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FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 3

CONTAINMENT STRUCTURE

POST-TENSIONING SYSTEM

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

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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 3 Containment Structure consisted of the physical inspection of nine tendons as described in the FSAR Technical Specification, Section 4.4.6. These tendons were: 62H18, 42H70, 64H50, 23VI, 45V7, 61V1, 1D27, 2D28 and 3D28. During the current inspection, it was determined that tendon 64H51 was inadvertently reported as 64H50 in the previous surveillances. It was, therefore, decided to survey 64H50 and 64H51 and include them in this report. In addition, tendon 1D27 was found to be located over the main steam valves causing concern about the safety of personnel during a sudden and unexpected discharge. Tendon 1D53 was selected and surveyed in place of preselected tendon 1D27.

## 2.0 SUMMARY AND CONCLUSIONS

### 2.1 Summary

This report covers the fifth-year tendon surveillance for the post-tensioning system of the Unit 3 containment structure, at the Turkey Point Nuclear Power Plant. The surveillance was started in July 1977 and completed in August 1977.

The lift-off forces in all surveillance tendons, including the two new tendons, (64H50 & 1D53), 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. One tendon was found to have an excessive number of off-size buttonheads. However, the tendon was stressed to the full effective force with no observable adverse effect, and the lift-off forces were well within the acceptable limits. Washer faces of four of the tendons appeared to have hammer marks which were probably caused in an attempt to separate button heads from washers during the initial installation of the tendons or during one of the previous tendon surveillances. However, these marks do not affect the structural integrity of the washers. No discontinued wire was found on any of the tendons inspected.

Wires which were removed from the horizontal and dome tendons for physical testing were found in excellent condition with the exception of some minor surface scratches at a few places

along the length of the wires. The wire removed from the vertical tendon was in poor condition, with pitting and visible oxidation. This condition might have resulted from the presence of water in the tendon sheath filler as discussed below.

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.

No presence of water or abnormal discoloration was observed in the horizontal and dome tendon sheath fillers. Vertical tendon sheath fillers contained some water which probably seeped through the pockets in which these tendons are housed at the top of the dome. 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.

There was no grease leakage from the tendon grease caps surveyed during this surveillance. Some corrosion of grease caps and bearing plates, particularly on vertical tendons, was observed.

During the surveillance of tendon 1D53 it was observed that some concrete, about 5" x 6" x 24" long, was chipped off along the upper edge of the tendon pocket. It was assumed that this concrete was removed during the initial installation of the tendon. Careful examination of the area showed no exposure of the rebars and no adverse impact on the tendon bearing area or the structure.

The pockets housing the vertical tendons were found to be filled with water. In order to protect the anchorage assemblies and sheath filler against constant presence of water, it is recommended that the existing covers for the pockets be sealed water tight.

### 2.2 Conclusions

Based on the inspection and tests described herein, it is concluded that the post-tensioning system in the Unit 3 Containment Structure, at the Turkey Point Nuclear Power Plant, is in satisfactory condition and that stress levels are in accordance with predicted values.

## 3.0 GENERAL

The fifth-year tendon surveillance of the Turkey Point Nuclear Power Plant, Unit 3 Containment Structure Post-Tensioning System began in July 1977, three years after the completion of the third year surveillance in July 1974. 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, 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 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 "Surveillance Procedure for Containment Structure Post-Tensioning System," dated June 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 from horizontal and dome tendons were dark brown in appearance,

indicating the lack of water or impurities that may cause discoloration. However, the samples taken from the vertical tendons were dark brown mixed with light brown indicating the presence of some water.

### 4.2 End Anchorage Assemblies

The end anchorage assemblies of the surveillance tendons were examined and found to be in satisfactory condition. Off-size button heads were observed, which may have existed at the time of the initial tendon-stressing. One end anchorage assembly had a rather large number of off-size buttonheads. However, the tendon was stressed to the full effective force with no observable adverse effect, and the lift-off forces were well within the acceptable limits.

Mill scales and minor corrosion were noted on the mill-stock surfaces of the shims and the bearing plates. Surfaces cut during fabrication of the anchorage components showed slight spotty reddish discoloration; but no progressive corrosion was apparent.

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's:

$F_i = 0.70\ f's \times A_s$

$= 0.70 \times 240 \times 0.049$

$= 8.25$ kips/wire

where f's = ultimate strength of wire

$A_s$ = Area of wire

2. Wire force at 40 years (F40) 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 0.70 f's, 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.

Wires removed from the horizontal and dome tendons showed no physical imperfection with the exception of some surface scratches at a few places along the length of the wires. It is assumed that these scratches resulted either during the initial installation or during the removal of the wires. In either case they appeared to have no structural significance.

The wire removed from the vertical tendon contained some corrosion and pitting. However, overall condition of the wire was found to be satisfactory.

### 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. | 1

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 except one, exceeded the specified minimum yield strength of 192 ksi at one percent elongation. The yield strength of one specimen was lower than the specified value by approximately 2.3 percent. However, the average yield value for all the specimens tested from this wire was 201.2 ksi or 4.8 percent more than the specified minimum value. Therefore, the results for the yield strength are considered satisfactory.

7.1.4.2 Ultimate Strength

The ultimate strength of five out of nine wire specimens was lower than the specified minimum value of 240 ksi from approximately 0.7 percent to 6.0 percent. As explained in Section 7.1.2, a lower ultimate strength was expected because a 100-in-gage-length was used instead of the required 10-in-gage-length. Since the difference between the tested ultimate strength values and that specified is relatively small, no further testing of the wire samples is considered necessary. It is also important to note that the tested yield strength values are well above the minimum specified value thus showing that the structural integrity of the structure is not impaired.

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

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

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.

The laboratory report indicated that sample for tendon 64H50 could not be analyzed due to formation of emulsion during leaching. Another sample of filler from this tendon, from the retained samples, was sent to the laboratory for reanalysis. The results show that the the filler meets specification requirements.

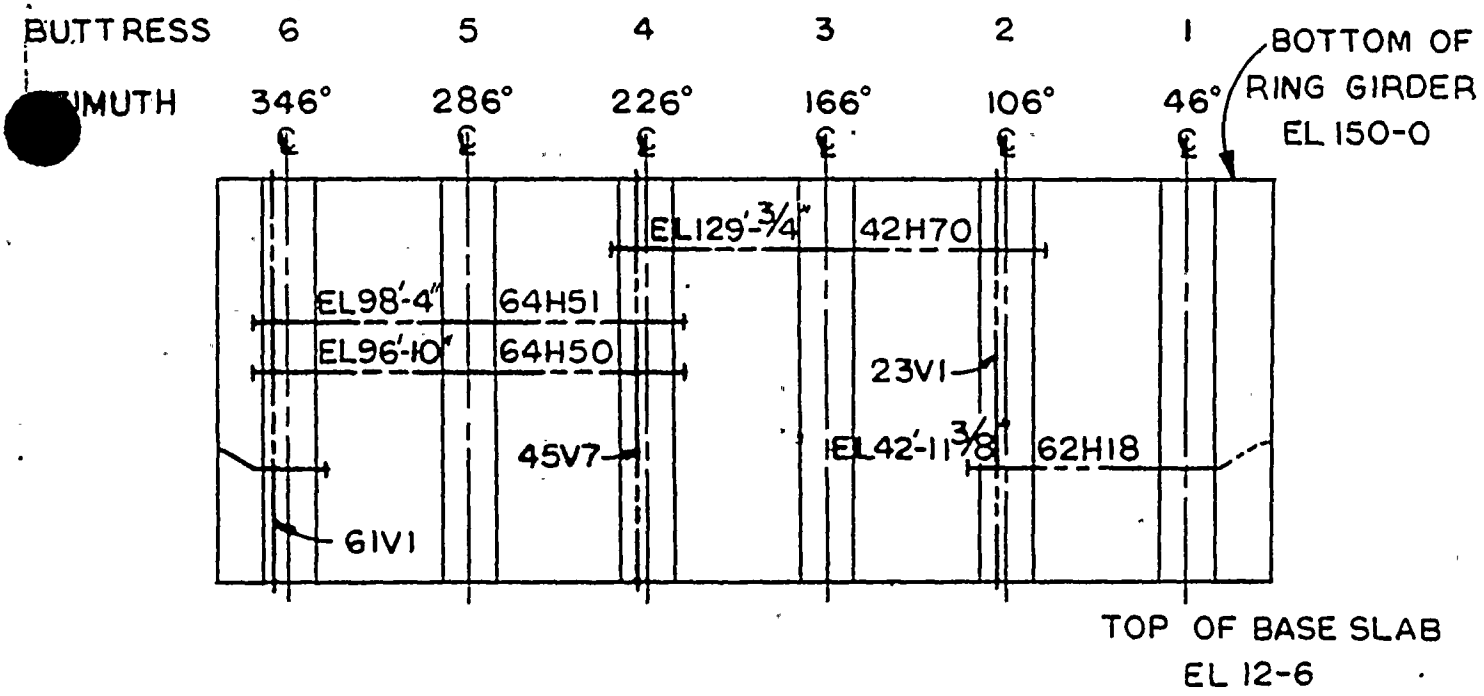
7.2.2 Test Procedures

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

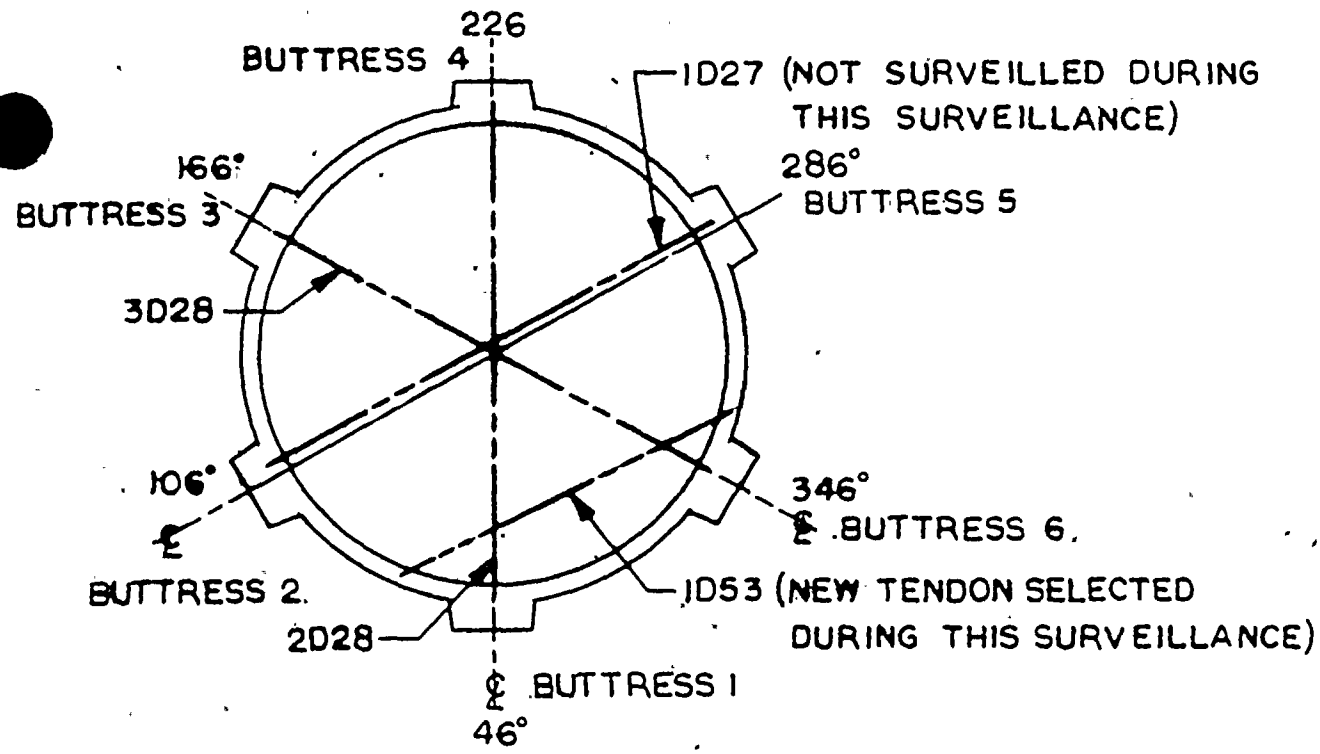
7.2.3 Test Results

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.




DEVELOPED EXTERIOR ELEVATION
HOOP AND VERTICAL TENDONS




PLAN

DOME TENDONS

| FLORIDA POWER & LIGHT CO. |
|---|
| TURKEY POINT NUCLEAR POWER PLANT UNIT 3 |
| POST-TENSIONING SYSTEM SURVEILLANCE TENDONS LOCATION AND IDENTIFICATION |
| FIGURE 3-1 |

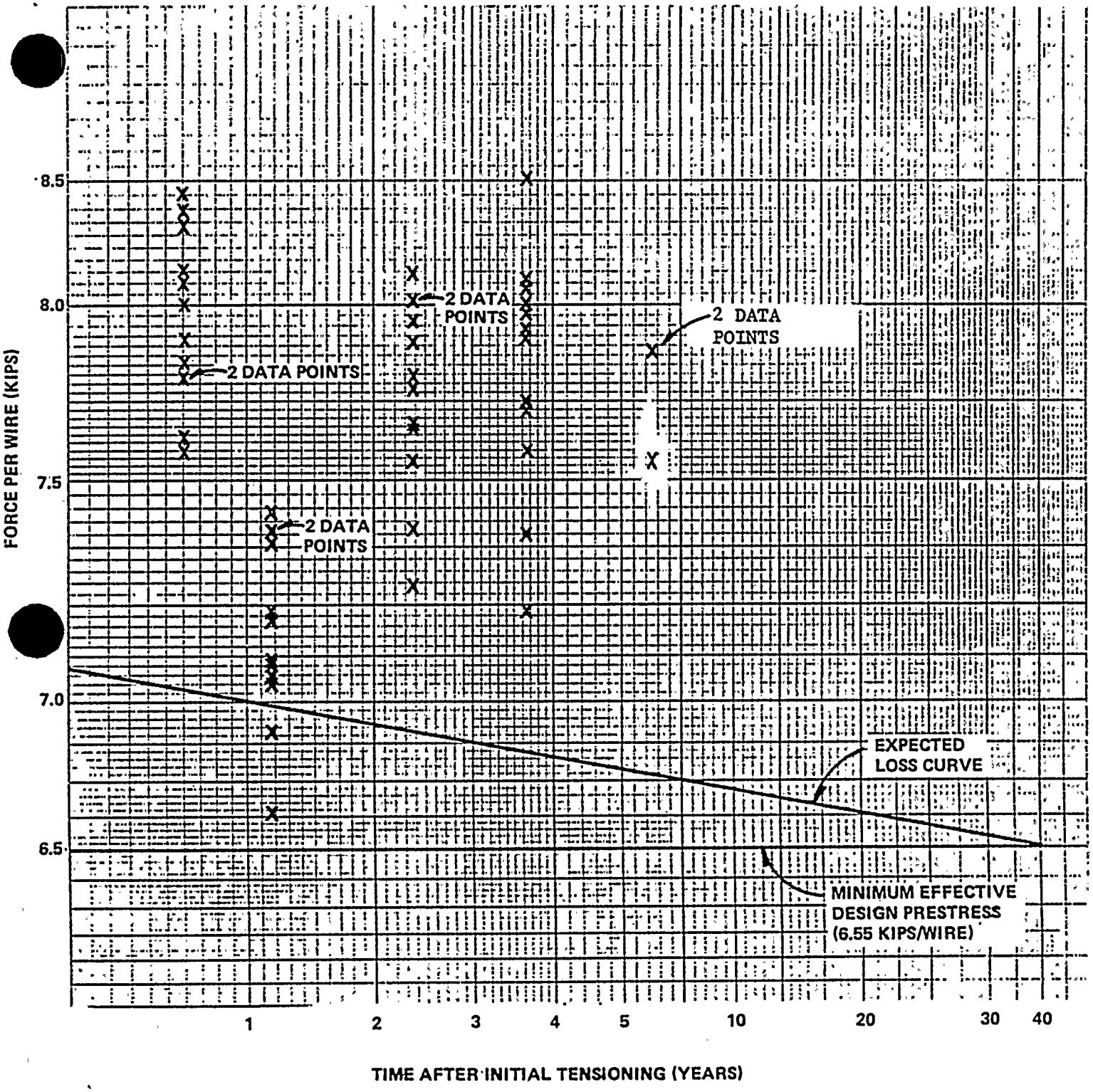



FIGURE 5.1

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
DOME TENDON AVERAGE
NORMALIZED LIFT-OFF WIRE FORCE
VS
TIME

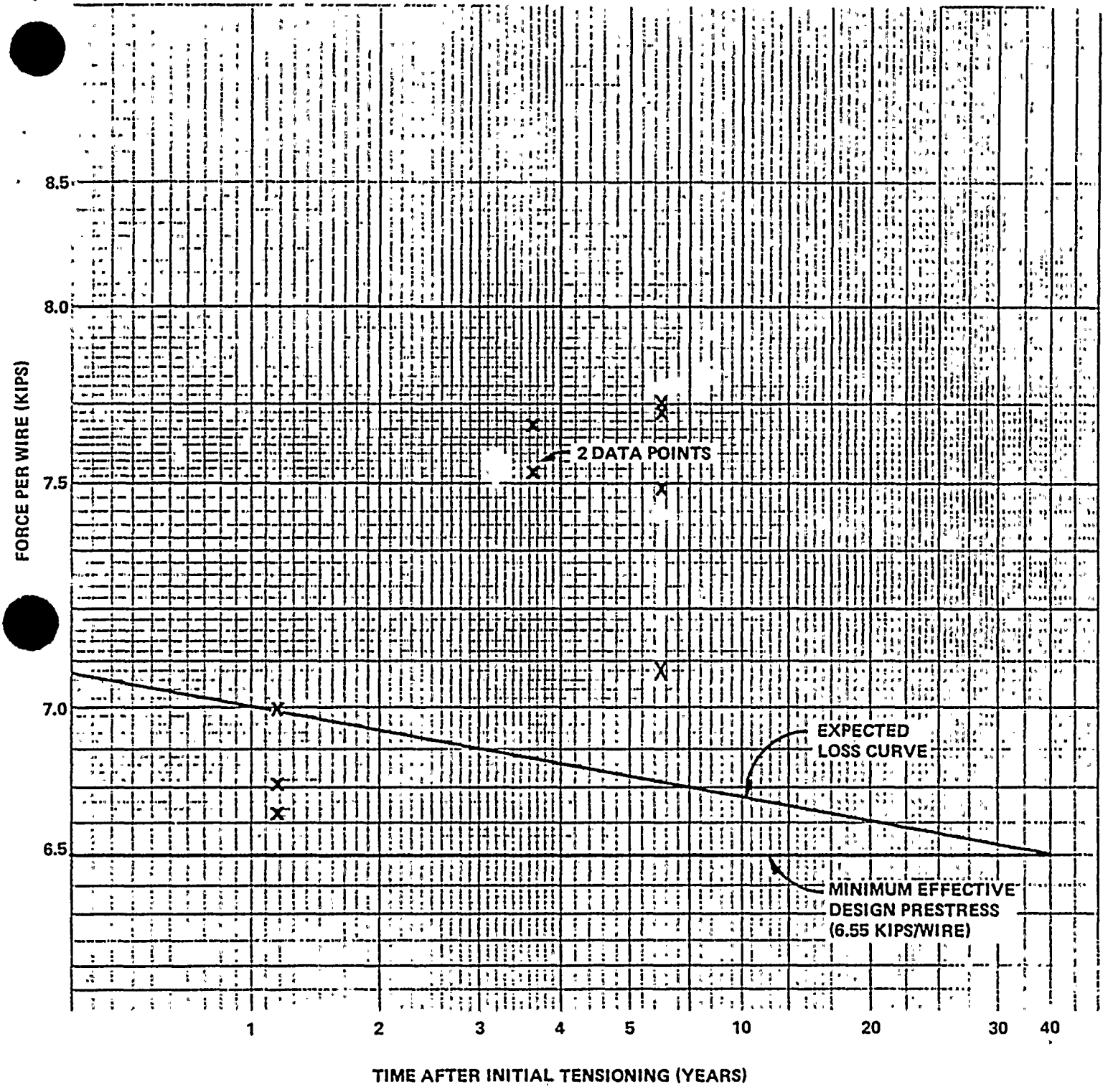



FIGURE 5.2

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST- TENSIONING SYSTEM
HORIZONTAL TENDON AVERAGE
NORMALIZED LIFT-OFF WIRE FORCE
VS
TIME

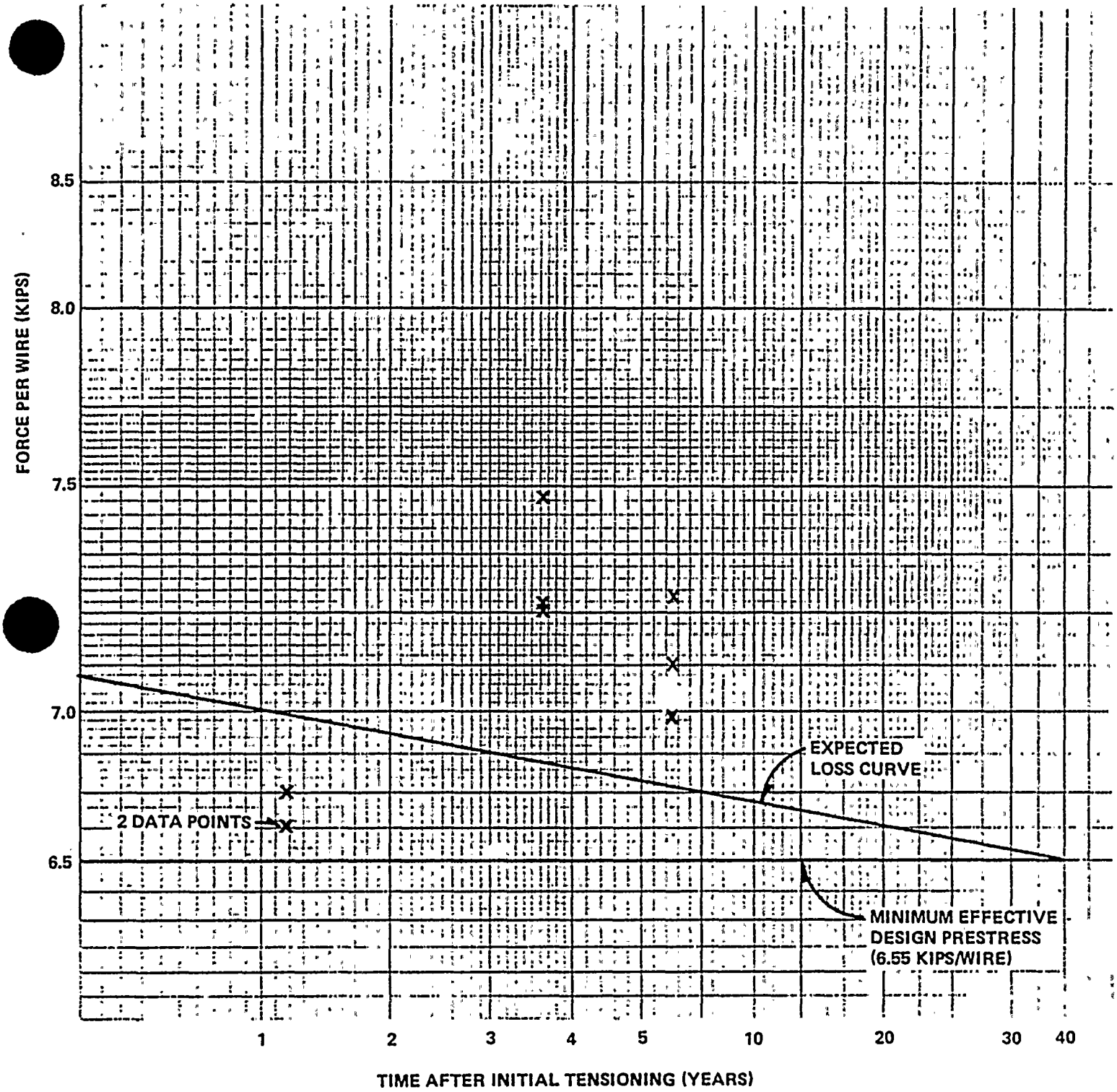



FIGURE 5.3

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
VERTICAL TENDON
NORMALIZED LIFT-OFF WIRE FORCE
VS
TIME

## 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 | CORROSION LEVEL | CRACKS | CORROSION LEVEL | CRACKS | CORROSION 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 |
| 62H18 | WALL | 2 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | 41 | 2 | NONE | 1 | NONE | 1 | NONE | 116 | 85[6] | 7-26-77 | ONE WIRE REMOVED FOR EXAMINATION |
| | HORIZ | 6 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | NONE | 1 | NONE | 1 | NONE | 1 | NONE | | 92 | 7-26-77 | |
| 64H50 | WALL | 4 | YES | YES | YES | YES | YES | NO | | 90 | 1 | NONE | NONE | 1 | NONE | 1 | NONE | 1 | NONE | 116 | 79 | 7-21-77 | |
| | HORIZ | 6 | YES | YES | YES | YES | YES | NO | | 90 | 1 | NONE | NONE | 1 | NONE | 2 | NONE | 1 | NONE | | 83 | 7-21-77 | |
| 64H51 | WALL | 4 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | NONE | 1 | NONE | 1 | NONE | 1 | NONE | 117 | 83 | 7-25-77 | |
| | HORIZ | 6 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | NONE | 1 | NONE | 1 | NONE | 1 | NONE | | 87 | 7-25-77 | |
| 42H70 | WALL | 4 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | NONE | 2 | NONE | 2 | NONE | 1 | NONE | 116 | 84 | 7-18-77 | |
| | HORIZ | 2 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | 1 | 1 | NONE | 1 | NONE | 1 | NONE | | 86 | 7-18-77 | |
| 1D53 | DOME | 1 | YES | YES | YES | YES | YES | NO | SEE NOTE 4 | 90 | 3[5] | NONE | NONE | 2 | NONE | 1 | NONE | 1 | NONE | 116 | 80 | 8-9-77 | |
| | | 6 | YES | YES | YES | YES | YES | NO | | 90 | 1 | NONE | 1 | 1 | NONE | 1 | NONE | 1 | NONE | | 85 | 8-9-77 | |
| 2D28 | DOME | 1 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | NONE | 1 | NONE | 1 | NONE | 1 | NONE | 117 | 83 | 7-29-77 | ONE WIRE REMOVED FOR EXAMINATION |
| | | 4 | YES | YES | YES | YES | YES | NO | | 88 | 1 | NONE | 1 | 1 | NONE | 1 | NONE | 1 | NONE | | 91 | 7-29-77 | |
| 3D28 | DOME | 3 | YES | YES | YES | YES | YES | NO | | 89 | 1 | NONE | 1 | 2 | NONE | 1 | NONE | 1 | NONE | 117 | 80 | 7-28-77 | |
| | | 6 | YES | YES | YES | YES | YES | NO | | 89 | 1 | NONE | 1 | 3[5] | NONE | 1 | NONE | 2 | NONE | | 95 | 7-28-77 | |
| 23V1 | WALL | 2/T | YES | YES | YES | YES | YES | YES* | | 88 | 1 | NONE | NONE | 2 | NONE | 1 | NONE | 1 | NONE | 117 | 82 | 8-4-77 | ONE WIRE REMOVED FOR EXAMINATION |
| | VERT | 2/B | YES | YES | YES | YES | YES | YES* | | 88 | 1 | NONE | NONE | 2 | NONE | – | – | 1 | NONE | | – | 8-4-77 | |
| 45V7 | WALL | 4/T | NO** | NO** | NO** | NO** | NO** | YES* | | 86 | 1 | NONE | NONE | 2 | NONE | 1 | NONE | 1 | NONE | 117 | 85 | 8-3-77 | |
| | VERT | 4/B | YES | YES | YES | YES | YES | YES* | | 86 | 1 | NONE | NONE | 1 | NONE | – | – | 1 | NONE | | – | 8-4-77 | |
| 61V7 | WALL | 6/T | YES | YES | YES | YES | YES | YES* | | 88 | 1 | NONE | NONE | 1 | NONE | 2 | NONE | 1 | NONE | 116 | 89 | 8-2-77 | |
| | VERT | 6/B | YES | YES | YES | YES | YES | YES* | | 88 | 1 | NONE | 1 | 1 | NONE | – | – | 1 | NONE | | – | 8-3-77 | |

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 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 0.003" DEPTH
   LEVEL 4 – 0.003" PITTING 0.006"
   LEVEL 5 – 0.006" PITTING 0.010"
   LEVEL 2 IS EQUIVALENT TO LEVELS B 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. ABOUT 20% PITTING.

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

*SOME CHANGE IN COLOR DUE TO PRESENCE OF WATER.

**5% COVERAGE ONLY.

## TABLE 5.1
## SUMMARY OF DATA-DETENSIONING AND WIRE REMOVAL

| TENDON | | NO. OF EFFECTIVE WIRES | DATE DETENSIONED | AIR TEMPERATURE °F | | @ LIFT-OFF | | | @ 0.8$f_s$ | | | @ 1000 LBS./WIRE | | | TENSIONING EQUIPMENT | | INITIAL WIRE LENGTH (FT) | WIRE REMOVAL | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | TENSION | | | TENSION | | | TENSION | | | | | | | | CORROSION LEVEL[4] | |
| IDENTIFICATION | ANCHORAGE LOCATION | | | INT. | (7) EXT. | 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 |
| 62H18 | 2 | 88 | 7-26-77 | 116 | 85 | 6033 | 730 | 4-3/4 | 6900 | 830 | 5-1/4 | 800 | 86 | 3/4 | 04-08 | G-221 | 140.97 | 6 | 141.17 | 1 | 1 |
| | 6 | | | | 82 | 5784 | 700 | 4-1/4 | 6900 | 830 | 4-1/2 | 750 | 88 | 1/16 | 05-08 | G-109 | | | | | |
| 64H50 | 4 | 90 | 7-22-77 | 118 | 79 | 5367 | 650 | 2-1/2 | 7100 | 849 | 3-5/8 | 800 | 90 | -3/4 | 04-08 | G-221 | | – | – | – | – |
| | 6 | | | | 84 | 5367 | 645 | 2-1/8 | 7050 | 849 | 3-9/16 | 800 | 90 | -1-1/4 | 05-08 | G-109 | | | | | |
| 64H51 | 4 | 88 | 7-25-77 | 117 | 83 | 6367 | 765 | 4-1/4 | 6900 | 830 | 4-1/2 | 800 | 88 | 1/2 | 04-08 | G-221 | | – | – | – | – |
| | 6 | | | | 81 | 5817 | 700 | 3-7/8 | 6900 | 830 | 4-5/16 | 750 | 88 | -1-15/16 | 05-08 | G-109 | | | | | |
| 42H70 | 4 | 88 | 7-19-77 | 116 | 84 | 5933 | 720 | 3-5/8 | 6900 | 830 | 4-3/8 | 800 | 88 | 1/2 | 04-08 | G-221 | | – | – | – | – |
| | 2 | | | | 86 | 5884 | 710 | 4-1/8 | 6900 | 830 | 4-15/16 | 800 | 88 | -5/8 | 05-08 | G-109 | | | | | |
| 1D53 | 1 | 90 | 8-9-77 | 116 | 82 | 5885 | 690 | 3 | 7200 | 849 | 3-3/4 | 800 | 90 | 3/8 | 03-16 | A-216 | | – | – | – | – |
| | 6 | | | | 85 | 5800 | 700 | 3-3/8 | 7050 | 849 | 4-1/2 | 800 | 90 | 7/16 | 05-08 | G-109 | | | | | |
| 2D28 | 1 | 88 | 8-1-77 | 117 | 82 | 5968 | 705 | 4-1/2 | 7100 | 830 | 5-1/2 | 750 | 88 | 3/8 | 03-16 | A-216 | 132.56 | 4 | 132.75 | 1 | 1 |
| | 4 | | | | 87 | 6300 | 760 | 4-3/4 | 6900 | 830 | 5-3/16 | 750 | 88 | -1/8 | 05-08 | G-109 | | | | | |
| 3D28 | 3 | 89 | 7-28-77 | 117 | 80 | 6166 | 725 | 4 | 7150 | 840 | 4-3/4 | 775 | 89 | 3/8 | 03-16 | A-216 | | – | – | – | – |
| | 6 | | | | 87 | 6117 | 735 | 4-1/8 | 7000 | 849 | 4-5/8 | 750 | 89 | -1-7/16 | 05-08 | G-109 | | | | | |
| 23V1 | 2/T | 88 | 8-5-77 | 117 | 80 | 5900 | 695 | 8-1/2 | 7100 | 830 | 11 | 800 | 88 | -7/8 | 03-16 | A-216 | 169.48 | B | 169.92 | 1 | 3 |
| | 2/B | | | | – | – | – | – | – | – | – | – | – | – | – | – | | | | | |
| 45V7 | 4/T | 86 | 8-4-77 | 117 | 83 | 5580 | 645 | 8-3/8 | 6900 | 811 | 10-3/4 | 700 | 86 | -1 | 03-16 | A-216 | | – | – | – | – |
| | 4/B | | | | – | – | – | – | – | – | – | – | – | – | – | – | | | | | |
| 61V1 | 6/T | 88 | 8-3-77 | 118 | 85 | 5734 | 675 | 8-1/2 | 7100 | 830 | 10-3/4 | 750 | 88 | -1-3/8 | 03-16 | A-216 | | – | – | – | – |
| | 6/B | | | | – | – | – | – | – | – | – | – | – | – | – | – | | | | | |

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 1.0 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. 0.001 < PITTING ≤ 0.003"
4. 0.003 < PITTING ≤ 0.006"
5. 0.003 < PITTING ≤ 0.010"

(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 |
| 62H18 | 6 | 0.937 | 7.45 | 7.49 |
| | 2 | 0.907 | 7.53 | |
| 64H50 | 6 | 1.016 | 7.28 | 7.10 |
| | 4 | 0.957 | 6.91 | |
| 64H51 | 6 | 0.951 | 7.56 | 7.74 |
| | 4 | 0.912 | 7.93 | |
| 42H70 | 4 | 0.971 | 7.94 | 7.72 |
| | 2 | 0.928 | 7.49 | |
| 1D53 | 6 | 0.978 | 7.61 | 7.56 |
| | 1 | 0.978 | 7.50 | |
| 2D28 | 4 | 0.980 | 8.47 | 7.84 |
| | 1 | 0.901 | 7.22 | |
| 3D28 | 6 | 0.967 | 7.99 | 7.85 |
| | 3 | 0.946 | 7.71 | |
| 23V1 | T* | 0.923 | 7.29 | 7.29 |
| 45V7 | T | 0.950 | 7.13 | 7.13 |
| 61V1 | T | 0.905 | 6.95 | 6.95 |

*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 |
| 62H18 | 2 | 87 | 7-27-77 | 116 | 84 | 775 | 87 | 3/4 | -5/16 | 6850 | 820.5 | 4-3/4 | -7/16 | 6025 | 730 | 4-3/4 | 0 | 04-08 | G-221 | 7-27-77 | 21 | 86 |
| | 6 | | | | 89 | 700 | 87 | -1/4 | | 6800 | 820.5 | 4-9/16 | | 6300 | 760 | 4-1/4 | | 05-08 | G-109 | | | |
| 64H50 | 4 | 90 | 7-25-77 | 117 | 84 | 800 | 90 | -7/16 | 5/16 | 7100 | 849 | 4-1/4 | 1/16 | 5433 | 660 | 2-7/8 | 7/8 | 04-08 | G-221 | 7-25-77 | 23 | 92 |
| | 6 | | | | 87 | 800 | 90 | -1-1/4 | | 7050 | 849 | 3 | | 5650 | 680 | 2-5/8 | | 05-08 | G-109 | | | |
| 64H51 | 4 | 88 | 7-26-77 | 116 | 80 | 800 | 88 | 1 | 2-1/16 | 6900 | 831 | 4-3/4 | 7/16 | 6367 | 765 | 4-1/4 | 0 | 04-08 | G-221 | 7-26-77 | 12 | 87 |
| | 6 | | | | 81 | 750 | 88 | -3/8 | | 6900 | 831 | 4-1/2 | | 5900 | 710 | 3-7/8 | | 05-08 | G-109 | | | |
| 42H70 | 4 | 88 | 7-20-77 | 116 | 80 | 800 | 88 | -1/2 | 0 | 6900 | 831 | 2-3/4 | -1-3/8 | 6265 | 755 | 3-1/2 | 1/2 | 04-08 | G-221 | 7-20-77 | 17 | 84 |
| | 2 | | | | 87 | 750 | 88 | 3/8 | | 6900 | 831 | 5-3/16 | | 6100 | 735 | 4-3/4 | | 05-08 | G-109 | | | |
| 1D53 | 1 | 90 | 8-10-77 | 116 | 81 | 800 | 90 | 1/2 | 3/16 | 7200 | 841 | 4-1/16 | -5/16 | 6400 | 750 | 4 | 1 | 03-16 | A-216 | 8-10-77 | 21 | 121 |
| | 6 | | | | 91 | 800 | 90 | 1/2 | | 7050 | 849 | 3-7/8 | | 6367 | 765 | 3-3/8 | | 05-08 | G-109 | | | |
| 2D28 | 1 | 87 | 8-1-77 | 117 | 81 | 750 | 87 | 3/4 | 7/16 | 7000 | 820.5 | 5-7/8 | 0 | 6700 | 785 | 5-1/4 | 1/2 | 03-16 | A-216 | 8-1-77 | 24 | 132 |
| | 4 | | | | 88 | 700 | 87 | -1/16 | | 6800 | 820.5 | 4-13/16 | | 6367 | 765 | 4-1/2 | | 05-08 | G-109 | | | |
| 3D28 | 3 | 89 | 7-29-77 | 117 | 80 | 775 | 89 | -5/8 | 13/16 | 7150 | 840 | 4-1/4 | 1/8 | 6517 | 770 | 4-1/4 | 1/2 | 03-16 | A-216 | 7-29-77 | 30 | 110 |
| | 6 | | | | 92 | 750 | 89 | 3/8 | | 7000 | 840 | 5-1/4 | | 6300 | 760 | 4-3/8 | | 05-08 | G-109 | | | |
| 23V1 | 2/T | 87 | 8-5-77 | 117 | 83 | 800 | 87 | -1 | -1/8 | 7000 | 826.5 | 11 | 0 | 6000 | 705 | 9 | 1/2 | 03-16 | A-216 | 8-5-77 | 80 | 108 |
| | 2/B | | | | – | – | – | – | | – | – | – | | – | – | – | | – | – | | | |
| 45V7 | 4/T | 86 | 8-4-77 | 117 | 84 | 700 | 86 | -1 | 0 | 6900 | 815 | 10-7/8 | 1/8 | 5684 | 670 | 8-3/8 | 0 | 03-16 | A-216 | 8-4-77 | 90 | 110 |
| | 4/B | | | | – | – | – | – | | – | – | – | | – | – | – | | – | – | | | |
| 61V1 | 6/T | 88 | 8-3-77 | 116 | 85 | 750 | 88 | -1-1/2 | -1/8 | 7100 | 838 | 11-3/4 | 1 | 5850 | 685 | 8-3/8 | -1/8 | 03-16 | A-216 | 8-3-77 | 87 | 121 |
| | 6/B | | | | – | – | – | – | | – | – | – | | – | – | – | | – | – | | | |

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.) |
|---|---|---|---|---|---|---|---|
| 23V1 | C.E. | 10,450 | 212,400 | 12,050 | 244,900 | 4.84 | 47.06 |
| | B.E. | 9,250 | 187,600 | 11,350 | 230,200 | 4.85 | 16.27 |
| | M.S. | 10,000 | 203,700 | 11,800 | 240,300 | 4.20 | 46.69 |
| 62H18 | C.E. | 10,300 | 210,200 | 11,550 | 235,700 | 4.21 | 27.63 |
| | B.E. | 10,000 | 203,700 | 11,700 | 238,300 | 4.85 | 3.75 |
| | M.S. | 9,900 | 202,000 | 11,050 | 225,500 | 3.91 | 13.94 |
| 2D28 | C.E. | 11,200 | 227,600 | 12,200 | 248,000 | 4.96 | 15.63 |
| | B.E. | 10,050 | 203,900 | 12,000 | 243,400 | 4.77 | 12.87 |
| | M.S. | 9,950 | 202,600 | 11,700 | 238,300 | 5.27 | 25.75 |

(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 3

# FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

By: Charles Andrews
Charles W. Andrews

June 1977

Revision 1, July 7, 1977
Revision 2, July 22, 1977
Revision 3, December 15, 1977

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

## 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 Appendix E. 3

2.9 Testing sheath filler per Appendix 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 3 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: 1D27, 2D28, 3D28

One wire shall be removed from Tendon 2D28



3

3.2 Horizontal tendons: 62H18, 64H50, 42H70

One wire shall be removed from Tendon 62H18

3.3 Vertical tendons: 23V1, 45V7, 61V1

One wire shall be removed from Tendon 23V1

## 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: 2D28

Horizontal tendon: 62H18

Vertical tendon: 23V1

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 $\pm 0.02$ inches.



|3

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. |2

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. Visconorust 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.

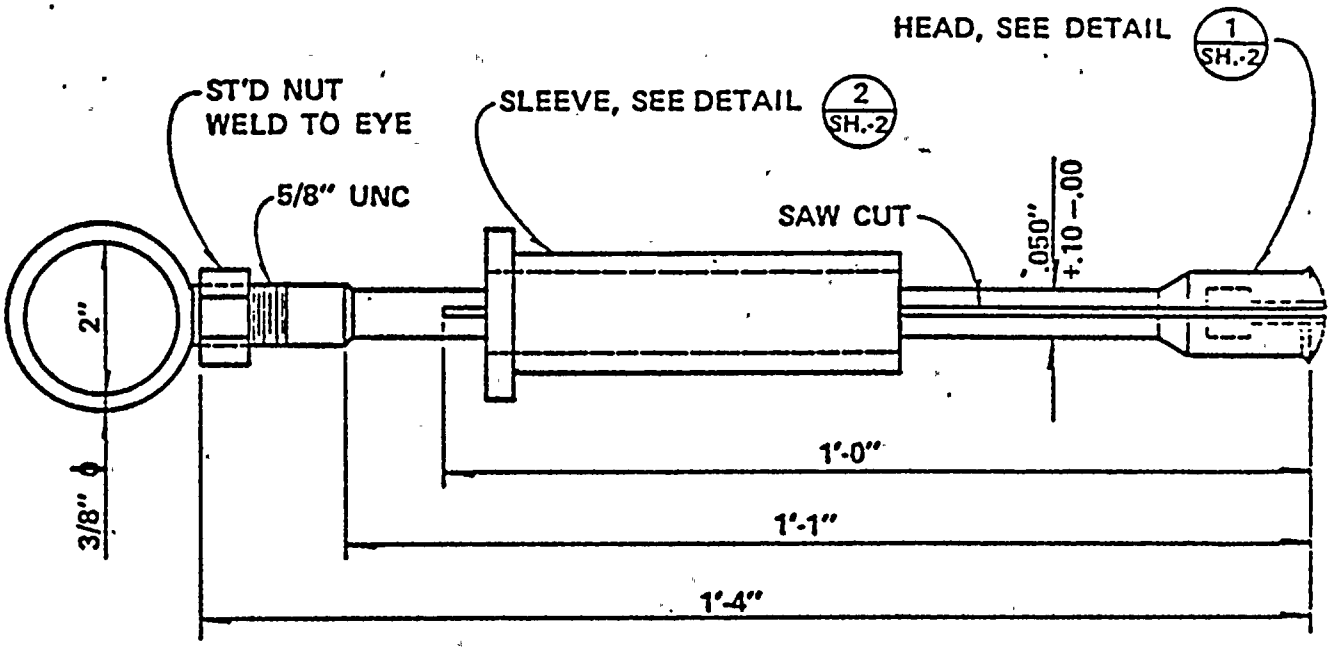
e. Significant changes in wire elongation, yield, and ultimate strength have occurred.

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

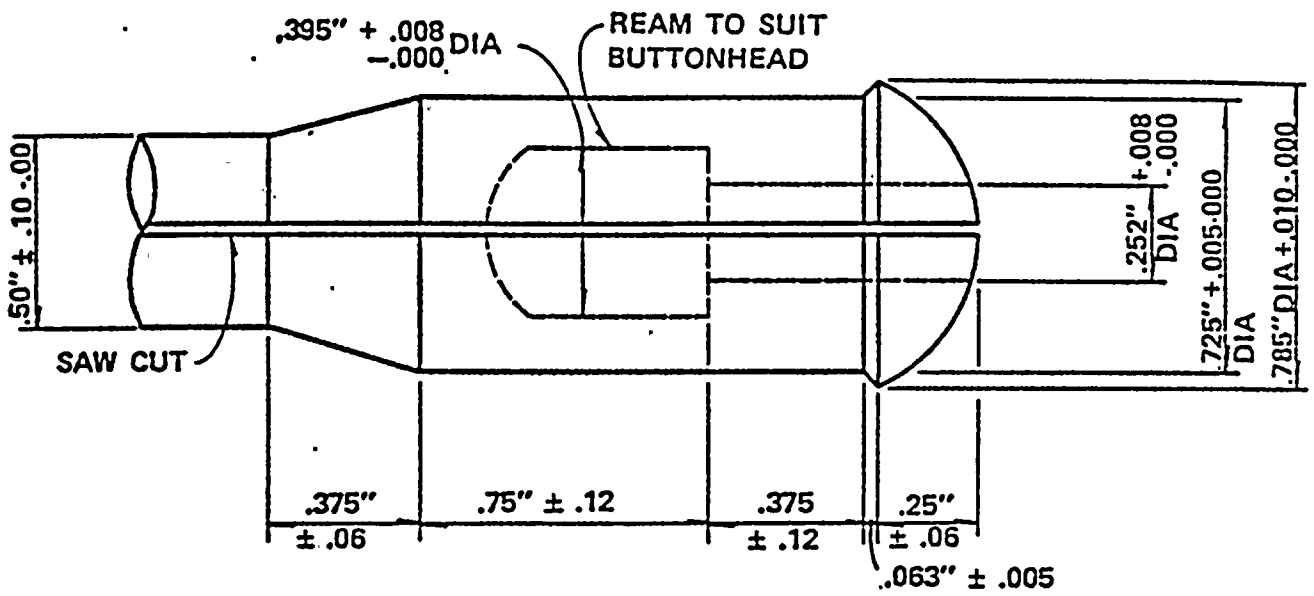



NOTES:

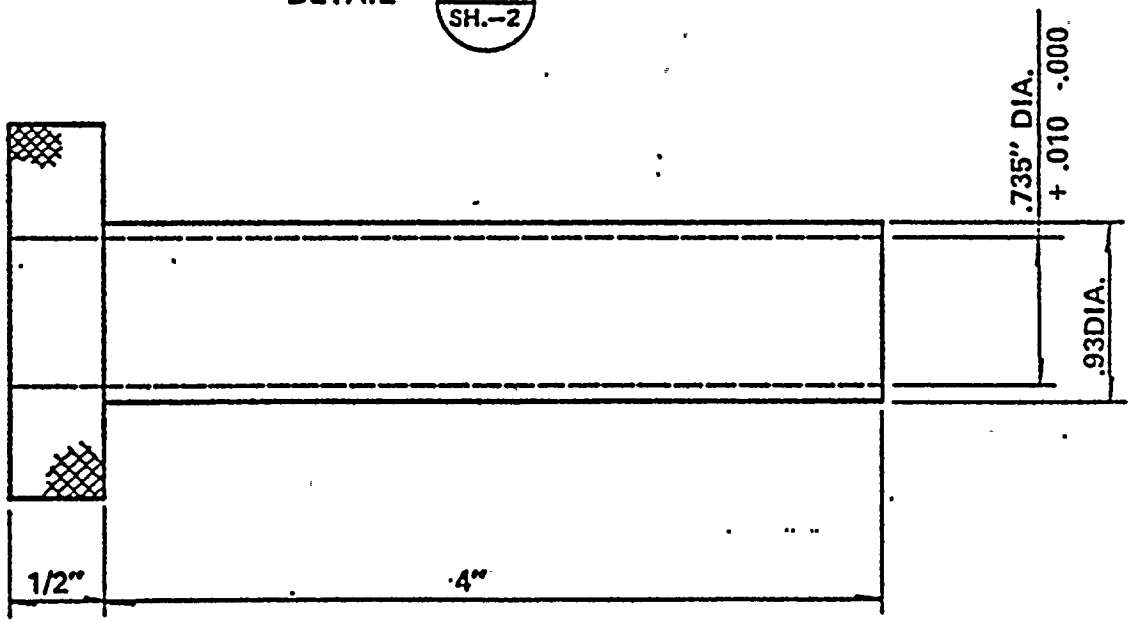
1. The nut with the pulling ring welded to it may be replaced with an eye nut.
2. The hardness of this tool shall not exceed Rockwell C40.

FIGURE A-2 SHEET 1 OF 2

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
TENDON SURVEILLANCE
UNIT 3
WIRE PULLER




HEAD DETAIL 1 / SH.–2



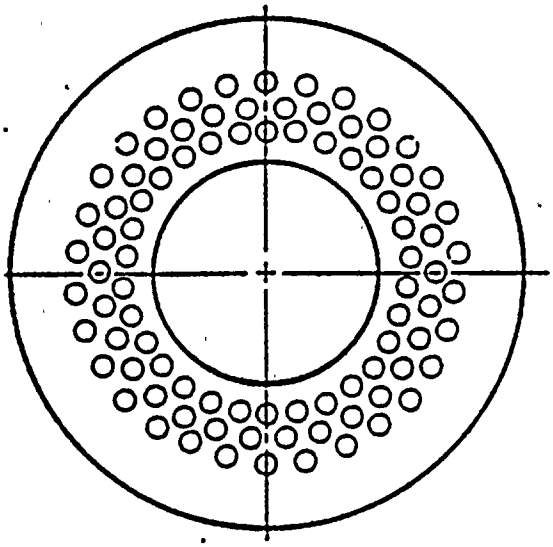

MOVABLE SLEEVE DETAIL 2 / SH.–2

FIGURE A-2 SHEET 2 OF 2

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
TENDON SURVEILLANCE
UNIT 3
WIRE PULLER

Revision 3

TENDON NO. _____ LOCATION (CLOSEST BUTTRESS) _____



END ANCHORAGE A

(CLOSEST BUTTRESS____)

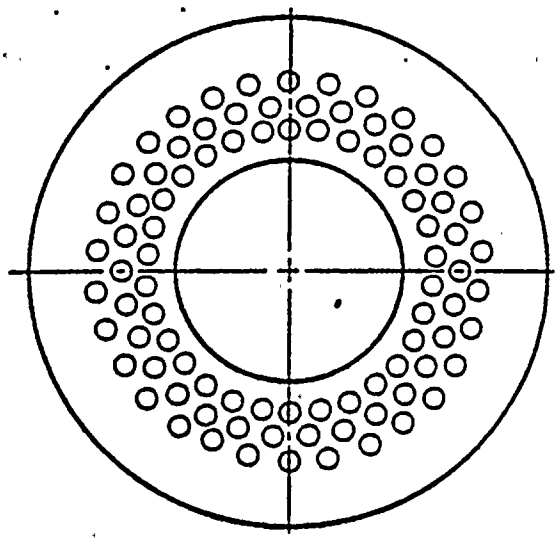
CORROSION LEVEL

WASHER _____

BUTTONHEADS _____

SHIMS _____

BEARING PLATE ____



END ANCHORAGE B

(CLOSEST BUTTRESS____)

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 3
POST-TENSIONING SYSTEM
-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 _____

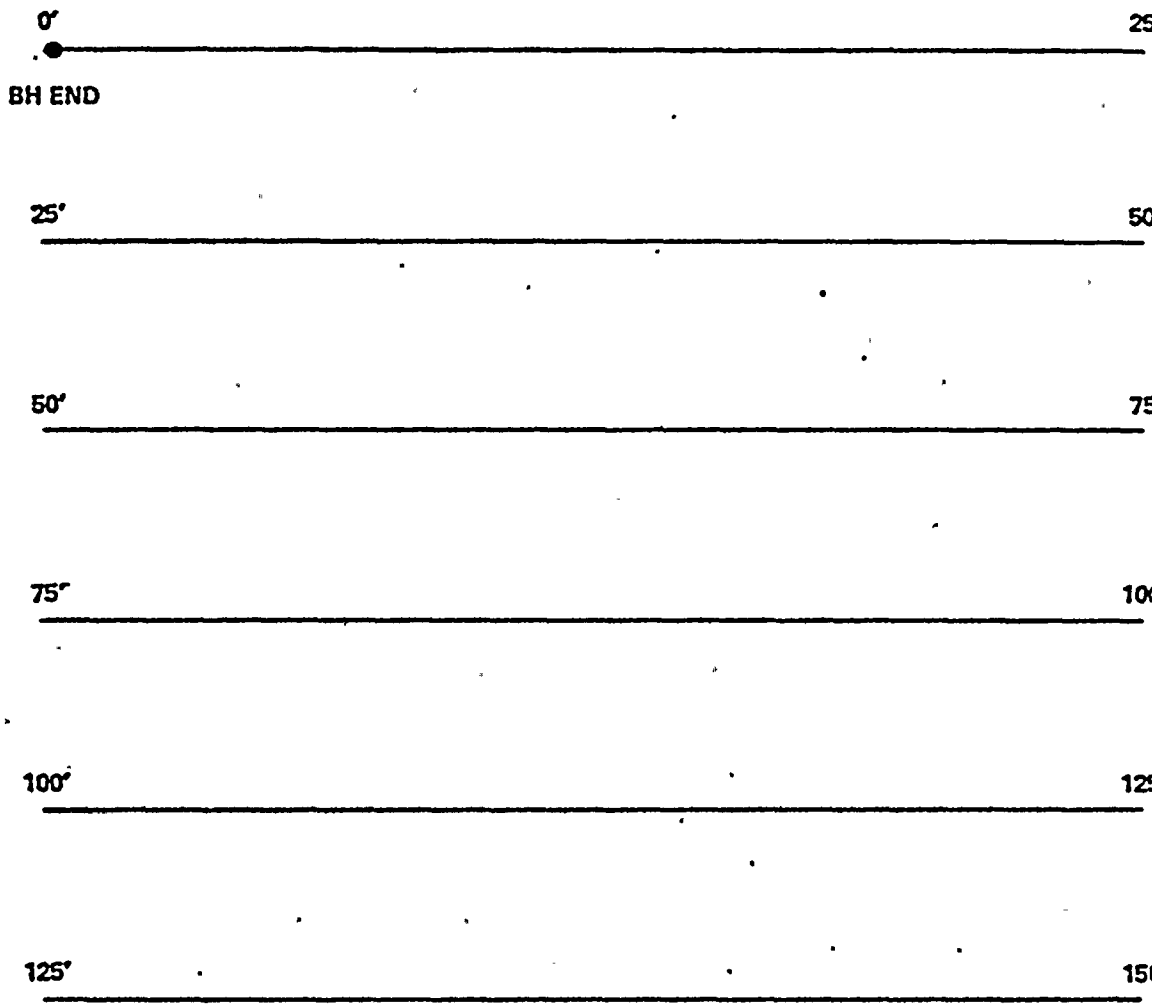
| | DESCRIPTION | OBJECTIVE | ACTUAL MEASURED |
|---|---|---|---|
| DETENSIONING | CHECK GAGES (ZERO) | | |
| | MEASURE SHIMS | | |
| | OBTAIN LIFT-OFF | | |
| | PRESSURIZE TO .8$f'_s$ | | |
| | MEASURE ELONGATION @ .8$f'_s$ ** | | |
| | DEPRESSURIZE TO ZERO | | |
| | PRESSURIZE TO 1000 LB/WIRE | | |
| | 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 .8$f'_s$ | | |
| | MEASURE ELONGATION AT .8$f'_s$ ** | | |
| | PRESSURE @ RESHIM * | | |
| | A) NEW LIFT-OFF | | |
| | B) NEW SHIMS | | |

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

** 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 3
POST TENSIONING SYSTEM
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 3
POST-TENSIONING SYSTEM
YEAR SURVEILLANCE



SHEET OF

# APPENDIX B

FORMULAS

FOR

NORMALIZING FACTORS AND NORMALIZED FORCES

FOR

FLORIDA POWER & LIGHT COMPANY

TURKEY POINT NUCLEAR POWER PLANT

UNIT 3

FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland
August 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

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

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

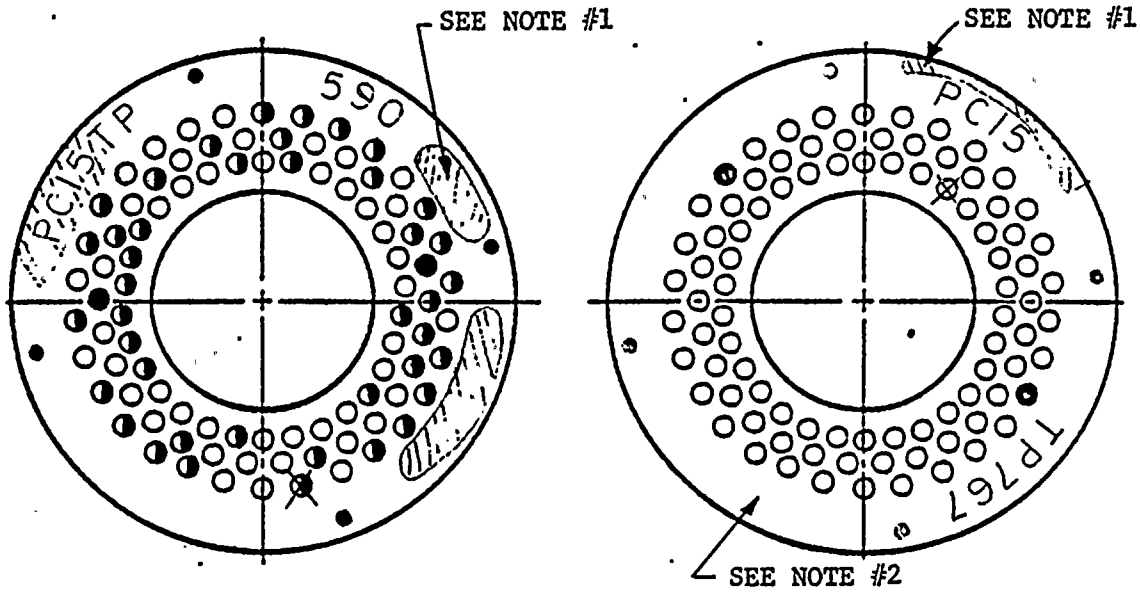
## TURKEY POINT NUCLEAR POWER PLANT

## UNIT 3

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

August 1977

TENDON NO. 62H18 LOCATION (CLOSEST BUTTRESS) 2 & 6




END ANCHORAGE A

(CLOSEST BUTTRESS 2)

END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

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 R.B. DATE 7-26-77

END ANCHORAGE B A.H. DATE 7-26-77

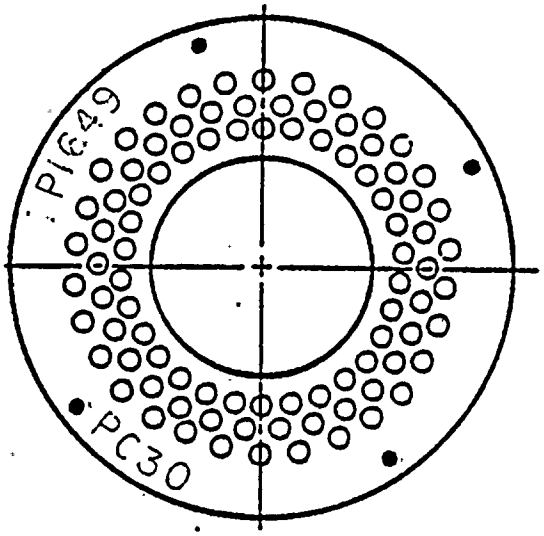
NOTES

1. ▨ indicates area of washer that appears to have been beaten with a hammer.
2. Overall face of washer has some hammer markings.

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 64H50 LOCATION (CLOSEST BUTTRESS) 4 & 6




END ANCHORAGE A

(CLOSEST BUTTRESS 4 )

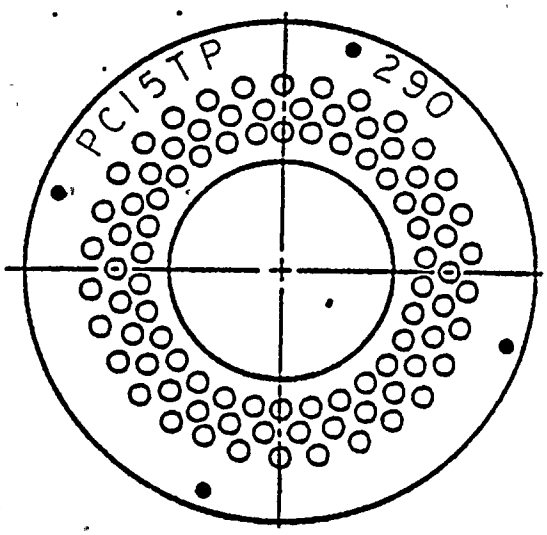
CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1




END ANCHORAGE B

(CLOSEST BUTTRESS 6 )

CORROSION LEVEL

WASHER 1

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

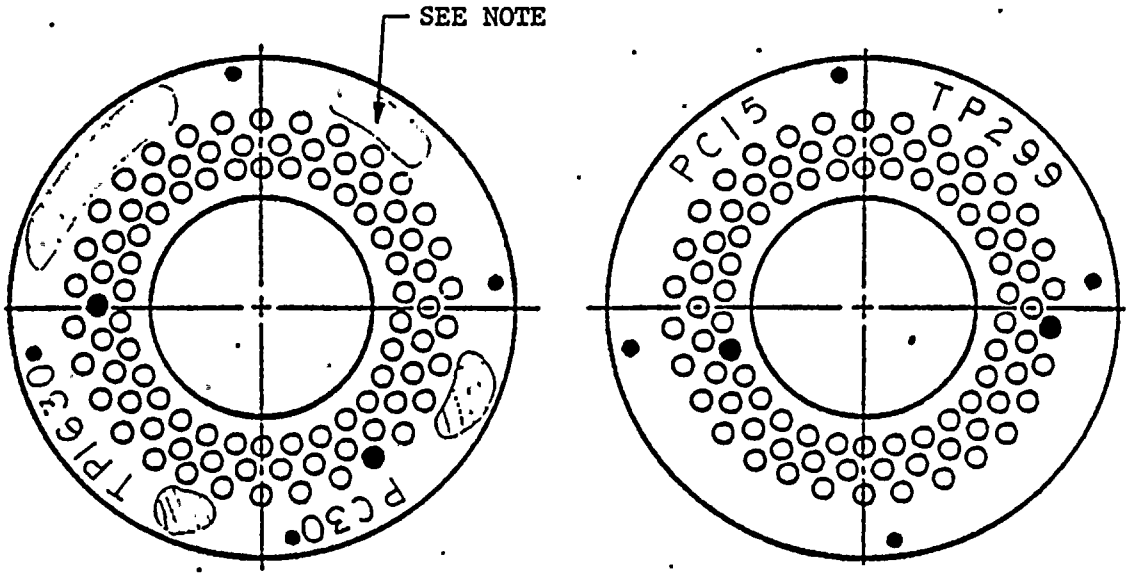
END ANCHORAGE A R.B. DATE 7-21-77

END ANCHORAGE B A.H. DATE 7-21-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 64H51 LOCATION (CLOSEST BUTTRESS) 4 & 6




END ANCHORAGE A

(CLOSEST BUTTRESS 4)

END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 1
BUTTONHEADS 1
SHIMS 1
BEARING PLATE 1

CORROSION LEVEL

WASHER 1
BUTTONHEADS 1
SHIMS 1
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 R.B. DATE 7-25-77

END ANCHORAGE B A.H. DATE 7-25-77

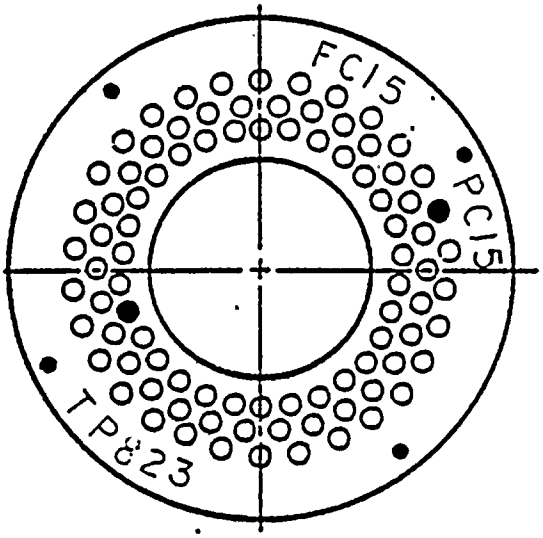
NOTE

1. ▨ indicates area of washer that appears to have been beaten with a hammer.

FIGURE 3

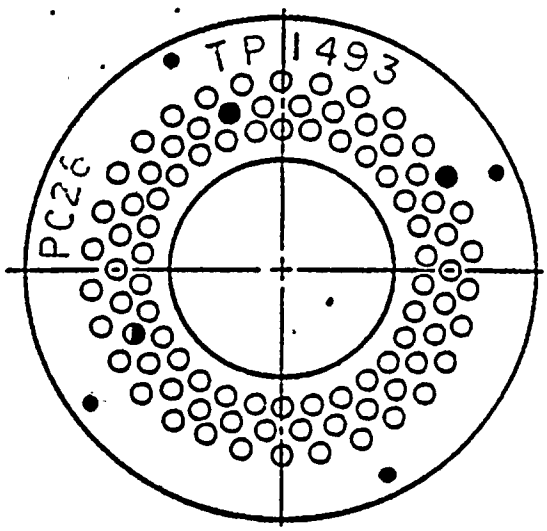
FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 42H70 LOCATION (CLOSEST BUTTRESS) 4 & 2




END ANCHORAGE A

(CLOSEST BUTTRESS 4)




END ANCHORAGE B

(CLOSEST BUTTRESS 2)

CORROSION LEVEL

WASHER 2
BUTTONHEADS 1
SHIMS 2
BEARING PLATE 1

CORROSION LEVEL

WASHER 1
BUTTONHEADS 1
SHIMS 1
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 R.B. DATE 7-18-77
END ANCHORAGE B A.H. DATE 7-18-77

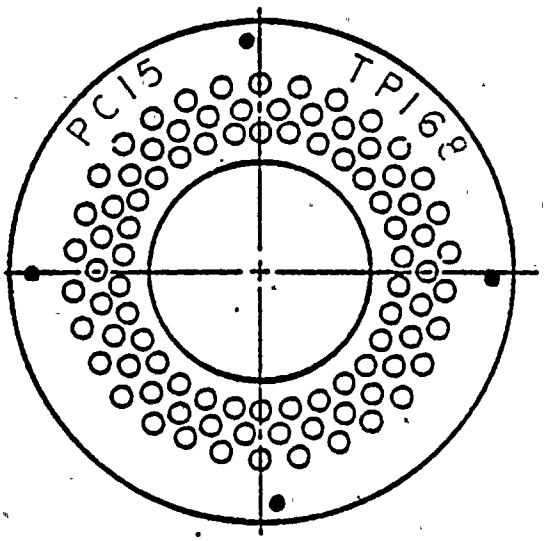
FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION



SHEET 4 OF 10

TENDON NO. 1D53 LOCATION (CLOSEST BUTTRESS) 1 & 6




END ANCHORAGE A

(CLOSEST BUTTRESS 1)

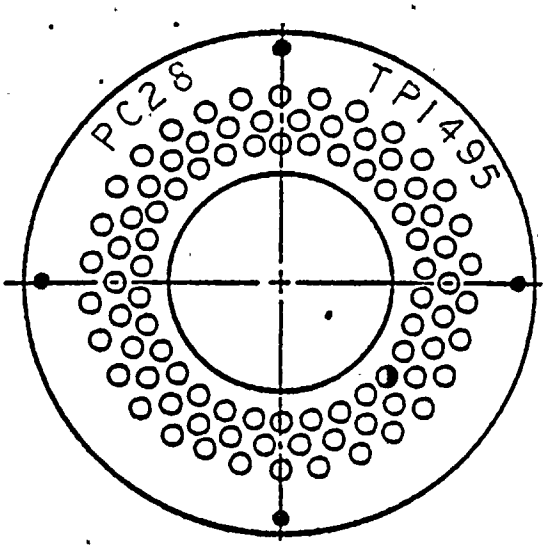
CORROSION LEVEL

WASHER 2

BUTTONHEADS 3 & 1 (20%-#3)

SHIMS 1

BEARING PLATE 1




END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

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 R.B. DATE 8-9-77

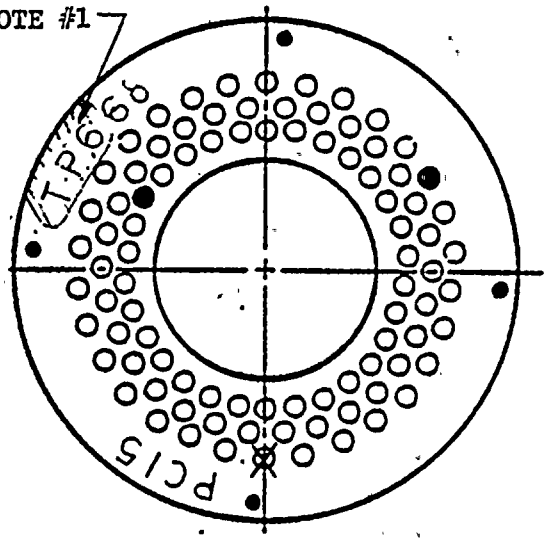
END ANCHORAGE B A.H. DATE 8-9-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

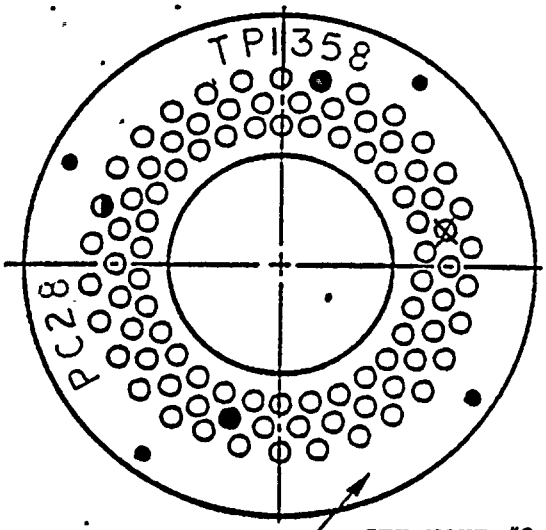
TENDON NO. 2D28 LOCATION (CLOSEST BUTTRESS) 1 & 4

SEE NOTE #1




END ANCHORAGE A

(CLOSEST BUTTRESS 1 )




SEE NOTE #2

END ANCHORAGE B

(CLOSEST BUTTRESS 4 )

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 1

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 R.B. DATE 7-29-77

END ANCHORAGE B A.H. DATE 7-29-77

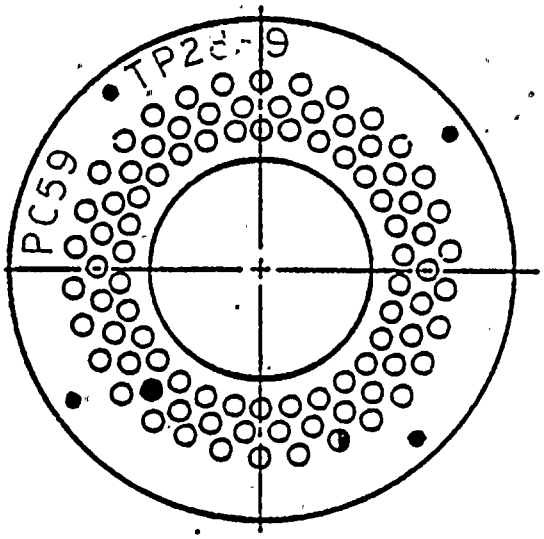
NOTES

1. ▨ indicates area of washer that appears to have been beaten with a hammer.
2. Overall face of washer has some hammer markings.

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

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




END ANCHORAGE A

(CLOSEST BUTTRESS 3)

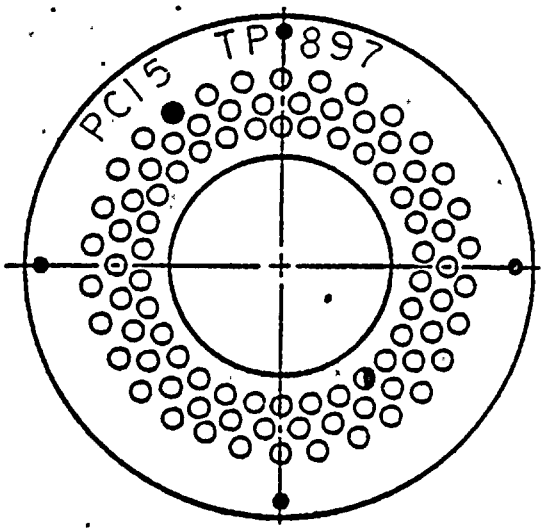
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1




END ANCHORAGE B

(CLOSEST BUTTRESS 6)

CORROSION LEVEL

WASHER 3

BUTTONHEADS 1

SHIMS 1

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 R.B. DATE 7-27-77

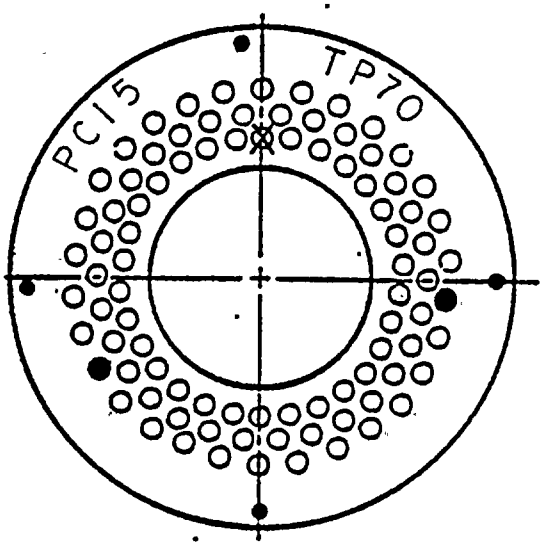
END ANCHORAGE B A.H. DATE 7-27-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

SHEET 2 OF 10

TENDON NO. 23V1 LOCATION (CLOSEST BUTTRESS) 2




END ANCHORAGE A

(CLOSEST BUTTRESS 2)
TOP

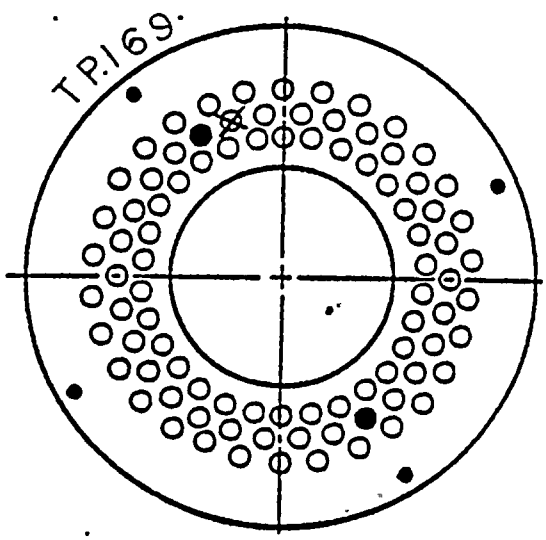
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1




END ANCHORAGE B

(CLOSEST BUTTRESS 2)
BOTTOM

CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS

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

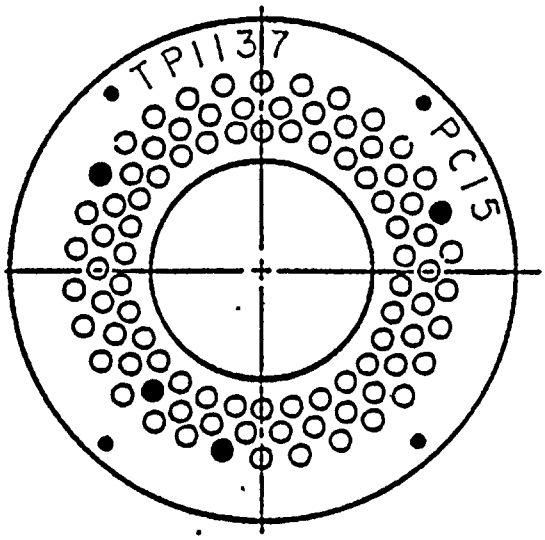
END ANCHORAGE A R.B. DATE 8-4-77

END ANCHORAGE B A.H. DATE 8-4-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 45V7 LOCATION (CLOSEST BUTTRESS) 4




END ANCHORAGE A

(CLOSEST BUTTRESS 4)
TOP

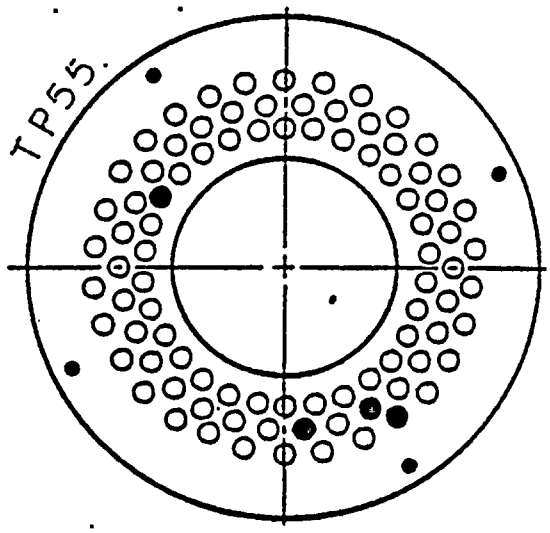
CORROSION LEVEL

WASHER 2

BUTTONHEADS 1

SHIMS 1

BEARING PLATE 1




END ANCHORAGE B

(CLOSEST BUTTRESS 4)
BOTTOM

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS

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

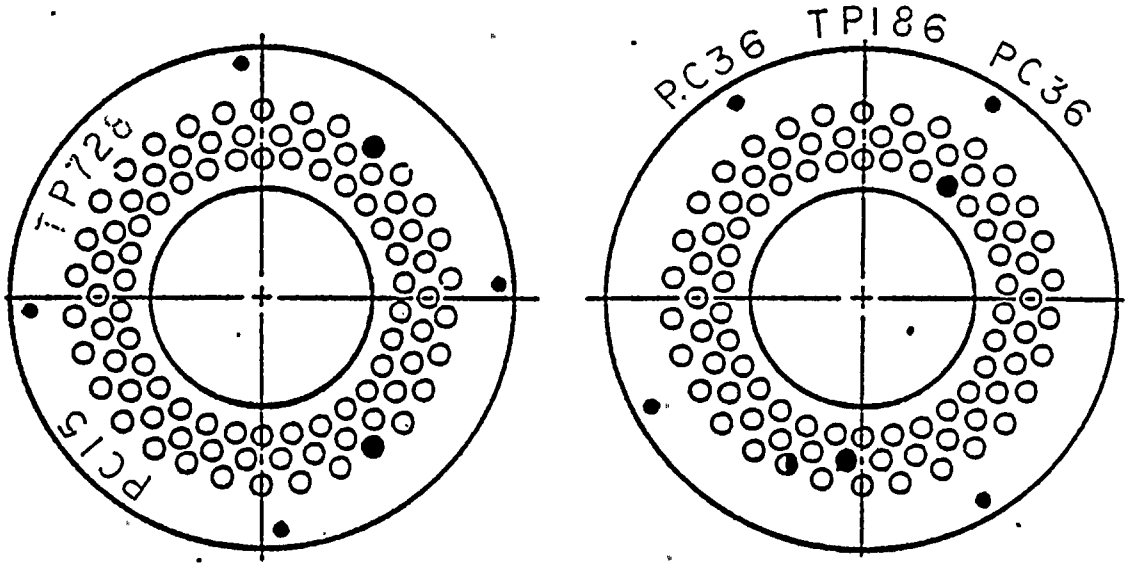
END ANCHORAGE A R.B. DATE 8-3-77

END ANCHORAGE B A.H. DATE 8-3-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

TENDON NO. 61V1 LOCATION (CLOSEST BUTTRESS) 6




END ANCHORAGE A

(CLOSEST BUTTRESS 6)
TOP

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS 2

BEARING PLATE 1

END ANCHORAGE B

(CLOSEST BUTTRESS 6)
BOTTOM

CORROSION LEVEL

WASHER 1

BUTTONHEADS 1

SHIMS

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 R.B. DATE 8-2-77

END ANCHORAGE B A.H. DATE 8-2-77

FIGURE 3

FLORIDA POWER & LIGHT
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST-TENSIONING SYSTEM
-YEAR SURVEILLANCE
END ANCHORAGE INSPECTION

# APPENDIX D

## WIRE INSPECTION DATA SHEETS

## FOR

## CONTAINMENT STRUCTURE

## POST-TENSIONING SYSTEM

## FIFTH-YEAR SURVEILLANCE

## FOR

## FLORIDA POWER & LIGHT COMPANY

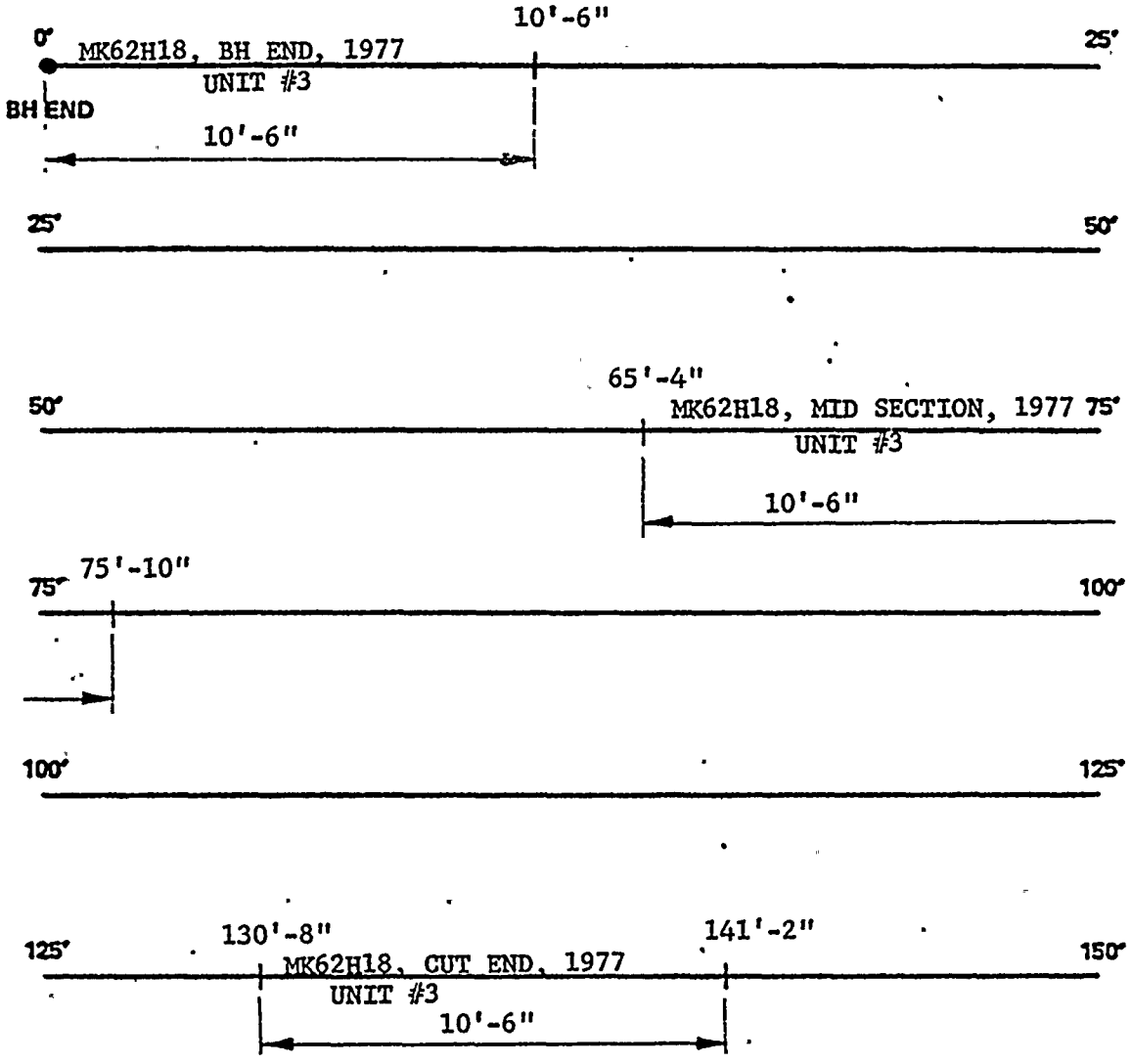
## TURKEY POINT NUCLEAR POWER PLANT

## UNIT 3

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

August 1977

TENDON NO. 62H18 CLOSEST BUTTRESSES 2 & 6




TOTAL LENGTH OF WIRE 141'-2"

NOTE

Corrosion level #1, some minor scratches along the length of wire.

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.R.S.

DATE 7-27-77

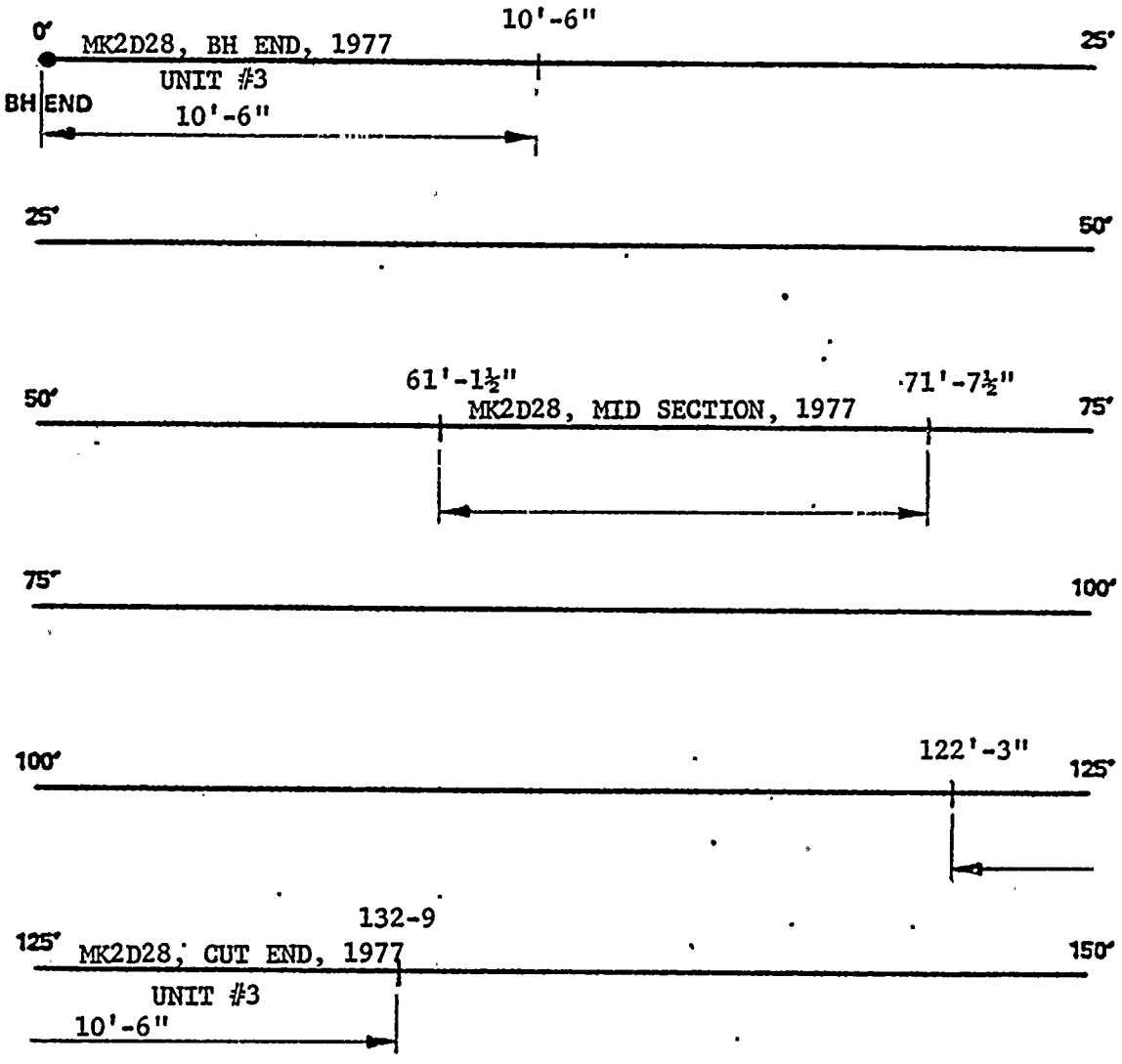
BH. - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST TENSIONING SYSTEM
5TH YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET 1 OF 3

TENDON NO. 2D28 CLOSEST BUTTRESSES 1 & 4




TOTAL LENGTH OF WIRE 132'-9

CORROSION LEVEL:

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

NOTE

Corrosion level #1, some minor scratches along the length of wire.

INSPECTED BY M.R.S.

DATE 8-1-77

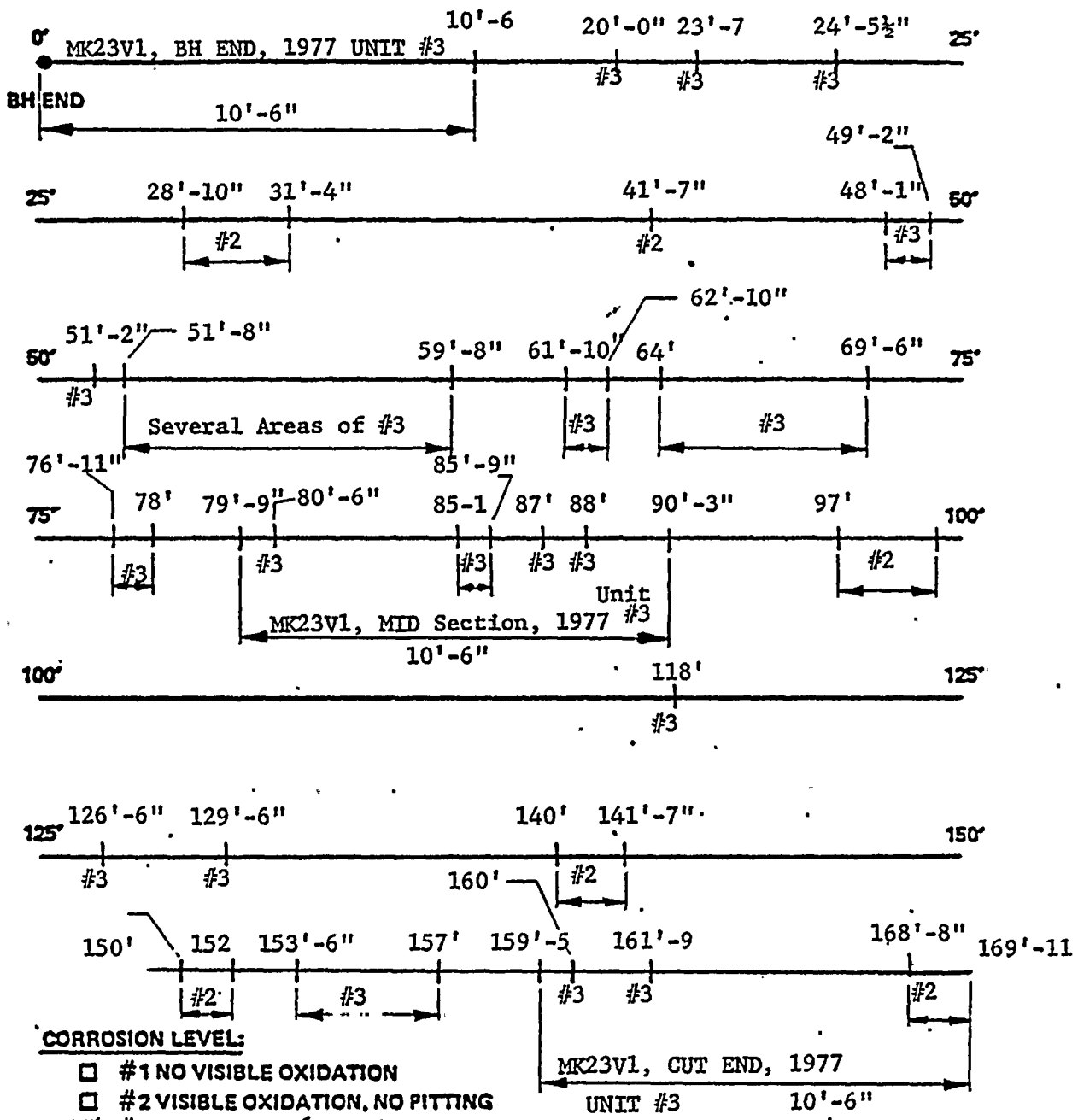
BH. - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
POST TENSIONING SYSTEM
5TH YEAR SURVEILLANCE
WIRE INSPECTION
& TENSION SAMPLE LOCATIONS

SHEET 2 OF 3

TENDON NO. 23V1 CLOSEST BUTTRESSES 2




CORROSION LEVEL:

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

TOTAL LENGTH OF WIRE 169'-11"
Wire cut at bottom end.

INSPECTED BY MS./A.H.

DATE 8-5-77

BH. - BUTTONHEAD

FIGURE 5

FLORIDA POWER & LIGHT CO.
TURKEY POINT NUCLEAR POWER PLANT
UNIT 3
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 3

# POST-TENSIONING SYSTEM

# FIFTY-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

By: Charles Andrews
Charles W. Andrews

June 1977

Revision 1, December 15, 1977

Approved: K. Lee FOR
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 3

# POST-TENSIONING SYSTEM

# FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

By: Charles Andrews
Charles W. Andrews

June 1977

Revision 1, December 15, 1977

Approved: K. Lee FOR
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.

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 3

# POST-TENSIONING SYSTEM

# FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

August 1977

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1891
850 POPLAR STREET, PITTSBURGH, PA. 15220
PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230
AREA CODE 412 · TELEPHONE 922-4000



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

---

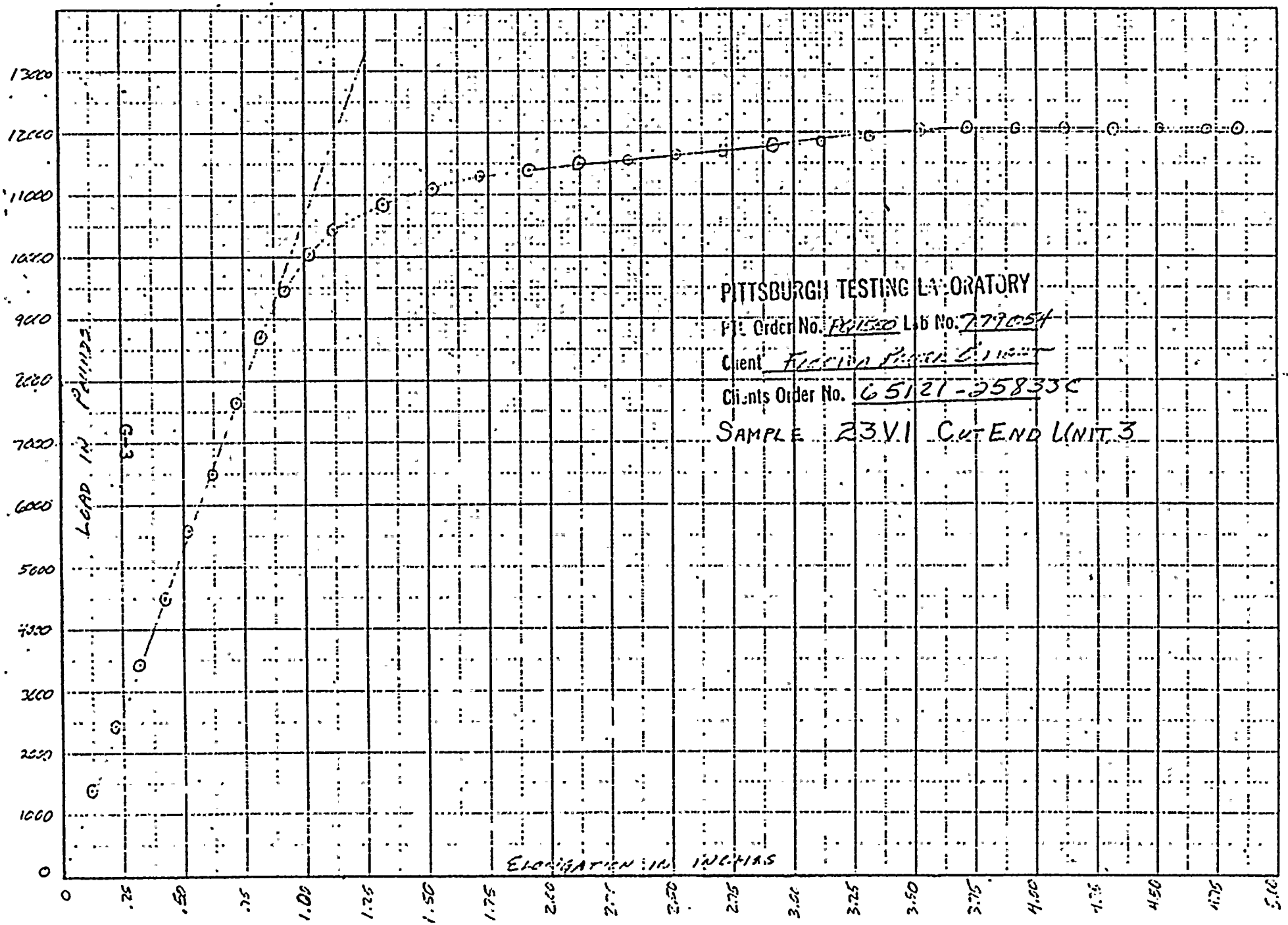
| | |
|---|---|
| Specimen Identification: | 23V1 Cut End Unit 3 |
| Diameter, Inches: | .2502 |
| Original Area, Sq. Inches: | .0492 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .120 |
| Load at 1% Extension, Pounds: | 10,450 |
| Stess at 1% Extension, PSI: | 212,400 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 12,050 |
| Stess PSI at Fracture: | 244,900 |
| Elongation at Fracture, Inches: | 4.84 |
| Elongation at Fracture, Percent: | 4.84 |

Location of Fracture relative to grip in the moving head: 47.06"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.



PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000
PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

---

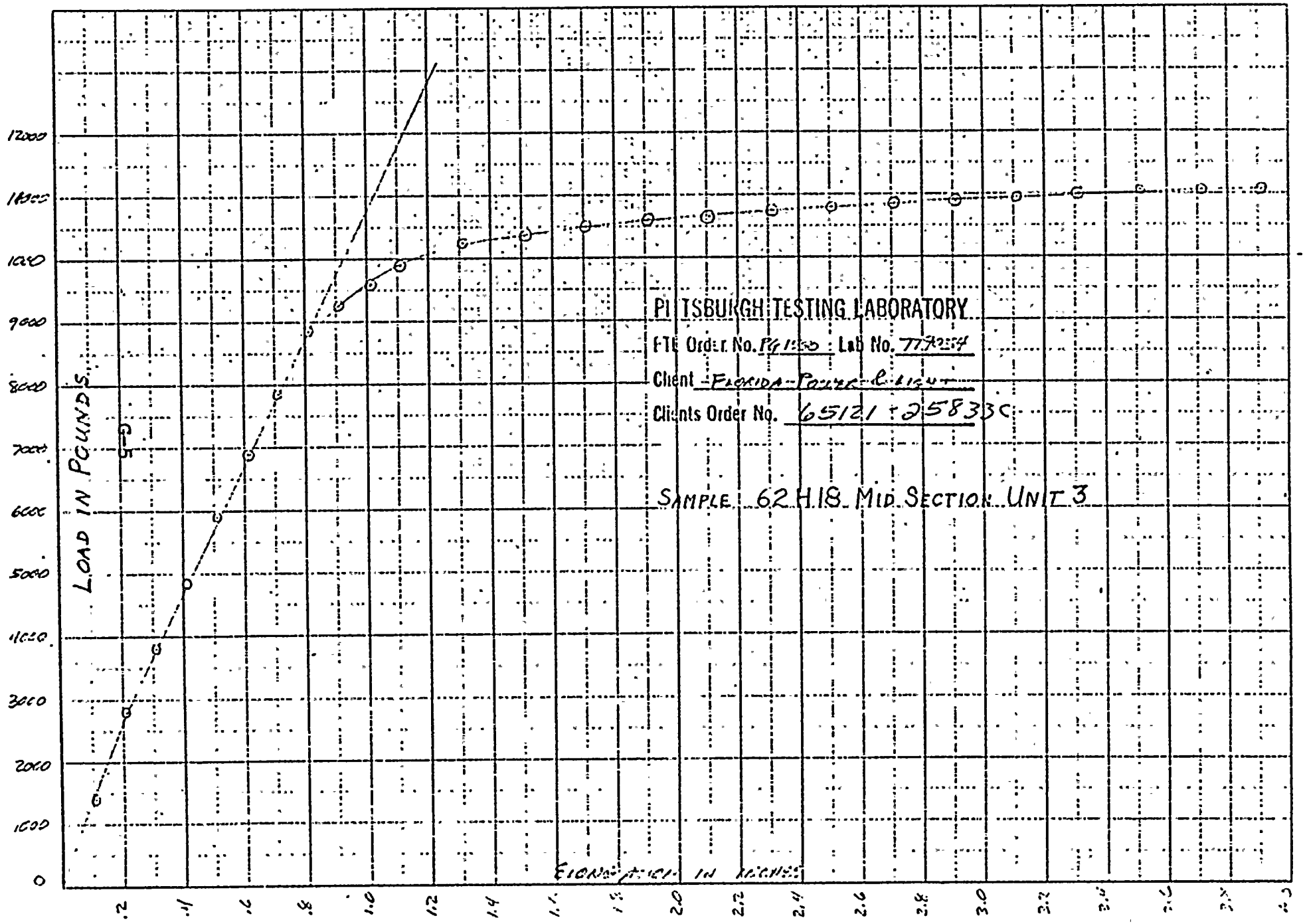
| | |
|---|---|
| Specimen Identification: | 62H18 Mid Section Unit 3 |
| Diameter, Inches: | .2499 |
| Original Area, Sq. Inches: | .0490 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .110 |
| Load at 1% Extension, Pounds: | 9,900 |
| Stess at 1% Extension, PSI: | 202,000 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 11,050 |
| Stess PSI at Fracture: | 225,500 |
| Elongation at Fracture, Inches: | 3.91 |
| Elongation at Fracture, Percent: | 3.91 |

Location of Fracture relative to grip in the moving head: 13.94"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.


LOAD IN POUNDS
12000
1100
1000
9000
8000
7000
6000
5000
1000
3000
2000
1000
0
.2
.4
.6
.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
PITTSBURGH TESTING LABORATORY
PTL Order No. PG 1550 Lab No. 77237
Client FLORIDA POWER & LIGHT
Clients Order No. 65121 + 25833C
SAMPLE 62 H 18 MID SECTION UNIT 3
G-5

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. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

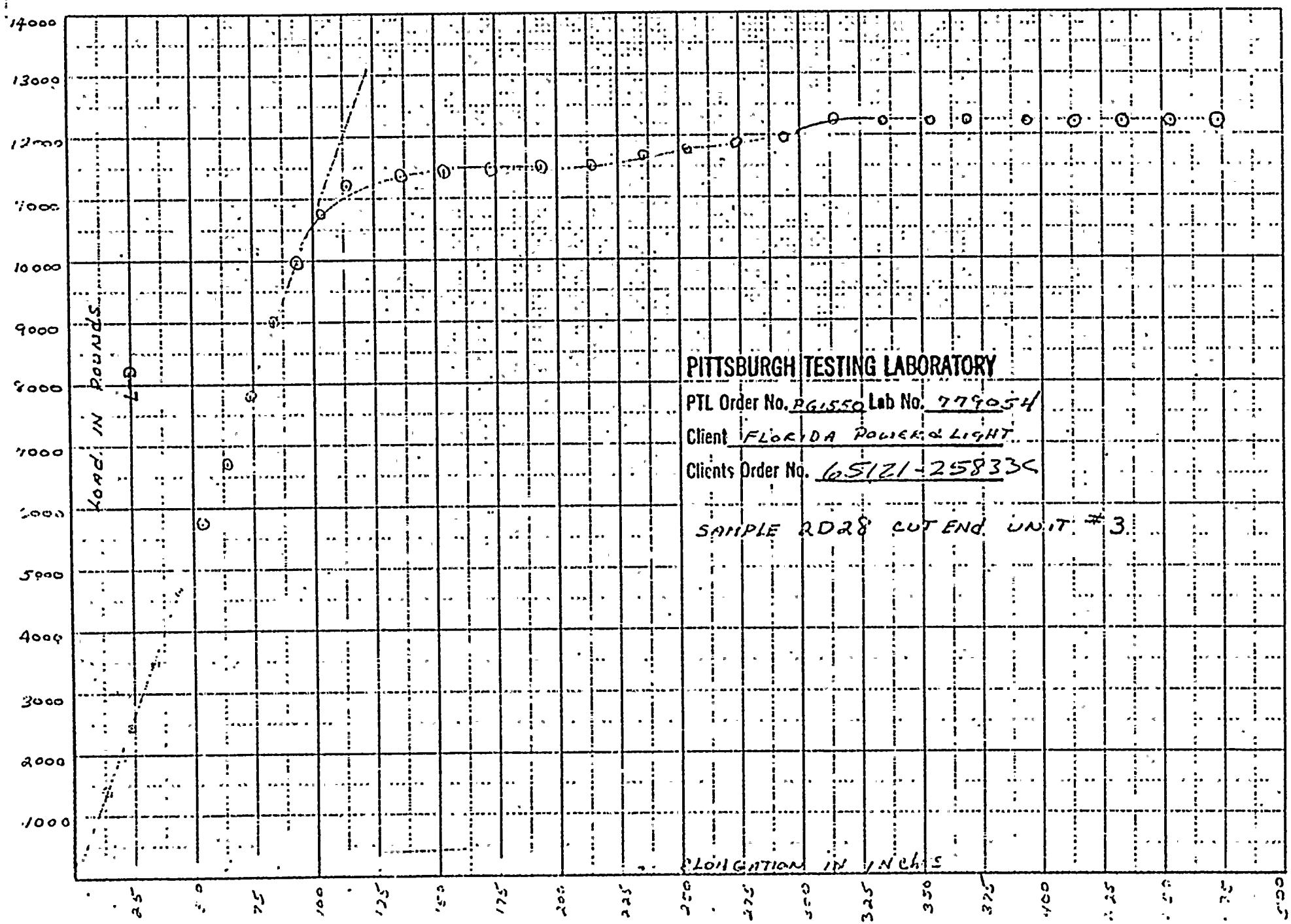
---

| | |
|---|---|
| Specimen Identification: | 2D28 Cut End Unit 3 |
| Diameter, Inches: | .2503 |
| Original Area, Sq. Inches: | .0492 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .130 |
| Load at 1% Extension, Pounds: | 11,200 |
| Stess at 1% Extension, PSI: | 227,600 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 12,200 |
| Stess PSI at Fracture: | 248,000 |
| Elongation at Fracture, Inches: | .496 |
| Elongation at Fracture, Percent: | .496 |
| Location of Fracture relative to grip in the moving head: | 15.63 |

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.



PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
PLEASE REPLY TO:
P. O. BOX 1645
PITTSBURGH, PA. 15230
AREA CODE 412 TELEPHONE 922-4000



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

# REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

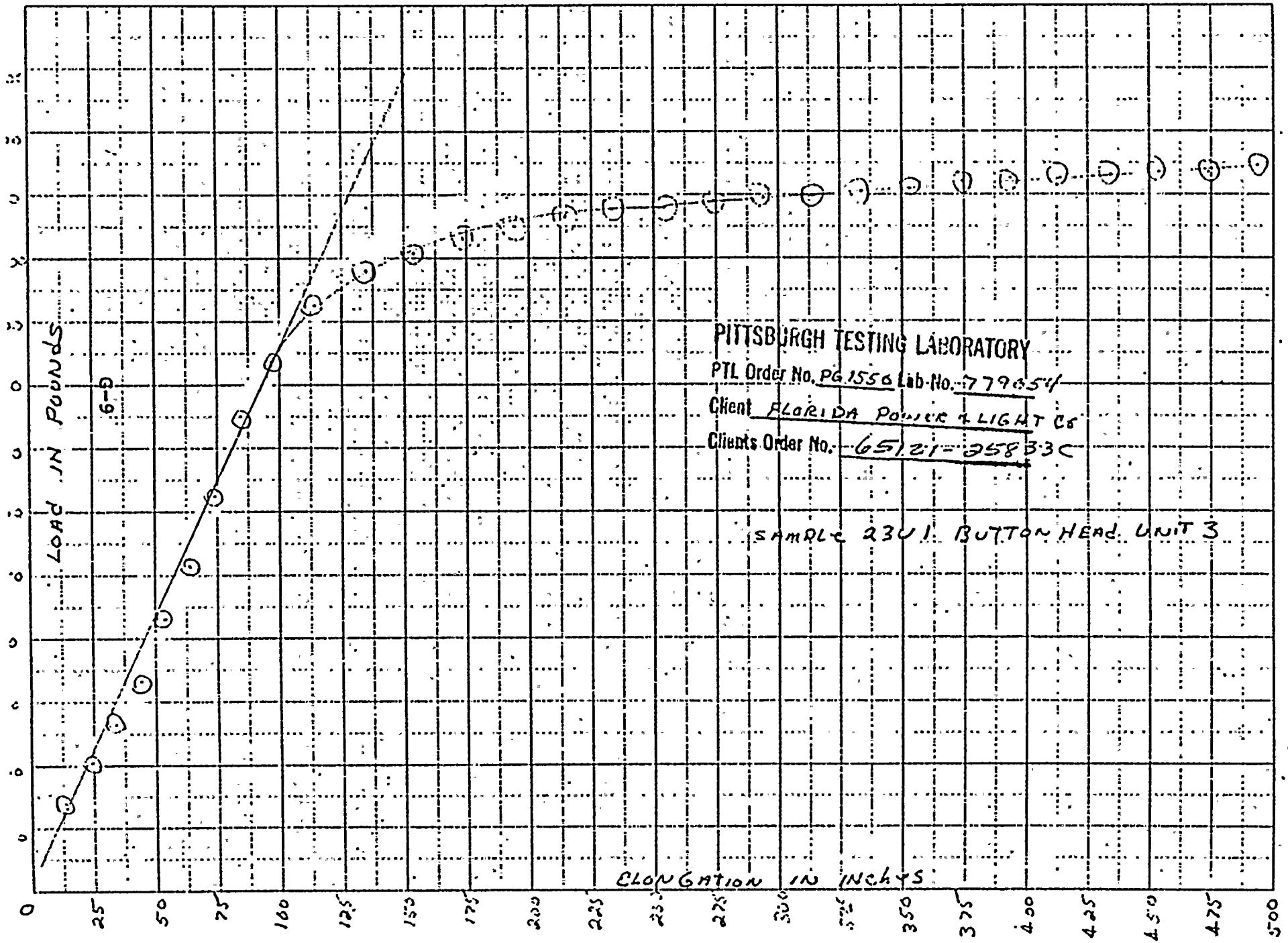
| | |
|---|---|
| Specimen Identification: | 23V1 Button Head Unit 3 |
| Diameter, Inches: | .2506 |
| Original Area, Sq. Inches: | .0493 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1450 |
| Elongation at Initial Load, Inches: | .130 |
| Load at 1% Extension, Pounds: | 9,250 |
| Stess at 1% Extension, PSI: | 187,600 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 11,350 |
| Stess PSI at Fracture: | 230,200 |
| Elongation at Fracture, Inches: | 4.85 |
| Elongation at Fracture, Percent: | 4.85 |

Location of Fracture relative to grip in the moving head: 16.27"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.



PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000
PLEASE REPLY TO:
P. O. BOX 1646
PITTSBURGH, PA. 15230



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

REPORT

ORDER No. PG-1550

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

---

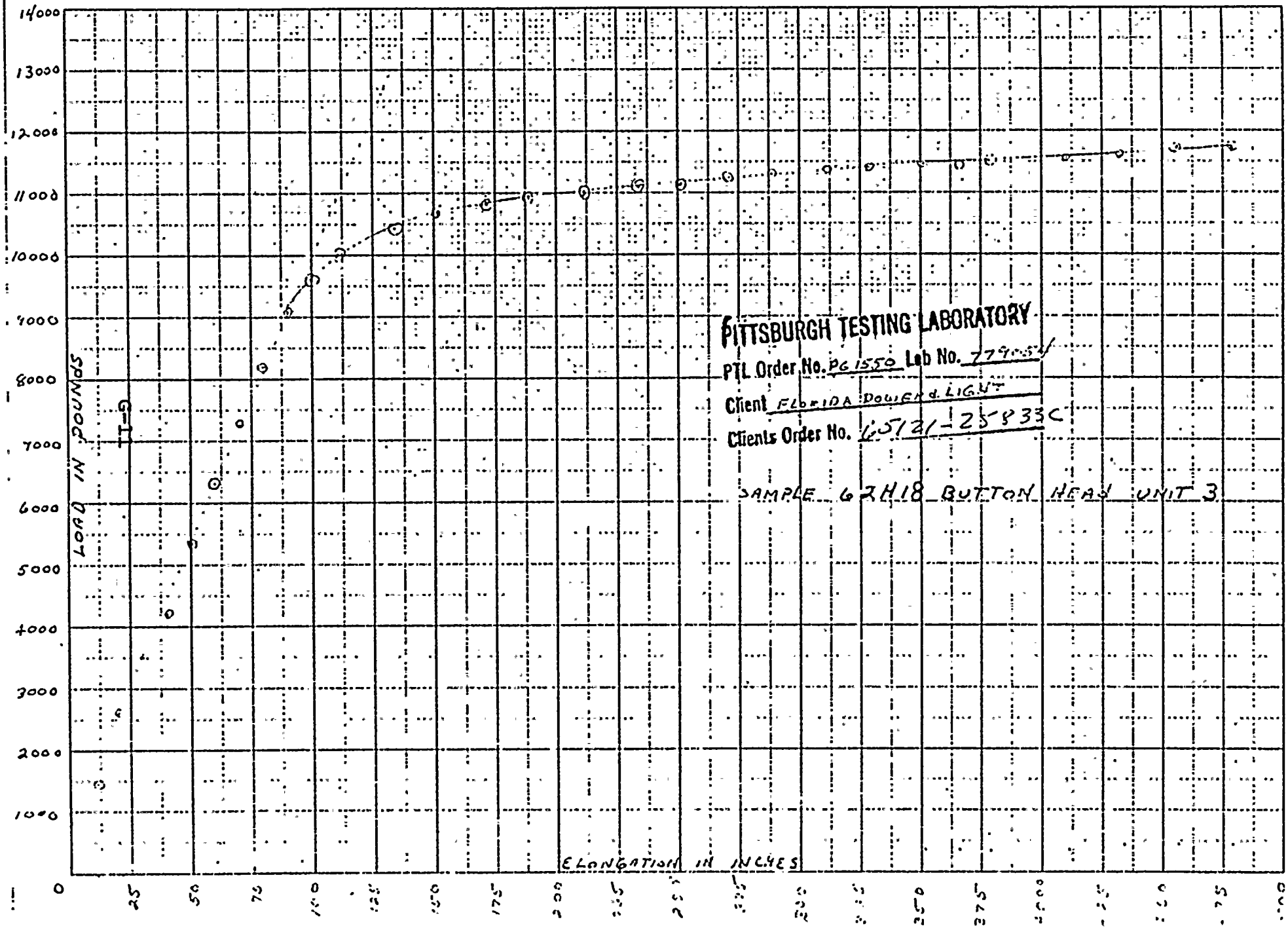
| | |
|---|---|
| Specimen Identification: | 62H18 Button Head Unit 3 |
| Diameter, Inches: | .2500 |
| Original Area, Sq. Inches: | .0491 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .120 |
| Load at 1% Extension, Pounds: | 10,000 |
| Stess at 1% Extension, PSI: | 203,700 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 11,700 |
| Stess PSI at Fracture: | 238,300 |
| Elongation at Fracture, Inches: | 4.85 |
| Elongation at Fracture, Percent: | 4.85 |

Location of Fracture relative to grip in the moving head: 3.75"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.



PITTSBURGH TESTING LABORATORY
ESTABLISHED 1891
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000

FORM 407 REV.-PG

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LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

---

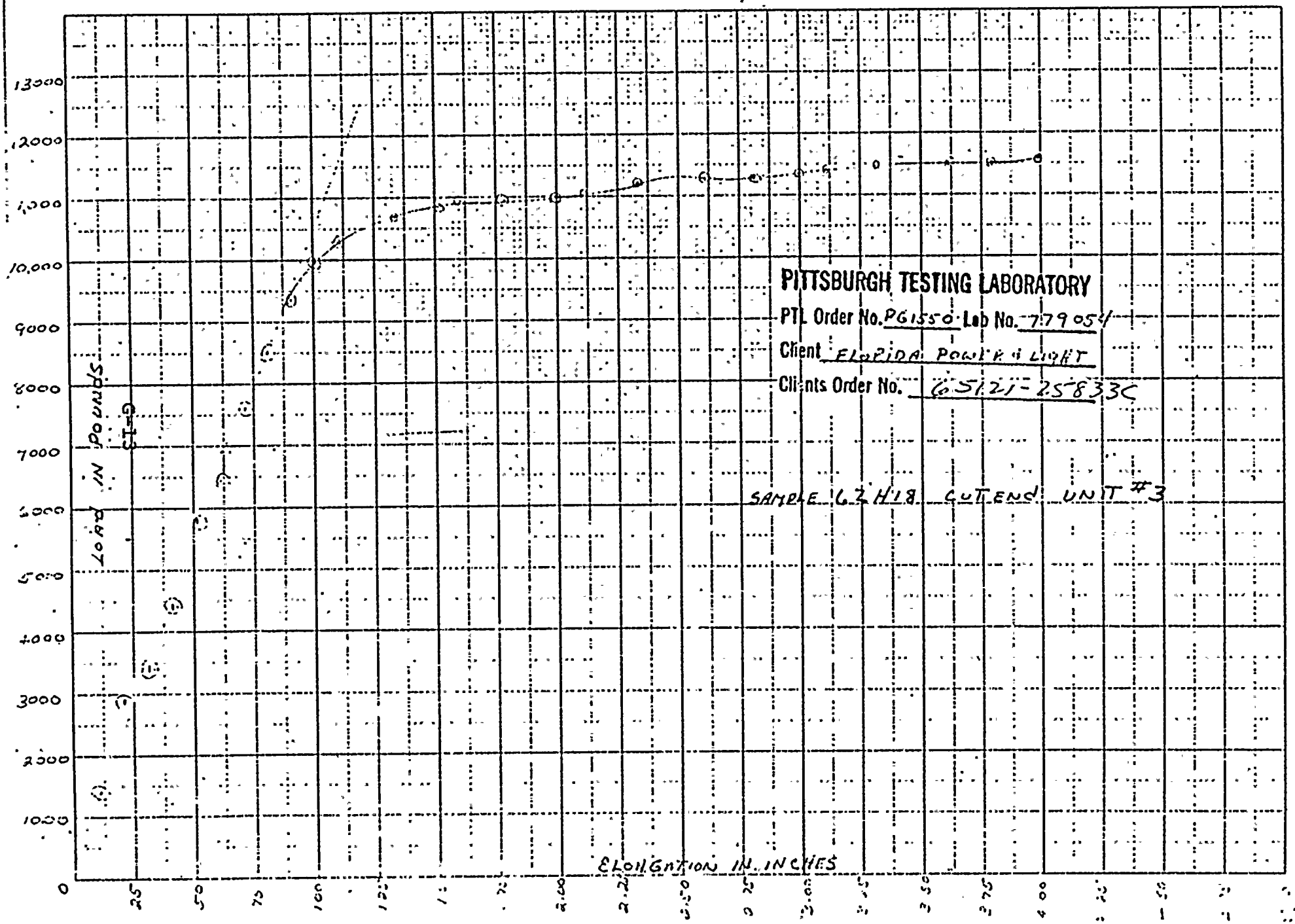
| | |
|---|---|
| Specimen Identification: | 62H18 Cut End Unit 3 |
| Diameter, Inches: | .2499 |
| Original Area, Sq. Inches: | .0490 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .110 |
| Load at 1% Extension, Pounds: | 10,300 |
| Stess at 1% Extension, PSI: | 210,200 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 11,550 |
| Stess PSI at Fracture: | 235,700 |
| Elongation at Fracture, Inches: | 4.21 |
| Elongation at Fracture, Percent: | 4.21 |

Location of Fracture relative to grip in the moving head: 27.63"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.


PITTSBURGH TESTING LABORATORY
PTL Order No. PG1550 Lab No. 779054
Client FLORIDA POWER & LIGHT
Clients Order No. 65121-25833C
SAMPLE 6.2 H18 CUT END UNIT #3
LOAD IN POUNDS
ELONGATION IN INCHES
13000
12000
11000
10,000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
G-13

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
PLEASE REPLY TO:
P. O. BOX 1645
PITTSBURGH, PA. 15230
AREA CODE 412 TELEPHONE 922-4000



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

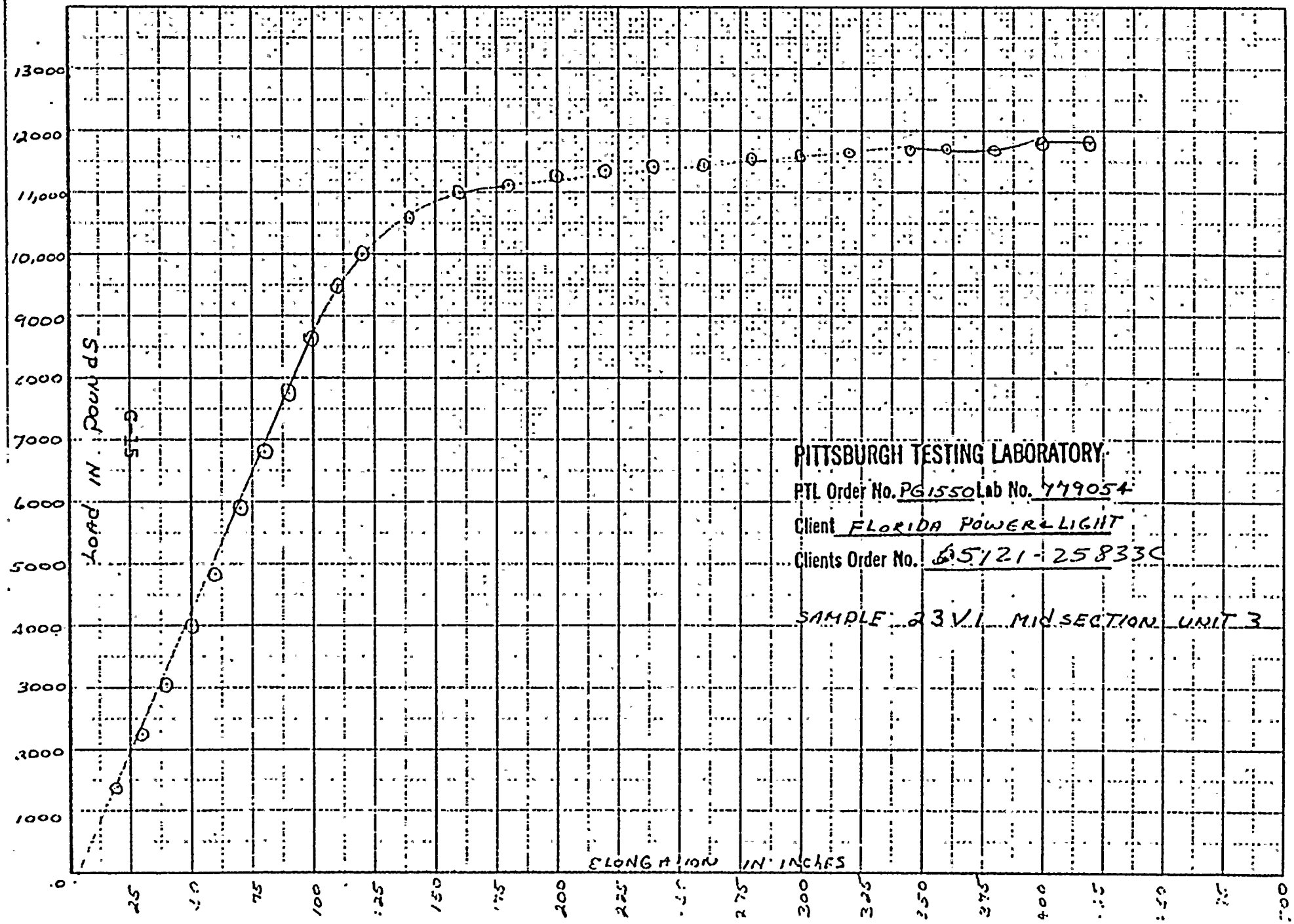
Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

| | |
|---|---|
| Specimen Identification: | 23V1 Mid Section Unit 3 |
| Diameter, Inches: | .2501 |
| Original Area, Sq. Inches: | .0491 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .20 |
| Load at 1% Extension, Pounds: | 10,000 |
| Stess at 1% Extension, PSI: | 203,700 |
| Elongation at 1% Extension, Inches: | 1.2 |
| Load Pounds at Fracture: | 11,800 |
| Stess PSI at Fracture: | 240,300 |
| Elongation at Fracture, Inches: | 4.20 |
| Elongation at Fracture, Percent: | 4.20 |
| Location of Fracture relative to grip in the moving head: | 46.69" |

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.



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ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
PLEASE REPLY TO:
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PITTSBURGH, PA. 15230
AREA CODE 412 TELEPHONE 922-4000



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

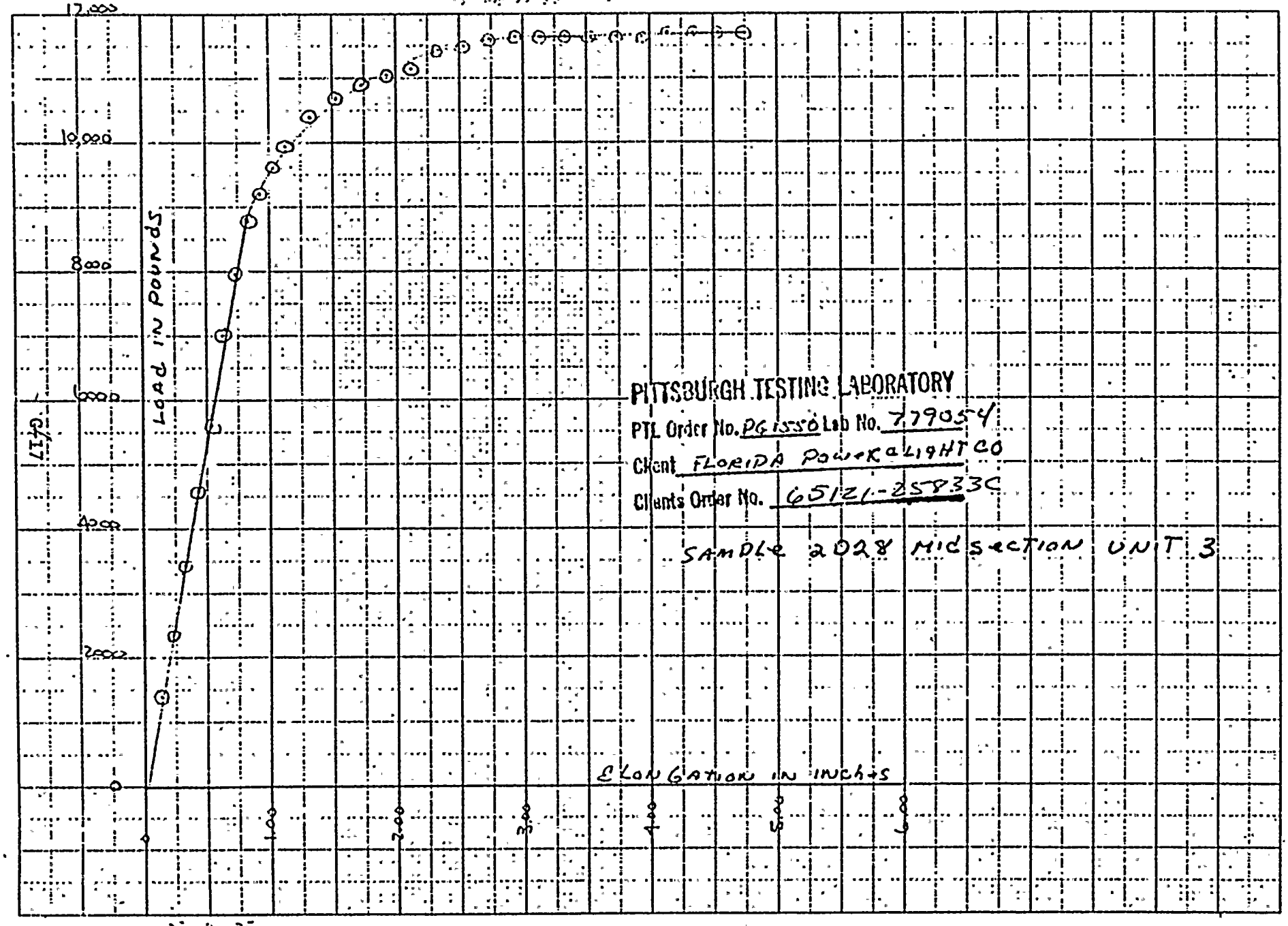
| | |
|---|---|
| Specimen Identification: | 2D28 Mid Section Unit 3 |
| Diameter, Inches: | .2501 |
| Original Area, Sq. Inches: | .0491 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1400 |
| Elongation at Initial Load, Inches: | .130 |
| Load at 1% Extension, Pounds: | 9,950 |
| Stess at 1% Extension, PSI: | 202,600 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 11,700 |
| Stess PSI at Fracture: | 238,300 |
| Elongation at Fracture, Inches: | 5.27 |
| Elongation at Fracture, Percent: | 5.27 |

Location of Fracture relative to grip in the moving head: 25.75"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.




PITTSBURGH TESTING LABORATORY

PTL Order No. PG 1550 Lab No. 779054

Client FLORIDA POWER & LIGHT CO

Clients Order No. 6512-25833C

SAMPLE 2028 MIDSECTION UNIT 3

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1901
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000
PLEASE REPLY TO:
P. O. BOX 1645
PITTSBURGH, PA. 15230

FORM 407 REV.-PG



LABORATORY No. 779054

CLIENT'S No. PO. NO. 65121-25833C

ORDER No. PG-1550

# REPORT

Date: October 11, 1977

Report of: Tension Test of
Post-Tensioning Tendon Wire

Report to: Bechtel Power Corporation
Post Office Box 607
Gaithersburg, Maryland 20760
Attn: Mr. M. Malcom
Project Engineer

---

| | |
|---|---|
| Specimen Identification: | 2D28 Button Head End Unit 3 |
| Diameter, Inches: | .2505 |
| Original Area, Sq. Inches: | .0493 |
| Initial Load, Pounds Equivalent 29,00 PSI: | 1450 |
| Elongation at Initial Load, Inches: | .120 |
| Load at 1% Extension, Pounds: | 10,050 |
| Stess at 1% Extension, PSI: | 203,900 |
| Elongation at 1% Extension, Inches: | 1.1 |
| Load Pounds at Fracture: | 12,000 |
| Stess PSI at Fracture: | 243,400 |
| Elongation at Fracture, Inches: | 4.77 |
| Elongation at Fracture, Percent: | 4.77 |

Location of Fracture relative to grip in the moving head: 12.87"

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

Attachment I Dated June 1977 and ASTM A421, Stress Strain curves are attached.

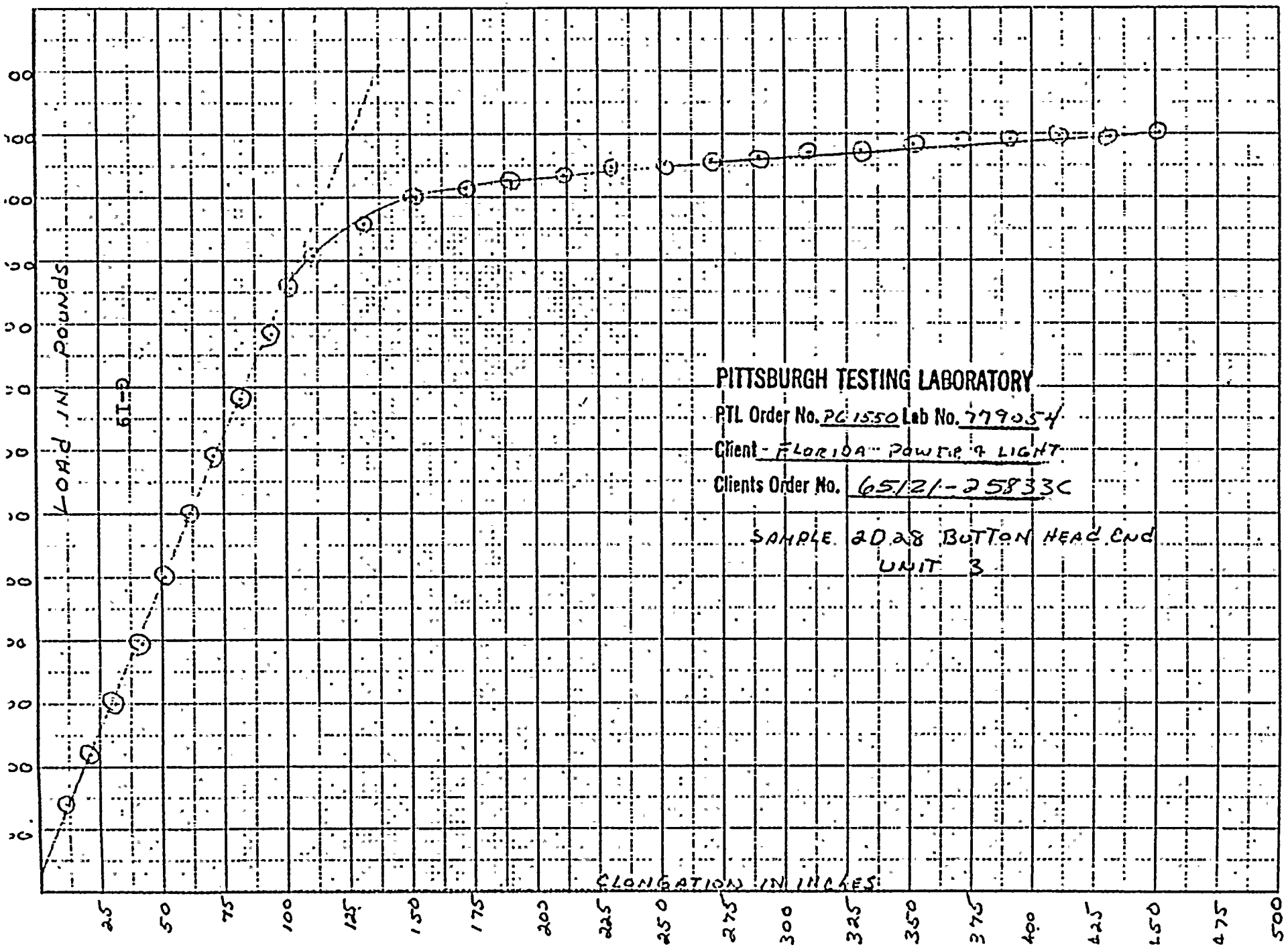
SAMPLE SUBMITTED BY THE CLIENT FOR TESTING.

PITTSBURGH TESTING LABORATORY

Earl Gallagher

Earl Gallagher, Manager
Physical Testing Department

cc: 3- client
Attn: Mr. M. Malcom
1- Attn: H. L. Blocker
1cc


LOAD IN Pounds
61-D
ELONGATION IN INCHES
25
50
75
100
125
150
175
200
225
250
275
300
325
350
375
400
425
450
475
500
PITTSBURGH TESTING LABORATORY
PTL Order No. PC 1550 Lab No. 77905-4
Client - FLORIDA POWER & LIGHT
Clients Order No. 6512/-25833C
SAMPLE 2028 BUTTON HEAD END
UNIT 3

# APPENDIX H

# RESULTS

# OF

# LABORATORY ANALYSIS

# OF

# SHEATH FILLER

# FOR

# FLORIDA POWER & LIGHT COMPANY

# TURKEY POINT NUCLEAR POWER PLANT

# UNIT 3

# POST-TENSIONING SYSTEM

# FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

August 1977

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000
PLEASE REPLY TO:
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PITTSBURGH, PA. 15230

FORM 407 REV.-PG



LABORATORY No. 779055

Purchase Order
CLIENT'S No. 65121-258330

ORDER No. PG-6834

RECEIVED
SEP 30 1977

# REPORT

Sept. 27, 1977

Analysis of: FILLER SAMPLES

Specification: Attachment II - Specification For Laboratory Testing of Sheath Filler (Visconorust 2090P) For Florida Power & Light Company Turkey Point Nuclear Plant Unit 3 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 Chlorde (D-512) | Specification Requirements |
|---|---|---|
| ID53 | Less Than .5 ppm | 10 Max. |
| 23V1 | Less Than .5 ppm | 10 Max. |
| ID55 | Less Than .5 ppm | 10 Max. |
| D28 | Less Than .5 ppm | 10 Max. |
| 45V7 | Less Than .5 ppm | 10 Max. |
| 42H70 | Less Than .5 ppm | 10 Max. |
| 61V1 | Less Than .5 ppm | 10 Max. |
| 62H18 | Less Than .5 ppm | 10 Max. |
| 64H51 | Less Than .5 ppm | 10 Max. |
| | **Water Soluble Nitrate (D-992)** | |
| ID53 | Less Than .1 ppm | 10 Max. |
| 23V1 | Less Than .1 ppm | 10 Max. |
| ID55 | Less Than .1 ppm | 10 Max. |
| D28 | Less Than .1 ppm | 10 Max. |
| 45V7 | Less Than .1 ppm | 10 Max. |
| 42H70 | Less Than .1 ppm | 10 Max. |
| 61V1 | Less Than .1 ppm | 10 Max. |
| 62H18 | Less Than .1 ppm | 10 Max. |
| 64H51 | Less Than .1 ppm | 10 Max. |

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. 779055

ORDER No. PG-6834

CLIENT'S No.

## REPORT

Sept. 28, 1977

| | Water Soluble Sulfide (APA) | Specification Requirement |
|---|---|---|
| ID53 | Less Than .1 ppm | 10 Max. |
| 23V1 | Less Than .1 ppm | 10 Max. |
| ID55 | Less Than .1 ppm | 10 Max. |
| D28 | Less Than .1 ppm | 10 Max. |
| 45V7 | Less Than .1 ppm | 10 Max. |
| 42H70 | Less Than .1 ppm | 10 Max. |
| 61V1 | Less Than .1 ppm | 10 Max. |
| 62H18 | Less Than .1 ppm | 10 Max. |
| 64H51 | Less Than .1 ppm | 10 Max. |

| | Water (D95) | |
|---|---|---|
| ID53 | Less Than .1% | 10 Max. |
| 23V1 | .8% | 10 Max. |
| ID55 | .4% | 10 Max. |
| D28 | .4% | 10 Max. |
| 45V7 | .4% | 10 Max. |
| 42H70 | Less Than .1% | 10 Max. |
| 61V1 | .8% | 10 Max. |
| 62H18 | .8% | 10 Max. |
| 64H51 | Less Than .1% | 10 Max. |
| 64H50 | Less Than .1% | 10 Max. |

| | Neutralization # (D-664) |
|---|---|
| ID53 | .37 mg/KOH/g |
| 23V1 | .29 mg/KOH/g |
| ID55 | .35 mg/KOH/g |
| D28 | .05 mg/KOH/g |
| 45V7 | .05 mg/KOH/g |
| 42H70 | .05 mg/KOH/g |
| 61V1 | .42 mg/KOH/g |
| 62H18 | .33 mg/KOH/g |
| 62H51 | .13 mg/KOH/g |
| 64H50 | .08 mg/KOH/g |

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

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AREA CODE 412 TELEPHONE 922-4000

FORM 407 REV.-PG

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PITTSBURGH, PA. 15230



LABORATORY No. 779055

CLIENT'S No.

ORDER No. PG-6834

# REPORT

Sept. 28, 1977

to the crude leaching procedure requirement by the specification. Sample #6450 Could not be analyzed due to formation of emulsion during leaching.

PITTSBURGH TESTING LABORATORY

Robert J. King
Manager, Chemical Department

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

fvl

PITTSBURGH TESTING LABORATORY
ESTABLISHED 1881
850 POPLAR STREET, PITTSBURGH, PA. 15220
AREA CODE 412 TELEPHONE 922-4000

FORM 407 REV-PG



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

CLIENT'S No. 65121-25833C

LABORATORY No. 780237

ORDER No. PG-6834

# REPORT

October 31, 1977

Analysis of: GREASE

Marked: 64H50

Submitted by: Florida Power & Light Co.

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

---

| | Water Soluble Results |
|---|---|
| Chloride | .49 ppm |
| Nitrate | *.2 ppm |
| Sulfide | *.1 ppm |
| Water | *.1% |
| Neutralization # | .06 |

*Less Than

PITTSBURGH TESTING LABORATORY

Robert J. King

Robert J. King
Manager, Chemical Department

2-Client
Attn: H. L. Blocker
Bechtel Power Corp.
Attn: M. Malcolm
1-PTL- Tampa



pd

# APPENDIX I

## TESTING MACHINE CALIBRATION

## REPORT

## FOR

## FLORIDA POWER & LIGHT COMPANY

## TURKEY POINT NUCLEAR POWER PLANT

## UNIT 3

## POST-TENSIONING SYSTEM

## FIFTH-YEAR SURVEILLANCE

BECHTEL POWER CORPORATION
Gaithersburg, Maryland

September 13, 1978



Page Added Rev. 1
September 13, 1978

Form 60-A

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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
Earl Gallagher

Page Added Rev. 1
September 13, 1978

I-2

Form C-8

# PITTSBURGH TESTING LABORATORY

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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 | |
| | | | | |
| | | | | Page Added Rev. 1 September 13, 1978 |
| | | | | |



PITTSBURGH TESTING LABORATORY

Paul Blacker

Form 00-0

# 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 | |
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PITTSBURGH TESTING LABORATORY