tendon, until at least 5 gallons of filler, without any air bubbles or visible foreign substances, flows out of the outlet at the opposite end of the tendon.

5.6.3 Record the temperature of the sheath filler at the drum and at the outlet. Also, record on the Sheath Filler Inspection Form the volume of sheath filler replaced for each surveillance tendon.

5.7 Laboratory Testing of Tendon Wire Samples and Sheath Filler Samples

5.7.1 Tendon Wire Sample Testing

5.7.1.1 Tensile tests shall be performed on at least three specimens from each surveillance wire removed. Tensile test specimens, each approximately 126 inches long, shall be taken from near the center and each end of the wires. Additional specimens shall be taken from the portions of the wire that appear to have a corrosion rating one or more levels greater than the average descriptions of the wires.

5.7.1.2 Remaining wires not used for testing, shall be protected against corrosion and retained until test results have been finalized.

5.7.1.3 Tensile tests also shall be made on at least one specimen from each discontinuous wire removed. The test specimen shall be taken near the break and shall be approximately 126 inches long.

5.7.1.4 All tensile tests shall be performed in accordance with Appendix E, "Specification for Tensile Testing of Post-Tensioning Tendon Wire." |3

5.7.2 Sheath Filler Sample Testing

5.7.2.1 Analytical testing shall be performed on at least one specimen, each one quart in size, from each surveillance tendon.

5.7.2.2 Additional specimen obtained from the surveillance tendons, but not used for testing, shall be retained until test results have been finalized.

5.7.2.3 All sheath filler testing shall be performed in accordance with Appendix F, "Specification for Laboratory Testing of Sheath Filler." |3

5.8 Report

5.8.1 Data

Data obtained during the surveillance shall be summarized in a report. The original data and records of the surveillance shall be submitted to Florida Power and Light Company within 90 days of completion of the tendon surveillance at the Turkey Point Plant.

|3

5.8.2 Evaluation

The surveillance data for each tendon shall be compared with previous records to determine if:

a. Additional wires have broken since last surveillance.

b. The lift-off force for the tendon is below the minimum effective design prestress.

c. Changes in wire corrosion level, or anchorage assembly corrosion level, have occurred.

d. Deterioration of sheath filler has occurred.

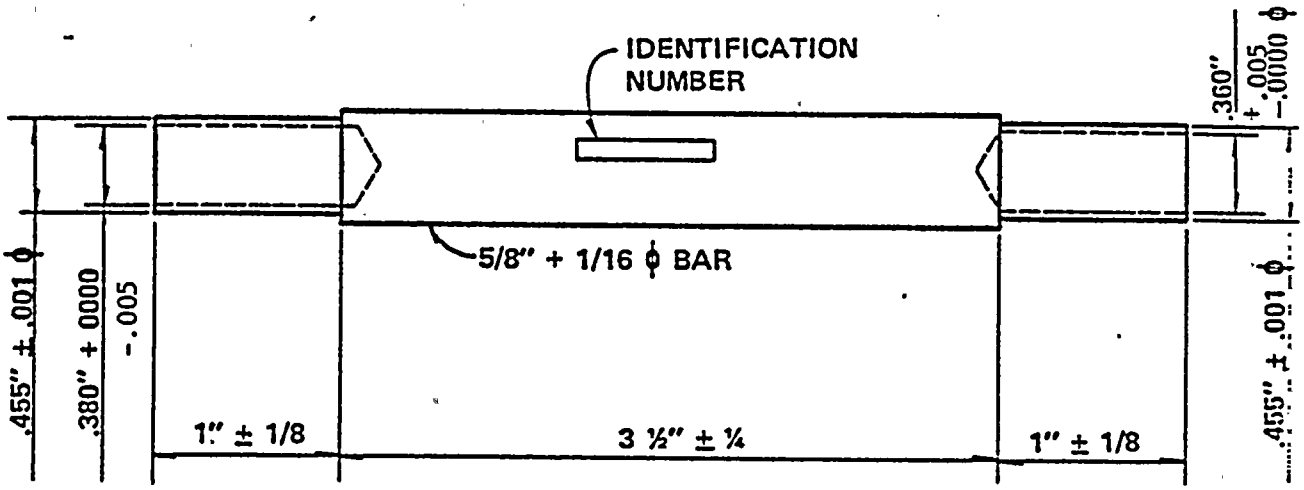
e. Significant changes in wire elongation, yield, and ultimate strength have occurred.

If any of these conditions exists, the report shall include an evaluation of condition and, where necessary, recommendations for remedial actions.

5.8.3 Formulas

Formulas for normalizing factors and normalized forces are given in Appendix B. . |3

|3



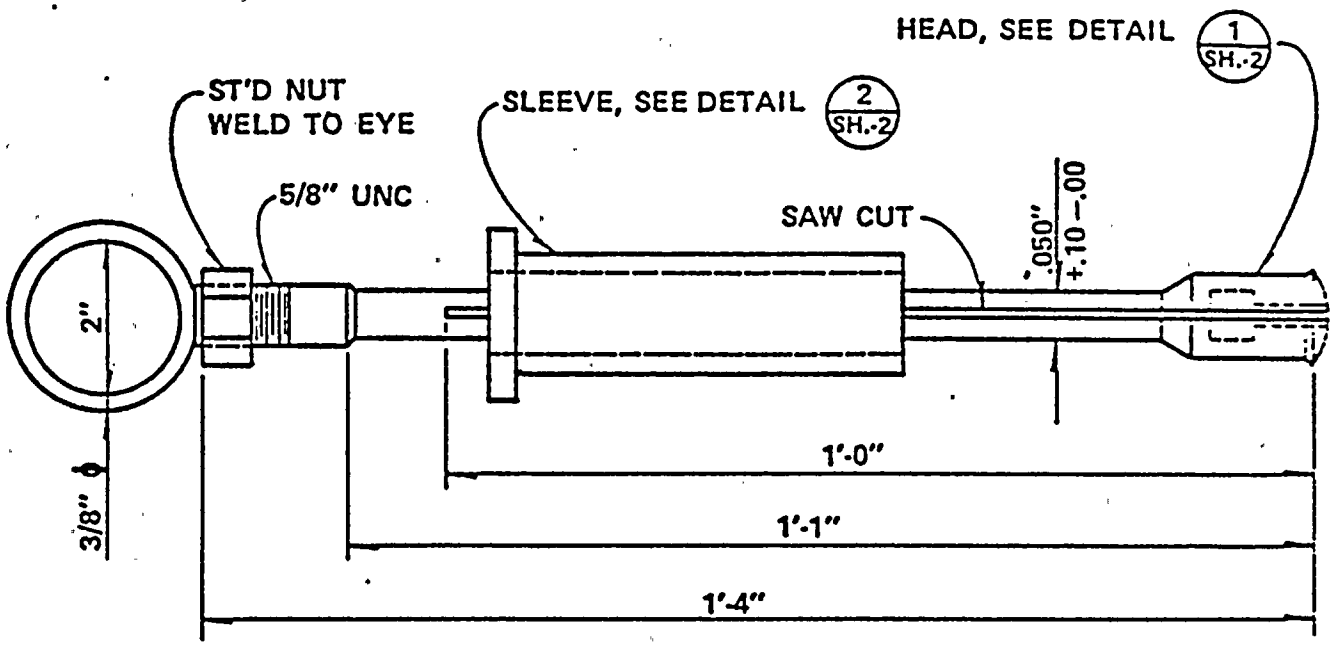
NOTES:

1. Hole diameter shall be certified by an independent laboratory.

2. Each gage shall have an identifying number.

Figure A-1

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
TENDON SURVEILLANCE
UNIT 4
GO/NO-GO GAGE

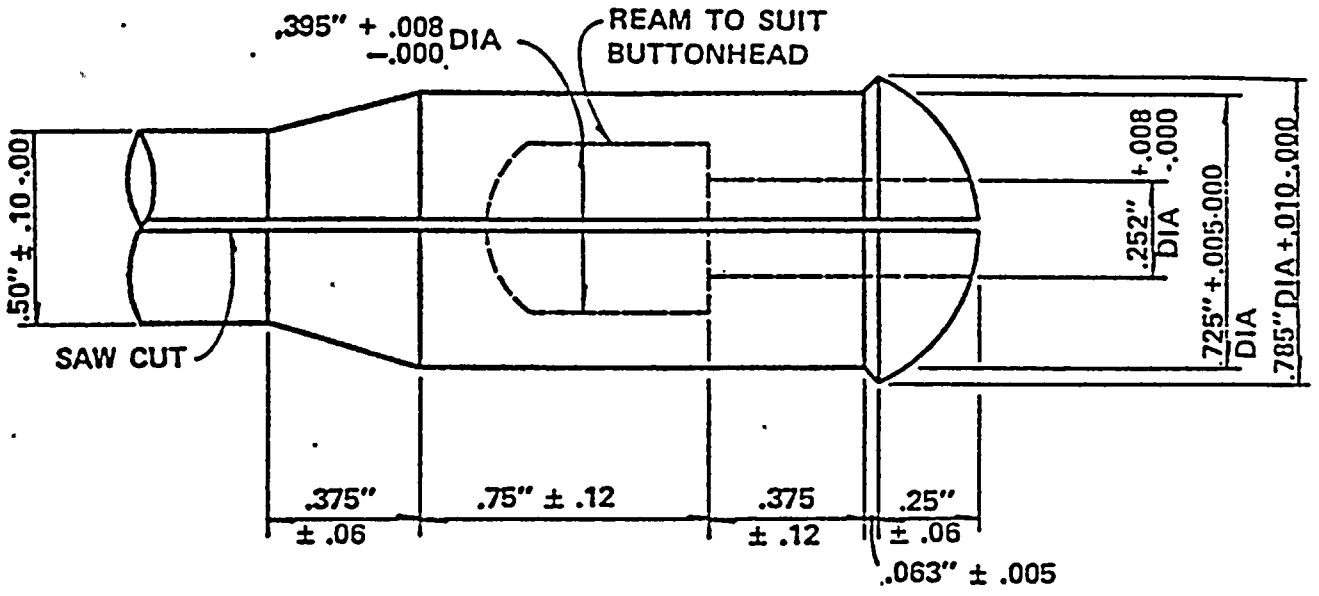


NOTES:

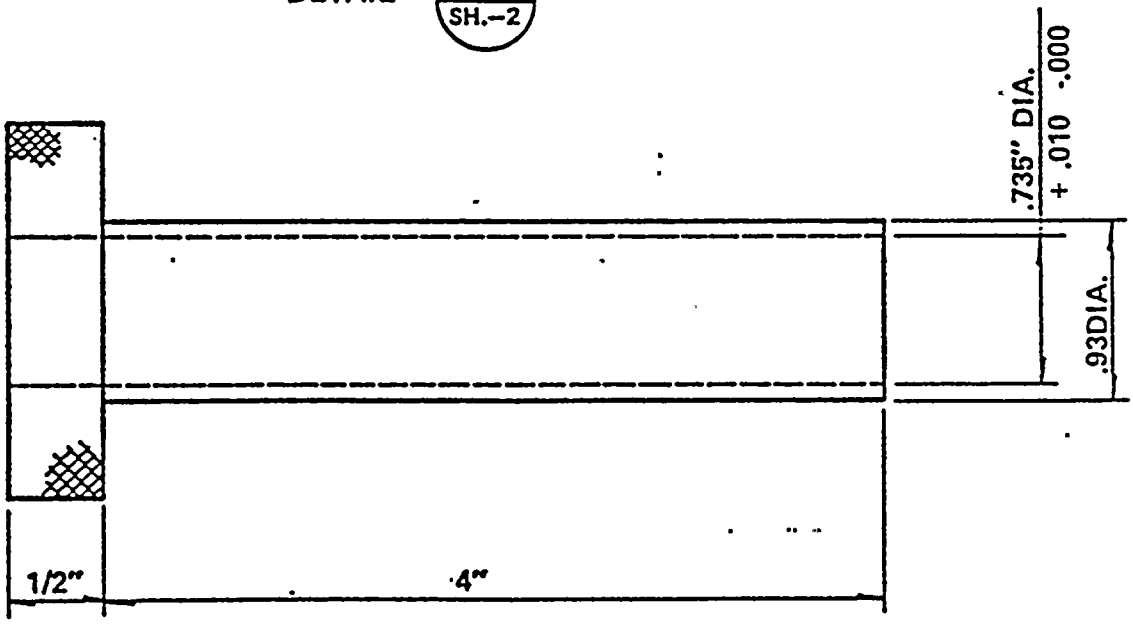
1. The nut with the pulling ring welded to it may be replaced with an eye nut.
2. The hardness of this tool shall not exceed Rockwell C40.

FIGURE A-2 SHEET 1 OF 2

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
TENDON SURVEILLANCE
Unit 4
WIRE PULLER



HEAD DETAIL 1 SH.–2

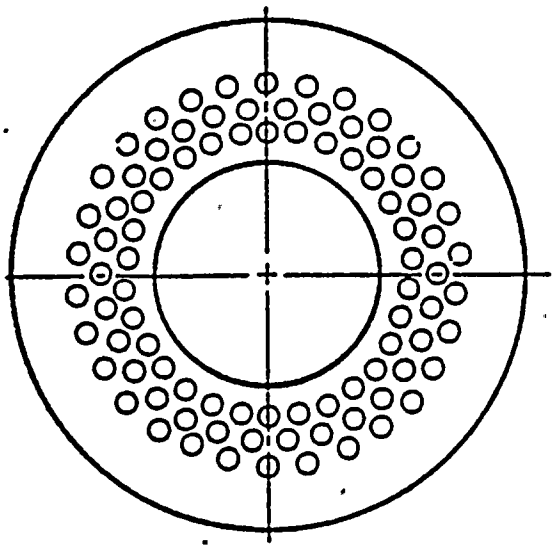


MOVABLE SLEEVE DETAIL 2 SH.–2

FIGURE A-2 SHEET 2 OF 2

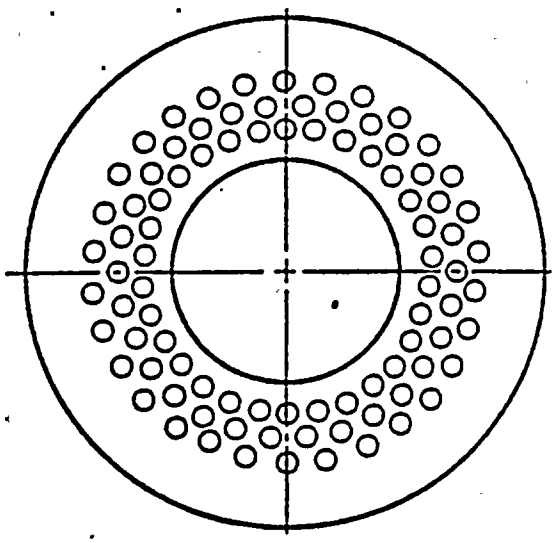
FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
TENDON SURVEILLANCE
Unit 4
WIRE PULLER

TENDON NO. _____ LOCATION (CLOSEST BUTTRESS) _____



END ANCHORAGE A

(CLOSEST BUTTRESS____)



END ANCHORAGE B

(CLOSEST BUTTRESS____)

CORROSION LEVEL

WASHER _____

BUTTONHEADS _____

SHIMS _____

BEARING PLATE _____

CORROSION LEVEL

WASHER _____

BUTTONHEADS _____

SHIMS _____

BEARING PLATE _____

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ⊛ WIRE REMOVED PREVIOUSLY
- ⌀ DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A _____ DATE _____

END ANCHORAGE B _____ DATE _____

FIGURE A-3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
Unit 4
POST-TENSIONING SYSTEM
5th-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

SHEET__OF__

TENDON NO. _____ BUTTRESS _____ INSPECTED BY _____ DATE _____

RAM NO. _____ NUM. EFF. WIRES EXTERIOR TEMPERATURE _____

GAGE NO. _____ @ DETENSIONING _____ INTERIOR TEMPERATURE _____

@ RETENSIONING _____

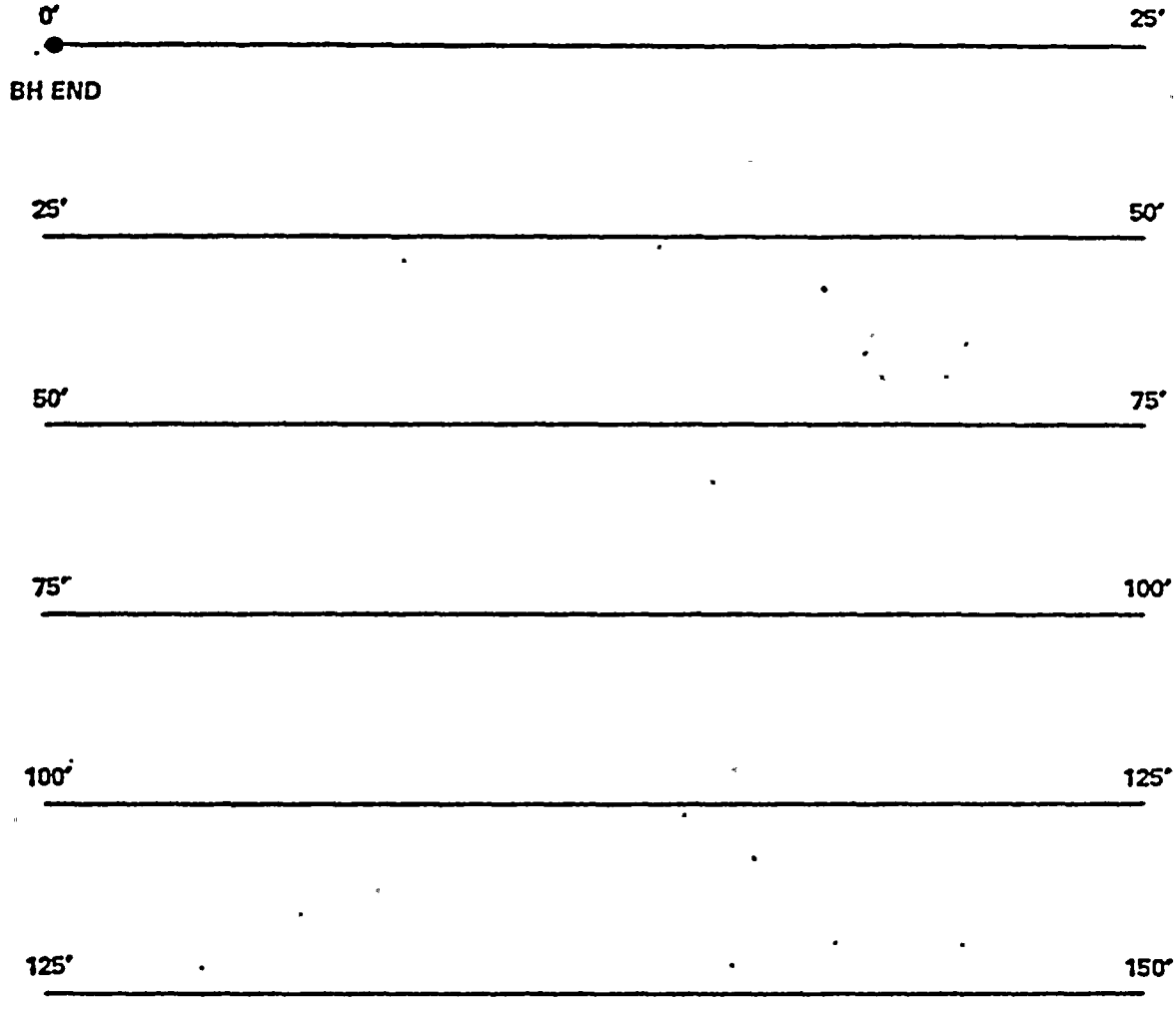
	DESCRIPTION	OBJECTIVE	ACTUAL MEASURED
DETENSIONING	CHECK GAGES (ZERO)		
	MEASURE SHIMS		
	OBTAIN LIFT-OFF		
	PRESSURIZE TO $.8f'_s$		
	MEASURE ELONGATION @ $.8f'_s$ **		
	DEPRESSURIZE TO ZERO		
	PRESSURIZE TO 1000 LB/WIRE		
	MEASURE ELONGATION **		
	DEPRESSURIZE TO ZERO		
	REMOVE RAM		
	REMOVE WIRE		
	WAS THIS END CUT?		
	CHECK CONTINUITY		
RETENSIONING	PRESSURIZE AT 1000 LB/WIRE		
	MEASURE ELONGATION **		
	PRESSURIZE TO $.8f'_s$		
	MEASURE ELONGATION AT $.8f'_s$ **		
	PRESSURE @ RESHIM *		
	A) NEW LIFT-OFF		
	B) NEW SHIMS		

* PRESSURE SHALL NOT DROP BELOW THIS LEVEL AFTER PRESSURIZATION TO $.8f'_s$

** ELONGATION IS THE DISTANCE FROM THE OUTSIDE FACE OF THE BEARING PLATE TO THE INSIDE FACE OF THE STRESSING WASHER. (THIS WILL BE A NEGATIVE NUMBER IF THE WASHER IS INSIDE THE TRUMPET.)

FIGURE A-4

TENDON NO. _____ CLOSEST BUTTRESSES _____



TOTAL LENGTH OF WIRE _____

CORROSION LEVEL:

- ☐ #1 NO VISIBLE OXIDATION
- ☐ #2 VISIBLE OXIDATION, NO PITTING
- ☐ #3 0" < PITTING ≤ 0.003"
- ☐ #4 0.003" < PITTING ≤ 0.006"
- ☐ #5 0.006" < PITTING ≤ 0.010"

INSPECTED BY _____

DATE _____

BH. - BUTTONHEAD

FIGURE A-5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
Unit 4
POST TENSIONING SYSTEM
5th YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET __ OF __

Revision 3

SHEATHING FILLER INSPECTION

TENDON NO. _____

END ANCHORAGE A	END ANCHORAGE B
CLOSEST BUTTRESS _____	CLOSEST BUTTRESS _____
DETENSIONING:	DETENSIONING:
TEMPERATURE:	TEMPERATURE:
OUTSIDE _____	OUTSIDE _____
INSIDE _____	INSIDE _____
GREASE REMOVED _____	GREASE REMOVED _____
COLOR _____	COLOR _____
BY: _____	BY: _____
DATE: _____	DATE: _____
RETENSIONING:	RETENSIONING:
TEMPERATURE:	TEMPERATURE:
OUTSIDE _____	OUTSIDE _____
INSIDE _____	INSIDE _____
INLET _____	INLET _____
OUTLET _____	OUTLET _____
GREASE REPLACED _____	GREASE REPLACED _____
BY: _____	BY: _____
DATE: _____	DATE: _____

FIGURE A-6

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
Unit 4
POST-TENSIONING SYSTEM
5th YEAR SURVEILLANCE

SHEET OF

APPENDIX B

FORMULAS

FOR

NORMALIZING FACTORS AND NORMALIZED FORCES

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland
June 1977
Revision 1, December 15, 1977

1.0 GENERAL

In order to provide a common base for comparison, tendon lift-off forces must be normalized to account for elastic stress loss during initial installation (a function of the post-tensioning sequence), the lift-off force deviation from the base value, and the number of effective tendon wires or strands. The base value for evaluating the normalized tendon force is assumed to be the force which produces an average tendon wire or strand stress of 0.7fpu. In cases where the same tendon is subjected to two or more surveillances, the base value for the ith surveillance is the normalized force for the i-1 surveillance.

The normalized force is equal to the measured lift-off forces multiplied by the normalizing factors.

2.0 NORMALIZING FORMULAE

2.1 Normalizing Formulae for First Surveillance (i = 1)

2.1.1 Vertical Tendons

$$N_{F_1} = \frac{0.7f_{pu}}{\frac{L_c}{N_{wc}A_w} - \left(\frac{N_v - n_v}{N_v}\right)S_{E_V} + V\left(\frac{N_h - n_h}{N_h}\right)S_{E_H}} \qquad \text{(Eq. 1)}$$

2.1.2 Hoop Tendons

$$N_{F_1} = \frac{0.7f_{pu}}{\frac{L_c}{N_{wc}A_w} - \left(\frac{N_h - n_h}{N_h}\right)S_{E_H} + V\left(\frac{N_v - n_v}{N_v}\right)S_{E_V}} \qquad \text{(Eq. 2)}$$

2.1.3 Dome Tendons

$$N_{F_1} = \frac{0.7f_{pu}}{\frac{L_c}{N_{wc}A_w} - \left(\frac{N_d - n_d}{N_d}\right)\left(2 - v\sqrt{3}\right)S_{E_D}} \qquad \text{(Eq. 3)}$$

2.2 Normalized Lift-Off Force Per Wire or Strand

$$F_{N_i} = F_{w_i} \times N_{F_i} \qquad \text{(Eq. 4)}$$

1

2.3 Normalizing Factor for Subsequent Surveillances (i > 1)

The following equation is used for vertical-dome, hoop-wall, or hoop-dome tendon:

$$N_{F_i} = N_{F_{(i-1)}} \left(\frac{L_{(i-1)} \times N_{wr(i-1)}}{L_{r(i-1)} \times N_{w(i-1)}} \right) \qquad \text{(Eq. 5)}$$

3.0 NOMENCLATURE

L_c = initial lift-off force of surveillance tendon (kips)

$L_{(i-1)}$ = lift-off force obtained at the i-1 surveillance (kips)

$L_{r_{(i-1)}}$ = lift-off force during retensioning at the i-1 surveillance (kips)

n_h = number of hoop tendons tensioned prior to tensioning surveillance tendon

N_h = total number of hoop tendons

n_v = number of vertical tendons tensioned prior to tensioning surveillance tendon

N_v = total number of vertical tendons in one group

n_d = number of dome tendons in one group tensioned prior to tensioning surveillance tendon

N_d = total number of dome tendons

N_{wc} = number of effective wires or strands in surveillance tendon at initial installation

N_{wi} = number of effective wires or strands in surveillance tendon at ith surveillance

$N_{w_{(i-1)}}$ = number of effective wires or strands in surveillance tendon at i-1 surveillance

$N_{wr_{(i-1)}}$ = number of effective wires or strands in surveillance tendon when retensioned during the i-1 surveillance

S_{E_h} = total elastic stress loss in hoop tondons during initial tensioning (ksi) = 15.3 ksi

S_{E_v} = total elastic stress loss in vertical tendons during initial tensioning (ksi) = 6.6 ksi

F_{wi} = lift-off force per wire or strand at i^{th} surveillance (kips)

$F_{wr_{(i-1)}}$ = lift-off force per wire or strand after retensioning at the i-1 surveillance (kips)

F_{N_i} = normalized lift-off force per wire or strand for the i^{th} surveillance (kips)

N_{F_i} = normalizing factor for the i^{th} surveillance

$N_{F_{(i-1)}}$ = normalizing factor for the i-1 surveillance

S_{E_d} = total elastic loss in dome tendons during initial tensioning (ksi) due to one group = 14.7 ksi

V = Poisson's ratio for concrete = 0.16

f_{pu} = minimum specified ultimate strength of tendon wire or strand (ksi)

A_w = cross-sectional area of one tendon wire or strand (in^2)

APPENDIX C

END ANCHORAGE INSPECTION DATA SHEETS

FOR

CONTAINMENT STRUCTURE

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

FOR

FLORIDA POWER & LIGHT COMPANY

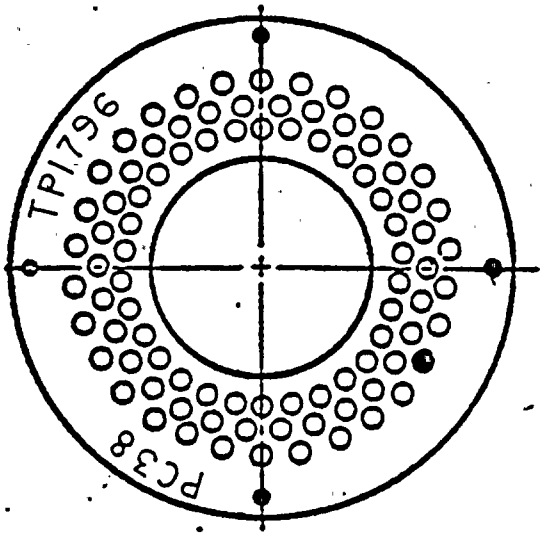
TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

August 1977

TENDON NO. 56V29 LOCATION (CLOSEST BUTTRESS) 6



END ANCHORAGE A

(CLOSEST BUTTRESS 6 TOP)

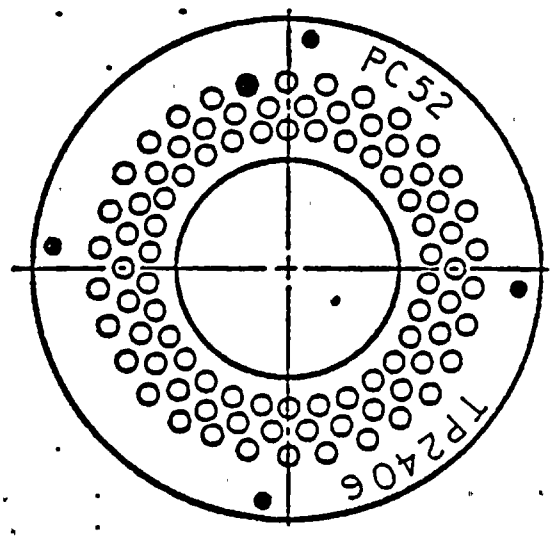
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1



END ANCHORAGE B

(CLOSEST BUTTRESS 6 BOTTOM)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 2

SHIMS 2

BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A RB DATE 10-25-77

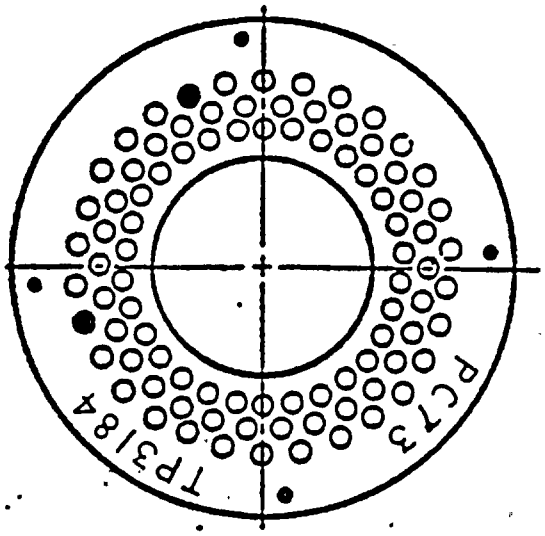
END ANCHORAGE B AH DATE 10-25-77

FIGURE

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

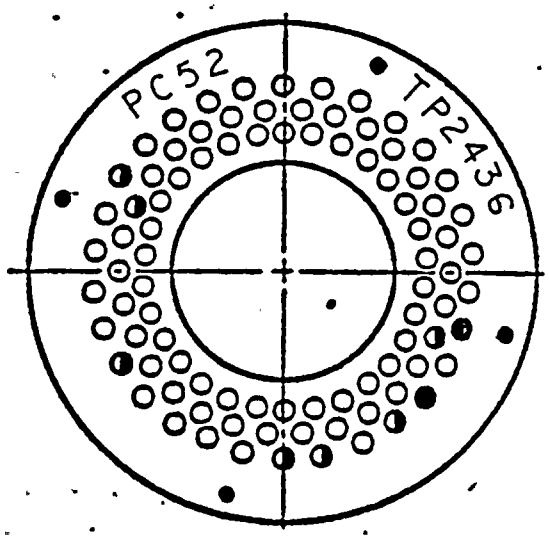
SHEET 1 OF 9

TENDON NO. 12V29 LOCATION (CLOSEST BUTTRESS) 2



END ANCHORAGE A

(CLOSEST BUTTRESS 2 TOP)



END ANCHORAGE B

(CLOSEST BUTTRESS 2 BOTTOM)

CORROSION LEVEL

WASHER 1
BUTTONHEADS 1
SHIMS 1
BEARING PLATE 2

CORROSION LEVEL

WASHER 2
BUTTONHEADS 1
SHIMS 2
BEARING PLATE 2

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

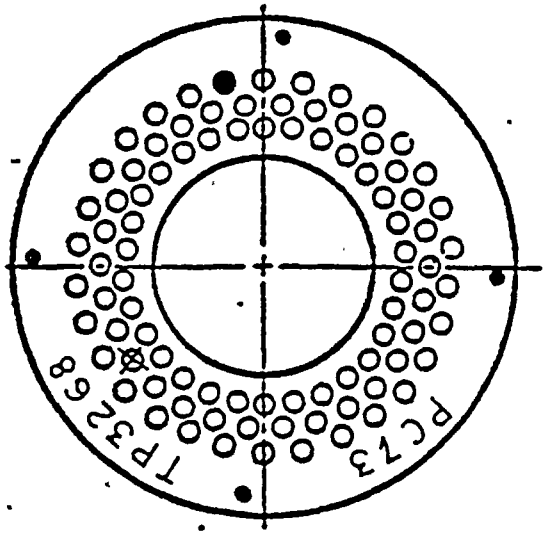
INSPECTED BY

END ANCHORAGE A RB DATE 10-26-77
END ANCHORAGE B AH DATE 1-26-77

FIGURE 3

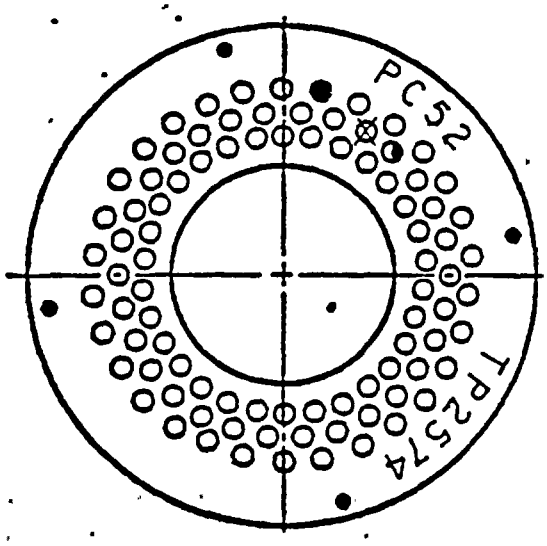
FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 34V29 LOCATION (CLOSEST BUTTRESS) 4



END ANCHORAGE A

(CLOSEST BUTTRESS 4 TOP)



END ANCHORAGE B

(CLOSEST BUTTRESS 4 BOTTOM)

CORROSION LEVEL

WASHER 1
BUTTONHEADS 1
SHIMS 1
BEARING PLATE 2

CORROSION LEVEL

WASHER 2
BUTTONHEADS 1
SHIMS 2
BEARING PLATE 2

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

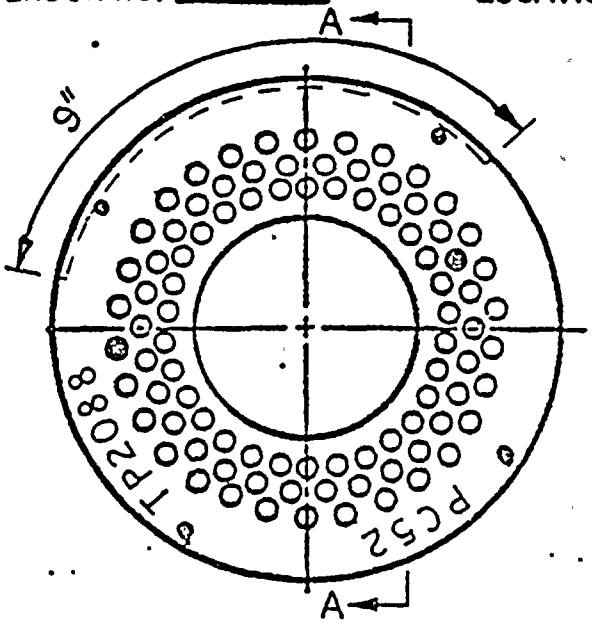
INSPECTED BY

END ANCHORAGE A RB DATE 10-28-77
END ANCHORAGE B AH DATE 10-28-77

FIGURE 3

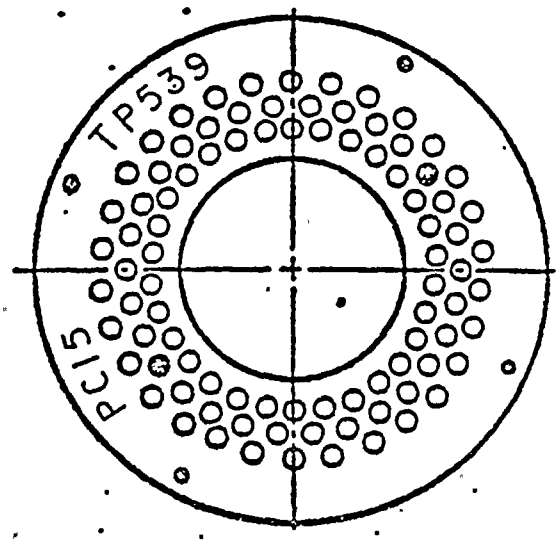
FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 1D28 LOCATION (CLOSEST BUTTRESS) 4 & 1



END ANCHORAGE A

(CLOSEST BUTTRESS 4)



END ANCHORAGE B

(CLOSEST BUTTRESS 1)

CORROSION LEVEL

WASHER	2
BUTTONHEADS	1
SHIMS	2
BEARING PLATE	1

CORROSION LEVEL

WASHER	2
BUTTONHEADS	2
SHIMS	2
BEARING PLATE	2

LEGEND:

BUTTONHEADS:

- ① OFF-SIZE BUTTONHEAD
- ① BUTTONHEAD WITH SPLIT
- ② WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

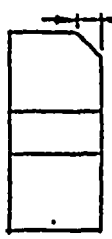
CORROSION LEVELS:

- #1 NO VISIBLE OXIDATION
- #2 VISIBLE OXIDATION NO PITTING
- #3 0" < PITTING ≤ 0.003"
- #4 0.003" < PITTING ≤ 0.005"
- #5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A RB DATE 11-2-77

END ANCHORAGE B AH DATE 11-2-77



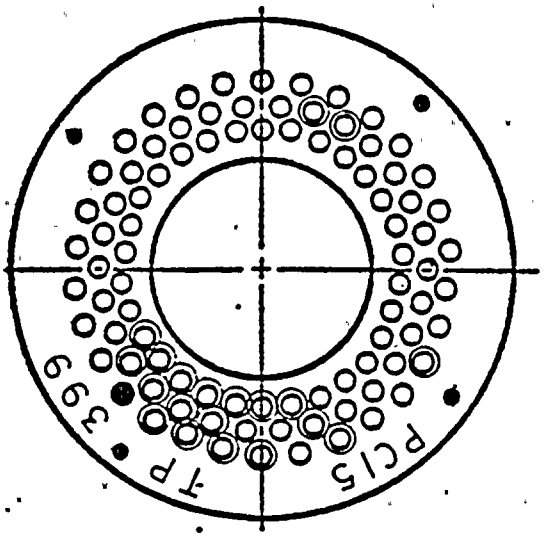
A-A

Rev. 1
September 8, 1978

FIGURE 3

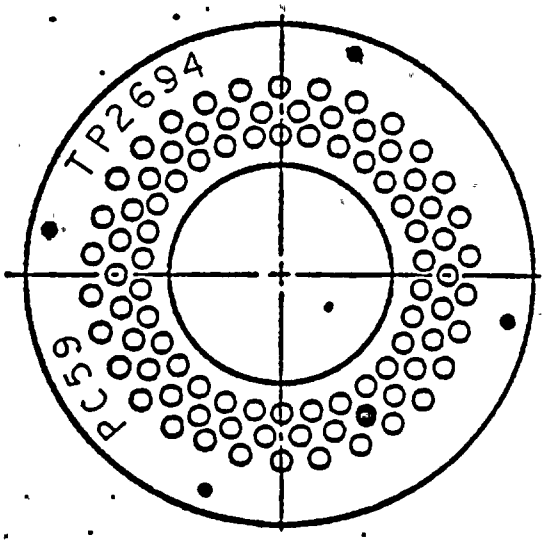
FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5thYEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 3D28 LOCATION (CLOSEST BUTTRESS) 3 & 6



END ANCHORAGE A

(CLOSEST BUTTRESS 3)



END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1 & 2*

SHIMS 2

BEARING PLATE 1

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- ⌀ DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

*Circled Button Heads Indicate Corrosion Level #2

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

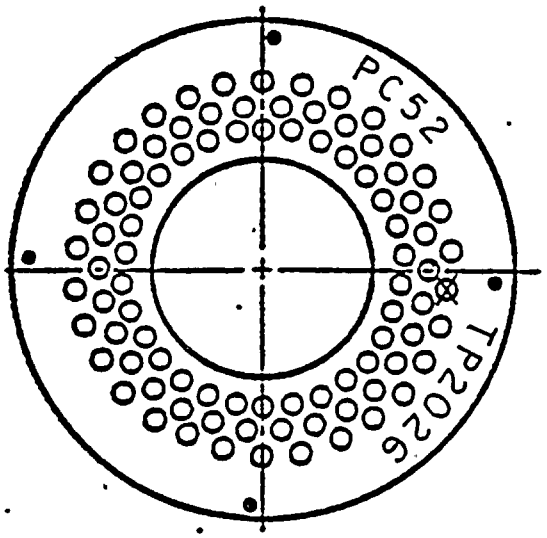
END ANCHORAGE A RB DATE 11-4-77

END ANCHORAGE B AH DATE 11-4-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO: 2D3 LOCATION (CLOSEST BUTTRESS) 6 & 1



END ANCHORAGE A

(CLOSEST BUTTRESS 6)

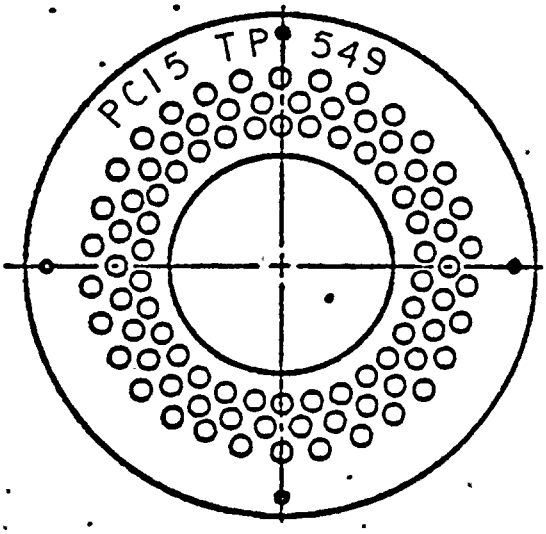
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1



END ANCHORAGE B

(CLOSEST BUTTRESS 1)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ⊖ WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A RB DATE 11-7-77

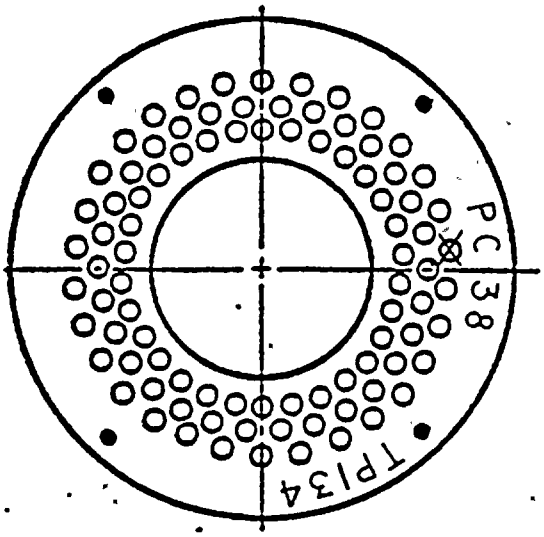
END ANCHORAGE B AH DATE 11-7-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5thYEAR SURVEILLANCE
END ANCHORAGE INSPECTION

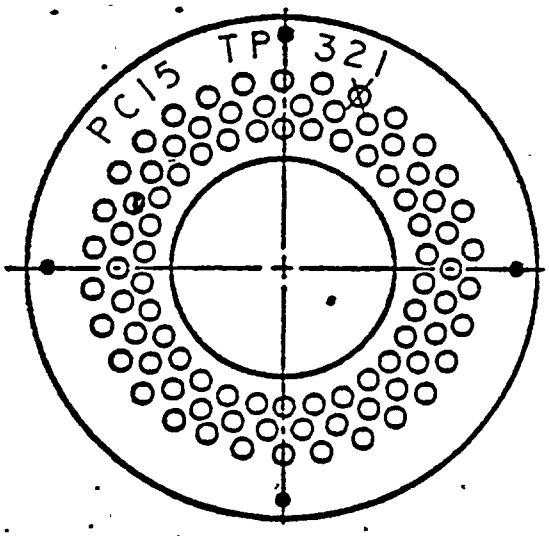
SHEET 6 OF 9

TENDON NO. 42H80 LOCATION (CLOSEST BUTTRESS) 4 & 2



END ANCHORAGE A

(CLOSEST BUTTRESS 4)



END ANCHORAGE B

(CLOSEST BUTTRESS 2)

CORROSION LEVEL

WASHER 3

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1

CORROSION LEVEL

WASHER 2

BUTTONHEADS 2

SHIMS 2

BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

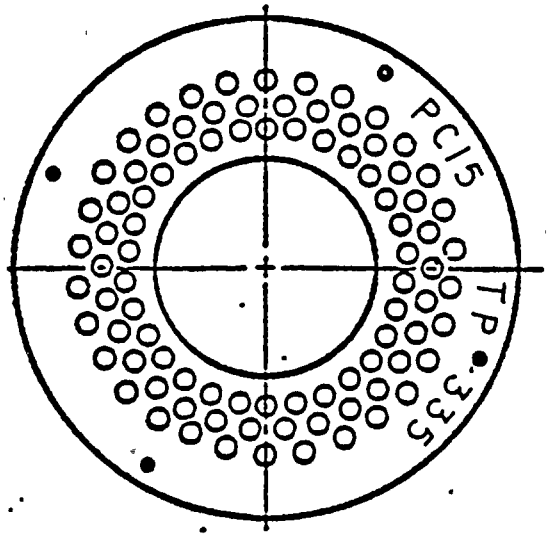
END ANCHORAGE A RB DATE 11-9-77

END ANCHORAGE B AH DATE 11-9-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 64H70 LOCATION (CLOSEST BUTTRESS) 4 & 6



END ANCHORAGE A

(CLOSEST BUTTRESS 4)

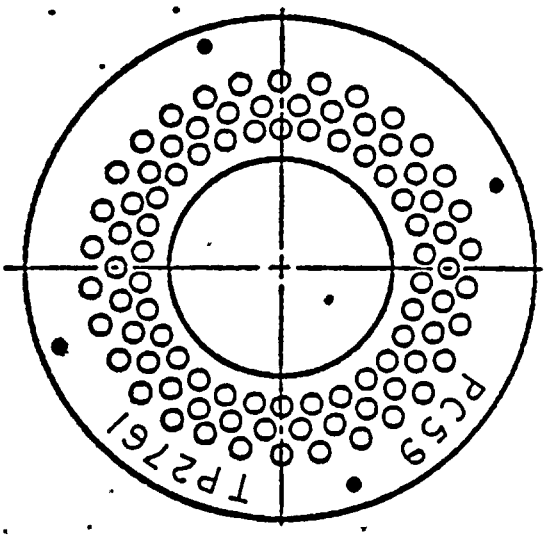
CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1



END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- ⌀ DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊗ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

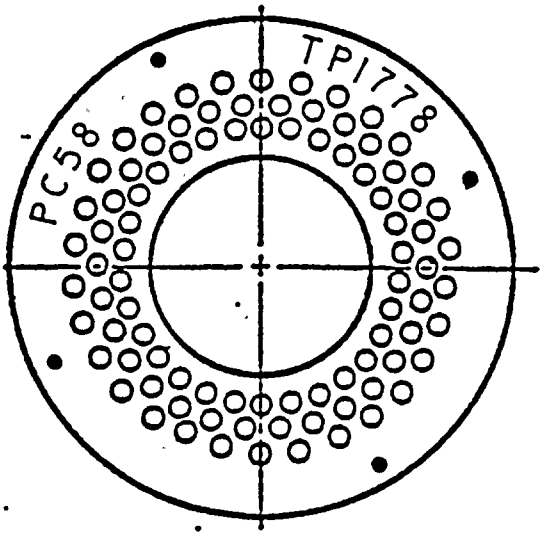
END ANCHORAGE A RB DATE 11-11-77

END ANCHORAGE B AH DATE 11-11-77

FIGURE 3

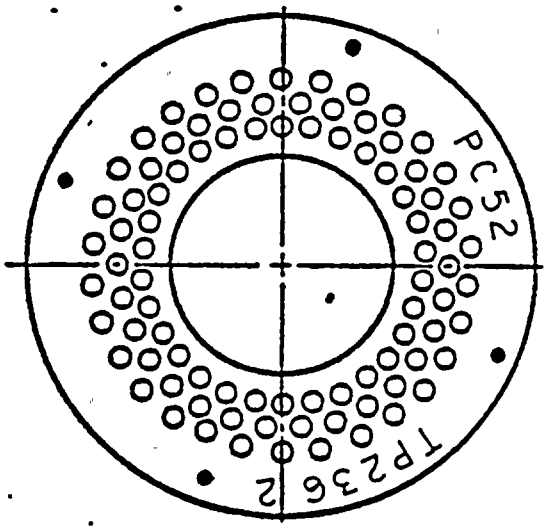
FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 62H38 LOCATION (CLOSEST BUTTRESS) 6 & 2



END ANCHORAGE A

(CLOSEST BUTTRESS 6)



END ANCHORAGE B

(CLOSEST BUTTRESS 2)

CORROSION LEVEL

WASHER 2
BUTTONHEADS 1
SHIMS 2
BEARING PLATE 1

CORROSION LEVEL

WASHER 2
BUTTONHEADS 1
SHIMS 2
BEARING PLATE 1

LEGEND:

BUTTONHEADS:

- ◑ OFF-SIZE BUTTONHEAD
- ◐ BUTTONHEAD WITH SPLIT
- ● WIRE REMOVED PREVIOUSLY
- Ø DISCONTINUOUS WIRE REMOVED THIS SURVEILLANCE
- ⊠ WIRE REMOVED FOR INSPECTION AND TESTING THIS SURVEILLANCE

CORROSION LEVELS:

#1 NO VISIBLE OXIDATION
#2 VISIBLE OXIDATION NO PITTING
#3 0" < PITTING ≤ 0.003"
#4 0.003" < PITTING ≤ 0.006"
#5 0.006" < PITTING ≤ 0.010"

INSPECTED BY

END ANCHORAGE A RB DATE 11-15-77
END ANCHORAGE B AH DATE 11-15-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
5th-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

SHEET 9 OF 9

APPENDIX D

WIRE INSPECTION DATA SHEETS

FOR

CONTAINMENT STRUCTURE

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

FOR

FLORIDA POWER & LIGHT COMPANY

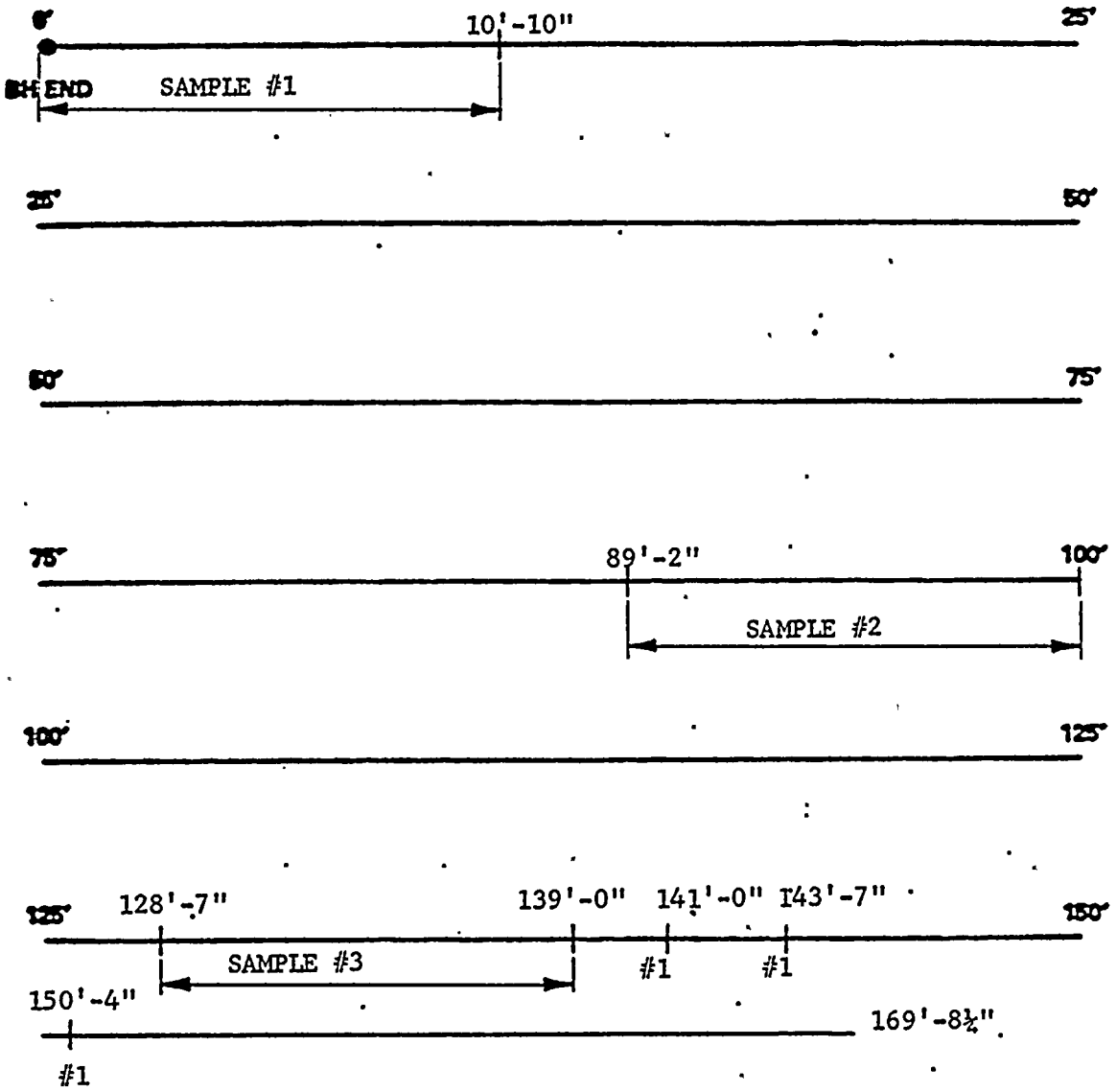
TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

November 1977

TENDON NO. 34V29 CLOSEST BUTTRESSES 4(T)



CORROSION LEVEL:

- ☒ #1 NO VISIBLE OXIDATION
- ☐ #2 VISIBLE OXIDATION, NO PITTING
- ☐ #3 0" < PITTING ≤ 0.003"
- ☐ #4 0.003" < PITTING ≤ 0.006"
- ☐ #5 0.006" < PITTING ≤ 0.010"

INSPECTED BY M. V.

DATE 10-31-77

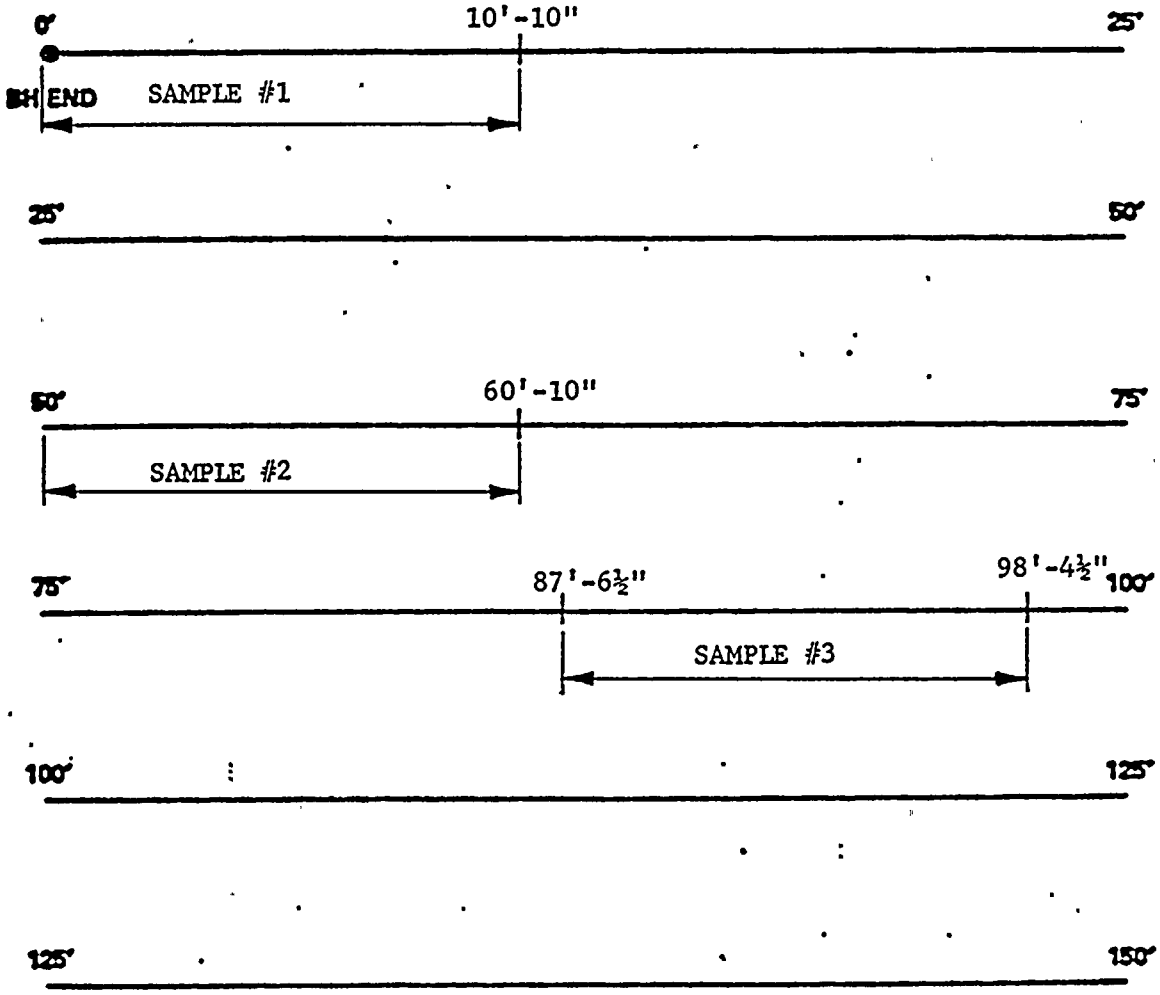
BH. - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST TENSIONING SYSTEM
5th YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET 1 OF 3

TENDON NO. 2D3 CLOSEST BUTTRESSES 1 & 6



TOTAL LENGTH OF WIRE 98'-4½"

CORROSION LEVEL:

- [x] #1 NO VISIBLE OXIDATION
- [ ] #2 VISIBLE OXIDATION, NO PITTING
- [ ] #3 0" < PITTING ≤ 0.003"
- [ ] #4 0.003" < PITTING ≤ 0.006"
- [ ] #5 0.006" < PITTING ≤ 0.010"

INSPECTED BY M. V.

DATE 11-11-78

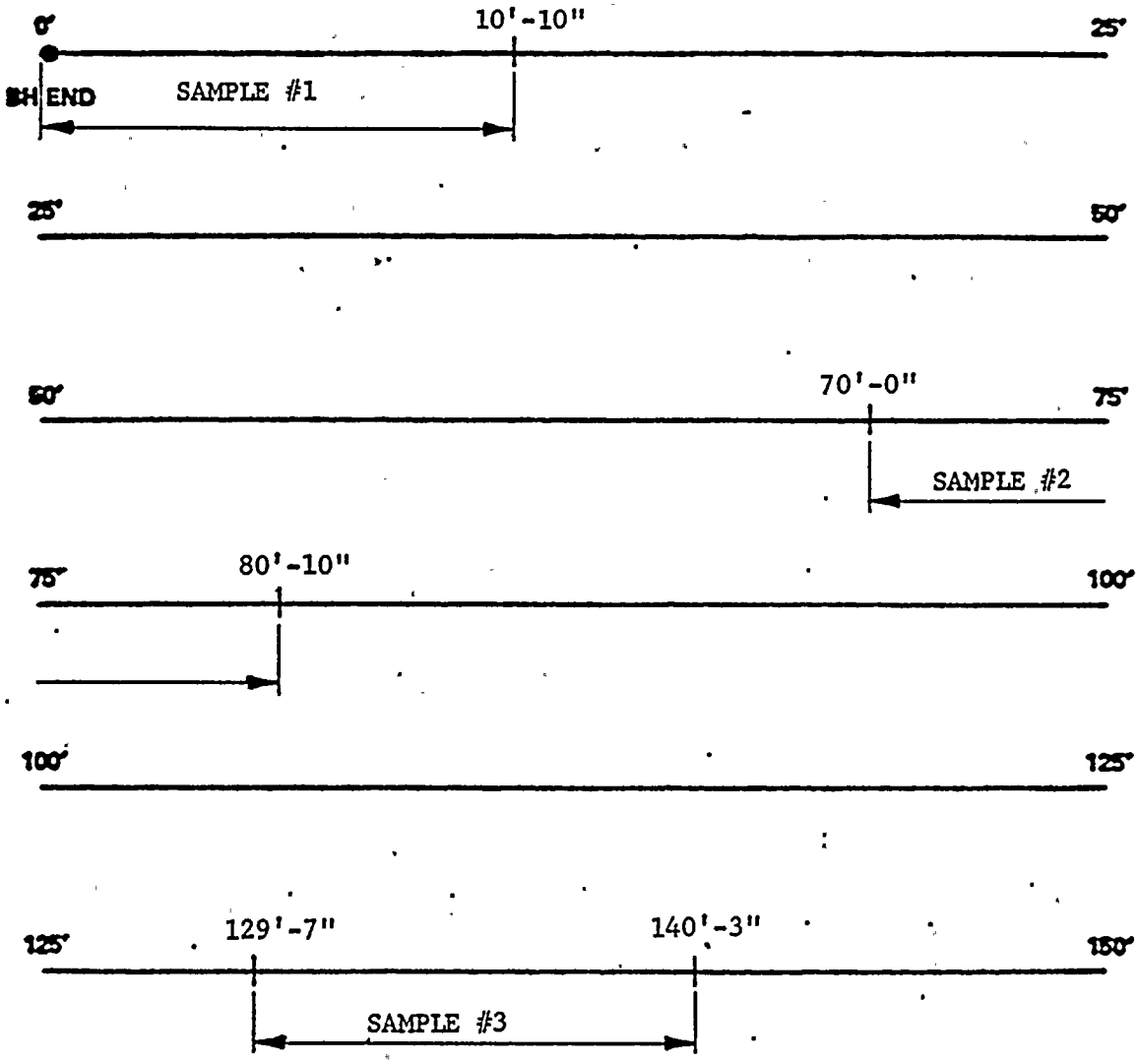
BH. - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST TENSIONING SYSTEM
5th YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET 2 OF 3

TENDON NO. 42H80 CLOSEST BUTTRESSES 2 & 4



TOTAL LENGTH OF WIRE 140'-3"

CORROSION LEVEL:

- ☒ #1 NO VISIBLE OXIDATION
- ☐ #2 VISIBLE OXIDATION, NO PITTING
- ☐ #3 0" < PITTING ≤ 0.003"
- ☐ #4 0.003" < PITTING ≤ 0.006"
- ☐ #5 0.006" < PITTING ≤ 0.010"

INSPECTED BY M. V.

DATE 11-11-77

BH - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST TENSIONING SYSTEM
5th YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET 3 OF 3

APPENDIX E

SPECIFICATION

FOR

TENSILE TESTING

OF

POST-TENSIONING TENDON WIRE (ASTM A-421)

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

June, 1977

Revision 1, December 15, 1977 CWA

By: Charles W. Andrews
Charles W. Andrews

Approved: K. P. Buchert
K. P. Buchert
Chief Civil Engineer
Gaithersburg Power
Division

1.0 GENERAL

This document specifies the general procedures which shall be used for the tensile testing of the 1/4"-diameter post-tensioning tendon wires (ASTM A-421, Type BA). This document does not relieve the testing laboratory of the responsibility for conducting the tensile tests in a manner consistend with the industry standards.

2.0 WORK INCLUDED

Nine (9) 1/4"-diameter wire specimens, approximately 10'-6" long, will be sent to the laboratory for testing in accordance with Section 3.0. Each of these specimens will have an identification tag attached close to one end; this tag will identify the tendon from which the wire was removed and the location of the specimen with respect to the wire. Specimens shall be disposed of in accordance with Section 4.0 and a report meeting the requirements of Section 5.0 shall be prepared.

3.0 TEST DESCRIPTION

Tendon wires shall be tested in accordance with ASTM A-421-65, "Standard Specification for Uncoated Stress-Relieved Wire for Prestressed Concrete", except that the gage length shall be 100 (± 1.0) inches, instead of the 10 inches as specified. This test shall include the following:

3.1 Measurement of wire diameter with an accuracy of ± 0.0005".

3.2 Measurement of gage length with an accuracy of ± 0.05"..

3.3 Application of an initial load corresponding to 29,000 psi.

3.4 Application of additional load to obtain the force corresponding to 1.0 percent extension.

3.5 Application of additional load and obtaining load at failure and elongation under load at failure (± 0.05").

4.0 DISPOSAL OF TESTED SPECIMENS

A sample approximately 6" long on each side of the break of each specimen shall be bound and returned as a unit with the identification tag attached. Specimens shall be returned to:

Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760

Attention: Mr. M. Malcom
Project Engineer

REPORT

Three (3) copies of the report on tendon wire testing shall be submitted to:

Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760

Attention: Mr. M. Malcom
Project Engineer

The report shall contain the following information:

5.1 Testing machine calibration report.

5.2 Wire identification.

5.3 Wire diameter (± 0.0005 inches).

5.4 Gage length (± 0.05 inches).

5.5 Force and elongation (± 0.001 inches) at initial load.

5.6 Force and elongation (± 0.01 inches) at 1% extension.

5.7 Force and elongation under load (± 0.05 inches) at failure.

5.8 Location of failure relative to the grip in the moving head (± 0.005 inches).

APPENDIX F

SPECIFICATION

FOR

LABORATORY TESTING

OF

SHEATH FILLER (VISCONORUST 2090P)

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

By: Charles W. Andrews
Charles W. Andrews

June, 1977
Revision 1, December 15, 1977 CWA

Approved: K. P. Buchert
K. P. Buchert
Chief Civil Engineer
Gaithersburg Power
Division

1.0 GENERAL

This document specifies the procedures which shall be used for laboratory testing of sheath filler Visconorust 2090P to determine:

a. The amount of water soluble chlorides, nitrates and sulfides which are leached from a given contact area between water and the sheath filler under standrad conditions.

b. The water content of the sheath filler.

c. The reserve alkalinity of the sheath filler.

This document does not relieve the testing laboratory of responsibility for conducting the necessary laboratory tests in a manner consistent with the industry standards.

2.0 WORK INCLUDED

Nine (9) one-quart test samples will be sent to the laboratory for testing in accordance with Section 3.0. The concentration of water soluble impurities and water in these samples will likely not exceed the following:

2.1 Chlorides - 10 ppm

2.2 Nitrates - 10 ppm

2.3 Sulfides - 10 ppm

2.4 Water (H_2O) - 10% Dry Weight

A report meeting the requirements of Section 4.0 shall be prepared.

3.0 TEST DESCRIPTIONS

Each sample of sheath filler shall be mixed and then tested as follows:

3.1 Water Soluble Impurities

A water extraction of each sample of sheath filler shall be made and tested as indicated below:

3.1.1 Using a spatula, coat the inside (bottom and sides) of a 1 liter glass beaker with a 1/4-inch layer of sheath filler.

3.1.2 Fill the beaker with distilled water at room temperature.

3.1.3 Heat the water to a controlled temperature of 100°F and maintain for four hours. Do not heat on a hot plate. Heat either in an oven or by use of an immersion heater so that the water will remain clear for tests.

1

3.1.4 Run a blank on distilled water. If titrate, use a microburet, 1 ml or 5 ml, with 0.01 - 0.05 ml graduation intervals.

3.1.5 Decant water and analyze for soluble ions. Test only for salts in leached water. The water analyses shall be as follows:

3.1.5.1 Chlorides (Cl) by ASTM D-512.

3.1.5.2 Nitrate (NO_3) by ASTM D-992, Brucine Method or Cadminum Reduction Method by Hach Chemical Co., Ames, Iowa.

3.1.5.3 Sulfides (S) by APHA (American Public Health Association) Standard Method - Methylene Blue - or the method by Hach Chemical Company, Ames, Iowa.

3.2 Water Content

Water content (H_2O as percent of dry weight) shall be determined in accordance with ASTM D-95.

3.3 Neutralization Number

Neutralization number shall be determined in accordance with ASTM D-664.

4.0 REPORT

Three copies of the report on laboratory testing of the sheath filler shall be submitted to:

Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760

Attention: Mr. M. Malcom
Project Engineer

The report shall contain the following information:

4.1 Sample identification.

4.2 Concentration of water soluble chlorides, nitrates and sulfides within an accuracy of 0.1 ppm.

4.3 Concentration of water (H_2O) within an accuracy of 0.1 percent of dry weight of the filler.

4.4 Neutralization number within an accuracy of 0.01 mg reagent per gram of filler.

APPENDIX G

RESULTS

OF

LABORATORY TESTING

OF

WIRE SAMPLES

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

July 1978

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

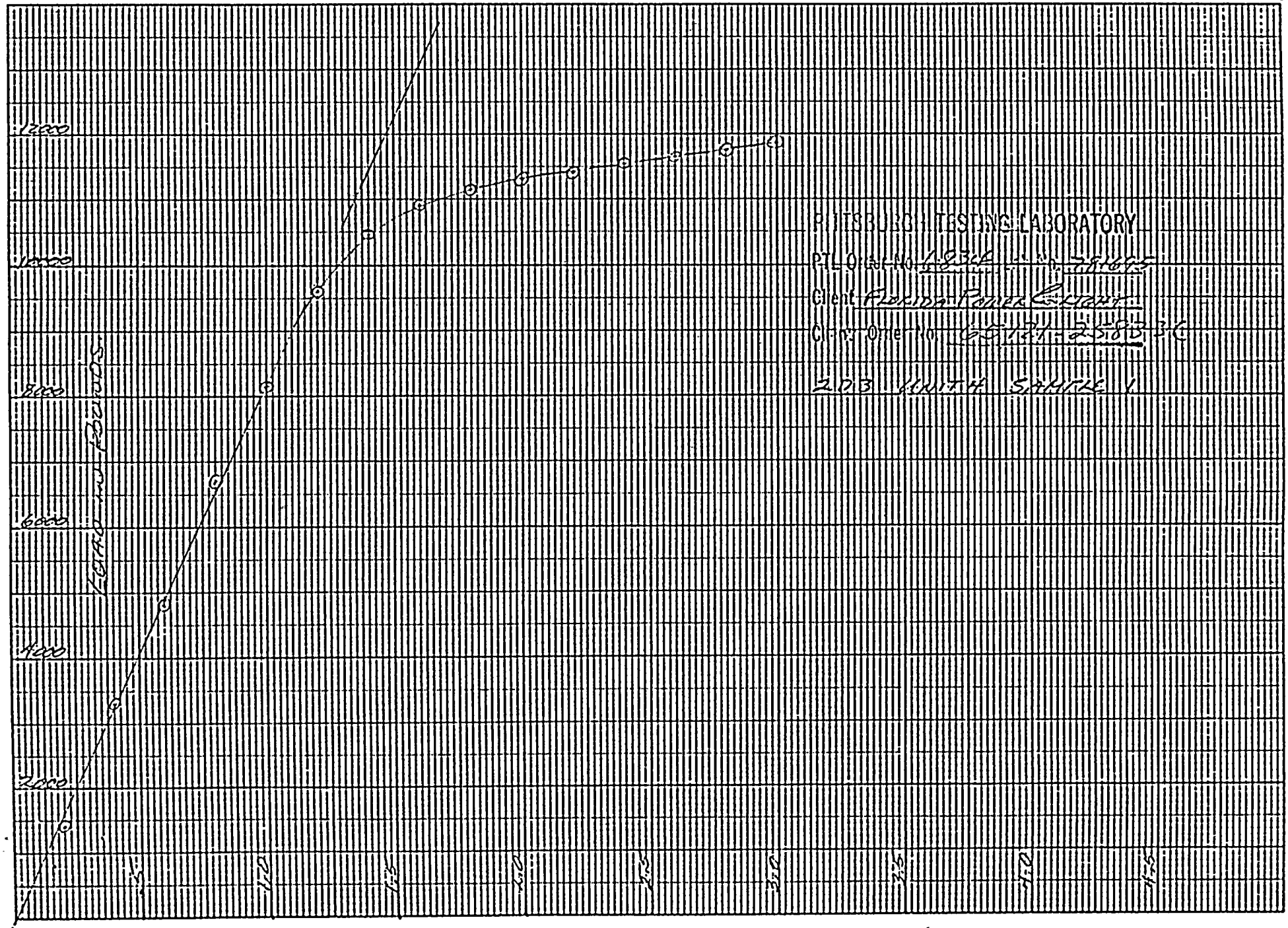
Specimen Identification	2D3 #1
Diameter, Inches	.2500
Original Area, Sq. Inches	.0491
Initial Load, Pounds Equivalent 29,00 PSI	1400#
Elongation at Initial Load, Inches	.21
Load at 1% Extension, Pounds	9,600
Stress at 1% Extension, PSI	195,500
Elongation at 1% Extension, Inches	1.21
Load Pounds at Fracture	12,250
Stress PSI at Fracture	249,500
Elongation at Fracture, Inches	4.92
Elongation at Fracture, Percent	4.92%

Location of Fracture relative to grip in the moving head 9"

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.



G-3

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 1523(

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

Specimen Identification	2D3 #2
Diameter, Inches	.2499
Original Area, Sq. Inches	.049
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.18
Load at 1% Extension, Pounds	10,150
Stress at 1% Extension, PSI	207,100
Elongation at 1% Extension, Inches	1.18
Load Pounds at Fracture	12,350
Stress PSI at Fracture	252,000
Elongation at Fracture, Inches	5.56
Elongation at Fracture, Percent	5.56%

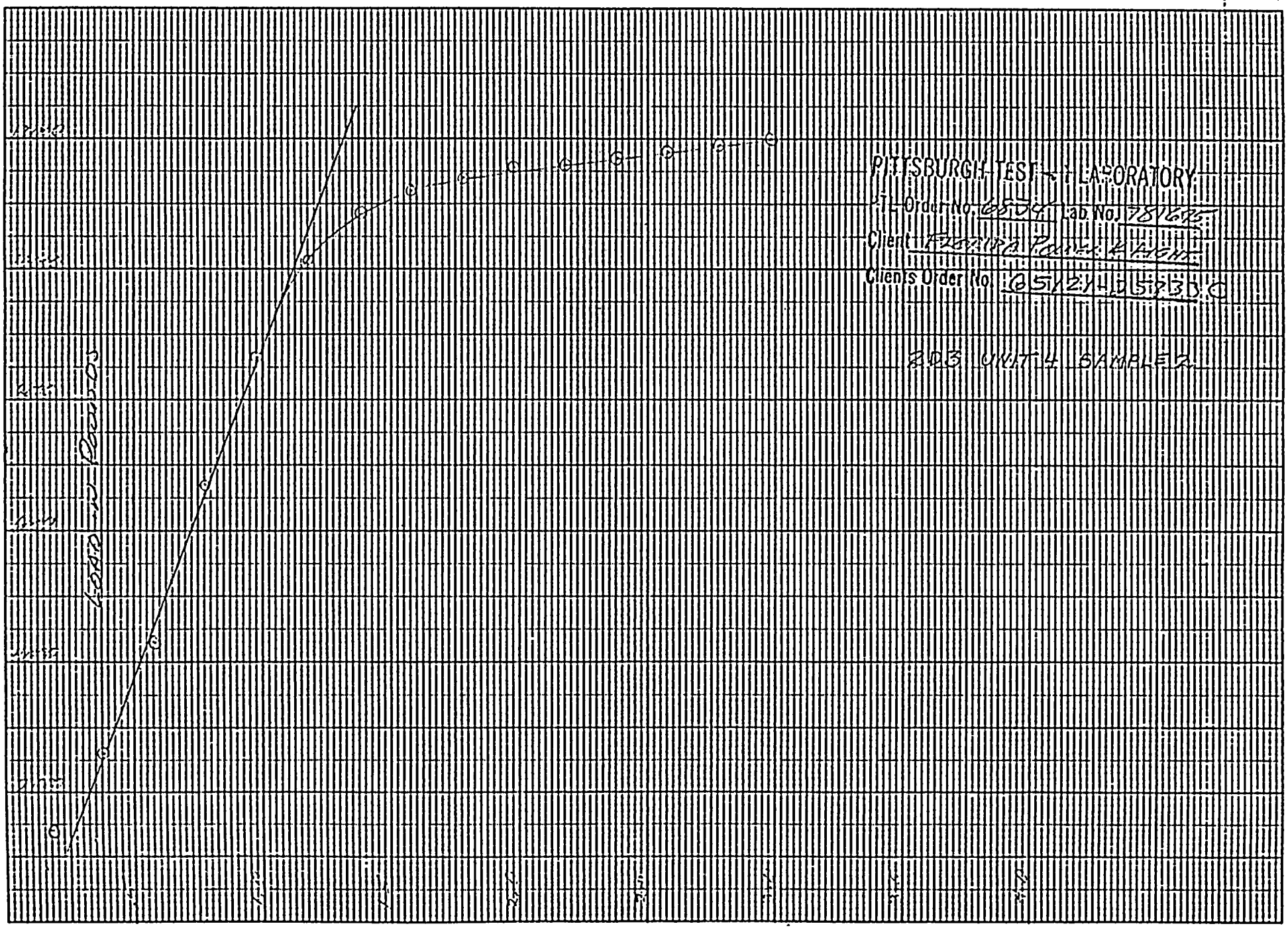
Location of Fracture relative to grip in the moving head 30¼"

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.

46 1240



G-5

FORM 407 REV.-P G

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 1523

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

REPORT

ORDER No. PG-6834

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

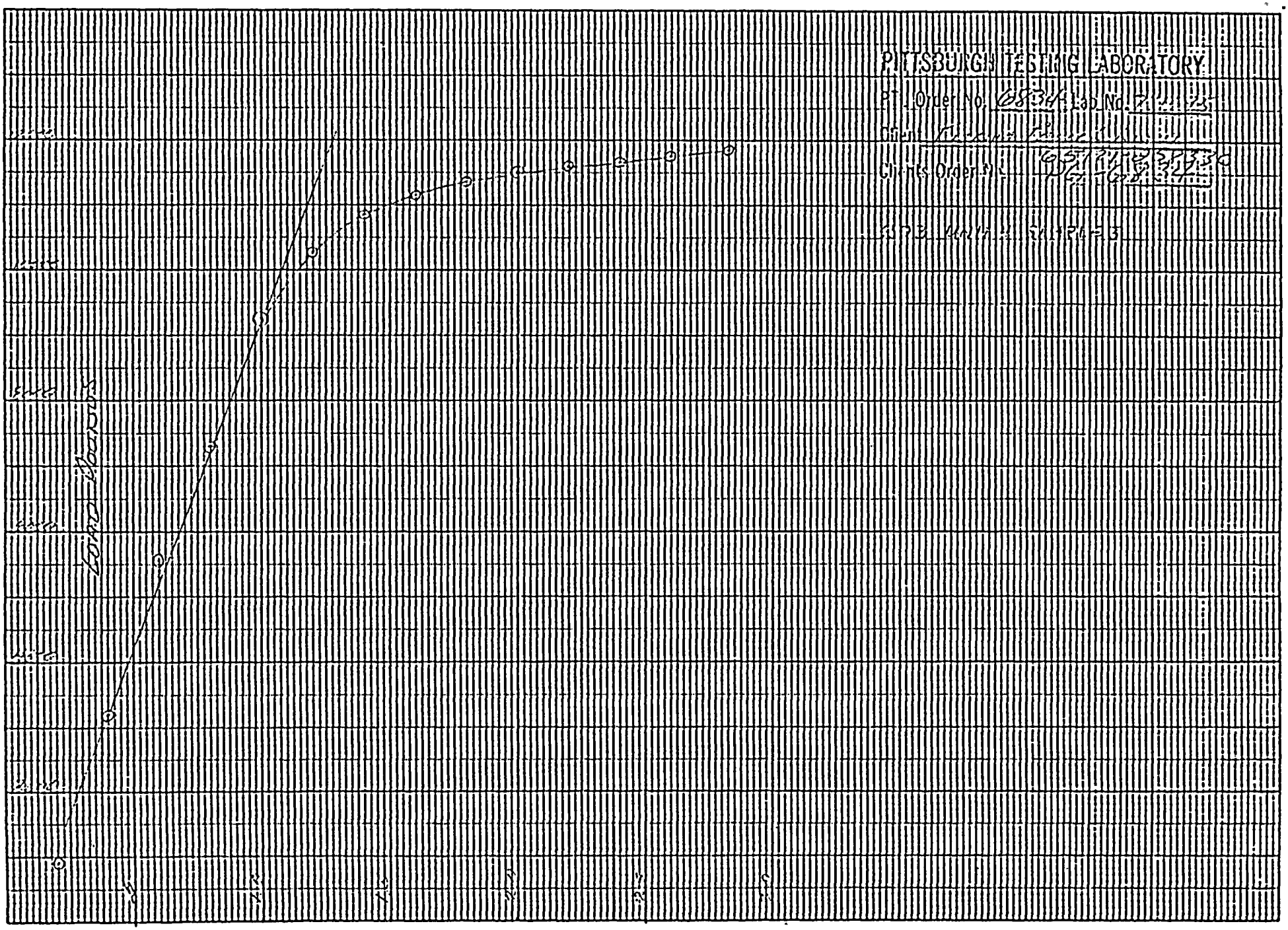
Specimen Identification	2D3 #3
Diameter, Inches	.2500
Original Area, Sq. Inches	.0491
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.20
Load at 1% Extension, Pounds	10,250
Stress at 1% Extension, PSI	208,900
Elongation at 1% Extension, Inches	1.20
Load Pounds at Fracture	12,350
Stress PSI at Fracture	251,500
Elongation at Fracture, Inches	5.53
Elongation at Fracture, Percent	5.53%

Location of Fracture relative to grip in the moving head 3"

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.



FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 1523

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENTS No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

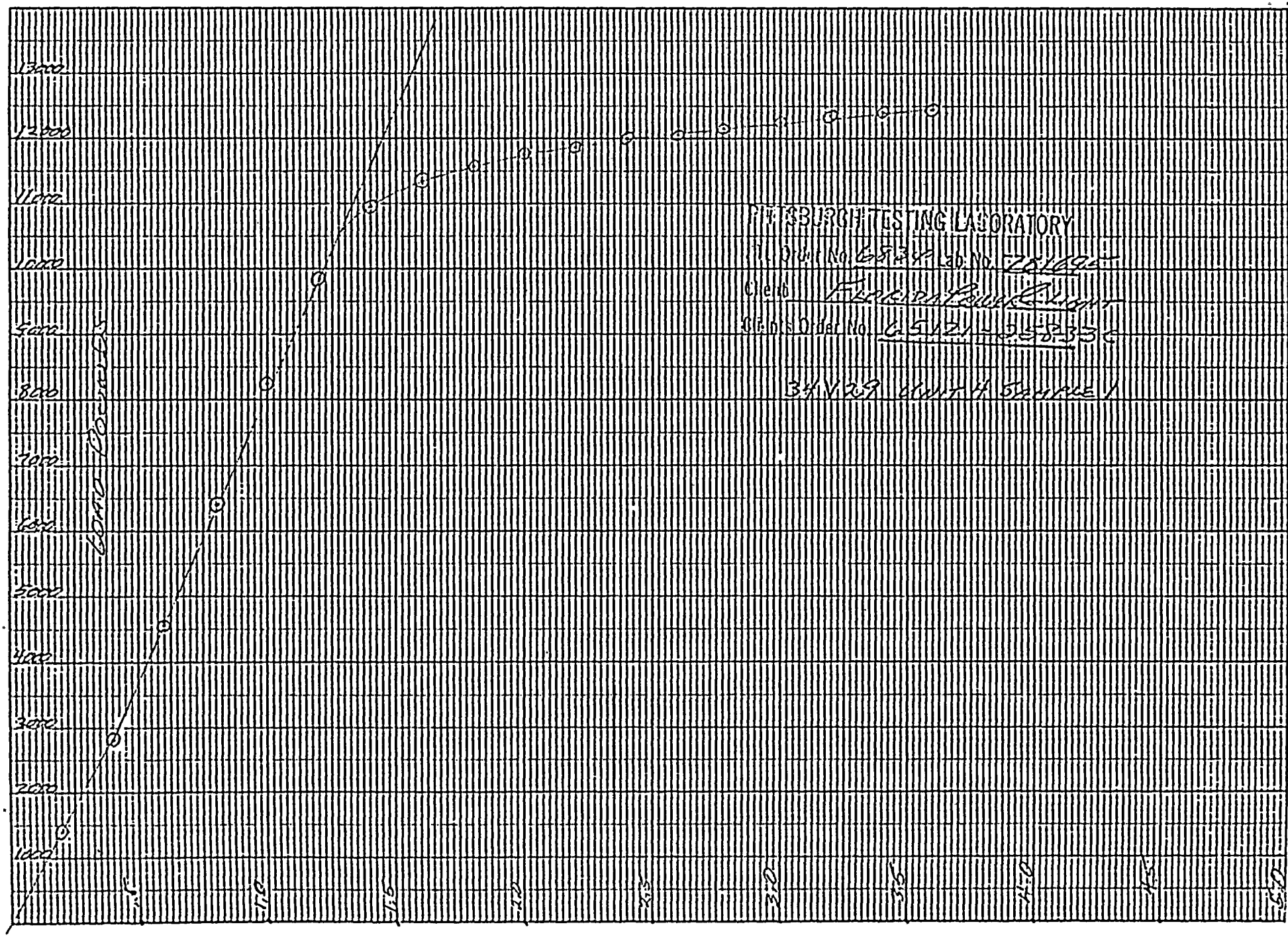
UNIT #4

Specimen Identification	34V29 #1
Diameter, Inches	.2499
Original Area, Sq. Inches	.0491
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.20
Load at 1% Extension, Pounds	9,850
Stress at 1% Extension, PSI	200,600
Elongation at 1% Extension, Inches	1.20
Load Pounds at Fracture	12,700
Stress PSI at Fracture	258,700
Elongation at Fracture, Inches	4.87
Elongation at Fracture, Percent	4.87%
Location of Fracture relative to grip in the moving head	3"

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.


13000
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
Load, Pounds
PITTSBURGH TESTING LABORATORY
Client
Client's Order No.
Lab. No.

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

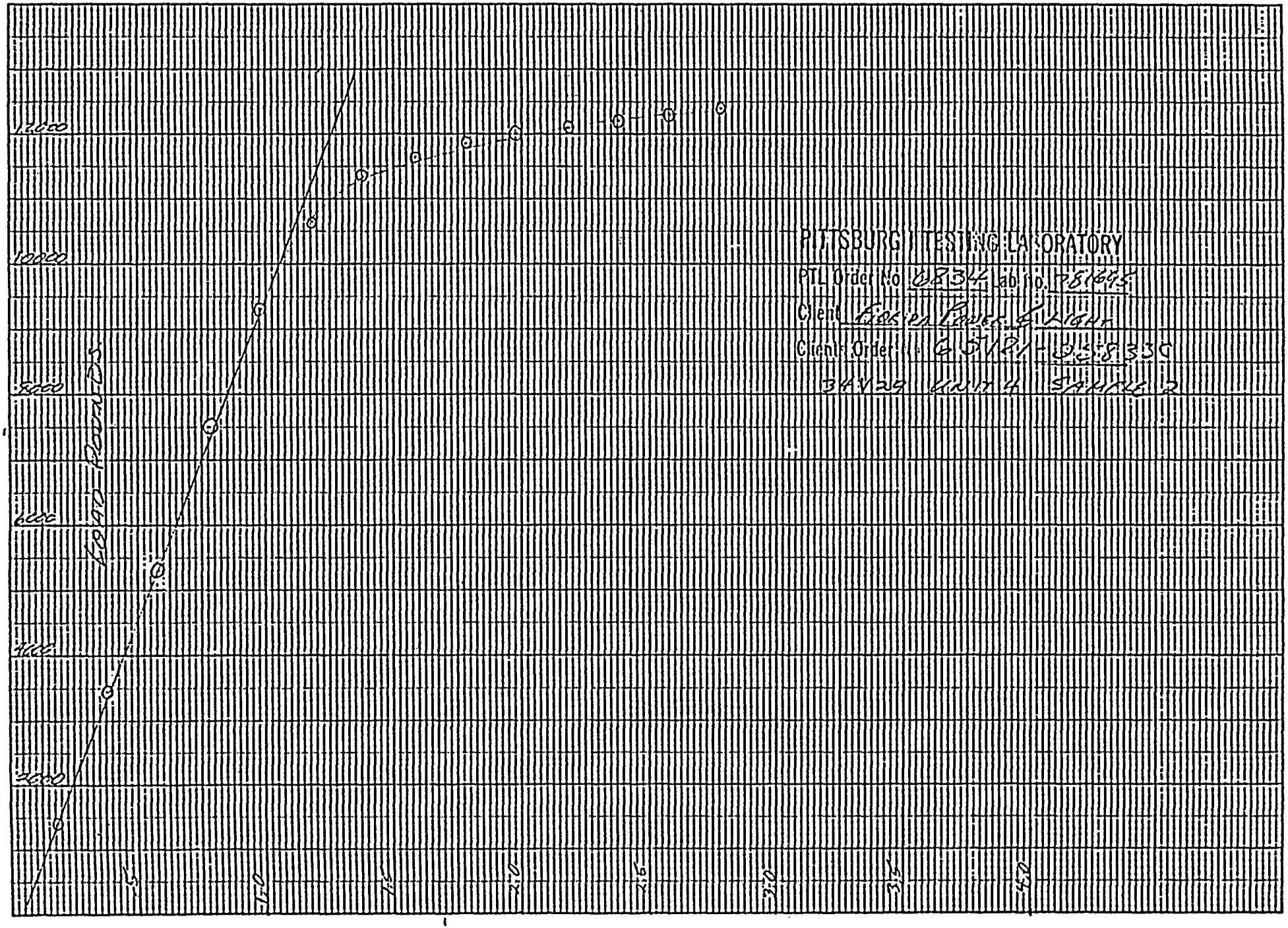
UNIT #4

Specimen Identification	34V29 #2
Diameter, Inches	.2498
Original Area, Sq. Inches	.0490
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.18
Load at 1% Extension, Pounds	10,650
Stress at 1% Extension, PSI	217,300
Elongation at 1% Extension, Inches	1.18
Load Pounds at Fracture	12,800
Stress PSI at Fracture	261,200
Elongation at Fracture, Inches	4.51
Elongation at Fracture, Percent	4.51%
Location of Fracture relative to grip in the moving head	6.63

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.



FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 152:

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

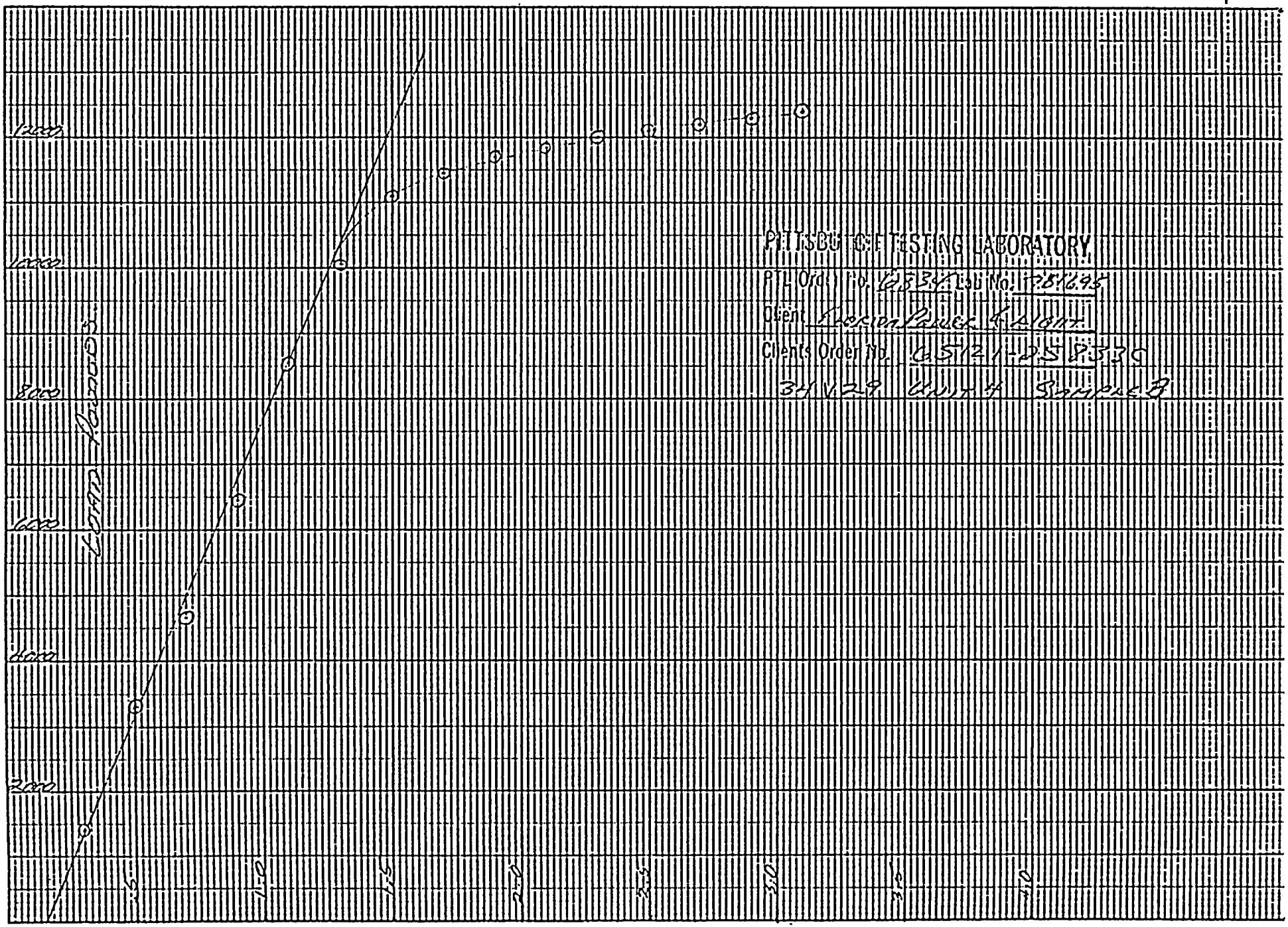
UNIT #4

Specimen Identification	34V29 #3
Diameter, Inches	.2498
Original Area, Sq. Inches	.0490
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.31
Load at 1% Extension, Pounds	10,050
Stress at 1% Extension, PSI	205,100
Elongation at 1% Extension, Inches	1.31
Load Pounds at Fracture	12,700
Stress PSI at Fracture	259,200
Elongation at Fracture, Inches	4.59
Elongation at Fracture, Percent	4.59%
Location of Fracture relative to grip in the moving head	37.0

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.



FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

Specimen Identification	42H80 #1
Diameter, Inches	.2502
Original Area, Sq. Inches	.0492
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.19
Load at 1% Extension, Pounds	10,150
Stress at 1% Extension, PSI	206,300
Elongation at 1% Extension, Inches	1.19
Load Pounds at Fracture	12,200
Stress PSI at Fracture	247,950
Elongation at Fracture, Inches	5.42
Elongation at Fracture, Percent	5.42%
Location of Fracture relative to grip in the moving head	37.5

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.

PITTSBURGH TESTING LABORATORY

Earl Gallagher

Earl Gallagher, Manager
Physical Testing Department

cc: 3- client
Attn: Mr. Feeney

lcc

PITTSBURGH TES LABORATORY

P.L. Order No: 6824 Date:

Client:

Client's Order No.:

Name of Unit & Symbol:

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

Specimen Identification	42H80 #2
Diameter, Inches	.2502
Original Area, Sq. Inches	.0492
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.19
Load at 1% Extension, Pounds	10,300
Stress at 1% Extension, PSI	209,350
Elongation at 1% Extension, Inches	1.19
Load Pounds at Fracture	12,200
Stress PSI at Fracture	247,950
Elongation at Fracture, Inches	5.49
Elongation at Fracture, Percent	5.49%

Location of Fracture relative to grip in the moving head At Jaw

Samples tested in accordance with order no. 65121-25833C

Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.

PITTSBURGH TESTING LABORATORY

PTL Order No. [illegible] Lab No. [illegible]

Client [illegible]

Client's Order No. [illegible]

[illegible]

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15223

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781695

CLIENT'S No. P.O. No. 65121-25833C

ORDER No. PG-6834

REPORT

May 15, 1978

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Florida Power & Light Company
P.O. Box 3088
Florida City Florida 33034
Attn: Mr. Feeney

UNIT #4

Specimen Identification	42H80 #3
Diameter, Inches	.2504
Original Area, Sq. Inches	.0492
Initial Load, Pounds Equivalent 29,00 PSI	1400
Elongation at Initial Load, Inches	.21
Load at 1% Extension, Pounds	10,150
Stress at 1% Extension, PSI	206,300
Elongation at 1% Extension, Inches	1.21
Load Pounds at Fracture	12,150
Stress PSI at Fracture	246,950
Elongation at Fracture, Inches	4.72
Elongation at Fracture, Percent	4.72%
Location of Fracture relative to grip in the moving head	3"

Samples tested in accordance with order no. 65121-25833C

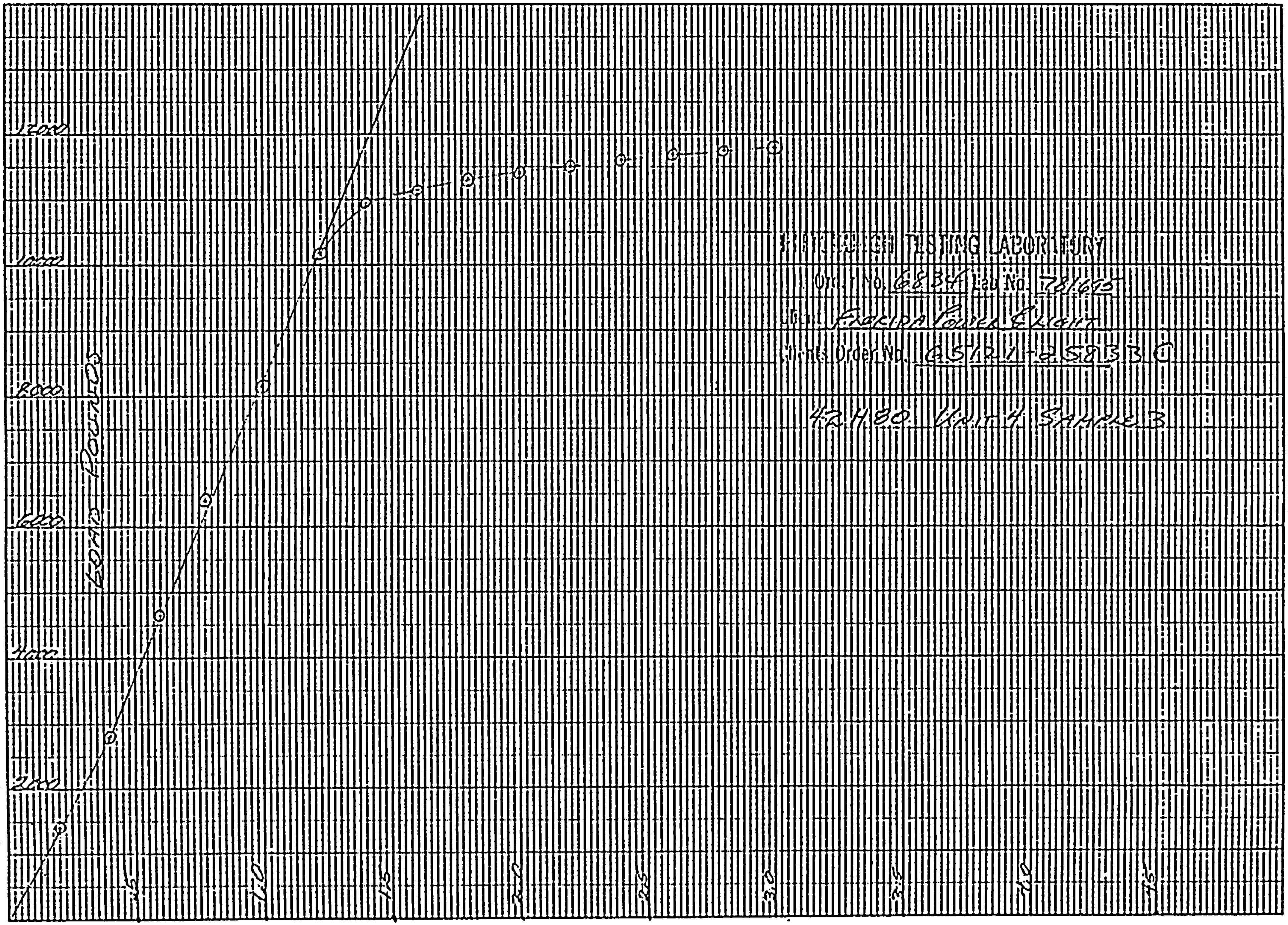
Attachment I dated June 1977 and ASTM A421, Stress Strain Curves are attached.

SAMPLES SUBMITTED BY CLIENT FOR TESTING.

K+E 20 X 20 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

46 1240

G-19



ELONGATION IN INCHES

APPENDIX H

RESULTS
OF
LABORATORY ANALYSIS
OF
SHEATH FILLER
FOR
FLORIDA POWER & LIGHT COMPANY
TURKEY POINT NUCLEAR POWER PLANT
UNIT 4
POST-TENSIONING SYSTEM
FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

July 1978

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1486
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781674 to 781682

CLIENT'S No. P.O. 65121-258330

ORDER No. PG-6834

REPORT

December 16, 1977

Analysis of: G R E A S E

Specification: Attachment II - Specification For Laboratory Testing of Sheath Filler (Visconorust 2090P) For Florida Power & Light Company Turkey Point Nuclear Plant Unit 4 Post-Tensioning System Fifth-Year Surveillance

Submitted by: Florida Power & Light Company

Reported to: Florida Power & Light Company
Construction Warehouse
P. O. Box 3088
Florida City, Florida 33034

	Water Soluble Chloride (D-512)	Specification Requirements
1D-28	Less Than .5 ppm	10 Max.
2D-3	Less Than .5 ppm	10 Max.
3D-28	Less Than .5 ppm	10 Max.
62H38	Less Than .5 ppm	10 Max.
42H80	Less Than .5 ppm	10 Max.
64H70	Less Than .5 ppm	10 Max.
12V29	Less Than .5 ppm	10 Max.
34V29	Less Than .5 ppm	10 Max.
56V29	Less Than .5 ppm	10 Max.

	Water Soluble Nitrate (D-992)	
1D-28	Less Than .2 ppm	10 Max.
2D-3	Less Than .2 ppm	10 Max.
3D-28	Less Than .2 ppm	10 Max.
62H38	Less Than .2 ppm	10 Max.
42H80	Less Than .2 ppm	10 Max.
64H70	Less Than .2 ppm	10 Max.
12V29	Less Than .2 ppm	10 Max.
34V29	Less Than .2 ppm	10 Max.
56V29	Less Than .2 ppm	10 Max.

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
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PLEASE REPLY TO:
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PITTSBURGH, PA. 15230
AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781674 to 781682

CLIENT'S No. P.O. 65121-258330

ORDER No. PG-6834

REPORT

December 16, 1977

	Water Soluble Sulfide (APA)	Specification Requirements
ID-28	Less Than .1 ppm	10 Max.
2D-3	Less Than .1 ppm	10 Max.
3D-28	Less Than .1 ppm	10 Max.
62H38	Less Than .1 ppm	10 Max.
42H80	Less Than .1 ppm	10 Max.
64H70	Less Than .1 ppm	10 Max.
12V29	Less Than .1 ppm	10 Max.
34V29	Less Than .1 ppm	10 Max.
56V29	Less Than .1 ppm	10 Max.

	Water (D95)	
ID-28	Less Than .1%	10 Max.
2D-3	Less Than .1%	10 Max.
3D-28	Less Than .1%	10 Max.
62H38	Less Than .1%	10 Max.
42H80	Less Than .1%	10 Max.
64H70	Less Than .1%	10 Max.
12V29	Less Than .1%	10 Max.
34V29	Less Than .1%	10 Max.
56V29	Less Than .1%	10 Max.

	Neutralization # (D-664)
ID-28	.07 mg/KOH/g
2D-3	.03 mg/KOH/g
3D-28	.03 mg/KOH/g
62H38	.10 mg/KOH/g
42H80	.11 mg/KOH/g
64H70	.15 mg/KOH/g
12V29	.25 mg/KOH/g
34V29	.11 mg/KOH/g
56V29	.11 mg/KOH/g

FORM 407 REV.-PG

PITTSBURGH TESTING LABORATORY

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850 POPLAR STREET, PITTSBURGH, PA. 15220

PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230

AREA CODE 412 TELEPHONE 922-4000

LABORATORY No. 781674 to 781682

CLIENT'S No. P.O. 65121-25833C

ORDER No. PG-6834

REPORT

December 16, 1977

The above samples comply with the specification requirements.

The above reported values for water soluble ions are correct in that no chloride, nitrate or sulfite were found. Had these ions been present the analytical accuracy would have been questionable due to the crude leaching procedure requirement by the specification.

PITTSBURGH TESTING LABORATORY

Robert J. King
Manager, Chemical Department

2-Client
Attn: H. L. Blocker
1-PTL-Tampa

pd

APPENDIX I

TESTING MACHINE CALIBRATION

REPORT

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 4

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland
July 1978

Form 60-A

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881
PITTSBURGH, PA.

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ORDER NO.

FILE NO.

CLIENT'S NO.

TESTING MACHINE CALIBRATION REPORT

DATE Nov. 25, 1977

MACHINE IDENTIFICATION

OWNER: PITTSBURGH TESTING LABORATORY

LOCATION: 850 POPLAR STREET, PITTSBURGH, PA 15220

MANUFACTURER: Tinius Olsen SERIAL NUMBER: 69069 PTL S/N 217

TYPE: Hydraulic

CALIBRATION APPARATUS DATA

Method of verification is in accordance with "Methods of Verification of Testing Machines" A.S.T.M. Specification E4-47T.

TYPE OF APPARATUS USED: Proving Rings

MANUFACTURER: Morehouse

APPARATUS VERIFIED BY: National Standards Laboratory

APPARATUS VERIFIED IN ACCORDANCE WITH: ASTM E 74-74

SERIAL NUMBER	LOADING RANGE	VERIFICATION DATE
3258	1,000 - 10,000	11/18/76
557	10,000 - 100,000	11/17/76
4656	100,000 - 1,000,000	5/7/75

RESULTS

MACHINE RANGE	LOADING RANGE WITHIN	PERCENT
0- 60,000	1,000 - 60,000	
0- 120,000	10,000 - 120,000	
0- 600,000	50,000 - 600,000	
0-1,200,000	100,000 - 1,000,000	

The above verification shows this machine complies with the requirements of the specifications within the loading ranges shown above.

Respectfully submitted,
PITTSBURGH TESTING LABORATORY

I-2

Paul Gallasher

Form 60-8

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881
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CLIENT'S NO.

TESTING MACHINE CALIBRATION DATA

MANUFACTURER	CAPACITY	SERIAL NO.	DATE
Tinius Olsen	1,200,000 lb.	69069 PTL S/N 217	11/25/77

LOCATION

Pittsburgh Testing Laboratory

850 Poplar Street

Pittsburgh, PA 15220

MACHINE READING lb.	PROVING RING READING lb.	MACHINE ERROR lb.	MACHINE ERROR %	REMARKS
1,000	1,007.9	-7.9	-0.78	60,000 Pound Range
5,000	5,028.5	-28.5	-0.57	
10,000	10,000	--		
15,000	14,924	+76	+0.51	
30,000	29,791	+208	+0.70	
45,000	44,788	+212	+0.47	
60,000	59,749	+253	+0.42	
				120,000 Pound Range
10,000	10,084	-84	-0.83	
30,000	29,961	+39	+0.13	
50,000	49,956	+44	+0.09	
70,000	70,116	-116	-0.17	
90,000	90,509	-509	-0.56	
99,000	99,654	-654	-0.66	
				600,000 Pound Range
50,000	50,337	-337	-0.67	
100,000	99,830	+170	+0.17	
200,000	198,903	+1097	+0.55	
300,000	299,495	+505	+0.17	
400,000	399,480	+520	+0.13	
500,000	497,506	+2494	+0.50	
600,000	595,991	+4009	+0.67	

PITTSBURGH TESTING LABORATORY

Form 60-B

PITTSBURGH TESTING LABORATORY

ESTABLISHED 1881

PITTSBURGH, PA.

ORDER NO.

CLIENT'S NO.

TESTING MACHINE CALIBRATION DATA

MANUFACTURER	CAPACITY	SERIAL NO.	DATE
Tinius Olsen	1,200,000 lb.	69069 PTL S/N 217	11/25/77

LOCATION

PITTSBURGH TESTING LABORATORY

850 POPLAR STREET

PITTSBURGH, PA 15220

MACHINE READING lb.	PROVING RING READING lb.	MACHINE ERROR lb.	MACHINE ERROR %	REMARKS
				1,200,000 Pound Range
100,000	99,910	+90	+0.09	
300,000	298,266	+1734	+0.58	
500,000	498,302	+1698	+0.34	
700,000	699,466	+534	+0.08	
900,000	896,991	+3009	+0.34	
1,000,000	995,984	+4106	+0.41	

PITTSBURGH TESTING LABORATORY