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February 11, 1997

FCS-14771
Contract N00821AD, WA048

Mr. W. W. Nisula
Contract Manager
Florida Power Corporation (NA1B)
15760 West Power Line Street
Crystal River, FL 34428-6708

Attention: Mr. J. Lese

Re: Crystal River Unit 3
6th Tendon Surveillance Force Curve
Calculation

Dear Mr. Nisula:

Please find attached calculation S-95-0082 Revision 1, which documents the generation of the tendon force curves to accommodate the proposed inspection date of early March 1997.

Included are disks with related electronic files used in the preparation of the data and force curves.

Should there be any questions please feel free to contact Dr. Samir Serhan at (610) 855-3209.

Very truly yours,

Samir J. Serhan, Ph.D., P.E.
Supervising Engineer

Roy W. Adler
Project Manager

RWA/SJS/bmb

Attachment

cc: W. W. Nisula (NA1B)
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S-95-0082
Revision #1
Cover Letter for Info

PARSONS

Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO. Calculation S-95-0082 | REVISION 3

R3

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Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO. Calculation S-95-0082 | REVISION 0

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1.0 PURPOSE AND OBJECTIVE

File CR3C6TSP.DOC (Word 6.0)

The purpose of this calculation is to provide tendon force curves for Florida Power Corporation for the Crystal River Unit 3 facility in support of the upcoming 6th tendon surveillance period scheduled for the Fall of 1997. Specific tasks to be performed as part of this scope include the following: R2

A.) Determine the predicted tendon losses and develop force/time curves for each of the selected tendons for the upcoming sixth surveillance period. Generate the tendon force curves for the selected tendons, the tendons adjacent to the selected tendons, and alternate tendons. Alternate tendons are tendons not specifically scheduled for this surveillance but force curves are prepared to be available in case a substitute tendon should be required during the surveillance. In addition, force curves for a group of tendons deferred/exempted from the previous surveillance will also be prepared. These are discussed in detail in Section 5.0.

B.) In addition to the force curve development, other calculations which are required to support Enclosures included within Surveillance Procedure SP-182 will also be prepared within this same calculation.

2.0 DESIGN INPUT

Design input information has been reviewed and is included as Attachment A to this calculation. Note that there are no significant changes to the basic criteria and related documentation which address the licensing of the CR3 plant with respect to the tendon surveillance program. The previous surveillance efforts completed various studies and addressed the CR3 tendon program and its' compliance with U.S. Regulatory Guide 1.35, Revision 3, since it was formally issued in July 1990. Based on FPC licensing efforts and Technical Specification revisions performed at the time of the last surveillance period, as well as recent discussions with the NRC, FPC has now committed the CR3 tendon surveillance program to be performed in accordance with U.S. NRC Regulatory Guide 1.35, Revision 3 (Reference 3).

U.S. Regulatory Guide 1.35.1, Revision 0 (Reference 4) is a daughter document referred to by the above Reg. Guide and deals specifically with the calculation of individual tendon losses and the generation of tendon force curves. While calculation efforts for the CR3 tendon force curves have followed closely with both of these Regulatory Guides as they evolved through the 1970's and 1980's, the format and current procedure for the preparation of the force curves is not in exact compliance with Regulatory Guide 1.35.1 Revision 0 as issued in 1990. The method and approach used in the generation of the CR3 force curves is superior to that of the Reg. Guide in that a specific curve is generated for each individual tendon. Based on the discussions held with the NRC and the results of their review, the method and approach used for these calculations shall be the same as used for previous surveillances. See the Attachment A information for further discussion and references to recent correspondence and documentation with the NRC on various issues related to the tendon surveillance program.

Applicable Technical Specification sections, as well as FSAR sections were also reviewed for this effort. They support the position noted above on the FPC commitment to R.G. 1.35, Rev. 3 and are discussed and referenced within the Attachment A information.

3.0 COMPUTER CODES

This calculation package is being prepared using Microsoft Word, Version 6.0 and Microsoft Excel, Version 5.0. Spreadsheets from earlier surveillance efforts were prepared using Lotus 123, Release 2.01 and 3.0 and were converted to Excel format for this calculation. All input and calculations are manually checked and verified, therefore, verification of computer programs is not applicable or necessary.

4.0 ASSUMPTIONS

Any assumptions made are noted and contained within the calculation package. None require future confirmation.

5.0 SCOPE AND TENDON SELECTION

Tendons were selected for the sixth surveillance period in accordance with the requirements of Reg. Guide 1.35, Revision 3 and using the same methodology as was used in the past surveillance. Basically, a random but representative sample was selected and checked at the site for accessibility. Specific criteria used for this selection process is summarized as follows:

Tendon Selection Process

The tendon selection process has remained the same as that completed for the last several surveillances where a random but representative sample is selected for inspection and testing. The intent is to get as many new and never tested tendons in the sample population, but still keeping one control tendon from each major tendon group to be investigated in each surveillance. Note that this current method differs from methods used during the early life of the plant where some tendons were repeated for inspection every third surveillance. Basically, the selection criteria and process used considers the following:

1.) Select tendons based on Reg. Guide 1.35 Revision 3
Based on the good results of prior surveillances, the Reg. Guide requires a minimum of 11 tendons to be inspected, including 5 hoop, 3 vertical and 3 dome. Tendons should be selected which were never previously inspected or tested. Previously detensioned and retensioned tendons should not be included (unless there is a specific need to investigate the tendon per item 3 below). In addition to being selected at random, tendon selection should be representative of various areas and conditions. For example, the hoop tendons selection was based on random selection but also considered what tendons were inspected in the past and in what hoop area. A plot of previously inspected hoop tendons was prepared to track tendons inspected by grouping (i.e. 13's, 42's, 35's, 46's, 51's, and 62's). Therefore, the selection process considered those sections not equally represented by as many tendons as completed within other sections from prior surveillances. See Attachment J for various plots and information of the hoop group. The same procedure was applied to the dome group (i.e. 100's, 200's & 300's groups) and to the vertical group (i.e. 12's, 23's, 34's, 45's, 56's & 61's & quadrants). See Attachment D for groups information.

2.) Maintain Control Tendons to be completed each surveillance.
The Reg. Guide also requires a control tendon from each group to be inspected every surveillance for comparative purposes. CR3 has not had control tendons since the first surveillance. The concept was introduced probably in the fourth surveillance. Tendons D212, 12V1 and 51H26 were probably the original control tendons since about the time of the fourth surveillance. They were intended to be inspected during the fifth surveillance but the group of tendons selected was based on the surveillance being performed during an outage. FPC decided to complete the 5th surveillance during normal plant operation and the original tendons selected were affected because many tendons were located within the area of the plant steam vent zone. This included the above three control tendons, and three new control tendons, D215, 34V6 and 46H29 were selected for completion of that surveillance. A problem with 46H29 during the 5th surveillance forced the selection of another control tendon, 46H21, for the hoop group. New control tendons may need to be selected periodically if the tendon has a problem and is ever detensioned and/or retensioned. As earlier surveillances on CR3 did repeat some tendons, the selection of these other control tendons was easily done from several good candidates. New control tendons should be selected from those previously inspected as far back as possible and cannot be one previously detensioned and/or retensioned. A tendon inspected in more than one prior surveillance is preferred.
Based on the above, it is recommended that both of the above two sets of control tendons be used by FPC as control tendons, with one set of three to be utilized in the 6th surveillance during a plant outage, and for the other three to be used in any future inspections scheduled to be performed on-line.

3.) Consider any tendons with problems or abnormal conditions as reported by plant personnel.
Any leaking tendons or tendons with any reported problems should be considered within the scope of the surveillance. Also, past inspection reports and records should be checked for open items, recommendations, or noted problem tendons.

4.) In the selection of tendons for detensioning, (one per group is required per R.G.) consider the number of effective wires as recorded in the tendon history sheets and summarized in the effective wire summary in Attachment D to this calculation. As any tendon is to be considered ineffective if it has less than 155 effective wires per the FSAR, it is therefore not desirable to select a tendon with many missing, cut or ineffective wires. Unless there was a specific need to detension that particular tendon, doing so could therefore render the entire tendon as out of service. Only a maximum of 3 tendons are allowed out of service at one time per criteria in the FSAR.

5.) The reduced force dome tendons are not normal candidates for normal liftoff testing per SP-182, Enclosure 8.

6.) Tendons adjacent to the selected tendon may require testing and should also be feasible to inspect and test. Adjacent tendons in the dome should not include any reduced force dome tendons. Jump to the next regular dome tendon for the required adjacent tendon. Also, adjacent tendons of the lowest hoop tendons (#1) shall be considered as the two directly above the selected tendon. Adjacent tendons of the highest hoop tendons (#47) shall be considered as the two directly below the selected tendon.

7.) One alternate tendon should be selected from each group, and the two adjacent tendons of these alternates at least considered for possible inclusion.

In addition to the above selection criteria, there are several other factors which have influenced the scheduling of actual field inspection and testing. These include:

A.) Steam Vent Zone -
Plant steam venting can impose a safety hazard to personnel during plant operation and early modes of shutdown. Tendon work in the range between 0 and 120 degrees is affected during plant operation by the potential steam venting of the plant. Tendon work in this area must be held off until the potential hazard is eliminated or other approval is obtained from plant operations. Note that for the fifth surveillance per FPC operations, this even includes the outside tendon caps of the affected butresses at 0 and at 120 degrees.

B.) Fuel Pool Area -
Work over the fuel pool can only be performed while missile shields are in place. (Nureg 0612 reqmt.)

C.) Plant Interior Work -
Work inside some plant areas is difficult due to access problems, high radiation areas, interferences, ram accessibility, etc.

Deferred/Exempted Tendons

After the tendons were selected for the fifth surveillance for an outage surveillance, it was decided that the 5th surveillance would be completed during normal plant operation. A group of tendons originally selected for inspection during that surveillance had to be exempted from that surveillance due to their proximity to the main steam vent zone and the associated hazards with working in that area. FPC discussed this issue with the NRC and has documented the following 8 tendons as deferred tendons:

EXEMPTED TENDON	COMMENTS
D115	Never inspected in any surveillance.
D212	Inspected in Surveillance 3 and 4. Considered as Control Tendon for outage condition.
D311	Never inspected in any surveillance.
12V1	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
42H44	Never inspected in any surveillance.
51H26	Previously included for liftoff testing in the 3rd and 4th surveillances. Considered as Control Tendon for outage condition.
53H46	Never inspected in any surveillance.
62H46	Never inspected in any surveillance.

As FPC has committed to the NRC to address the above tendons within the upcoming 6th surveillance, these tendons were considered in the scope of this calculation. The 6th surveillance is scheduled to be completed during an outage. Since three of the above exempted tendons were also previous control tendons, it was considered that these tendons can again be used as control tendons for this surveillance instead of the 3 control tendons used in last surveillance (when the surveillance was done on-line). Therefore, the three exempted control tendons can be considered as three of the 11 tendons required per Reg. Guide. A total of 16 tendons should be inspected during the surveillance with three additional alternates selected. Note however that the scope of this calculation will include force curves to be regenerated for the other control tendons, D215, 34V6 and 46H21.

A complete historical record of all tendons included in all prior surveillances, along with the list of selected adjacent, exempted and alternate tendons which are planned for in the 6th surveillance is provided on the following Table.

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DESIGN ANALYSIS/CALCULATION

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REVISION 2

Page 8

********** CR3 TENDON SURVEILLANCE HISTORICAL RECORD **********

8-Sep-97
FILE-CR3R6TSP.XLS

TENDONS INSPECTED THROUGH THE 5TH SURVEILLANCE & PLANNED FOR IN 6TH SURVEILLANCE

SURVEILLANCE PERIOD	1ST SURVEILLANCE 11/27/77 TO 2/9/78		2ND SURVEILLANCE 3/5/80 TO 5/9/80		3RD SURVEILLANCE 9/28/81 TO 12/7/81		4TH SURVEILLANCE 9/15/87 TO 11/17/87		5TH SURVEILLANCE 11/93 TO 1/94		PLANNED 6TH SURVEILLANCE FALL 1997		PRIOR TENDON INSPECTION SUMMARY DATA
YEARS AFTER SIT SIT 11/76	1 YEAR		3.5 YEARS		5 YEARS		11 YEARS		17 YEARS		21 YEARS		
REQUIRED TO INSPECT	21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		11 TOT-5H,3V,3D		85 TOT-40H,24V,21D
ACTUALLY INSPECTED	23 TOT-10H,7V,6D		22 TOT-10H,7V,5D		21 TOT-10H,6V,5D		11 TOT-5H,3V,3D		14 TOT-8H,3V,3D		INCL 8 DEFERRED		91 TOT-43H,26V,22D
SP BASIS	SP-5583, SP-5909		SP-182		SP-182		SP-182		SP-182		TOTAL = 16		
	SP-395, SP-6456		REV -		REV 4		REV 7		REV 10 & 11				
G/C REPORT DATE	3/27/80 & 4/80		5/80		5/19/82		3/10/88		5/94				
DOME TENDONS	D139		D122		D123		D105	D	D215	R,C	D212	R,C,E	22 DOME TENDONS
123 TOTAL	D215		D140		D215	R	D212	R,C	D231	D	D304	D	INSPECTED
3 GROUPS OF 41	D221	D	D208	D	D212		D328		D224	A	D113		TO DATE
D100'S, D200'S, D300'S	D228		D323		D322	D					D115	E	
	D234		D331		D329						D311	E	
	D340										D131	A	
VERTICAL TENDONS	12V19		12V12		12V1		12V1	R,C	34V6	R,C	12V1	R,C,E	26 VERT. TENDONS
144 TOTAL	12V20		12V20	R	34V6	R	34V4		56V15	D	61V21	D	INSPECTED
6 GROUPS OF 24	12V21		23V5		34V19	D	56V2	D	61V14		23V2		TO DATE
12, 34, 56, 23, 45, 61	23V15		34V1		45V16						61V10	A	
	34V6		45V6		56V11								
	45V3	D	56V20		61V5								
	56V1		56V1	D,R									
HORIZONTAL TENDONS	13H10		13H22		13H19	R	13H20		35H1		51H26	R,C,E	43 HOOP TENDONS
282 TOTAL	13H19		13H32	D	13H46		13H40	D	42H1		42H18		INSPECTED
6 GROUPS @ 47 HIGH	13H37		13H43		42H20		51H26	R	46H21	C(New)	42H32		TO DATE
13, 24, 35, 46, 51, 62	13H47		51H10		42H40		51H41		46H28	ADJ.,T	42H44	E	
3 TENDONS PER HOOP	51H11		51H23		51H26		46H19		46H29	R,C(Old),D	62H22		
	62H9		51H37		51H45				46H30	ADJ.	62H41	D	
	46H21		53H24		53H35				46H47	D	62H46	E	
	46H29		53H28		53H40				62H8		53H46	E	
	46H37	D	53H44		62H34						53H2	A	
TOTAL TENDONS = 549	46H46		46H42		46H10	D							
TOTAL INSPECTED	23		22		21		11		14		16 + 3 ALT.		91 TOTAL INSPECTED

LEGEND - A, ALTERNATE ADJ.,ADJACENT C, CONTROL D, DETENSIONED & RETENSIONED
E, EXEMPTED/DEFERRED FROM 5TH SURV. R, REPEATED T, RETENSIONED

R2

6.0 CALCULATIONS

6.1 General Background and Schedule Information

General Background

Tendon forces curves are to be prepared for the upcoming 6th tendon surveillance period at CR3. From the basic criteria as presented in the Design Input Section, as well as from several discussions with Mr. Joe Lese of Florida Power & Light, it was determined that the criteria for this surveillance period has not changed since the last surveillance efforts. A review of Tech Spec and FSAR criteria confirms the FPC positions with respect to the tendon program. Supporting work for this surveillance period will be based on the same criteria that was used and accepted in the previous surveillance periods.

Tendon losses have been calculated in the past per the Reference 8, 9, 10 and 11documentation. Individual tendon losses include the following:

- Force loss due to elastic shortening of the containment as a result of the prestressing process and the particular sequence of tendon stressing.
- Force loss due to the stress relaxation of the tendon wires.
- Loss of prestress force due to the creep characteristics of the concrete structure.
- Loss of prestress force due to the shrinkage of the concrete structure.

Based on some earlier calculations made for tendon losses per the Reference 11 document, Lotus spread sheet templates were prepared for tendon losses calculations for the 4th tendon surveillance calculations. See References 9 & 10. These templates were reran and tested for their accuracy and validity for the fifth surveillance. In addition, the procedure for the gathering of all input data was automated in the fifth surveillance to the format presented herein. Numerous test cases were ran to duplicate force curves prepared in the past. There were four master templates prepared for the fourth surveillance; one for the hoop tendons, one for the vertical tendons, and two for the dome tendons. The dome tendons are divided into two groups; one for tendons with an original stressing sequence below 27, and the other for tendons with stressing sequences above 27.

Based on the work previously accomplished in the prior surveillances, new spreadsheets were prepared this surveillance using Microsoft Excel for the collection of input data and for the calculation of tendon losses needed for generation of force curves. The generation of the force curves was also automated this surveillance by using Excel to plot the graphs. The organization of most data used for this calculation was setup into Excel workbooks with subfiles built and included in each workbook. There is a separate workbook for each of the three tendon groups and each one contains the following:

- Tabulated input data
- Original tendon stressing sequences.
- Effective wire summaries.
- "Original Stressing Data" calculations for SP-182.
- Separate files including each tendon loss spreadsheet, plot data and an individual force curve. R2

Additional information on electronic file names etc. used in this calculation is provided in Attachment K.

Schedule Information

The expected timing for the sixth surveillance is Fall 1997. A date of November 1, 1997 will be used as a bases for determining the predicted values of base, 95% base and 90% base and labeling this information on the force curves. This allows for field use and decisions to be made based on the requirements of Surveillance Procedure, SP-182. R2

The scales of the force curves are based upon previous surveillance efforts. The x axis is a log scale in time representing the time after average date of dome or wall concrete placement, in years. This scale is labeled at the top of each curve. Force curves are plotted using the actual log scale points for the x axis (not the scheduled surveillance years after SIT) versus the calculated tendon forces in kips on the y axis. The scale at the bottom of the curve for scheduled surveillance periods after SIT are for ease and readability relative to regular scheduled surveillances per Reg. Guide 1.35, Revision 3.

Most of the CR3 surveillances were performed on the regularly scheduled years, however, the 5th surveillance was actually performed in the 17th year after SIT. Note that the containment Structural Integrity Test (SIT) was performed in November 1976.

For the dome tendons force curves, the point on the bottom scale at SIT corresponds to the log scale at the top of 2.5 years. Therefore, a corresponding log scale data point must be determined for curve plotting for the period of the 6th surveillance.

Based on a date of November 1, 1997 for the Fall 1997 surveillance, the length of time between November 1976 (@ SIT) and November 1, 1997 is 21 years. Since the dome group at SIT is at year 2.5 on the log scale, the 6th surveillance will correspond to (21.0 + 2.5) or 23.5 years on the log scale. R2

The same procedure must be performed for the hoop and vertical groups as they have different reference points on the log scale for time after concrete wall placement. Both hoop and vertical groups are the same with SIT corresponding to year 4.4 on the log scale. Therefore, the 6th surveillance period will correspond to (21.0 + 4.4) or 25.4 years on the log scale. R2

A vertical line will be shown on the force curves at the point of the next surveillance and the calculated values of base, 95% base and 90% base representing points on the curves at that time will be included on each of the curves.

6.2 General Procedure for Force Curve Generation

The same procedure within the calculation for the preparation of the force curves for the fourth and fifth surveillance periods will be followed.

6.2.1 Preparation of Data Input Spreadsheets

In each of the Excel workbooks is a data input file where data from source calculations and current tendon history sheets has been tabulated. See DOMER3.XLW (DOMEINP), HOOPR3.XLW (HOOPINP) & VERTR2.XLW (VERTINP). R3

The compiled books of tendon surveillance historical information, as updated to include the results of the fifth surveillance, provide key input data for the development of force curves. See References 12, 13 & 14. The selected tendon history sheets related to this surveillance have been included herein as Attachment B of this calculation. The Reference 11 calculation is essentially a source calculation for this procedure with the Reference 8 & 10 calculations also providing information.

Notes and references related to the tabulation of the data on these spreadsheets are shown on the individual sheets. The data input tabulations are presented as the first sheet within the following Sections 6.3, 6.4 & 6.5.

6.2.2 Procedure for Determination of Individual Tendon Losses

The procedure for the tendon loss calculations, as derived from the reference documentation, is as follows:

1.) Calculate original force in the tendons

The original force in the tendons is determined as follows:

$$ORIG.FORCE = 0.7 * F_{ULT} * \left[\frac{ActualLiftoff\ Pressure}{Predicted Liftoff\ Pressure} \right] \times WireFactor$$

Where:
f_{ult} = 240 Ksi, typical for all CR3 wires.

Wire area = 0.07685 in2 per Appendix F of the Reference 11 calculation.

F_{ult} (Kip Force)= Tendon Area (in2) x f_{ult} (Ksi) = 0.05985 * 240

Tendon Area (in2) = Area/Wire (in2) x No. of Wires. (Considered by wire factor.)

Actual and predicted original liftoff pressures are obtained from Tendon History Sheets References 12, 13, 14, with those within the scope of this calculation attached in Attachment B.

Refer to the Appendix F part of the Reference 11 calculation, for source data of above formula. The above expression was used as the basis for the calculations for all the shop and field end forces calculated on the Data Input Spreadsheets. This procedure does not apply to retensioned tendons.

Note that the wire factor as shown in the various spreadsheets is a value representing the tabulated number of effective wires over a total of 163. The number of wires is usually 163 unless cut, loose or considered ineffective. The number of effective wires as recorded from the original installation is documented on the tendon history sheets. The number of effective wires for each tendon has been updated, tabulated and presented in the Effective Wires Summary for each individual group within Attachment D. This tabulation was updated to include the results of all previous surveillances. It does not imply each of the tendons was specifically checked for the numbers of effective wires as presented in the table. It represents only data from the original records and as made available from surveillance records and subsequent inspections.

Note that the wire factor used is based on current information and is not based on the number of wires at the time of original installation, therefore the original Force calculated may not be the "original force" in the tendon back at that time. The effect of less effective wires lowers the curve vertically. This is insignificant at the current time as the curve of interest will be correct for use at this time. Another method would have been to plot the original value using the wire factor then and then to show a step down on the curve should a lower wire factor occur at some point later on the graph.

2.) Calculate Elastic Shortening Losses

The elastic shortening losses are a function of the stressing sequence number for the individual tendon. In addition, the tendon wire factors are also considered and used. The base expression used to calculate these forces is the same as used in previous calculations and is already built into the basic spreadsheet templates. All the equations for elastic shortening were confirmed as being the same as established in prior calculations. Based on the review of the procedure for calculating these losses, it is concluded that the existing templates are still appropriate and correct with the additional input of stressing sequence data and wire factors to be input for the current group of tendons for this surveillance.

Reference 10 & Reference 11 data and information on elastic shortening was included in Attachment E to these calculations. See Attachment C for original stressing sequences for all tendons and see the Data Input Worksheets & Attachment D information for tendon wire factors and source data.

Elastic Shortening Losses for Dome Tendons

Note there are two expressions used for elastic shortening for the dome tendons depending on the stress sequence numbers. For dome tendons in sequences 1 through 27, the Domelow template is used. For dome tendons in sequences 28 through 32, the Domehigh template is to be used. This is because of the two separate expressions used for the calculation.

Elastic Shortening Losses-
For Dome Tendons in Sequences 1 through 27-

N = 27 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening = F_{les}

$$F_{les} = \left[\frac{N-n}{N} \times 82.7 + 75\right] \times WireFactor$$

Elastic Shortening Losses-
For Dome Tendons in Sequences 28 through 32-

N = 5 (Sequences 28 through 32)
n = Sequence number less 27

i.e. for sequence 28, n = 1
for sequence 29, n = 2
for sequence 30, n = 3
for sequence 31, n = 4
for sequence 32, n = 5

$$Fles = \left[\frac{N-n}{N} \times 47.4 - 13.7\right] \times WireFactor$$

The value for elastic shortening in kips declines as the stressing sequence increases. A review of the data for the dome group shows that values for the dome group go from 154.6 kips for sequence 1 tendons down to 75 kips for sequence 27 tendons, and further going down to -13.7 kips for the last sequence, sequence 32. Note that wire factor differences between individual tendons will cause the calculated result to vary slightly for two tendons within the same stressing sequence.

Elastic Shortening Losses for Hoop Tendons -

N = 60 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 134.0\right] \times WireFactor$$

A review of the data for the hoop tendon group shows that the range of values for the calculated elastic shortening go from 127.3 kips for sequence 3 tendons down to 0 kips for the last tendon sequence, sequence 60.

Elastic Shortening Losses for Vertical Tendons -

N = 31 Total Sequences
n = Sequence of particular tendon.

Force Loss due to elastic shortening =

$$Fles = \left[\frac{(N-n)}{N} \times 73.5 \right] \times WireFactor$$

A review of the data for the vertical tendon group shows that the range of values calculated for elastic shortening go from 71.1 kips for sequence 1 tendons down to 4.7 kips for sequence 29 tendons. There are a total of 31 stressing sequences for the vertical tendons.

3.) Calculate Wire Stress Relaxation Losses

Wire stress relaxation losses and the procedure for the determination of these losses for the 4th and 5th surveillances are addressed in the Reference 10 and 11 calculations. The original wire relaxation curve, as provided by test data from the wire vendor forms the bases for wire relaxation loss values (See also FSAR Figure 5-23). It was determined that the same procedures and figures as calculated in those prior calculations are still applicable for this surveillance. Applicable data from the reference sources was attached and included within this calculation as Attachment F.

Note that there were adjustments made to the original stress relaxation values from the vendor relaxation curve to allow for some conservatism and for temperature consideration of 100 degrees vs. 68 degrees F. Also, per the original design the wire factor or actual number of effective wires was considered as negligible for these losses and was not included. Note that values for stress relaxation range between 40 and 50 kips for the surveillance period for all three tendon groups.

4.) Calculate Creep Losses

Concrete creep calculations in the Reference 11 document are attached in Attachment G. The losses are based on the curve contained in the reference calculation. Creep values are different for each of the three groups of tendons. For the dome tendons in the coming surveillance period, creep values are the same and are about 152 to 158 kips, hoop values are between 79 and 83 kips, verticals are 36 to 38 kips.

5.) Calculate Shrinkage Losses

Attachment H contains source information for concrete shrinkage from Reference 10, pg. 11 and Reference 11, cover page & Pages 13 & 14. The straight line shrinkage losses in micro inches per inch as calculated in the above two references are still applicable for this surveillance period. Tabulated values from these references were input into the dome, hoop and vertical spreadsheets. There are no additional variables or considerations and the same values are to be used for this calculation. From a review of the output information, the dome values are constant at 8 to 9 kips, hoop values are above 5 kips, verticals are also slightly above 5 kips.

6.) Total Losses

Calculated force losses for elastic shortening, wire stress relaxation, creep and shrinkage are added for a total of all losses. Also, a percent of this total of all losses is calculated based on the original average force in the tendon.

7.) Determine Predicted Forces for Base, 95% Base and 90% Base values

The original force less the total of losses calculated yields the base predicted value for the subject period of surveillance inspection. The 95% and 90% values are then calculated based on the calculated predicted base value.

8.) Normalization Factors

Normalization factors are calculated based on the expressions and the source article contained in Attachment I of this calculation. This factor usually does not change much over the forty year time span of the calculation. The base expression for the dome normalization factor value is presented as follows:

$$(A-B)\times(1-C)+(D-97.7)$$

Where:

A = Average of all Domes group
B = Original average tendon force
C = Wire Stress Relaxation Percentage
D = Elastic Shortening

As an example, Dome tendon D112 calculates as follows:

$$NormalizationFactor=(1639-1676)\times(1-0.0257)+(D-97.7) \text{ or}$$

$$NF=(-37)\times(0.9743)+(-101.9) \text{ or}$$

NF = -138 which matches the spreadsheet calculation.

Similar expressions are shown for the hoop and vertical tendons in the information in Attachment I.

9.) Plotting of Data

Only the data from Column B, L, M, & N are tabulated on a separate area on the side of the spreadsheet. See Columns R, S, T & U; Rows 40 through 50. Only these values are selected for plotting on the force curves. This is for ease of plotting and has no affect on the quality or accuracy of the plots. An example copy of this data immediately follows the first dome tendon.

The plots of all dome curves with all the data points showed the force curve plot line as slightly crooked from a true linear plot. The large scale used showed some inflection points slightly off of linear. After investigation, the condition was avoided by omitting data points at year 10 and 15 after SIT for the final plotted figures. This was done only for presentation purposes and there is no affect on the accuracy of the plot or the base values calculated and presented on each curve.

A column by column explanation of the losses calculation worksheet follows:

INDIVIDUAL TENDON LOSSES
LOSSES CALCULATION WORKSHEET
NOTES AND LEGEND

Individual tendon losses are calculated based on the procedure presented in the preceding section. The following notes explain the spreadsheet process, input and calculations performed for each of the columns presented. The shaded values on the losses worksheet are extracted from the data input worksheet.

Column **Description**

A. Inspection Period after SIT
Scale based on years after SIT which is shown on the bottom scale of each individual plot. Note that this information is provided for easier readability with respect to SIT but is not the actual log scale used to construct the x axis of the plots.

B. Years after Concrete Placement
Scale of years after concrete placement as used for the x axis for plotting of the force curves and shown as the upper log scale at the top of each plot.. Note that one year after SIT for the dome tendons is 3.5 years on the log scale and for the hoop and vertical tendons is 5.4 years. See Section 6.1 of this calculation for further information.

C. Elastic Shortening
Calculated based on formulas presented in Section 6.2.2 and Attachment E information.

D. Stress Relaxation Percent
Calculated based on original wire loss curve percentages modified per the information presented in Attachment F of this calculation.

E. Stress Relaxation Forces
Data input from the Reference 11 calculation page 12. See Attachment F.

F. Creep Strain
Strain value (x 0.0001Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

G. Creep Strain Force
Data input from the Reference 11 calculation. See Attachment G of this calculation for data.

H. Shrinkage Values
Data input from the Reference 11 calculation based on the shrinkage curve. See Attachment H of this calculation for data.

I. Shrinkage Force
Data input from the Reference 11 calculation. See Attachment H of this calculation for data.

J. Total Force Loss
Calculated value, Sum of columns C, E, G,& I.

K. Total Percent Loss
Total loss in percentage, Column J / Average of original forces for shop & field ends calculated and shown above on the spreadsheet.

L. Base
The average original force for the tendon noted above on the spreadsheet, less the total losses calculated in Column J. Note that total losses were not calculated on the row for the 17 year period, the 21 year 3 month period, as well as the 21 year period after SIT. These rows represent the fifth, the originally planned sixth and the current sixth surveillance periods and the values of Base were derived through linear interpolation of above and below data presented on the spreadsheet. The quality and accuracy is not affected by this procedure. R2

M. 95% Base
0.95 x Column L for the same row.

N. 90% Base
0.90 x Column L for the same row.

O. Normalization Factor -
Calculated based on formula presented in this calculation and in the information presented in Attachment I.

CRYSTAL RIVER UNIT 3 - 6th TENDON SURVEILLANCE
DOME TENDONS DATA INPUT

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PAGE 20

			Ref.
Initial Concrete Stress =	1732.0	(ksi)	(2) Pages 7A, 7B, 7C
Average Force =	1639.0	(kips)	(2) Page 15

For Tendons in Sequences 1 through 27 :
Total Stress Sequence (N) = 27
Total Elastic Shortening Losses = 82.7

For Tendons in Sequences 28 thru 32 :
Total Stress Sequence (N) = 5
Total Elastic Shortening Losses = 47.4

Ref. (2) Page 10) & Attchmt E

Tendon No.	Lift-off Pressure (ksi) (1) Shop End Predicted	Shop End Actual	Field End Predicted	Field End Actual	Stress Sequence (n) (2)	No. of Effective Wires (1)	Wire Factor #/163 (4)	Original Forces (kips) Shop End (5)	Field End (5)	Remarks (3)
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
D111	6810	7000	6810	6900	5	163	1.000	1685	1661	
D112	6800	6950	6840	7000	31	163	1.000	1675	1677	
D113	6800	7100	6840	6850	19	163	1.000	1711	1641	S
D114	6800	7000	6840	6900	32	162	0.994	1677	1643	
D115	6840	7050	6800	7100	4	163	1.000	1689	1711	E
D116	6760	6950	6800	6750	29	162	0.994	1675	1617	
D130	6870	6850	6810	6800	1	163	1.000	1634	1637	
D131	6710	6700	6740	6600	29	161	0.988	1616	1585	A
D132	6760	6700	6800	6700	27	162	0.994	1614	1605	
D211	6810	7100	6870	7000	1	162	0.994	1698	1660	
D212	6770	6600	6770	6700	27	162	0.994	1588	1612	R,C,E,S
D213	6840	6900	6800	6800	14	163	1.000	1653	1639	
D214	6670	6800	6740	6800	30	161	0.988	1650	1633	
D215	6800	6900	6870	7000	2	163	1.000	1663	1670	C (on line)
D216	6800	6700	6810	6700	27	163	1.000	1615	1612	
D302	6530	6550	6510	6600	22	156	0.957	1573	1590	
D303	6760	6700	6770	7030	8	161	0.988	1604	1681	
D304	6840	6800	6800	6600	30	163	1.000	1629	1591	D,S
D305	6700	6900	6680	6650	20	160	0.982	1657	1602	
D306	6810	6750	6810	6900	23	161	0.988	1605	1640	
D310	6770	6800	6770	6800	24	162	0.994	1636	1636	
D311	6800	7000	6840	7000	6	163	1.000	1687	1677	E
D312	6840	6950	6800	6700	30	163	1.000	1665	1615	

R3 R3 R3 R3

File: DOMER3.XLW (DOMEINP)

Notes:
(1) Ref.12, 13, 14 Crystal River 3 R/B Tendon History Sheets - Dome Tendons for Original Stressing. See Attachments B&D.
(2) Ref. 11 Crystal River 3 Tendon Surveillance Loss Calculations. See Attachment C for stress sequences.
(3) S= Selected Tendons, C =Control tendon, D =Detensioned tendon, A =Alternate tendon
E = Exempted Tendons (5th Surveillance), All Other Tendons are Adjacents
(4) Wire factors are calculated based on the number of effective wires divided by 163.
(5) Original forces calculated based on the expression in Section 6.2.2

21-Jan-98
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R3

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER3.XLW (D111)

TENDON: D111 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1685 FIELD: 1661 AVERAGE: 1673 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 5 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	142.4	2.57%	42.3	3.28	92.5	15	4.0	281.2	16.81%	1391	1322	1252	12
3	5.5	142.4	2.60%	42.7	3.86	108.8	18	5.0	298.9	17.87%	1374	1305	1236	12
5	7.5	142.4	2.68%	44.1	4.21	118.7	21	6.0	311.2	18.60%	1361	1293	1225	12
10	12.5	142.4	2.76%	45.4	4.62	130.3	25	7.0	325.1	19.44%	1348	1280	1213	12
15	17.5	142.4	2.81%	46.2	5.21	146.9	27.5	8.0	343.5	20.54%	1329	1263	1196	12
17	19.5	142.4									1327	1260	1194	12
20	22.5	142.4	2.87%	47.2	5.39	152.0	29	8.0	349.6	20.90%	1323	1257	1191	12
21:3	23.75	142.4									1321	1255	1189	12
25	27.5	142.4	2.89%	47.3	5.59	157.6	30.8	9.0	356.3	21.30%	1316	1251	1185	12
30	32.5	142.4	2.91%	47.8	5.78	163.0	32	9.0	362.2	21.65%	1310	1245	1179	12
35	37.5	142.4	2.93%	48.2	5.98	168.6	33	9.0	368.2	22.01%	1304	1239	1174	12
40	42.5	142.4	2.95%	48.5	6.18	174.3	34	10.0	375.2	22.43%	1297	1233	1168	12
21	23.5										1322	1256	1190	

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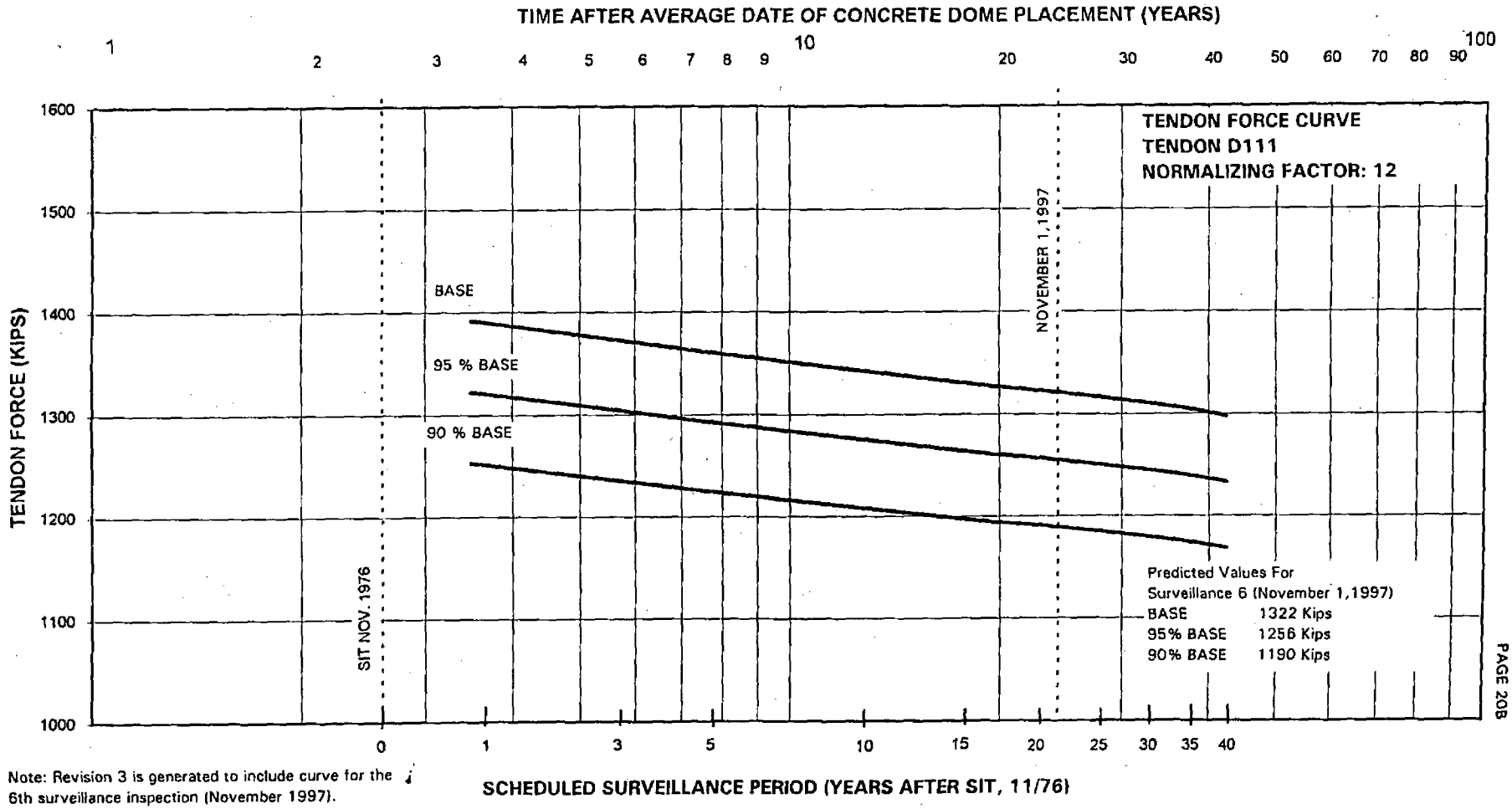

Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D112)

R2

TENDON: D112 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1675 FIELD: 1677 AVERAGE: 1676 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 31 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	-4.2	2.57%	42.3	3.28	92.5	15	4.0	134.6	8.03%	1542	1465	1387	-138
3	5.5	-4.2	2.60%	42.7	3.86	108.8	18	5.0	152.3	9.08%	1524	1448	1372	-138
5	7.5	-4.2	2.68%	44.1	4.21	118.7	21	6.0	164.6	9.82%	1512	1436	1360	-138
10	12.5	-4.2	2.76%	45.4	4.62	130.3	25	7.0	178.5	10.65%	1498	1423	1348	-138
15	17.5	-4.2	2.81%	46.2	5.21	146.9	27.5	8.0	196.9	11.75%	1479	1405	1331	-138
17	19.5	-4.2									1477	1403	1329	-138
20	22.5	-4.2	2.87%	47.2	5.39	152.0	29	8.0	203.0	12.11%	1473	1400	1326	-138
21:3	23.75	-4.2									1472	1398	1324	-138
25	27.5	-4.2	2.89%	47.3	5.59	157.6	30.8	9.0	209.7	12.51%	1466	1393	1320	-138
30	32.5	-4.2	2.91%	47.8	5.78	163.0	32	9.0	215.6	12.86%	1461	1388	1315	-138
35	37.5	-4.2	2.93%	48.2	5.98	168.6	33	9.0	221.6	13.22%	1455	1382	1309	-138
40	42.5	-4.2	2.95%	48.5	6.18	174.3	34	10.0	228.6	13.64%	1448	1375	1303	-138
21	23.5										1472	1398	1325	

R2

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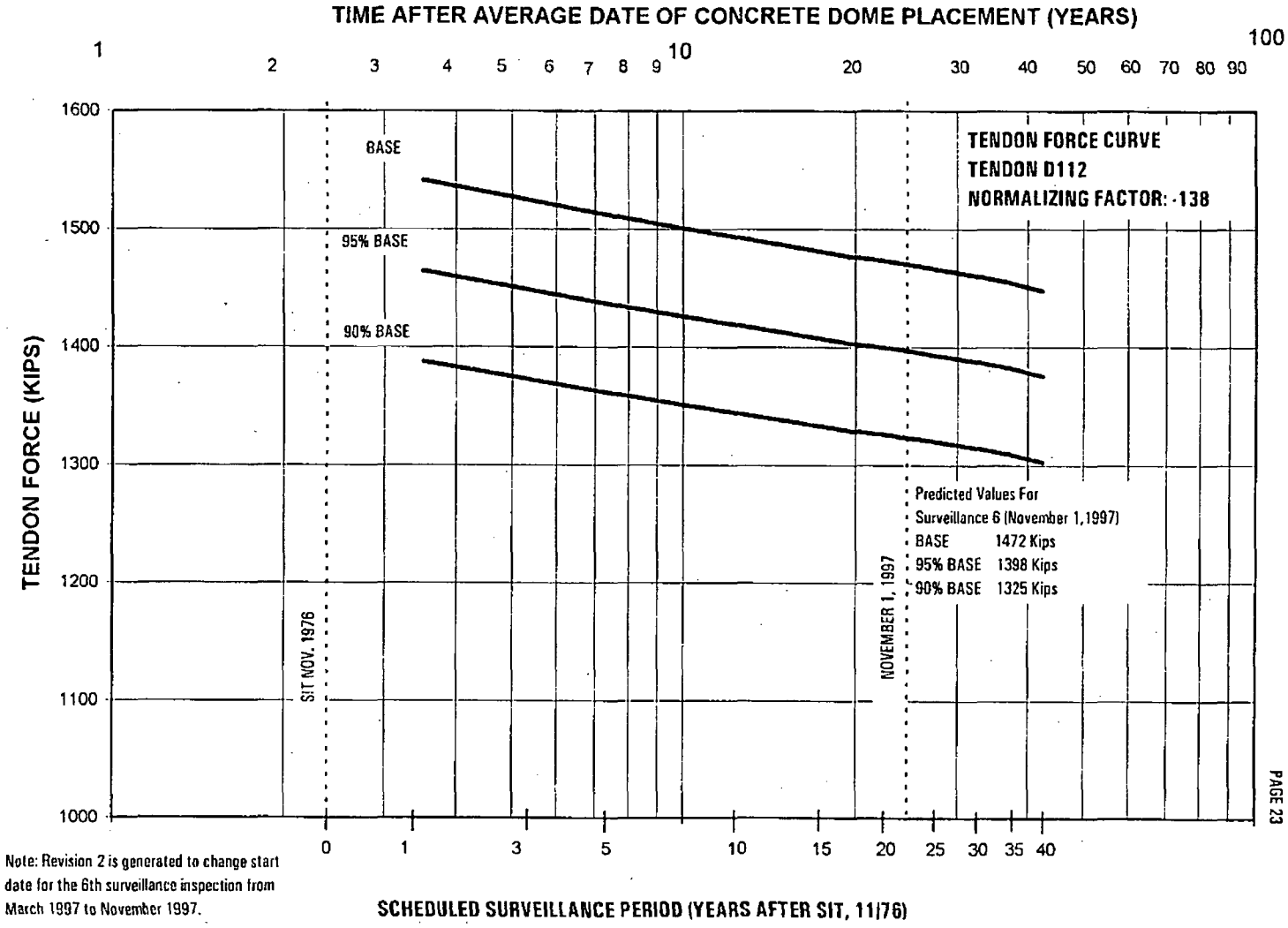
D112

Typical data used for plotting of Force Curves
Copied from cells on losses worksheet

Row/Col	R	S	T	U
40	2.5	1350		
41	3.5	1542	1465	1387
42	5.5	1524	1448	1372
43	7.5	1512	1436	1360
44	19.5	1477	1403	1329
45	22.5	1473	1400	1326
46	23.75	1472	1398	1324
47	27.5	1466	1393	1320
48	32.5	1461	1388	1315
49	37.5	1455	1382	1309
50	42.5	1448	1375	1303
	from Col B	Col L	Col. M.	Col. N.

595-0082



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D113)

R2

TENDON: D113 INITIAL CONCRETE STRESS (PSI) : NA

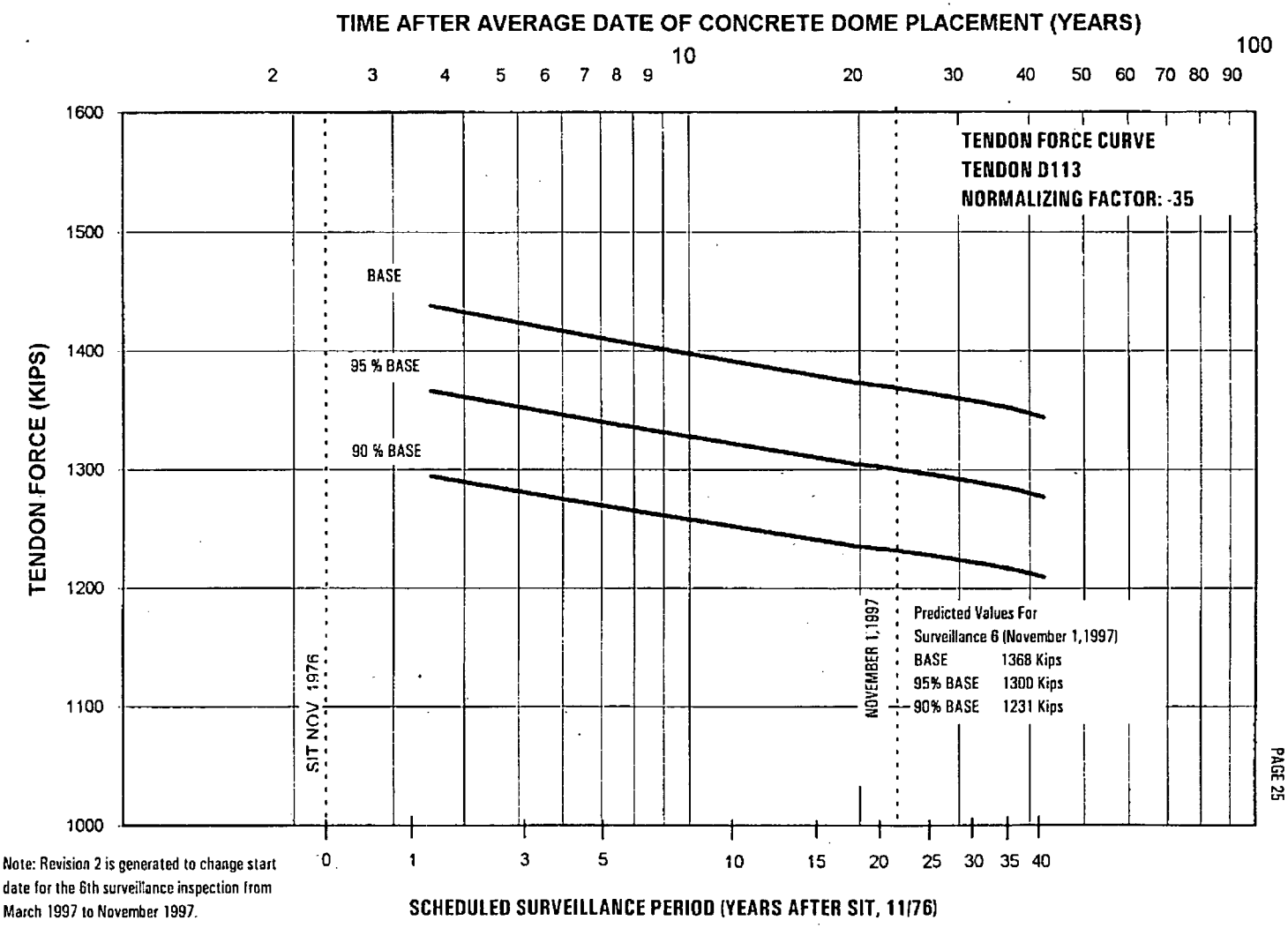
ORIGINAL FORCES (KIPS): SHOP: 1711 FIELD: 1641 AVERAGE: 1676 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 19 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	99.5	2.57%	42.3	3.28	92.5	15	4.0	238.3	14.22%	1438	1366	1294	-35
3	5.5	99.5	2.60%	42.7	3.86	108.8	18	5.0	256.0	15.27%	1420	1349	1278	-35
5	7.5	99.5	2.68%	44.1	4.21	118.7	21	6.0	268.3	16.01%	1408	1338	1267	-35
10	12.5	99.5	2.76%	45.4	4.62	130.3	25	7.0	282.2	16.84%	1394	1324	1255	-35
15	17.5	99.5	2.81%	46.2	5.21	146.9	27.5	8.0	300.6	17.93%	1376	1307	1238	-35
17	19.5	99.5									1373	1305	1236	-35
20	22.5	99.5	2.87%	47.2	5.39	152.0	29	8.0	306.7	18.30%	1370	1301	1233	-35
21:3	23.75	99.5									1368	1300	1231	-35
25	27.5	99.5	2.89%	47.3	5.59	157.6	30.8	9.0	313.4	18.70%	1363	1295	1227	-35
30	32.5	99.5	2.91%	47.8	5.78	163.0	32	9.0	319.3	19.05%	1357	1289	1221	-35
35	37.5	99.5	2.93%	48.2	5.98	168.6	33	9.0	325.3	19.41%	1351	1283	1216	-35
40	42.5	99.5	2.95%	48.5	6.18	174.3	34	10.0	332.3	19.82%	1344	1277	1210	-35
21	23.5										1368	1300	1231	

R2

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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RZ

RZ

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D114)

R2

TENDON: D114 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1677 FIELD: 1643 AVERAGE: 1660 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 32 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	-13.7	2.57%	42.3	3.28	92.5	15	4.0	125.1	7.54%	1535	1458	1381	-132
3	5.5	-13.7	2.60%	42.7	3.86	108.8	18	5.0	142.8	8.60%	1517	1441	1365	-132
5	7.5	-13.7	2.68%	44.1	4.21	118.7	21	6.0	155.1	9.34%	1505	1430	1354	-132
10	12.5	-13.7	2.76%	45.4	4.62	130.3	25	7.0	169.0	10.18%	1491	1416	1342	-132
15	17.5	-13.7	2.81%	46.2	5.21	146.9	27.5	8.0	187.4	11.29%	1473	1399	1325	-132
17	19.5	-13.7									1470	1397	1323	-132
20	22.5	-13.7	2.87%	47.2	5.39	152.0	29	8.0	193.5	11.66%	1466	1393	1320	-132
21:3	23.75	-13.7									1465	1392	1318	-132
25	27.5	-13.7	2.89%	47.3	5.59	157.6	30.8	9.0	200.2	12.06%	1460	1387	1314	-132
30	32.5	-13.7	2.91%	47.8	5.78	163.0	32	9.0	206.1	12.42%	1454	1381	1308	-132
35	37.5	-13.7	2.93%	48.2	5.98	168.6	33	9.0	212.1	12.78%	1448	1375	1303	-132
40	42.5	-13.7	2.95%	48.5	6.18	174.3	34	10.0	219.1	13.20%	1441	1369	1297	-132
21	23.5										1465	1392	1319	

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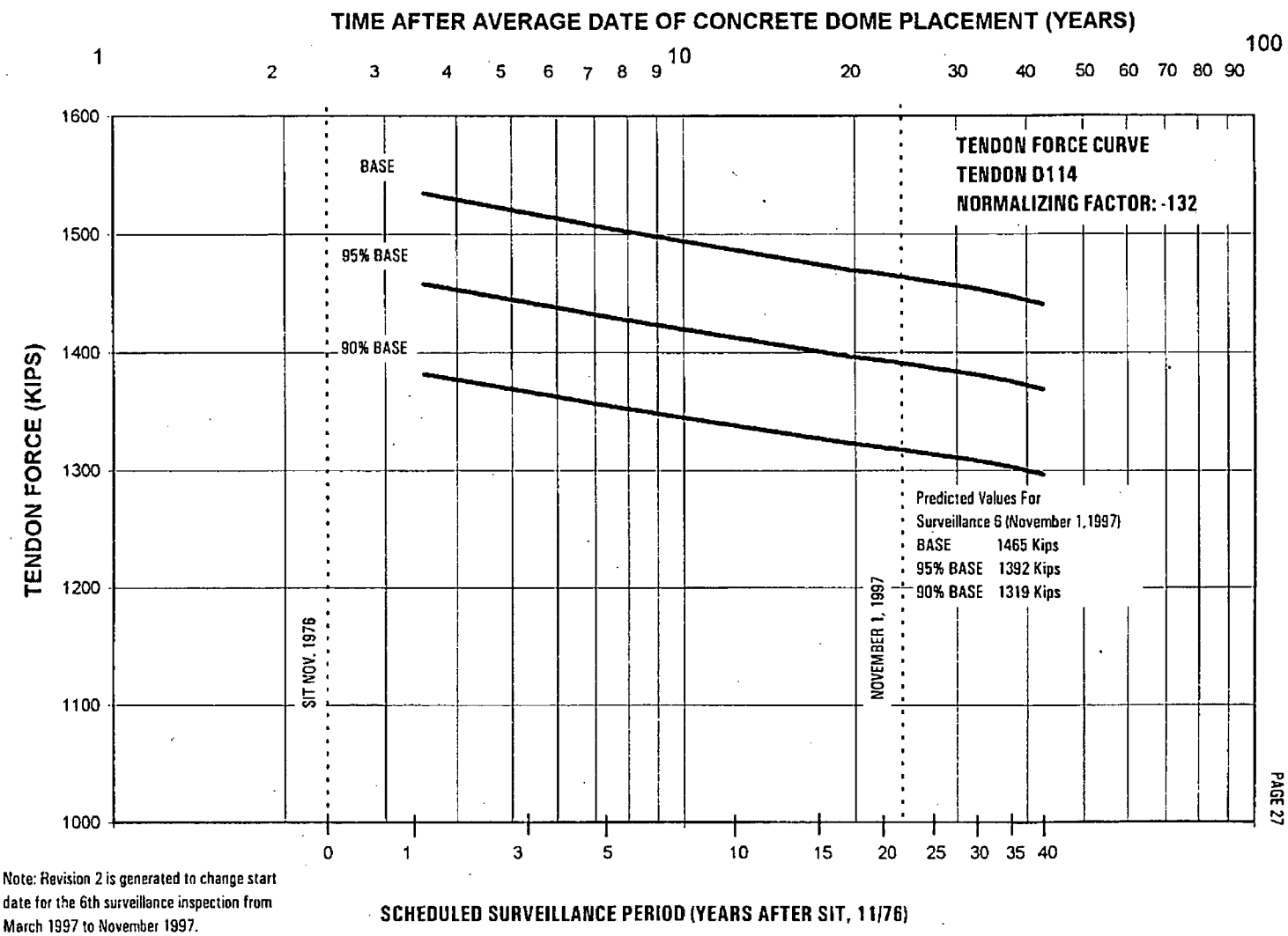

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D115)

TENDON: D115 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1689 FIELD: 1711 AVERAGE: 1700 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 4 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	145.4	2.57%	42.3	3.28	92.5	15	4.0	284.2	16.72%	1416	1345	1274	-12
3	5.5	145.4	2.60%	42.7	3.86	108.8	18	5.0	301.9	17.76%	1398	1328	1258	-12
5	7.5	145.4	2.68%	44.1	4.21	118.7	21	6.0	314.2	18.48%	1386	1317	1247	-12
10	12.5	145.4	2.76%	45.4	4.62	130.3	25	7.0	328.1	19.30%	1372	1303	1235	-12
15	17.5	145.4	2.81%	46.2	5.21	146.9	27.5	8.0	346.5	20.38%	1354	1286	1218	-12
17	19.5	145.4									1351	1284	1216	-12
20	22.5	145.4	2.87%	47.2	5.39	152.0	29	8.0	352.6	20.74%	1348	1280	1213	-12
21:3	23.75	145.4									1346	1279	1211	-12
25	27.5	145.4	2.89%	47.3	5.59	157.6	30.8	9.0	359.3	21.14%	1341	1274	1207	-12
30	32.5	145.4	2.91%	47.8	5.78	163.0	32	9.0	365.2	21.48%	1335	1268	1201	-12
35	37.5	145.4	2.93%	48.2	5.98	168.6	33	9.0	371.2	21.83%	1329	1263	1196	-12
40	42.5	145.4	2.95%	48.5	6.18	174.3	34	10.0	378.2	22.25%	1322	1256	1190	-12
21	23.5										1346	1279	1212	

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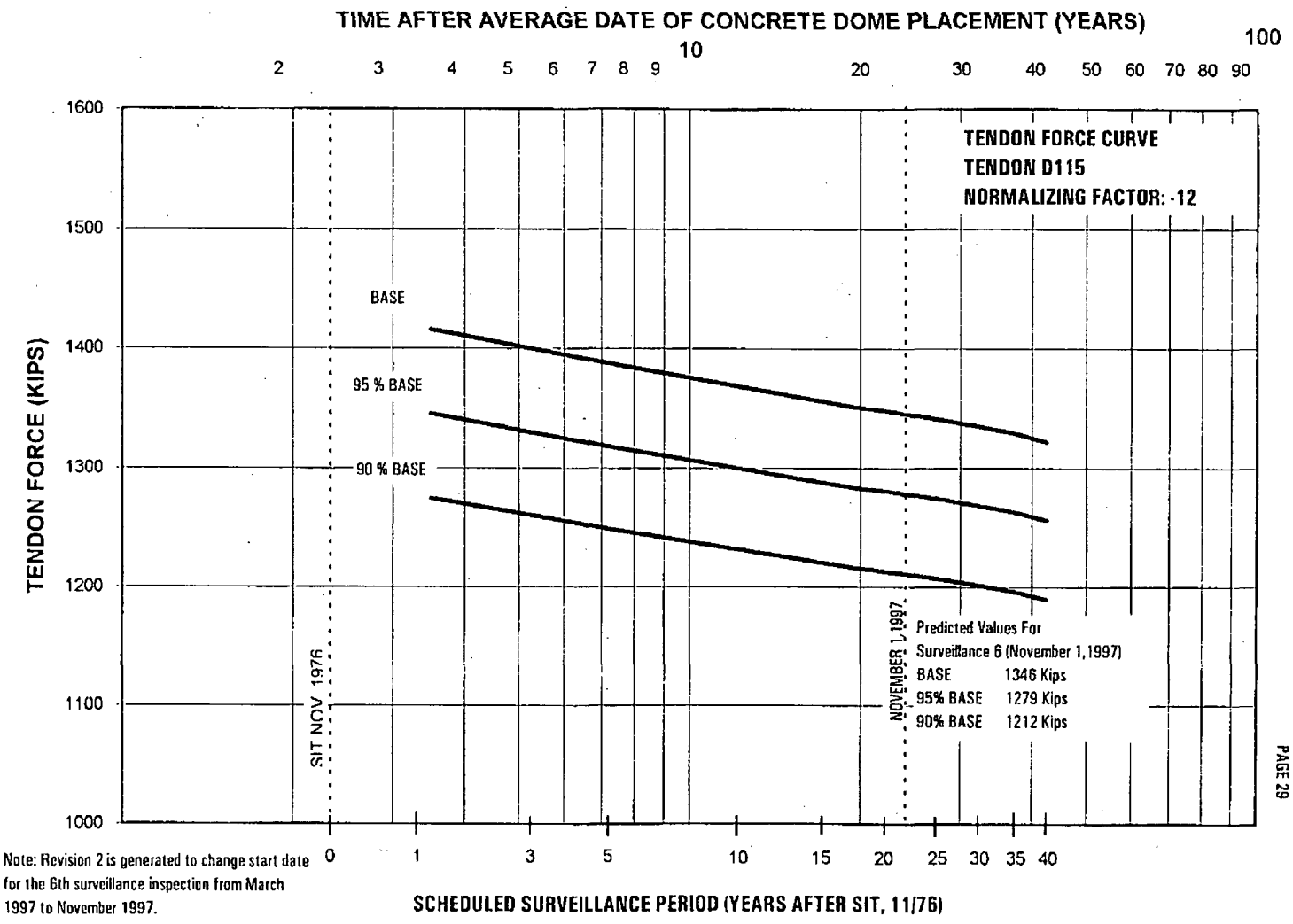

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D116)

RZ

TENDON: D116 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1675 FIELD: 1617 AVERAGE: 1646 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 29 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	14.7	2.57%	42.3	3.28	92.5	15	4.0	153.5	9.33%	1492	1418	1343	-90
3	5.5	14.7	2.60%	42.7	3.86	108.8	18	5.0	171.2	10.40%	1475	1401	1327	-90
5	7.5	14.7	2.68%	44.1	4.21	118.7	21	6.0	183.5	11.15%	1462	1389	1316	-90
10	12.5	14.7	2.76%	45.4	4.62	130.3	25	7.0	197.4	12.00%	1448	1376	1304	-90
15	17.5	14.7	2.81%	46.2	5.21	146.9	27.5	8.0	215.8	13.11%	1430	1358	1287	-90
17	19.5	14.7									1428	1356	1285	-90
20	22.5	14.7	2.87%	47.2	5.39	152.0	29	8.0	221.9	13.49%	1424	1353	1281	-90
21:3	23.75	14.7									1422	1351	1280	-90
25	27.5	14.7	2.89%	47.3	5.59	157.6	30.8	9.0	228.6	13.89%	1417	1346	1275	-90
30	32.5	14.7	2.91%	47.8	5.78	163.0	32	9.0	234.5	14.25%	1411	1341	1270	-90
35	37.5	14.7	2.93%	48.2	5.98	168.6	33	9.0	240.5	14.62%	1405	1335	1265	-90
40	42.5	14.7	2.95%	48.5	6.18	174.3	34	10.0	247.5	15.04%	1398	1328	1258	-90
21	23.5										1423	1351	1280	

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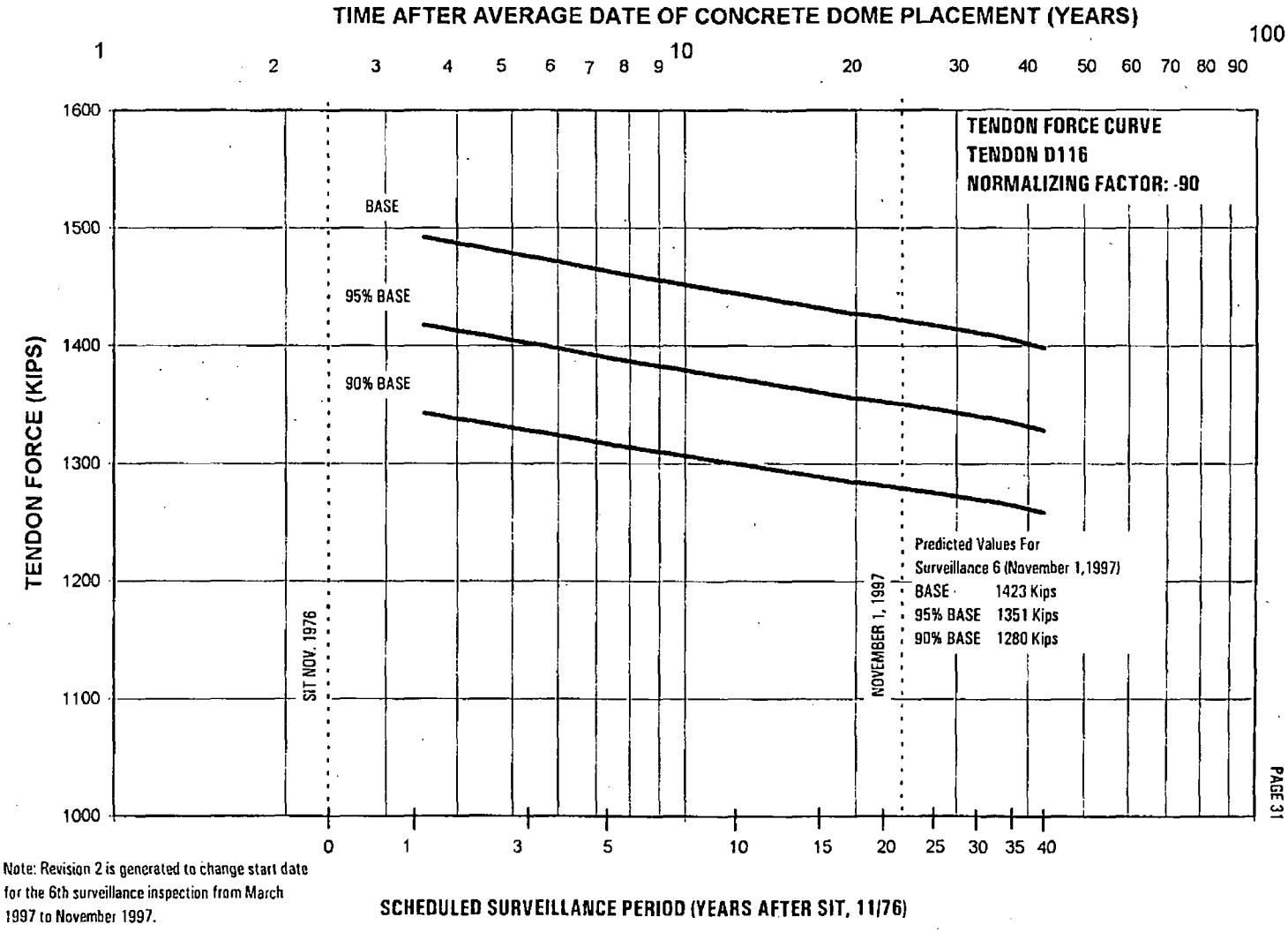

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D130)

TENDON: D130 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1634 FIELD: 1637 AVERAGE: 1635 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 1 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS. AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	154.6	2.57%	42.3	3.28	92.5	15	4.0	293.4	17.94%	1342	1275	1208	60
3	5.5	154.6	2.60%	42.7	3.86	108.8	18	5.0	311.1	19.03%	1324	1258	1192	60
5	7.5	154.6	2.68%	44.1	4.21	118.7	21	6.0	323.4	19.78%	1312	1246	1181	60
10	12.5	154.6	2.76%	45.4	4.62	130.3	25	7.0	337.3	20.63%	1298	1233	1168	60
15	17.5	154.6	2.81%	46.2	5.21	146.9	27.5	8.0	355.7	21.75%	1280	1216	1152	60
17	19.5	154.6									1277	1213	1149	60
20	22.5	154.6	2.87%	47.2	5.39	152.0	29	8.0	361.8	22.13%	1274	1210	1146	60
21:3	23.75	154.6									1272	1208	1145	60
25	27.5	154.6	2.89%	47.3	5.59	157.6	30.8	9.0	368.5	22.54%	1267	1203	1140	60
30	32.5	154.6	2.91%	47.8	5.78	163.0	32	9.0	374.4	22.90%	1261	1198	1135	60
35	37.5	154.6	2.93%	48.2	5.98	168.6	33	9.0	380.4	23.26%	1255	1192	1129	60
40	42.5	154.6	2.95%	48.5	6.18	174.3	34	10.0	387.4	23.69%	1248	1186	1123	60
21	23.5										1272	1209	1145	

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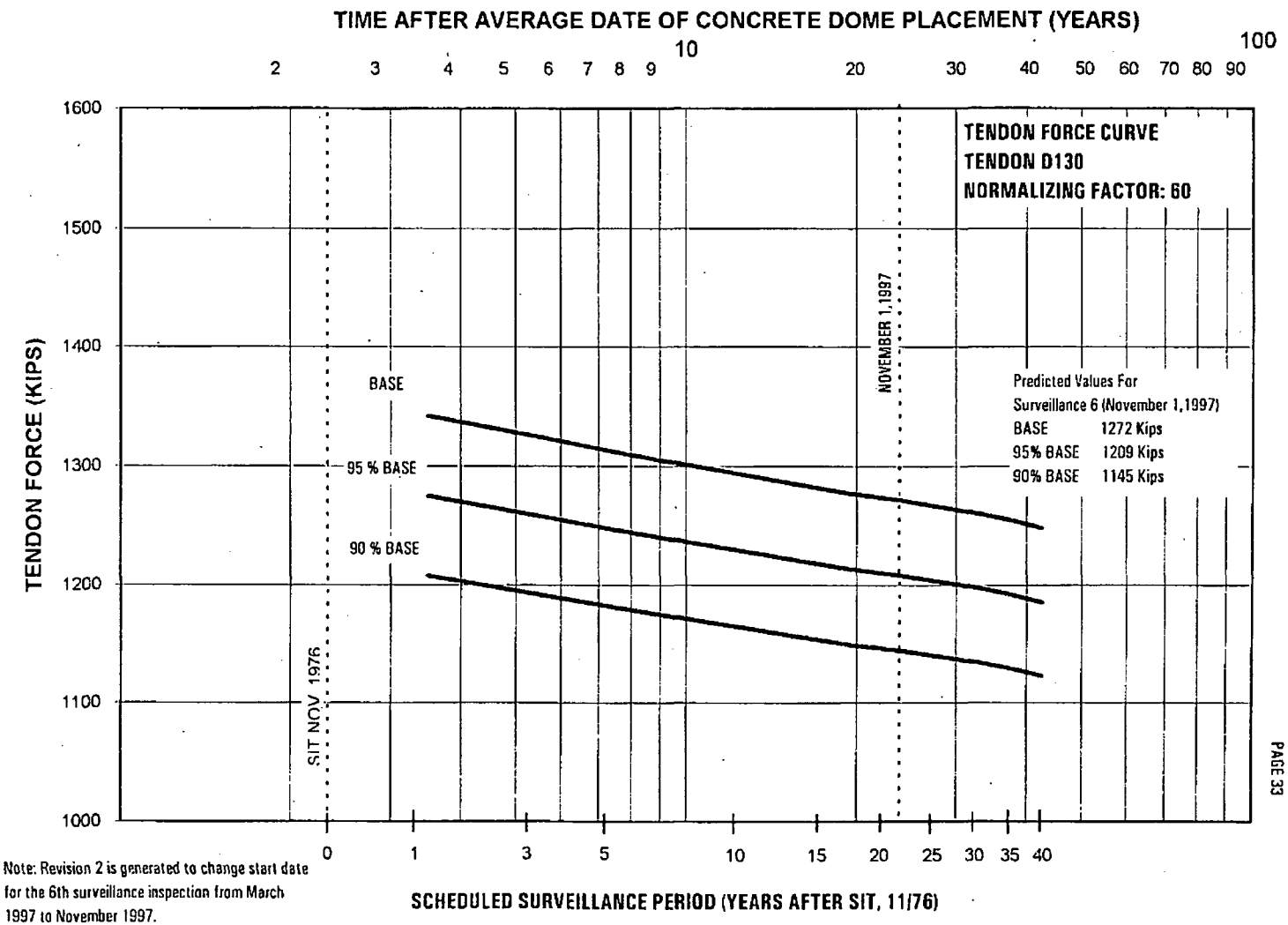

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D131)

TENDON: D131 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1616 FIELD: 1585 AVERAGE: 1601 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 29 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	14.7	2.57%	42.3	3.28	92.5	15	4.0	153.5	9.59%	1447	1375	1303	-46
3	5.5	14.7	2.60%	42.7	3.86	108.8	18	5.0	171.2	10.70%	1430	1358	1287	-46
5	7.5	14.7	2.68%	44.1	4.21	118.7	21	6.0	183.5	11.47%	1417	1346	1276	-46
10	12.5	14.7	2.76%	45.4	4.62	130.3	25	7.0	197.4	12.33%	1403	1333	1263	-46
15	17.5	14.7	2.81%	46.2	5.21	146.9	27.5	8.0	215.8	13.48%	1385	1316	1246	-46
17	19.5	14.7									1383	1313	1244	-46
20	22.5	14.7	2.87%	47.2	5.39	152.0	29	8.0	221.9	13.86%	1379	1310	1241	-46
21:3	23.75	14.7									1377	1308	1239	-46
25	27.5	14.7	2.89%	47.3	5.59	157.6	30.8	9.0	228.6	14.28%	1372	1304	1235	-46
30	32.5	14.7	2.91%	47.8	5.78	163.0	32	9.0	234.5	14.65%	1366	1298	1230	-46
35	37.5	14.7	2.93%	48.2	5.98	168.6	33	9.0	240.5	15.03%	1360	1292	1224	-46
40	42.5	14.7	2.95%	48.5	6.18	174.3	34	10.0	247.5	15.46%	1353	1286	1218	-46
21	23.5										1378	1309	1240	

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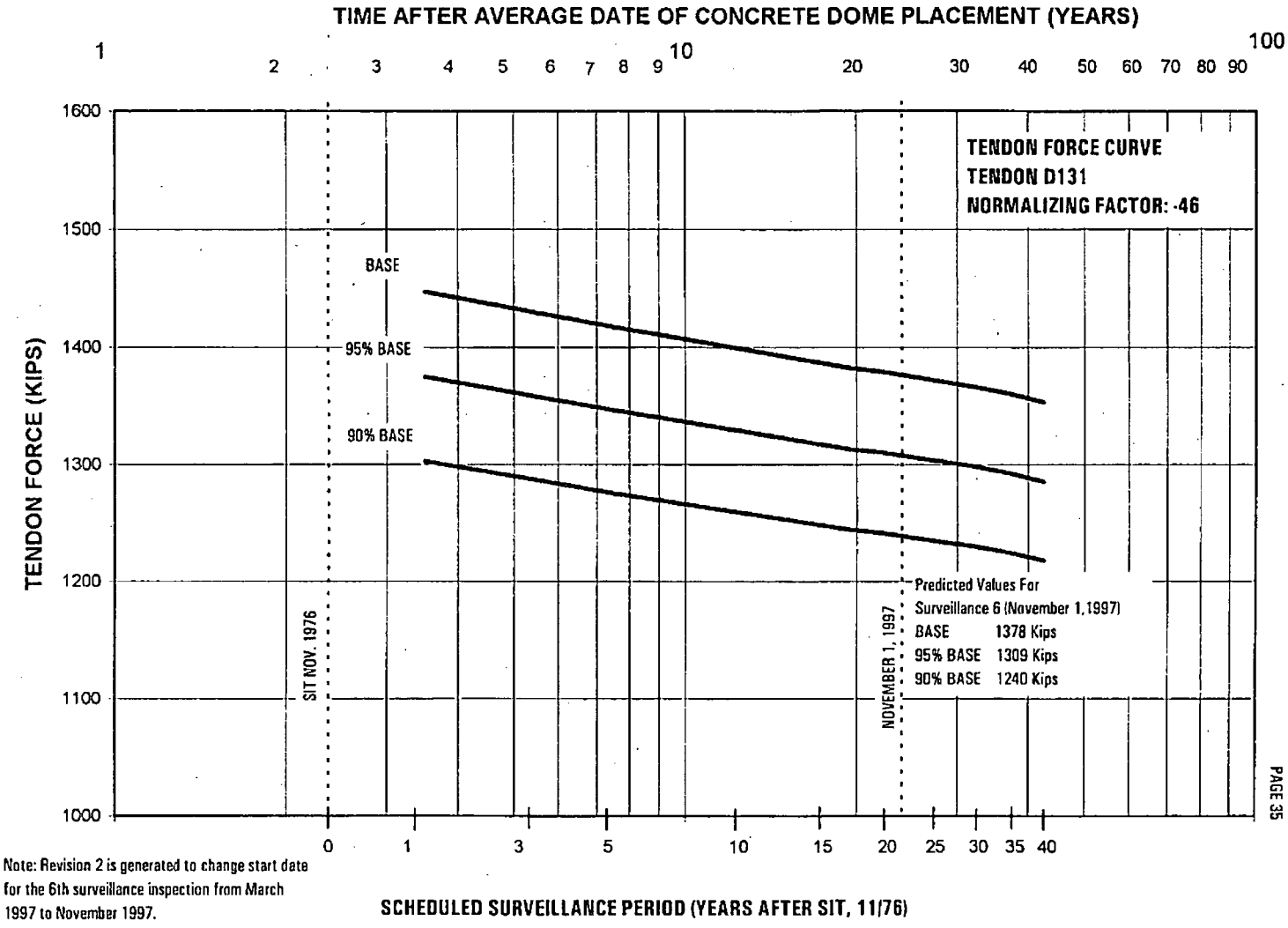

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D132)

TENDON: D132 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1614 FIELD: 1605 AVERAGE: 1610 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 27 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	75.0	2.57%	42.3	3.28	92.5	15	4.0	213.8	13.28%	1396	1326	1256	6
3	5.5	75.0	2.60%	42.7	3.86	108.8	18	5.0	231.5	14.38%	1378	1309	1240	6
5	7.5	75.0	2.68%	44.1	4.21	118.7	21	6.0	243.8	15.15%	1366	1298	1229	6
10	12.5	75.0	2.76%	45.4	4.62	130.3	25	7.0	257.7	16.01%	1352	1284	1217	6
15	17.5	75.0	2.81%	46.2	5.21	146.9	27.5	8.0	276.1	17.15%	1334	1267	1200	6
17	19.5	75.0									1331	1265	1198	6
20	22.5	75.0	2.87%	47.2	5.39	152.0	29	8.0	282.2	17.53%	1327	1261	1195	6
21:3	23.75	75.0									1326	1260	1193	6
25	27.5	75.0	2.89%	47.3	5.59	157.6	30.8	9.0	288.9	17.95%	1321	1255	1189	6
30	32.5	75.0	2.91%	47.8	5.78	163.0	32	9.0	294.8	18.31%	1315	1249	1183	6
35	37.5	75.0	2.93%	48.2	5.98	168.6	33	9.0	300.8	18.69%	1309	1243	1178	6
40	42.5	75.0	2.95%	48.5	6.18	174.3	34	10.0	307.8	19.12%	1302	1237	1172	6
21	23.5										1326	1260	1194	

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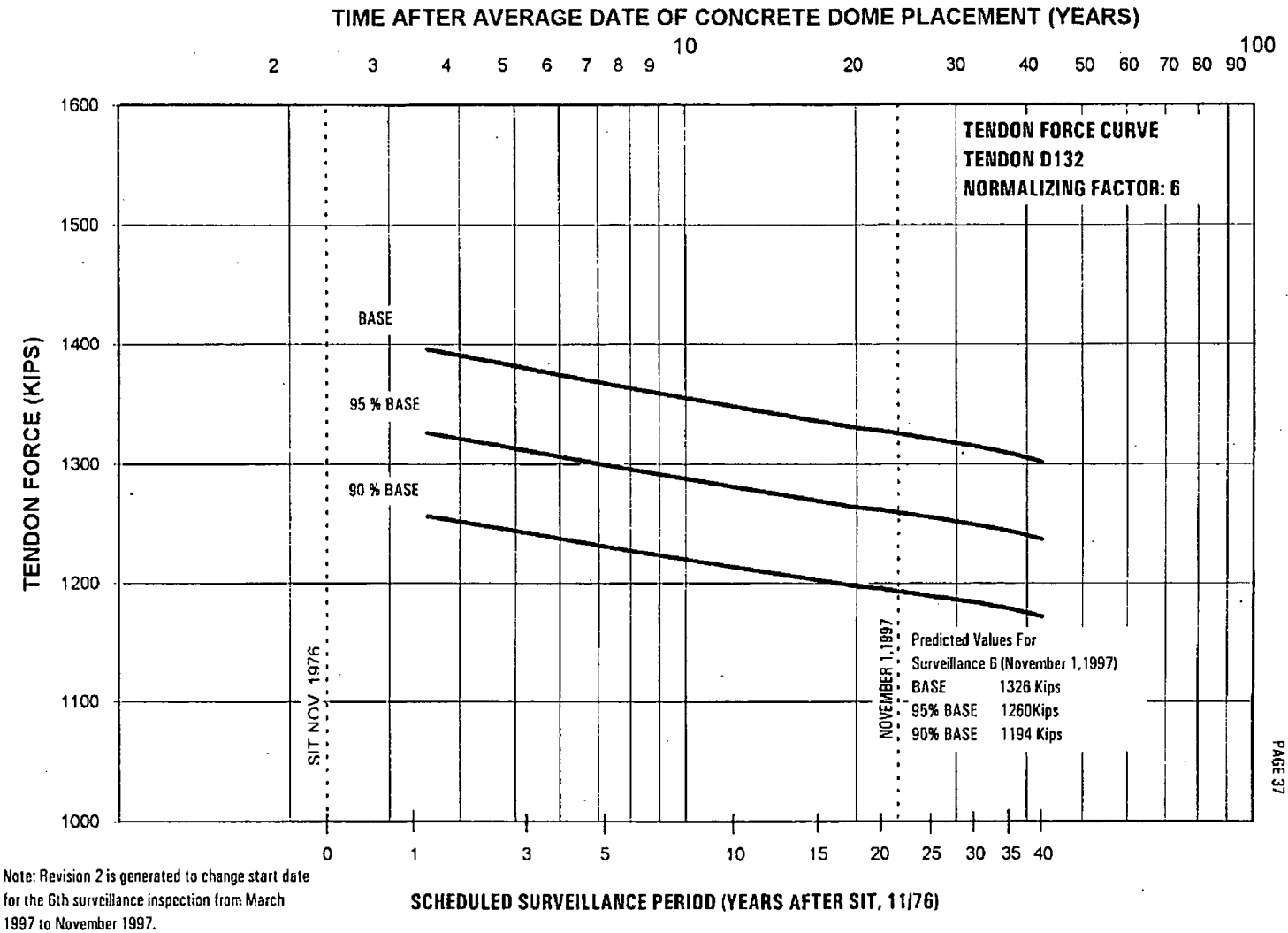

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D211)

TENDON: D211 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1698 FIELD: 1660 AVERAGE: 1679 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 11 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	154.6	2.57%	42.3	3.28	92.5	15	4.0	293.4	17.48%	1386	1316	1247	18
3	5.5	154.6	2.60%	42.7	3.86	108.8	18	5.0	311.1	18.53%	1368	1299	1231	18
5	7.5	154.6	2.68%	44.1	4.21	118.7	21	6.0	323.4	19.26%	1356	1288	1220	18
10	12.5	154.6	2.76%	45.4	4.62	130.3	25	7.0	337.3	20.09%	1342	1275	1207	18
15	17.5	154.6	2.81%	46.2	5.21	146.9	27.5	8.0	355.7	21.19%	1323	1257	1191	18
17	19.5	154.6									1321	1255	1189	18
20	22.5	154.6	2.87%	47.2	5.39	152.0	29	8.0	361.8	21.55%	1317	1251	1185	18
21:3	23.75	154.6									1315	1250	1184	18
25	27.5	154.6	2.89%	47.3	5.59	157.6	30.8	9.0	368.5	21.95%	1310	1245	1179	18
30	32.5	154.6	2.91%	47.8	5.78	163.0	32	9.0	374.4	22.30%	1305	1239	1174	18
35	37.5	154.6	2.93%	48.2	5.98	168.6	33	9.0	380.4	22.66%	1299	1234	1169	18
40	42.5	154.6	2.95%	48.5	6.18	174.3	34	10.0	387.4	23.08%	1292	1227	1162	18
21	23.5										1316	1250	1184	

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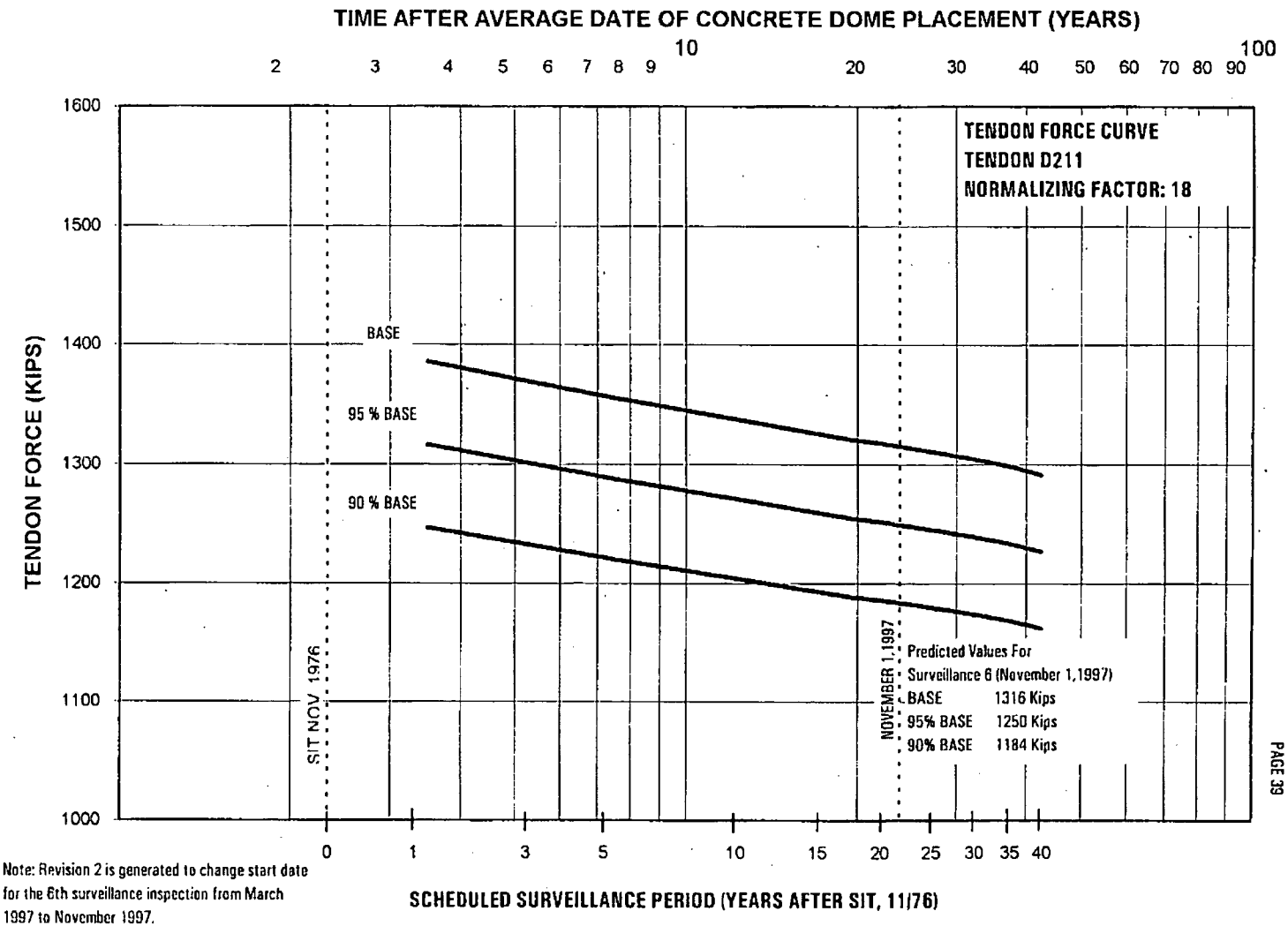

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D212)

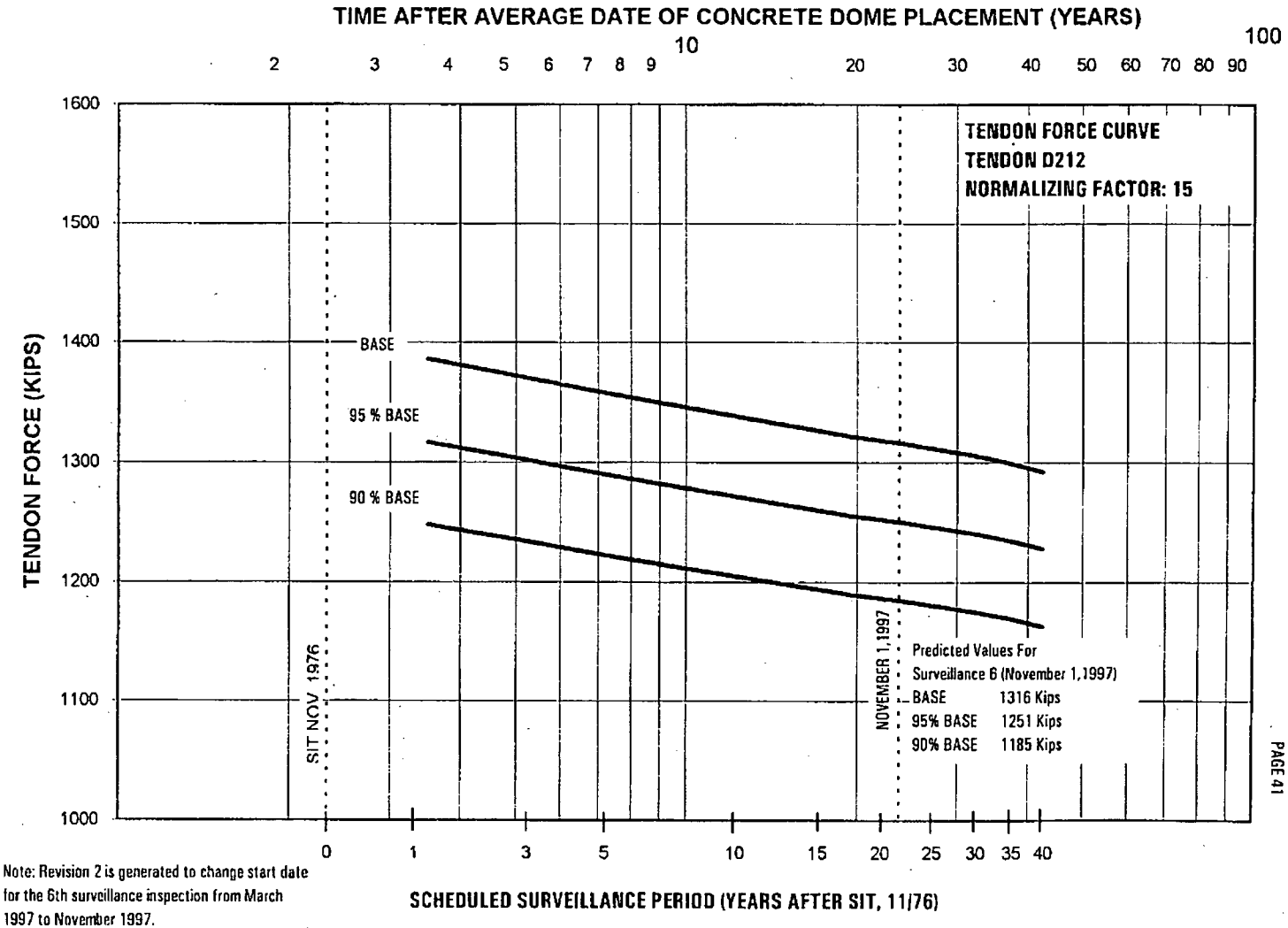
TENDON: D212 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1588 FIELD: 1612 AVERAGE: 1600 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 27 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	75.0	2.57%	42.3	3.28	92.5	15	4.0	213.8	13.36%	1386	1317	1248	15
3	5.5	75.0	2.60%	42.7	3.86	108.8	18	5.0	231.5	14.47%	1369	1300	1232	15
5	7.5	75.0	2.68%	44.1	4.21	118.7	21	6.0	243.8	15.24%	1356	1288	1221	15
10	12.5	75.0	2.76%	45.4	4.62	130.3	25	7.0	257.7	16.11%	1342	1275	1208	15
15	17.5	75.0	2.81%	46.2	5.21	146.9	27.5	8.0	276.1	17.26%	1324	1258	1192	15
17	19.5	75.0									1321	1255	1189	15
20	22.5	75.0	2.87%	47.2	5.39	152.0	29	8.0	282.2	17.64%	1318	1252	1186	15
21:3	23.75	75.0									1316	1250	1185	15
25	27.5	75.0	2.89%	47.3	5.59	157.6	30.8	9.0	288.9	18.06%	1311	1246	1180	15
30	32.5	75.0	2.91%	47.8	5.78	163.0	32	9.0	294.8	18.42%	1305	1240	1175	15
35	37.5	75.0	2.93%	48.2	5.98	168.6	33	9.0	300.8	18.80%	1299	1234	1169	15
40	42.5	75.0	2.95%	48.5	6.18	174.3	34	10.0	307.8	19.24%	1292	1228	1163	15
21	23.5										1316	1251	1185	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

RZ

RZ

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES· 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D213)

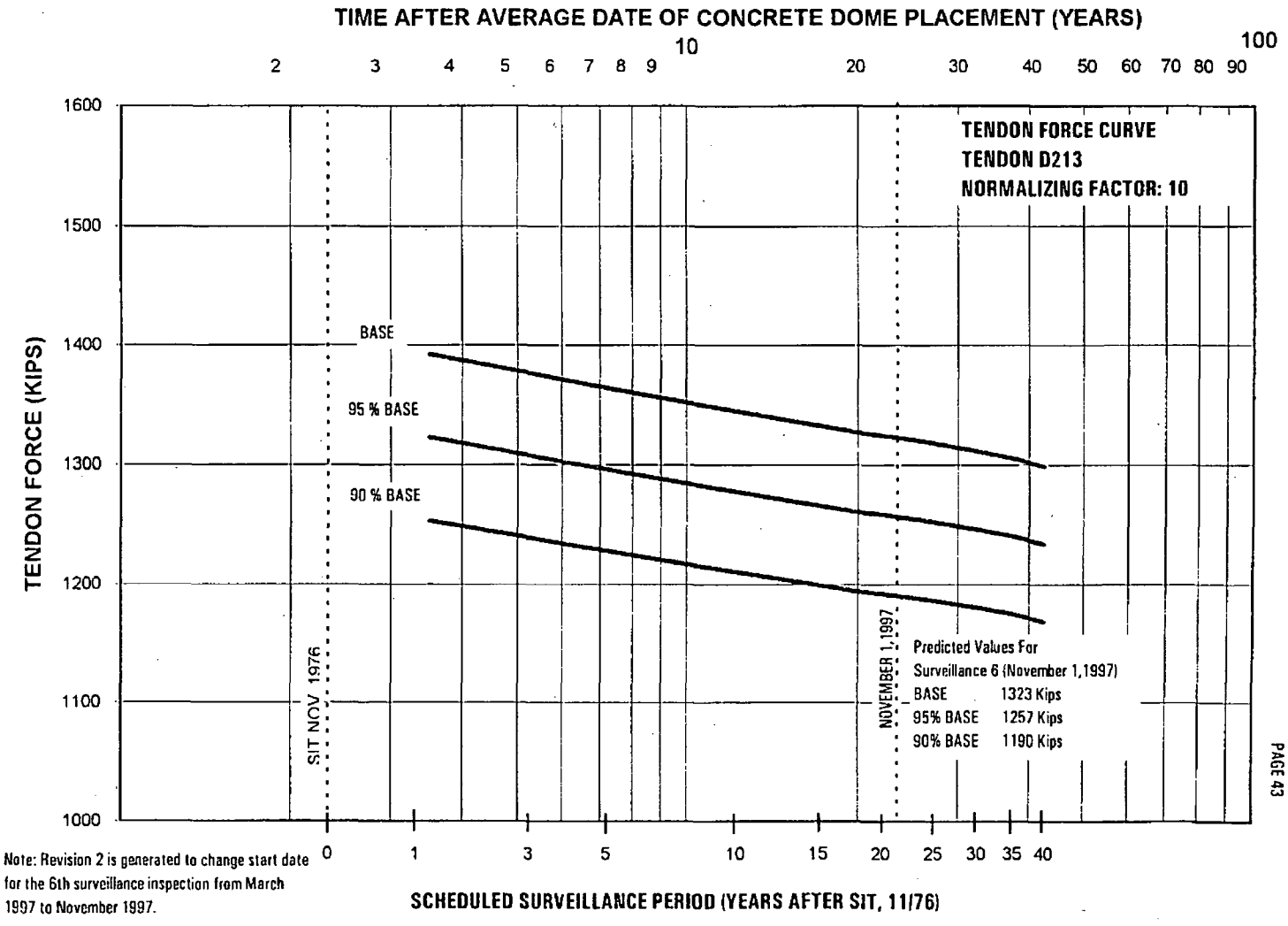
TENDON: D213 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1653 FIELD: 1639 AVERAGE: 1646 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 14 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	114.8	2.57%	42.3	3.28	92.5	15	4.0	253.6	15.41%	1393	1323	1253	10
3	5.5	114.8	2.60%	42.7	3.88	108.8	18	5.0	271.3	16.48%	1375	1306	1237	10
5	7.5	114.8	2.68%	44.1	4.21	118.7	21	6.0	283.6	17.23%	1363	1294	1226	10
10	12.5	114.8	2.76%	45.4	4.62	130.3	25	7.0	297.5	18.07%	1349	1281	1214	10
15	17.5	114.8	2.81%	46.2	5.21	146.9	27.5	8.0	315.9	19.19%	1330	1264	1197	10
17	19.5	114.8									1328	1261	1195	10
20	22.5	114.8	2.87%	47.2	5.39	152.0	29	8.0	322.0	19.56%	1324	1258	1192	10
21:3	23.75	114.8									1322	1256	1190	10
25	27.5	114.8	2.89%	47.3	5.59	157.6	30.8	9.0	328.7	19.97%	1317	1252	1186	10
30	32.5	114.8	2.91%	47.8	5.78	163.0	32	9.0	334.6	20.33%	1312	1246	1180	10
35	37.5	114.8	2.93%	48.2	5.98	168.6	33	9.0	340.6	20.69%	1306	1240	1175	10
40	42.5	114.8	2.95%	48.5	6.18	174.3	34	10.0	347.6	21.12%	1299	1234	1169	10
21	23.5										1323	1257	1190	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D214)

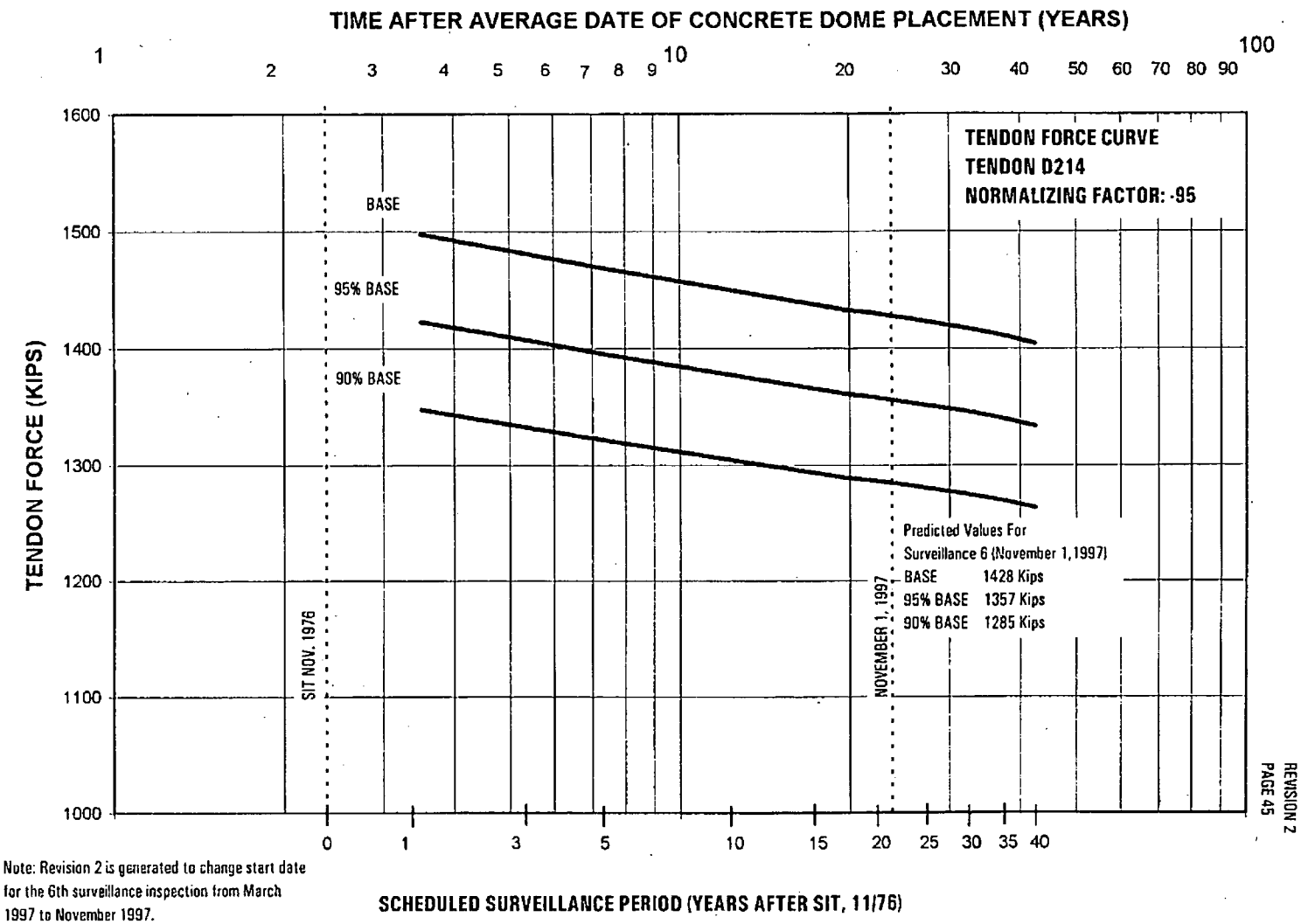
TENDON: D214 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1650 FIELD: 1633 AVERAGE: 1642 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 30 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	5.3	2.57%	42.3	3.28	92.5	15	4.0	144.1	8.77%	1498	1423	1348	·95
3	5.5	5.3	2.60%	42.7	3.86	108.8	18	5.0	161.8	9.85%	1480	1406	1332	·95
5	7.5	5.3	2.68%	44.1	4.21	118.7	21	6.0	174.1	10.60%	1468	1394	1321	·95
10	12.5	5.3	2.76%	45.4	4.62	130.3	25	7.0	188.0	11.45%	1454	1381	1308	·95
15	17.5	5.3	2.81%	46.2	5.21	146.9	27.5	8.0	206.4	12.57%	1435	1364	1292	·95
17	19.5	5.3									1433	1361	1290	·95
20	22.5	5.3	2.87%	47.2	5.39	152.0	29	8.0	212.5	12.94%	1429	1358	1286	·95
21:3	23.75	5.3									1428	1356	1285	·95
25	27.5	5.3	2.89%	47.3	5.59	157.6	30.8	9.0	219.2	13.35%	1423	1352	1280	·95
30	32.5	5.3	2.91%	47.8	5.78	163.0	32	9.0	225.1	13.71%	1417	1346	1275	·95
35	37.5	5.3	2.93%	48.2	5.98	168.6	33	9.0	231.1	14.07%	1411	1340	1270	·95
40	42.5	5.3	2.95%	48.5	6.18	174.3	34	10.0	238.1	14.50%	1404	1334	1263	·95
21	23.5										1428	1357	1285	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D215)

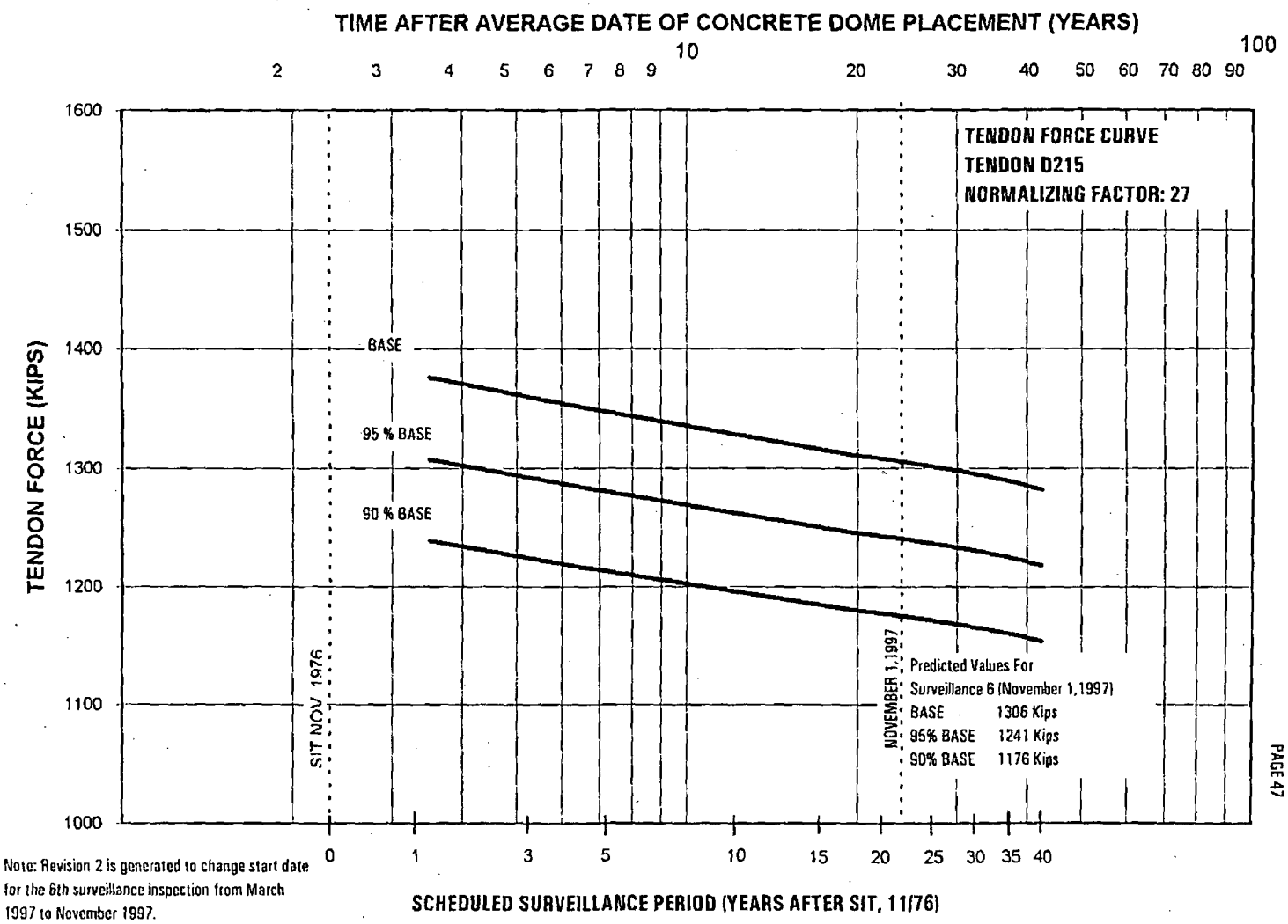
TENDON: D215 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1663 FIELD: 1670 AVERAGE: 1666 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 2 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	151.6	2.57%	42.3	3.28	92.5	15	4.0	290.4	17.42%	1376	1307	1239	27
3	5.5	151.6	2.60%	42.7	3.86	108.8	18	5.0	308.1	18.49%	1358	1290	1223	27
5	7.5	151.6	2.68%	44.1	4.21	118.7	21	6.0	320.4	19.22%	1346	1279	1212	27
10	12.5	151.6	2.76%	45.4	4.62	130.3	25	7.0	334.3	20.06%	1332	1266	1199	27
15	17.5	151.6	2.81%	46.2	5.21	146.9	27.5	8.0	352.7	21.16%	1314	1248	1182	27
17	19.5	151.6									1311	1246	1180	27
20	22.5	151.6	2.87%	47.2	5.39	152.0	29	8.0	358.8	21.53%	1308	1242	1177	27
21:3	23.75	151.6									1306	1241	1175	27
25	27.5	151.6	2.89%	47.3	5.59	157.6	30.8	9.0	365.5	21.93%	1301	1236	1171	27
30	32.5	151.6	2.91%	47.8	5.78	163.0	32	9.0	371.4	22.28%	1295	1230	1166	27
35	37.5	151.6	2.93%	48.2	5.98	168.6	33	9.0	377.4	22.64%	1289	1225	1160	27
40	42.5	151.6	2.95%	48.5	6.18	174.3	34	10.0	384.4	23.06%	1282	1218	1154	27
21	23.5										1306	1241	1176	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (0216)

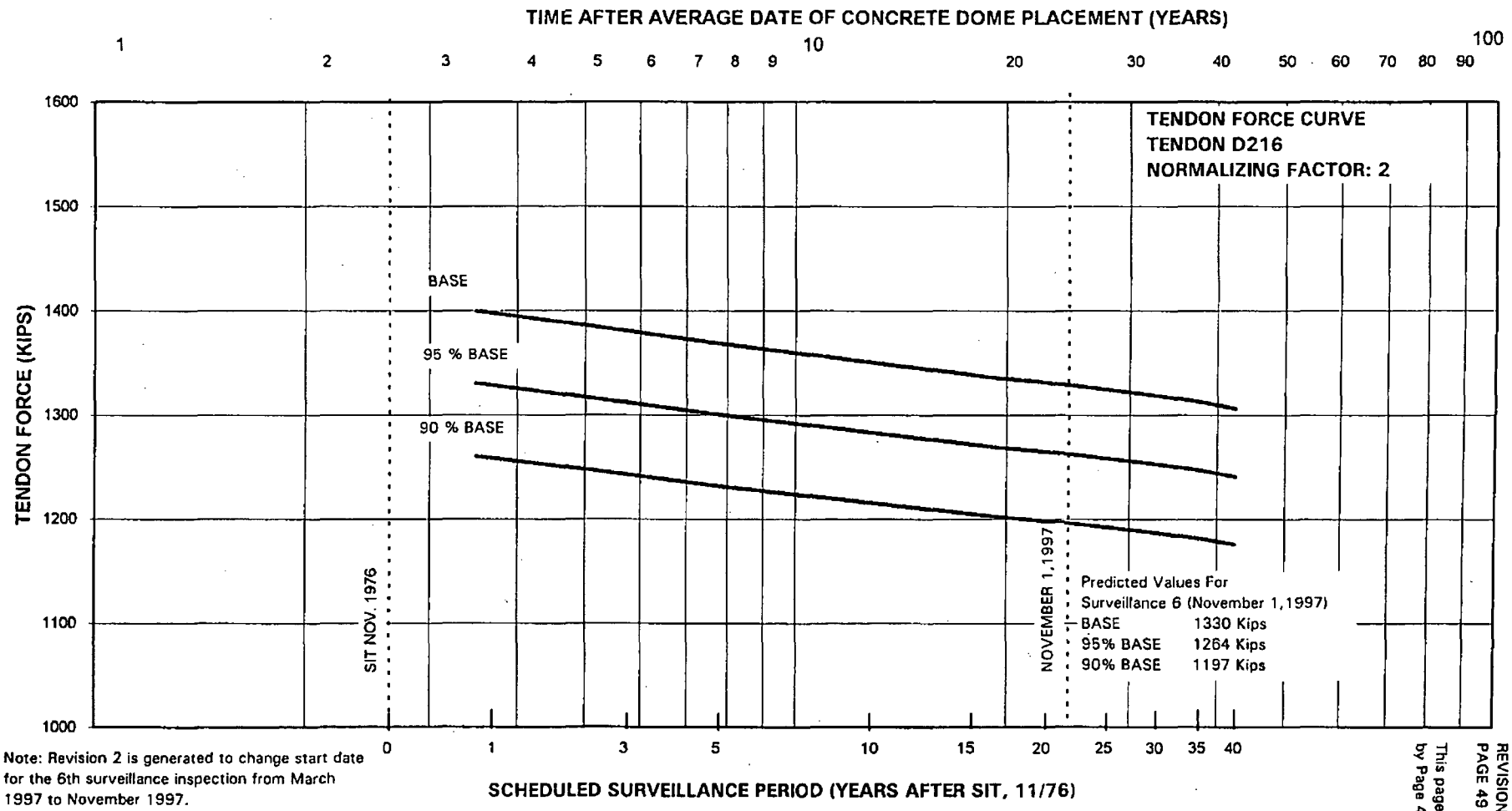
TENDON: 0216 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1615 FIELD: 1612 AVERAGE: 1614 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 27 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	75.0	2.57%	42.3	3.28	92.5	15	4.0	213.8	13.25%	1400	1330	1260	2
3	5.5	75.0	2.60%	42.7	3.86	108.8	18	5.0	231.5	14.35%	1382	1313	1244	2
5	7.5	75.0	2.68%	44.1	4.21	118.7	21	6.0	243.8	15.11%	1370	1301	1233	2
10	12.5	75.0	2.76%	45.4	4.62	130.3	25	7.0	257.7	15.97%	1356	1288	1220	2
15	17.5	75.0	2.81%	46.2	5.21	146.9	27.5	8.0	276.1	17.11%	1338	1271	1204	2
17	19.5	75.0									1335	1268	1202	2
20	22.5	75.0	2.87%	47.2	5.39	152.0	29	8.0	282.2	17.49%	1331	1265	1198	2
21:3	23.75	75.0									1330	1263	1197	2
25	27.5	75.0	2.89%	47.3	5.59	157.6	30.8	9.0	288.9	17.90%	1325	1259	1192	2
30	32.5	75.0	2.91%	47.8	5.78	163.0	32	9.0	294.8	18.27%	1319	1253	1187	2
35	37.5	75.0	2.93%	48.2	5.98	168.6	33	9.0	300.8	18.64%	1313	1247	1182	2
40	42.5	75.0	2.95%	48.5	6.18	174.3	34	10.0	307.8	19.07%	1306	1241	1175	2
21	23.5										1330	1264	1197	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R3

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER3.XLW (D302)

TENDON: D302 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1573 FIELD: 1590 AVERAGE: 1582 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 22 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.957

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	90.3	2.57%	42.3	3.28	92.5	15	4.0	229.1	14.48%	1353	1285	1217	48
3	5.5	90.3	2.60%	42.7	3.86	108.8	18	5.0	246.8	15.60%	1335	1268	1201	48
5	7.5	90.3	2.68%	44.1	4.21	118.7	21	6.0	259.1	16.38%	1323	1257	1190	48
10	12.5	90.3	2.76%	45.4	4.62	130.3	25	7.0	273.0	17.26%	1309	1243	1178	48
15	17.5	90.3	2.81%	46.2	5.21	146.9	27.5	8.0	291.4	18.42%	1290	1226	1161	48
17	19.5	90.3									1288	1224	1159	48
20	22.5	90.3	2.87%	47.2	5.39	152.0	29	8.0	297.5	18.81%	1284	1220	1156	48
21:3	23.75	90.3									1283	1218	1154	48
25	27.5	90.3	2.89%	47.3	5.59	157.6	30.8	9.0	304.2	19.23%	1278	1214	1150	48
30	32.5	90.3	2.91%	47.8	5.78	163.0	32	9.0	310.1	19.61%	1272	1208	1145	48
35	37.5	90.3	2.93%	48.2	5.98	168.6	33	9.0	316.1	19.98%	1266	1202	1139	48
40	42.5	90.3	2.95%	48.5	6.18	174.3	34	10.0	323.1	20.43%	1259	1196	1133	48
21	23.5										1283	1219	1155	

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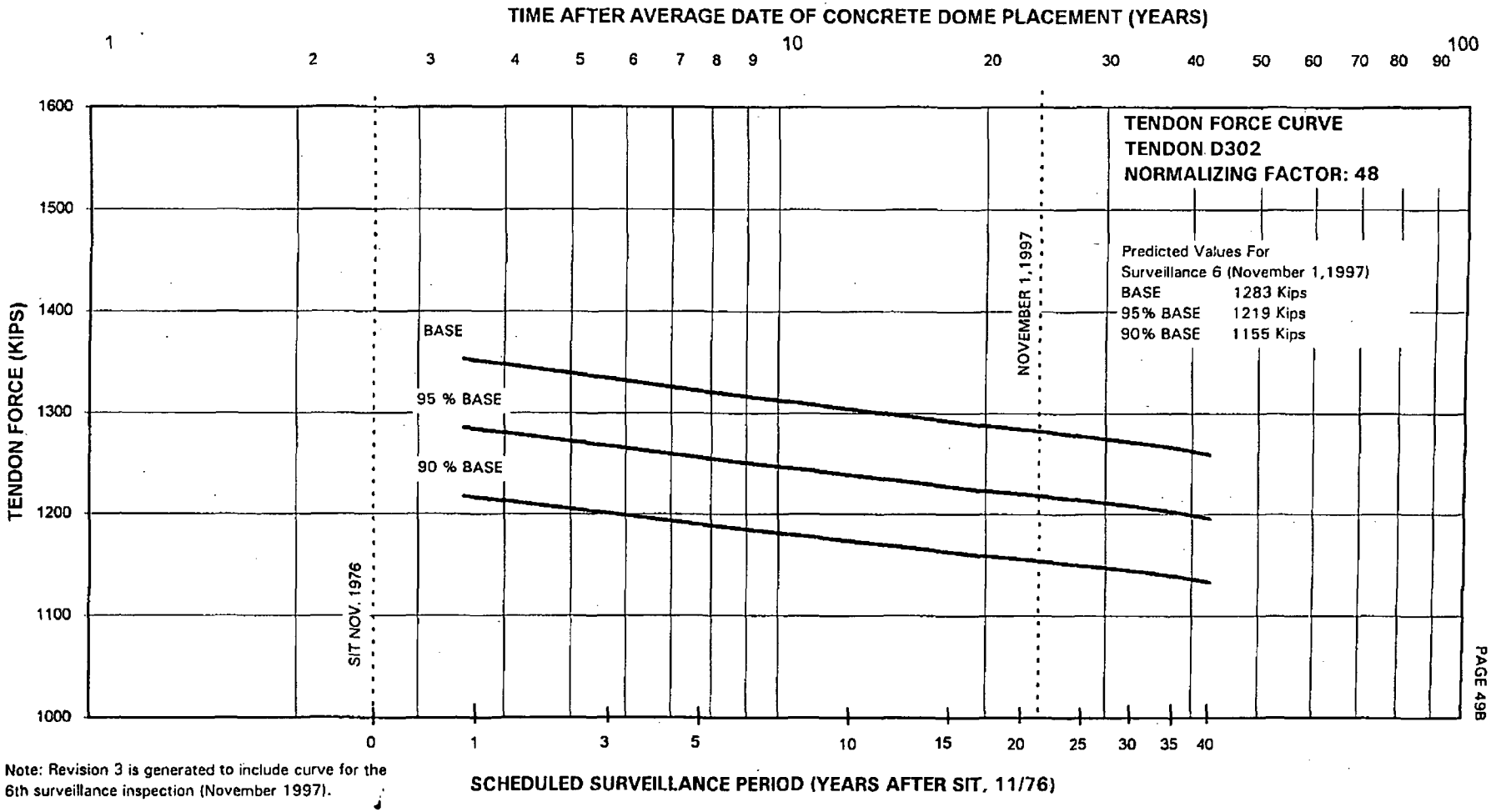
21-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D303)

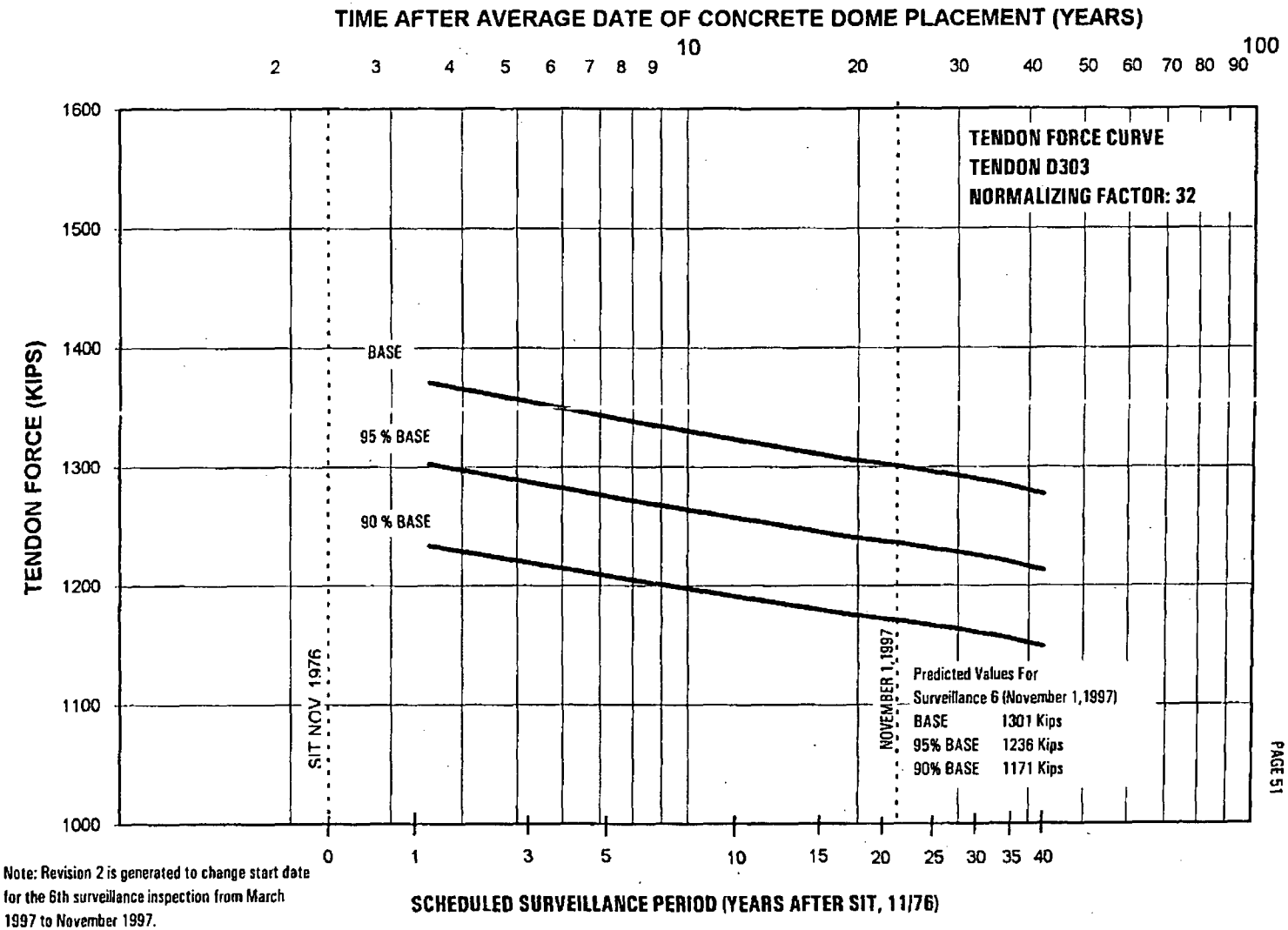
TENDON: D303 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1604 FIELD: 1681 AVERAGE: 1643 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 8 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	133.2	2.57%	42.3	3.28	92.5	15	4.0	272.0	16.56%	1371	1302	1234	32
3	5.5	133.2	2.60%	42.7	3.86	108.8	18	5.0	289.7	17.64%	1353	1285	1218	32
5	7.5	133.2	2.68%	44.1	4.21	118.7	21	6.0	302.0	18.38%	1341	1274	1207	32
10	12.5	133.2	2.76%	45.4	4.62	130.3	25	7.0	315.9	19.23%	1327	1260	1194	32
15	17.5	133.2	2.81%	46.2	5.21	146.9	27.5	8.0	334.3	20.35%	1308	1243	1178	32
17	19.5	133.2									1306	1241	1175	32
20	22.5	133.2	2.87%	47.2	5.39	152.0	29	8.0	340.4	20.72%	1302	1237	1172	32
21:3	23.75	133.2									1301	1236	1171	32
25	27.5	133.2	2.89%	47.3	5.59	157.6	30.8	9.0	347.1	21.13%	1296	1231	1166	32
30	32.5	133.2	2.91%	47.8	5.78	163.0	32	9.0	353.0	21.49%	1290	1225	1161	32
35	37.5	133.2	2.93%	48.2	5.98	168.6	33	9.0	359.0	21.85%	1284	1220	1155	32
40	42.5	133.2	2.95%	48.5	6.18	174.3	34	10.0	366.0	22.28%	1277	1213	1149	32
21	23.5										1301	1236	1171	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D304)

R2

TENDON: D304 INITIAL CONCRETE STRESS (PSI): NA

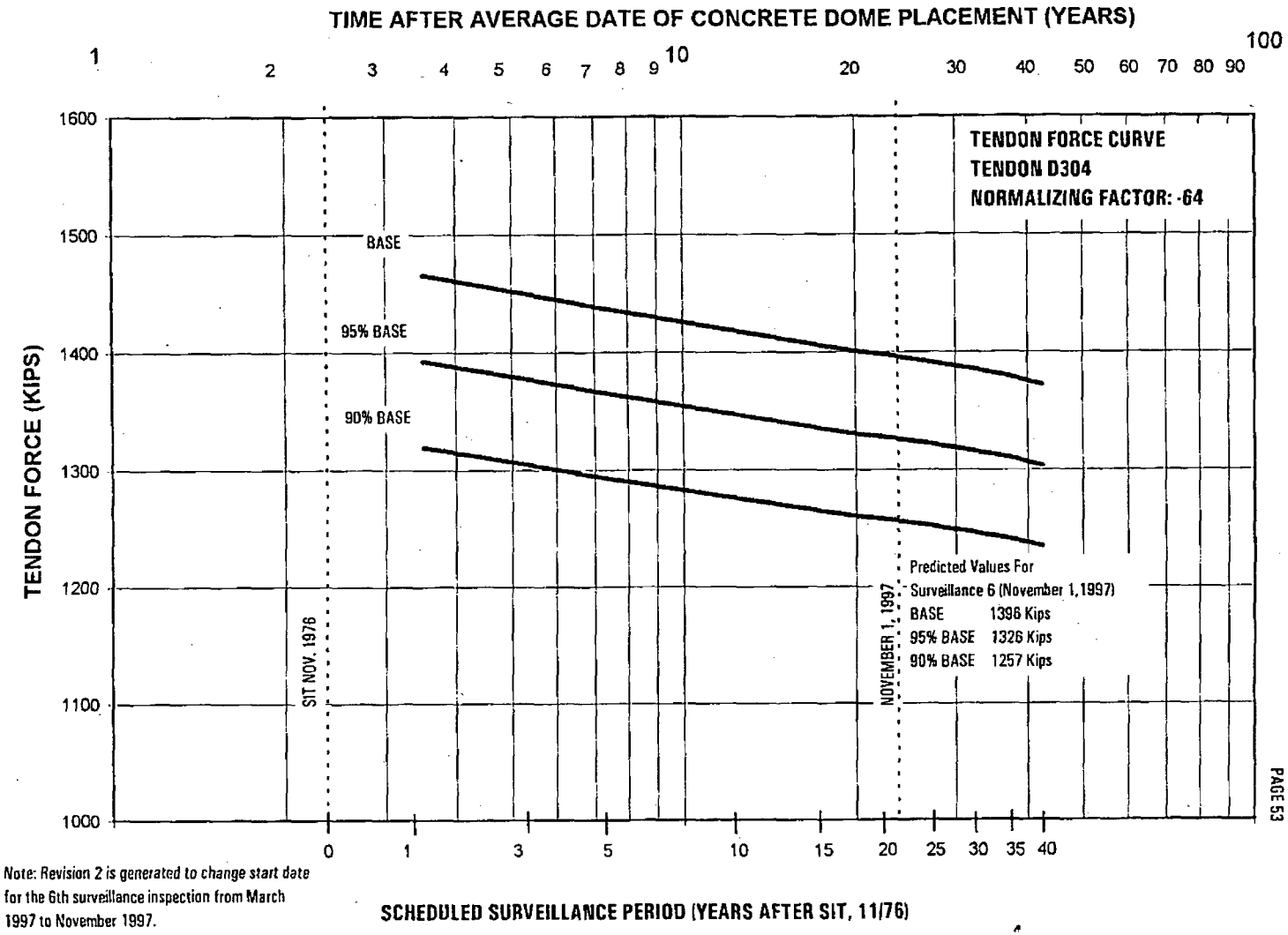
ORIGINAL FORCES (KIPS): SHOP: 1629 FIELD: 1591 AVERAGE: 1610 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 30 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	5.3	2.57%	42.3	3.28	92.5	15	4.0	144.1	8.95%	1466	1393	1319	-64
3	5.5	5.3	2.60%	42.7	3.86	108.8	18	5.0	161.8	10.05%	1448	1376	1303	-64
5	7.5	5.3	2.68%	44.1	4.21	118.7	21	6.0	174.1	10.81%	1436	1364	1292	-64
10	12.5	5.3	2.76%	45.4	4.62	130.3	25	7.0	188.0	11.67%	1422	1351	1280	-64
15	17.5	5.3	2.81%	46.2	5.21	146.9	27.5	8.0	206.4	12.82%	1404	1333	1263	-64
17	19.5	5.3									1401	1331	1261	-64
20	22.5	5.3	2.87%	47.2	5.39	152.0	29	8.0	212.5	13.20%	1398	1328	1258	-64
21:3	23.75	5.3									1396	1326	1256	-64
25	27.5	5.3	2.89%	47.3	5.59	157.6	30.8	9.0	219.2	13.61%	1391	1321	1252	-64
30	32.5	5.3	2.91%	47.8	5.78	163.0	32	9.0	225.1	13.98%	1385	1316	1246	-64
35	37.5	5.3	2.93%	48.2	5.98	168.6	33	9.0	231.1	14.35%	1379	1310	1241	-64
40	42.5	5.3	2.95%	48.5	6.18	174.3	34	10.0	238.1	14.79%	1372	1303	1235	-64
21	23.5										1396	1326	1257	

R2

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D305)

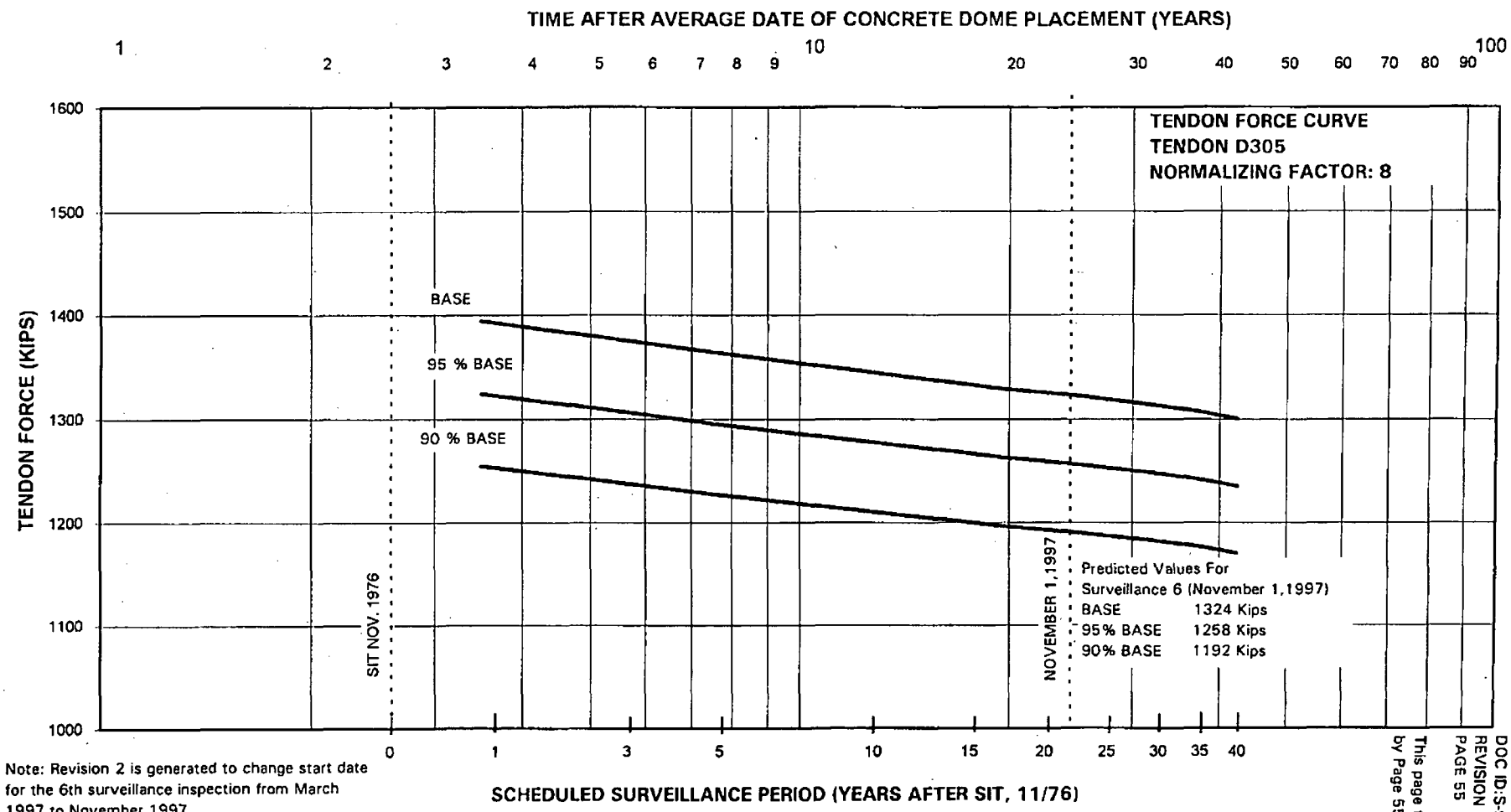
TENDON: D305 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1657 FIELD: 1602 AVERAGE: 1629 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 20 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	96.4	2.57%	42.3	3.28	92.5	15	4.0	235.2	14.44%	1394	1324	1255	8
3	5.5	96.4	2.60%	42.7	3.86	108.8	18	5.0	252.9	15.53%	1376	1307	1239	8
5	7.5	96.4	2.68%	44.1	4.21	118.7	21	6.0	265.2	16.28%	1364	1296	1228	8
10	12.5	96.4	2.76%	45.4	4.62	130.3	25	7.0	279.1	17.13%	1350	1283	1215	8
15	17.5	96.4	2.81%	46.2	5.21	146.9	27.5	8.0	297.5	18.26%	1332	1265	1198	8
17	19.5	96.4									1329	1263	1196	8
20	22.5	96.4	2.87%	47.2	5.39	152.0	29	8.0	303.6	18.64%	1326	1259	1193	8
21:3	23.75	96.4									1324	1258	1191	8
25	27.5	96.4	2.89%	47.3	5.59	157.6	30.8	9.0	310.3	19.05%	1319	1253	1187	8
30	32.5	96.4	2.91%	47.8	5.78	163.0	32	9.0	316.2	19.41%	1313	1247	1182	8
35	37.5	96.4	2.93%	48.2	5.98	168.6	33	9.0	322.2	19.78%	1307	1242	1176	8
40	42.5	96.4	2.95%	48.5	6.18	174.3	34	10.0	329.2	20.21%	1300	1235	1170	8
21	23.5										1324	1258	1192	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

This page followed by Page 55A.

R3

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER3.XLW (D306)

TENDON: D306 INITIAL CONCRETE STRESS (PSI) : NA

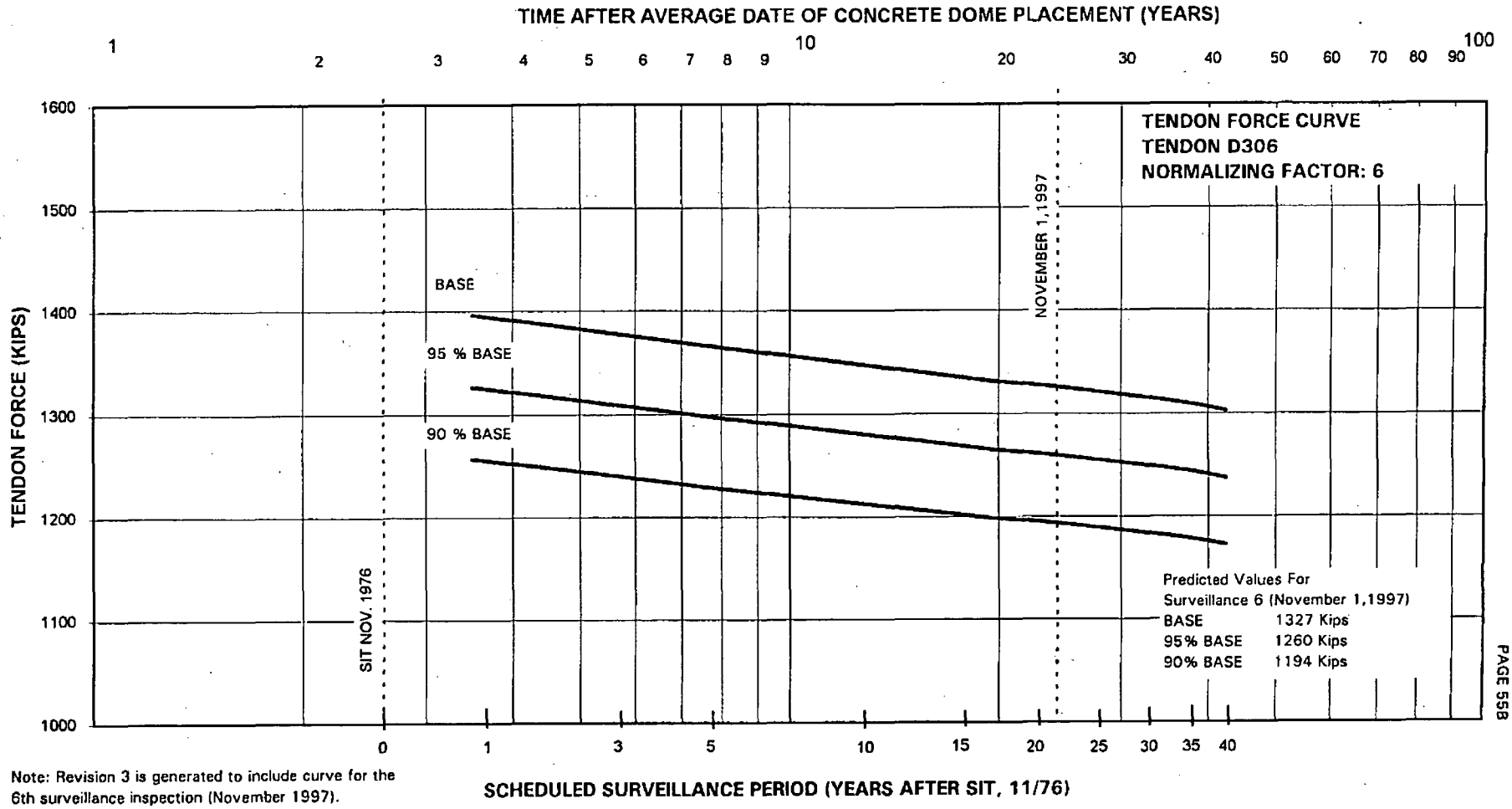
ORIGINAL FORCES (KIPS): SHOP: 1605 FIELD: 1640 AVERAGE: 1622 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 23 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	87.3	2.57%	42.3	3.28	92.5	15	4.0	226.1	13.93%	1396	1327	1257	6
3	5.5	87.3	2.60%	42.7	3.86	108.8	18	5.0	243.8	15.02%	1379	1310	1241	6
5	7.5	87.3	2.68%	44.1	4.21	118.7	21	6.0	256.1	15.78%	1366	1298	1230	6
10	12.5	87.3	2.76%	45.4	4.62	130.3	25	7.0	270.0	16.64%	1352	1285	1217	6
15	17.5	87.3	2.81%	46.2	5.21	146.9	27.5	8.0	288.4	17.77%	1334	1267	1201	6
17	19.5	87.3									1332	1265	1198	6
20	22.5	87.3	2.87%	47.2	5.39	152.0	29	8.0	294.5	18.15%	1328	1262	1195	6
21:3	23.75	87.3									1326	1260	1194	6
25	27.5	87.3	2.89%	47.3	5.59	157.6	30.8	9.0	301.2	18.56%	1321	1255	1189	6
30	32.5	87.3	2.91%	47.8	5.78	163.0	32	9.0	307.1	18.93%	1315	1250	1184	6
35	37.5	87.3	2.93%	48.2	5.98	168.6	33	9.0	313.1	19.30%	1309	1244	1178	6
40	42.5	87.3	2.95%	48.5	6.18	174.3	34	10.0	320.1	19.73%	1302	1237	1172	6
21	23.5										1327	1260	1194	

22-Jan-98

This page followed by Page 55B



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES· 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D310)

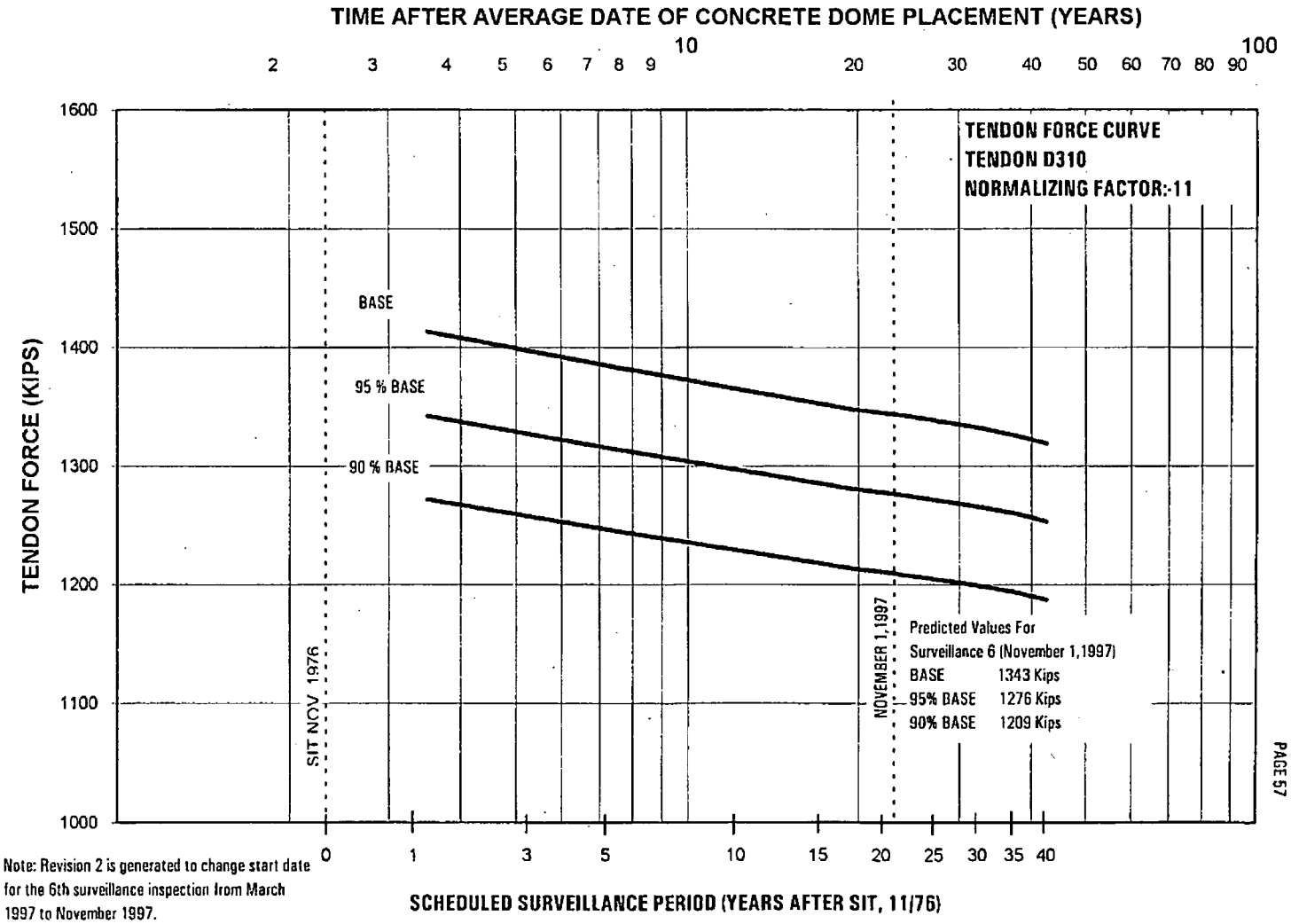
TENDON: D310 INITIAL CONCRETE STRESS (PSI) : NA

ORIGINAL FORCES (KIPS): SHOP: 1636 FIELD: 1636 AVERAGE: 1636 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 24 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	84.2	2.57%	42.3	3.28	92.5	15	4.0	223.0	13.63%	1413	1342	1272	-11
3	5.5	84.2	2.60%	42.7	3.86	108.8	18	5.0	240.7	14.71%	1395	1326	1256	-11
5	7.5	84.2	2.68%	44.1	4.21	118.7	21	6.0	253.0	15.46%	1383	1314	1245	-11
10	12.5	84.2	2.76%	45.4	4.62	130.3	25	7.0	266.9	16.31%	1369	1301	1232	-11
15	17.5	84.2	2.81%	46.2	5.21	146.9	27.5	8.0	285.3	17.44%	1351	1283	1216	-11
17	19.5	84.2									1348	1281	1214	-11
20	22.5	84.2	2.87%	47.2	5.39	152.0	29	8.0	291.4	17.81%	1345	1277	1210	-11
21:3	23.75	84.2									1343	1276	1209	-11
25	27.5	84.2	2.89%	47.3	5.59	157.6	30.8	9.0	298.1	18.22%	1338	1271	1204	-11
30	32.5	84.2	2.91%	47.8	5.78	163.0	32	9.0	304.0	18.58%	1332	1266	1199	-11
35	37.5	84.2	2.93%	48.2	5.98	168.6	33	9.0	310.0	18.95%	1326	1260	1193	-11
40	42.5	84.2	2.95%	48.5	6.18	174.3	34	10.0	317.0	19.37%	1319	1253	1187	-11
21	23.5										1343	1276	1209	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER UNIT 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMELOW GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES LESS THAN 27
FILE: DOMER2.XLW (D311)

R2

TENDON: D311 INITIAL CONCRETE STRESS (PSI) : NA

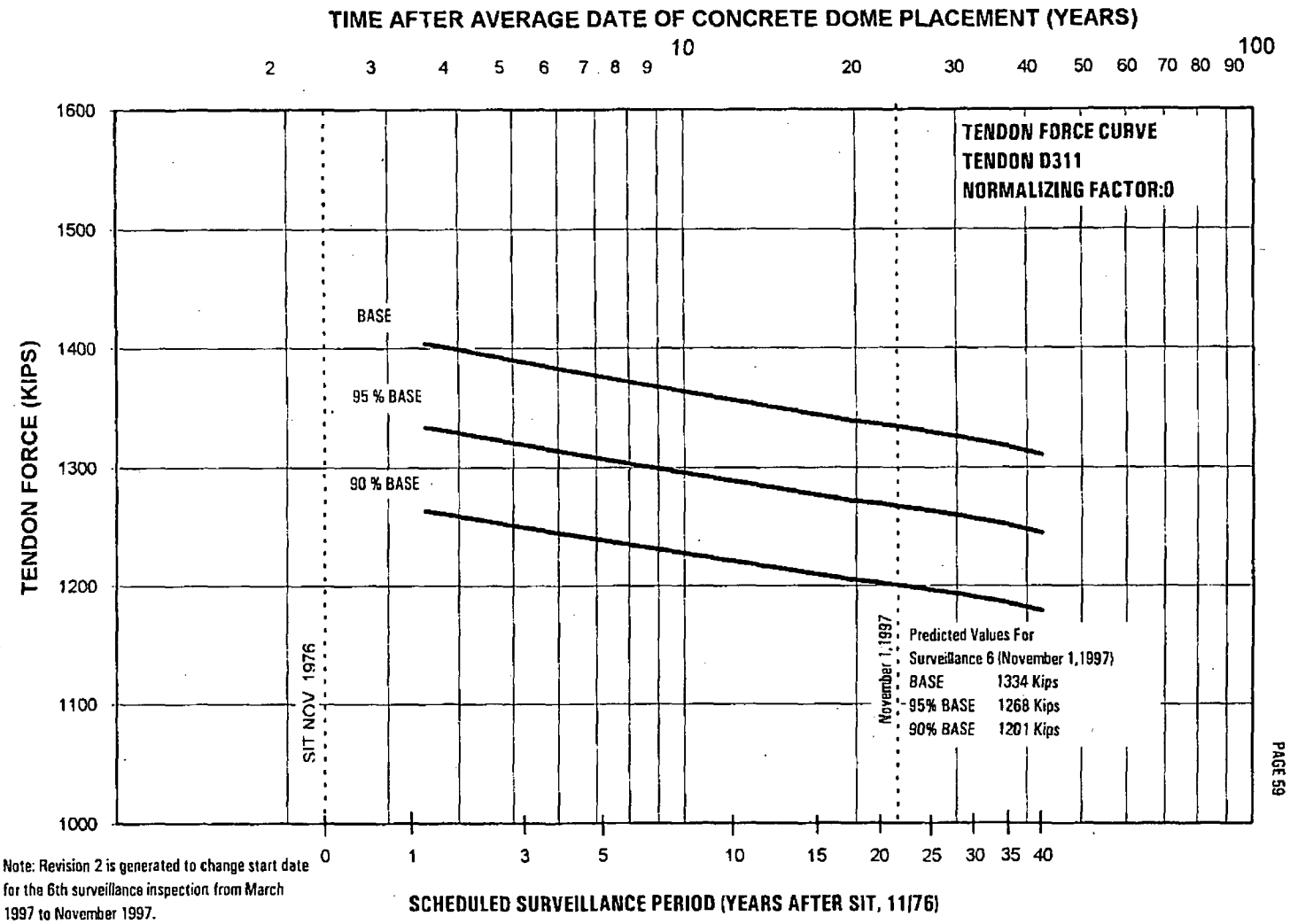
ORIGINAL FORCES (KIPS): SHOP: 1687 FIELD: 1677 AVERAGE: 1682 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 6 OF 27 TOTAL ELASTIC SHORT. LOSS: 82.7 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	CR. STR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	139.3	2.57%	42.3	3.28	92.5	15	4.0	278.1	16.53%	1404	1334	1264	0
3	5.5	139.3	2.60%	42.7	3.86	108.8	18	5.0	295.8	17.59%	1386	1317	1248	0
5	7.5	139.3	2.68%	44.1	4.21	118.7	21	6.0	308.1	18.32%	1374	1305	1237	0
10	12.5	139.3	2.76%	45.4	4.62	130.3	25	7.0	322.0	19.14%	1360	1292	1224	0
15	17.5	139.3	2.81%	46.2	5.21	146.9	27.5	8.0	340.4	20.24%	1342	1275	1208	0
17	19.5	139.3									1339	1272	1205	0
20	22.5	139.3	2.87%	47.2	5.39	152.0	29	8.0	346.5	20.60%	1336	1269	1202	0
21:3	23.75	139.3									1334	1267	1201	0
25	27.5	139.3	2.89%	47.3	5.59	157.6	30.8	9.0	353.2	21.00%	1329	1263	1196	0
30	32.5	139.3	2.91%	47.8	5.78	163.0	32	9.0	359.1	21.35%	1323	1257	1191	0
35	37.5	139.3	2.93%	48.2	5.98	168.6	33	9.0	365.1	21.71%	1317	1251	1185	0
40	42.5	139.3	2.95%	48.5	6.18	174.3	34	10.0	372.1	22.12%	1310	1245	1179	0
21	23.5										1334	1268	1201	

R2

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES- 6th TENDON SURVEILLANCE
DOME TENDON LOSSES WORK SHEET (DOMEHI GROUP)
USE FOR DOME TENDONS WITH STRESSING SEQUENCES GREATER THAN 27
FILE: DOMER2.XLW (D312)

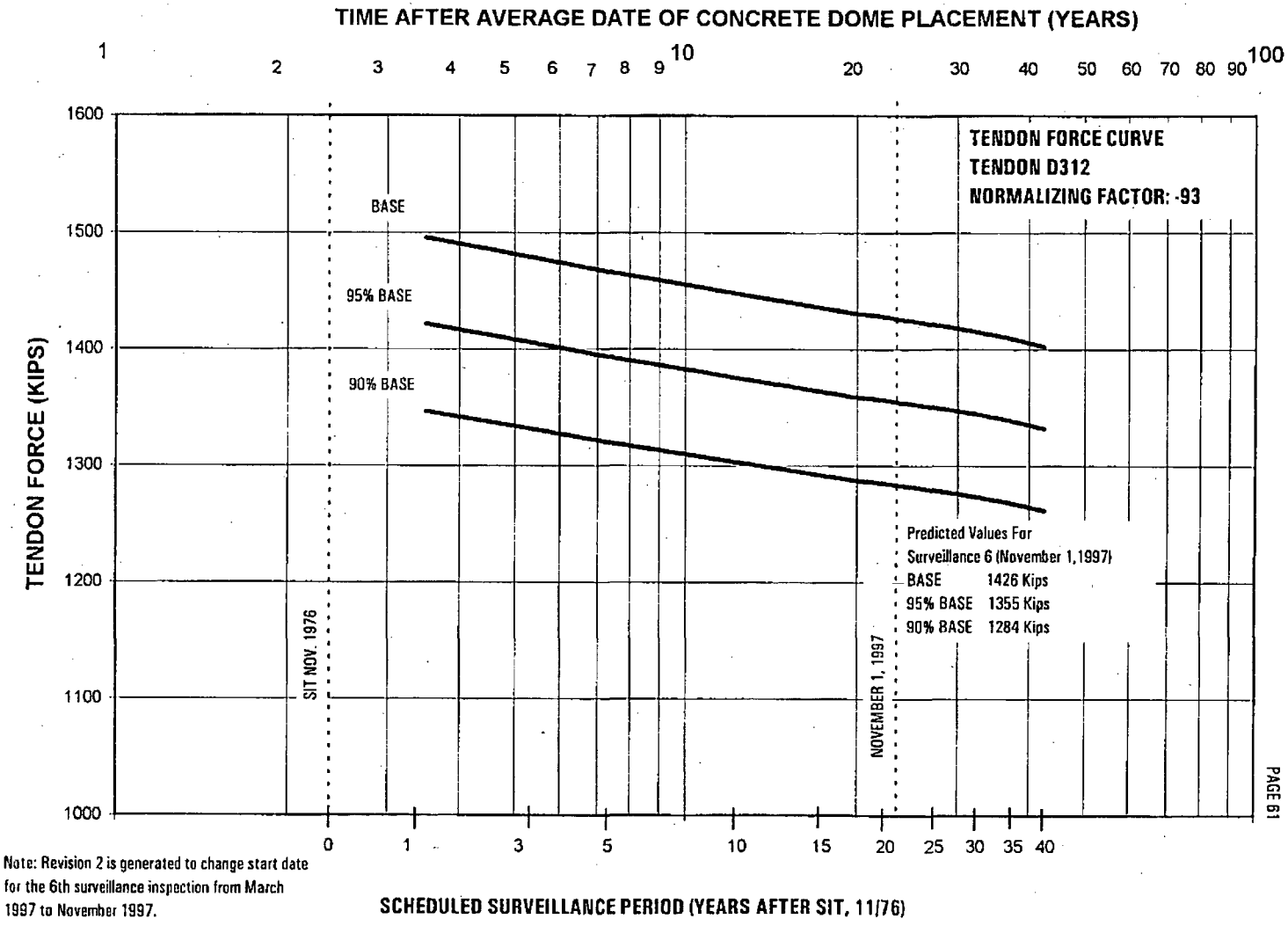
TENDON: D312 INITIAL CONCRETE STRESS (PSI): NA

ORIGINAL FORCES (KIPS): SHOP: 1665 FIELD: 1615 AVERAGE: 1640 AVERAGE ALL DOME TENDONS: 1639
STRESS SEQUENCE: 30 OF 5 TOTAL ELASTIC SHORT. LOSS: 47.4 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM DOMEINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	CR. STR. (* .0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	3.5	5.3	2.57%	42.3	3.28	92.5	15	4.0	144.1	8.78%	1496	1421	1346	-93
3	5.5	5.3	2.60%	42.7	3.86	108.8	18	5.0	161.8	9.86%	1478	1404	1330	-93
5	7.5	5.3	2.68%	44.1	4.21	118.7	21	6.0	174.1	10.61%	1466	1393	1319	-93
10	12.5	5.3	2.76%	45.4	4.62	130.3	25	7.0	188.0	11.46%	1452	1379	1307	-93
15	17.5	5.3	2.81%	46.2	5.21	146.9	27.5	8.0	206.4	12.58%	1434	1362	1290	-93
17	19.5	5.3									1431	1360	1288	-93
20	22.5	5.3	2.87%	47.2	5.39	152.0	29	8.0	212.5	12.95%	1428	1356	1285	-93
21:3	23.75	5.3									1426	1355	1283	-93
25	27.5	5.3	2.89%	47.3	5.59	157.6	30.8	9.0	219.2	13.36%	1421	1350	1279	-93
30	32.5	5.3	2.91%	47.8	5.78	163.0	32	9.0	225.1	13.72%	1415	1344	1273	-93
35	37.5	5.3	2.93%	48.2	5.98	168.6	33	9.0	231.1	14.09%	1409	1339	1268	-93
40	42.5	5.3	2.95%	48.5	6.18	174.3	34	10.0	238.1	14.52%	1402	1332	1262	-93
21	23.5										1426	1355	1284	

08-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO	REVISION
Calculation S-95-0082	0

6.4 Hoop Tendons

HOOP TENDONS

Tendons Listing & Input Data Sheet

Individual Tendons Losses Worksheets

Individual Tendons Force Curves

CRYSTAL RIVER UNIT 3 - 6th TENDON SURVEILLANCE
HOOP TENDONS DATA INPUT

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			Ref.
Initial Concrete Stress =	1732.0	(ksi)	(2) Page 7A, 7B, 7C
Average Force =	1635.0	(kips)	(2) Page 15
Total Stress Sequence (N) =	60		
Total Elastic Shortening Losses =	134		See (2) & Attachment E

Tendon No.	Lift-off Pressure (ksi) (1)				Stress Sequence (n) (2)	No. of Effective Wires (1)	Wire Factor #/163 (4)	Original Forces (kips)		Remarks (3)
	Shop End		Field End					Shop End (5)	Field End (5)	
	Predicted	Actual	Predicted	Actual						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
42H17	6870	7060	6810	6800	27	163	1.000	1684	1637	
42H18	6840	7100	6799	6750	43	163	1.000	1701	1627	S
42H19	6870	6900	6810	6850	27	163	1.000	1646	1649	
42H29	6870	6850	6810	6850	31	163	1.000	1634	1649	
42H30	6870	6950	6790	6750	41	163	1.000	1658	1629	
42H31	6870	7000	6810	6800	32	163	1.000	1670	1637	
42H32	6870	6750	6790	6800	41	163	1.000	1610	1641	S
42H33	6870	7000	6810	6900	33	163	1.000	1670	1661	
42H34	6750	6800	6660	6750	41	160	0.982	1621	1631	
42H35	6830	7000	6770	6750	33	162	0.994	1669	1624	
42H36	6870	7150	6790	6850	40	163	1.000	1706	1653	
42H37	6870	6800	6810	6900	34	163	1.000	1622	1661	
42H43	6870	6750	6810	6700	36	163	1.000	1610	1612	
42H44	6790	6600	6840	6750	39	163	1.000	1593	1617	E
42H45	6870	7000	6810	6900	37	163	1.000	1670	1661	
46H20	6640	6930	6600	6600	44	160	0.982	1679	1609	
46H21	6720	6700	6730	6950	28	162	0.994	1624	1682	C on line
46H22	6720	6750	6730	7000	43	162	0.994	1636	1694	
51H25	6770	6650	6800	7000	12	162	0.994	1600	1677	
51H26	6760	7000	6760	6700	53	163	1.000	1697	1624	R,C,E,S
51H27	6740	6700	6670	6650	9	161	0.988	1609	1614	
51H28	6760	6950	6750	6800	52	163	1.000	1685	1651	
51H29	6810	6775	6750	6700	9	163	1.000	1631	1627	
53H1	6700	6850	6760	6700	20	161	0.988	1655	1604	
53H2	6800	6900	7770	6950	60	162	0.994	1653	1457	A
53H3	6670	6660	6710	6660	20	161	0.988	1616	1607	
53H45	6840	6700	6800	6900	3	163	1.000	1605	1663	
53H46	6760	6650	6730	6750	49	163	1.000	1612	1644	E
53H47	6840	7000	6800	7050	3	163	1.000	1677	1699	
62H21	6760	6800	6700	6750	27	162	0.994	1639	1641	
62H22	6800	6900	6750	6850	42	163	1.000	1663	1663	S
62H23	6800	6800	6750	6750	28	163	1.000	1639	1639	

CRYSTAL RIVER UNIT 3 - 6th TENDON SURVEILLANCE
HOOP TENDONS DATA INPUT

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			Ref.
Initial Concrete Stress =	1732.0	(ksi)	(2) Page 7A, 7B, 7C
Average Force =	1635.0	(kips)	(2) Page 15
Total Stress Sequence (N) =	60		
Total Elastic Shortening Losses =	134		See (2) & Attachment E

Tendon No.	Lift-off Pressure (ksi) (1)				Stress Sequence (n) (2)	No. of Effective Wires (1)	Wire Factor #/163 (4)	Original Forces (kips)		Remarks (3)
	Shop End		Field End					Shop End (5)	Field End (5)	
	Predicted	Actual	Predicted	Actual						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
62H39	6800	6900	6750	6800	35	162	0.994	1653	1641	
62H40	6800	6800	6750	6750	39	163	1.000	1639	1639	
62H41	6800	6700	6750	6600	35	163	1.000	1615	1603	D,S
62H42	6800	6700	6750	6600	39	163	1.000	1615	1603	
62H43	6710	6550	6670	6600	36	161	0.988	1580	1602	
62H44	6800	6750	6750	6900	38	163	1.000	1627	1675	
62H45	6760	6800	6700	6600	37	162	0.994	1639	1605	
62H46	6800	6600	6750	7000	38	163	1.000	1591	1700	E
62H47	6680	6600	6640	6500	38	160	0.982	1590	1575	

File: HOOPR3.XLW (HOOPINP)

Note:

(1) Ref. Crystal River 3 R/B Tendon History Sheets - Hoop Tendons for Original Stressing

(2) Ref. Crystal River 3 Tendon Surveillance Loss Calculations, Tendon Stress Sequence, Pages 29, 29a and 29b.

(3) S = Selected tensons, C = Control tendon, D = Detensioned tendon, A = Alternate tendon
E = Exempted Tendons (5th Surveillance), All Other Tendons are Adjacents

(4) Wire factors are calculated based on the number of effective wires divided by 163.

(5) Original forces calculated based on the expression in Section 6.2.2

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R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H17)

TENDON: 42H17 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1684 FIELD: 1637 AVERAGE: 1660 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 27 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	73.7	2.57%	42.0	0.090	39.5	6.0	1.7	156.9	9.45%	1504	1428	1353	-17
3	7.4	73.7	2.60%	42.5	0.110	48.5	8.5	2.4	167.1	10.06%	1493	1419	1344	-17
5	9.4	73.7	2.68%	43.8	0.123	54.1	10.0	2.8	174.4	10.50%	1486	1412	1337	-17
10	14.4	73.7	2.76%	45.1	0.150	66.0	13.5	3.8	188.6	11.36%	1472	1398	1325	-17
15	19.4	73.7	2.81%	45.9	0.167	73.6	15.5	4.4	197.6	11.90%	1463	1390	1317	-17
17	21.4	73.7									1460	1387	1314	
20	24.4	73.7	2.87%	46.9	0.181	79.0	17.5	4.9	204.5	12.32%	1456	1383	1310	-17
21:3	25.65	73.7									1455	1382	1309	
25	29.4	73.7	2.88%	47.1	0.190	83.2	19.5	5.5	209.5	12.62%	1451	1378	1306	-17
30	34.4	73.7	2.91%	47.6	0.200	88.0	20.4	5.8	215.1	12.95%	1445	1373	1301	-17
35	39.4	73.7	2.93%	47.9	0.209	91.9	21.5	6.1	219.6	13.22%	1441	1369	1297	-17
40	44.4	73.7	2.95%	48.2	0.215	94.7	22.5	6.4	223.0	13.43%	1437	1366	1294	-17
21	25.4										1455	1382	1309	

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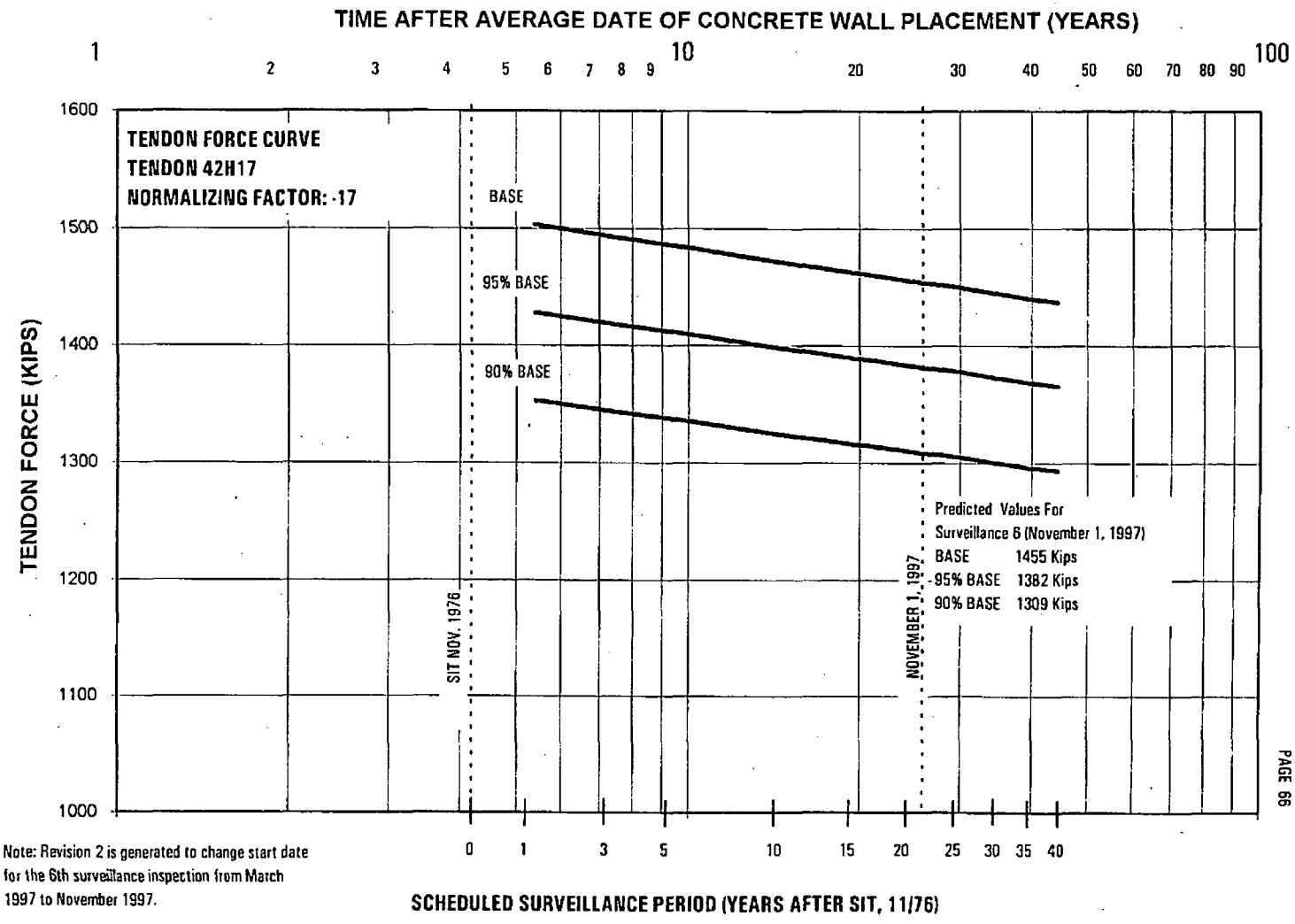

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H18)

TENDON: 42H18 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1701 FIELD: 1627 AVERAGE: 1664 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 43 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	38.0	2.57%	42.0	0.090	39.5	6.0	1.7	121.2	7.28%	1543	1466	1389	-56
3	7.4	38.0	2.60%	42.5	0.110	48.5	8.5	2.4	131.4	7.89%	1533	1456	1380	-56
5	9.4	38.0	2.68%	43.8	0.123	54.1	10.0	2.8	138.7	8.33%	1526	1449	1373	-56
10	14.4	38.0	2.76%	45.1	0.150	66.0	13.5	3.8	152.9	9.19%	1511	1436	1360	-56
15	19.4	38.0	2.81%	45.9	0.167	73.6	15.5	4.4	161.8	9.72%	1502	1427	1352	-56
17	21.4	38.0									1500	1425	1350	
20	24.4	38.0	2.87%	46.9	0.181	79.0	17.5	4.9	168.8	10.14%	1495	1421	1346	-56
21:3	25.65	38.0									1494	1419	1345	
25	29.4	38.0	2.88%	47.1	0.190	83.2	19.5	5.5	173.8	10.44%	1490	1416	1341	-56
30	34.4	38.0	2.91%	47.6	0.200	88.0	20.4	5.8	179.3	10.78%	1485	1411	1336	-56
35	39.4	38.0	2.93%	47.9	0.209	91.9	21.5	6.1	183.8	11.05%	1480	1406	1332	-56
40	44.4	38.0	2.95%	48.2	0.215	94.7	22.5	6.4	187.2	11.25%	1477	1403	1329	-56
21	25.4										1494	1420	1345	

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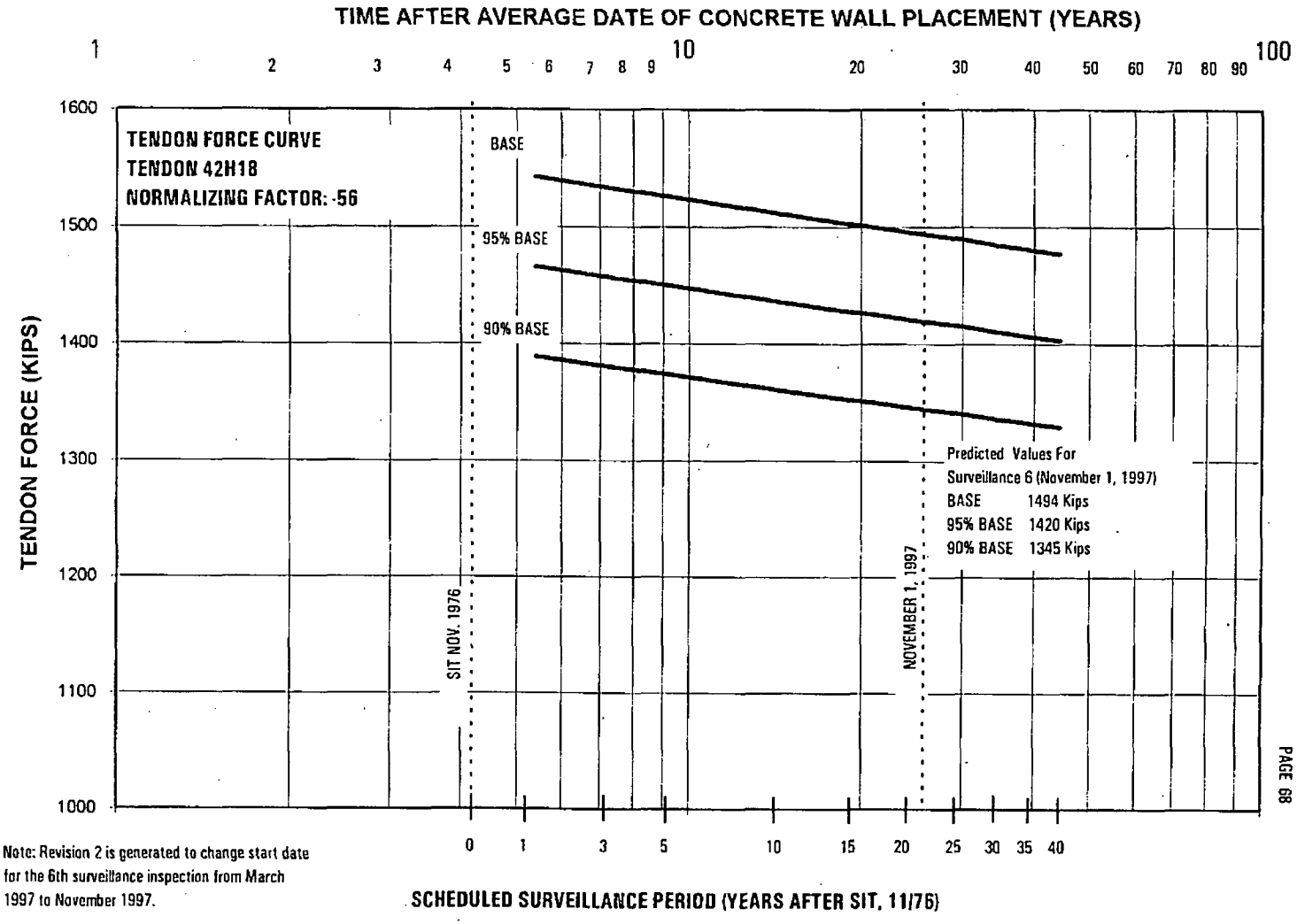

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H19)

R2

TENDON: 42H19 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1646 FIELD: 1649 AVERAGE: 1647 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 27 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	73.7	2.57%	42.0	0.090	39.5	6.0	1.7	156.9	9.52%	1490	1416	1341	-4
3	7.4	73.7	2.60%	42.5	0.110	48.5	8.5	2.4	167.1	10.14%	1480	1406	1332	-4
5	9.4	73.7	2.68%	43.8	0.123	54.1	10.0	2.8	174.4	10.59%	1473	1399	1326	-4
10	14.4	73.7	2.76%	45.1	0.150	66.0	13.5	3.8	188.6	11.45%	1459	1386	1313	-4
15	19.4	73.7	2.81%	45.9	0.167	73.6	15.5	4.4	197.6	11.99%	1450	1377	1305	-4
17	21.4	73.7									1447	1375	1302	
20	24.4	73.7	2.87%	46.9	0.181	79.0	17.5	4.9	204.5	12.42%	1443	1371	1299	-4
21:3	25.65	73.7									1442	1369	1297	
25	29.4	73.7	2.88%	47.1	0.190	83.2	19.5	5.5	209.5	12.72%	1438	1366	1294	-4
30	34.4	73.7	2.91%	47.6	0.200	88.0	20.4	5.8	215.1	13.05%	1432	1361	1289	-4
35	39.4	73.7	2.93%	47.9	0.209	91.9	21.5	6.1	219.6	13.33%	1428	1356	1285	-4
40	44.4	73.7	2.95%	48.2	0.215	94.7	22.5	6.4	223.0	13.53%	1424	1353	1282	-4
21	25.4										1442	1370	1298	

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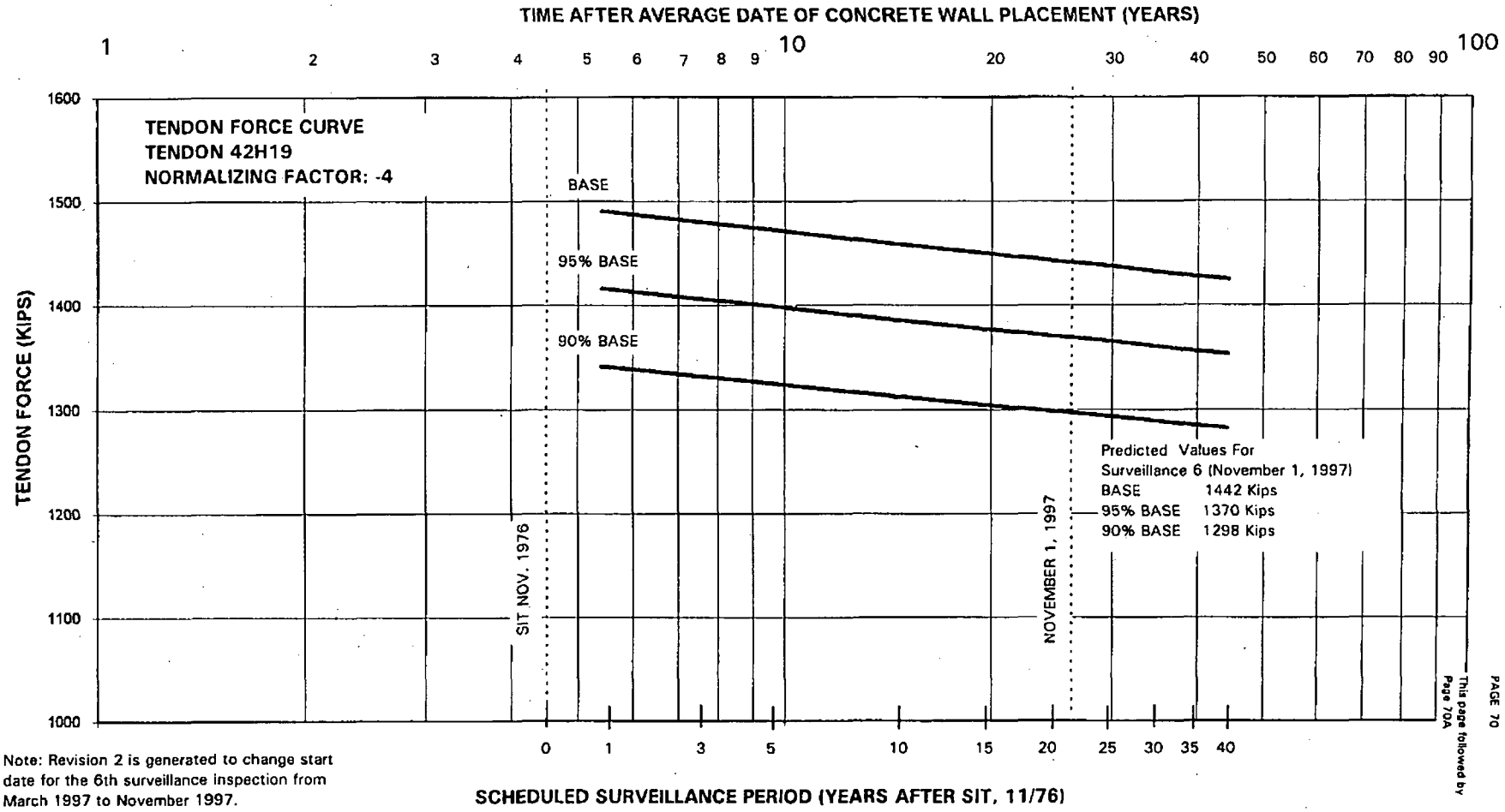

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H29)

TENDON: 42H29 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1634 FIELD: 1649 AVERAGE: 1641 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 31 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	64.8	2.57%	42.0	0.090	39.5	6.0	1.7	148.0	9.01%	1493	1419	1344	-7
3	7.4	64.8	2.60%	42.5	0.110	48.5	8.5	2.4	158.2	9.64%	1483	1409	1335	-7
5	9.4	64.8	2.68%	43.8	0.123	54.1	10.0	2.8	165.5	10.08%	1476	1402	1328	-7
10	14.4	64.8	2.76%	45.1	0.150	66.0	13.5	3.8	179.7	10.95%	1462	1389	1316	-7
15	19.4	64.8	2.81%	45.9	0.167	73.6	15.5	4.4	188.6	11.49%	1453	1380	1307	-7
17	21.4	64.8									1450	1377	1305	
20	24.4	64.8	2.87%	46.9	0.181	79.0	17.5	4.9	195.6	11.92%	1446	1373	1301	-7
21:3	25.65	64.8									1445	1372	1300	
25	29.4	64.8	2.88%	47.1	0.190	83.2	19.5	5.5	200.6	12.22%	1441	1369	1297	-7
30	34.4	64.8	2.91%	47.6	0.200	88.0	20.4	5.8	206.1	12.56%	1435	1363	1292	-7
35	39.4	64.8	2.93%	47.9	0.209	91.9	21.5	6.1	210.6	12.83%	1431	1359	1288	-7
40	44.4	64.8	2.95%	48.2	0.215	94.7	22.5	6.4	214.0	13.04%	1427	1356	1285	-7
21	25.4										1445	1373	1300	

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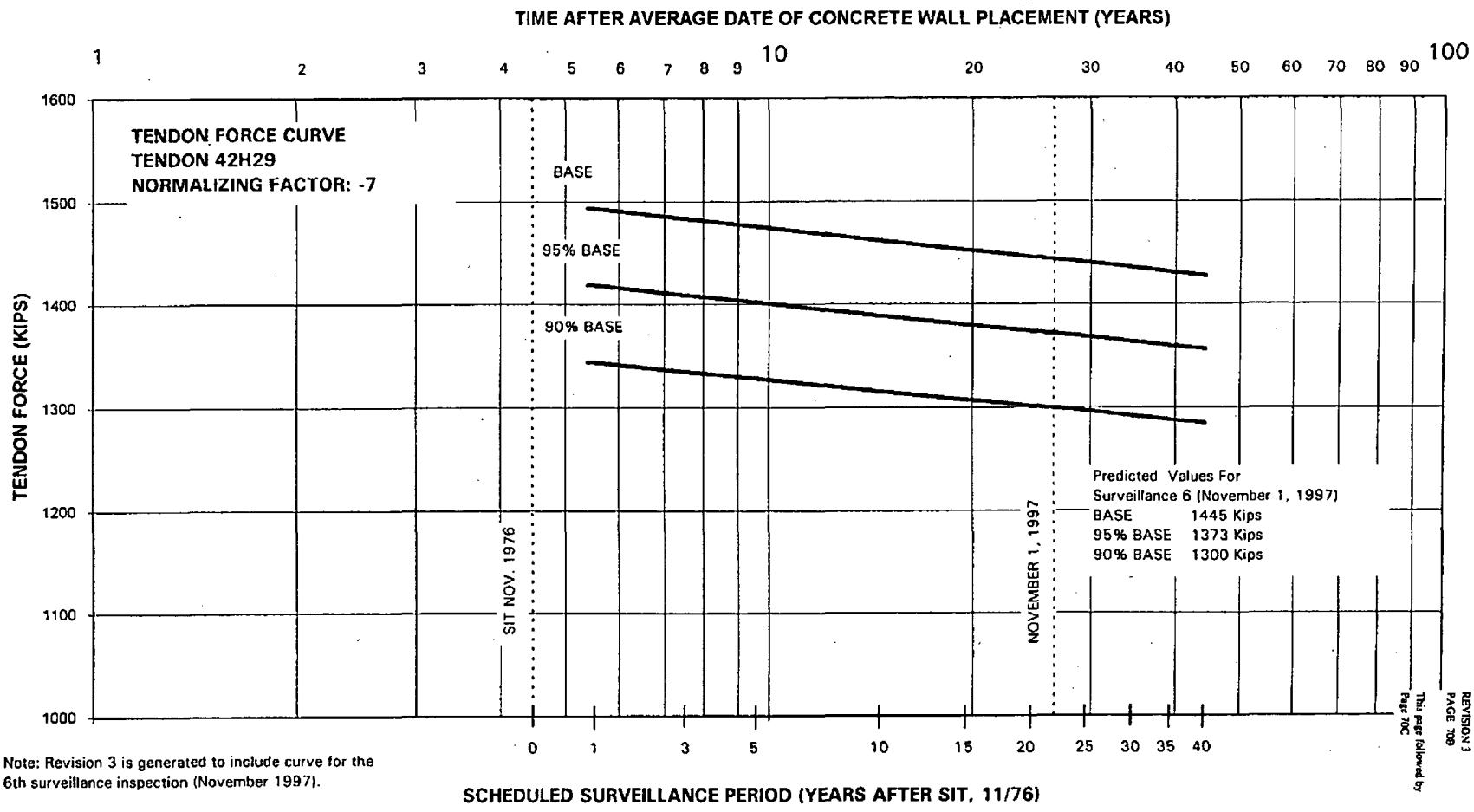

Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H30)

TENDON: 42H30 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1658 FIELD: 1629 AVERAGE: 1644 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 41 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	42.4	2.57%	42.0	0.090	39.5	6.0	1.7	125.6	7.64%	1518	1442	1366	-32
3	7.4	42.4	2.60%	42.5	0.110	48.5	8.5	2.4	135.8	8.26%	1508	1432	1357	-32
5	9.4	42.4	2.68%	43.8	0.123	54.1	10.0	2.8	143.1	8.71%	1501	1425	1350	-32
10	14.4	42.4	2.76%	45.1	0.150	66.0	13.5	3.8	157.3	9.57%	1486	1412	1338	-32
15	19.4	42.4	2.81%	45.9	0.167	73.6	15.5	4.4	166.3	10.12%	1477	1403	1330	-32
17	21.4	42.4									1475	1401	1327	
20	24.4	42.4	2.87%	46.9	0.181	79.0	17.5	4.9	173.3	10.54%	1470	1397	1323	-32
21:3	25.65	42.4									1469	1396	1322	
25	29.4	42.4	2.88%	47.1	0.190	83.2	19.5	5.5	178.2	10.84%	1465	1392	1319	-32
30	34.4	42.4	2.91%	47.6	0.200	88.0	20.4	5.8	183.8	11.18%	1460	1387	1314	-32
35	39.4	42.4	2.93%	47.9	0.209	91.9	21.5	6.1	188.3	11.46%	1455	1383	1310	-32
40	44.4	42.4	2.95%	48.2	0.215	94.7	22.5	6.4	191.7	11.66%	1452	1379	1307	-32
21	25.4										1469	1396	1322	

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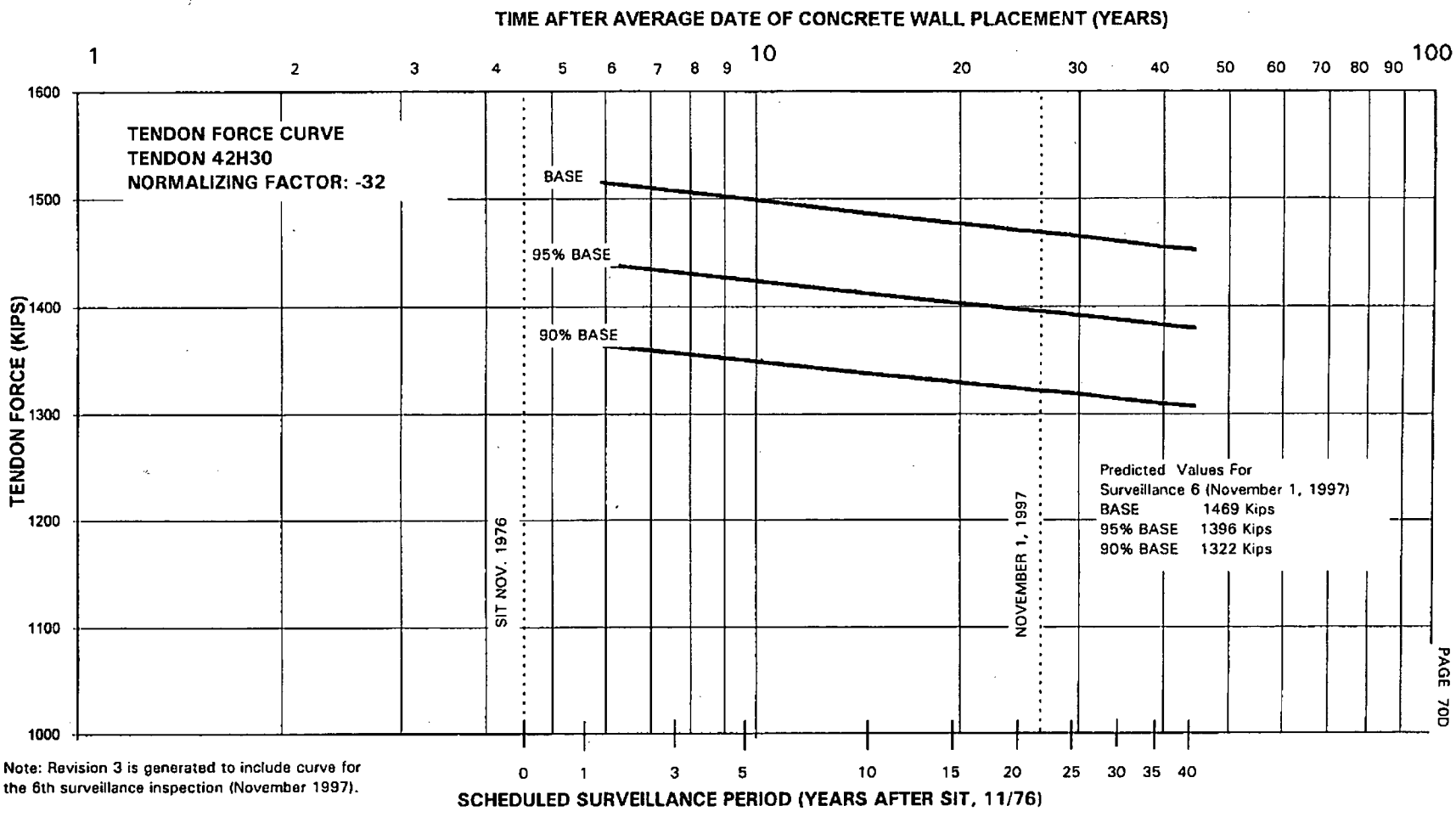
27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H31)

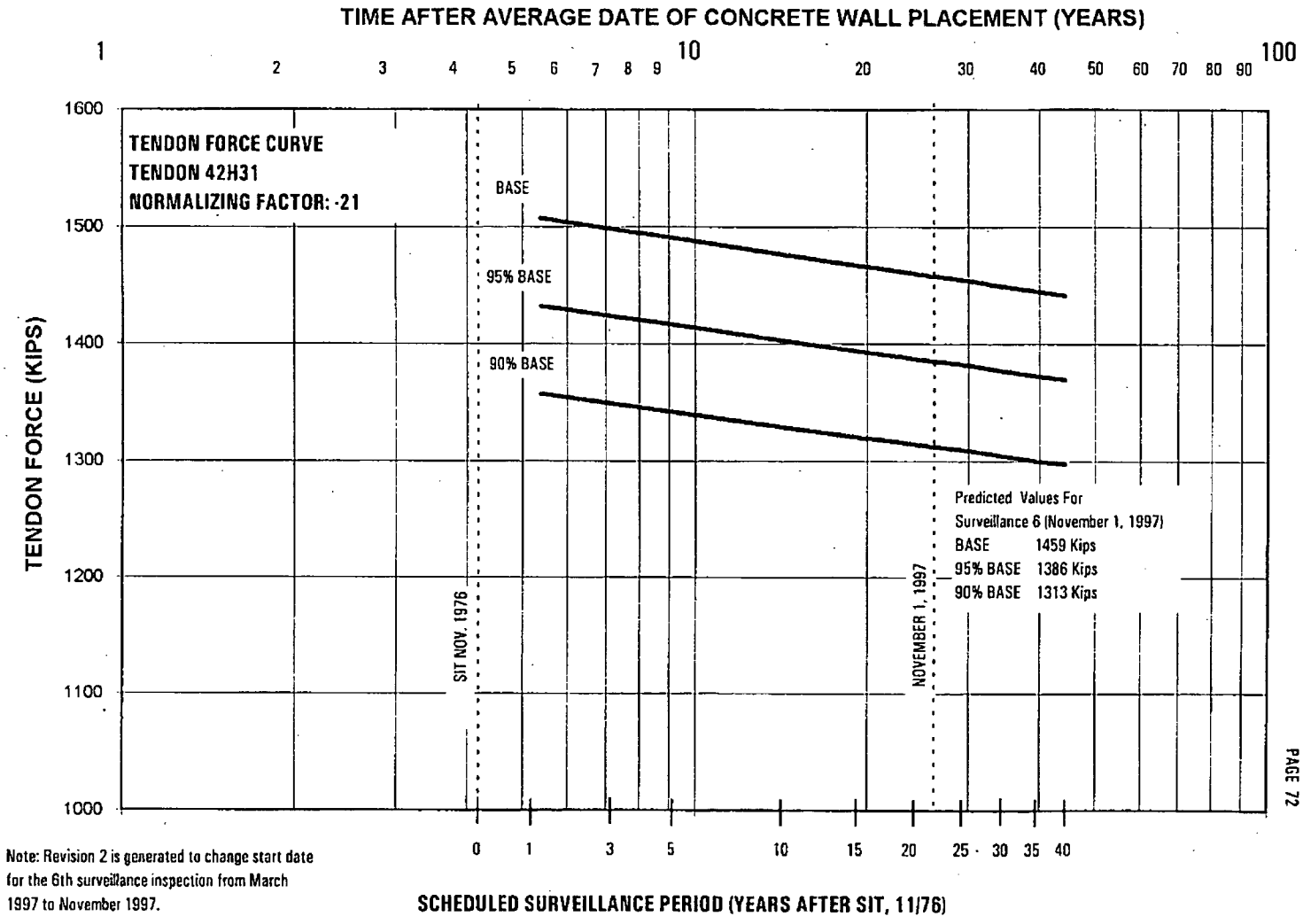
TENDON: 42H31 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1670 FIELD: 1637 AVERAGE: 1653 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 32 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	62.5	2.57%	42.0	0.090	39.5	6.0	1.7	145.7	8.81%	1508	1432	1357	-21
3	7.4	62.5	2.60%	42.5	0.110	48.5	8.5	2.4	155.9	9.43%	1497	1422	1348	-21
5	9.4	62.5	2.68%	43.8	0.123	54.1	10.0	2.8	163.2	9.87%	1490	1416	1341	-21
10	14.4	62.5	2.76%	45.1	0.150	66.0	13.5	3.8	177.4	10.73%	1476	1402	1328	-21
15	19.4	62.5	2.81%	45.9	0.167	73.6	15.5	4.4	186.4	11.28%	1467	1393	1320	-21
17	21.4	62.5									1464	1391	1318	
20	24.4	62.5	2.87%	46.9	0.181	79.0	17.5	4.9	193.4	11.70%	1460	1387	1314	-21
21:3	25.65	62.5									1459	1386	1313	
25	29.4	62.5	2.88%	47.1	0.190	83.2	19.5	5.5	198.3	12.00%	1455	1382	1309	-21
30	34.4	62.5	2.91%	47.6	0.200	88.0	20.4	5.8	203.9	12.33%	1449	1377	1304	-21
35	39.4	62.5	2.93%	47.9	0.209	91.9	21.5	6.1	208.4	12.61%	1445	1373	1300	-21
40	44.4	62.5	2.95%	48.2	0.215	94.7	22.5	6.4	211.8	12.81%	1441	1369	1297	-21
21	25.4										1459	1386	1313	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H32)

R2

TENDON: 42H32 INITIAL CONCRETE STRESS (PSI): 1732

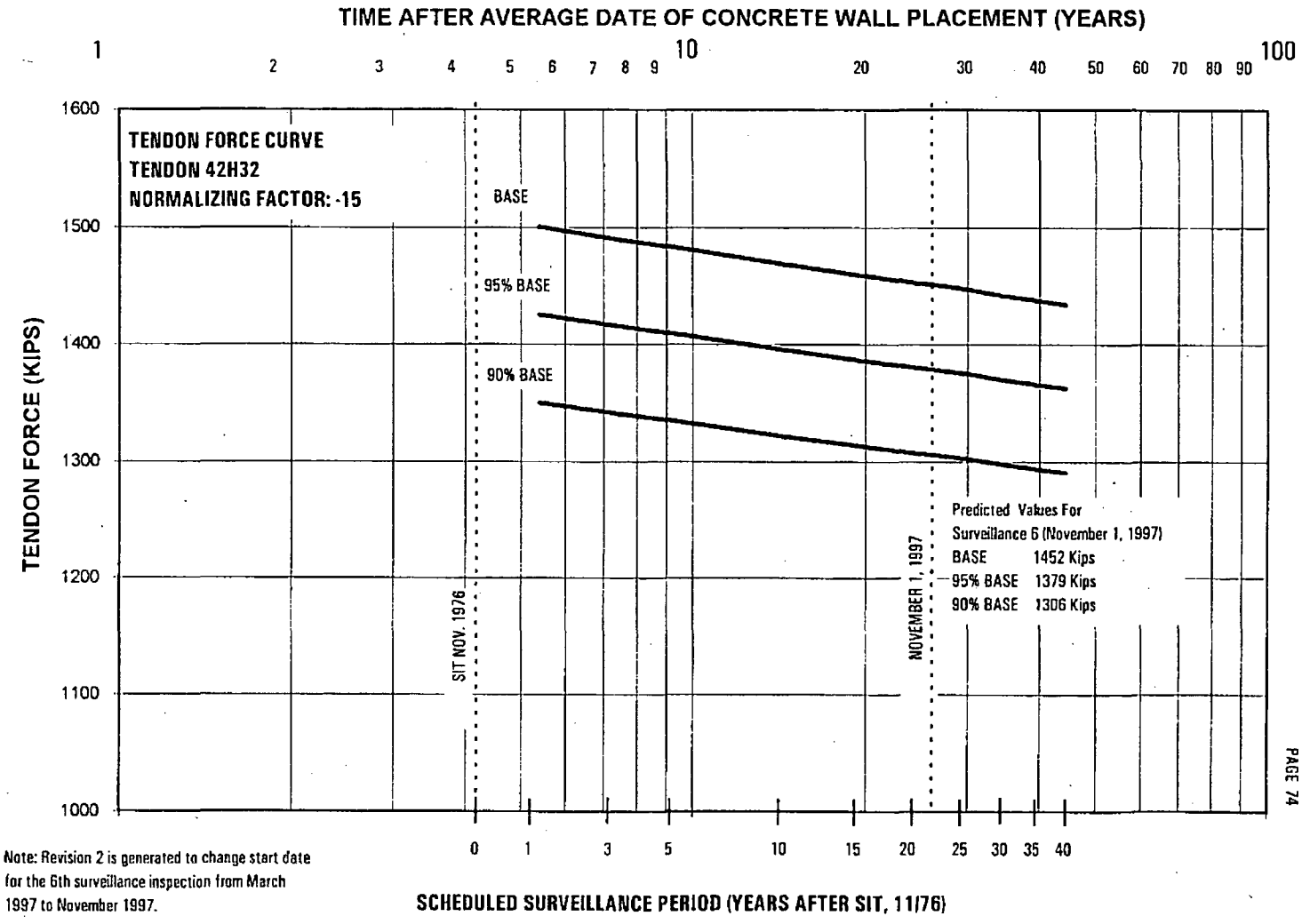
ORIGINAL FORCES (KIPS): SHOP: 1610 FIELD: 1641 AVERAGE: 1626 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 41 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	42.4	2.57%	42.0	0.090	39.5	6.0	1.7	125.6	7.73%	1500	1425	1350	-15
3	7.4	42.4	2.60%	42.5	0.110	48.5	8.5	2.4	135.8	8.35%	1490	1415	1341	-15
5	9.4	42.4	2.68%	43.8	0.123	54.1	10.0	2.8	143.1	8.80%	1483	1409	1334	-15
10	14.4	42.4	2.76%	45.1	0.150	66.0	13.5	3.8	157.3	9.68%	1468	1395	1322	-15
15	19.4	42.4	2.81%	45.9	0.167	73.6	15.5	4.4	166.3	10.23%	1460	1387	1314	-15
17	21.4	42.4									1457	1384	1311	
20	24.4	42.4	2.87%	46.9	0.181	79.0	17.5	4.9	173.3	10.66%	1453	1380	1307	-15
21:3	25.65	42.4									1451	1379	1306	
25	29.4	42.4	2.88%	47.1	0.190	83.2	19.5	5.5	178.2	10.96%	1448	1375	1303	-15
30	34.4	42.4	2.91%	47.6	0.200	88.0	20.4	5.8	183.8	11.30%	1442	1370	1298	-15
35	39.4	42.4	2.93%	47.9	0.209	91.9	21.5	6.1	188.3	11.58%	1438	1366	1294	-15
40	44.4	42.4	2.95%	48.2	0.215	94.7	22.5	6.4	191.7	11.79%	1434	1362	1291	-15
21	25.4										1452	1379	1306	

R2

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H33)

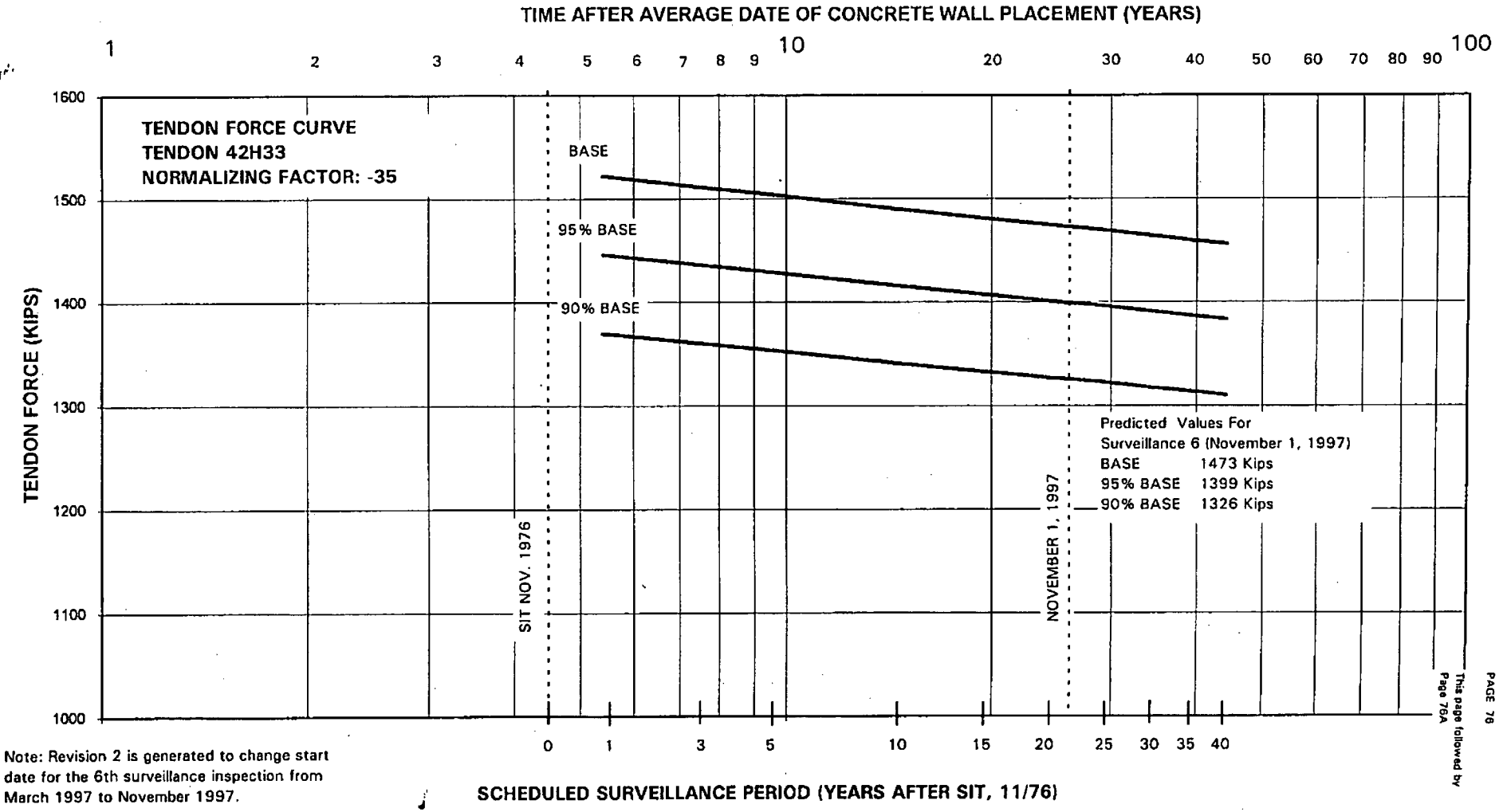
TENDON: 42H33 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1670 FIELD: 1661 AVERAGE: 1665 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 33 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	60.3	2.57%	42.0	0.090	39.5	6.0	1.7	143.5	8.62%	1522	1446	1370	-35
3	7.4	60.3	2.60%	42.5	0.110	48.5	8.5	2.4	153.7	9.23%	1512	1436	1360	-35
5	9.4	60.3	2.68%	43.8	0.123	54.1	10.0	2.8	161.0	9.67%	1504	1429	1354	-35
10	14.4	60.3	2.76%	45.1	0.150	66.0	13.5	3.8	175.2	10.52%	1490	1416	1341	-35
15	19.4	60.3	2.81%	45.9	0.167	73.6	15.5	4.4	184.2	11.06%	1481	1407	1333	-35
17	21.4	60.3									1478	1404	1330	
20	24.4	60.3	2.87%	46.9	0.181	79.0	17.5	4.9	191.1	11.48%	1474	1400	1327	-35
21:3	25.65	60.3									1473	1399	1326	
25	29.4	60.3	2.88%	47.1	0.190	83.2	19.5	5.5	196.1	11.78%	1469	1396	1322	-35
30	34.4	60.3	2.91%	47.6	0.200	88.0	20.4	5.8	201.7	12.11%	1464	1390	1317	-35
35	39.4	60.3	2.93%	47.9	0.209	91.9	21.5	6.1	206.2	12.38%	1459	1386	1313	-35
40	44.4	60.3	2.95%	48.2	0.215	94.7	22.5	6.4	209.6	12.58%	1456	1383	1310	-35
21	25.4										1473	1399	1326	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R-3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H34)

TENDON: 42H34 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1621 FIELD: 1631 AVERAGE: 1626 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 41 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	41.7	2.57%	42.0	0.090	39.5	6.0	1.7	124.8	7.68%	1501	1426	1351	-14
3	7.4	41.7	2.60%	42.5	0.110	48.5	8.5	2.4	135.1	8.31%	1491	1416	1341	-14
5	9.4	41.7	2.68%	43.8	0.123	54.1	10.0	2.8	142.4	8.76%	1483	1409	1335	-14
10	14.4	41.7	2.76%	45.1	0.150	66.0	13.5	3.8	156.6	9.63%	1469	1396	1322	-14
15	19.4	41.7	2.81%	45.9	0.167	73.6	15.5	4.4	165.5	10.18%	1460	1387	1314	-14
17	21.4	41.7									1457	1384	1312	
20	24.4	41.7	2.87%	46.9	0.181	79.0	17.5	4.9	172.5	10.61%	1453	1380	1308	-14
21:3	25.65	41.7									1452	1379	1307	
25	29.4	41.7	2.88%	47.1	0.190	83.2	19.5	5.5	177.5	10.92%	1448	1376	1303	-14
30	34.4	41.7	2.91%	47.6	0.200	88.0	20.4	5.8	183.0	11.26%	1443	1370	1298	-14
35	39.4	41.7	2.93%	47.9	0.209	91.9	21.5	6.1	187.5	11.53%	1438	1366	1294	-14
40	44.4	41.7	2.95%	48.2	0.215	94.7	22.5	6.4	190.9	11.74%	1435	1363	1291	-14
21	25.4										1452	1380	1307	

27-Jan-98

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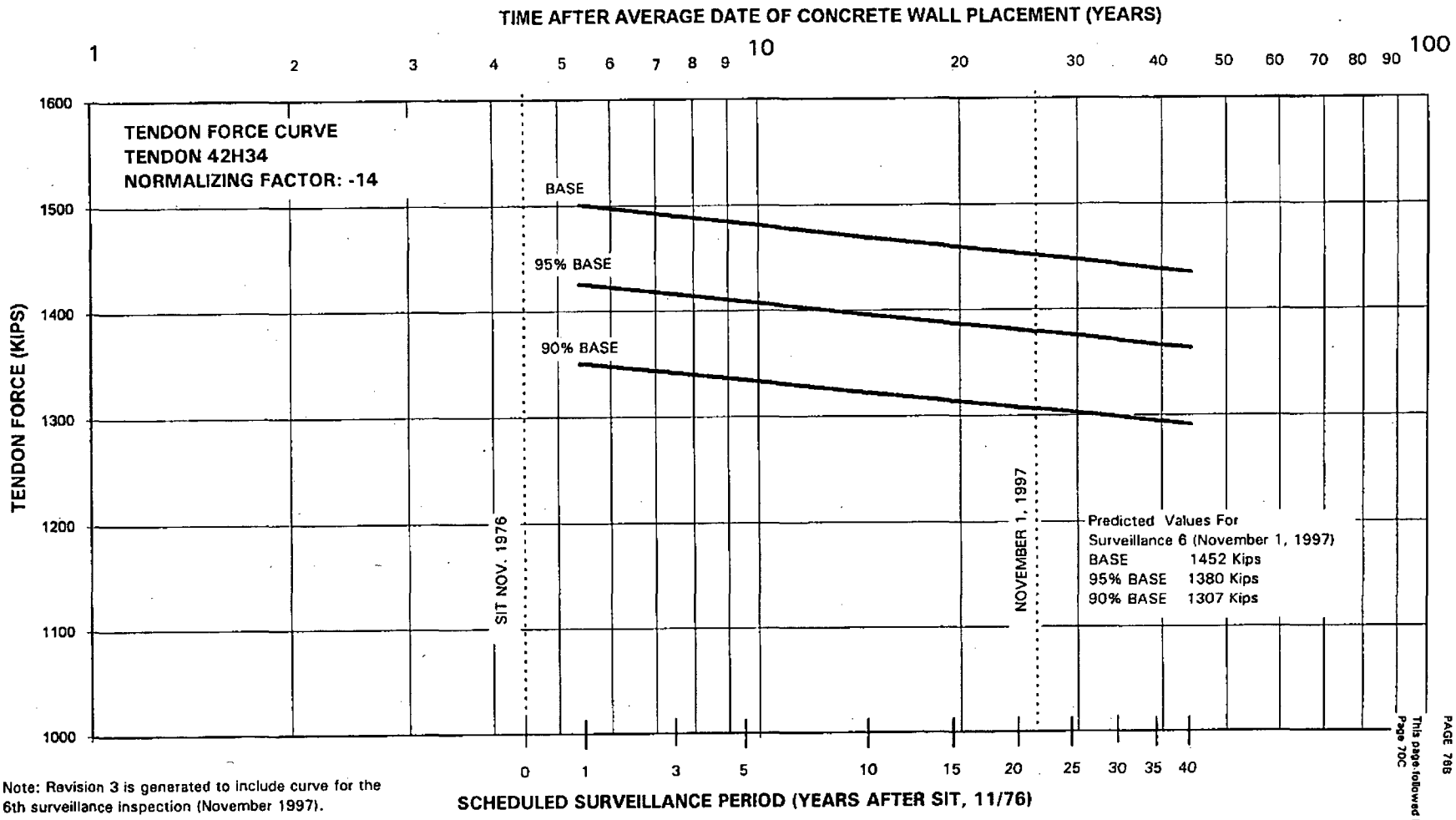

Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H35)

TENDON: 42H35 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1669 FIELD: 1624 AVERAGE: 1647 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 33 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	59.9	2.57%	42.0	0.090	39.5	6.0	1.7	143.1	8.69%	1504	1428	1353	-17
3	7.4	59.9	2.60%	42.5	0.110	48.5	8.5	2.4	153.3	9.31%	1493	1419	1344	-17
5	9.4	59.9	2.68%	43.8	0.123	54.1	10.0	2.8	160.6	9.75%	1486	1412	1338	-17
10	14.4	59.9	2.76%	45.1	0.150	66.0	13.5	3.8	174.8	10.62%	1472	1398	1325	-17
15	19.4	59.9	2.81%	45.9	0.167	73.6	15.5	4.4	183.8	11.16%	1463	1390	1317	-17
17	21.4	59.9									1460	1387	1314	
20	24.4	59.9	2.87%	46.9	0.181	79.0	17.5	4.9	190.8	11.58%	1456	1383	1310	-17
21:3	25.65	59.9									1455	1382	1309	
25	29.4	59.9	2.88%	47.1	0.190	83.2	19.5	5.5	195.7	11.89%	1451	1378	1306	-17
30	34.4	59.9	2.91%	47.6	0.200	88.0	20.4	5.8	201.3	12.22%	1445	1373	1301	-17
35	39.4	59.9	2.93%	47.9	0.209	91.9	21.5	6.1	205.8	12.50%	1441	1369	1297	-17
40	44.4	59.9	2.95%	48.2	0.215	94.7	22.5	6.4	209.2	12.70%	1438	1366	1294	-17
21	25.4										1455	1382	1309	

27-Jan-98

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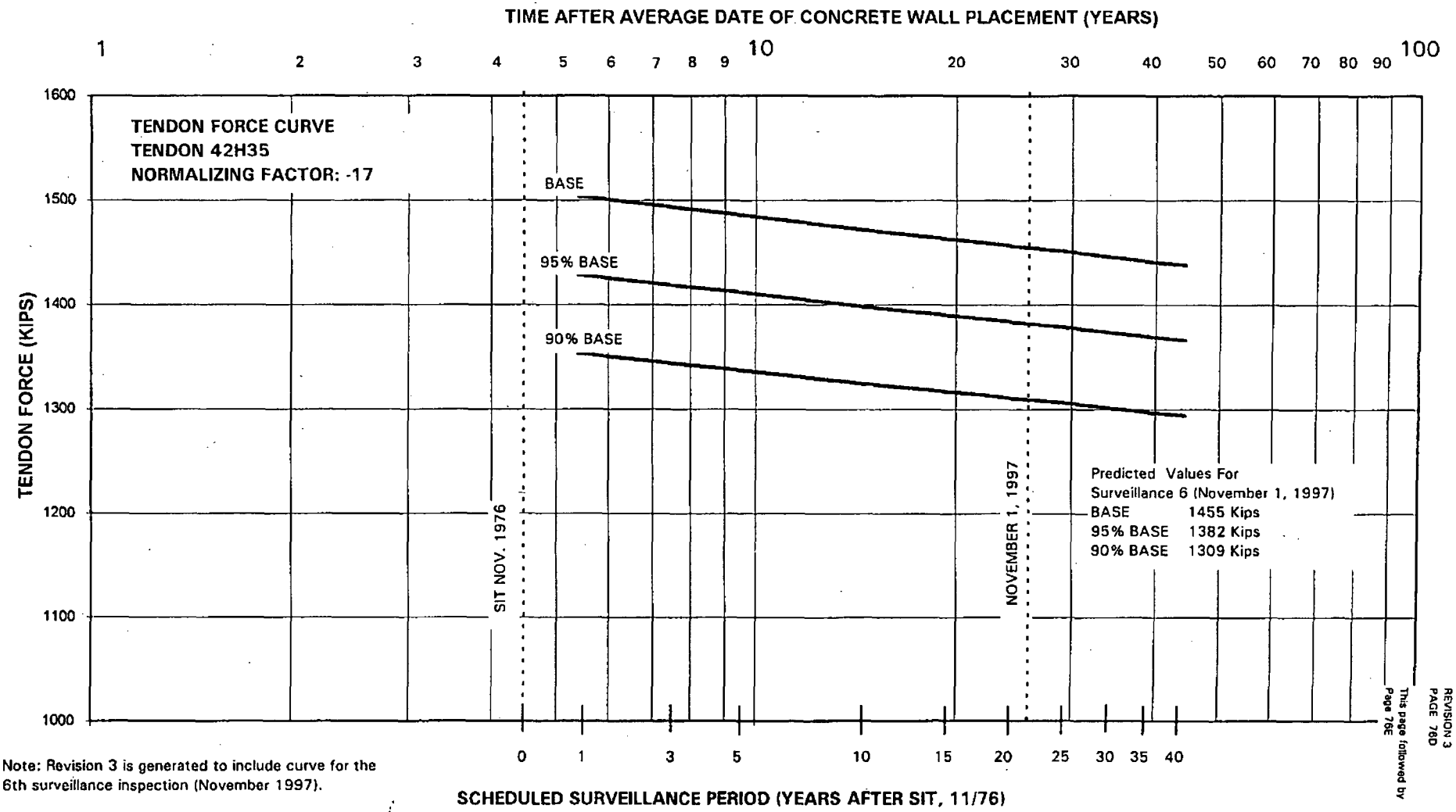

Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H36)

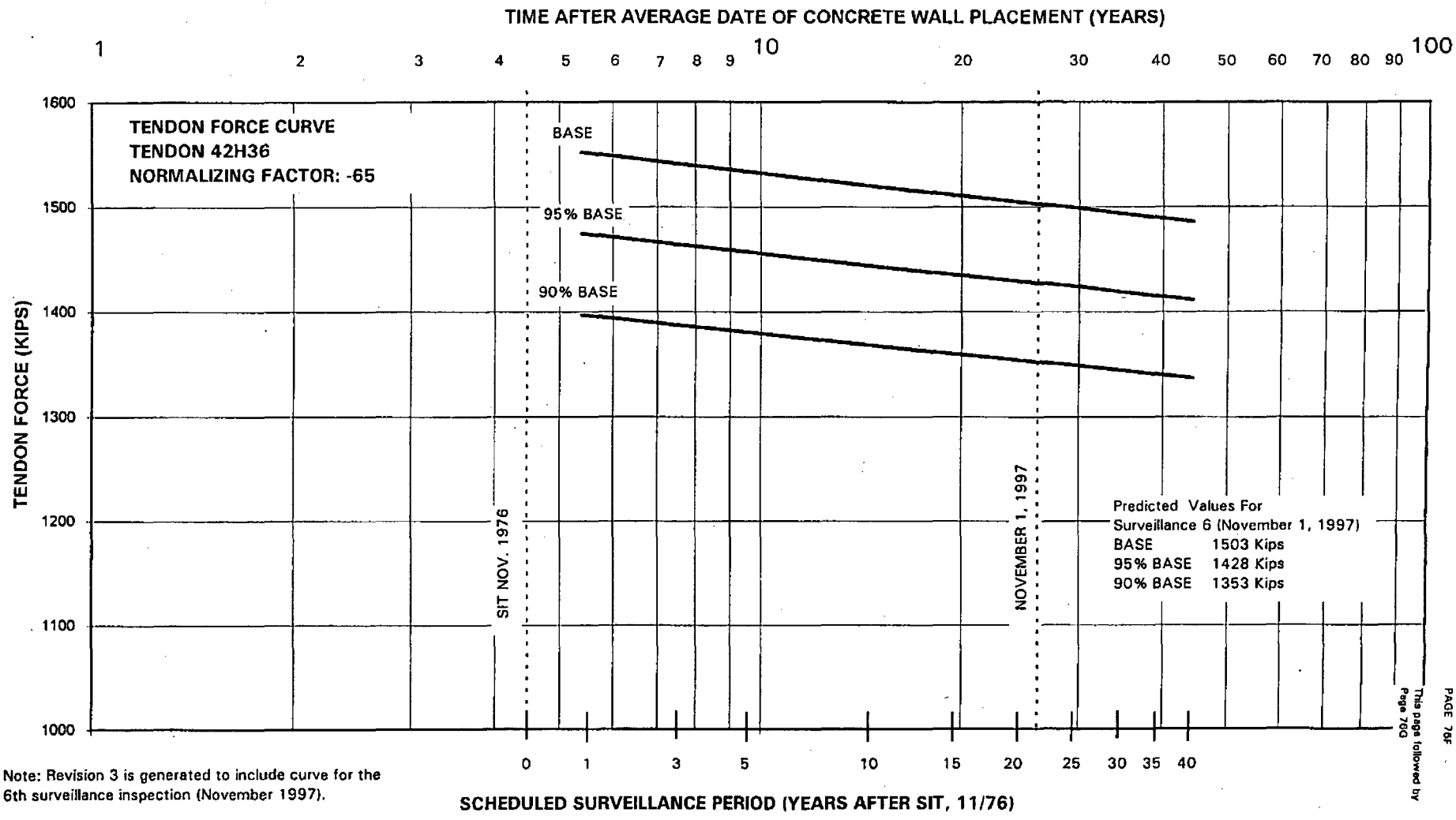
TENDON: 42H36 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1706 FIELD: 1653 AVERAGE: 1680 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 40 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	44.7	2.57%	42.0	0.090	39.5	6.0	1.7	127.9	7.61%	1552	1474	1397	-65
3	7.4	44.7	2.60%	42.5	0.110	48.5	8.5	2.4	138.1	8.22%	1542	1464	1387	-65
5	9.4	44.7	2.68%	43.8	0.123	54.1	10.0	2.8	145.4	8.65%	1534	1457	1381	-65
10	14.4	44.7	2.76%	45.1	0.150	66.0	13.5	3.8	159.6	9.50%	1520	1444	1368	-65
15	19.4	44.7	2.81%	45.9	0.167	73.6	15.5	4.4	168.5	10.03%	1511	1435	1360	-65
17	21.4	44.7									1508	1433	1357	
20	24.4	44.7	2.87%	46.9	0.181	79.0	17.5	4.9	175.5	10.45%	1504	1429	1354	-65
21:3	25.65	44.7									1503	1428	1353	
25	29.4	44.7	2.88%	47.1	0.190	83.2	19.5	5.5	180.5	10.74%	1499	1424	1349	-65
30	34.4	44.7	2.91%	47.6	0.200	88.0	20.4	5.8	186.0	11.08%	1494	1419	1344	-64
35	39.4	44.7	2.93%	47.9	0.209	91.9	21.5	6.1	190.5	11.34%	1489	1415	1340	-64
40	44.4	44.7	2.95%	48.2	0.215	94.7	22.5	6.4	193.9	11.55%	1486	1411	1337	-64
21	25.4										1503	1428	1353	

27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (42H37)

TENDON: 42H37 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1622 FIELD: 1661 AVERAGE: 1641 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 34 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	58.1	2.57%	42.0	0.090	39.5	6.0	1.7	141.3	8.61%	1500	1425	1350	-14
3	7.4	58.1	2.60%	42.5	0.110	48.5	8.5	2.4	151.5	9.23%	1490	1415	1341	-14
5	9.4	58.1	2.68%	43.8	0.123	54.1	10.0	2.8	158.8	9.67%	1483	1409	1334	-14
10	14.4	58.1	2.76%	45.1	0.150	66.0	13.5	3.8	173.0	10.54%	1468	1395	1322	-14
15	19.4	58.1	2.81%	45.9	0.167	73.6	15.5	4.4	181.9	11.08%	1459	1387	1314	-14
17	21.4	58.1									1457	1384	1311	
20	24.4	58.1	2.87%	46.9	0.181	79.0	17.5	4.9	188.9	11.51%	1453	1380	1307	-14
21:3	25.65	58.1									1451	1379	1306	
25	29.4	58.1	2.88%	47.1	0.190	83.2	19.5	5.5	193.9	11.81%	1448	1375	1303	-14
30	34.4	58.1	2.91%	47.6	0.200	88.0	20.4	5.8	199.4	12.15%	1442	1370	1298	-14
35	39.4	58.1	2.93%	47.9	0.209	91.9	21.5	6.1	203.9	12.42%	1437	1366	1294	-14
40	44.4	58.1	2.95%	48.2	0.215	94.7	22.5	6.4	207.3	12.63%	1434	1362	1291	-14
21	25.4										1452	1379	1306	

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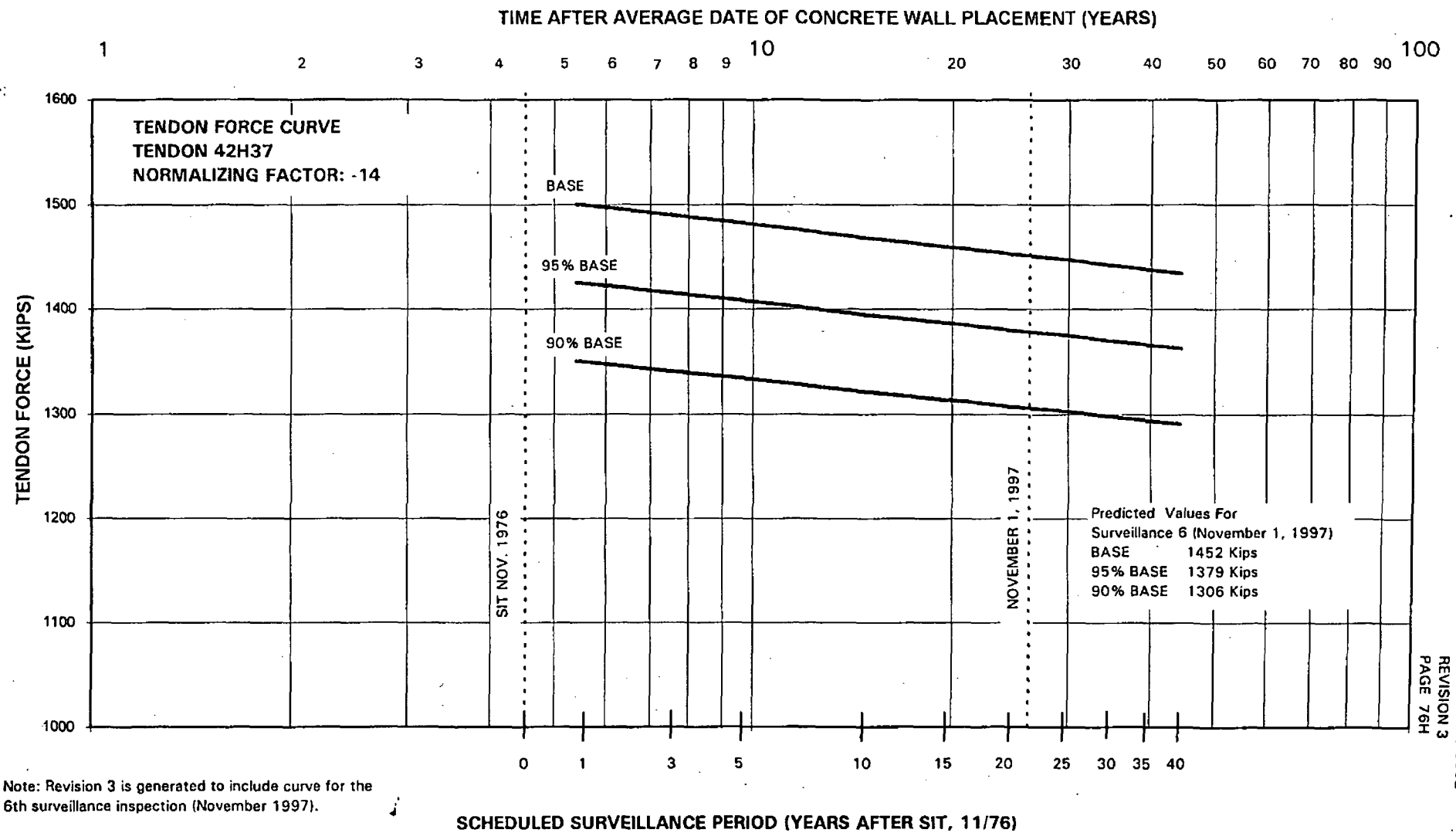
27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H43)

TENDON: 42H43 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1610 FIELD: 1612 AVERAGE: 1611 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 36 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	53.6	2.57%	42.0	0.090	39.5	6.0	1.7	136.8	8.49%	1475	1401	1327	11
3	7.4	53.6	2.60%	42.5	0.110	48.5	8.5	2.4	147.0	9.12%	1464	1391	1318	11
5	9.4	53.6	2.68%	43.8	0.123	54.1	10.0	2.8	154.3	9.58%	1457	1384	1311	11
10	14.4	53.6	2.76%	45.1	0.150	66.0	13.5	3.8	168.5	10.46%	1443	1371	1299	11
15	19.4	53.6	2.81%	45.9	0.167	73.6	15.5	4.4	177.5	11.01%	1434	1362	1291	11
17	21.4	53.6									1431	1360	1288	
20	24.4	53.6	2.87%	46.9	0.181	79.0	17.5	4.9	184.4	11.45%	1427	1356	1284	11
21:3	25.65	53.6									1426	1354	1283	
25	29.4	53.6	2.88%	47.1	0.190	83.2	19.5	5.5	189.4	11.75%	1422	1351	1280	11
30	34.4	53.6	2.91%	47.6	0.200	88.0	20.4	5.8	195.0	12.10%	1416	1346	1275	11
35	39.4	53.6	2.93%	47.9	0.209	91.9	21.5	6.1	199.5	12.38%	1412	1341	1271	11
40	44.4	53.6	2.95%	48.2	0.215	94.7	22.5	6.4	202.9	12.59%	1409	1338	1268	11
21	25.4										1426	1355	1283	

R2

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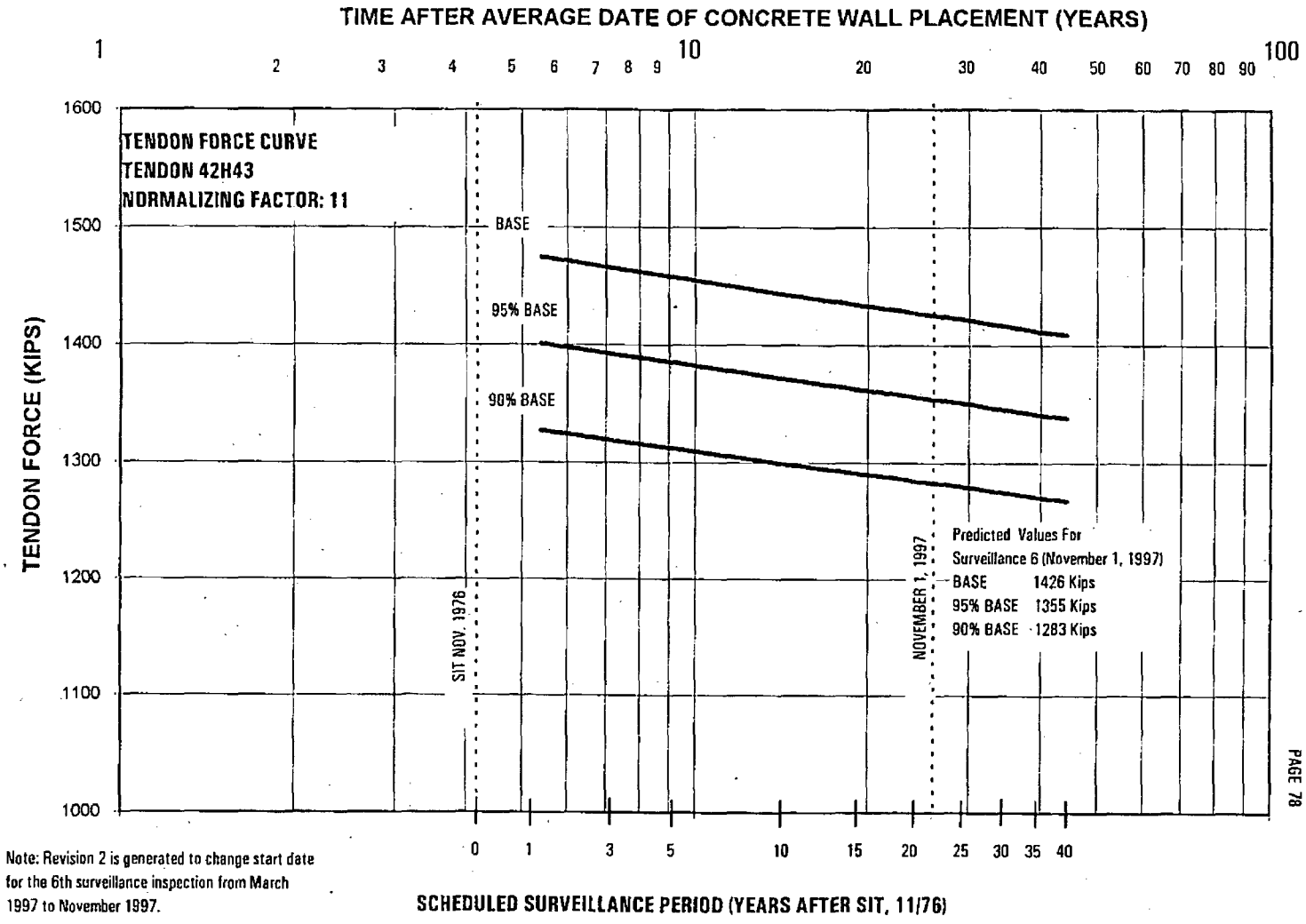
11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H44)

TENDON: 42H44 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1593 FIELD: 1617 AVERAGE: 1605 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 39 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	46.9	2.57%	42.0	0.090	39.5	6.0	1.7	130.1	8.10%	1475	1401	1328	10
3	7.4	46.9	2.60%	42.5	0.110	48.5	8.5	2.4	140.3	8.74%	1465	1392	1318	10
5	9.4	46.9	2.68%	43.8	0.123	54.1	10.0	2.8	147.6	9.20%	1458	1385	1312	10
10	14.4	46.9	2.76%	45.1	0.150	66.0	13.5	3.8	161.8	10.08%	1443	1371	1299	10
15	19.4	46.9	2.81%	45.9	0.167	73.6	15.5	4.4	170.8	10.64%	1434	1363	1291	10
17	21.4	46.9									1432	1360	1288	
20	24.4	46.9	2.87%	46.9	0.181	79.0	17.5	4.9	177.7	11.07%	1427	1356	1285	10
21:3	25.65	46.9									1426	1355	1284	
25	29.4	46.9	2.88%	47.1	0.190	83.2	19.5	5.5	182.7	11.38%	1423	1351	1280	10
30	34.4	46.9	2.91%	47.6	0.200	88.0	20.4	5.8	188.3	11.73%	1417	1346	1275	10
35	39.4	46.9	2.93%	47.9	0.209	91.9	21.5	6.1	192.8	12.01%	1412	1342	1271	10
40	44.4	46.9	2.95%	48.2	0.215	94.7	22.5	6.4	196.2	12.22%	1409	1339	1268	10
21	25.4										1426	1355	1284	

R2

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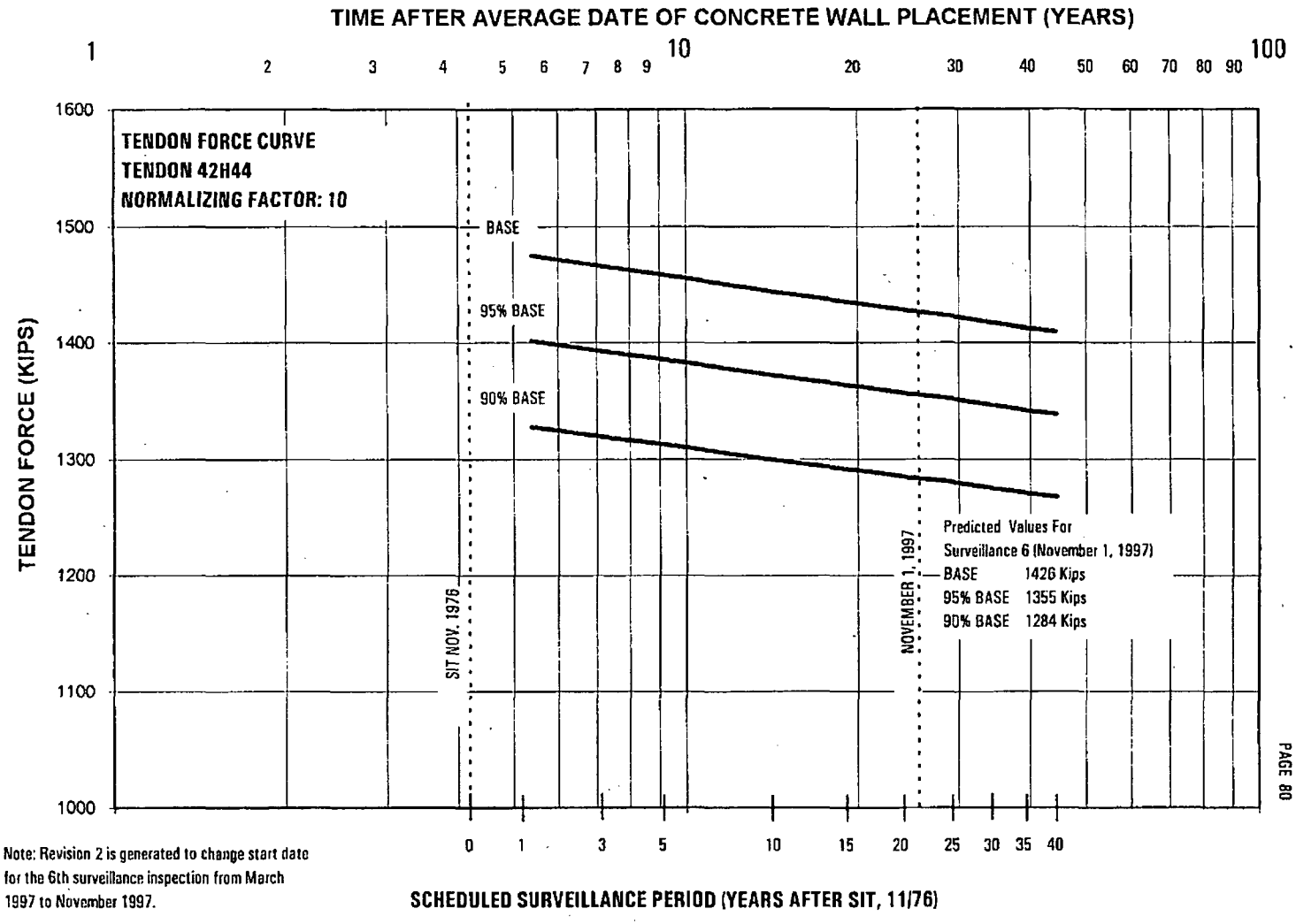

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (42H45)

TENDON: 42H45 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1670 FIELD: 1661 AVERAGE: 1665 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 37 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	51.4	2.57%	42.0	0.090	39.5	6.0	1.7	134.6	8.08%	1531	1454	1378	-44
3	7.4	51.4	2.60%	42.5	0.110	48.5	8.5	2.4	144.8	8.69%	1521	1444	1368	-44
5	9.4	51.4	2.68%	43.8	0.123	54.1	10.0	2.8	152.1	9.13%	1513	1438	1362	-44
10	14.4	51.4	2.76%	45.1	0.150	66.0	13.5	3.8	166.3	9.98%	1499	1424	1349	-44
15	19.4	51.4	2.81%	45.9	0.167	73.6	15.5	4.4	175.2	10.52%	1490	1416	1341	-44
17	21.4	51.4									1487	1413	1339	
20	24.4	51.4	2.87%	46.9	0.181	79.0	17.5	4.9	182.2	10.94%	1483	1409	1335	-44
21:3	25.65	51.4									1482	1408	1334	
25	29.4	51.4	2.88%	47.1	0.190	83.2	19.5	5.5	187.2	11.24%	1478	1404	1330	-44
30	34.4	51.4	2.91%	47.6	0.200	88.0	20.4	5.8	192.7	11.57%	1473	1399	1325	-44
35	39.4	51.4	2.93%	47.9	0.209	91.9	21.5	6.1	197.2	11.84%	1468	1395	1321	-44
40	44.4	51.4	2.95%	48.2	0.215	94.7	22.5	6.4	200.6	12.05%	1465	1391	1318	-44
21	25.4										1482	1408	1334	

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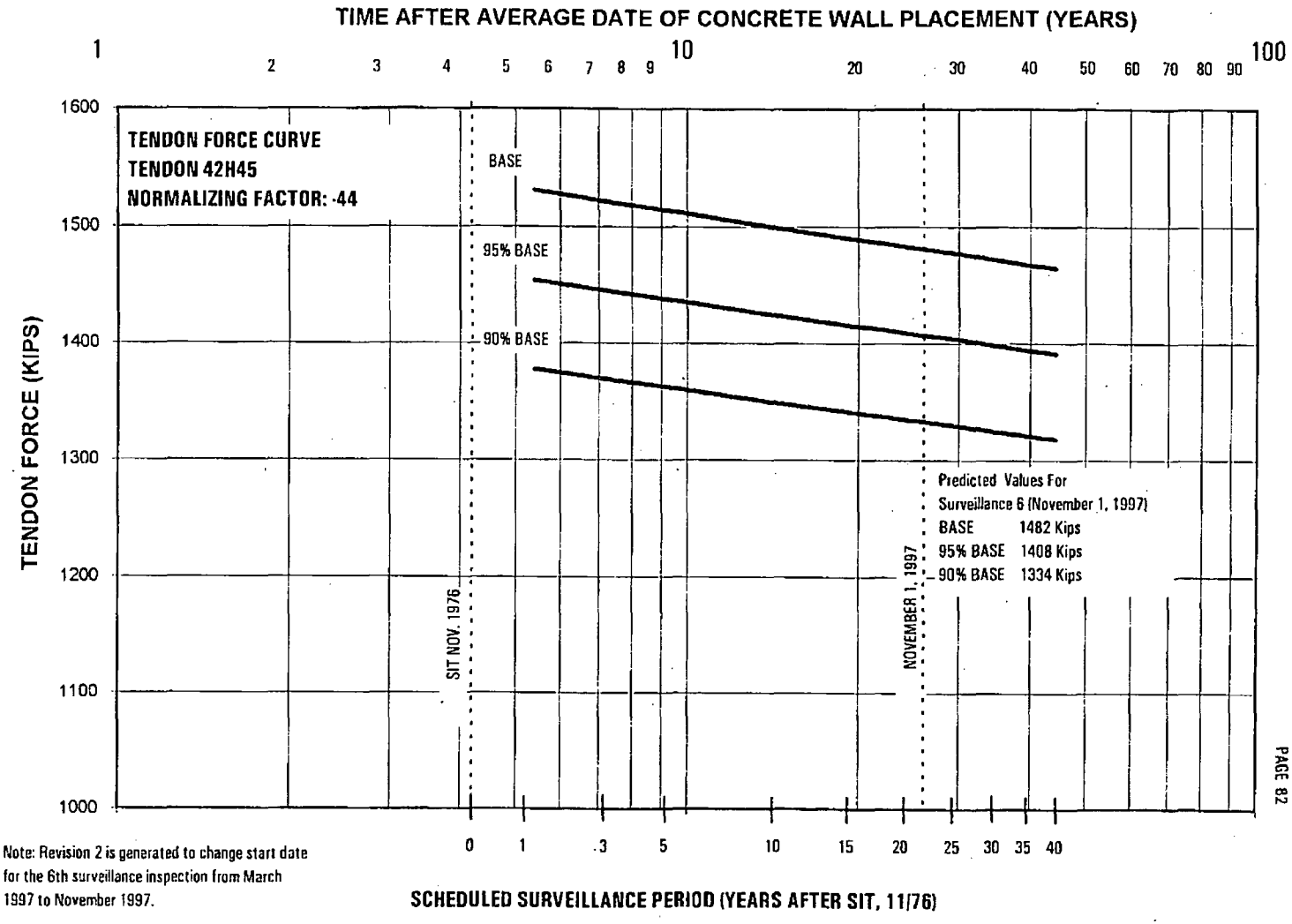

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (46H20)

R2

TENDON: 46H20 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1679 FIELD: 1609 AVERAGE: 1644 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 44 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	35.1	2.57%	42.0	0.090	39.5	6.0	1.7	118.3	7.19%	1526	1449	1373	-39
3	7.4	35.1	2.60%	42.5	0.110	48.5	8.5	2.4	128.5	7.82%	1515	1440	1364	-39
5	9.4	35.1	2.68%	43.8	0.123	54.1	10.0	2.8	135.8	8.26%	1508	1433	1357	-39
10	14.4	35.1	2.76%	45.1	0.150	66.0	13.5	3.8	150.0	9.12%	1494	1419	1345	-39
15	19.4	35.1	2.81%	45.9	0.167	73.6	15.5	4.4	158.9	9.67%	1485	1411	1336	-39
17	21.4	35.1									1482	1408	1334	
20	24.4	35.1	2.87%	46.9	0.181	79.0	17.5	4.9	165.9	10.09%	1478	1404	1330	-39
21:3	25.65	35.1									1477	1403	1329	
25	29.4	35.1	2.88%	47.1	0.190	83.2	19.5	5.5	170.9	10.39%	1473	1399	1326	-39
30	34.4	35.1	2.91%	47.6	0.200	88.0	20.4	5.8	176.4	10.73%	1467	1394	1321	-39
35	39.4	35.1	2.93%	47.9	0.209	91.9	21.5	6.1	180.9	11.01%	1463	1390	1317	-39
40	44.4	35.1	2.95%	48.2	0.215	94.7	22.5	6.4	184.3	11.21%	1460	1387	1314	-39
21	25.4										1477	1403	1329	

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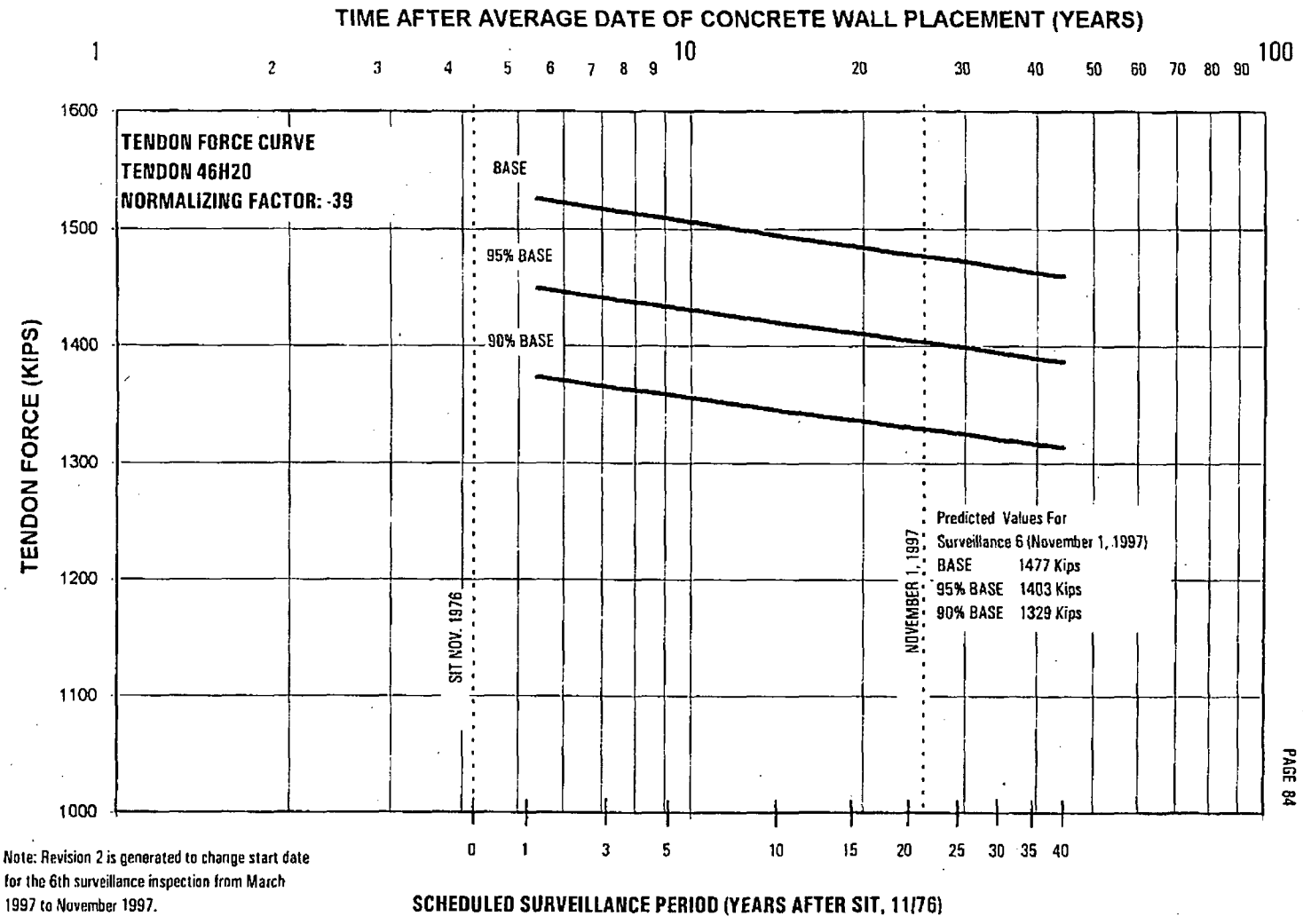

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (46H21)

TENDON: 46H21 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1624 FIELD: 1682 AVERAGE: 1653 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 28 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	71.0	2.57%	42.0	0.090	39.5	6.0	1.7	154.2	9.33%	1499	1424	1349	-12
3	7.4	71.0	2.60%	42.5	0.110	48.5	8.5	2.4	164.4	9.95%	1489	1414	1340	-12
5	9.4	71.0	2.68%	43.8	0.123	54.1	10.0	2.8	171.7	10.39%	1481	1407	1333	-12
10	14.4	71.0	2.76%	45.1	0.150	66.0	13.5	3.8	185.9	11.25%	1467	1394	1320	-12
15	19.4	71.0	2.81%	45.9	0.167	73.6	15.5	4.4	194.9	11.79%	1458	1385	1312	-12
17	21.4	71.0									1455	1383	1310	
20	24.4	71.0	2.87%	46.9	0.181	79.0	17.5	4.9	201.9	12.21%	1451	1379	1306	-12
21:3	25.65	71.0									1450	1377	1305	
25	29.4	71.0	2.88%	47.1	0.190	83.2	19.5	5.5	206.8	12.51%	1446	1374	1302	-12
30	34.4	71.0	2.91%	47.6	0.200	88.0	20.4	5.8	212.4	12.85%	1441	1369	1297	-12
35	39.4	71.0	2.93%	47.9	0.209	91.9	21.5	6.1	216.9	13.12%	1436	1364	1293	-12
40	44.4	71.0	2.95%	48.2	0.215	94.7	22.5	6.4	220.3	13.33%	1433	1361	1290	-12
21	25.4										1450	1378	1305	

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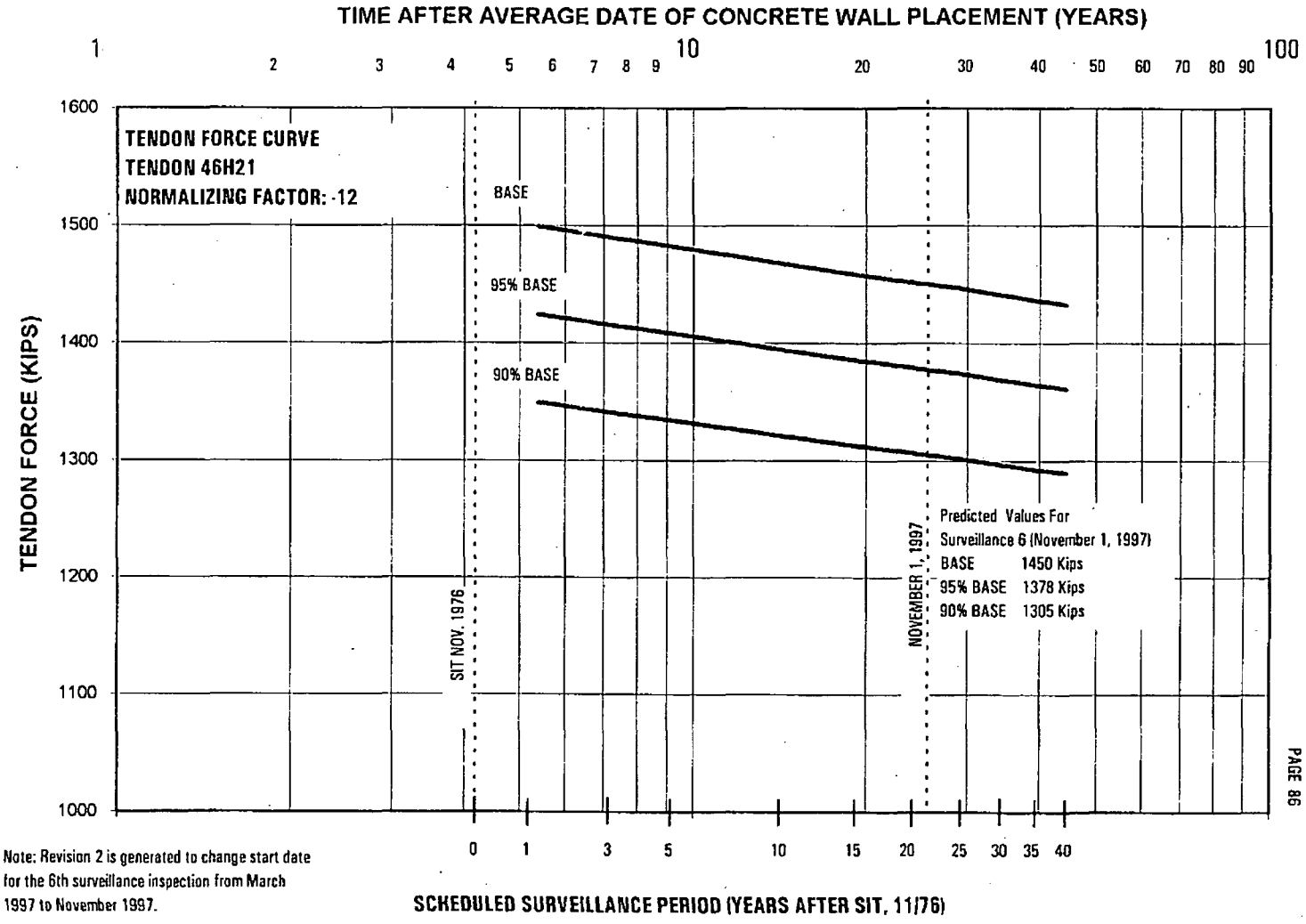

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (46H22)

R2

TENDON: 46H22 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1636 FIELD: 1694 AVERAGE: 1665 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 43 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	37.7	2.57%	42.0	0.090	39.5	6.0	1.7	120.9	7.26%	1544	1467	1390	-57
3	7.4	37.7	2.60%	42.5	0.110	48.5	8.5	2.4	131.1	7.88%	1534	1457	1381	-57
5	9.4	37.7	2.68%	43.8	0.123	54.1	10.0	2.8	138.4	8.31%	1527	1450	1374	-57
10	14.4	37.7	2.76%	45.1	0.150	66.0	13.5	3.8	152.6	9.17%	1513	1437	1361	-57
15	19.4	37.7	2.81%	45.9	0.167	73.6	15.5	4.4	161.6	9.70%	1504	1428	1353	-57
17	21.4	37.7									1501	1426	1351	
20	24.4	37.7	2.87%	46.9	0.181	79.0	17.5	4.9	168.6	10.12%	1497	1422	1347	-57
21:3	25.65	37.7									1495	1421	1346	
25	29.4	37.7	2.88%	47.1	0.190	83.2	19.5	5.5	173.5	10.42%	1492	1417	1342	-57
30	34.4	37.7	2.91%	47.6	0.200	88.0	20.4	5.8	179.1	10.75%	1486	1412	1337	-57
35	39.4	37.7	2.93%	47.9	0.209	91.9	21.5	6.1	183.6	11.03%	1482	1408	1333	-57
40	44.4	37.7	2.95%	48.2	0.215	94.7	22.5	6.4	187.0	11.23%	1478	1404	1330	-57
21	25.4										1496	1421	1346	

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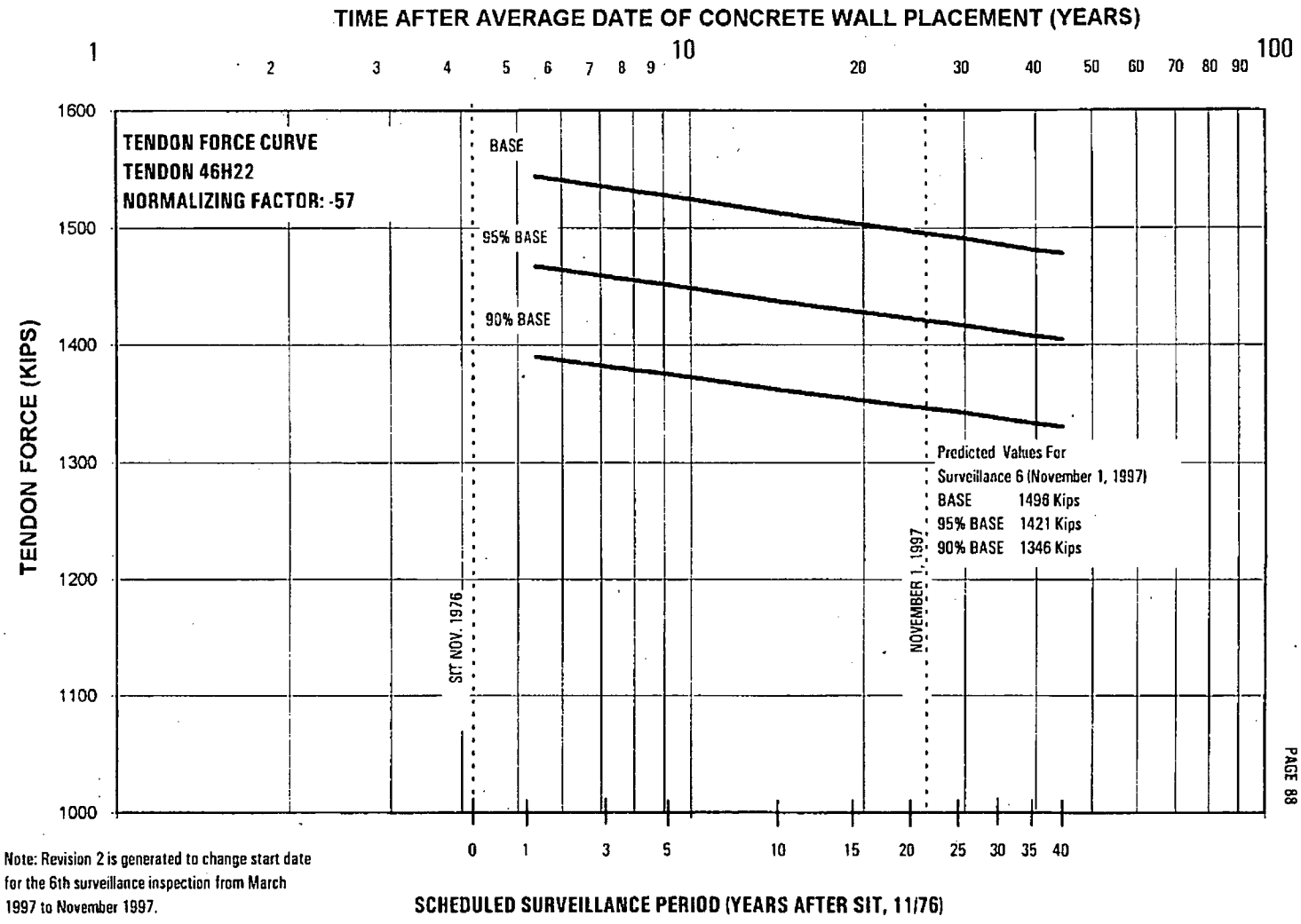

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (51H25)

R2

TENDON: 51H25 INITIAL CONCRETE STRESS (PSI): 1732

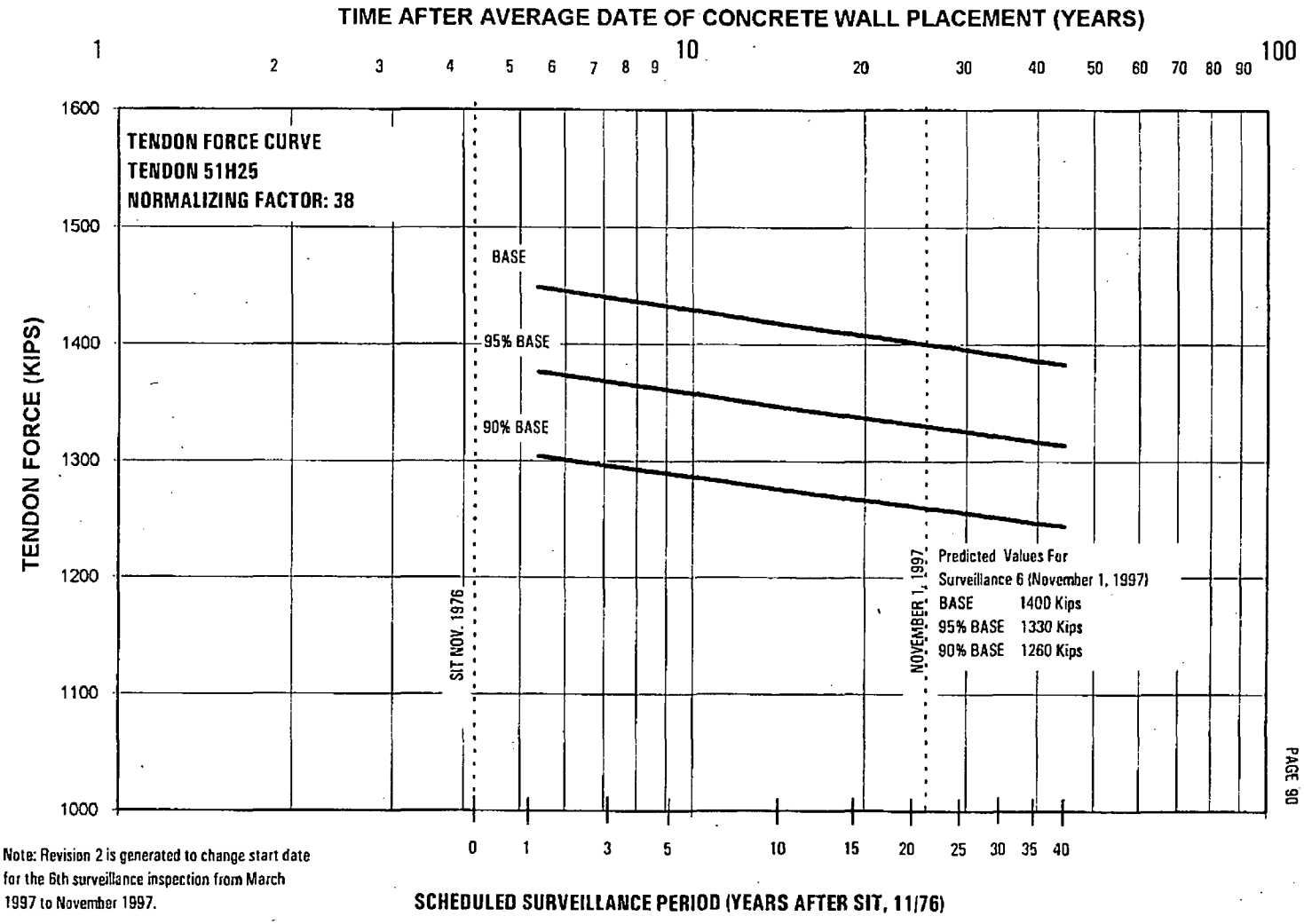
ORIGINAL FORCES (KIPS): SHOP: 1600 FIELD: 1677 AVERAGE: 1638 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 12 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	106.5	2.57%	42.0	0.090	39.5	6.0	1.7	189.7	11.58%	1449	1376	1304	38
3	7.4	106.5	2.60%	42.5	0.110	48.5	8.5	2.4	199.9	12.20%	1438	1367	1295	38
5	9.4	106.5	2.68%	43.8	0.123	54.1	10.0	2.8	207.2	12.65%	1431	1360	1288	38
10	14.4	106.5	2.76%	45.1	0.150	66.0	13.5	3.8	221.5	13.52%	1417	1346	1275	38
15	19.4	106.5	2.81%	45.9	0.167	73.6	15.5	4.4	230.4	14.06%	1408	1338	1267	38
17	21.4	106.5									1405	1335	1265	
20	24.4	106.5	2.87%	46.9	0.181	79.0	17.5	4.9	237.4	14.49%	1401	1331	1261	38
21:3	25.65	106.5									1400	1330	1260	
25	29.4	106.5	2.88%	47.1	0.190	83.2	19.5	5.5	242.3	14.79%	1396	1326	1256	38
30	34.4	106.5	2.91%	47.6	0.200	88.0	20.4	5.8	247.9	15.13%	1391	1321	1251	38
35	39.4	106.5	2.93%	47.9	0.209	91.9	21.5	6.1	252.4	15.41%	1386	1317	1247	38
40	44.4	106.5	2.95%	48.2	0.215	94.7	22.5	6.4	255.8	15.61%	1383	1313	1244	38
21	25.4										1400	1330	1260	

R2

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (51H26)

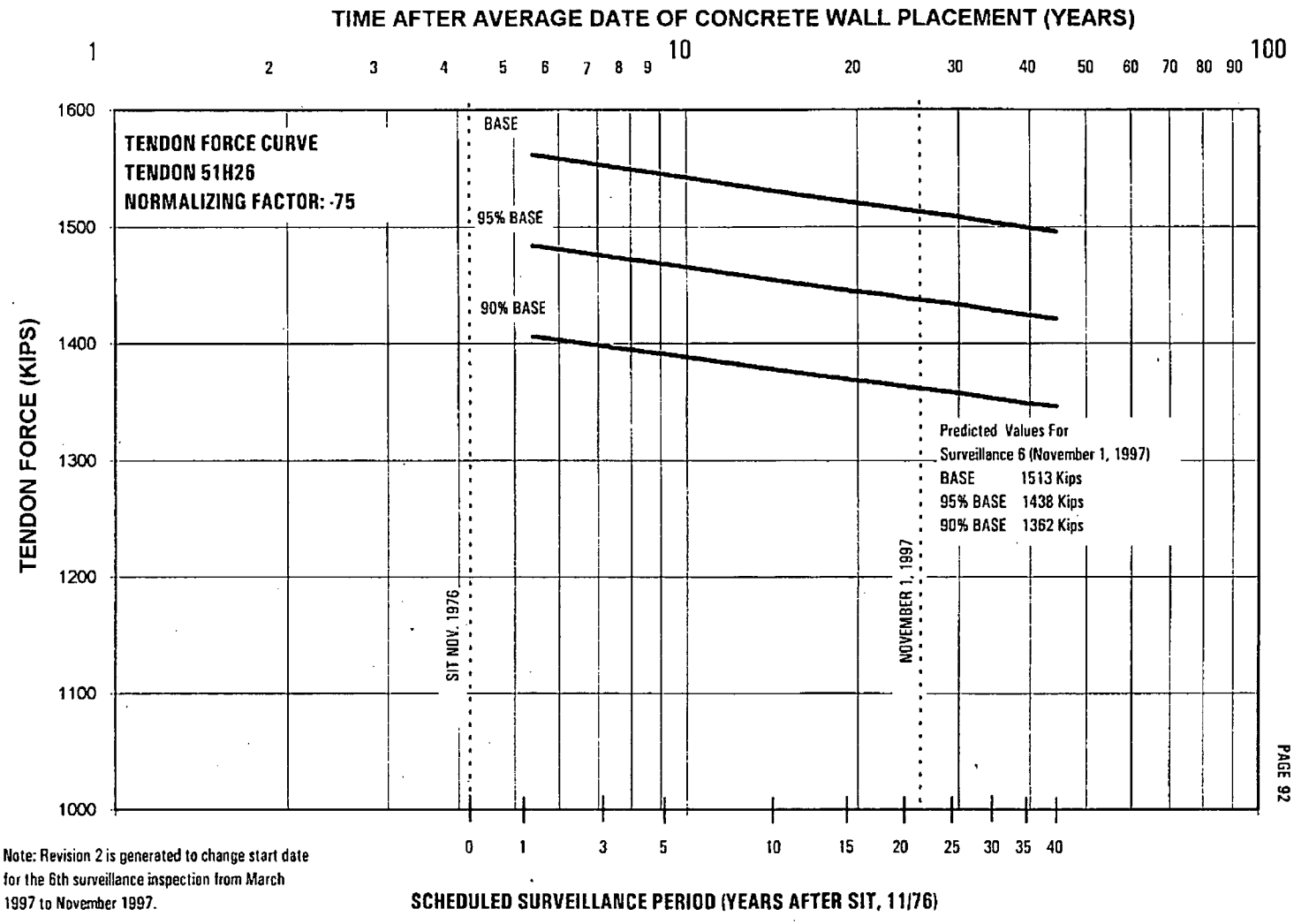
TENDON: 51H26 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1697 FIELD: 1624 AVERAGE: 1661 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 53 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	15.6	2.57%	42.0	0.090	39.5	6.0	1.7	98.8	5.95%	1562	1484	1406	-75
3	7.4	15.6	2.60%	42.5	0.110	48.5	8.5	2.4	109.0	6.57%	1552	1474	1397	-75
5	9.4	15.6	2.68%	43.8	0.123	54.1	10.0	2.8	116.3	7.00%	1544	1467	1390	-75
10	14.4	15.6	2.76%	45.1	0.150	66.0	13.5	3.8	130.5	7.86%	1530	1454	1377	-75
15	19.4	15.6	2.81%	45.9	0.167	73.6	15.5	4.4	139.5	8.40%	1521	1445	1369	-75
17	21.4	15.6									1518	1443	1367	
20	24.4	15.6	2.87%	46.9	0.181	79.0	17.5	4.9	146.5	8.82%	1514	1439	1363	-75
21:3	25.65	15.6									1513	1437	1362	
25	29.4	15.6	2.88%	47.1	0.190	83.2	19.5	5.5	151.4	9.12%	1509	1434	1358	-75
30	34.4	15.6	2.91%	47.6	0.200	88.0	20.4	5.8	157.0	9.45%	1504	1429	1353	-75
35	39.4	15.6	2.93%	47.9	0.209	91.9	21.5	6.1	161.5	9.72%	1499	1424	1349	-75
40	44.4	15.6	2.95%	48.2	0.215	94.7	22.5	6.4	164.9	9.93%	1496	1421	1346	-75
21	25.4										1513	1438	1362	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (51H27)

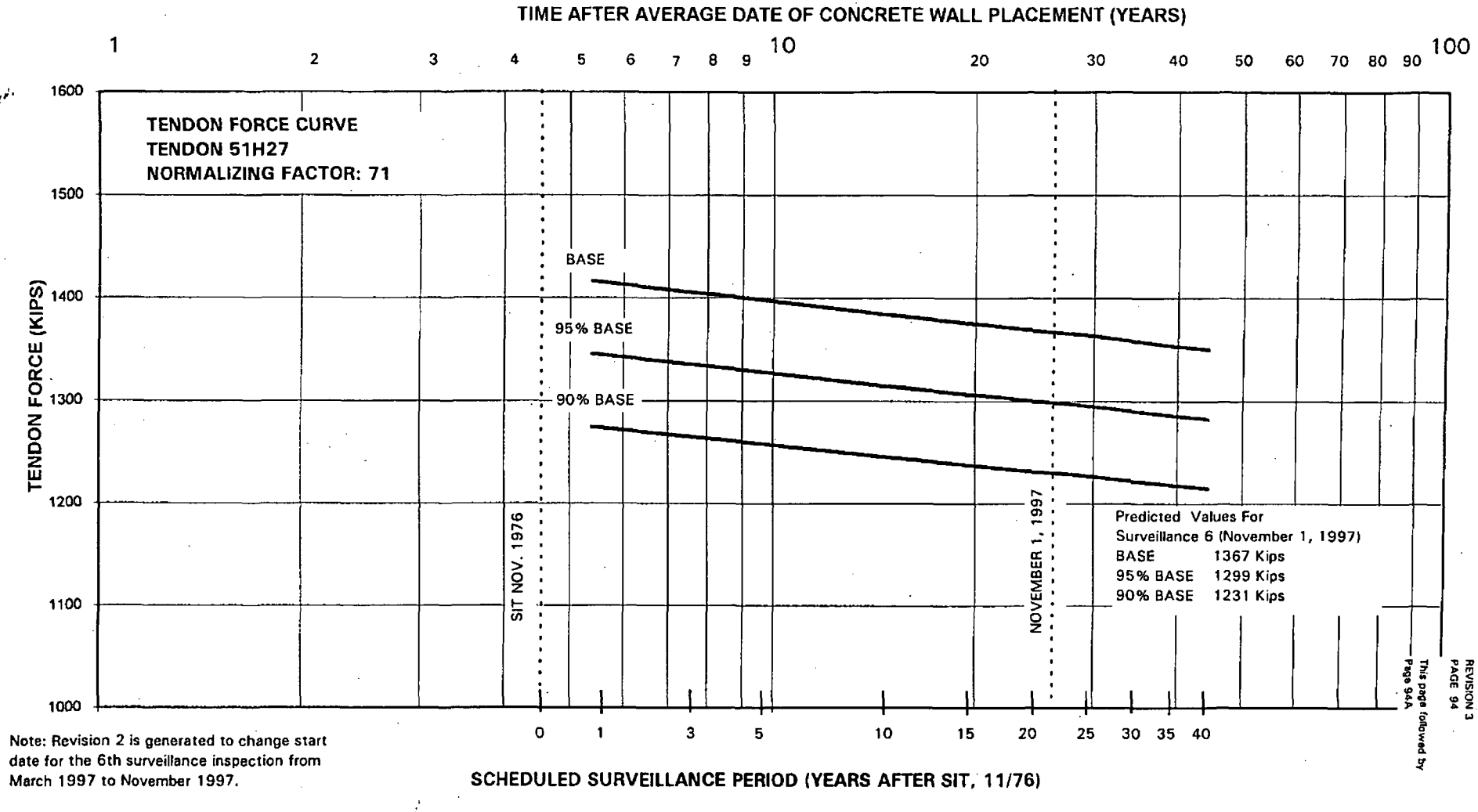
TENDON: 51H27 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1609 FIELD: 1614 AVERAGE: 1612 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 9 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	112.5	2.57%	42.0	0.090	39.5	6.0	1.7	195.7	12.14%	1416	1345	1274	71
3	7.4	112.5	2.60%	42.5	0.110	48.5	8.5	2.4	205.9	12.78%	1406	1335	1265	71
5	9.4	112.5	2.68%	43.8	0.123	54.1	10.0	2.8	213.2	13.23%	1398	1328	1259	71
10	14.4	112.5	2.76%	45.1	0.150	66.0	13.5	3.8	227.4	14.11%	1384	1315	1246	71
15	19.4	112.5	2.81%	45.9	0.167	73.6	15.5	4.4	236.4	14.67%	1375	1306	1238	71
17	21.4	112.5									1372	1304	1235	
20	24.4	112.5	2.87%	46.9	0.181	79.0	17.5	4.9	243.3	15.10%	1368	1300	1231	71
21:3	25.65	112.5									1367	1299	1230	
25	29.4	112.5	2.88%	47.1	0.190	83.2	19.5	5.5	248.3	15.41%	1363	1295	1227	71
30	34.4	112.5	2.91%	47.6	0.200	88.0	20.4	5.8	253.9	15.75%	1358	1290	1222	71
35	39.4	112.5	2.93%	47.9	0.209	91.9	21.5	6.1	258.4	16.03%	1353	1286	1218	71
40	44.4	112.5	2.95%	48.2	0.215	94.7	22.5	6.4	261.8	16.24%	1350	1282	1215	71
21	25.4										1367	1299	1231	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (51H28)

TENDON: 51H28 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1685 FIELD: 1651 AVERAGE: 1668 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 52 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	17.9	2.57%	42.0	0.090	39.5	6.0	1.7	101.1	6.06%	1567	1489	1410	-80
3	7.4	17.9	2.60%	42.5	0.110	48.5	8.5	2.4	111.3	6.67%	1557	1479	1401	-80
5	9.4	17.9	2.68%	43.8	0.123	54.1	10.0	2.8	118.6	7.11%	1549	1472	1395	-80
10	14.4	17.9	2.76%	45.1	0.150	66.0	13.5	3.8	132.8	7.96%	1535	1458	1382	-80
15	19.4	17.9	2.81%	45.9	0.167	73.6	15.5	4.4	141.7	8.50%	1526	1450	1374	-80
17	21.4	17.9									1524	1447	1371	
20	24.4	17.9	2.87%	46.9	0.181	79.0	17.5	4.9	148.7	8.92%	1519	1443	1367	-80
21:3	25.65	17.9									1518	1442	1366	
25	29.4	17.9	2.88%	47.1	0.190	83.2	19.5	5.5	153.7	9.21%	1514	1439	1363	-80
30	34.4	17.9	2.91%	47.6	0.200	88.0	20.4	5.8	159.2	9.55%	1509	1433	1358	-80
35	39.4	17.9	2.93%	47.9	0.209	91.9	21.5	6.1	163.7	9.82%	1504	1429	1354	-80
40	44.4	17.9	2.95%	48.2	0.215	94.7	22.5	6.4	167.1	10.02%	1501	1426	1351	-80
21	25.4										1518	1442	1367	

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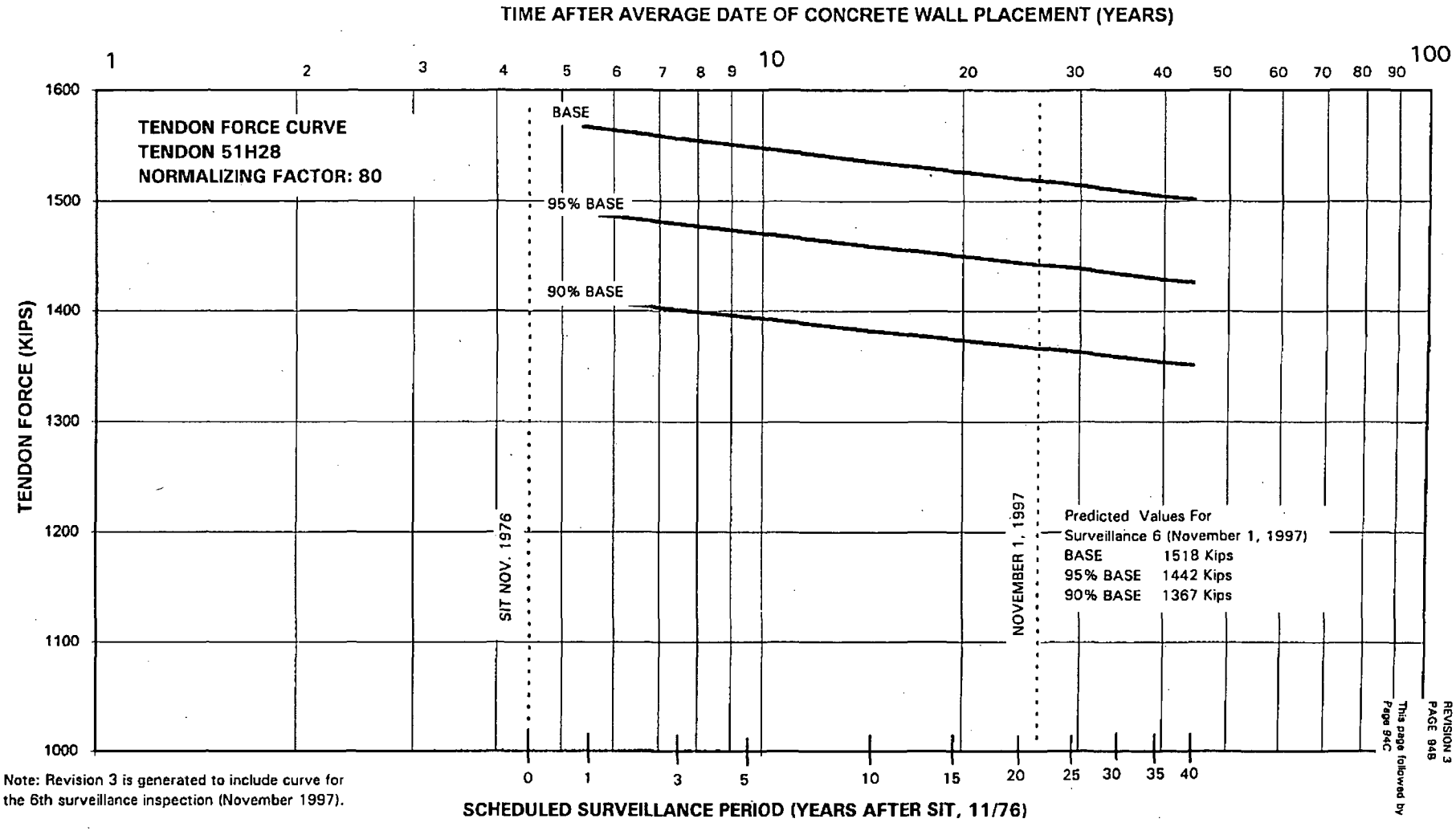
27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (51H29)

TENDON: 51H29 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1631 FIELD: 1627 AVERAGE: 1629 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 9 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	113.9	2.57%	42.0	0.090	39.5	6.0	1.7	197.1	12.10%	1432	1360	1288	54
3	7.4	113.9	2.60%	42.5	0.110	48.5	8.5	2.4	207.3	12.73%	1421	1350	1279	54
5	9.4	113.9	2.68%	43.8	0.123	54.1	10.0	2.8	214.6	13.18%	1414	1343	1273	54
10	14.4	113.9	2.76%	45.1	0.150	66.0	13.5	3.8	228.8	14.05%	1400	1330	1260	54
15	19.4	113.9	2.81%	45.9	0.167	73.6	15.5	4.4	237.8	14.60%	1391	1321	1252	54
17	21.4	113.9									1388	1319	1249	
20	24.4	113.9	2.87%	46.9	0.181	79.0	17.5	4.9	244.7	15.03%	1384	1315	1246	54
21:3	25.65	113.9									1383	1314	1244	
25	29.4	113.9	2.88%	47.1	0.190	83.2	19.5	5.5	249.7	15.33%	1379	1310	1241	54
30	34.4	113.9	2.91%	47.6	0.200	88.0	20.4	5.8	255.3	15.67%	1373	1305	1236	54
35	39.4	113.9	2.93%	47.9	0.209	91.9	21.5	6.1	259.8	15.95%	1369	1300	1232	54
40	44.4	113.9	2.95%	48.2	0.215	94.7	22.5	6.4	263.2	16.16%	1366	1297	1229	54
21	25.4										1383	1314	1245	

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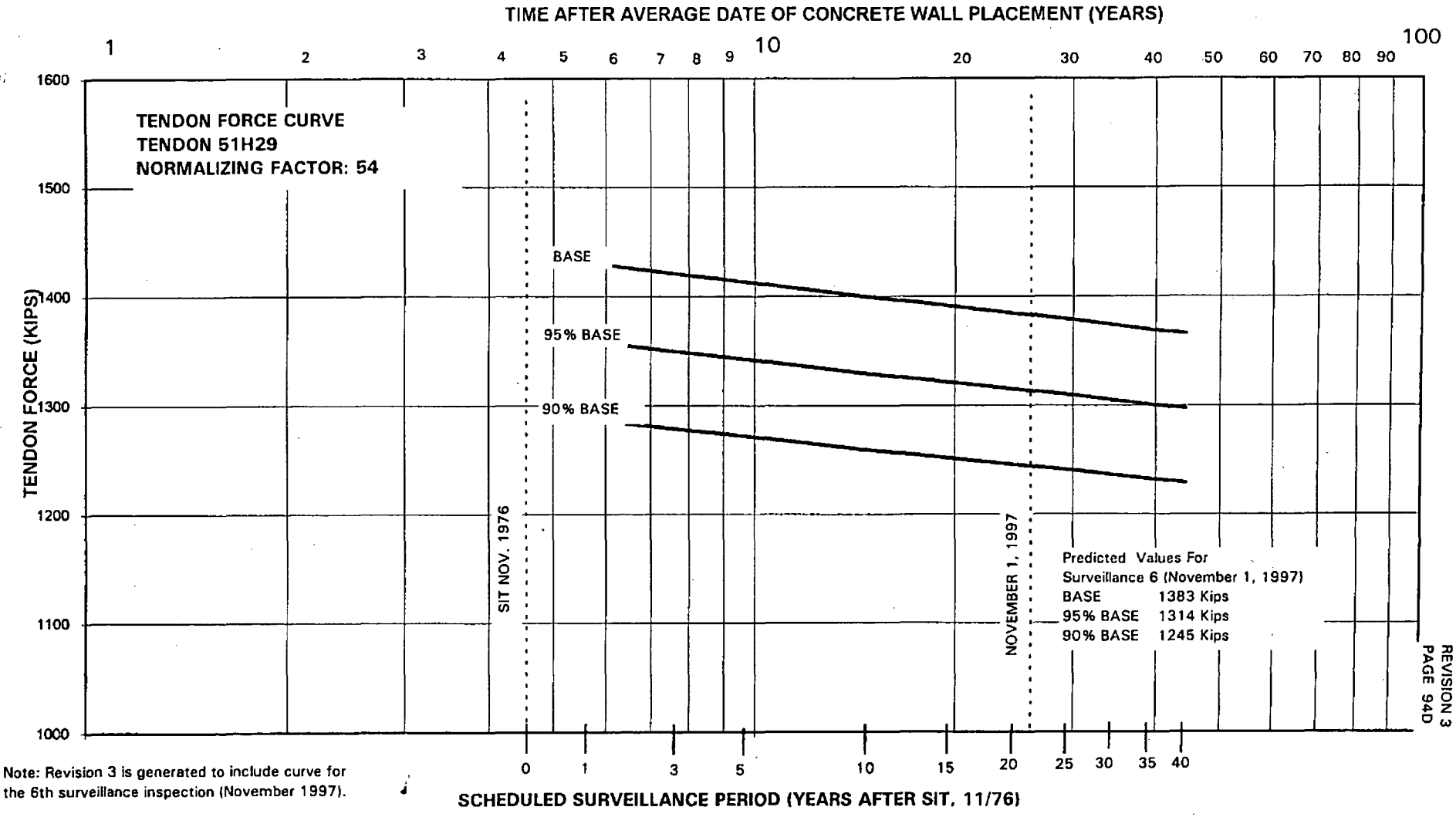
27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

DOC ID:S-95-0082
REVISION 3
PAGE 94D

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H1)

TENDON: 53H1 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1655 FIELD: 1604 AVERAGE: 1630 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 20 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.988

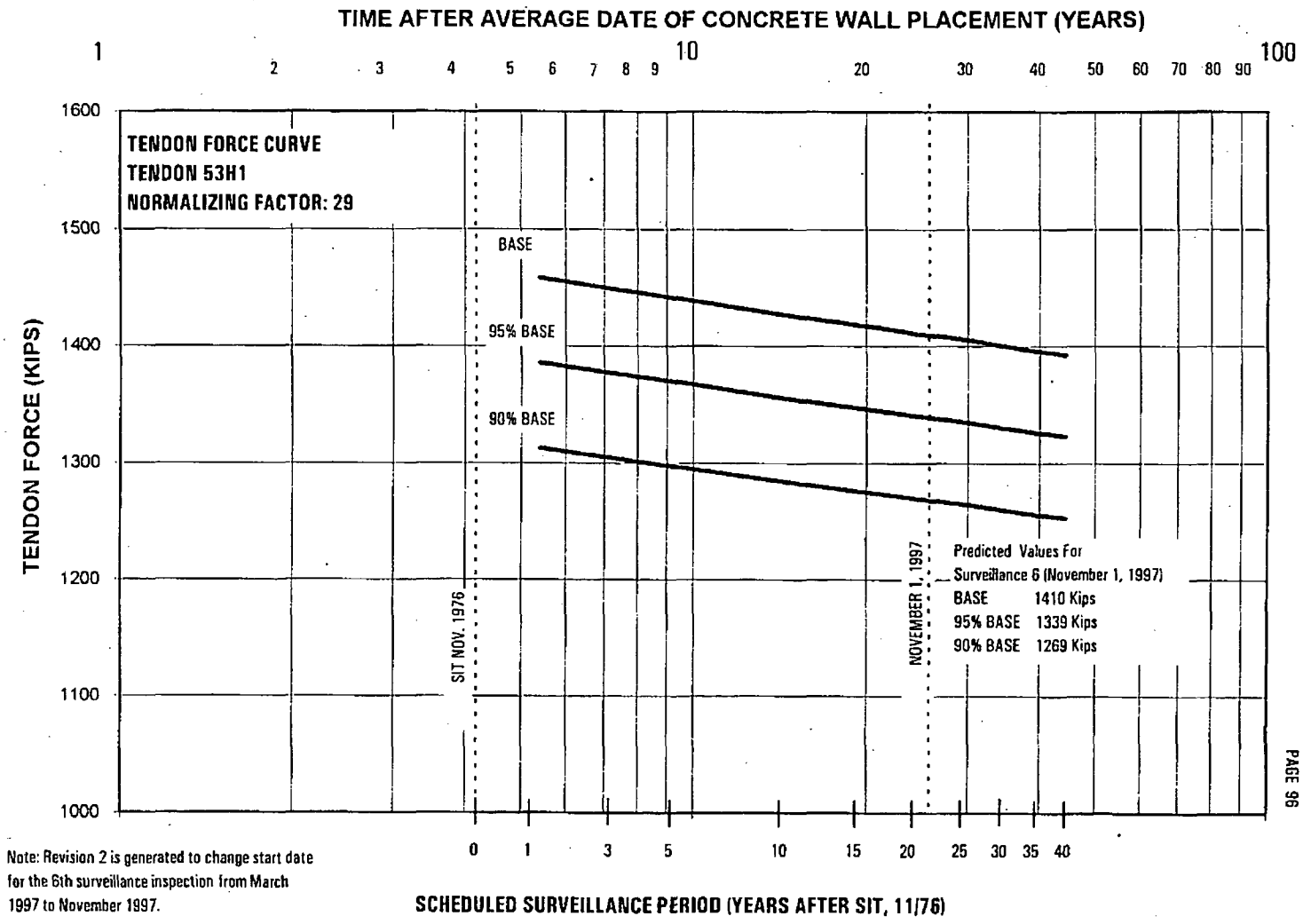
NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	88.2	2.57%	42.0	0.090	39.5	6.0	1.7	171.4	10.52%	1458	1385	1312	29
3	7.4	88.2	2.60%	42.5	0.110	48.5	8.5	2.4	181.6	11.15%	1448	1376	1303	29
5	9.4	88.2	2.68%	43.8	0.123	54.1	10.0	2.8	188.9	11.59%	1441	1369	1297	29
10	14.4	88.2	2.76%	45.1	0.150	66.0	13.5	3.8	203.1	12.46%	1427	1355	1284	29
15	19.4	88.2	2.81%	45.9	0.167	73.6	15.5	4.4	212.1	13.01%	1418	1347	1276	29
17	21.4	88.2									1415	1344	1273	
20	24.4	88.2	2.87%	46.9	0.181	79.0	17.5	4.9	219.1	13.44%	1411	1340	1270	29
21:3	25.65	88.2									1409	1339	1268	
25	29.4	88.2	2.88%	47.1	0.190	83.2	19.5	5.5	224.0	13.75%	1406	1335	1265	29
30	34.4	88.2	2.91%	47.6	0.200	88.0	20.4	5.8	229.6	14.09%	1400	1330	1260	29
35	39.4	88.2	2.93%	47.9	0.209	91.9	21.5	6.1	234.1	14.36%	1396	1326	1256	29
40	44.4	88.2	2.95%	48.2	0.215	94.7	22.5	6.4	237.5	14.57%	1392	1323	1253	29
21	25.4										1410	1339	1269	

RZ

RZ

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H2)

R2

TENDON: 53H2 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1653 FIELD: 1457 AVERAGE: 1555 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 60 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE -(KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	0.0	2.57%	42.0	0.090	39.5	6.0	1.7	83.2	5.35%	1472	1398	1325	12
3	7.4	0.0	2.60%	42.5	0.110	48.5	8.5	2.4	93.4	6.01%	1462	1388	1315	12
5	9.4	0.0	2.68%	43.8	0.123	54.1	10.0	2.8	100.7	6.48%	1454	1381	1309	12
10	14.4	0.0	2.76%	45.1	0.150	66.0	13.5	3.8	114.9	7.39%	1440	1368	1296	12
15	19.4	0.0	2.81%	45.9	0.167	73.6	15.5	4.4	123.9	7.97%	1431	1359	1288	12
17	21.4	0.0									1428	1357	1285	
20	24.4	0.0	2.87%	46.9	0.181	79.0	17.5	4.9	130.8	8.41%	1424	1353	1282	12
21:3	25.65	0.0									1423	1352	1281	
25	29.4	0.0	2.88%	47.1	0.190	83.2	19.5	5.5	135.8	8.73%	1419	1348	1277	12
30	34.4	0.0	2.91%	47.6	0.200	88.0	20.4	5.8	141.4	9.09%	1414	1343	1272	12
35	39.4	0.0	2.93%	47.9	0.209	91.9	21.5	6.1	145.9	9.38%	1409	1339	1268	12
40	44.4	0.0	2.95%	48.2	0.215	94.7	22.5	6.4	149.3	9.60%	1406	1335	1265	12
21	25.4										1423	1352	1281	

R2

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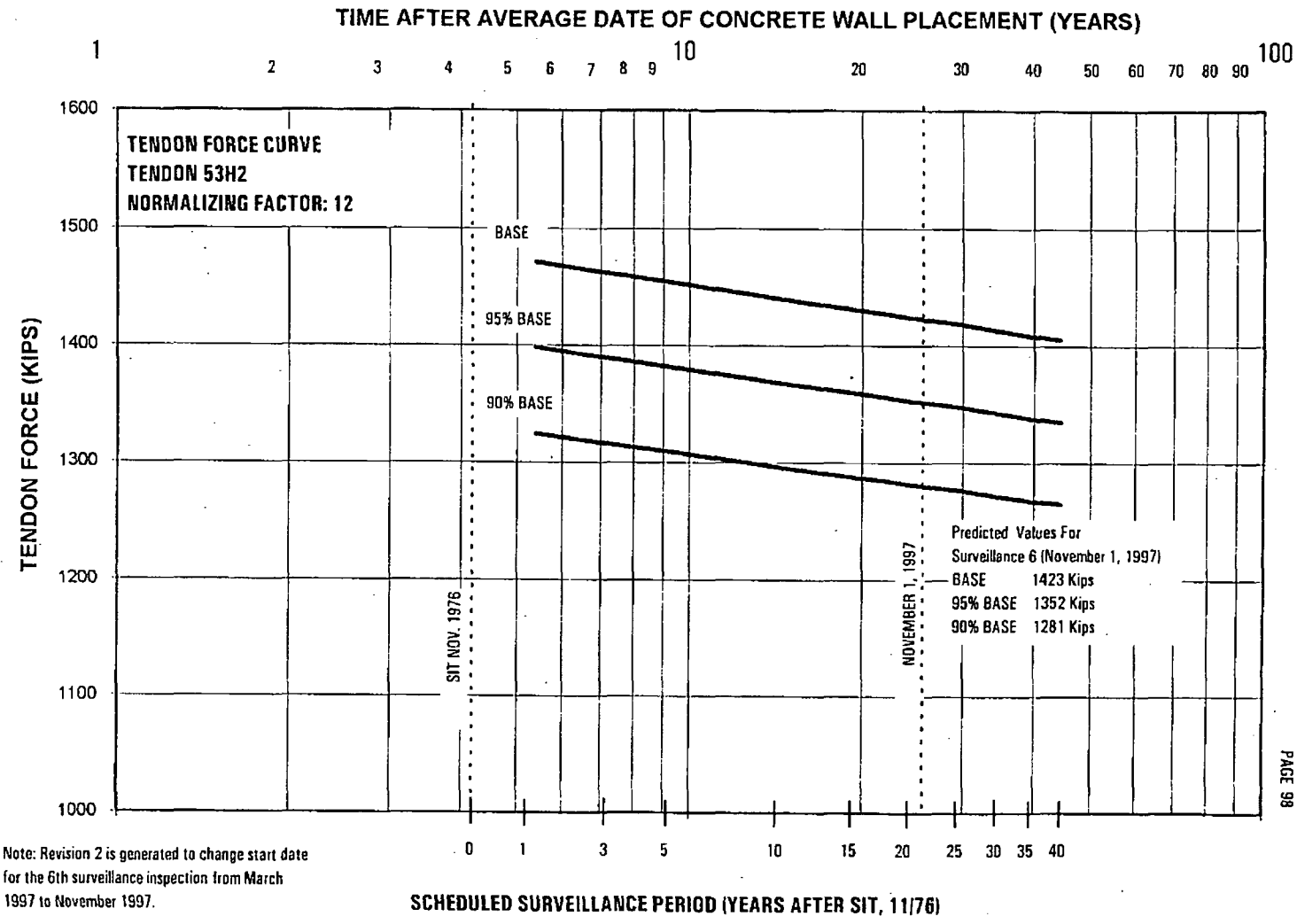

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H3)

TENDON: 53H3 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1616 FIELD: 1607 AVERAGE: 1612 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 20 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	88.2	2.57%	42.0	0.090	39.5	6.0	1.7	171.4	10.64%	1440	1368	1296	46
3	7.4	88.2	2.60%	42.5	0.110	48.5	8.5	2.4	181.6	11.27%	1430	1358	1287	46
5	9.4	88.2	2.68%	43.8	0.123	54.1	10.0	2.8	188.9	11.72%	1423	1352	1280	46
10	14.4	88.2	2.76%	45.1	0.150	66.0	13.5	3.8	203.1	12.61%	1408	1338	1268	46
15	19.4	88.2	2.81%	45.9	0.167	73.6	15.5	4.4	212.1	13.16%	1399	1329	1260	46
17	21.4	88.2									1397	1327	1257	
20	24.4	88.2	2.87%	46.9	0.181	79.0	17.5	4.9	219.1	13.59%	1393	1323	1253	46
21:3	25.65	88.2									1391	1322	1252	
25	29.4	88.2	2.88%	47.1	0.190	83.2	19.5	5.5	224.0	13.90%	1388	1318	1249	46
30	34.4	88.2	2.91%	47.6	0.200	88.0	20.4	5.8	229.6	14.25%	1382	1313	1244	46
35	39.4	88.2	2.93%	47.9	0.209	91.9	21.5	6.1	234.1	14.53%	1377	1309	1240	46
40	44.4	88.2	2.95%	48.2	0.215	94.7	22.5	6.4	237.5	14.74%	1374	1305	1237	46
21	25.4										1392	1322	1252	

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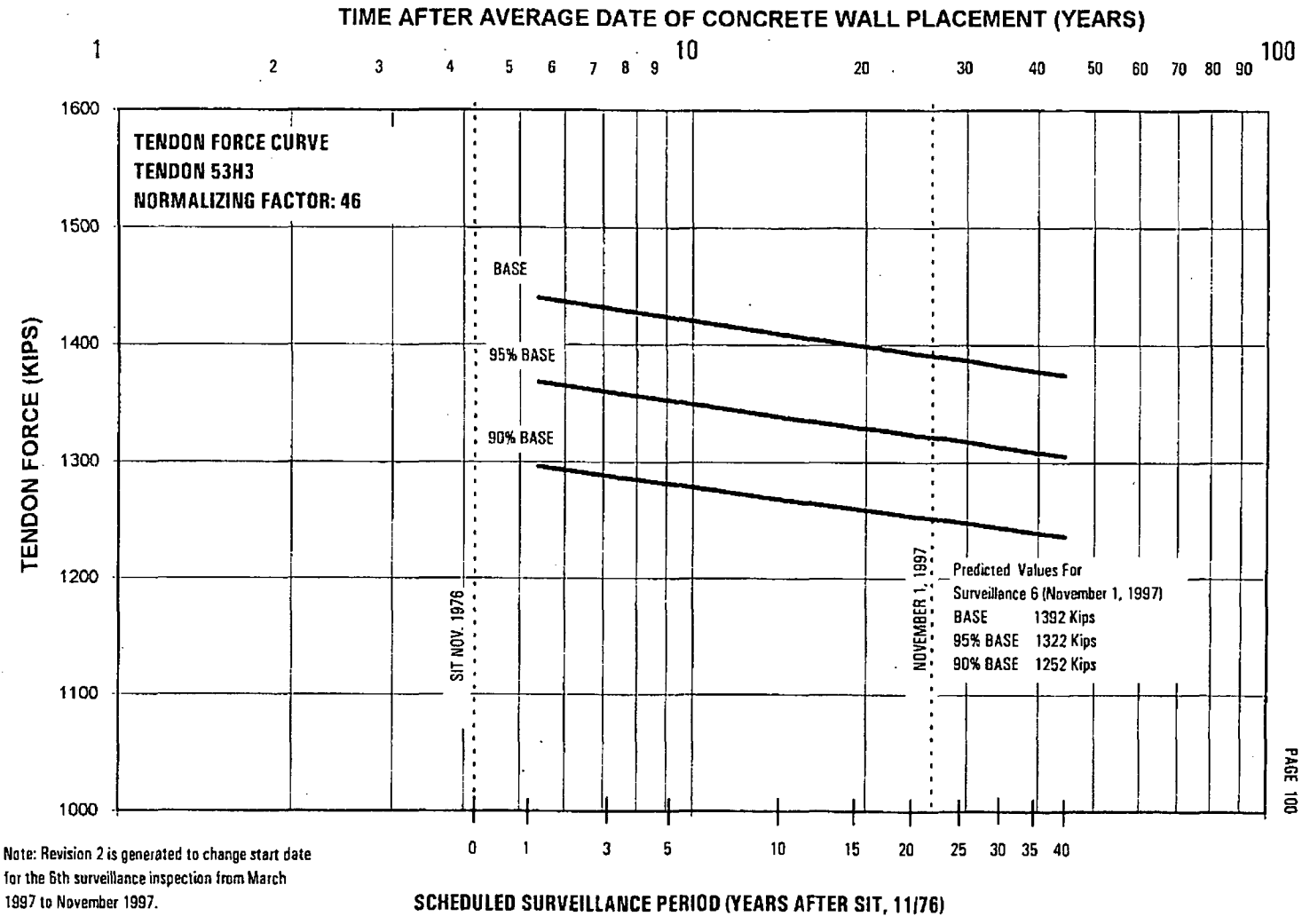

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H45)

TENDON: 53H45 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1605 FIELD: 1663 AVERAGE: 1634 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 3 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	127.3	2.57%	42.0	0.090	39.5	6.0	1.7	210.5	12.88%	1424	1353	1281	62
3	7.4	127.3	2.60%	42.5	0.110	48.5	8.5	2.4	220.7	13.50%	1414	1343	1272	62
5	9.4	127.3	2.68%	43.8	0.123	54.1	10.0	2.8	228.0	13.95%	1406	1336	1266	62
10	14.4	127.3	2.76%	45.1	0.150	66.0	13.5	3.8	242.2	14.82%	1392	1322	1253	62
15	19.4	127.3	2.81%	45.9	0.167	73.6	15.5	4.4	251.2	15.37%	1383	1314	1245	62
17	21.4	127.3									1380	1311	1242	
20	24.4	127.3	2.87%	46.9	0.181	79.0	17.5	4.9	258.1	15.80%	1376	1307	1238	62
21:3	25.65	127.3									1375	1306	1237	
25	29.4	127.3	2.88%	47.1	0.190	83.2	19.5	5.5	263.1	16.10%	1371	1303	1234	62
30	34.4	127.3	2.91%	47.6	0.200	88.0	20.4	5.8	268.7	16.44%	1366	1297	1229	62
35	39.4	127.3	2.93%	47.9	0.209	91.9	21.5	6.1	273.2	16.72%	1361	1293	1225	62
40	44.4	127.3	2.95%	48.2	0.215	94.7	22.5	6.4	276.6	16.92%	1358	1290	1222	62
21	25.4										1375	1306	1238	

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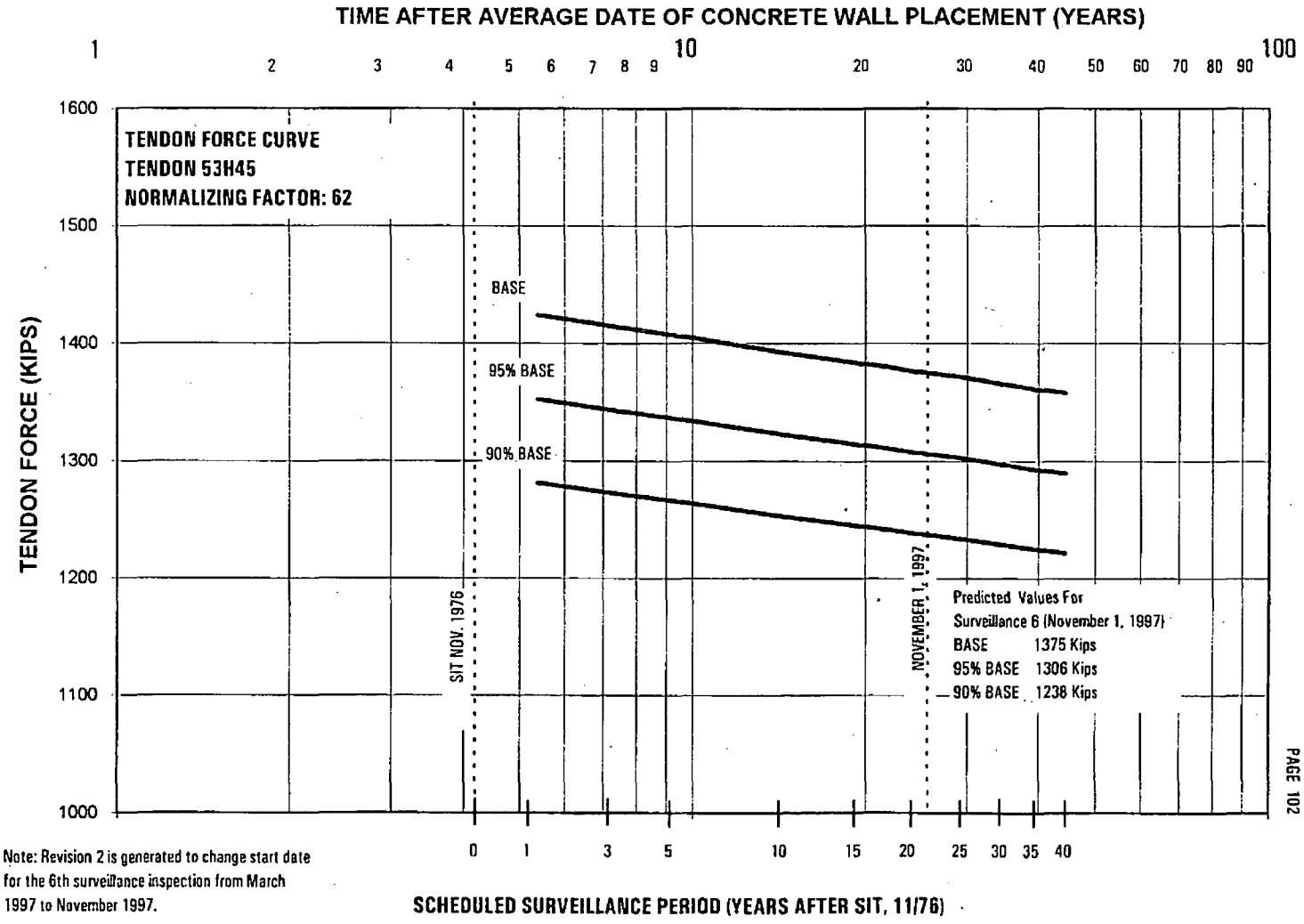

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H46)

TENDON: 53H46 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1612 FIELD: 1644 AVERAGE: 1628 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 49 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	24.6	2.57%	42.0	0.090	39.5	6.0	1.7	107.8	6.62%	1520	1444	1368	-35
3	7.4	24.6	2.60%	42.5	0.110	48.5	8.5	2.4	118.0	7.25%	1510	1435	1359	-35
5	9.4	24.6	2.68%	43.8	0.123	54.1	10.0	2.8	125.3	7.69%	1503	1428	1352	-35
10	14.4	24.6	2.76%	45.1	0.150	66.0	13.5	3.8	139.5	8.57%	1489	1414	1340	-35
15	19.4	24.6	2.81%	45.9	0.167	73.6	15.5	4.4	148.4	9.12%	1480	1406	1332	-35
17	21.4	24.6									1477	1403	1329	
20	24.4	24.6	2.87%	46.9	0.181	79.0	17.5	4.9	155.4	9.55%	1473	1399	1325	-35
21:3	25.65	24.6									1471	1398	1324	
25	29.4	24.6	2.88%	47.1	0.190	83.2	19.5	5.5	160.4	9.85%	1468	1394	1321	-35
30	34.4	24.6	2.91%	47.6	0.200	88.0	20.4	5.8	165.9	10.19%	1462	1389	1316	-35
35	39.4	24.6	2.93%	47.9	0.209	91.9	21.5	6.1	170.4	10.47%	1458	1385	1312	-35
40	44.4	24.6	2.95%	48.2	0.215	94.7	22.5	6.4	173.8	10.68%	1454	1382	1309	-35
21	25.4										1472	1398	1324	

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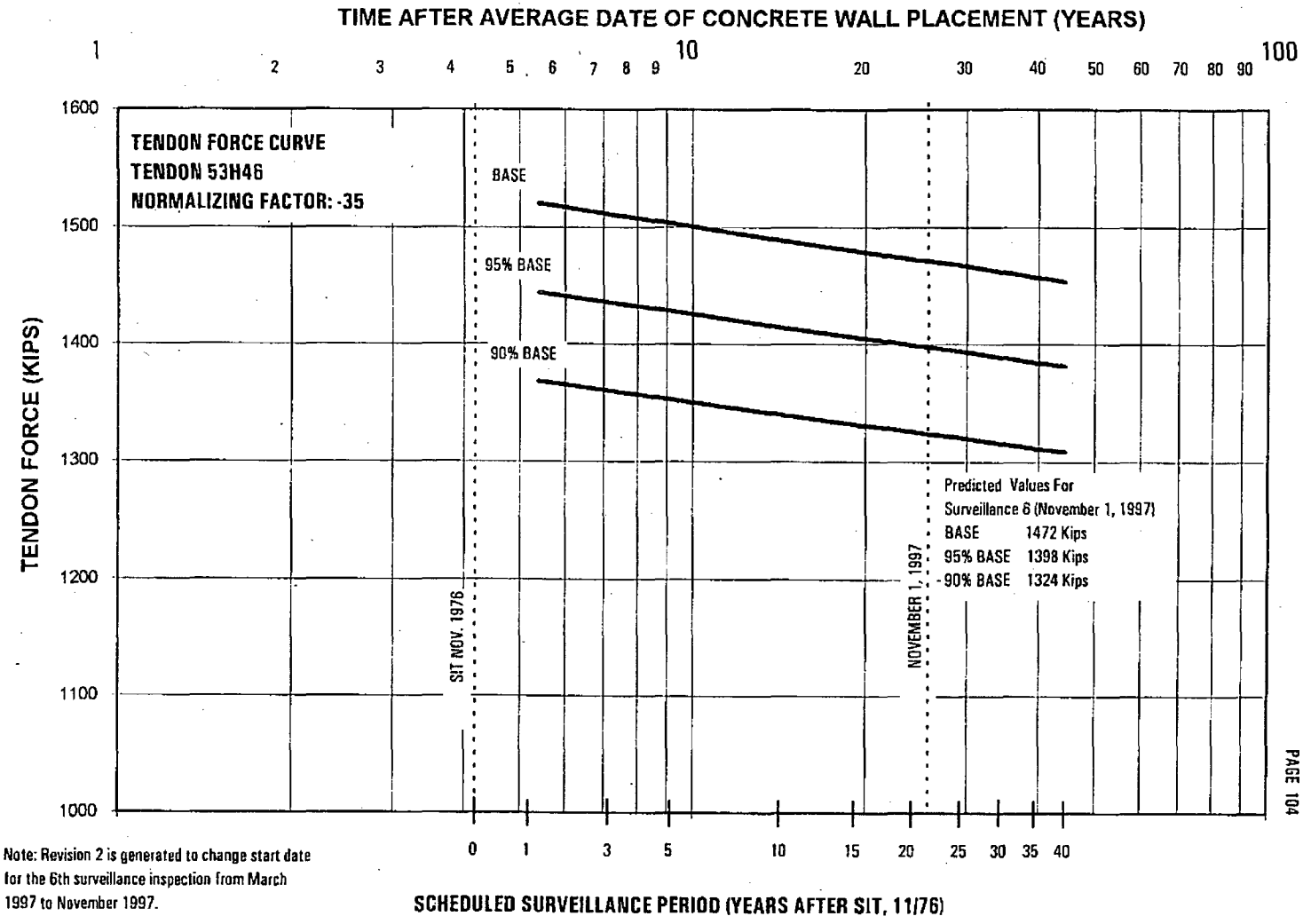

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (53H47)

TENDON: 53H47 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1677 FIELD: 1699 AVERAGE: 1688 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 3 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	127.3	2.57%	42.0	0.090	39.5	6.0	1.7	210.5	12.47%	1478	1404	1330	10
3	7.4	127.3	2.60%	42.5	0.110	48.5	8.5	2.4	220.7	13.07%	1468	1394	1321	10
5	9.4	127.3	2.68%	43.8	0.123	54.1	10.0	2.8	228.0	13.51%	1460	1387	1314	10
10	14.4	127.3	2.76%	45.1	0.150	66.0	13.5	3.8	242.2	14.35%	1446	1374	1301	10
15	19.4	127.3	2.81%	45.9	0.167	73.6	15.5	4.4	251.2	14.88%	1437	1365	1293	10
17	21.4	127.3									1434	1363	1291	
20	24.4	127.3	2.87%	46.9	0.181	79.0	17.5	4.9	258.1	15.29%	1430	1359	1287	10
21:3	25.65	127.3									1429	1357	1286	
25	29.4	127.3	2.88%	47.1	0.190	83.2	19.5	5.5	263.1	15.58%	1425	1354	1283	10
30	34.4	127.3	2.91%	47.6	0.200	88.0	20.4	5.8	268.7	15.91%	1420	1349	1278	10
35	39.4	127.3	2.93%	47.9	0.209	91.9	21.5	6.1	273.2	16.18%	1415	1344	1274	10
40	44.4	127.3	2.95%	48.2	0.215	94.7	22.5	6.4	276.6	16.38%	1412	1341	1271	10
21	25.4										1429	1358	1286	

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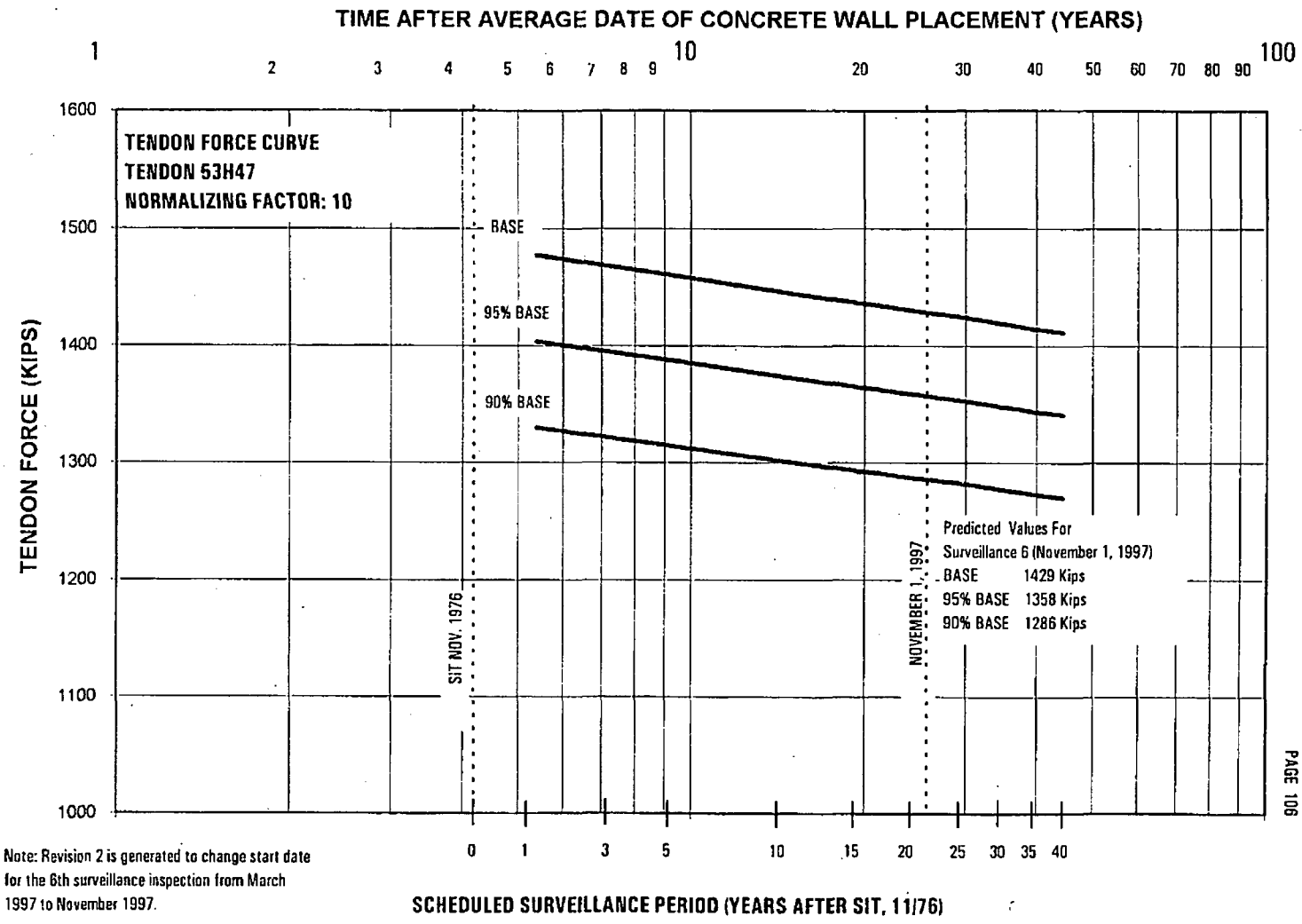

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H21)

TENDON: 62H21 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1639 FIELD: 1641 AVERAGE: 1640 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 27 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m infin	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	73.2	2.57%	42.0	0.090	39.5	6.0	1.7	156.4	9.54%	1483	1409	1335	3
3	7.4	73.2	2.60%	42.5	0.110	48.5	8.5	2.4	166.6	10.16%	1473	1399	1326	3
5	9.4	73.2	2.68%	43.8	0.123	54.1	10.0	2.8	173.9	10.61%	1466	1393	1319	3
10	14.4	73.2	2.76%	45.1	0.150	66.0	13.5	3.8	188.2	11.47%	1452	1379	1306	3
15	19.4	73.2	2.81%	45.9	0.167	73.6	15.5	4.4	197.1	12.02%	1443	1371	1298	3
17	21.4	73.2									1440	1368	1296	
20	24.4	73.2	2.87%	46.9	0.181	79.0	17.5	4.9	204.1	12.45%	1436	1364	1292	3
21:3	25.65	73.2									1434	1363	1291	
25	29.4	73.2	2.88%	47.1	0.190	83.2	19.5	5.5	209.0	12.75%	1431	1359	1288	3
30	34.4	73.2	2.91%	47.6	0.200	88.0	20.4	5.8	214.6	13.09%	1425	1354	1283	3
35	39.4	73.2	2.93%	47.9	0.209	91.9	21.5	6.1	219.1	13.36%	1421	1350	1279	3
40	44.4	73.2	2.95%	48.2	0.215	94.7	22.5	6.4	222.5	13.57%	1417	1346	1276	3
21	25.4										1435	1363	1291	

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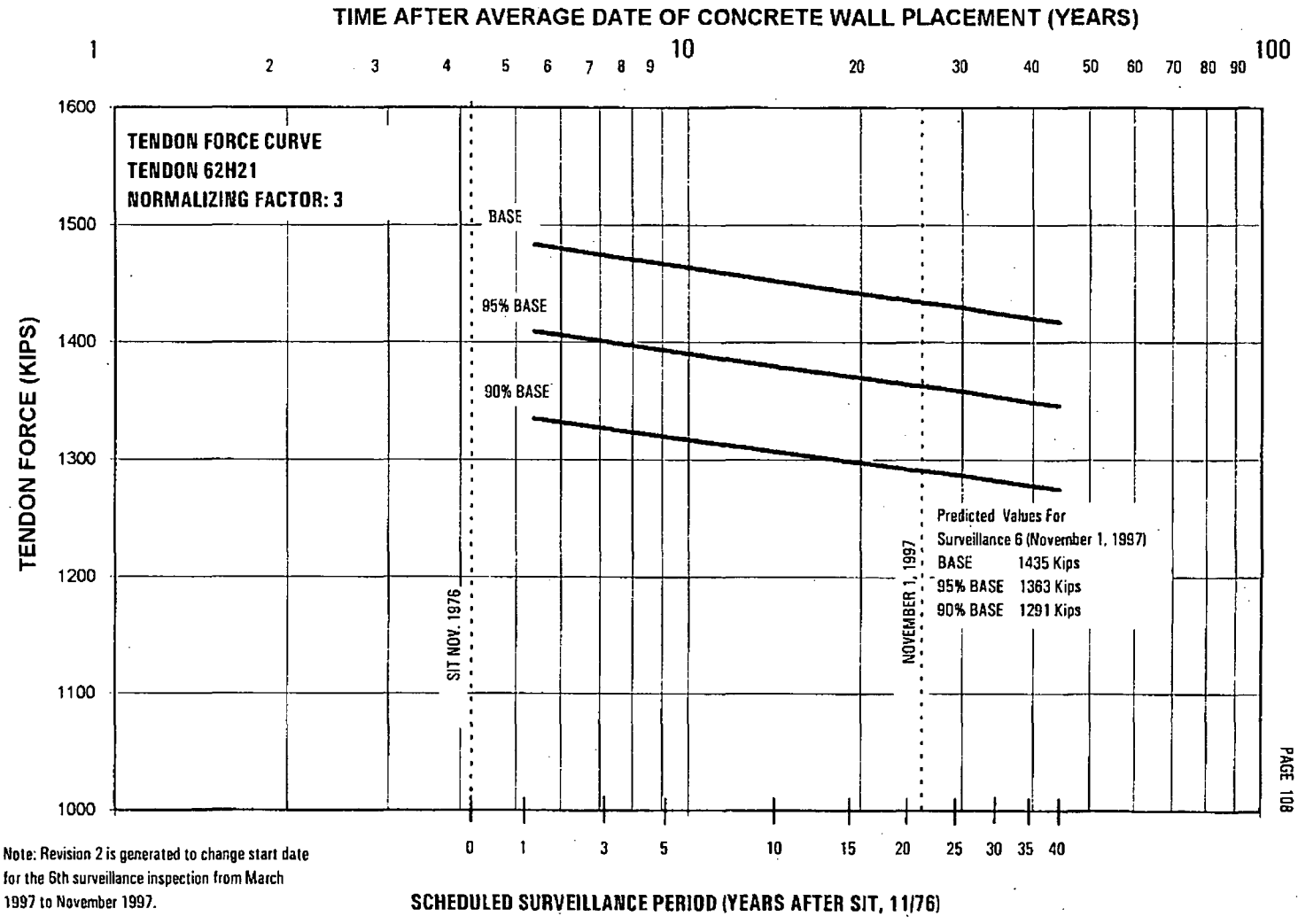

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H22)

TENDON: 62H22 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1663 FIELD: 1663 AVERAGE: 1663 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 42 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	40.2	2.57%	42.0	0.090	39.5	6.0	1.7	123.4	7.42%	1540	1463	1386	-53
3	7.4	40.2	2.60%	42.5	0.110	48.5	8.5	2.4	133.6	8.03%	1530	1453	1377	-53
5	9.4	40.2	2.68%	43.8	0.123	54.1	10.0	2.8	140.9	8.47%	1522	1446	1370	-53
10	14.4	40.2	2.76%	45.1	0.150	66.0	13.5	3.8	155.1	9.33%	1508	1433	1357	-53
15	19.4	40.2	2.81%	45.9	0.167	73.6	15.5	4.4	164.1	9.87%	1499	1424	1349	-53
17	21.4	40.2									1496	1421	1347	
20	24.4	40.2	2.87%	46.9	0.181	79.0	17.5	4.9	171.0	10.28%	1492	1417	1343	-53
21:3	25.65	40.2									1491	1416	1342	
25	29.4	40.2	2.88%	47.1	0.190	83.2	19.5	5.5	176.0	10.58%	1487	1413	1338	-53
30	34.4	40.2	2.91%	47.6	0.200	88.0	20.4	5.8	181.6	10.92%	1482	1407	1333	-53
35	39.4	40.2	2.93%	47.9	0.209	91.9	21.5	6.1	186.1	11.19%	1477	1403	1329	-53
40	44.4	40.2	2.95%	48.2	0.215	94.7	22.5	6.4	189.5	11.39%	1474	1400	1326	-53
21	25.4										1491	1417	1342	

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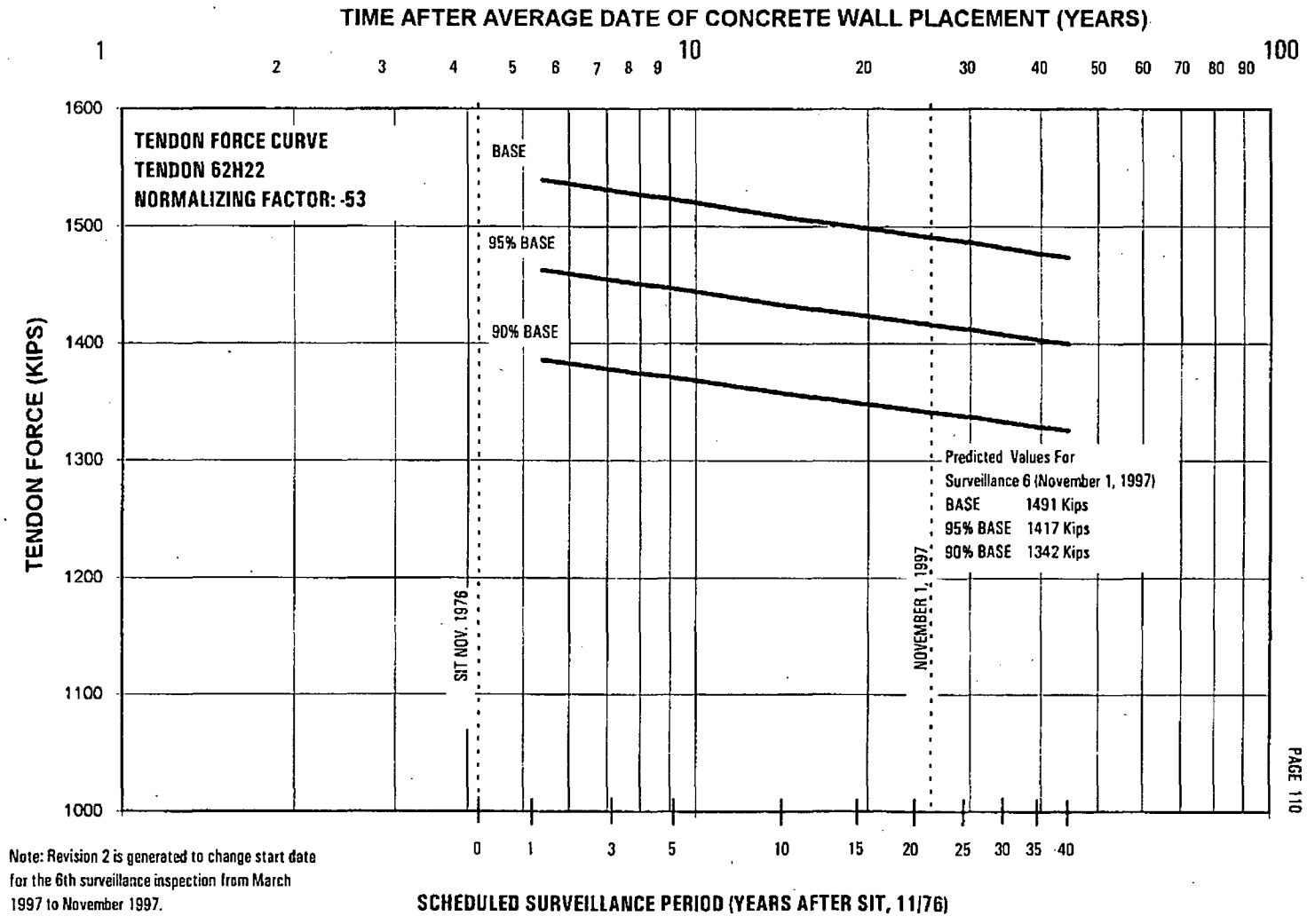

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H23)

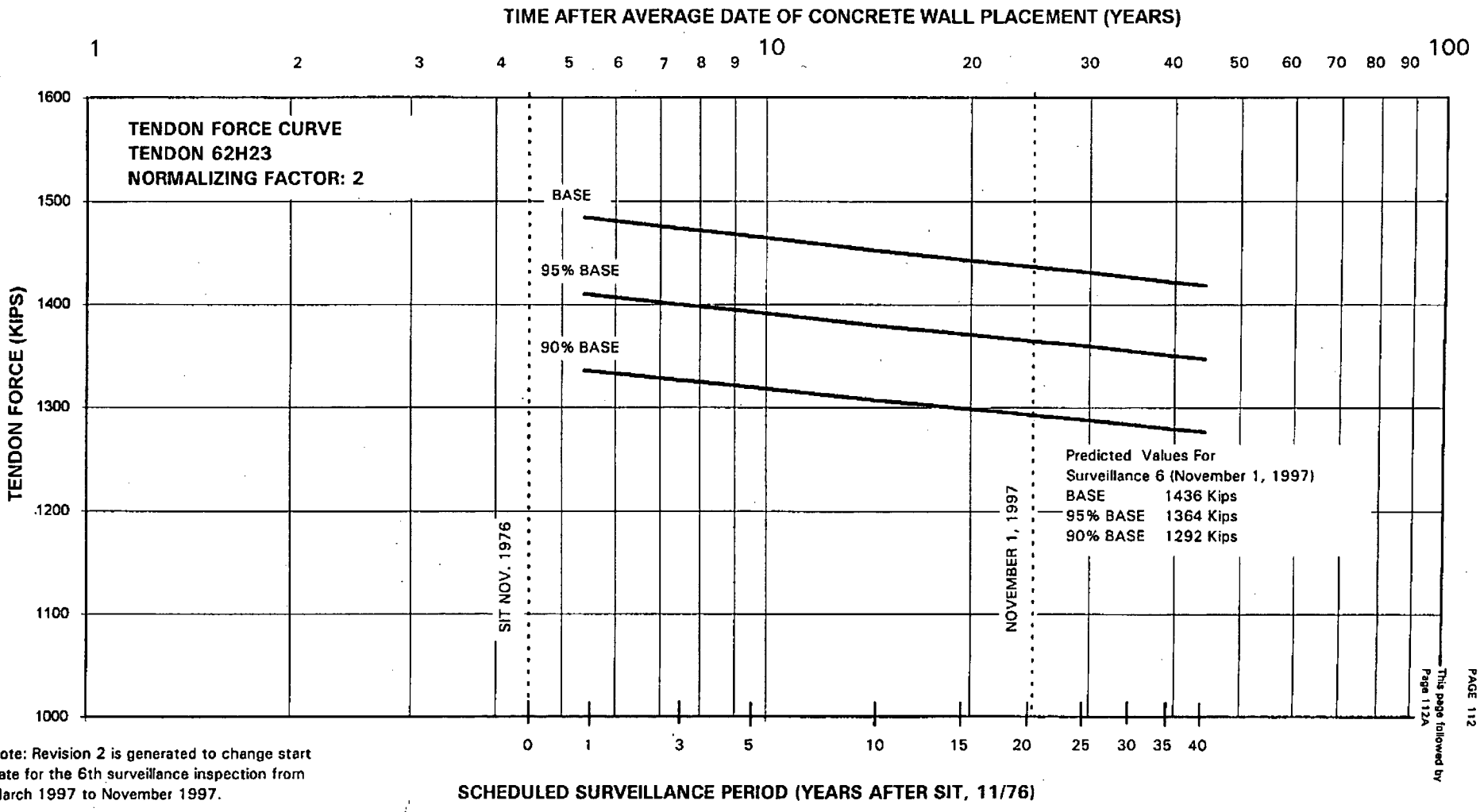
TENDON: 62H23 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1639 FIELD: 1639 AVERAGE: 1639 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 28 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	71.5	2.57%	42.0	0.090	39.5	6.0	1.7	154.7	9.44%	1484	1410	1336	2
3	7.4	71.5	2.60%	42.5	0.110	48.5	8.5	2.4	164.9	10.06%	1474	1400	1327	2
5	9.4	71.5	2.68%	43.8	0.123	54.1	10.0	2.8	172.2	10.50%	1467	1393	1320	2
10	14.4	71.5	2.76%	45.1	0.150	66.0	13.5	3.8	186.4	11.37%	1453	1380	1307	2
15	19.4	71.5	2.81%	45.9	0.167	73.6	15.5	4.4	195.3	11.92%	1444	1371	1299	2
17	21.4	71.5									1441	1369	1297	
20	24.4	71.5	2.87%	46.9	0.181	79.0	17.5	4.9	202.3	12.34%	1437	1365	1293	2
21:3	25.65	71.5									1435	1364	1292	
25	29.4	71.5	2.88%	47.1	0.190	83.2	19.5	5.5	207.3	12.65%	1432	1360	1288	2
30	34.4	71.5	2.91%	47.6	0.200	88.0	20.4	5.8	212.8	12.99%	1426	1355	1284	2
35	39.4	71.5	2.93%	47.9	0.209	91.9	21.5	6.1	217.3	13.26%	1422	1351	1279	2
40	44.4	71.5	2.95%	48.2	0.215	94.7	22.5	6.4	220.7	13.47%	1418	1347	1276	2
21	25.4										1436	1364	1292	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (62H39)

TENDON: 62H39 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1653 FIELD: 1641 AVERAGE: 1647 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 35 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	55.5	2.57%	42.0	0.090	39.5	6.0	1.7	138.7	8.42%	1508	1433	1357	-22
3	7.4	55.5	2.60%	42.5	0.110	48.5	8.5	2.4	148.9	9.04%	1498	1423	1348	-22
5	9.4	55.5	2.68%	43.8	0.123	54.1	10.0	2.8	156.2	9.48%	1491	1416	1342	-22
10	14.4	55.5	2.76%	45.1	0.150	66.0	13.5	3.8	170.4	10.35%	1476	1403	1329	-22
15	19.4	55.5	2.81%	45.9	0.167	73.6	15.5	4.4	179.4	10.89%	1468	1394	1321	-22
17	21.4	55.5									1465	1392	1318	
20	24.4	55.5	2.87%	46.9	0.181	79.0	17.5	4.9	186.3	11.31%	1461	1388	1315	-22
21:3	25.65	55.5									1459	1386	1313	
25	29.4	55.5	2.88%	47.1	0.190	83.2	19.5	5.5	191.3	11.62%	1456	1383	1310	-22
30	34.4	55.5	2.91%	47.6	0.200	88.0	20.4	5.8	196.8	11.95%	1450	1378	1305	-22
35	39.4	55.5	2.93%	47.9	0.209	91.9	21.5	6.1	201.4	12.23%	1446	1373	1301	-22
40	44.4	55.5	2.95%	48.2	0.215	94.7	22.5	6.4	204.7	12.43%	1442	1370	1298	-22
21	25.4										1460	1387	1314	

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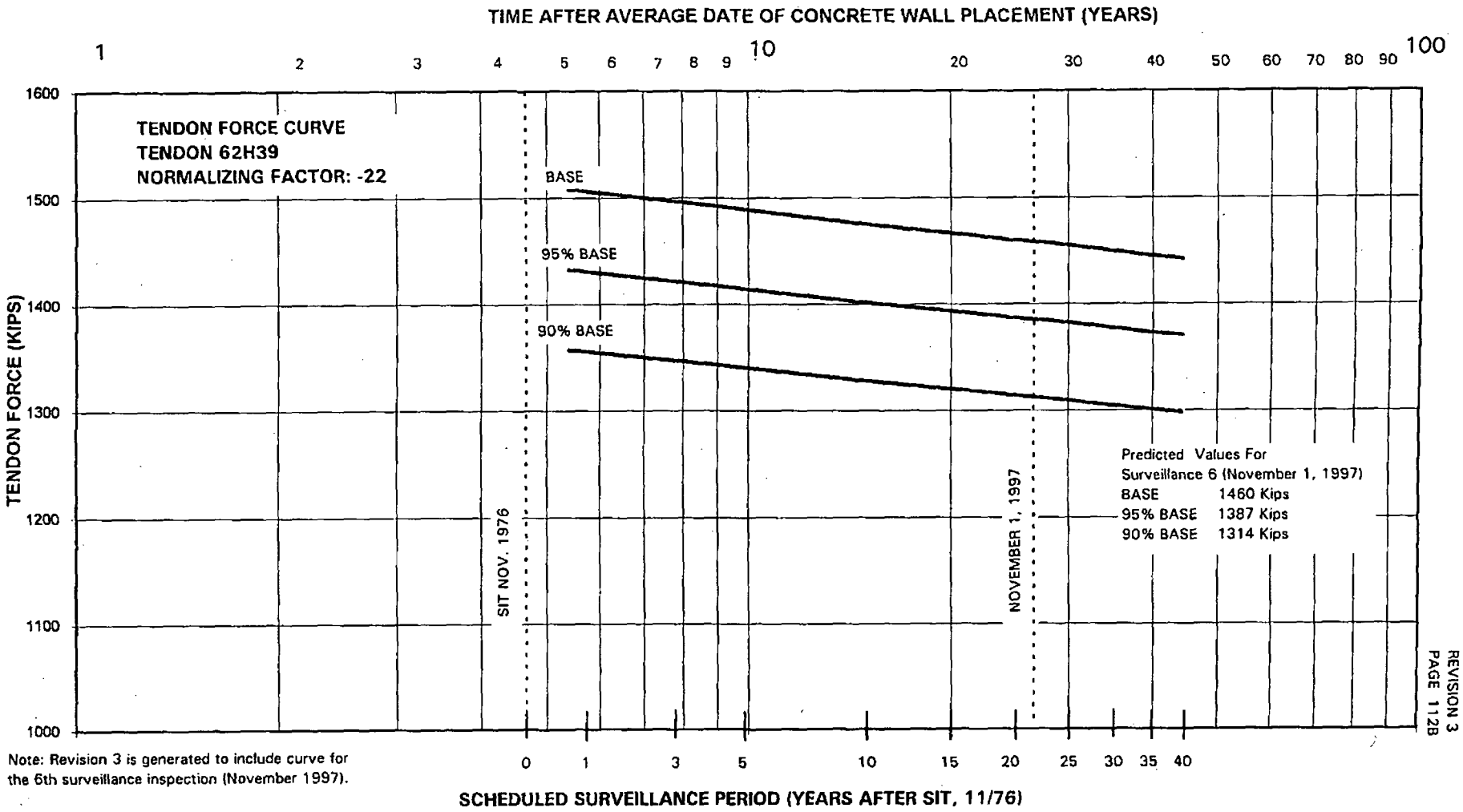
27-Jan-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H40)

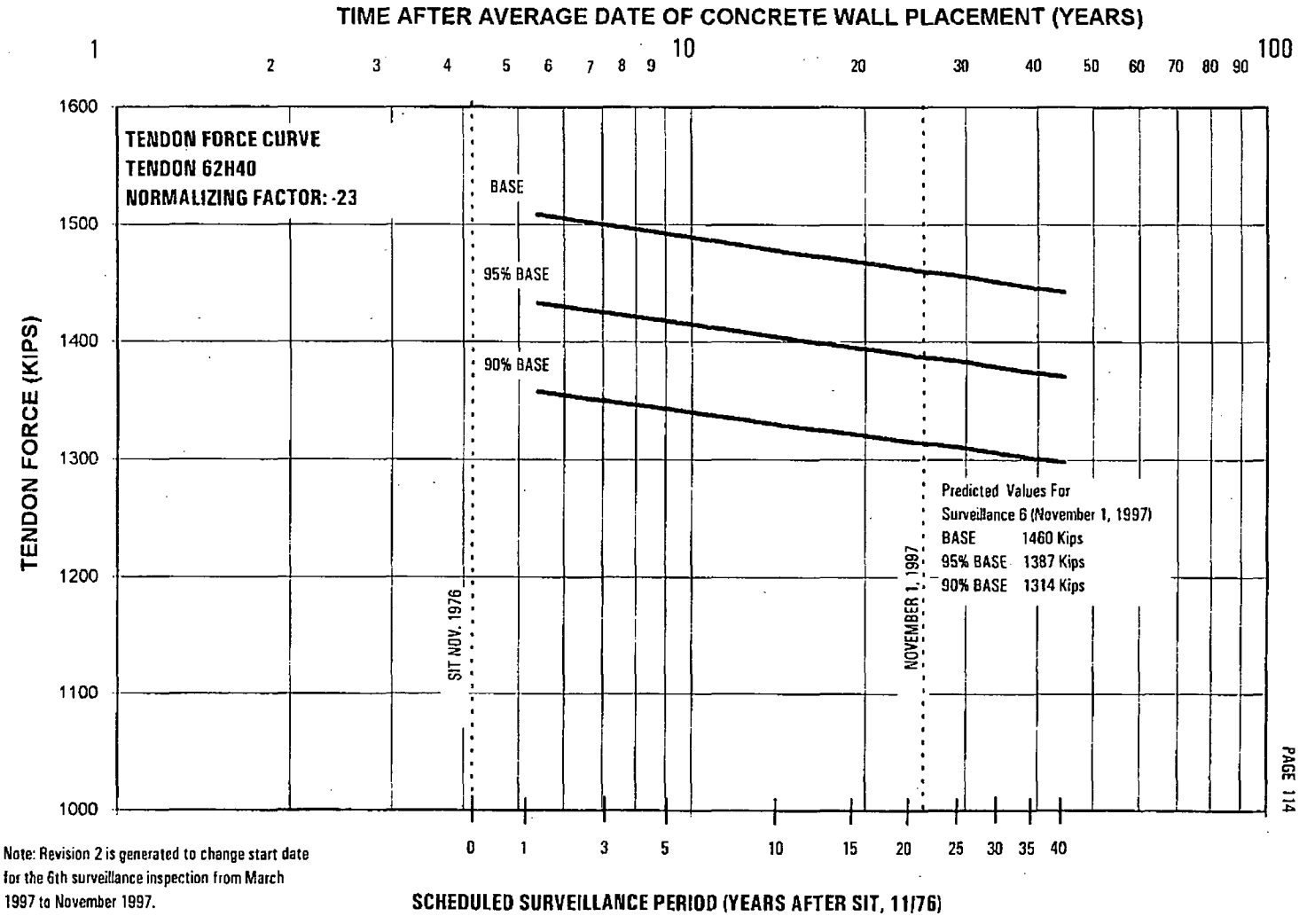
TENDON: 62H40 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1639 FIELD: 1639 AVERAGE: 1639 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 39 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	46.9	2.57%	42.0	0.090	39.5	6.0	1.7	130.1	7.94%	1509	1433	1358	-23
3	7.4	46.9	2.60%	42.5	0.110	48.5	8.5	2.4	140.3	8.56%	1499	1424	1349	-23
5	9.4	46.9	2.68%	43.8	0.123	54.1	10.0	2.8	147.6	9.01%	1491	1417	1342	-23
10	14.4	46.9	2.76%	45.1	0.150	66.0	13.5	3.8	161.8	9.87%	1477	1403	1329	-23
15	19.4	46.9	2.81%	45.9	0.167	73.6	15.5	4.4	170.8	10.42%	1468	1395	1321	-23
17	21.4	46.9									1465	1392	1319	
20	24.4	46.9	2.87%	46.9	0.181	79.0	17.5	4.9	177.7	10.84%	1461	1388	1315	-23
21:3	25.65	46.9									1460	1387	1314	
25	29.4	46.9	2.88%	47.1	0.190	83.2	19.5	5.5	182.7	11.15%	1456	1383	1311	-23
30	34.4	46.9	2.91%	47.6	0.200	88.0	20.4	5.8	188.3	11.49%	1451	1378	1306	-23
35	39.4	46.9	2.93%	47.9	0.209	91.9	21.5	6.1	192.8	11.76%	1446	1374	1302	-23
40	44.4	46.9	2.95%	48.2	0.215	94.7	22.5	6.4	196.2	11.97%	1443	1371	1299	-23
21	25.4										1460	1387	1314	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H41)

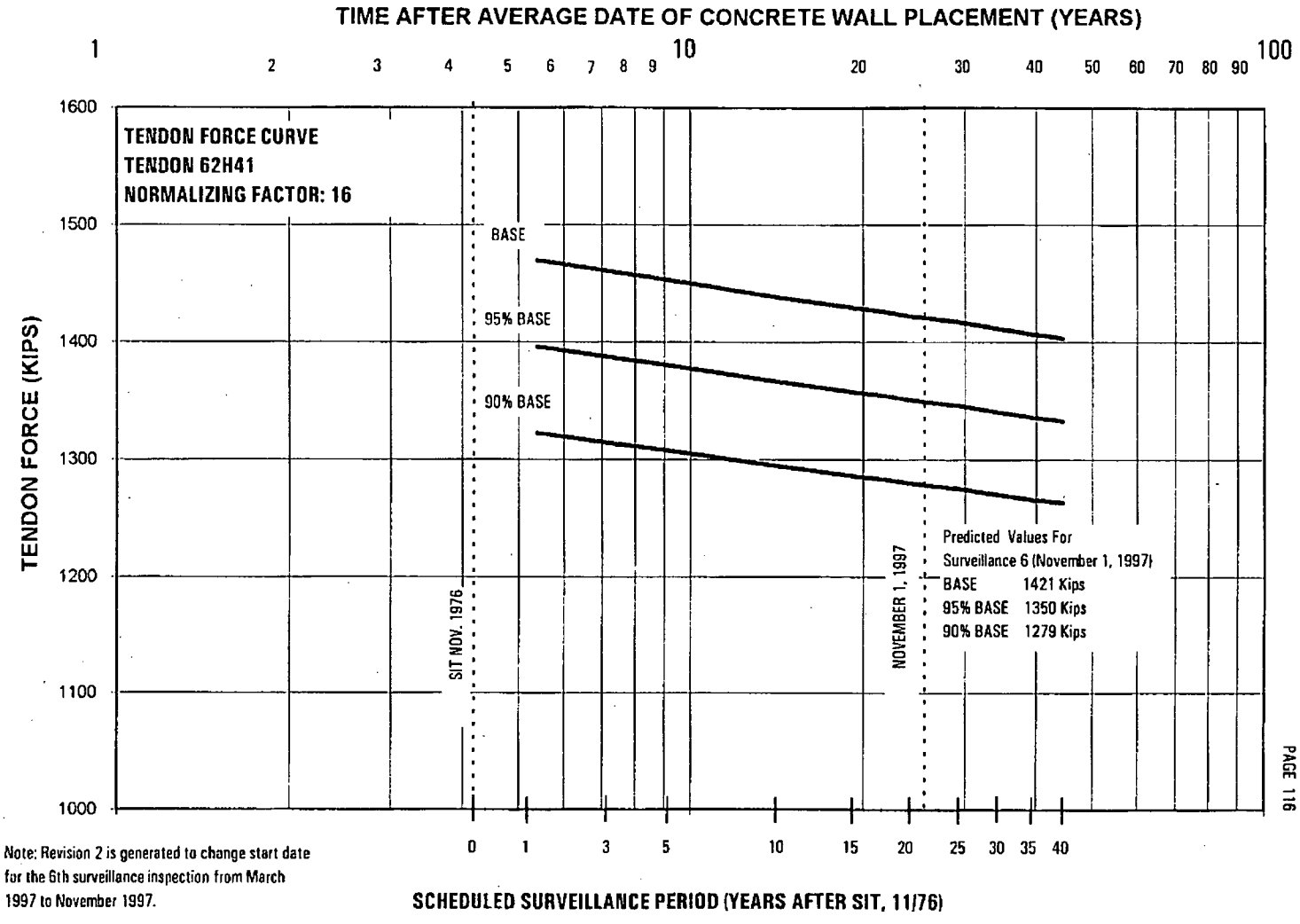
TENDON: 62H41 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1615 FIELD: 1603 AVERAGE: 1609 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 35 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	55.8	2.57%	42.0	0.090	39.5	6.0	1.7	139.0	8.64%	1470	1396	1323	16
3	7.4	55.8	2.60%	42.5	0.110	48.5	8.5	2.4	149.2	9.28%	1459	1386	1313	16
5	9.4	55.8	2.68%	43.8	0.123	54.1	10.0	2.8	156.5	9.73%	1452	1380	1307	16
10	14.4	55.8	2.76%	45.1	0.150	66.0	13.5	3.8	170.7	10.61%	1438	1366	1294	16
15	19.4	55.8	2.81%	45.9	0.167	73.6	15.5	4.4	179.7	11.17%	1429	1358	1286	16
17	21.4	55.8									1426	1355	1284	
20	24.4	55.8	2.87%	46.9	0.181	79.0	17.5	4.9	186.7	11.60%	1422	1351	1280	16
21:3	25.65	55.8									1421	1350	1279	
25	29.4	55.8	2.88%	47.1	0.190	83.2	19.5	5.5	191.6	11.91%	1417	1346	1275	16
30	34.4	55.8	2.91%	47.6	0.200	88.0	20.4	5.8	197.2	12.26%	1411	1341	1270	16
35	39.4	55.8	2.93%	47.9	0.209	91.9	21.5	6.1	201.7	12.54%	1407	1337	1266	16
40	44.4	55.8	2.95%	48.2	0.215	94.7	22.5	6.4	205.1	12.75%	1404	1333	1263	16
21	25.4										1421	1350	1279	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

RZ

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H42)

R2

TENDON: 62H42 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1615 FIELD: 1603 AVERAGE: 1609 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 39 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	46.9	2.57%	42.0	0.090	39.5	6.0	1.7	130.1	8.09%	1479	1405	1331	7
3	7.4	46.9	2.60%	42.5	0.110	48.5	8.5	2.4	140.3	8.72%	1468	1395	1322	7
5	9.4	46.9	2.68%	43.8	0.123	54.1	10.0	2.8	147.6	9.18%	1461	1388	1315	7
10	14.4	46.9	2.76%	45.1	0.150	66.0	13.5	3.8	161.8	10.06%	1447	1375	1302	7
15	19.4	46.9	2.81%	45.9	0.167	73.6	15.5	4.4	170.8	10.62%	1438	1366	1294	7
17	21.4	46.9									1435	1363	1292	
20	24.4	46.9	2.87%	46.9	0.181	79.0	17.5	4.9	177.7	11.05%	1431	1359	1288	7
21:3	25.65	46.9									1430	1358	1287	
25	29.4	46.9	2.88%	47.1	0.190	83.2	19.5	5.5	182.7	11.36%	1426	1355	1283	7
30	34.4	46.9	2.91%	47.6	0.200	88.0	20.4	5.8	188.3	11.70%	1420	1349	1278	7
35	39.4	46.9	2.93%	47.9	0.209	91.9	21.5	6.1	192.8	11.98%	1416	1345	1274	7
40	44.4	46.9	2.95%	48.2	0.215	94.7	22.5	6.4	196.2	12.19%	1413	1342	1271	7
21	25.4										1430	1358	1287	

R2

DOC ID:S-95-0082
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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H45)

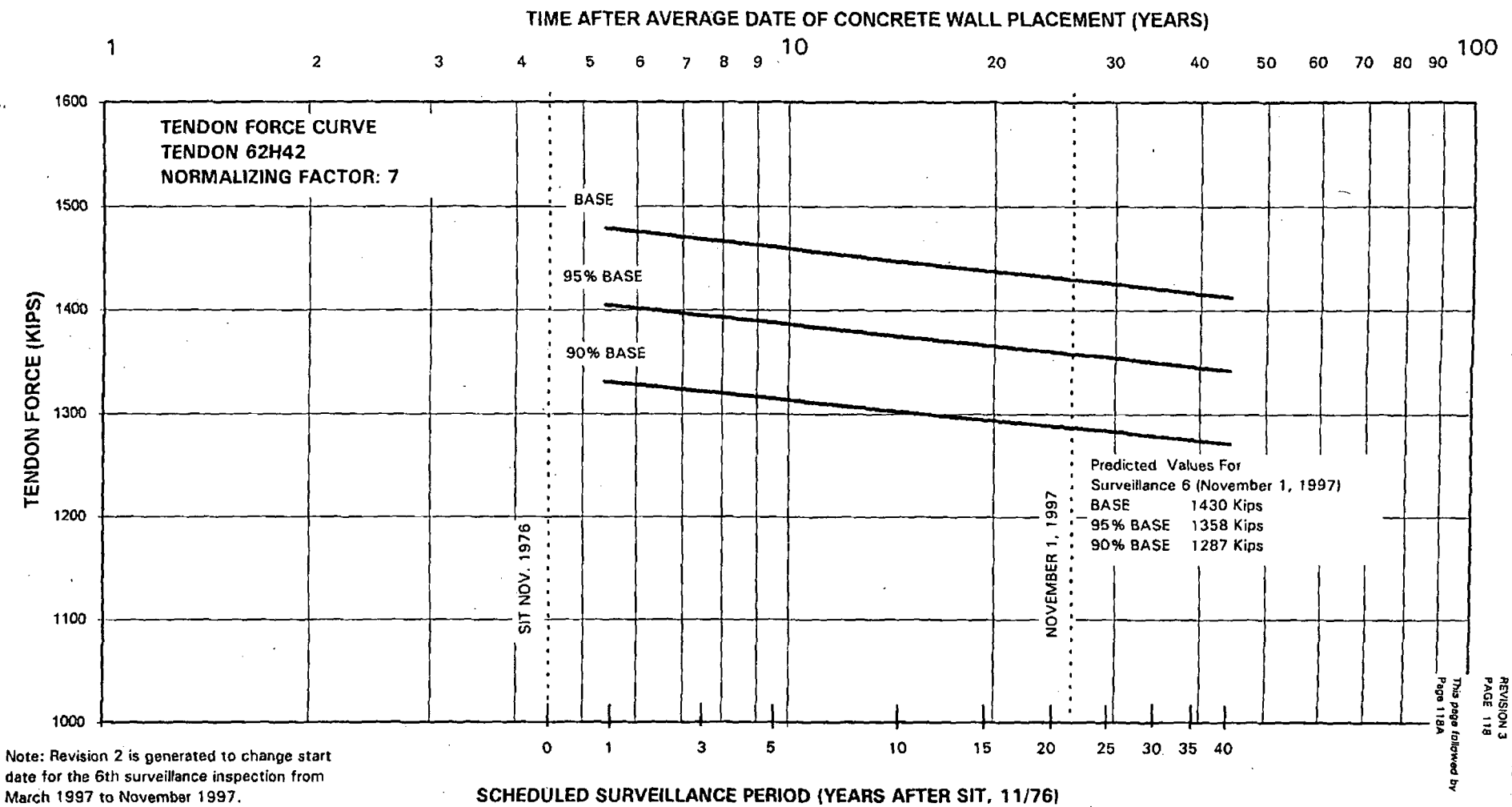
TENDON: 62H45 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1639 FIELD: 1605 AVERAGE: 1622 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 37 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	51.1	2.57%	42.0	0.090	39.5	6.0	1.7	134.2	8.28%	1487	1413	1339	-1
3	7.4	51.1	2.60%	42.5	0.110	48.5	8.5	2.4	144.5	8.91%	1477	1403	1329	-1
5	9.4	51.1	2.68%	43.8	0.123	54.1	10.0	2.8	151.8	9.36%	1470	1396	1323	-1
10	14.4	51.1	2.76%	45.1	0.150	66.0	13.5	3.8	166.0	10.23%	1456	1383	1310	-1
15	19.4	51.1	2.81%	45.9	0.167	73.6	15.5	4.4	174.9	10.79%	1447	1374	1302	-1
17	21.4	51.1									1444	1372	1299	
20	24.4	51.1	2.87%	46.9	0.181	79.0	17.5	4.9	181.9	11.22%	1440	1368	1296	-1
21:3	25.65	51.1									1438	1366	1295	
25	29.4	51.1	2.88%	47.1	0.190	83.2	19.5	5.5	186.9	11.52%	1435	1363	1291	-1
30	34.4	51.1	2.91%	47.6	0.200	88.0	20.4	5.8	192.4	11.87%	1429	1358	1286	-1
35	39.4	51.1	2.93%	47.9	0.209	91.9	21.5	6.1	196.9	12.14%	1425	1353	1282	-1
40	44.4	51.1	2.95%	48.2	0.215	94.7	22.5	6.4	200.3	12.35%	1421	1350	1279	-1
21	25.4										1439	1367	1295	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (62H43)

TENDON: 62H43 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1580 FIELD: 1602 AVERAGE: 1591 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 36 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.988

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	52.9	2.57%	42.0	0.090	39.5	6.0	1.7	136.1	8.56%	1455	1382	1309	31
3	7.4	52.9	2.60%	42.5	0.110	48.5	8.5	2.4	146.3	9.20%	1445	1372	1300	31
5	9.4	52.9	2.68%	43.8	0.123	54.1	10.0	2.8	153.6	9.66%	1437	1366	1294	31
10	14.4	52.9	2.76%	45.1	0.150	66.0	13.5	3.8	167.9	10.55%	1423	1352	1281	30
15	19.4	52.9	2.81%	45.9	0.167	73.6	15.5	4.4	176.8	11.11%	1414	1344	1273	30
17	21.4	52.9									1411	1341	1270	
20	24.4	52.9	2.87%	46.9	0.181	79.0	17.5	4.9	183.8	11.55%	1407	1337	1267	30
21:3	25.65	52.9									1406	1336	1265	
25	29.4	52.9	2.88%	47.1	0.190	83.2	19.5	5.5	188.7	11.86%	1402	1332	1262	30
30	34.4	52.9	2.91%	47.6	0.200	88.0	20.4	5.8	194.3	12.21%	1397	1327	1257	30
35	39.4	52.9	2.93%	47.9	0.209	91.9	21.5	6.1	198.8	12.50%	1392	1323	1253	30
40	44.4	52.9	2.95%	48.2	0.215	94.7	22.5	6.4	202.2	12.71%	1389	1319	1250	30
21	25.4										1406	1336	1266	

02-Feb-98

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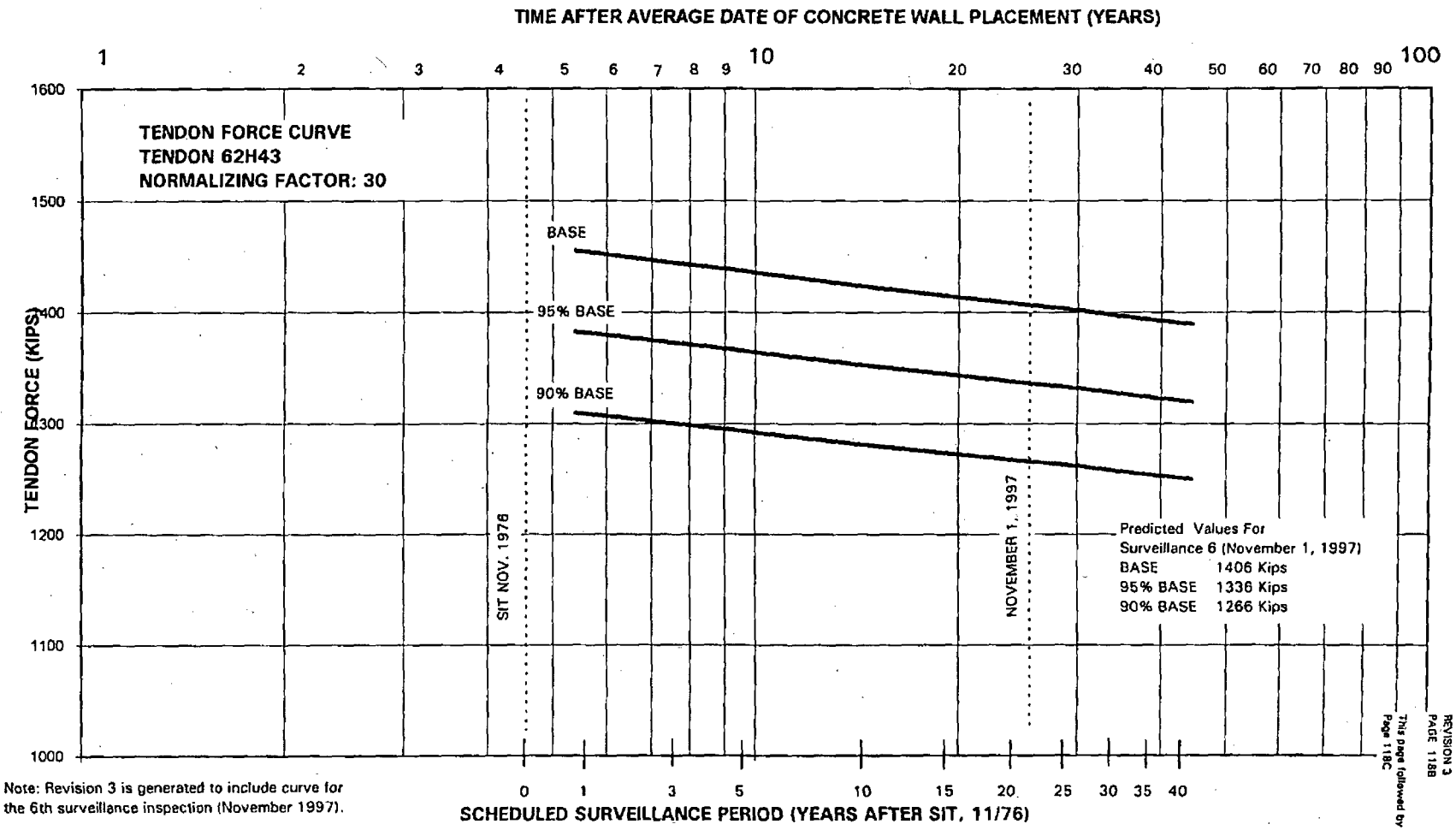
R3



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

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R3

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR3.XLW (62H44)

TENDON: 62H44 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1627 FIELD: 1675 AVERAGE: 1651 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 38 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

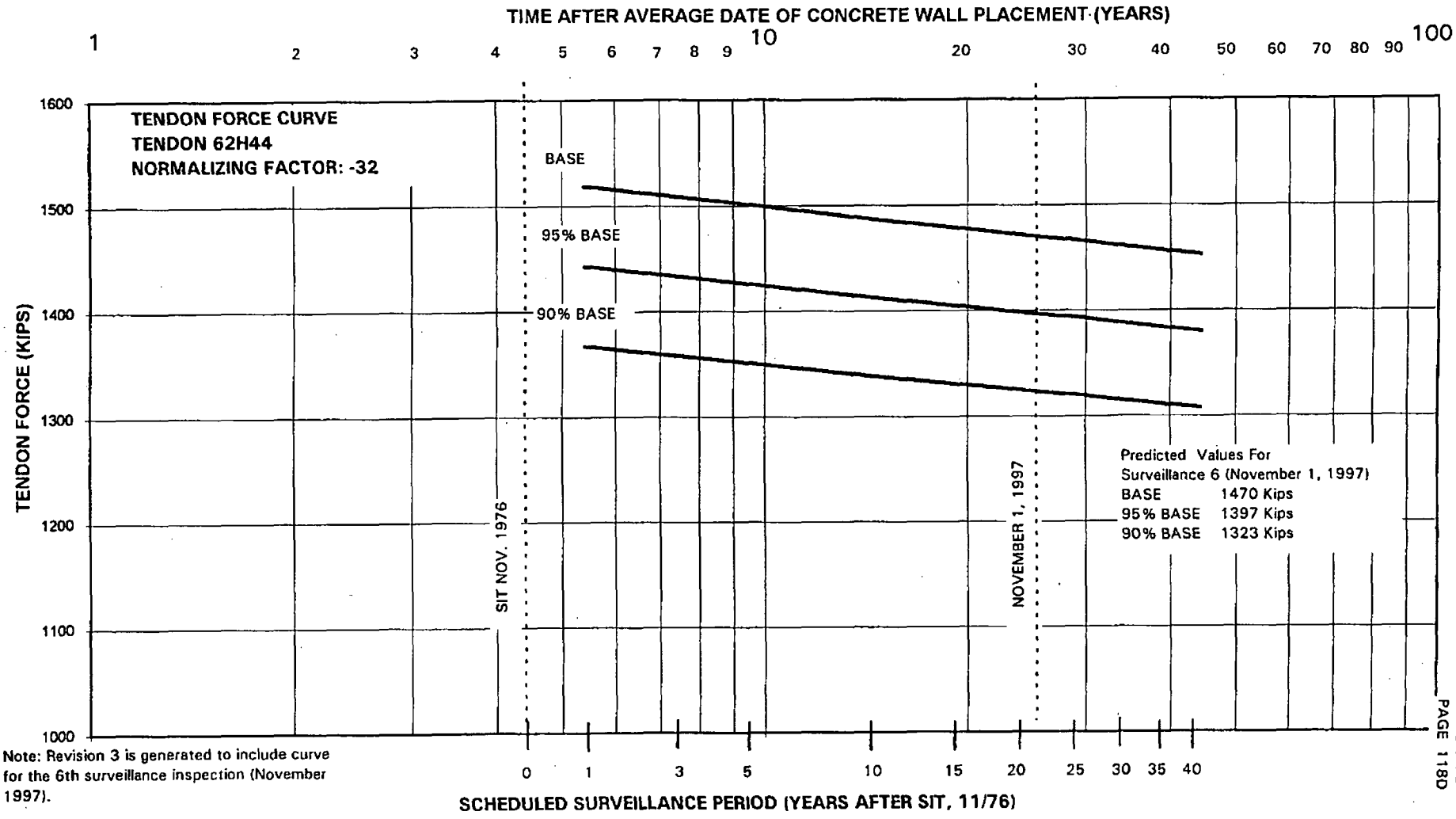
NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	49.1	2.57%	42.0	0.090	39.5	6.0	1.7	132.3	8.01%	1519	1443	1367	-32
3	7.4	49.1	2.60%	42.5	0.110	48.5	8.5	2.4	142.5	8.63%	1509	1433	1358	-32
5	9.4	49.1	2.68%	43.8	0.123	54.1	10.0	2.8	149.8	9.07%	1501	1426	1351	-32
10	14.4	49.1	2.76%	45.1	0.150	66.0	13.5	3.8	164.0	9.94%	1487	1413	1338	-32
15	19.4	49.1	2.81%	45.9	0.167	73.6	15.5	4.4	173.0	10.48%	1478	1404	1330	-32
17	21.4	49.1									1475	1402	1328	
20	24.4	49.1	2.87%	46.9	0.181	79.0	17.5	4.9	180.0	10.90%	1471	1398	1324	-32
21:3	25.65	49.1									1470	1396	1323	
25	29.4	49.1	2.88%	47.1	0.190	83.2	19.5	5.5	184.9	11.20%	1466	1393	1320	-32
30	34.4	49.1	2.91%	47.6	0.200	88.0	20.4	5.8	190.5	11.54%	1461	1388	1315	-32
35	39.4	49.1	2.93%	47.9	0.209	91.9	21.5	6.1	195.0	11.81%	1456	1383	1311	-32
40	44.4	49.1	2.95%	48.2	0.215	94.7	22.5	6.4	198.4	12.02%	1453	1380	1307	-32
21	25.4										1470	1397	1323	

This page followed by Page 118D

DOC ID: S-95-0082
REVISION 3
PAGE 118C

02-Feb-98



Note: Revision 3 is generated to include curve for the 6th surveillance inspection (November 1997).

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR1.XLW (62H45)

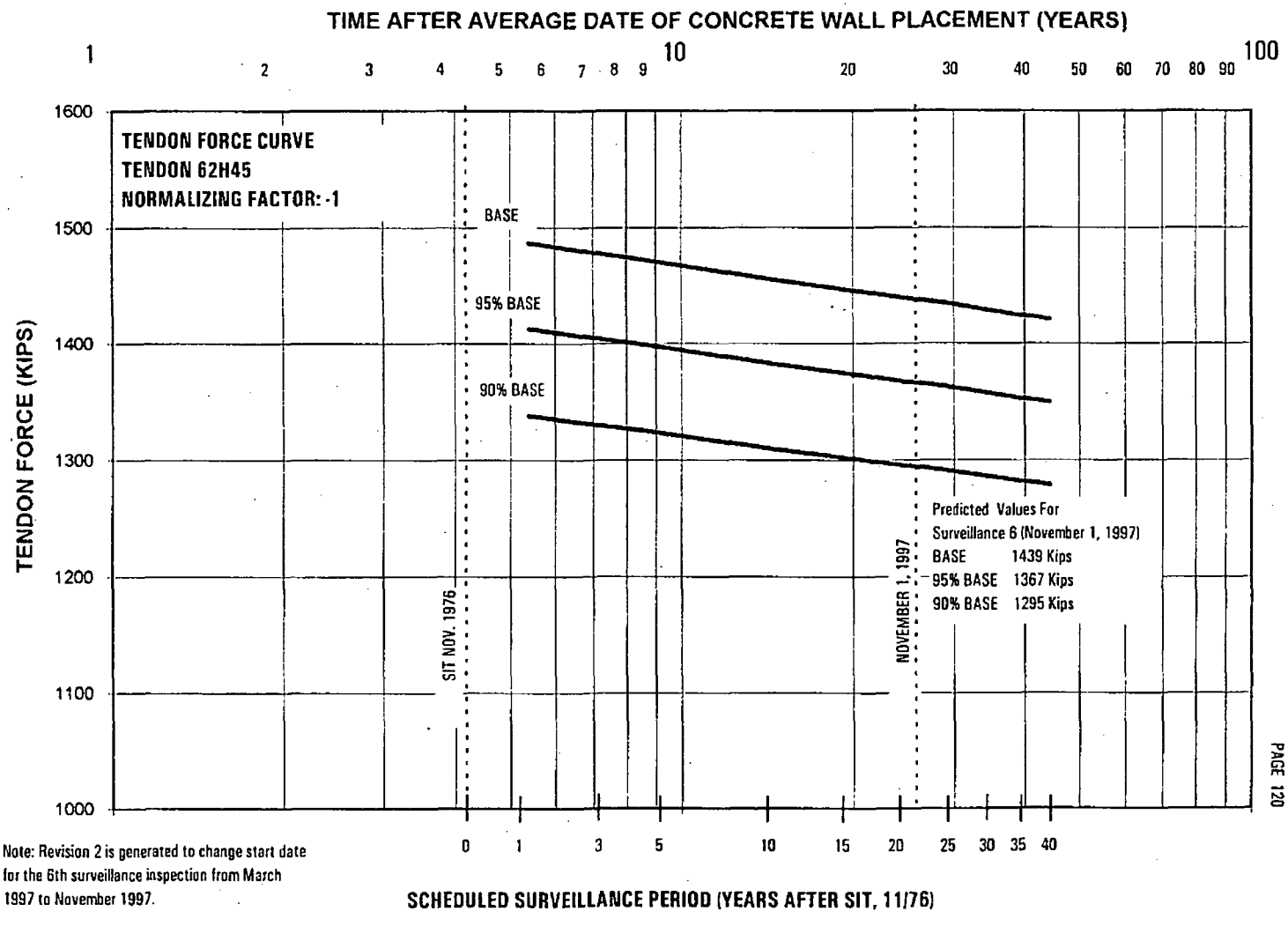
TENDON: 62H45 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1639 FIELD: 1605 AVERAGE: 1622 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 37 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.994

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	51.1	2.57%	42.0	0.090	39.5	6.0	1.7	134.2	8.28%	1487	1413	1339	-1
3	7.4	51.1	2.60%	42.5	0.110	48.5	8.5	2.4	144.5	8.91%	1477	1403	1329	-1
5	9.4	51.1	2.68%	43.8	0.123	54.1	10.0	2.8	151.8	9.36%	1470	1396	1323	-1
10	14.4	51.1	2.76%	45.1	0.150	66.0	13.5	3.8	166.0	10.23%	1456	1383	1310	-1
15	19.4	51.1	2.81%	45.9	0.167	73.6	15.5	4.4	174.9	10.79%	1447	1374	1302	-1
17	21.4	51.1									1444	1372	1299	
20	24.4	51.1	2.87%	46.9	0.181	79.0	17.5	4.9	181.9	11.22%	1440	1368	1296	-1
21:3	25.65	51.1									1438	1366	1295	
25	29.4	51.1	2.88%	47.1	0.190	83.2	19.5	5.5	186.9	11.52%	1435	1363	1291	-1
30	34.4	51.1	2.91%	47.6	0.200	88.0	20.4	5.8	192.4	11.87%	1429	1358	1286	-1
35	39.4	51.1	2.93%	47.9	0.209	91.9	21.5	6.1	196.9	12.14%	1425	1353	1282	-1
40	44.4	51.1	2.95%	48.2	0.215	94.7	22.5	6.4	200.3	12.35%	1421	1350	1279	-1
20:3	24.65										1439	1367	1295	

20-Jan-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H46)

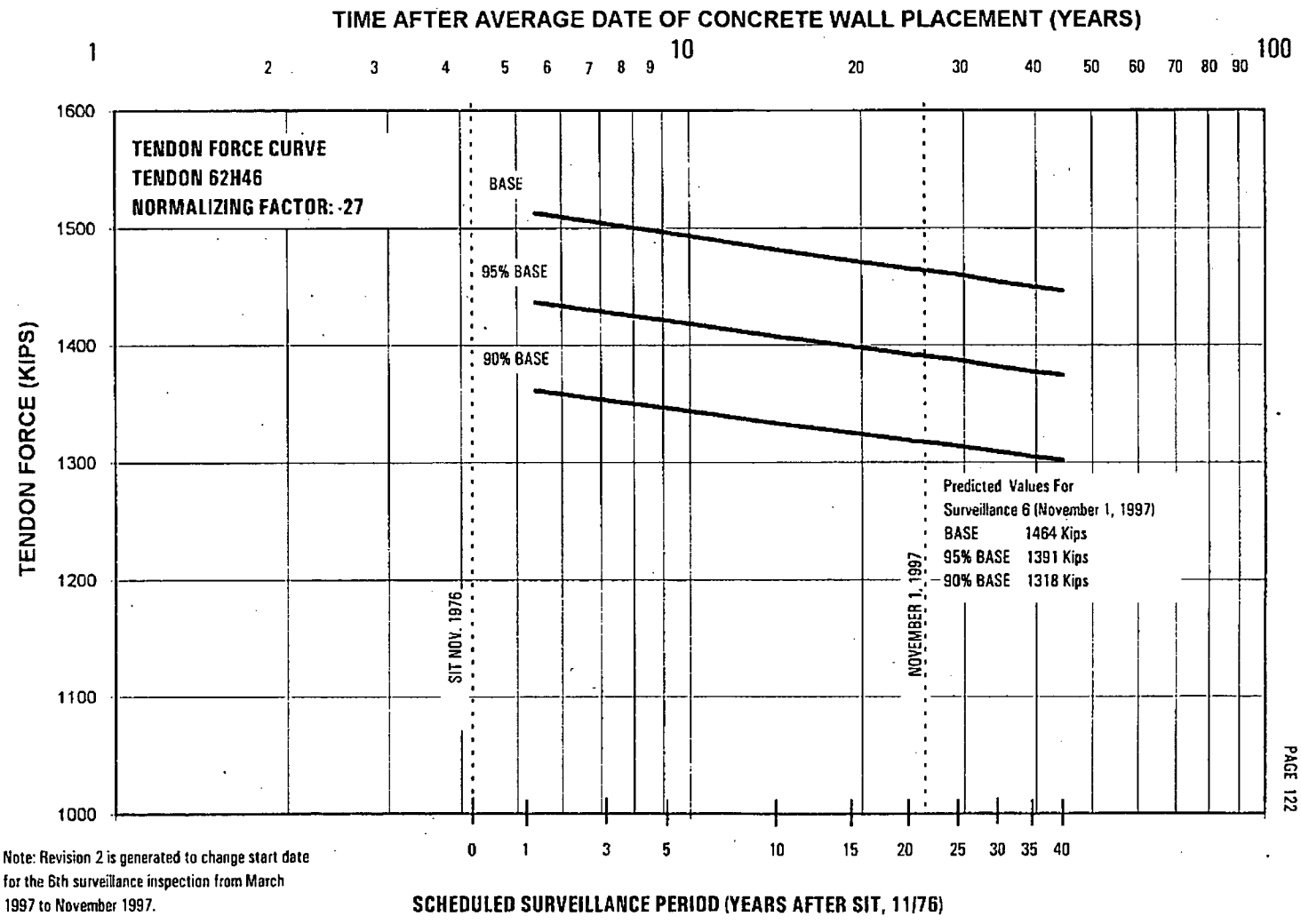
TENDON: 62H46 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1591 FIELD: 1700 AVERAGE: 1645 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 38 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	49.1	2.57%	42.0	0.090	39.5	6.0	1.7	132.3	8.04%	1513	1437	1362	-27
3	7.4	49.1	2.60%	42.5	0.110	48.5	8.5	2.4	142.5	8.66%	1503	1428	1352	-27
5	9.4	49.1	2.68%	43.8	0.123	54.1	10.0	2.8	149.8	9.11%	1495	1421	1346	-27
10	14.4	49.1	2.76%	45.1	0.150	66.0	13.5	3.8	164.0	9.97%	1481	1407	1333	-27
15	19.4	49.1	2.81%	45.9	0.167	73.6	15.5	4.4	173.0	10.52%	1472	1399	1325	-27
17	21.4	49.1									1469	1396	1322	
20	24.4	49.1	2.87%	46.9	0.181	79.0	17.5	4.9	180.0	10.94%	1465	1392	1319	-27
21:3	25.65	49.1									1464	1391	1318	
25	29.4	49.1	2.88%	47.1	0.190	83.2	19.5	5.5	184.9	11.24%	1460	1387	1314	-27
30	34.4	49.1	2.91%	47.6	0.200	88.0	20.4	5.8	190.5	11.58%	1455	1382	1309	-27
35	39.4	49.1	2.93%	47.9	0.209	91.9	21.5	6.1	195.0	11.85%	1450	1378	1305	-27
40	44.4	49.1	2.95%	48.2	0.215	94.7	22.5	6.4	198.4	12.06%	1447	1374	1302	-27
21	25.4										1464	1391	1318	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
HOOP TENDON LOSSES WORK SHEET
FILE: HOOPR2.XLW (62H47)

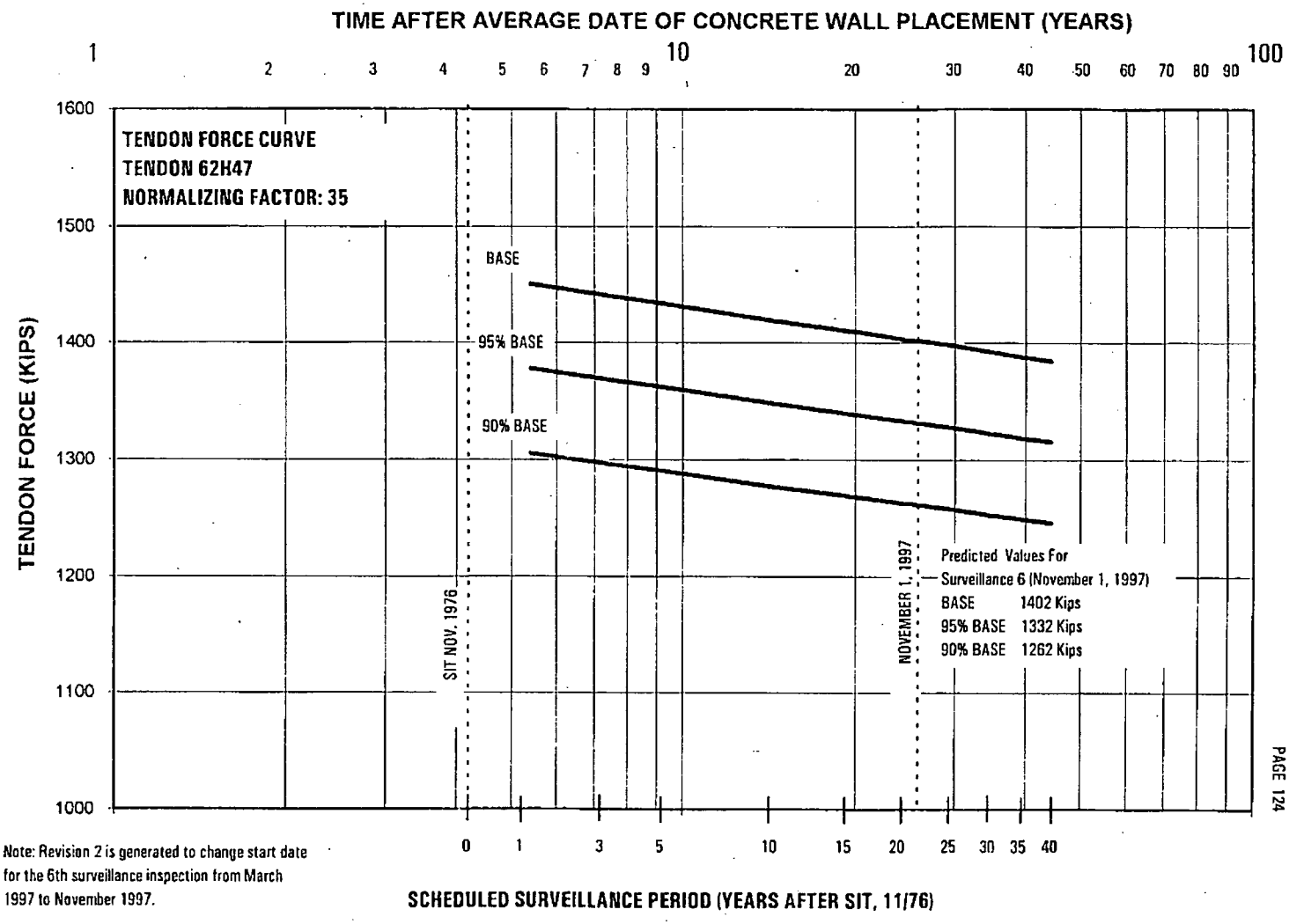
TENDON: 62H47 INITIAL CONCRETE STRESS (PSI): 1732

ORIGINAL FORCES (KIPS): SHOP: 1590 FIELD: 1575 AVERAGE: 1582 AVERAGE ALL HOOP TENDONS: 1635
STRESS SEQUENCE: 38 OF 60 TOTAL ELASTIC SHORT. LOSS: 134.0 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM HOOPINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	48.2	2.57%	42.0	0.090	39.5	6.0	1.7	131.4	8.31%	1451	1378	1306	35
3	7.4	48.2	2.60%	42.5	0.110	48.5	8.5	2.4	141.6	8.95%	1441	1369	1296	35
5	9.4	48.2	2.68%	43.8	0.123	54.1	10.0	2.8	148.9	9.41%	1433	1362	1290	35
10	14.4	48.2	2.76%	45.1	0.150	66.0	13.5	3.8	163.1	10.31%	1419	1348	1277	35
15	19.4	48.2	2.81%	45.9	0.167	73.6	15.5	4.4	172.1	10.88%	1410	1340	1269	35
17	21.4	48.2									1407	1337	1267	
20	24.4	48.2	2.87%	46.9	0.181	79.0	17.5	4.9	179.1	11.32%	1403	1333	1263	35
21:3	25.65	48.2									1402	1332	1262	
25	29.4	48.2	2.88%	47.1	0.190	83.2	19.5	5.5	184.0	11.63%	1398	1328	1258	35
30	34.4	48.2	2.91%	47.6	0.200	88.0	20.4	5.8	189.6	11.98%	1393	1323	1253	35
35	39.4	48.2	2.93%	47.9	0.209	91.9	21.5	6.1	194.1	12.27%	1388	1319	1249	35
40	44.4	48.2	2.95%	48.2	0.215	94.7	22.5	6.4	197.5	12.48%	1385	1315	1246	35
21	25.4										1402	1332	1262	

11-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

RZ

RZ

6.5 Vertical Tendons

VERTICAL TENDONS

Tendons Listing & Input Data Sheet

Individual Tendons Losses Worksheets

Individual Tendons Force Curves

CRYSTAL RIVER UNIT 3 - 6th TENDON SURVEILLANCE
VERTICAL TENDONS DATA INPUT

DOC ID:S-95-0082
REVISION 2
PAGE 126

			Ref.
Initial Concrete Stress =	967.0	(ksi)	(2) Page 7A, 7B, 7C
Average Force =	1644.0	(kips)	(2) Page 15
Total Stress Sequence (N) =	31		
Total Elastic Shortening =	73.5		See (2) & Attachment E

Tendon No.	Lift-off Pressure (ksi) (1)				Stress Sequence (n) (2)	No. of Effective Wires (1)	Wire Factor #/163 (4)	Original Forces (kips)		Remarks (3)
	Shop End		Field End					Shop End (5)	Field End (5)	
	Predicted	Actual	Predicted	Actual						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
23V24	6870	6850	N/A	N/A	24	163	1.000	1634	N/A	
12V1	6800	6950	N/A	N/A	7	163	1.000	1675	N/A	R,C,E,S
12V2	6800	7050	N/A	N/A	27	163	1.000	1699	N/A	
23V1	6800	7100	N/A	N/A	1	163	1.000	1711	N/A	
23V2	6870	6700	N/A	N/A	19	163	1.000	1598	N/A	S
23V3	6760	6850	N/A	N/A	10	163	1.000	1661	N/A	
34V5	6800	6775	N/A	N/A	5	163	1.000	1633	N/A	
34V6	6810	6700	N/A	N/A	26	163	1.000	1612	N/A	C(on-line)
34V7	6870	6900	N/A	N/A	14	163	1.000	1646	N/A	
61V9	6860	6800	N/A	N/A	5	163	1.000	1625	N/A	
61V10	6870	6700	N/A	N/A	26	163	1.000	1598	N/A	A
61V11	6710	6850	N/A	N/A	15	160	0.982	1642	N/A	
61V20	6870	6850	N/A	N/A	29	163	0.982	1634	N/A	
61V21	6870	6800	N/A	N/A	9	163	1.000	1622	N/A	D,S
61V22	6870	6800	N/A	N/A	26	163	0.982	1622	N/A	

File: VERTR2.XLW (VERTINP)

R2

Notes:

(1) Ref. Crystal River 3 R/B Tendon History Sheets - Vertical Tendons for Original Stressing

(2) Ref. Crystal River 3 Tendon Surveillance Loss Calculations, Tendon Stress Sequence, Pages 28 and 28a

(3) S = Selected Tendons, C = Control tendon, D = Detensioned tendon, A = Alternate tendon
E = Exempted Tendons (5th Surveillance), All Other Tendons are Adjacents

(4) Wire factors are calculated based on the number of effective wires divided by 163.

(5) Original forces calculated based on the expression in Section 6.2.2.

12-Sep-97
9:44 AM

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (23V24)

R2

TENDON: 23V24 INITIAL CONCRETE STRESS (PSI) : 967

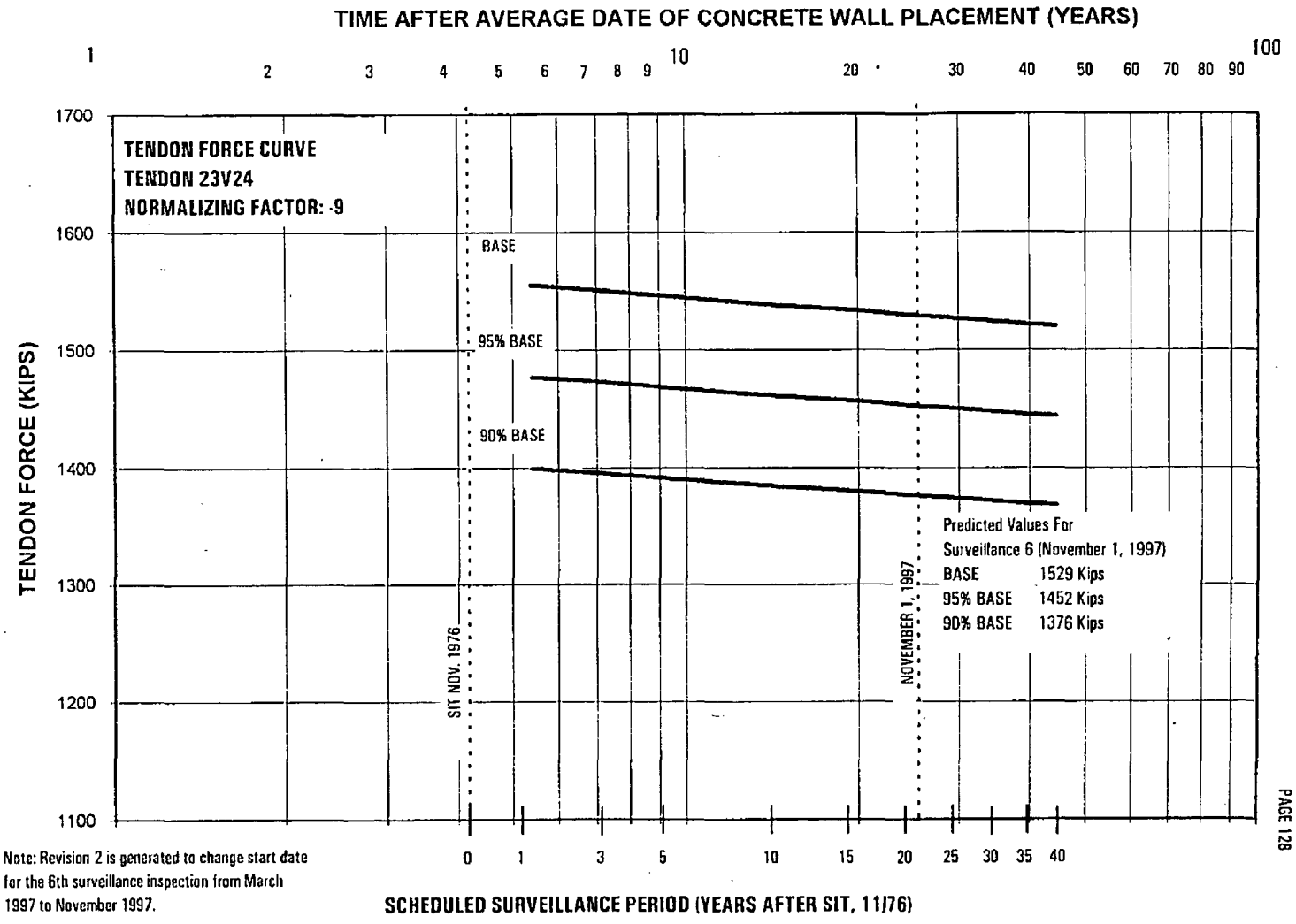
ORIGINAL FORCES (KIPS): SHOP: 1634 FIELD: 1634 AVERAGE: 1634 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 24 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	min/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	16.6	2.57%	42.3	0.096	18.6	6.0	1.7	79.2	4.85%	1555	1477	1399	-9
3	7.4	16.6	2.60%	42.7	0.117	22.6	8.5	2.4	84.3	5.16%	1550	1472	1395	-9
5	9.4	16.6	2.68%	44.1	0.130	25.4	10.0	2.8	88.9	5.44%	1545	1468	1391	-9
10	14.4	16.6	2.76%	45.4	0.157	30.5	13.5	3.8	96.3	5.89%	1538	1461	1384	-9
15	19.4	16.6	2.81%	46.2	0.173	33.3	15.5	4.4	100.5	6.15%	1534	1457	1380	-9
17	21.4	16.6									1532	1455	1379	
20	24.4	16.6	2.87%	47.2	0.188	36.1	17.5	4.9	104.8	6.41%	1529	1453	1376	-9
21:3	25.65	16.6									1529	1452	1376	
25	29.4	16.6	2.89%	47.3	0.197	37.8	19.5	5.5	107.2	6.56%	1527	1451	1374	-9
30	34.4	16.6	2.91%	47.8	0.207	39.8	20.4	5.8	110.0	6.73%	1524	1448	1372	-9
35	39.4	16.6	2.93%	48.2	0.216	41.5	21.5	6.1	112.4	6.88%	1522	1446	1370	-9
40	44.4	16.6	2.95%	48.5	0.221	42.6	22.5	6.4	114.1	6.98%	1520	1444	1368	-9
21	25.4										1529	1452	1376	

R2

12-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (12V1)

R2

TENDON: 12V1 INITIAL CONCRETE STRESS (PSI) : 967

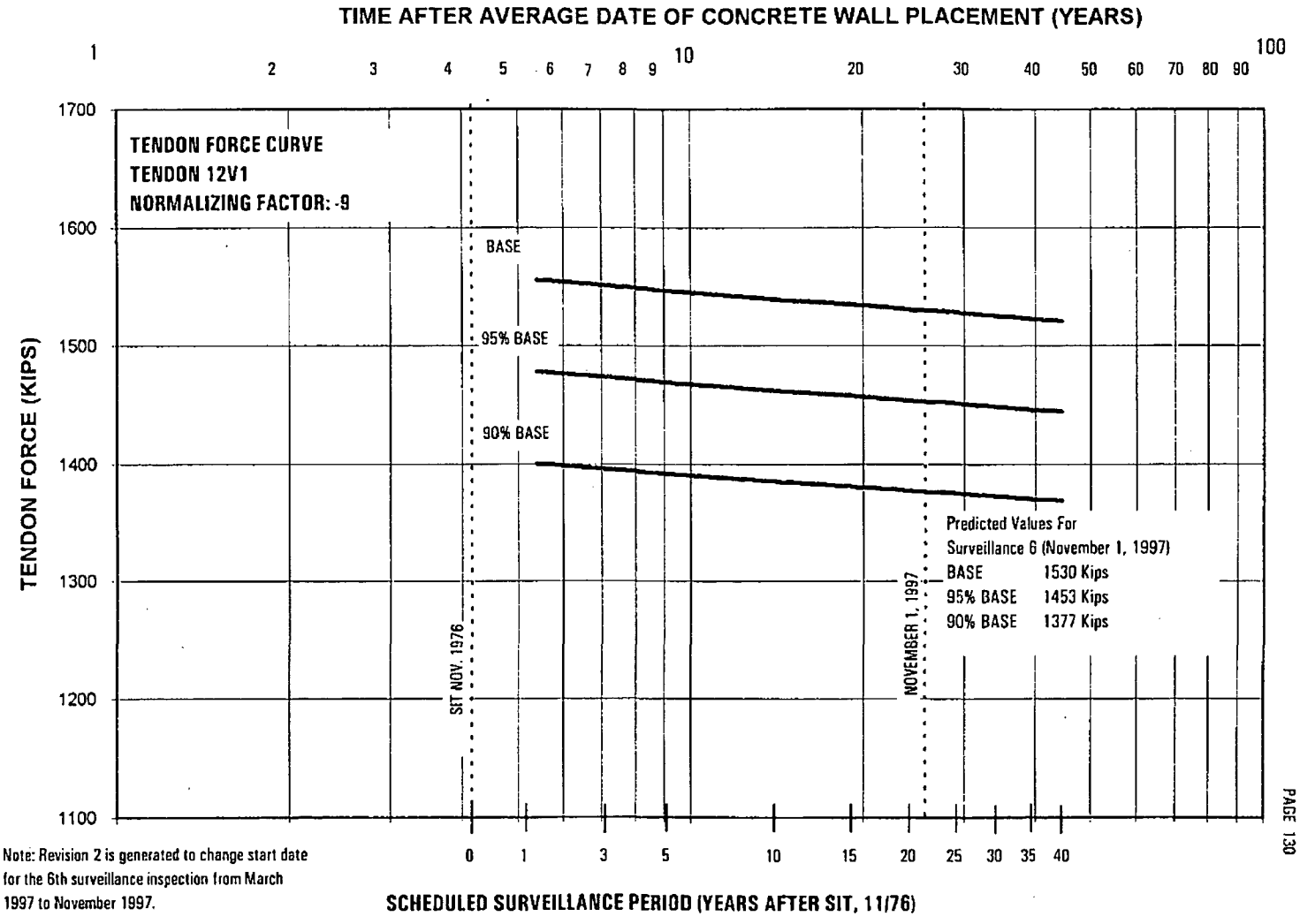
ORIGINAL FORCES (KIPS): SHOP: 1675 FIELD: 1675 AVERAGE: 1675 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 7 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	min/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	56.9	2.57%	42.3	0.096	18.6	6.0	1.7	119.5	7.13%	1556	1478	1400	-9
3	7.4	56.9	2.60%	42.7	0.117	22.6	8.5	2.4	124.6	7.44%	1550	1473	1395	-9
5	9.4	56.9	2.68%	44.1	0.130	25.4	10.0	2.8	129.2	7.71%	1546	1469	1391	-9
10	14.4	56.9	2.76%	45.4	0.157	30.5	13.5	3.8	136.6	8.16%	1538	1462	1385	-9
15	19.4	56.9	2.81%	46.2	0.173	33.3	15.5	4.4	140.8	8.41%	1534	1458	1381	-9
17	21.4	56.9									1533	1456	1379	
20	24.4	56.9	2.87%	47.2	0.188	36.1	17.5	4.9	145.1	8.66%	1530	1453	1377	-9
21:3	25.65	56.9									1529	1453	1376	
25	29.4	56.9	2.89%	47.3	0.197	37.8	19.5	5.5	147.5	8.81%	1528	1451	1375	-9
30	34.4	56.9	2.91%	47.8	0.207	39.8	20.4	5.8	150.3	8.97%	1525	1449	1372	-9
35	39.4	56.9	2.93%	48.2	0.216	41.5	21.5	6.1	152.7	9.12%	1522	1446	1370	-9
40	44.4	56.9	2.95%	48.5	0.221	42.6	22.5	6.4	154.4	9.22%	1521	1445	1369	-9
21	25.4										1530	1453	1377	

R2

12-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (12V2)

TENDON: 12V2 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1699 FIELD: 1699 AVERAGE: 1699 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 27 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	min/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	9.5	2.57%	42.3	0.096	18.6	6.0	1.7	72.1	4.24%	1627	1546	1464	-80
3	7.4	9.5	2.60%	42.7	0.117	22.6	8.5	2.4	77.2	4.54%	1622	1541	1460	-80
5	9.4	9.5	2.68%	44.1	0.130	25.4	10.0	2.8	81.8	4.81%	1617	1537	1456	-80
10	14.4	9.5	2.76%	45.4	0.157	30.5	13.5	3.8	89.2	5.25%	1610	1530	1449	-80
15	19.4	9.5	2.81%	46.2	0.173	33.3	15.5	4.4	93.4	5.50%	1606	1526	1445	-80
17	21.4	9.5									1604	1524	1444	
20	24.4	9.5	2.87%	47.2	0.188	36.1	17.5	4.9	97.7	5.75%	1602	1521	1441	-80
21:3	25.65	9.5									1601	1521	1441	
25	29.4	9.5	2.89%	47.3	0.197	37.8	19.5	5.5	100.1	5.89%	1599	1519	1439	-80
30	34.4	9.5	2.91%	47.8	0.207	39.8	20.4	5.8	102.9	6.05%	1596	1516	1437	-80
35	39.4	9.5	2.93%	48.2	0.216	41.5	21.5	6.1	105.3	6.20%	1594	1514	1435	-80
40	44.4	9.5	2.95%	48.5	0.221	42.6	22.5	6.4	107.0	6.30%	1592	1513	1433	-80
21	25.4										1601	1521	1441	

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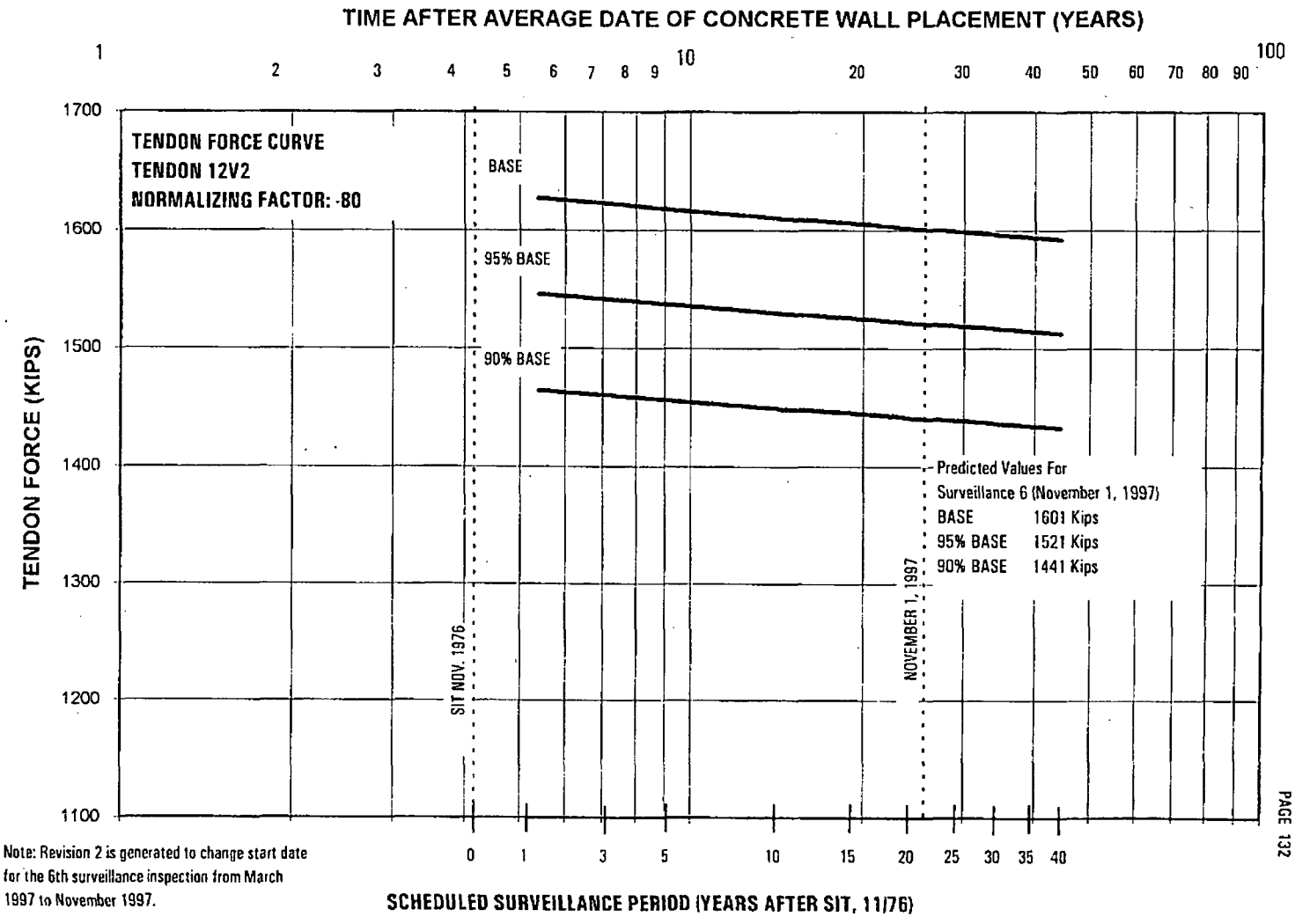

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (23V1)

R2

TENDON: 23V1 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1711 FIELD: 1711 AVERAGE: 1711 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 1 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	71.1	2.57%	42.3	0.096	18.6	6.0	1.7	133.7	7.81%	1578	1499	1420	-30
3	7.4	71.1	2.60%	42.7	0.117	22.6	8.5	2.4	138.8	8.11%	1572	1494	1415	-30
5	9.4	71.1	2.68%	44.1	0.130	25.4	10.0	2.8	143.4	8.38%	1568	1489	1411	-30
10	14.4	71.1	2.76%	45.4	0.157	30.5	13.5	3.8	150.8	8.81%	1560	1482	1404	-30
15	19.4	71.1	2.81%	46.2	0.173	33.3	15.5	4.4	155.0	9.06%	1556	1478	1401	-30
17	21.4	71.1									1554	1477	1399	
20	24.4	71.1	2.87%	47.2	0.188	36.1	17.5	4.9	159.3	9.31%	1552	1474	1397	-30
21:3	25.65	71.1									1551	1474	1396	
25	29.4	71.1	2.89%	47.3	0.197	37.8	19.5	5.5	161.7	9.45%	1550	1472	1395	-30
30	34.4	71.1	2.91%	47.8	0.207	39.8	20.4	5.8	164.5	9.61%	1547	1469	1392	-30
35	39.4	71.1	2.93%	48.2	0.216	41.5	21.5	6.1	166.9	9.75%	1544	1467	1390	-30
40	44.4	71.1	2.95%	48.5	0.221	42.6	22.5	6.4	168.6	9.85%	1543	1465	1388	-30
21	25.4										1551	1474	1396	

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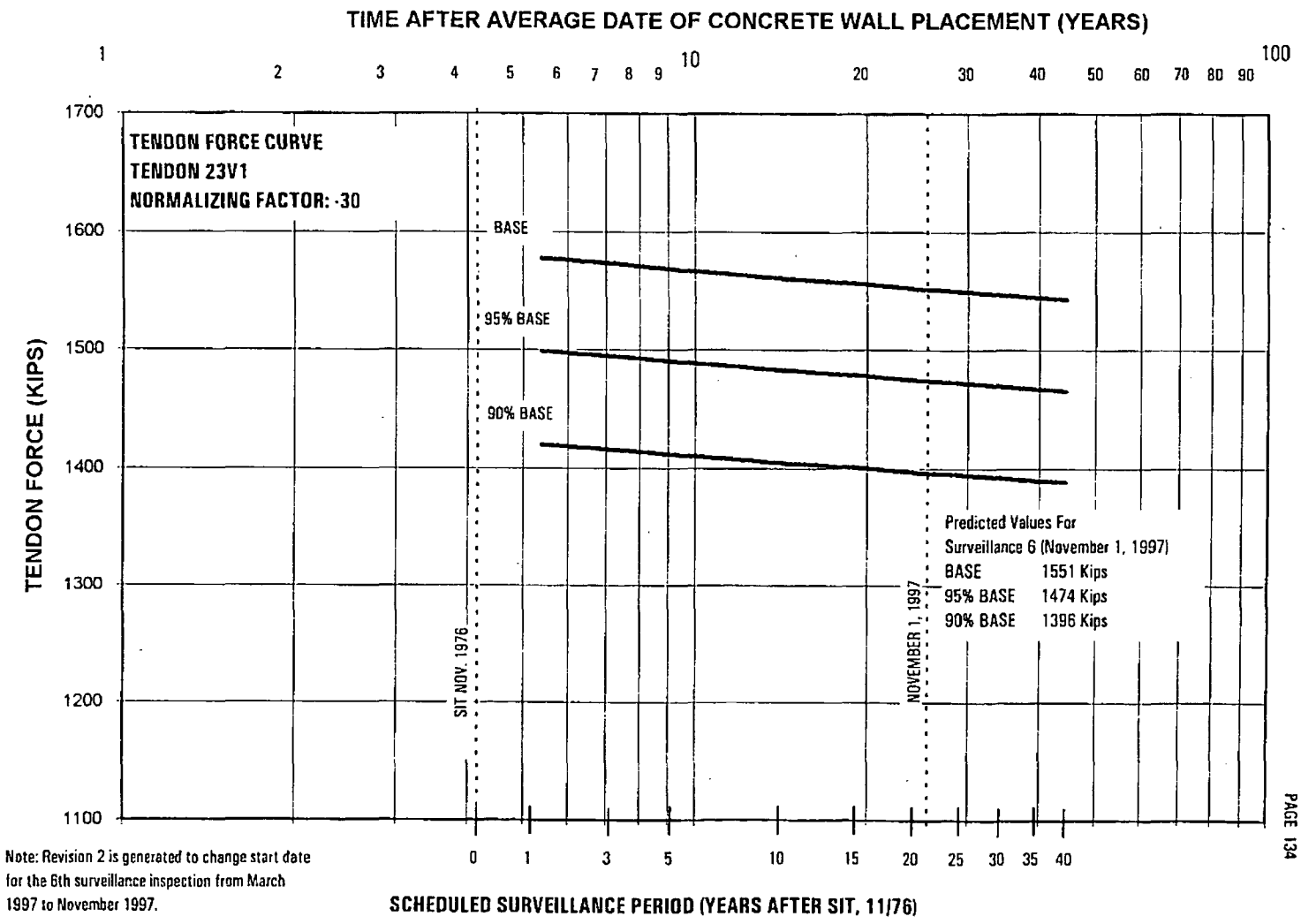

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (23V2)

R2

TENDON: 23V2 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1598 FIELD: 1598 AVERAGE: 1598 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 19 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	28.5	2.57%	42.3	0.096	18.6	6.0	1.7	91.1	5.70%	1507	1432	1357	37
3	7.4	28.5	2.60%	42.7	0.117	22.6	8.5	2.4	96.2	6.02%	1502	1427	1352	37
5	9.4	28.5	2.68%	44.1	0.130	25.4	10.0	2.8	100.8	6.30%	1498	1423	1348	37
10	14.4	28.5	2.76%	45.4	0.157	30.5	13.5	3.8	108.2	6.77%	1490	1416	1341	37
15	19.4	28.5	2.81%	46.2	0.173	33.3	15.5	4.4	112.4	7.03%	1486	1412	1337	37
17	21.4	28.5									1484	1410	1336	
20	24.4	28.5	2.87%	47.2	0.188	36.1	17.5	4.9	116.7	7.30%	1482	1408	1334	37
21:3	25.65	28.5									1481	1407	1333	
25	29.4	28.5	2.89%	47.3	0.197	37.8	19.5	5.5	119.1	7.45%	1479	1405	1331	37
30	34.4	28.5	2.91%	47.8	0.207	39.8	20.4	5.8	121.9	7.62%	1477	1403	1329	37
35	39.4	28.5	2.93%	48.2	0.216	41.5	21.5	6.1	124.3	7.77%	1474	1400	1327	37
40	44.4	28.5	2.95%	48.5	0.221	42.6	22.5	6.4	126.0	7.88%	1472	1399	1325	37
21	25.4										1481	1407	1333	

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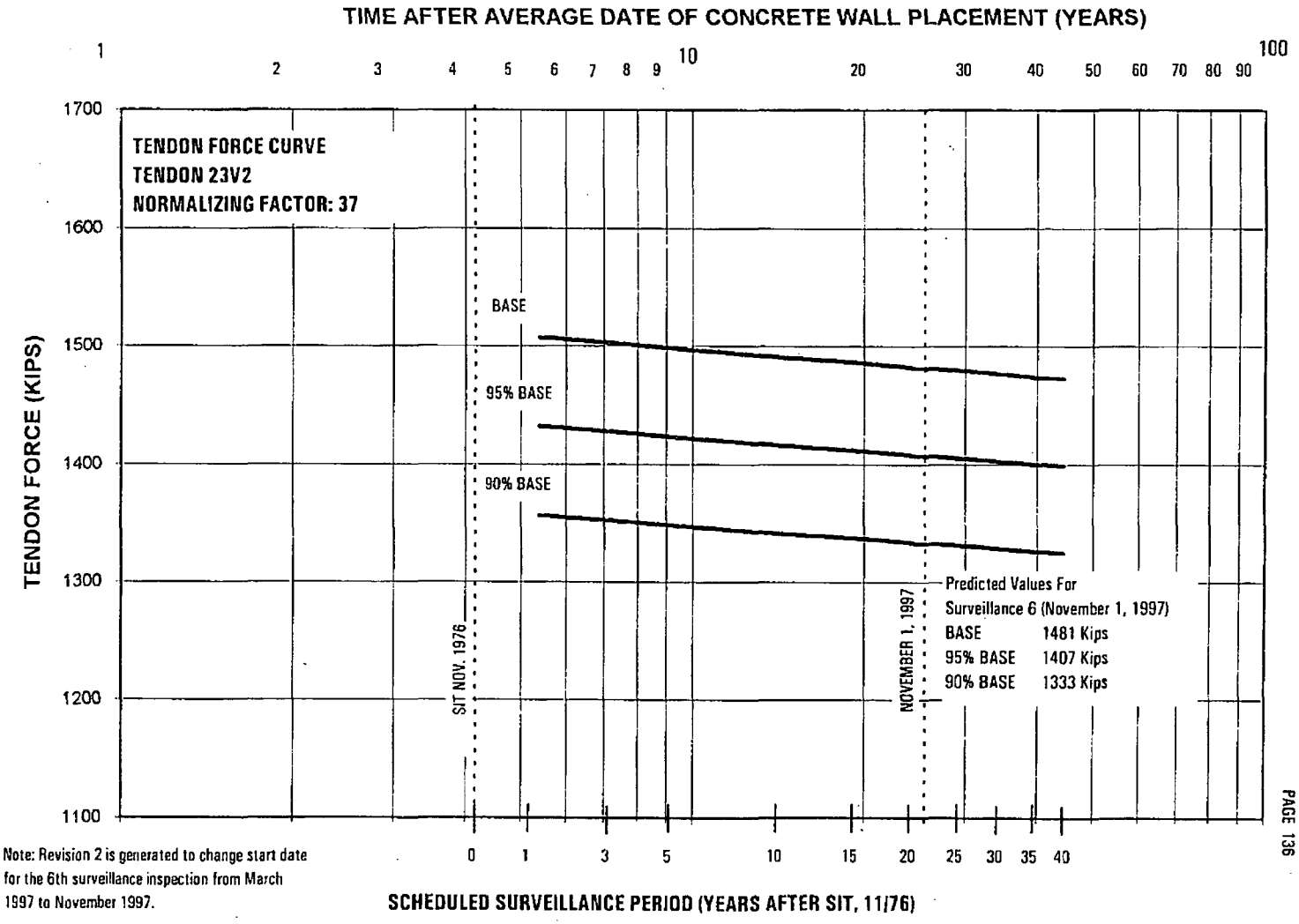

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 8th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (23V3)

R2

TENDON: 23V3 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1661 FIELD: 1661 AVERAGE: 1661 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 10 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	49.8	2.57%	42.3	0.096	18.6	6.0	1.7	112.4	6.77%	1548	1471	1394	-2
3	7.4	49.8	2.60%	42.7	0.117	22.6	8.5	2.4	117.5	7.07%	1543	1466	1389	-2
5	9.4	49.8	2.68%	44.1	0.130	25.4	10.0	2.8	122.1	7.35%	1539	1462	1385	-2
10	14.4	49.8	2.76%	45.4	0.157	30.5	13.5	3.8	129.5	7.80%	1531	1455	1378	-2
15	19.4	49.8	2.81%	46.2	0.173	33.3	15.5	4.4	133.7	8.05%	1527	1451	1374	-2
17	21.4	49.8									1525	1449	1373	
20	24.4	49.8	2.87%	47.2	0.188	36.1	17.5	4.9	138.0	8.31%	1523	1447	1370	-2
21:3	25.65	49.8									1522	1446	1370	
25	29.4	49.8	2.89%	47.3	0.197	37.8	19.5	5.5	140.4	8.45%	1520	1444	1368	-2
30	34.4	49.8	2.91%	47.8	0.207	39.8	20.4	5.8	143.2	8.62%	1518	1442	1366	-2
35	39.4	49.8	2.93%	48.2	0.216	41.5	21.5	6.1	145.6	8.77%	1515	1439	1364	-2
40	44.4	49.8	2.95%	48.5	0.221	42.6	22.5	6.4	147.3	8.87%	1513	1438	1362	-2
21	25.4										1522	1446	1370	

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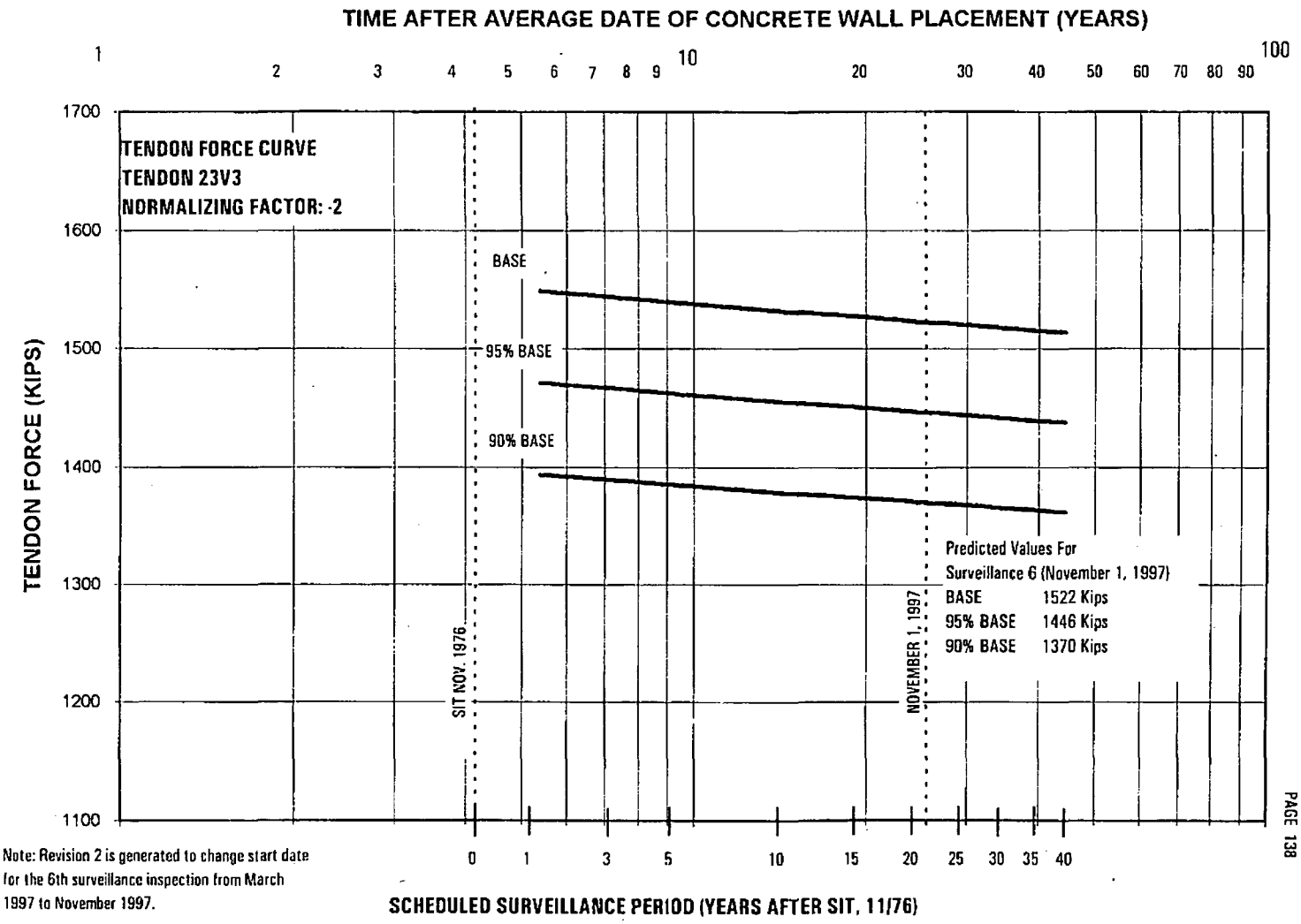

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (34V5)

R2

TENDON: 34V5 INITIAL CONCRETE STRESS (PSI): 3967

ORIGINAL FORCES (KIPS): SHOP: 1633 FIELD: 1633 AVERAGE: 1633 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 5 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	61.6	2.57%	42.3	0.096	18.6	6.0	1.7	124.2	7.61%	1509	1433	1358	37
3	7.4	61.6	2.60%	42.7	0.117	22.6	8.5	2.4	129.3	7.92%	1504	1428	1353	37
5	9.4	61.6	2.68%	44.1	0.130	25.4	10.0	2.8	133.9	8.20%	1499	1424	1349	37
10	14.4	61.6	2.76%	45.4	0.157	30.5	13.5	3.8	141.3	8.66%	1492	1417	1342	37
15	19.4	61.6	2.81%	46.2	0.173	33.3	15.5	4.4	145.5	8.91%	1487	1413	1339	37
17	21.4	61.6									1486	1411	1337	
20	24.4	61.6	2.87%	47.2	0.188	36.1	17.5	4.9	149.8	9.18%	1483	1409	1335	37
21:3	25.65	61.6									1482	1408	1334	
25	29.4	61.6	2.89%	47.3	0.197	37.8	19.5	5.5	152.2	9.32%	1481	1407	1333	37
30	34.4	61.6	2.91%	47.8	0.207	39.8	20.4	5.8	155.0	9.50%	1478	1404	1330	37
35	39.4	61.6	2.93%	48.2	0.216	41.5	21.5	6.1	157.4	9.64%	1475	1402	1328	37
40	44.4	61.6	2.95%	48.5	0.221	42.6	22.5	6.4	159.1	9.75%	1474	1400	1326	37
21	25.4										1483	1408	1334	

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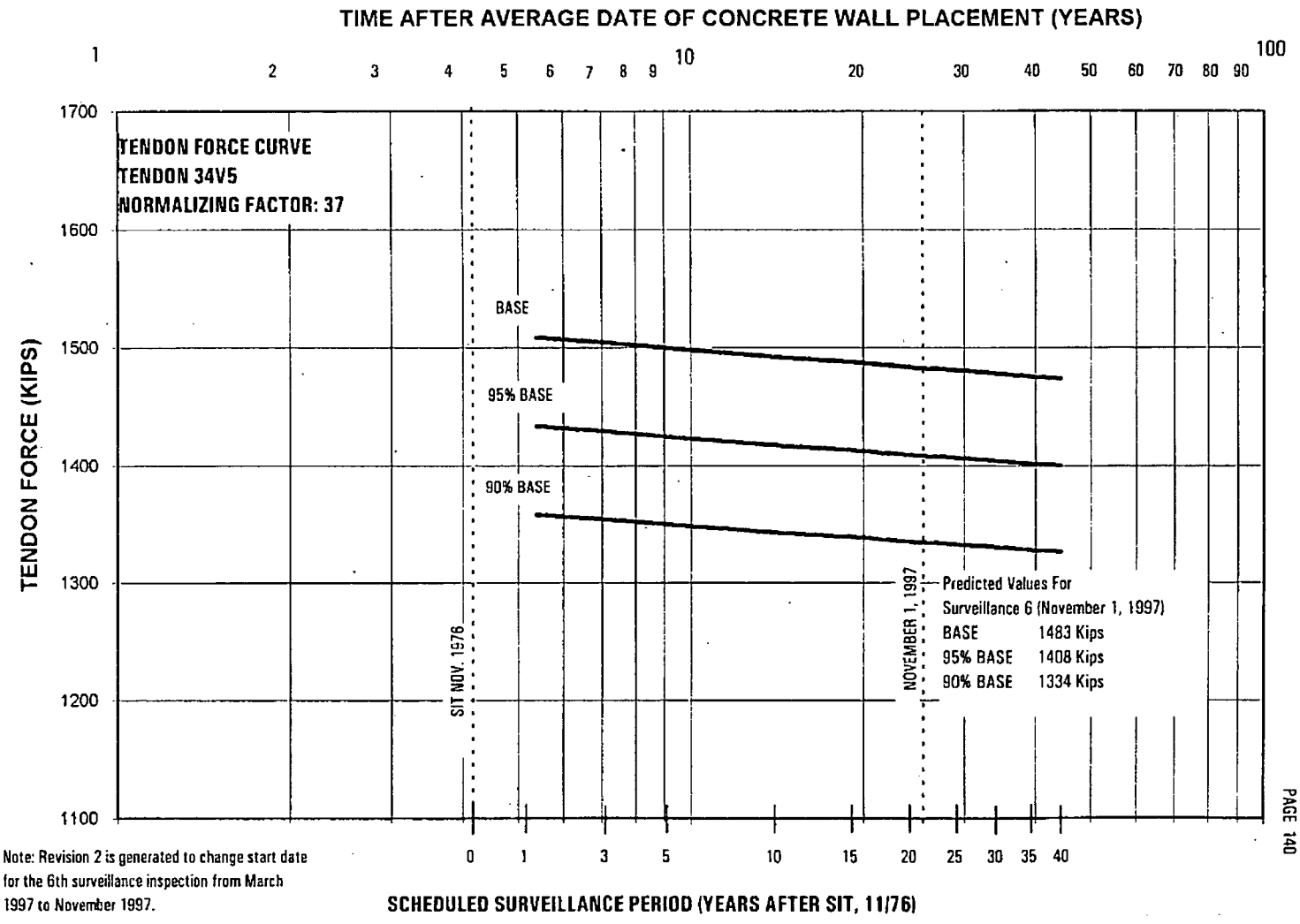

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (34V6)

R2

TENDON: 34V6 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1612 FIELD: 1612 AVERAGE: 1612 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 26 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	11.9	2.57%	42.3	0.096	18.6	6.0	1.7	74.5	4.62%	1538	1461	1384	7
3	7.4	11.9	2.60%	42.7	0.117	22.6	8.5	2.4	79.6	4.93%	1533	1456	1380	7
5	9.4	11.9	2.68%	44.1	0.130	25.4	10.0	2.8	84.2	5.22%	1528	1452	1375	7
10	14.4	11.9	2.76%	45.4	0.157	30.5	13.5	3.8	91.6	5.68%	1521	1445	1369	7
15	19.4	11.9	2.81%	46.2	0.173	33.3	15.5	4.4	95.8	5.94%	1517	1441	1365	7
17	21.4	11.9									1515	1439	1363	
20	24.4	11.9	2.87%	47.2	0.188	36.1	17.5	4.9	100.1	6.21%	1512	1437	1361	7
21:3	25.65	11.9									1512	1436	1361	
25	29.4	11.9	2.89%	47.3	0.197	37.8	19.5	5.5	102.5	6.35%	1510	1435	1359	7
30	34.4	11.9	2.91%	47.8	0.207	39.8	20.4	5.8	105.3	6.53%	1507	1432	1356	7
35	39.4	11.9	2.93%	48.2	0.216	41.5	21.5	6.1	107.7	6.68%	1505	1430	1354	7
40	44.4	11.9	2.95%	48.5	0.221	42.6	22.5	6.4	109.4	6.78%	1503	1428	1353	7
21	25.4										1512	1436	1361	

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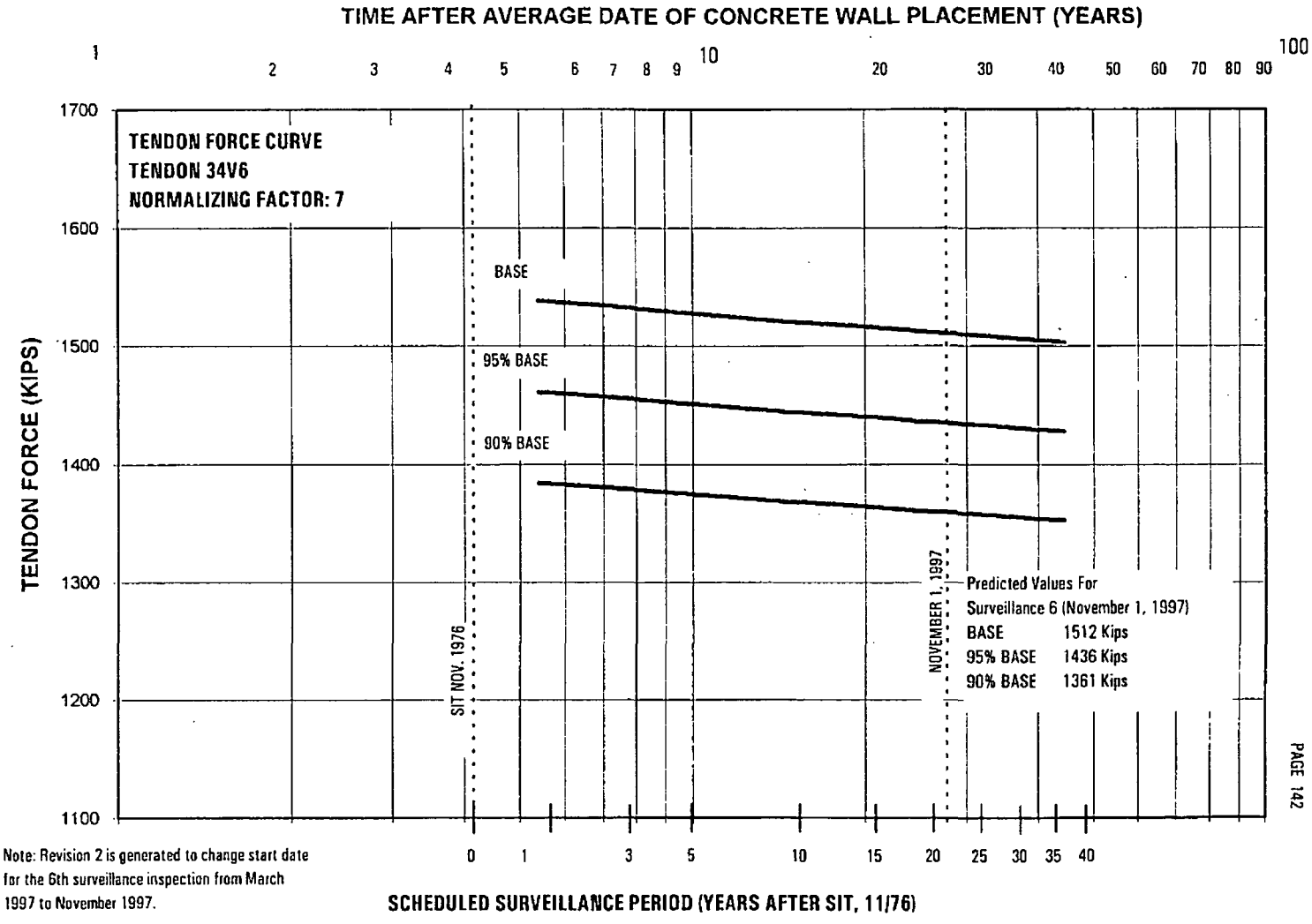

Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

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CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (34V7)

R2

TENDON: 34V7 INITIAL CONCRETE STRESS (PSI): 967

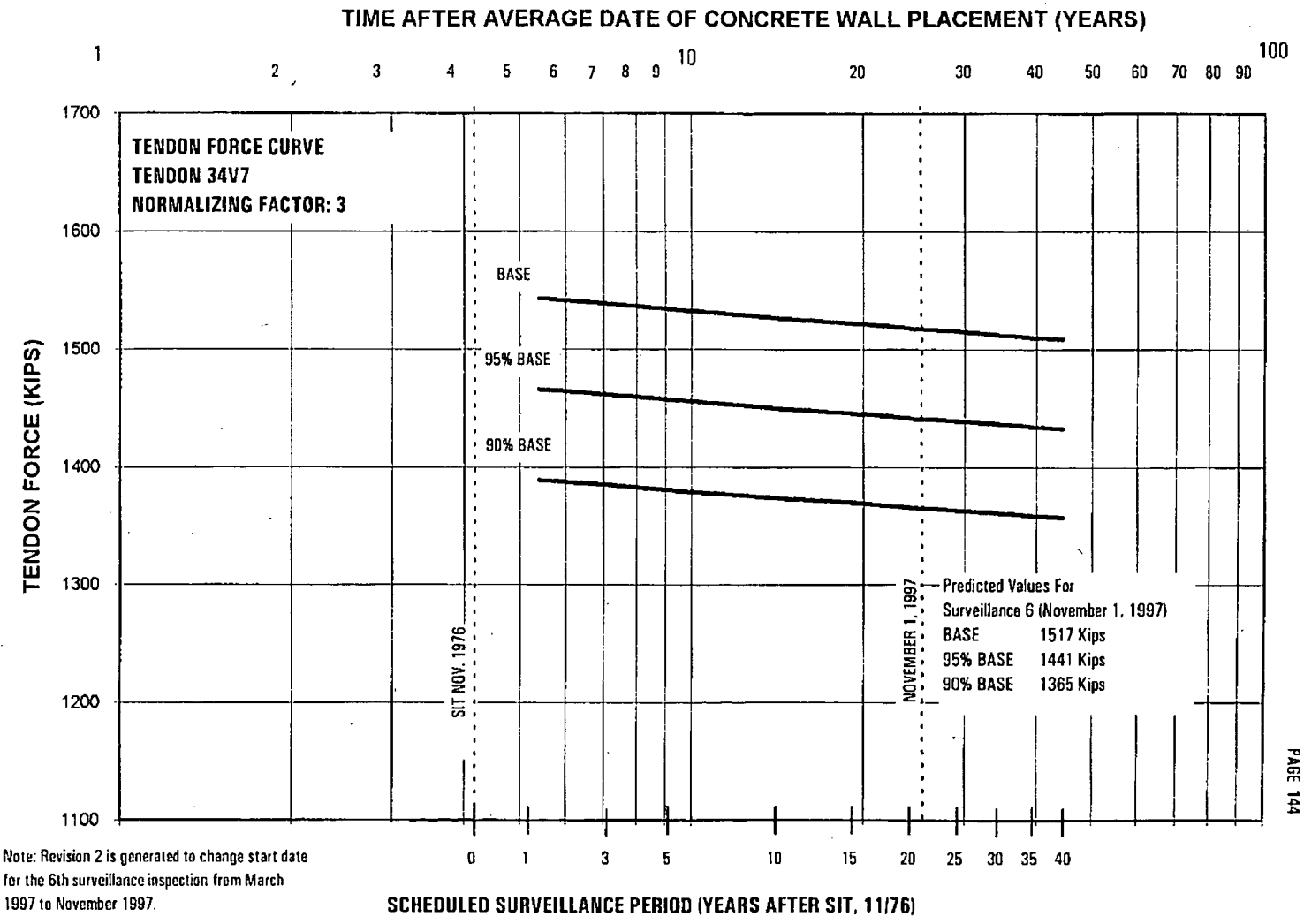
ORIGINAL FORCES (KIPS): SHOP: 1646 FIELD: 1646 AVERAGE: 1646 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 14 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	min/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	40.3	2.57%	42.3	0.096	18.6	6.0	1.7	102.9	6.25%	1543	1466	1389	3
3	7.4	40.3	2.60%	42.7	0.117	22.6	8.5	2.4	108.0	6.56%	1538	1461	1384	3
5	9.4	40.3	2.68%	44.1	0.130	25.4	10.0	2.8	112.6	6.84%	1533	1457	1380	3
10	14.4	40.3	2.76%	45.4	0.157	30.5	13.5	3.8	120.0	7.29%	1526	1450	1373	3
15	19.4	40.3	2.81%	46.2	0.173	33.3	15.5	4.4	124.2	7.55%	1522	1446	1370	3
17	21.4	40.3									1520	1444	1368	
20	24.4	40.3	2.87%	47.2	0.188	36.1	17.5	4.9	128.5	7.81%	1518	1442	1366	3
21:3	25.65	40.3									1517	1441	1365	
25	29.4	40.3	2.89%	47.3	0.197	37.8	19.5	5.5	130.9	7.95%	1515	1439	1364	3
30	34.4	40.3	2.91%	47.8	0.207	39.8	20.4	5.8	133.7	8.12%	1512	1437	1361	3
35	39.4	40.3	2.93%	48.2	0.216	41.5	21.5	6.1	136.1	8.27%	1510	1434	1359	3
40	44.4	40.3	2.95%	48.5	0.221	42.6	22.5	6.4	137.8	8.37%	1508	1433	1357	3
21	25.4										1517	1441	1365	

R2

12-Sep-97



Note: Revision 2 is generated to change start date for the 6th surveillance inspection from March 1997 to November 1997.

R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V9)

R2

TENDON: 61V9 INITIAL CONCRETE STRESS (PSI): 967

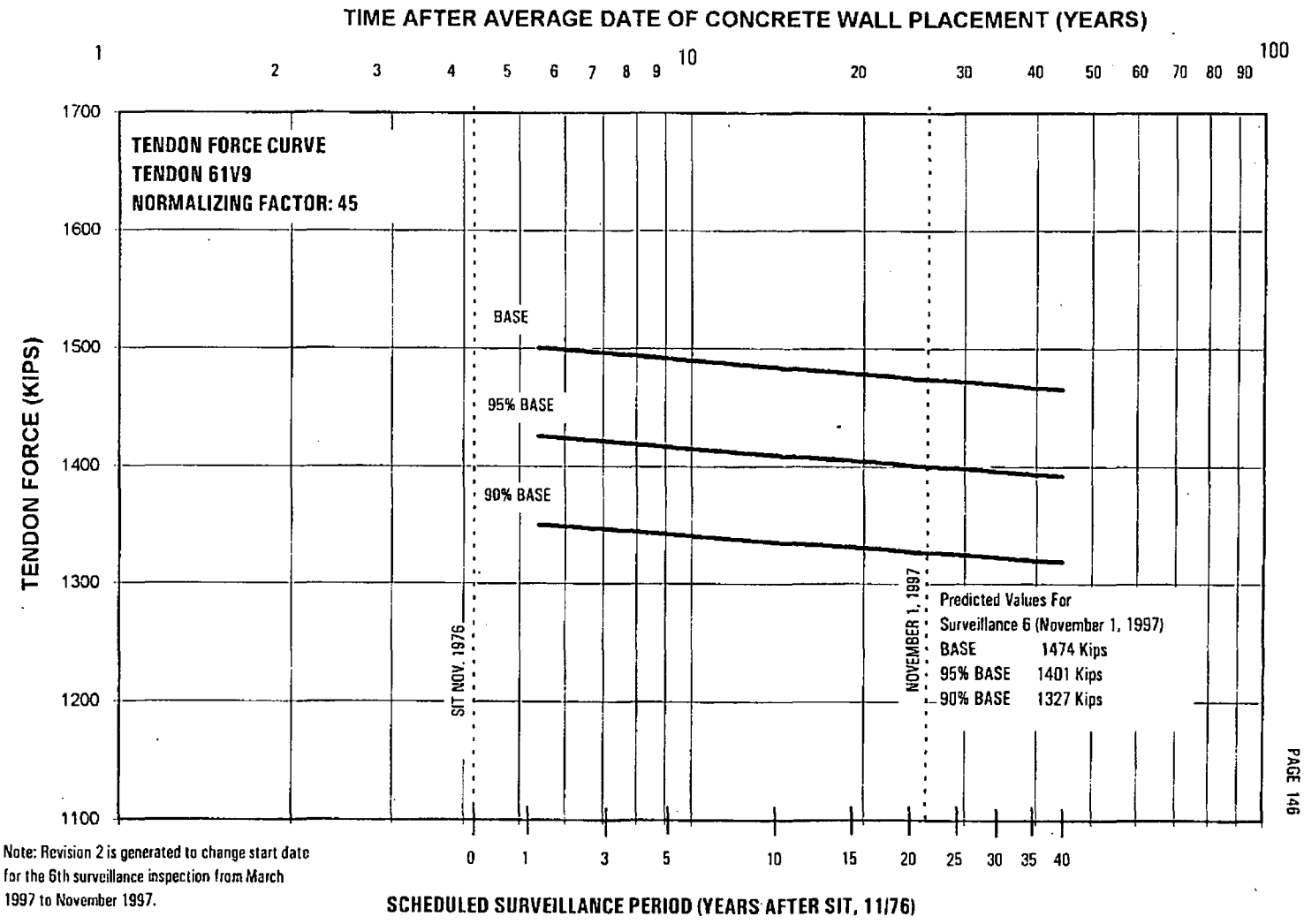
ORIGINAL FORCES (KIPS): SHOP: 1625 FIELD: 1625 AVERAGE: 1625 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 5 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m infin	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	61.6	2.57%	42.3	0.096	18.6	6.0	1.7	124.2	7.65%	1500	1425	1350	45
3	7.4	61.6	2.60%	42.7	0.117	22.6	8.5	2.4	129.3	7.96%	1495	1420	1346	45
5	9.4	61.6	2.68%	44.1	0.130	25.4	10.0	2.8	133.9	8.24%	1491	1416	1342	45
10	14.4	61.6	2.76%	45.4	0.157	30.5	13.5	3.8	141.3	8.70%	1483	1409	1335	45
15	19.4	61.6	2.81%	46.2	0.173	33.3	15.5	4.4	145.5	8.96%	1479	1405	1331	45
17	21.4	61.6									1477	1403	1330	
20	24.4	61.6	2.87%	47.2	0.188	36.1	17.5	4.9	149.8	9.22%	1475	1401	1327	45
21:3	25.65	61.6									1474	1400	1327	
25	29.4	61.6	2.89%	47.3	0.197	37.8	19.5	5.5	152.2	9.37%	1472	1399	1325	45
30	34.4	61.6	2.91%	47.8	0.207	39.8	20.4	5.8	155.0	9.54%	1470	1396	1323	45
35	39.4	61.6	2.93%	48.2	0.216	41.5	21.5	6.1	157.4	9.69%	1467	1394	1320	45
40	44.4	61.6	2.95%	48.5	0.221	42.6	22.5	6.4	159.1	9.80%	1465	1392	1319	45
21	25.4										1474	1401	1327	

R2

12-Sep-97



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R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V10)

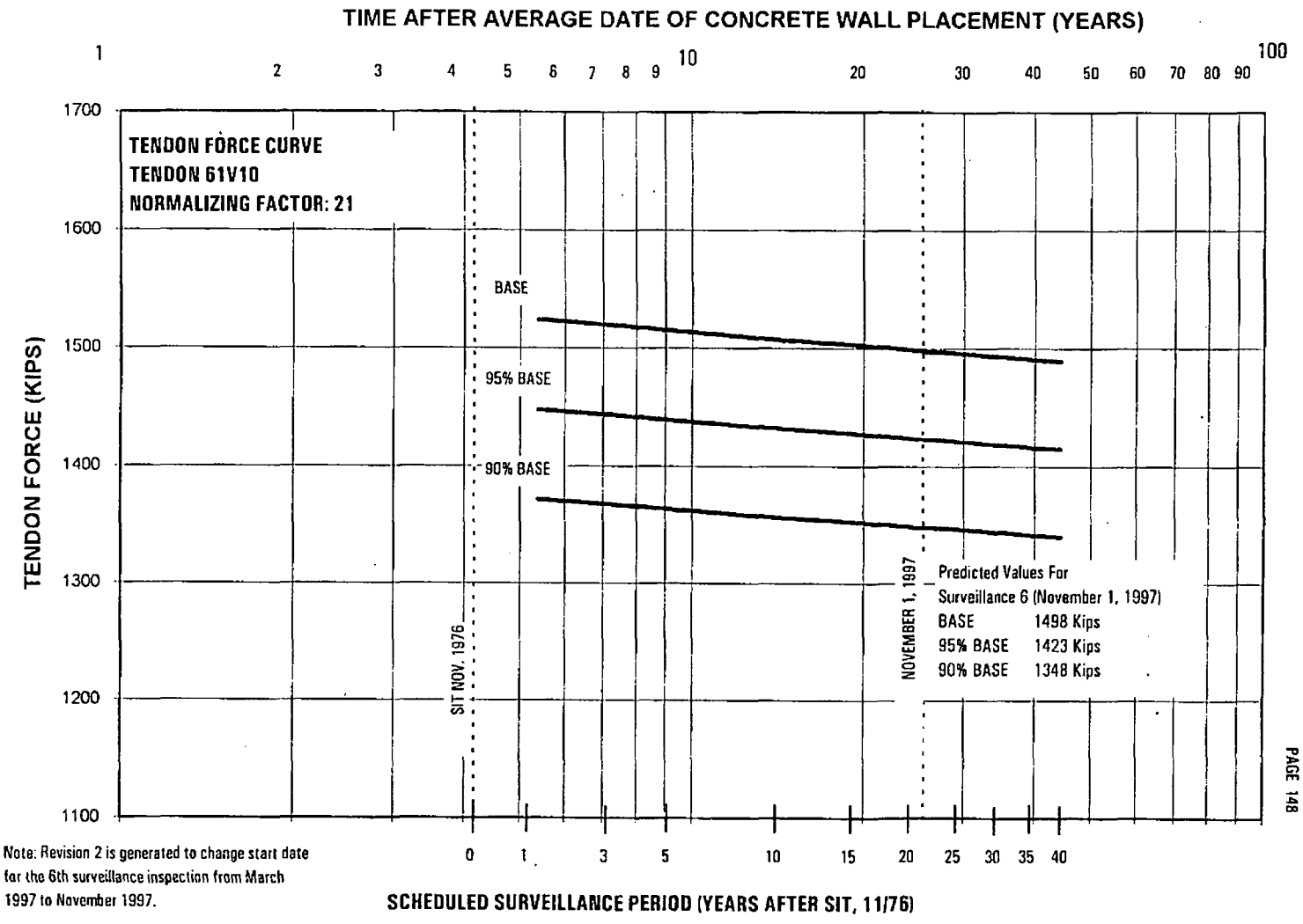
TENDON: 61V10 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1598 FIELD: 1598 AVERAGE: 1598 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 26 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	11.9	2.57%	42.3	0.096	18.6	6.0	1.7	74.5	4.66%	1524	1448	1372	21
3	7.4	11.9	2.60%	42.7	0.117	22.6	8.5	2.4	79.6	4.98%	1519	1443	1367	21
5	9.4	11.9	2.68%	44.1	0.130	25.4	10.0	2.8	84.2	5.27%	1514	1439	1363	21
10	14.4	11.9	2.76%	45.4	0.157	30.5	13.5	3.8	91.6	5.73%	1507	1431	1356	21
15	19.4	11.9	2.81%	46.2	0.173	33.3	15.5	4.4	95.8	5.99%	1503	1427	1352	21
17	21.4	11.9									1501	1426	1351	
20	24.4	11.9	2.87%	47.2	0.188	36.1	17.5	4.9	100.1	6.26%	1498	1423	1348	21
21:3	25.65	11.9									1498	1423	1348	
25	29.4	11.9	2.89%	47.3	0.197	37.8	19.5	5.5	102.5	6.41%	1496	1421	1346	21
30	34.4	11.9	2.91%	47.8	0.207	39.8	20.4	5.8	105.3	6.59%	1493	1418	1344	21
35	39.4	11.9	2.93%	48.2	0.216	41.5	21.5	6.1	107.7	6.74%	1491	1416	1342	21
40	44.4	11.9	2.95%	48.5	0.221	42.6	22.5	6.4	109.4	6.84%	1489	1415	1340	21
21	25.4										1498	1423	1348	

12-Sep-97



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R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V11)

R2

TENDON: 61V11 INITIAL CONCRETE STRESS (PSI): 967

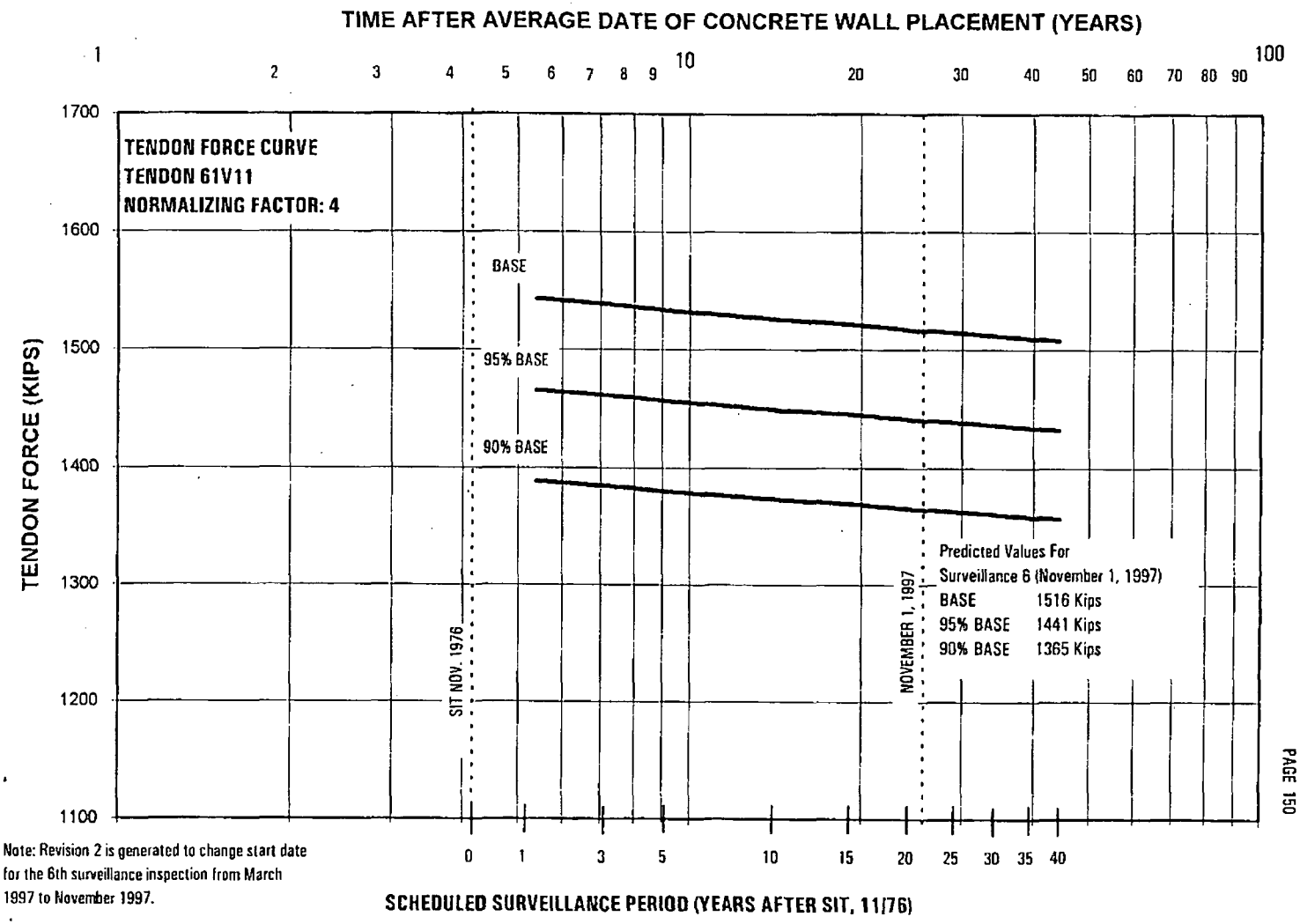
ORIGINAL FORCES (KIPS): SHOP: 1642 FIELD: 1642 AVERAGE: 1642 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 15 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	min/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	37.2	2.57%	42.3	0.096	18.6	6.0	1.7	99.8	6.08%	1542	1465	1388	4
3	7.4	37.2	2.60%	42.7	0.117	22.6	8.5	2.4	104.9	6.39%	1537	1461	1384	4
5	9.4	37.2	2.68%	44.1	0.130	25.4	10.0	2.8	109.5	6.67%	1533	1456	1380	4
10	14.4	37.2	2.76%	45.4	0.157	30.5	13.5	3.8	116.9	7.12%	1525	1449	1373	4
15	19.4	37.2	2.81%	46.2	0.173	33.3	15.5	4.4	121.1	7.38%	1521	1445	1369	4
17	21.4	37.2									1519	1444	1368	
20	24.4	37.2	2.87%	47.2	0.188	36.1	17.5	4.9	125.4	7.64%	1517	1441	1365	4
21:3	25.65	37.2									1516	1440	1365	
25	29.4	37.2	2.89%	47.3	0.197	37.8	19.5	5.5	127.8	7.78%	1514	1439	1363	4
30	34.4	37.2	2.91%	47.8	0.207	39.8	20.4	5.8	130.6	7.95%	1512	1436	1361	4
35	39.4	37.2	2.93%	48.2	0.216	41.5	21.5	6.1	133.0	8.10%	1509	1434	1358	4
40	44.4	37.2	2.95%	48.5	0.221	42.6	22.5	6.4	134.7	8.20%	1508	1432	1357	4
21	25.4										1516	1441	1365	

R2

12-Sep-97



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R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V20)

R2

TENDON: 61V20 INITIAL CONCRETE STRESS (PSI): 967

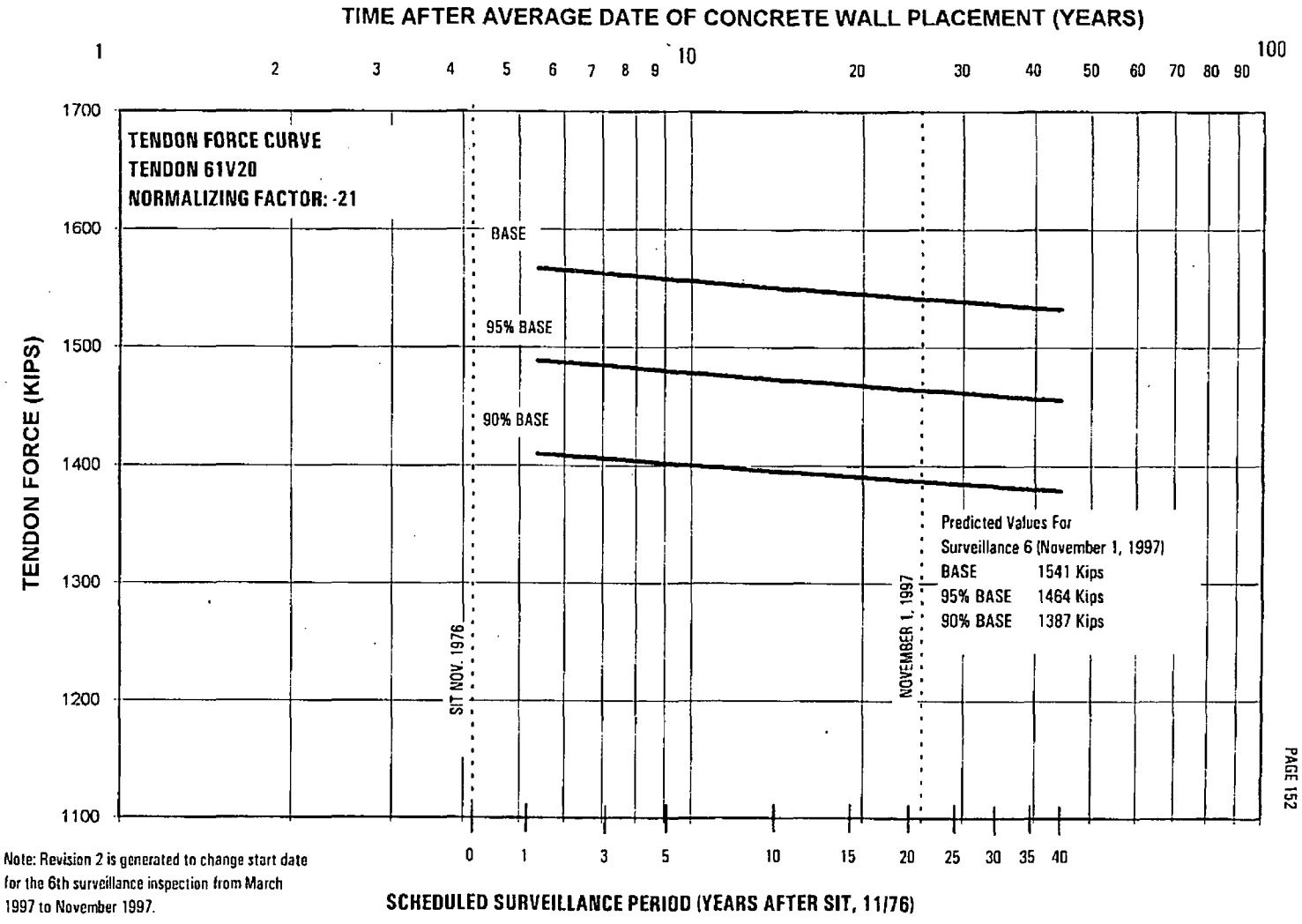
ORIGINAL FORCES (KIPS): SHOP: 1634 FIELD: 1634 AVERAGE: 1634 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 29 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	4.7	2.57%	42.3	0.096	18.6	6.0	1.7	67.3	4.12%	1567	1489	1410	-21
3	7.4	4.7	2.60%	42.7	0.117	22.6	8.5	2.4	72.4	4.43%	1562	1484	1406	-21
5	9.4	4.7	2.68%	44.1	0.130	25.4	10.0	2.8	77.0	4.71%	1557	1479	1401	-21
10	14.4	4.7	2.76%	45.4	0.157	30.5	13.5	3.8	84.4	5.16%	1550	1472	1395	-21
15	19.4	4.7	2.81%	46.2	0.173	33.3	15.5	4.4	88.6	5.42%	1546	1468	1391	-21
17	21.4	4.7									1544	1467	1389	
20	24.4	4.7	2.87%	47.2	0.188	36.1	17.5	4.9	92.9	5.68%	1541	1464	1387	-21
21:3	25.65	4.7									1541	1464	1387	
25	29.4	4.7	2.89%	47.3	0.197	37.8	19.5	5.5	95.3	5.83%	1539	1462	1385	-21
30	34.4	4.7	2.91%	47.8	0.207	39.8	20.4	5.8	98.1	6.00%	1536	1459	1382	-21
35	39.4	4.7	2.93%	48.2	0.216	41.5	21.5	6.1	100.5	6.15%	1534	1457	1380	-21
40	44.4	4.7	2.95%	48.5	0.221	42.6	22.5	6.4	102.2	6.25%	1532	1455	1379	-21
21	25.4										1541	1464	1387	

R2

12-Sep-97



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R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V21)

R2

TENDON: 61V21 INITIAL CONCRETE STRESS (PSI): 967

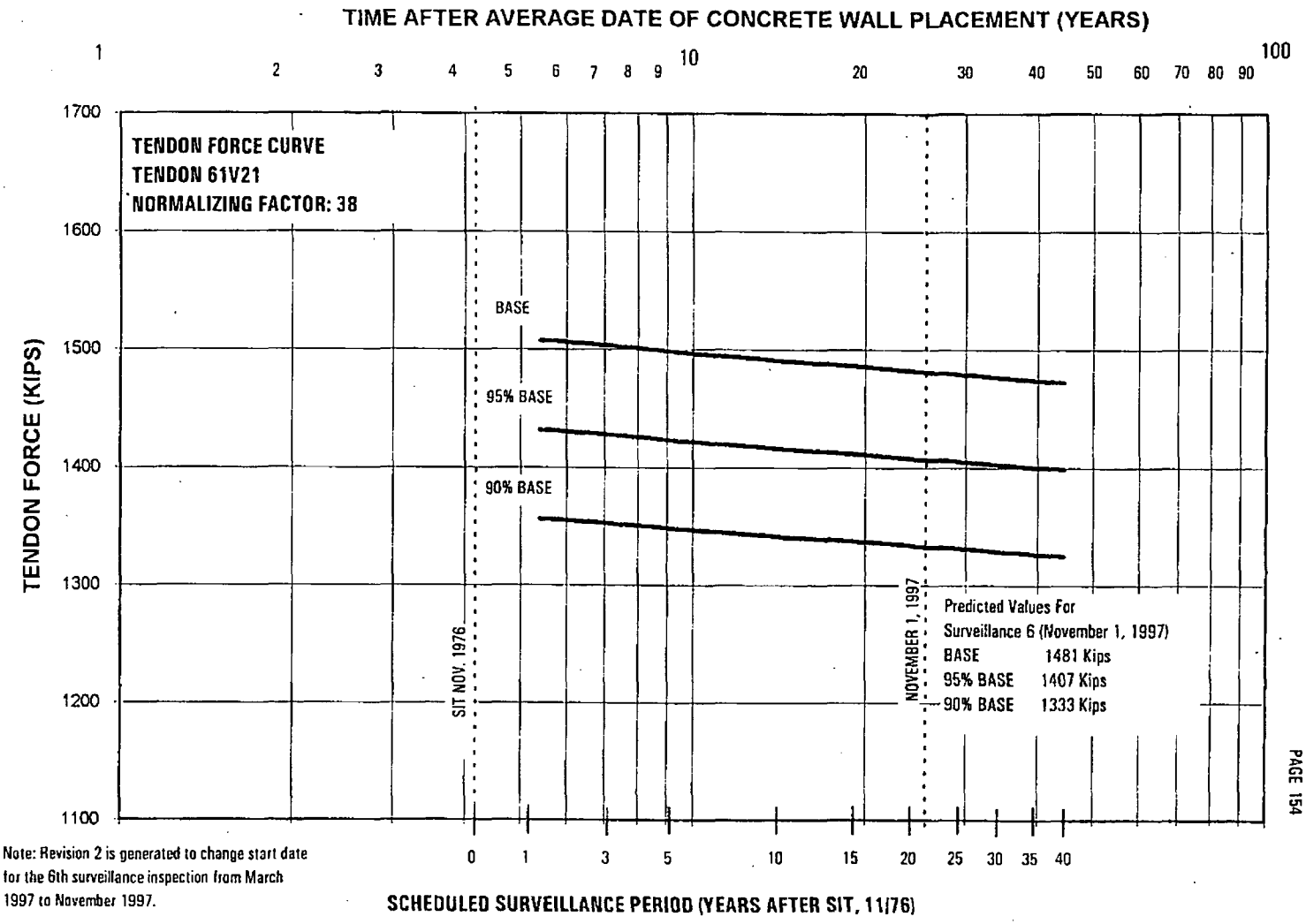
ORIGINAL FORCES (KIPS): SHOP: 1622 FIELD: 1622 AVERAGE: 1622 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 9 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 1.000

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR (KIPS)
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	52.2	2.57%	42.3	0.096	18.6	6.0	1.7	114.8	7.07%	1507	1432	1357	38
3	7.4	52.2	2.60%	42.7	0.117	22.6	8.5	2.4	119.9	7.39%	1502	1427	1352	38
5	9.4	52.2	2.68%	44.1	0.130	25.4	10.0	2.8	124.5	7.67%	1498	1423	1348	38
10	14.4	52.2	2.76%	45.4	0.157	30.5	13.5	3.8	131.9	8.13%	1490	1416	1341	38
15	19.4	52.2	2.81%	46.2	0.173	33.3	15.5	4.4	136.1	8.39%	1486	1412	1338	38
17	21.4	52.2									1484	1410	1336	
20	24.4	52.2	2.87%	47.2	0.188	36.1	17.5	4.9	140.4	8.65%	1482	1408	1334	38
21:3	25.65	52.2									1481	1407	1333	
25	29.4	52.2	2.89%	47.3	0.197	37.8	19.5	5.5	142.8	8.80%	1479	1405	1332	38
30	34.4	52.2	2.91%	47.8	0.207	39.8	20.4	5.8	145.6	8.97%	1477	1403	1329	38
35	39.4	52.2	2.93%	48.2	0.216	41.5	21.5	6.1	148.0	9.12%	1474	1401	1327	38
40	44.4	52.2	2.95%	48.5	0.221	42.6	22.5	6.4	149.7	9.23%	1473	1399	1325	38
21	25.4										1481	1407	1333	

R2

12-Sep-97



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R2

R2

CRYSTAL RIVER 3 TENDON FORCE PREDICTION / NON INTERACTION LOSSES - 6th TENDON SURVEILLANCE
VERTICAL TENDON LOSSES WORK SHEET
FILE: VERTR2.XLW (61V22)

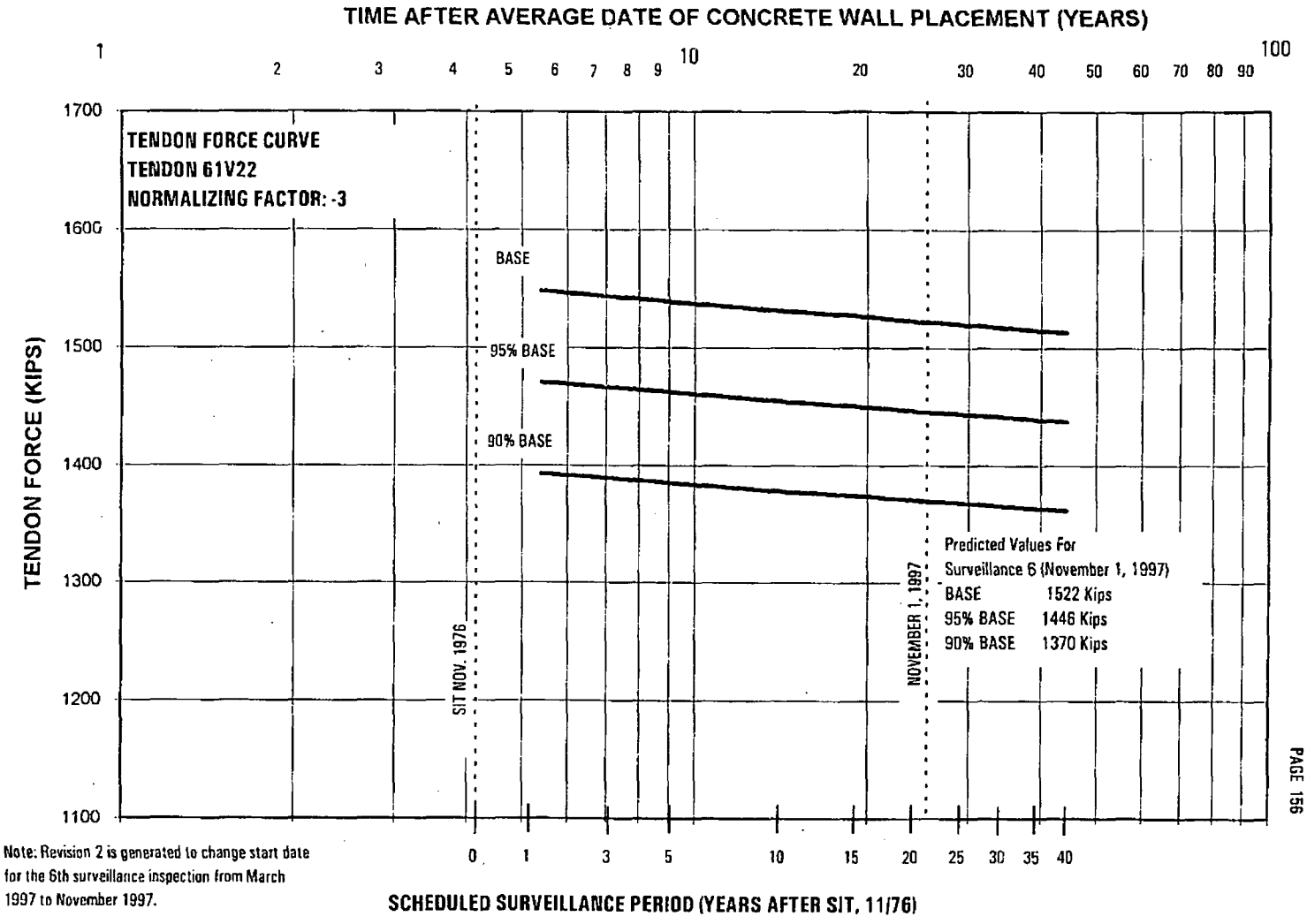
TENDON: 61V22 INITIAL CONCRETE STRESS (PSI): 967

ORIGINAL FORCES (KIPS): SHOP: 1622 FIELD: 1622 AVERAGE: 1622 AVERAGE ALL VERT TENDONS: 1644
STRESS SEQUENCE: 26 OF 31 TOTAL ELASTIC SHORT. LOSS: 73.5 WIRE FACTOR: 0.982

NOTE: SHADED VALUES ARE EXTRACTED FROM VERTINP WORK SHEET

INSPECT. PERIOD AFTER SIT (YR:MO)	YEARS AFTER CONCRETE PLACEMENT (LOG)	INDIVIDUAL LOSSES							TOTAL LOSSES		PREDICTED FORCES			NORMALIZING FACTOR
		ELASTIC SHORT.	STRESS RELAXATION		CREEP		SHRINKAGE		TOTAL FORCE LOSS (KIPS)	TOTAL PERCENT LOSS	BASE (KIPS)	95% BASE (KIPS)	90% BASE (KIPS)	(KIPS)
			PERCENT	FORCE (KIPS)	SP. CR. (*.0001)	FORCE (KIPS)	m in/in	FORCE (KIPS)						
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)
1	5.4	11.6	2.57%	42.3	0.096	18.6	6.0	1.7	74.2	4.58%	1548	1471	1393	-3
3	7.4	11.6	2.60%	42.7	0.117	22.6	8.5	2.4	79.3	4.89%	1543	1466	1389	-3
5	9.4	11.6	2.68%	44.1	0.130	25.4	10.0	2.8	83.9	5.17%	1538	1461	1384	-3
10	14.4	11.6	2.76%	45.4	0.157	30.5	13.5	3.8	91.3	5.63%	1531	1454	1378	-3
15	19.4	11.6	2.81%	46.2	0.173	33.3	15.5	4.4	95.5	5.89%	1527	1450	1374	-3
17	21.4	11.6									1525	1449	1372	
20	24.4	11.6	2.87%	47.2	0.188	36.1	17.5	4.9	99.8	6.15%	1522	1446	1370	-3
21:3	25.65	11.6									1522	1446	1370	
25	29.4	11.6	2.89%	47.3	0.197	37.8	19.5	5.5	102.2	6.30%	1520	1444	1368	-3
30	34.4	11.6	2.91%	47.8	0.207	39.8	20.4	5.8	105.0	6.47%	1517	1441	1365	-3
35	39.4	11.6	2.93%	48.2	0.216	41.5	21.5	6.1	107.4	6.62%	1515	1439	1363	-3
40	44.4	11.6	2.95%	48.5	0.221	42.6	22.5	6.4	109.1	6.73%	1513	1437	1362	-3
21	25.4										1522	1446	1370	

12-Sep-97



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R2

R2

Florida Power CORPORATION

DESIGN ANALYSIS/CALCULATION

Crystal River Unit 3

DOCUMENT IDENTIFICATION NO. Calculation S-95-0082 REVISION 0

Column H & I — Calculated force values in Kips which represent ram pressure @ 1500 psi. These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for the start of any retensioning effort. The following expression is used to calculate these values:

0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift-Off Pressure at 0.7 Tendon Ultimate Strength. See Reference 10 Calculation, page 34.

Column J & K — Calculated force values in Kips which represent forces at 80% ultimate based on the following expression:

(Actual pressure @ 80% ultimate strength (Columns F or G) * 0.7 Tendon Ultimate Strength) / Predicted pressure @ 70% Ultimate Strength.

Column L & M — Actual elongation data, repeated from columns B and C.

In addition, the following calculations support the ultimate strength values provided on these spreadsheets:

Tendon wire ultimate strength = f_{ult} for wire = 240 ksi
Tendon Ultimate Strength = F_{ult} = [f_{ult} for wire * Tendon wire area] =
= 240 ksi * (0.05985 * 163 wires) = 2341.3 Kips

0.7 * F_{ult} = 0.7 *2341.3 = 1638.9 Kips
0.8 * F_{ult} = 0.8 *2341.3 = 1873 Kips

FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
REACTOR BUILDING PRESTRESSING SYSTEM
6th TENDON SURVEILLANCE

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CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE DOME TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: DOMER3.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data" Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)		
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	
D111	5	5	6810	6810	7780	7780	361	361	1872	1872	5	5	R3
D112	4-3/4	5	6800	6840	7770	7790	362	359	1873	1867	4-3/4	5	R3
D113	4-7/8	4-3/4	6800	6840	7770	7790	362	359	1873	1867	4-7/8	4-3/4	
D114	5-1/8	4-5/8	6800	6840	7770	7790	362	359	1873	1867	5-1/8	4-5/8	
D115	5	5	6840	6800	7790	7770	359	362	1867	1873	5	5	
D116	4-3/4	5-1/8	6760	6800	7720	7750	364	362	1872	1868	4-3/4	5-1/8	
D130	5	5	6870	6810	7810	7780	358	361	1863	1872	5	5	
D131	4-1/2	4-7/8	6710	6740	7660	7700	366	365	1871	1872	4-1/2	4-7/8	
D132	4-1/2	4-7/8	6760	6800	7720	7750	364	362	1872	1868	4-1/2	4-7/8	
D211	5-1/4	5-1/2	6810	6870	7780	7810	361	358	1872	1863	5-1/4	5-1/2	
D212	4-5/8	4-7/8	6770	6770	7730	7720	363	363	1871	1869	4-5/8	4-7/8	
D213	4-3/4	4-3/4	6840	6800	7790	7770	359	362	1867	1873	4-3/4	4-3/4	
D214	4-3/4	4-7/8	6670	6740	7600	7680	369	365	1868	1868	4-3/4	4-7/8	
D215	4-1/2	5-1/8	6800	6870	7800	7810	362	358	1880	1863	4-1/2	5-1/8	
D216	5	5	6800	6810	7770	7780	362	361	1873	1872	5	5	
D302	3-5/8	3-7/8	6530	6510	7450	7430	376	378	1870	1871	3-5/8	3-7/8	R3
D303	4-1/4	3-3/4	6760	6770	7720	7730	364	363	1872	1871	4-1/4	3-3/4	
D304	4-1/8	4	6840	6800	7790	7770	359	362	1867	1873	4-1/8	4	
D305	4-1/8	4-3/16	6700	6680	7630	7620	367	368	1867	1870	4-1/8	4-3/16	
D306	4-3/4	4-3/4	6810	6810	7780	7780	361	361	1872	1872	4-3/4	4-3/4	R3
D310	5	4-1/2	6770	6770	7720	7730	363	363	1869	1871	5	4-1/2	
D311	4-11/16	4-5/8	6800	6840	7770	7790	362	359	1873	1867	4-11/16	4-5/8	
D312	4-7/8	4-7/8	6840	6800	7790	7770	359	362	1867	1873	4-7/8	4-7/8	

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
REACTOR BUILDING PRESTRESSING SYSTEM
6th TENDON SURVEILLANCE

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CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE HOOP TENDONS GROUP

0.7 Tendon Ultimate Strength = 1639 Kips
0.8 Tendon Ultimate Strength = 1873 Kips

File: HOOPR3.XLW

Tendon ID	Actual Elongation (In.)		Predicted Lift-Off Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data"					
							Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
42H17	5-5/8	4-5/8	6870	6810	7810	7780	358	361	1863	1872	5-5/8	4-5/8
42H18	5	5-3/8	6840	6799	7810	7750	359	362	1871	1868	5	5-3/8
42H19	5-1/4	5	6870	6810	7810	7780	358	361	1863	1872	5-1/4	5
42H29	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H30	4-7/8	5-3/4	6870	6790	7810	7750	358	362	1863	1871	4-7/8	5-3/4
42H31	5-1/4	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-1/4	4-7/8
42H32	5-1/4	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/4	5-1/8
42H33	5-3/8	5-1/4	6870	6810	7810	7780	358	361	1863	1872	5-3/8	5-1/4
42H34	5-1/2	5-3/8	6750	6660	7680	7600	364	369	1865	1870	5-1/2	5-3/8
42H35	5	5-1/4	6830	6770	7760	7720	360	363	1862	1869	5	5-1/4
42H36	5-1/8	5-1/8	6870	6790	7810	7750	358	362	1863	1871	5-1/8	5-1/8
42H37	5-5/16	4-7/8	6870	6810	7810	7780	358	361	1863	1872	5-5/16	4-7/8
42H43	5-1/2	5-1/8	6870	6810	7810	7780	358	361	1863	1872	5-1/2	5-1/8
42H44	5-1/8	5	6790	6840	7750	7790	362	359	1871	1867	5-1/8	5
42H45	5-7/16	5	6870	6810	7810	7780	358	361	1863	1872	5-7/16	5
46H20	5-1/4	5-1/8	6640	6600	7700	7610	370	373	1901	1890	5-1/4	5-1/8
46H21	5-1/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-1/8	5-1/4
46H22	5-5/8	5-1/4	6720	6730	7700	7640	366	365	1878	1861	5-5/8	5-1/4
51H25	5	5-1/8	6770	6800	7720	7750	363	362	1869	1868	5	5-1/8
51H26	5-1/2	5-1/4	6760	6760	7750	7700	364	364	1879	1867	5-1/2	5-1/4
51H27	5-1/8	4-7/8	6740	6670	7680	7600	365	369	1868	1868	5-1/8	4-7/8
51H28	5-1/8	5	6760	6750	7750	7700	364	364	1879	1870	5-1/8	5
51H29	5-1/2	4-3/4	6810	6750	7780	7700	361	364	1872	1870	5-1/2	4-3/4
53H1	5-3/4	5-1/8	6700	6760	7650	7720	367	364	1871	1872	5-3/4	5-1/8
53H2	5-3/4	4-5/8	6800	7770	7760	7720	362	316	1870	1628	5-3/4	4-5/8
53H3	5-3/8	4-1/8	6670	6710	7600	7660	369	366	1868	1871	5-3/8	4-1/8
53H45	5-1/4	5-1/4	6840	6800	7790	7770	359	362	1867	1873	5-1/4	5-1/4
53H46	4-7/8	5-3/8	6760	6730	7750	7660	364	365	1879	1865	4-7/8	5-3/8
53H47	4-3/4	5-1/2	6840	6800	7790	7770	359	362	1867	1873	4-3/4	5-1/2
62H21	5-1/8	4-3/4	6760	6700	7720	7650	364	367	1872	1871	5-1/8	4-3/4
62H22	5-5/16	5	6800	6750	7770	7700	362	364	1873	1870	5-5/16	5
62H23	5-1/8	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-1/4
62H39	5-7/16	5-1/4	6800	6750	7770	7700	362	364	1873	1870	5-7/16	5-1/4
62H40	5-3/8	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-3/8	4-7/8
62H41	5-1/4	5	6800	6750	7770	7700	362	364	1873	1870	5-1/4	5
62H42	5-3/8	5-1/16	6800	6750	7770	7700	362	364	1873	1870	5-3/8	5-1/16
62H43	5-3/8	4-7/8	6710	6670	7660	7600	366	369	1871	1868	5-3/8	4-7/8
62H44	5-1/2	4-7/8	6800	6750	7770	7700	362	364	1873	1870	5-1/2	4-7/8
62H45	5-3/16	5-1/8	6760	6700	7770	7700	364	367	1884	1884	5-3/16	5-1/8
62H46	5-1/8	5-3/8	6800	6750	7770	7700	362	364	1873	1870	5-1/8	5-3/8
62H47	5-5/8	4-1/2	6680	6640	7620	7550	368	370	1870	1864	5-5/8	4-1/2

Notes -
See the same calculations completed for the vertical group for notes and explanation of data & expressions used in Columns A through M.

28-Jan-98
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FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
REACTOR BUILDING PRESTRESSING SYSTEM
6th TENDON SURVEILLANCE

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CALCULATIONS SUPPORTING SP-182 "ORIGINAL STRESSING DATA" FOR THE VERTICAL TENDONS GROUP R2

0.7 Tendon Ultimate Strength 1639 Kips
0.8 Tendon Ultimate Strength 1873 Kips

File: VERTR2.XLW R2

Tendon ID	Actual Elongation (In.)		Predicted Lift-Of Pressure (psi)		80% Ultimate Pressure (psi)		For SP-182 "Original Stressing Data" Row 1 (Kips)		Row 2 (Kips)		Row 3 (In.)	
	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field	Shop	Field
(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)
23V24	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A
12V1	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
12V2	12-1/2	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/2	N/A
23V1	12-1/4	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-1/4	N/A
23V2	13-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	13-1/8	N/A
23V3	13	N/A	6760	N/A	7750	N/A	364	N/A	1879	N/A	13	N/A
34V5	12-5/8	N/A	6800	N/A	7770	N/A	362	N/A	1873	N/A	12-5/8	N/A
34V6	13	N/A	6810	N/A	7780	N/A	361	N/A	1872	N/A	13	N/A
34V7	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V9	12-5/16	N/A	6860	N/A	7840	N/A	358	N/A	1873	N/A	12-5/16	N/A
61V10	12-3/4	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-3/4	N/A
61V11	12-5/8	N/A	6710	N/A	7660	N/A	366	N/A	1871	N/A	12-5/8	N/A
61V20	12-1/2	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/2	N/A
61V21	12-1/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-1/8	N/A
61V22	12-7/8	N/A	6870	N/A	7810	N/A	358	N/A	1863	N/A	12-7/8	N/A

Notes -

Columns A through G are data input extracted from the tendon history books (applicable sheets contained in Attachment B).
Columns H through M are calculated using the expressions noted below.

Column Tendons within the scope of this surveillance.

Col.B&C Actual elongation data taken from tendon history sheets for shop and field ends respectively.
For the vertical tendons, only the shop end applies.

Col.D&E Predicted Liftoff Pressures taken from tendon history sheets for shop and field ends respectively.

Col.F&G 80% Ultimate pressures taken from tendon history sheets for shop and field ends respectively.

Col.H&I Columns H & I - Calculated force values in Kips for "Original Stressing Data" Row 1 which represent ram pressure @ 1500 psi. R2
These forces represent a zero slack starting point for both shop and field ends of each tendon and provide a basis for retensioning efforts.
The following expression is used to calculate the values for Row 1 data:
0.7 * Tendon Ultimate Strength * 1500 / Predicted Lift off Pressure at 0.7 tendon Ultimate Strength.
ie. for 23V24: 1639 * 1500 / 6870 = 358

Col.J&K Calculated force values in Kips for Original Stress Data" Row 2 data which represent forces at 80% Ultimate based on the following expression: R2
Actual pressure @ 80% Ultimate Strength (Cols. F or G) * 0.7 Ultimate Strength / Predicted pressure @ 70% Ult. from Cols. D or E.
ie. for 23V24: 7810 * 1639 / 6870 = 1863

Col.L& Actual elongation values repeated from Columns B & C for Row 3 of "Original Stressing Data". R2

12-Sep-97
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7.0 CONCLUSIONS

Tendon Force/Time Curves have been generated from the results of this calculation. Final force curves are presented and attached in Section 6.0 of this calculation.

Force curves for the three control tendons were also generated by this calculation and were used for comparison and verification of data and spread sheets with the same curves generated previously for the same tendons. The comparison was completed and the data sheets and force curves were found to be the same as that previously generated.

Other calculations supporting the "Original Stressing Data" and "Data Sheets" in SP-182 were completed and are presented in Section 6.6 of this calculation. R2

8.0 REFERENCES

The following references are used in the preparation of this calculation:

1. G/C Letter to FPC, FCS-14594, Scope Document, November 24, 1995, for Preparation of Tendon Force Curves for the 6th Surveillance and site trip to CR3.

2. G/C Letter to FPC, FCS-12439, August 13, 1991, Tendon Selection and Recommendations for the Fifth Surveillance.

3. Reg. Guide 1.35, Revision 3

4. Reg. Guide 1.35.1, Revision 0

5. CR3 FSAR, Section 5.2

6. Technical Specification, Section 3.6.1.6 & Section 4.6.1.6.

7. Design Input for the 5th Surveillance, DI-55220-152.0 SE, Revision 2.

8. G/C Calculation of Force curves for the 5th Surveillance for SP-182, Revision 11.

9. Design Input 5500-528-1, Revision to SP-182 Procedure for Tendons and Calculations for Force-Time Curves for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.

10. G/C Calculation 5500-528-1, Tendon Loss Calculations for Surveillance 4, Revisions 0 and 1, Jan.87 and Sept.87.

11. G/C Calculation 04-4762-099, Tendon Loss Calculations and Appendices for CR3 Tendons, J.Fulton and G.T.DeMoss, 3/6/87 and 1980 calculations.

12. Dome Tendon History Sheets updated to the 5th surveillance.

13. Hoop Tendon History Sheets updated to the 5th surveillance.

14. Vertical Tendon History Sheets updated to the 5th surveillance.
15. Effective Wire Summary information, letter to FPC
16. Prescon Vendor Drawings
17. SP-182, Rev 11.
18. Surveillance Report for the Fifth Inspection Period, VSL.
19. Engineering Report for the Fifth Tendon Surveillance, G/C Letter to FPC, FCS 14401, 6/20/94.

DOCKET COPY

Florida Power
CORPORATION

Crystal River Unit 3
Docket No. 50-302

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K.R. WILSON	NA2I

January 29, 1992
3F0192-16

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Subject: Reactor Containment Building Integrated Leak Rate Test Report

Dear Sir:

Attached please find the Reactor Containment Building Integrated Leak Rate Test Report for Crystal River Unit 3. This report is submitted in accordance with 10 CFR 50, Appendix J. The Integrated Leak Rate Test (ILRT) was successfully completed on November 7, 1991. Conforming to the Appendix J requirements, this report contains types A, B and C data summaries including results from the type A test performed in November 1991 and the results of type B and C tests which were performed since the ILRT conducted in November 1987. Also included is the analysis and interpretation of the November 1991 ILRT and the results and analysis of the supplemental verification test which demonstrated the validity of the leakage rate test measurements obtained. Other details are provided for clarity and completeness.

Sincerely,

P. M. Beard, Jr.
Senior Vice President
Nuclear Operations

PMB:LVC
Attachment

xc: Regional Administrator, Region II
NRR Project Manager
Senior Resident Inspector

FLORIDA POWER CORPORATION

Crystal River Unit 3 Nuclear Power Plant

REACTOR CONTAINMENT BUILDING INTEGRATED LEAKAGE RATE TEST REPORT

November 7, 1991

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- F. Information Retained at Plant

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V. REFERENCES

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- F. Local Leakage Rate Test Summaries
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I. INTRODUCTION

The Reactor Building Integrated Leakage Rate "Type A" Test is performed to demonstrate that leakage through the primary reactor containment systems and components penetrating primary reactor containment do not exceed the allowable leakage rates specified in the Plant Technical Specifications.

The purpose of this report is to provide information pertinent to the activities related to the preparation, test performance, and reporting of the Crystal River Unit 3 Nuclear Power Plant Integrated Leakage Rate Test (ILRT).

Highlights of activities and events which occurred prior to and during the ILRT are presented in Section II, Test Synopsis.

Section III, Test Data Summary, contains data and results necessary to demonstrate containment atmosphere stabilization, acceptable leakage rate, and successful verification test. In addition, plots provided in Appendices B and C supply a visual history of containment atmospheric conditions beginning with the 24 hour ILRT test period and ending with the verification test.

Information in Section IV, Analysis and Interpretation, supplies the technical details associated with the ILRT computer program and its associated hardware as well as the instrumentation used during the ILRT.

Section V, References, lists the documents used for the conduct of the ILRT.

The successful periodic Type A and verification test were performed according to the requirements of the Crystal River Unit 3 Technical Specifications and 10CFR50, Appendix J. The test method used was the Absolute Method, as described in ANSI/ANS 56.8-1987, "Containment System Leakage Testing Requirements".

Leakage rates were calculated using the mass point analysis technique described in ANSI/ANS 56.8-1987. Total Time Analysis equations from ANSI N45.4-1972, "Leakage-Rate Testing of Containment Structures for Nuclear Reactors" were run concurrently for informational purposes. The test results are reported in accordance with the requirements of 10CFR50, Appendix J, Section V.B.3.

II. TEST SYNOPSIS

Prior to containment pressurization on November 4, 1991, site personnel were engaged in prerequisite activities for the conduct of the ILRT. The ILRT was conducted at the end of the 8M midcycle outage. The following discussion highlights some of the activities that were essential to the successful and timely completion of the ILRT. These items are presented in chronological order.

A. Pre-pressurization Activities

These activities included: local leakage rate testing of penetrations which were to be isolated during the ILRT, "as found" and "as left" local leakage rate testing of penetrations which were scheduled for maintenance prior to the ILRT, ILRT procedure review and finalization, ILRT computer program check out and linkup to the Fluke 2285B Data Acquisition System, ILRT instrumentation installation and operability checks, and containment subvolume weighting factor and sensor failure analysis calculation.

The ILRT test procedure was reviewed against the requirements of the Plant Technical Specifications; 10CFR50, Appendix J; and ANSI/ANS 56.8-1987.

The ILRT instrumentation was calibrated prior to the ILRT as recommended by ANSI N45.4-1972, Sections 6.2 and 6.3. Final ILRT instrumentation operability checks and in-situ checks, as specified in ANSI/ANS 56.8-1987, Section 4.2.3.1, were performed to ensure that all instrumentation was operating correctly. Calibration records for the ILRT instrumentation system components are retained at the plant.

B. Test Summary Time-Line

Phase	Time Frame	Duration
Pressurization	From: 22:50 on 11/04/91 To: 23:40 on 11/05/91	24.83 hours
Stabilization	From: 23:45 on 11/05/91 To: 05:30 on 11/06/91	5.75 hours
ILRT Test	From: 05:30 on 11/06/91 To: 05:30 on 11/07/91	24.00 hours
Verification Test	From: 05:30 on 11/07/91 To: 09:45 on 11/07/91	4.25 hours

C. Containment Pressurization

Containment pressurization started at 22:50 on November 4, 1991 using six 1500 cfm diesel-driven 100% oil-free air compressors. The pressurization rate was maintained at approximately 3.6 psi per hour until containment pressure reached 48 psig. At this time, the pressurization rate was gradually reduced by reducing the number of operating compressors and increasing backpressure with LRV-24. All compressors were stopped when the containment pressure reached 54.5 psig. at 23:40 on November 5, 1991. This was within the procedural limits of 53.9 +1,-0 psig.

During pressurization an external containment walkdown was performed to identify potential leakage. During the walkdown a pressure buildup approximating building pressure was noted on the personnel airlock seals. Pressurization was stopped at 7 psig and the seals were inspected. The door seals were found to be in good condition and pressurization was resumed. No measurable leakage was observed from any other penetration in the test lineup. Pressurization was conducted with the use of the reactor building recirculation fans in slow speed. The fans were stopped at a pressure of 48.7 psig and were not used during the ILRT or verification test. Very little temperature stratification was observed.

D. Containment Atmospheric Stabilization

The stabilization phase was started at 23:45 on November 5, 1991. By 03:45 on November 6, 1991, the temperature stabilization criteria of ANSI/ANS 56.8-1987 had been met. The containment was declared stable at 05:30 of November 6, 1991 and the ILRT test period was begun.

E. ILRT Test Period

The ILRT was officially started after the 05:15 data point with the next data point at 05:30 on November 6, 1991 and was successfully completed at 05:30 on November 7, 1991. The maximum allowable leakage rate (L_a) for the containment is 0.25 % wt. per day with a test acceptance limit of 0.1875 % wt. per day (0.75 L_a). The Total Time and Mass Point Analyses were run concurrently on the General Physics ILRT Computer Program. The leakage rate results are as follows:

	Total Time Analysis % wt./day	Mass Point Analysis % wt./day
Calculated Leakage Rate	0.0871 *	0.0962 *
95 % Upper Confidence Leakage rate	0.0958 *	0.0968 *

* Does not include penalties for nonstandard alignments and water level changes

F. Verification Test

A successful verification test was conducted following the ILRT. At 05:30 on November 7, 1991, a leakage rate of 15.15 scfm leakage imposed on the primary containment. The 15.15 scfm leakage imposed (L_o) on the existing containment leakage was slightly less than L_a (.25 % wt./day) at 0.2383 % wt. per day. The verification phase was completed at 09:45 of the same day.

As a twenty four hour test was performed, the mass point verification test results are presented below:

	Mass Point Analysis % wt./day
Leakage Rate (L_{am})	0.0962
Imposed Leak (L_o)	0.2383
Lower Limit: $L_o + L_{am} - 0.25\ L_a$	0.2720
Composite Leakage (L_c)	0.2810
Upper Limit: $L_o + L_{am} + 0.25\ L_a$	0.3970

G. Local Leakage Rate Testing

Prior to the start of the ILRT, "as found" local leakage rate testing (LLRT) was performed as required by 10CFR50, Appendix J. Results from this testing were required for those penetrations not exposed to the ILRT pressure to complete the analysis of the "as found" ILRT results. The "as found" local leakage rate testing was completed on October 26, 1991.

III. TEST DATA SUMMARY

A. Plant Information

Owner	Florida Power Corporation
Plant	Crystal River Unit 3 Nuclear Power Plant
Location	Approx. 5 miles north of Crystal River, FL
Docket No.	50-302
Containment Type	Reinforced concrete structure composed of cylindrical walls (prestressed with a post-testing tendon system in the vertical and horizontal directions), with a flat foundation mat (conventional reinforcing) and a shallow dome roof (prestressed utilizing a three-way post tensioning tendon system). The inside surface is lined with a carbon steel liner.
NSSS Supplier, Type	Babcock & Wilcox PWR
Date Test Completed	November 7, 1991.

B. Technical Data

Containment Net Free Volume	2,000,000 cubic feet
Design Pressure	55 psig
Design Temperature	281° F
Calculated Peak Accident Pressure	53.9 psig
Calculated Peak Accident Temperature	278° F

C. Test Results - Type A

Test Method	Absolute
Test Pressure	54.5 psig

Integrated Leakage Rate Total Time Analysis Test Results (Presented for information only):

Calculated Leakage Rate, L_{am}	0.0871 % wt./day
95 % Upper Confidence Limit Leakage Rate	0.0958 % wt./day

Integrated Leakage Rate Mass Point Analysis Test Results:

Calculated Leakage Rate, L_{am}	0.0962 % wt./day
95 % Upper Confidence Limit Leakage Rate	0.0986 % wt./day
Maximum Allowable Leakage Rate, L_a	0.25 % wt./day
ILRT Acceptance Criteria, 0.75 L_a	0.1875 % wt./day
Verification Test Imposed Leakage Rate, L_o	15.15 scfm or 0.2383 % wt./day

Verification Test Mass Point Analysis Results and Limits:

Upper Limit ($L_o + L_{am} + 0.25\ L_a$)	0.3970 % wt./day
Calculated Composite Leakage Rate, L_c	0.2810 % wt./day
Lower Limit ($L_o + L_{am} - 0.25\ L_a$)	0.2720 % wt./day

Report Printouts

The report printouts of the ILRT and verification test calculations for the Total Time and Mass Point Analyses are provided in Appendices B and C. Stabilization data is provided in Appendix A.

D. Test Results - Type B and C Tests

A summary of local leakage rate test results since the ILRT in November 1987 are included in Appendix F.

E. Integrated Leakage Rate Measurement System

1. Absolute Pressure

Quantity	2
Manufacturer	Paroscientific
Type	DigiQuartz Model 740
Range	0 - 100 psia
Accuracy	± 0.01 % F.S.
Sensitivity	± 0.005 psia
Repeatability	± 0.005 psia
Resolution	± 0.0001 psia

2. Drybulb Temperature

Quantity	24
Manufacturer	Rosemount
Type	78N01N00N120 100 ohm platinum resistance temperature detectors (RTD)
Range, calibrated	75 - 125 ° F
Accuracy	± 0.5 ° F
Sensitivity	± 0.01 ° F

3. Water Vapor Pressure

Quantity	10
Manufacturer	Phys-Chem Scientific
Type	Humitemp-5 Precision Relative Humidity-Temperature Monitor, Model 2150 with PCRC-11 HPB probes

	Range	0 - 100% RH
	Accuracy	± 1.8° F (Dewpoint Temperature)
	Sensitivity	± 0.1° F (Dewpoint Temperature)
4.	Verification Flow	
	Quantity	2
	Manufacturer	Brooks
	Type	Model 1110-08 Rotometer
	Range	.76-7.6 scfm @ 14.7 psig and 70° F
	Accuracy	± 2% F.S.
5.	Readout Device	
	Quantity	1
	Manufacturer	Fluke
	Type	Model 2285B
	Repeatability	
	Drybulb Temp	± 0.054° F
	Dewpoint Temp	± 0.04° F
	Resolution	± 0.01° F

The instrumentation Selection Guide (ISG) value from ANSI/ANS 56.8-1987 based on a 24 hour test and the above ILRT instrumentation configuration is 0.0108 % wt./day (Refer to Appendix D for calculations). The sensor locations and volume fractions as installed for the ILRT are shown in Appendix G.

G. Information Retained at Plant

The following information is available for review at Crystal River Unit 3 Nuclear Power Plant site:

1. A listing of all containment penetrations including the total number, size, and function.
2. A listing of normal operating instrumentation used for the leakage test.
3. A system lineup (at time of test) showing required valve positions and status of piping systems.
4. A continuous, sequential log of events from the initial survey of containment to restoration of tested systems.
5. Documentation of instrumentation calibrations and standards, including a sensor failure analysis.
6. Data to verify temperature stabilization criteria as established by test procedure (Appendix A).
7. The working copy of the test procedure that includes signature sign-offs of procedural steps.
8. The procedure and data that verifies completion of penetration and valve testing including as-found leak rates, corrective action, and final leak rates.
9. Computer printouts of ILRT data and automated data acquisition printouts along with a summary description of the computer program.
10. A review of confidence limits of test results with accompanying computer printouts.

11. Description of the method of leakage rate verification.
12. ILRT data plots obtained during the test.
13. The P&IDs of pertinent systems.

IV. ANALYSIS AND INTERPRETATION

The upper 95% confidence limit (UCL) Total Time and Mass Point leakage rates calculated during the ILRT were less than the test acceptance criteria of 0.75 L_a (0.1875% wt/day). Additions to the calculated leakage rates must be made to account for penetration paths not exposed to the ILRT pressure and for changes in the net free containment volume due to changes to containment water levels. These additions are discussed below.

A. Type C Penalties

Penetration paths not exposed to the ILRT pressure and the corresponding minimum pathway leakage rates are as follows:

Pen. No.	System	Leakage Rate (sccm)
116	RB Leak Rate	41
122	RB Leak Rate	15
202	RB Leak Rate	69.6
314	Main Steam	420
316	Main Steam	1030
318	Main Steam	20
320	Main Steam	20
427	Main Steam	605
428	Main Steam	1255

The total applicable local leakage rate Type C penalty addition is 3,475.6sccm which is equivalent to 0.0019% wt. per day.

B. Volume Change Corrections

The following volumes were monitored for liquid level changes which would affect the containment net free volume:

Volume Monitored	Level Change	Volume Change
Pressurizer	-10 inches	+30.8 cu. ft.
Reactor Building Sump	+ 3 inches	-9.48 cu. ft.

Conservatively, level decreases can be disregarded since their effect is already included in the measured leakage rate. The increase in reactor building sump resulted in a decrease of 9.48 cubic feet in the containment net free volume. This is equivalent to a leakage rate of 0.0005 % wt. per day.

C. As Left ILRT Results

The as left ILRT leakage rate including the required additions is as follows:

	Total Time Analysis (% wt./day)	Mass Point Analysis (% wt./day)
95 % UCL Leakage Rate	0.0958	0.0986
Type C Penalties	0.0019	0.0019
Volume Change	0.0005	0.0005
As Left 95 % UCL Leakage Rate	0.0982	0.1010

The as left Total Time and Mass Point 95 % UCL leakage rates are less than the maximum allowable leakage rate value stated in the technical specifications of 0.75 L_a (0.1875 % wt./day).

D. As Found ILRT Results

Repairs or adjustments were made to the following penetrations which would require correction to the as left ILRT result.

Penetration	Leakage Savings(sccm)
113	595
439	105.7

The total leakage savings is 700.7 sccm based on minimum pathway analysis. This is equivalent to 0.0004 % wt. per day. The as found ILRT leakage is determined as follows:

	Total Time Analysis (% wt./day)	Mass Point Analysis (% wt./day)
As Left 95 % UCL Leakage Rate	0.0982	0.1010
Leakage Savings	0.0004	0.0004
As Found 95 % UCL Leakage Rate	0.0986	0.1014

V. REFERENCES

A. Crystal River Unit 3 Nuclear Power Plant Surveillance Procedure SP-178 Rev. 17, Reactor Containment Building Integrated Leakage Rate Test.

B. Crystal River Unit 3 Nuclear Power Plant Technical Specifications.

C. Crystal River Unit 3 Nuclear Power Plant Updated Final Safety Analysis Report.

D. Code of Federal Regulations, Title 10, Part 50, Appendix J, Primary Reactor Containment Leakage Testing for Water Cooled Power Reactors.

E. ANSI N45.4-1972, Leakage-Rate Testing of Containment Structures for Nuclear Reactors.

F. ANSI/ANS 56.8-1987, Containment System Leakage Testing Requirements.

VI APPENDICES

APPENDIX A

STABILIZATION PHASE DATA

STABLIZATION MODE
OPTIONS

1 - MANUAL DATA ENTRY
2 - PARAMATER GRAPHS
3 - SENSOR PLOTS
4 - SENSOR DIFFERENTIALS
5 - ANSI STABILIZATION CRITERIA
6 - BN-TOP-1 STAB.CRITERIA
7 - ANSI CRITERIA PRINTOUT
8 - BN-TOP-1 CRITERIA PRINTOUT
9 - REPRINT CURRENT DATA POINT
P - PASS WORD MENU
0 - FLASH OFF

TIME : 0515
MODE SUMMARY

# OF DATA POINTS =	23
MODE DURATION (IN HRS) =	5.5
TOT TIME MEASURED LEAK =	0.2696
TOT TIME CALCULATED LEAK =	0.1632
TOT TIME 95% UCL =	0.5072
MASS PT LEAK =	0.2415
MASS PT 95% UCL =	0.2551

ANSI TEMPERATURE STABLIZATION CRITERIA MET
BN-TOP TEMPERATURE STABLIZATION CRITERIA MET

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

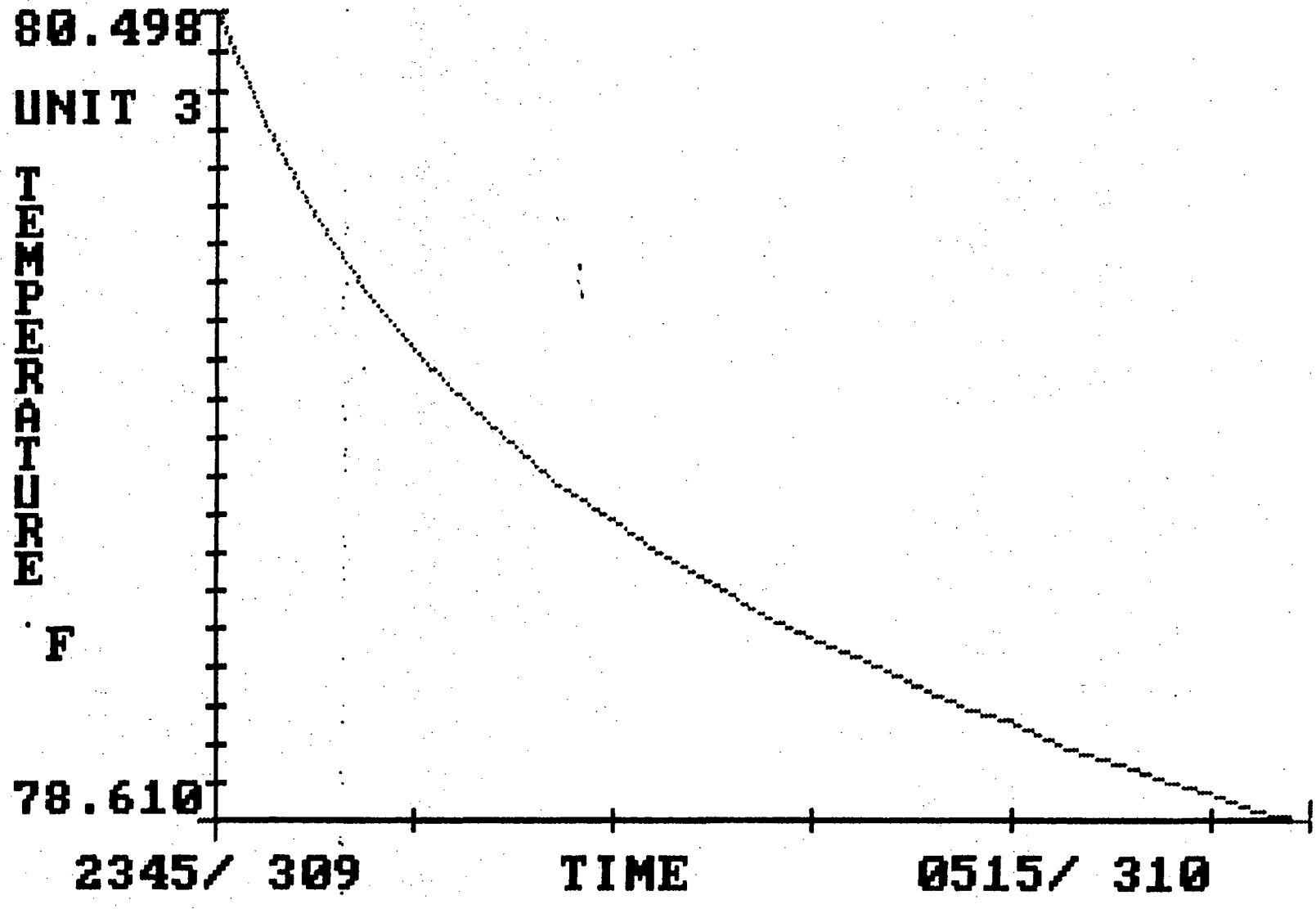
AVG TEMP:	78.610/ -0.029	AVG PRESS:	68.618/ -0.005
MASS:	688156.50/ -10.000	AVG DEW PRESS:	0.4208/-0.0013
		TOTAL PRESS:	69.039/ -0.006

LEAK RATE ANALYSIS UNIT # 3

DATE	TIME	MEASURED LEAK RATE	TOTAL TIME CALCULATED LEAK RATE	UCL	MASS POINT CALC. LEAK RATE	L95
309	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
310	0.25	1.2029	0.0000	0.0000	0.0000	0.0000
310	0.50	0.7145	0.7145	0.0000	0.7157	3.1300
310	0.75	0.5437	0.4908	1.7472	0.5124	1.0186
310	1.00	0.4529	0.3654	1.0963	0.4060	0.6812
310	1.25	0.4143	0.2979	0.9158	0.3532	0.5281
310	1.50	0.4468	0.2884	0.8933	0.3625	0.4799
310	1.75	0.3699	0.2532	0.7948	0.3286	0.4213
310	2.00	0.3604	0.2319	0.7374	0.3098	0.3826
310	2.25	0.3403	0.2140	0.6911	0.2937	0.3533
310	2.50	0.3785	0.2177	0.6873	0.3046	0.3538
310	2.75	0.3194	0.2039	0.6508	0.2886	0.3325
310	3.00	0.3181	0.1953	0.6256	0.2798	0.3178
310	3.25	0.3186	0.1905	0.6082	0.2751	0.3077
310	3.50	0.2990	0.1831	0.5876	0.2664	0.2959
310	3.75	0.2963	0.1778	0.5715	0.2608	0.2871
310	4.00	0.2941	0.1741	0.5586	0.2563	0.2797
310	4.25	0.3017	0.1737	0.5513	0.2564	0.2772
310	4.50	0.2895	0.1715	0.5416	0.2534	0.2721
310	4.75	0.2837	0.1693	0.5322	0.2507	0.2677
310	5.00	0.2789	0.1671	0.5234	0.2475	0.2631
310	5.25	0.2758	0.1653	0.5153	0.2446	0.2591
310	5.50	0.2696	0.1632	0.5072	0.2415	0.2551

AVG. DATA VALUES UNIT # 3

DATE	TIME	T(I)	P(I)	DT(I)	VF(I)	MASS(I)
309	0.00	80.498	68.901	0.000	0.425	688582.00
310	0.25	80.245	68.860	0.000	0.424	688495.69
310	0.50	80.030	68.831	0.000	0.423	688479.50
310	0.75	79.858	68.808	0.000	0.423	688465.00
310	1.00	79.719	68.789	0.000	0.423	688452.00
310	1.25	79.601	68.772	0.000	0.423	688433.38
310	1.50	79.502	68.755	0.000	0.425	688389.69
310	1.75	79.401	68.743	0.000	0.424	688396.31
310	2.00	79.320	68.730	0.000	0.424	688375.19
310	2.25	79.241	68.719	0.000	0.423	688362.31
310	2.50	79.174	68.705	0.000	0.426	688310.50
310	2.75	79.102	68.698	0.000	0.423	688329.88
310	3.00	79.046	68.689	0.000	0.423	688308.13
310	3.25	78.997	68.680	0.000	0.423	688284.88
310	3.50	78.937	68.672	0.000	0.422	688281.69
310	3.75	78.889	68.664	0.000	0.422	688263.13
310	4.00	78.847	68.657	0.000	0.421	688244.38
310	4.25	78.801	68.648	0.000	0.423	688214.00
310	4.50	78.758	68.642	0.000	0.422	688208.19
310	4.75	78.716	68.635	0.000	0.422	688195.38
310	5.00	78.680	68.629	0.000	0.422	688181.88
310	5.25	78.640	68.623	0.000	0.422	688166.50
310	5.50	78.610	68.618	0.000	0.421	688156.50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UNIT 3
TEMPERATURE
°F
78.610
2345/ 309
TIME
0515/ 310

TIME	TEMP	BN dT	BN dT2
5.50	78.6103	-0.1634	0.0606
5.25	78.6396	-0.1785	0.0183
5.00	78.6803	-0.1831	0.0399
4.75	78.7162	-0.1931	0.0600
4.50	78.7579	-0.2081	0.0492
4.25	78.8005	-0.2204	0.0643
4.00	78.8474	-0.2365	0.0781
3.75	78.8893	-0.2560	0.1061
3.50	78.9370	-0.2825	0.0791
3.25	78.9966	-0.3023	0.1353
3.00	79.0465	-0.3361	0.1672
2.75	79.1023	-0.3779	0.1995
2.50	79.1741	-0.4278	0.2957
2.25	79.2413	-0.5017	0.3490
2.00	79.3203	-0.5890	0.0000
1.75	79.4013	0.0000	0.0000
1.50	79.5021	0.0000	0.0000
1.25	79.6012	0.0000	0.0000
1.00	79.7187	0.0000	0.0000
0.75	79.8582	0.0000	0.0000
0.50	80.0297	0.0000	0.0000
0.25	80.2447	0.0000	0.0000
0.00	80.4983	0.0000	0.0000

STABILIZATION ANSI56.8

TIME	TEMP	56.8 1 HR F/HR	56.8 4 HR F/HR	4-1 HR
5.50	78.610	0.148	0.223	0.075
5.25	78.640	0.161	0.240	0.079
5.00	78.680	0.167	0.260	0.093
4.75	78.716	0.173	0.285	0.112
4.50	78.758	0.179	0.318	0.139
4.25	78.801	0.196	0.361	0.165
4.00	78.847	0.199	0.413	0.214
3.75	78.889	0.213	0.000	-0.213
3.50	78.937	0.237	0.000	-0.237
3.25	78.997	0.245	0.000	-0.245
3.00	79.046	0.274	0.000	-0.274
2.75	79.102	0.299	0.000	-0.299
2.50	79.174	0.328	0.000	-0.328
2.25	79.241	0.360	0.000	-0.360
2.00	79.320	0.398	0.000	-0.398
1.75	79.401	0.457	0.000	-0.457
1.50	79.502	0.528	0.000	-0.528
1.25	79.601	0.644	0.000	-0.644
1.00	79.719	0.780	0.000	-0.780
0.75	79.858	0.000	0.000	0.000
0.50	80.030	0.000	0.000	0.000
0.25	80.245	0.000	0.000	0.000

APPENDIX B

ILRT TEST DATA AND PLOTS

PLEASE SELECT THE OPTION
YOU WISH TO USE:

1 - MANUAL DATA ENTRY
2 - PARAMETER GRAPHS
3 - SENSOR PLOTS
4 - TREND ANALYSIS
5 - REPRINT CURRENT DATA PT
6 - SENSOR DIFFERENTIALS

P - PASS WORD MENU

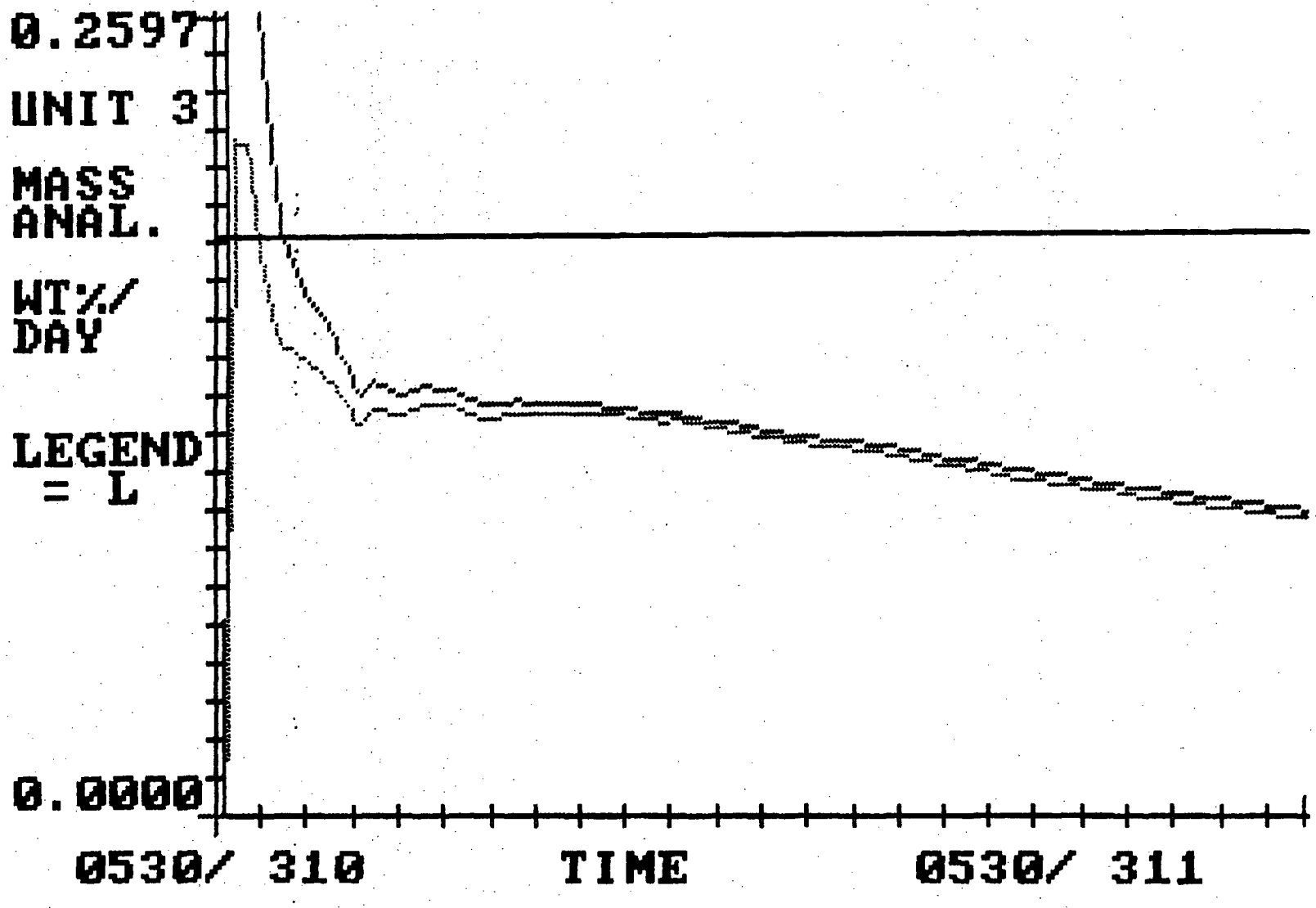
SELECTED OPTION=

TEST DATA 0530

# OF DATA POINTS	= 97
MODE DURATION (IN HOURS)	= 24
TOT TIME MEASURED LEAK	= 0.0968
TOT TIME CALCULATED LEAK	= 0.0871
TOT TIME 95% UCL	= 0.0958
MASS POINT LEAK	= 0.0962
MASS POINT 95% UCL	= 0.0986
75% La	= .1875
MASS	= 687461.19

POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

AVG TEMP:	77.069 / -0.014	AVG PRESS:	68.352 / -0.001
MASS:	687461.19 / +4.375	AVG DEW PRESS:	0.4010 / -0.0003
		TOTAL PRESS:	68.753 / -0.002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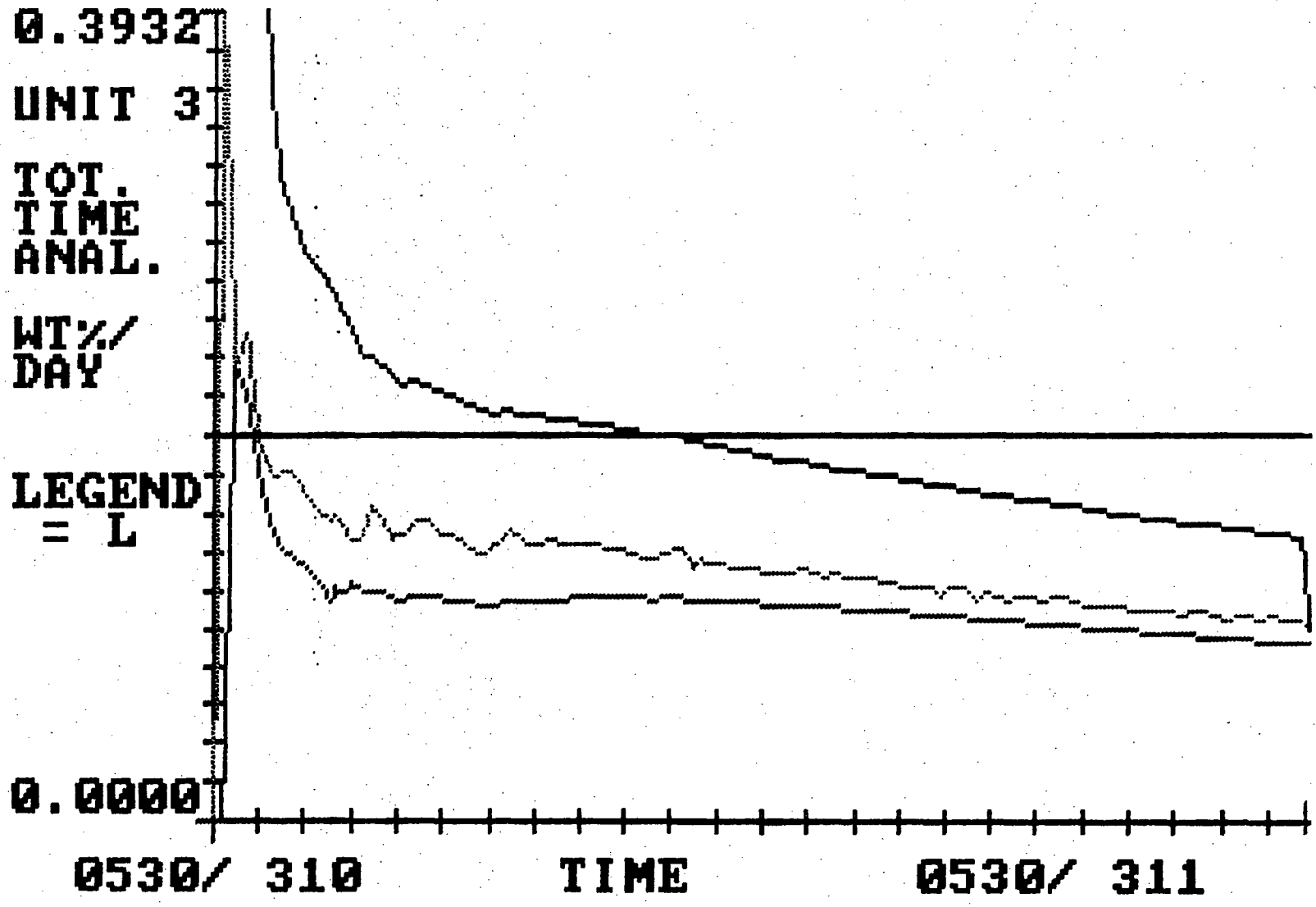
UNIT 3
MASS
ANAL.
WT%/
DAY
LEGEND
= L
0.0000
0530/ 310
TIME
0530/ 311


0.3932
UNIT 3
TOT.
TIME
ANAL.
WT%/
DAY
LEGEND
= L
0.0000
0530/ 310
TIME
0530/ 311

TOTAL TIME/MASS POINT UNIT # 3

DATE	TIME	TTLM	LMCALC	SL	LAM	L95
310	0.00	0.0000	0.0000	0.0000	0.0000	0.0000
310	0.25	0.3932	0.0000	0.0000	0.0000	0.0000
310	0.50	0.2223	0.2223	0.0000	0.2209	1.0630
310	0.75	0.2380	0.2069	0.9452	0.2190	0.3486
310	1.00	0.1867	0.1695	0.4623	0.1808	0.2597
310	1.25	0.1725	0.1471	0.3523	0.1610	0.2140
310	1.50	0.1707	0.1367	0.3120	0.1537	0.1901
310	1.75	0.1713	0.1327	0.2935	0.1528	0.1790
310	2.00	0.1631	0.1280	0.2762	0.1496	0.1698
310	2.58	0.1498	0.1086	0.2581	0.1408	0.1570
310	2.75	0.1505	0.1161	0.2536	0.1383	0.1514
310	3.00	0.1417	0.1134	0.2421	0.1329	0.1447
310	3.05	0.1393	0.1178	0.2365	0.1295	0.1403
310	3.25	0.1404	0.1148	0.2279	0.1277	0.1373
310	3.53	0.1549	0.1132	0.2253	0.1314	0.1408
310	3.75	0.1467	0.1129	0.2221	0.1321	0.1403
310	4.00	0.1399	0.1104	0.2167	0.1307	0.1381
310	4.27	0.1419	0.1088	0.2130	0.1305	0.1371
310	4.50	0.1492	0.1100	0.2131	0.1326	0.1389
310	4.75	0.1483	0.1107	0.2126	0.1341	0.1399
310	5.00	0.1408	0.1102	0.2102	0.1336	0.1389
310	5.25	0.1409	0.1099	0.2082	0.1330	0.1379
310	5.50	0.1384	0.1094	0.2060	0.1324	0.1369
310	5.75	0.1336	0.1084	0.2030	0.1308	0.1353
310	6.00	0.1328	0.1075	0.2004	0.1293	0.1336
310	6.25	0.1362	0.1073	0.1989	0.1291	0.1331

TOTAL TIME/MASS POINT UNIT # 3

DATE	TIME	TTLM	LMCALC	SL	LAM	L95
310	6.50	0.1429	0.1082	0.1991	0.1302	0.1341
310	6.75	0.1416	0.1090	0.1989	0.1311	0.1347
310	7.00	0.1366	0.1090	0.1978	0.1308	0.1342
310	7.25	0.1366	0.1091	0.1968	0.1305	0.1337
310	7.50	0.1403	0.1097	0.1966	0.1312	0.1342
310	7.75	0.1367	0.1099	0.1957	0.1312	0.1340
310	8.00	0.1362	0.1100	0.1949	0.1309	0.1336
310	8.25	0.1362	0.1102	0.1941	0.1308	0.1333
310	8.50	0.1368	0.1105	0.1935	0.1308	0.1332
310	8.75	0.1336	0.1104	0.1925	0.1302	0.1325
310	9.00	0.1357	0.1106	0.1919	0.1303	0.1324
310	9.25	0.1331	0.1105	0.1909	0.1298	0.1319
310	9.50	0.1288	0.1101	0.1895	0.1290	0.1312
310	9.75	0.1310	0.1099	0.1885	0.1284	0.1305
310	10.00	0.1331	0.1100	0.1878	0.1282	0.1302
310	10.25	0.1347	0.1103	0.1874	0.1283	0.1302
310	10.50	0.1257	0.1097	0.1860	0.1272	0.1293
310	10.75	0.1307	0.1096	0.1852	0.1268	0.1289
310	11.00	0.1274	0.1093	0.1841	0.1262	0.1283
310	11.25	0.1273	0.1090	0.1831	0.1256	0.1277
310	11.50	0.1250	0.1086	0.1819	0.1249	0.1270
310	11.75	0.1262	0.1083	0.1809	0.1244	0.1265
310	12.00	0.1242	0.1079	0.1798	0.1236	0.1257
310	12.25	0.1228	0.1074	0.1786	0.1228	0.1250
310	12.50	0.1240	0.1071	0.1777	0.1224	0.1245
310	12.75	0.1218	0.1066	0.1766	0.1214	0.1236

TOTAL TIME/MASS POINT UNIT # 3

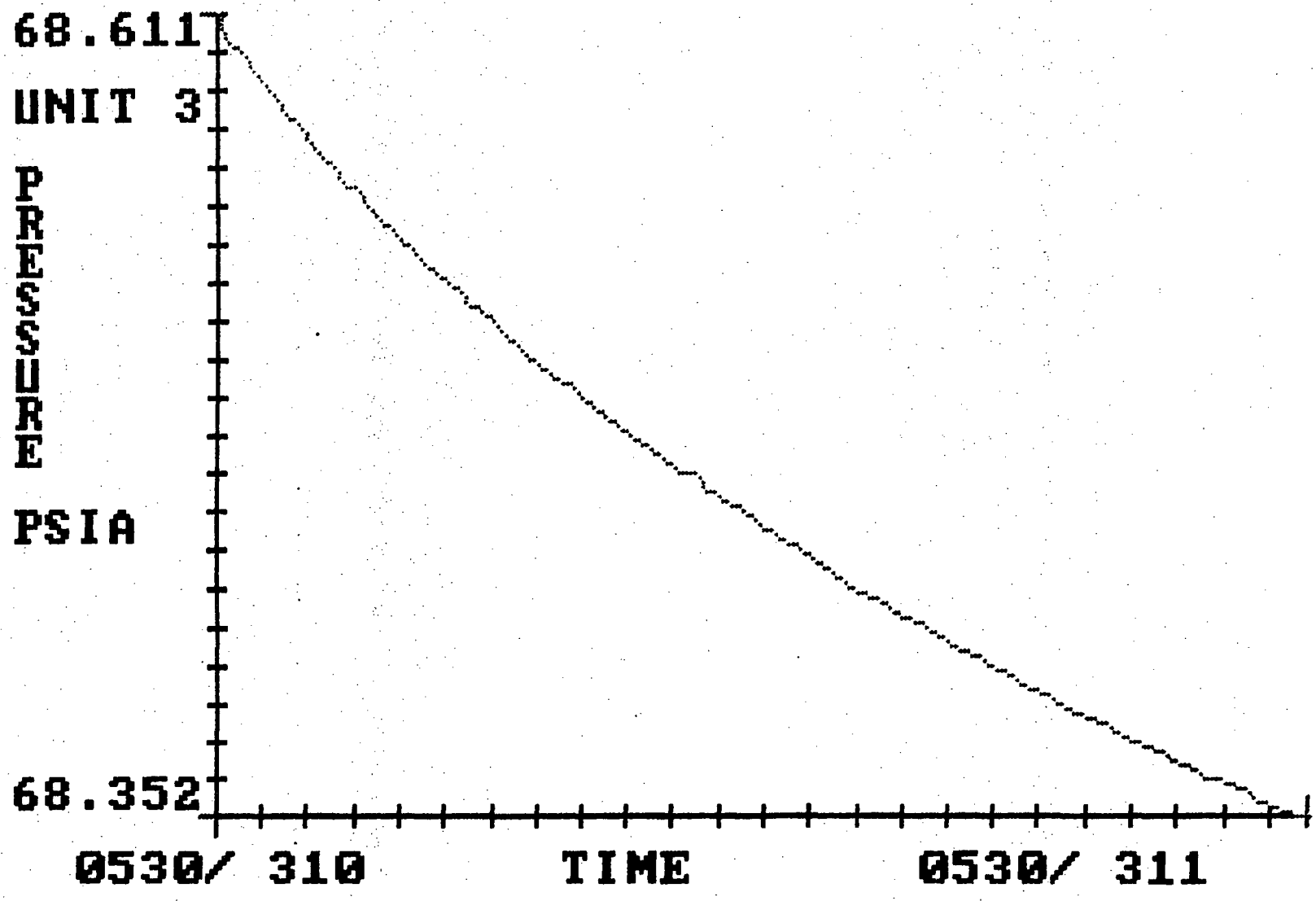
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
310	13.00	0.1241	0.1064	0.1757	0.1209	0.1231
310	13.25	0.1238	0.1062	0.1750	0.1206	0.1227
310	13.50	0.1208	0.1057	0.1739	0.1199	0.1220
310	13.75	0.1228	0.1055	0.1732	0.1195	0.1216
310	14.00	0.1209	0.1052	0.1723	0.1191	0.1211
310	14.25	0.1211	0.1049	0.1715	0.1187	0.1207
310	14.50	0.1205	0.1045	0.1707	0.1181	0.1201
310	14.75	0.1187	0.1041	0.1697	0.1176	0.1196
310	15.00	0.1187	0.1038	0.1689	0.1170	0.1191
310	15.25	0.1166	0.1033	0.1679	0.1164	0.1184
310	15.50	0.1159	0.1028	0.1670	0.1156	0.1177
310	15.75	0.1162	0.1024	0.1661	0.1151	0.1173
310	16.00	0.1118	0.1018	0.1649	0.1142	0.1165
310	16.25	0.1158	0.1014	0.1641	0.1137	0.1159
310	16.50	0.1153	0.1010	0.1633	0.1131	0.1154
310	16.75	0.1096	0.1003	0.1622	0.1122	0.1146
310	17.00	0.1137	0.0999	0.1613	0.1117	0.1140
310	17.25	0.1107	0.0994	0.1604	0.1110	0.1134
310	17.50	0.1100	0.0988	0.1594	0.1103	0.1127
310	17.75	0.1111	0.0984	0.1586	0.1096	0.1120
310	18.00	0.1118	0.0980	0.1578	0.1092	0.1116
310	18.25	0.1097	0.0975	0.1570	0.1086	0.1109
311	18.50	0.1101	0.0971	0.1562	0.1081	0.1105
311	18.75	0.1103	0.0967	0.1554	0.1077	0.1100
311	19.00	0.1084	0.0963	0.1546	0.1070	0.1094
311	19.25	0.1069	0.0958	0.1538	0.1064	0.1088

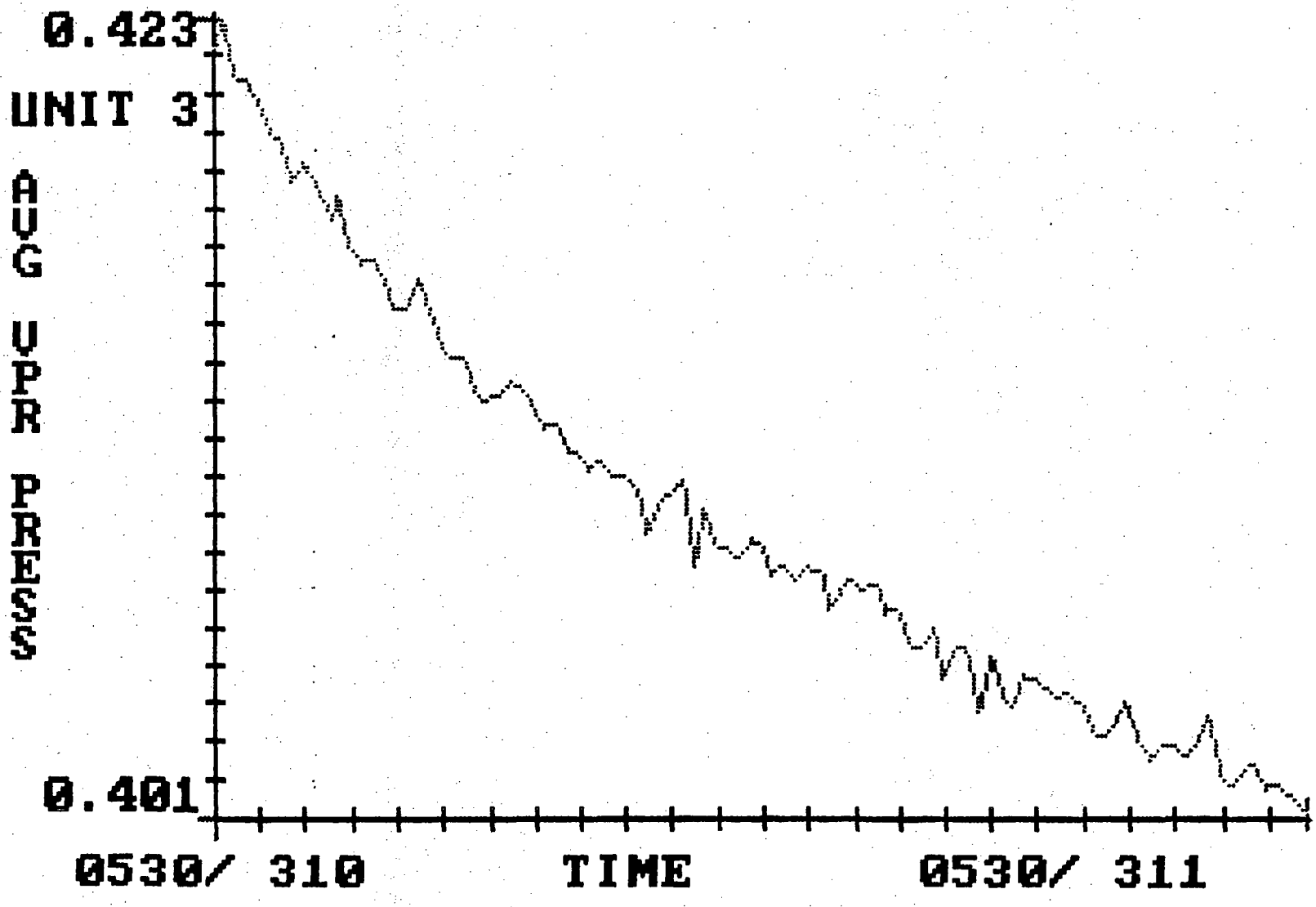
TOTAL TIME/MASS POINT UNIT # 3

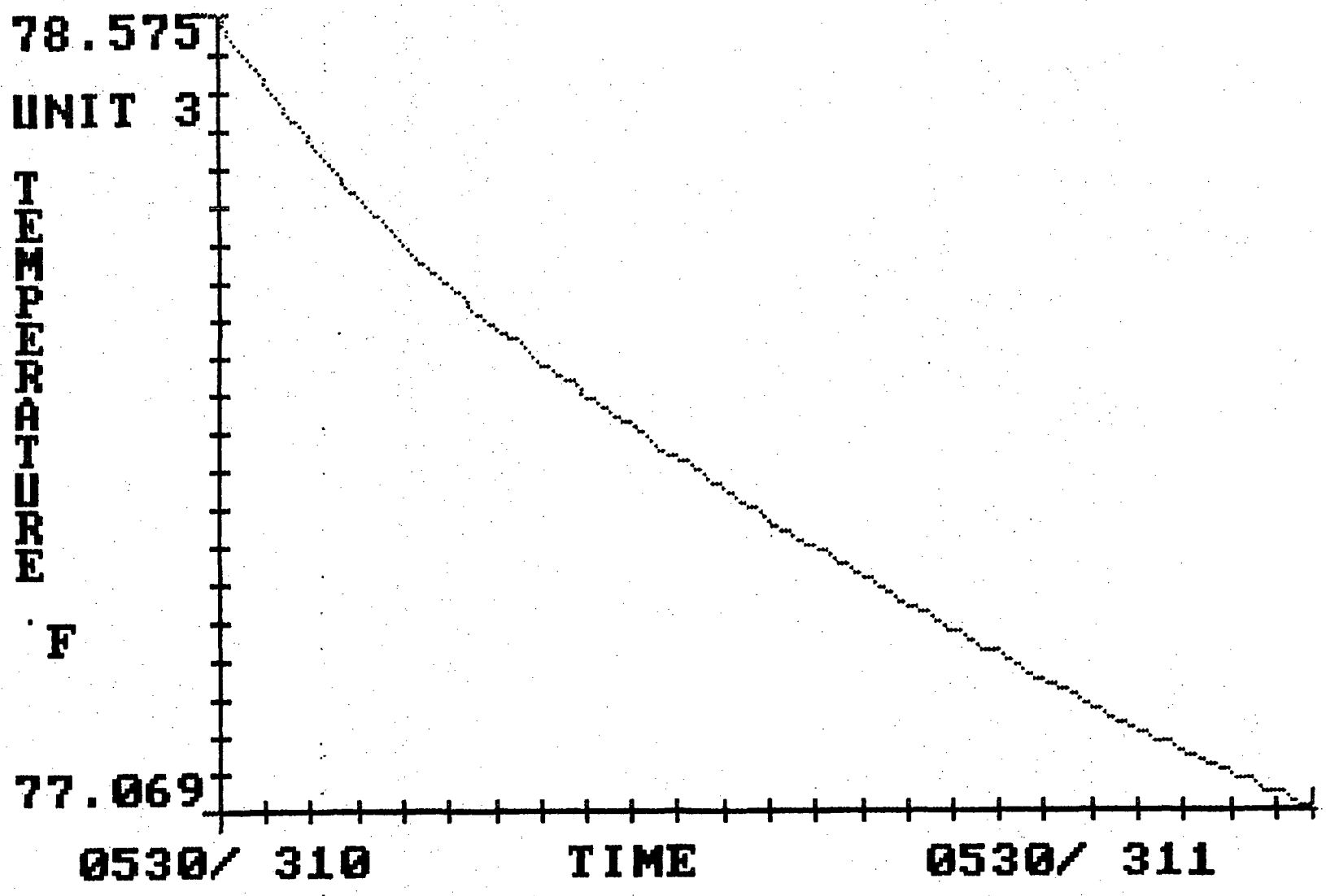
DATE	TIME	TTLM	LMCALC	SL	LAM	L95
311	19.50	0.1057	0.0952	0.1529	0.1057	0.1081
311	19.75	0.1068	0.0948	0.1521	0.1052	0.1076
311	20.00	0.1061	0.0943	0.1513	0.1046	0.1070
311	20.25	0.1045	0.0938	0.1505	0.1040	0.1064
311	20.50	0.1035	0.0933	0.1496	0.1033	0.1058
311	20.75	0.1050	0.0928	0.1489	0.1029	0.1053
311	21.00	0.1040	0.0924	0.1481	0.1024	0.1048
311	21.25	0.1026	0.0919	0.1473	0.1018	0.1042
311	21.50	0.1031	0.0914	0.1466	0.1012	0.1037
311	21.75	0.1043	0.0911	0.1459	0.1008	0.1032
311	22.00	0.1026	0.0906	0.1452	0.1003	0.1027
311	22.25	0.1005	0.0901	0.1444	0.0998	0.1022
311	22.50	0.1016	0.0897	0.1437	0.0993	0.1017
311	22.75	0.1008	0.0893	0.1430	0.0988	0.1012
311	23.00	0.1004	0.0888	0.1423	0.0983	0.1007
311	23.25	0.1009	0.0885	0.1417	0.0979	0.1002
311	23.50	0.0994	0.0880	0.1410	0.0973	0.0997
311	23.75	0.0985	0.0876	0.1403	0.0968	0.0992
311	24.00	0.0968	0.0871	0.0958	0.0962	0.0986

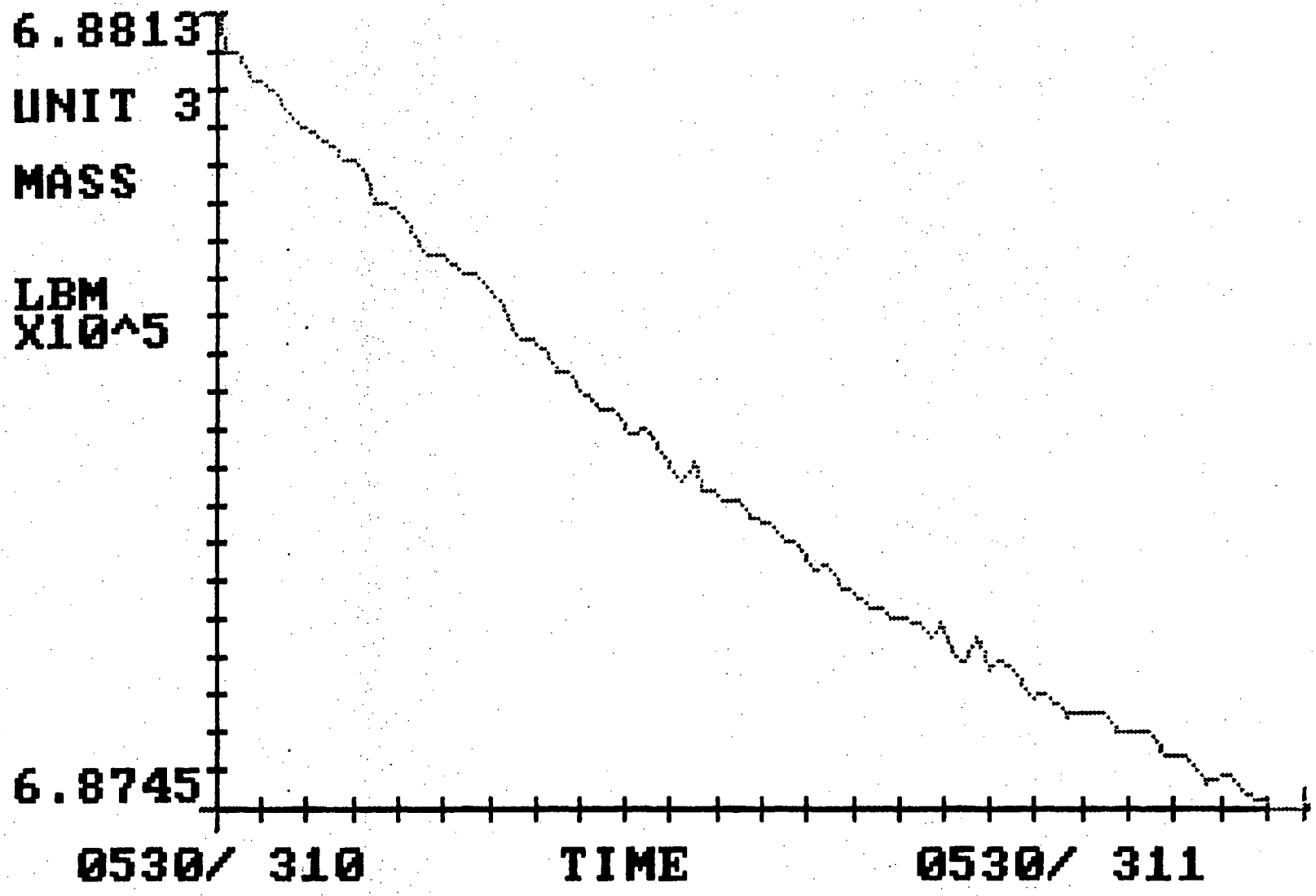
DATE	TIME	T(I)	P(I)	DT(I)	VP(I)	MASS(I)
310	0.00	78.575	68.611	0.000	0.422	688127
310	0.25	78.545	68.604	0.000	0.423	688099
310	0.50	78.518	68.600	0.000	0.422	688095
310	0.75	78.491	68.595	0.000	0.421	688076
310	1.00	78.456	68.590	0.000	0.421	688074
310	1.25	78.429	68.586	0.000	0.420	688066
310	1.50	78.400	68.581	0.000	0.420	688054
310	1.75	78.380	68.577	0.000	0.419	688041
310	2.00	78.345	68.572	0.000	0.419	688034
310	2.58	78.286	68.563	0.000	0.418	688016
310	2.75	78.266	68.559	0.000	0.418	688009
310	3.00	78.244	68.556	0.000	0.417	688005
310	3.05	78.239	68.555	0.000	0.417	688006
310	3.25	78.219	68.552	0.000	0.416	687996
310	3.53	78.201	68.547	0.000	0.416	687970
310	3.75	78.180	68.544	0.000	0.416	687970
310	4.00	78.156	68.541	0.000	0.415	687967
310	4.27	78.132	68.537	0.000	0.415	687954
310	4.50	78.112	68.532	0.000	0.416	687935
310	4.75	78.099	68.530	0.000	0.415	687925
310	5.00	78.075	68.527	0.000	0.414	687925
310	5.25	78.057	68.523	0.000	0.414	687915
310	5.50	78.033	68.520	0.000	0.414	687909
310	5.75	78.015	68.517	0.000	0.413	687907
310	6.00	77.996	68.514	0.000	0.413	687899
310	6.25	77.979	68.510	0.000	0.413	687883
310	6.50	77.967	68.506	0.000	0.413	687861
310	6.75	77.949	68.503	0.000	0.413	687853
310	7.00	77.927	68.501	0.000	0.412	687853
310	7.25	77.914	68.498	0.000	0.412	687843
310	7.50	77.902	68.495	0.000	0.412	687826
310	7.75	77.885	68.492	0.000	0.411	687823
310	8.00	77.867	68.489	0.000	0.411	687815
310	8.25	77.854	68.486	0.000	0.411	687805
310	8.50	77.837	68.483	0.000	0.411	687794
310	8.75	77.818	68.481	0.000	0.410	687792
310	9.00	77.806	68.478	0.000	0.411	687777
310	9.25	77.790	68.475	0.000	0.410	687774
310	9.50	77.774	68.473	0.000	0.409	687776
310	9.75	77.757	68.470	0.000	0.410	687761
310	10.00	77.744	68.467	0.000	0.410	687746
310	10.25	77.733	68.464	0.000	0.410	687731
310	10.50	77.715	68.463	0.000	0.408	687749
310	10.75	77.701	68.459	0.000	0.410	687725
310	11.00	77.688	68.457	0.000	0.409	687725
310	11.25	77.675	68.455	0.000	0.409	687717
310	11.50	77.657	68.453	0.000	0.408	687715
310	11.75	77.644	68.450	0.000	0.409	687702
310	12.00	77.625	68.447	0.000	0.409	687700
310	12.25	77.614	68.445	0.000	0.408	687696
310	12.50	77.603	68.442	0.000	0.408	687683

DATE	TIME	T(I)	P(I)	DT(I)	VP(I)	MASS(I)
310	12.75	77.587	68.440	0.000	0.408	687682
310	13.00	77.578	68.437	0.000	0.408	687665
310	13.25	77.564	68.435	0.000	0.408	687657
310	13.50	77.550	68.433	0.000	0.407	687660
310	13.75	77.540	68.430	0.000	0.407	687643
310	14.00	77.518	68.428	0.000	0.408	687642
310	14.25	77.510	68.426	0.000	0.407	687633
310	14.50	77.496	68.423	0.000	0.408	687627
310	14.75	77.484	68.422	0.000	0.407	687625
310	15.00	77.471	68.419	0.000	0.407	687617
310	15.25	77.459	68.417	0.000	0.406	687617
310	15.50	77.447	68.415	0.000	0.406	687612
310	15.75	77.432	68.413	0.000	0.406	687603
310	16.00	77.416	68.412	0.000	0.405	687615
310	16.25	77.413	68.409	0.000	0.406	687588
310	16.50	77.399	68.406	0.000	0.406	687582
310	16.75	77.381	68.406	0.000	0.404	687601
310	17.00	77.374	68.402	0.000	0.405	687573
310	17.25	77.360	68.401	0.000	0.404	687580
310	17.50	77.348	68.399	0.000	0.404	687576
310	17.75	77.335	68.396	0.000	0.405	687562
310	18.00	77.328	68.394	0.000	0.405	687551
310	18.25	77.313	68.393	0.000	0.405	687554
311	18.50	77.306	68.391	0.000	0.404	687544
311	18.75	77.297	68.389	0.000	0.404	687534
311	19.00	77.281	68.387	0.000	0.404	687537
311	19.25	77.269	68.385	0.000	0.403	687537
311	19.50	77.256	68.384	0.000	0.403	687536
311	19.75	77.246	68.381	0.000	0.404	687522
311	20.00	77.231	68.379	0.000	0.404	687519
311	20.25	77.223	68.378	0.000	0.403	687521
311	20.50	77.212	68.376	0.000	0.403	687519
311	20.75	77.206	68.374	0.000	0.403	687503
311	21.00	77.192	68.372	0.000	0.403	687501
311	21.25	77.180	68.371	0.000	0.403	687502
311	21.50	77.171	68.368	0.000	0.403	687492
311	21.75	77.162	68.366	0.000	0.404	687477
311	22.00	77.157	68.365	0.000	0.402	687480
311	22.25	77.140	68.364	0.000	0.402	687486
311	22.50	77.133	68.362	0.000	0.402	687472
311	22.75	77.120	68.360	0.000	0.403	687470
311	23.00	77.114	68.358	0.000	0.402	687465
311	23.25	77.107	68.357	0.000	0.402	687455
311	23.50	77.093	68.355	0.000	0.402	687457
311	23.75	77.083	68.354	0.000	0.401	687457
311	24.00	77.069	68.352	0.000	0.401	687461


68.611
UNIT 3
PRESSURE
PSIA
68.352
0530/ 310
TIME
0530/ 311


0.423
UNIT 3
AVG UPR PRESS
0.401
0530/ 310
TIME
0530/ 311


78.575
UNIT 3
TEMPERATURE
°F
77.069
0530/ 310
TIME
0530/ 311


6.8813
UNIT 3
MASS
LBM
X10^5
6.8745
0530/ 310
TIME
0530/ 311

APPENDIX C

VERIFICATION TEST DATA AND PLOTS

VERIFICATION MODE
OPTIONS:

1 - MANUAL DATA ENTRY
2 - PARAMETER GRAPHS
3 - SENSOR PLOTS
4 - TREND ANALYSIS
5 - REPRINT CURRENT DATA PT
6 - SENSOR DIFFERENTIALS

P - PASS WORD MENU

SELECTED OPTION =

TIME= 0945
TEST SUMMARY

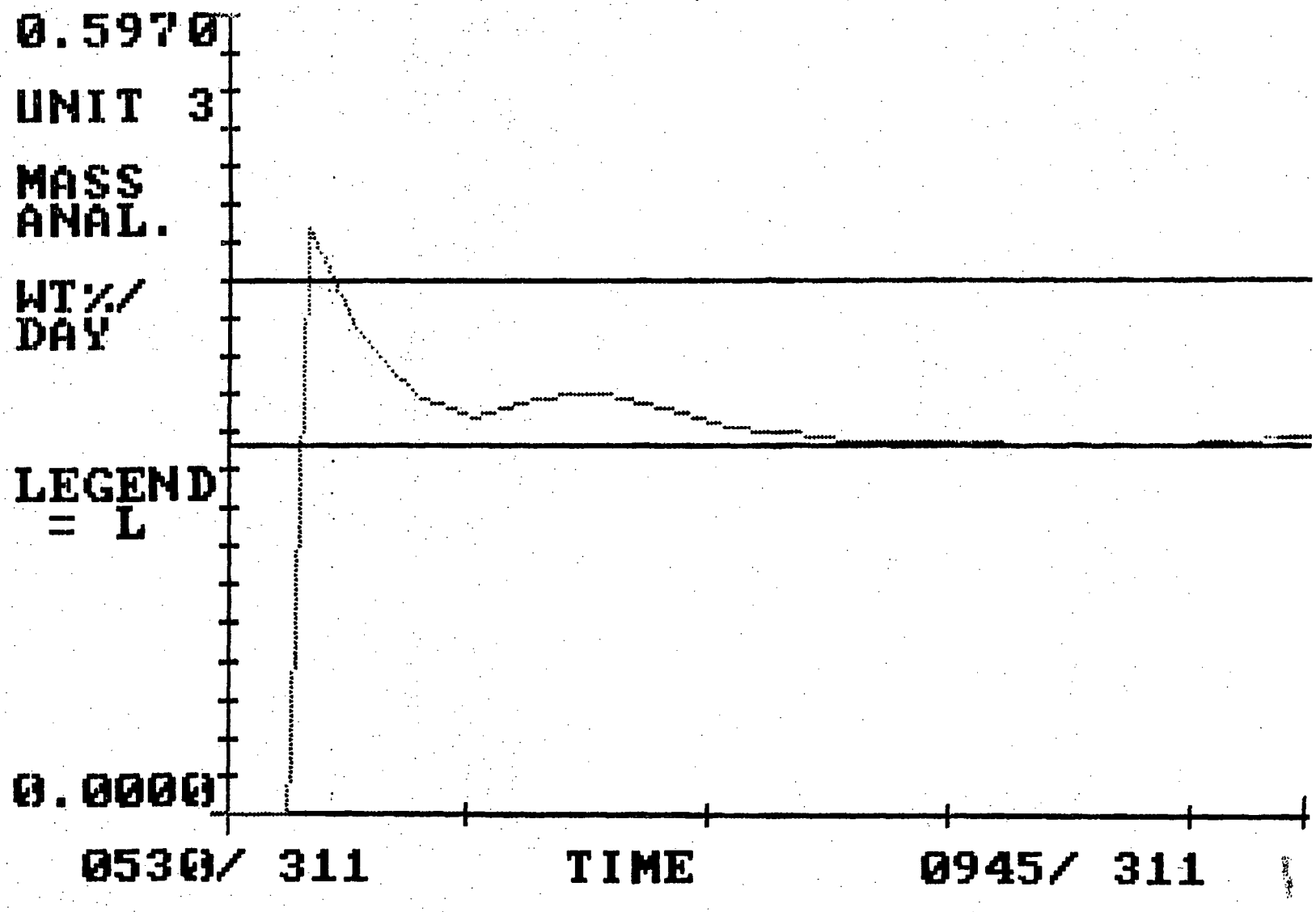
# OF DATA POINTS =	19
MODE DURATION (IN HOURS) =	4.25
TOT TIME MEASURED LEAK =	0.2937
TOT TIME CALCULATED LEAK =	0.2620
MASS PT LEAK =	0.2810
IMPOSED LEAK =	0.2383
TOT TIME UPPER LIMIT =	0.3879
TOT TIME LOWER LIMIT =	0.2629
MASS PT UPPER LIMIT =	0.3970
MASS PT LOWER LIMIT =	0.2720

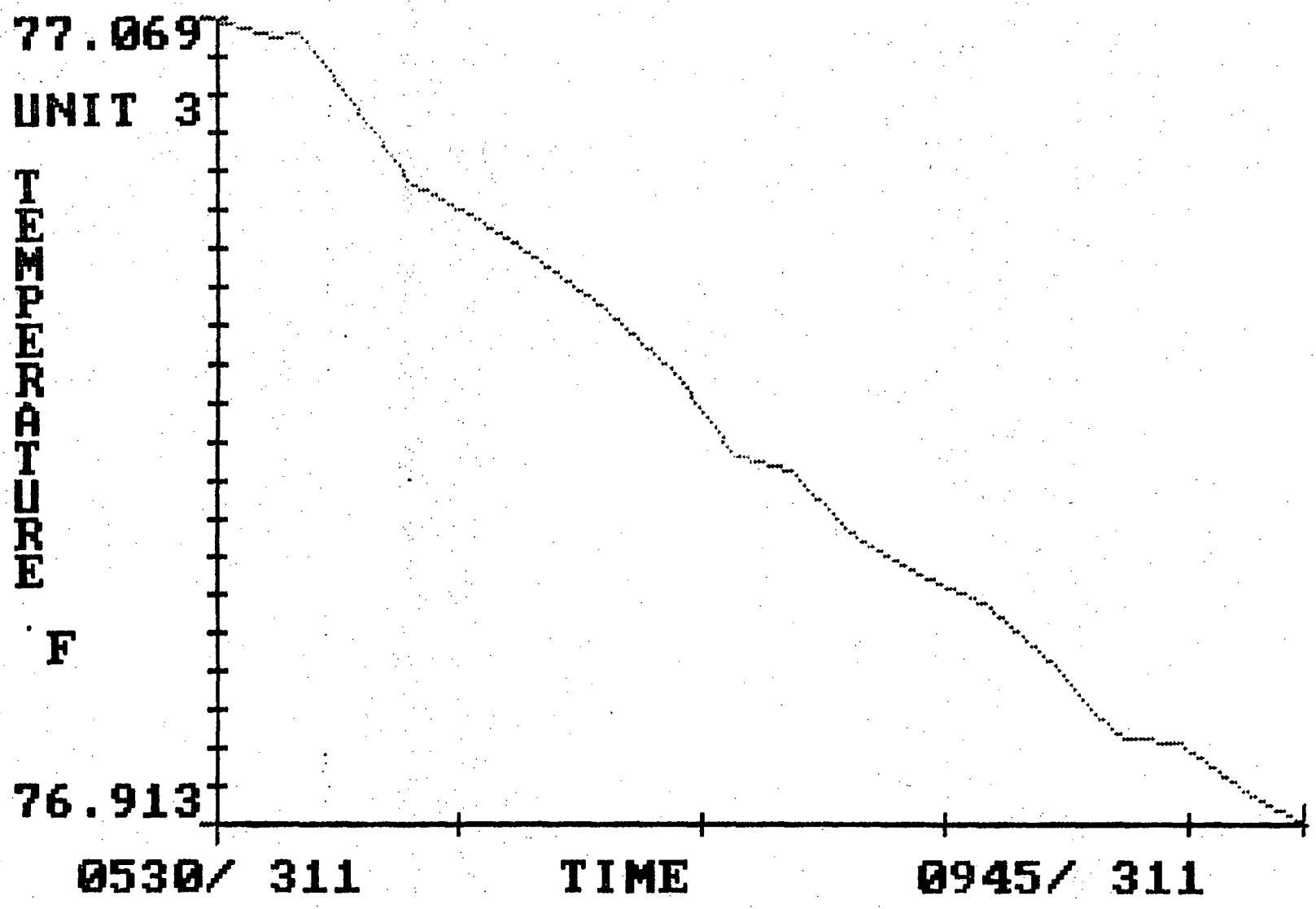
TOT TIME VERIFICATION CRITERIA HAS NOT BEEN MET

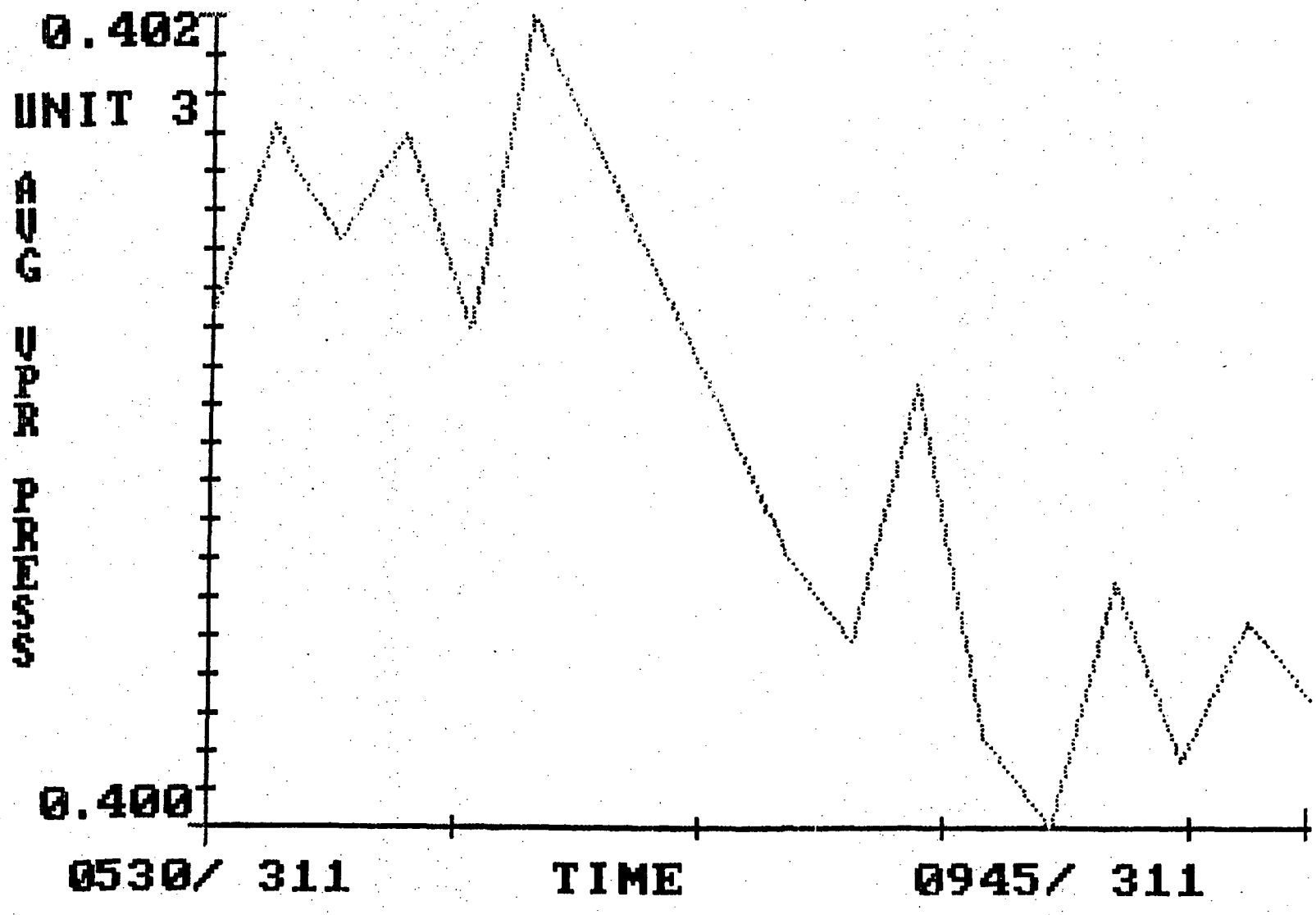
MASS PT VERIFICATION CRITERIA HAS BEEN MET

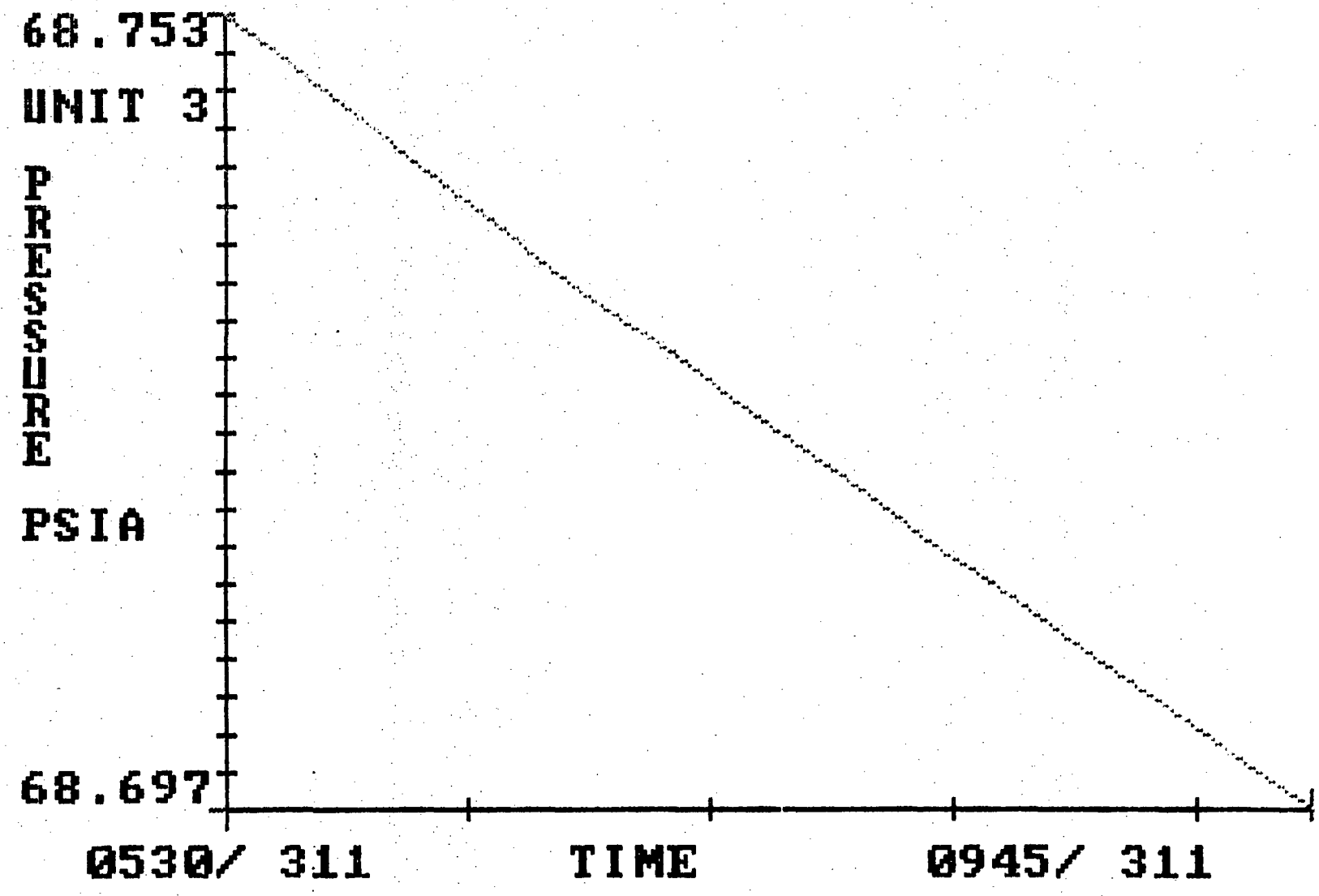
POINT SUMMARY: CURRENT VALUE/DIFFERENCE FROM PREVIOUS POINT

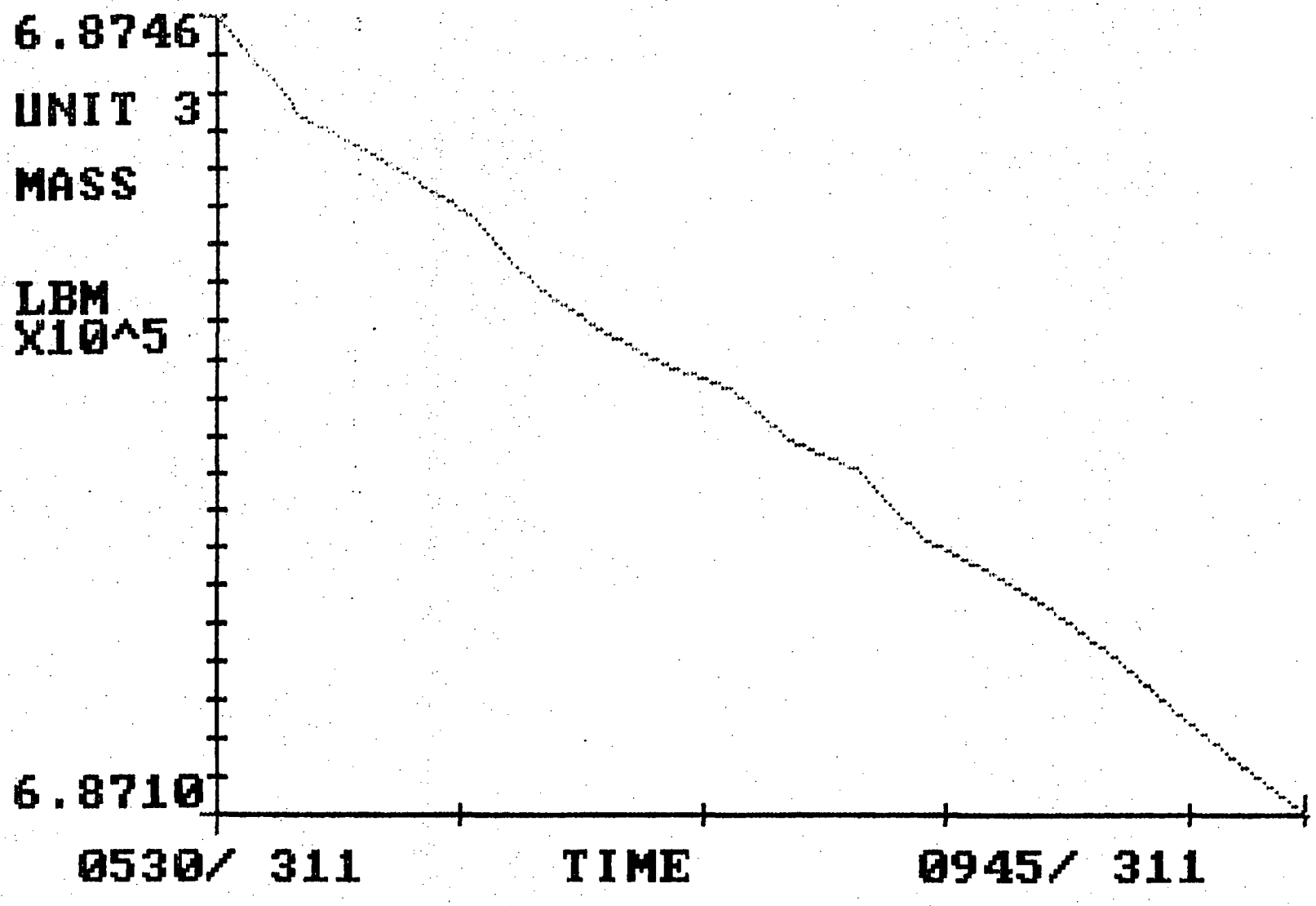
AVG TEMP:	76.913/ -0.007	AVG PRESS:	68.297 / -0.003
MASS:	687103.63/ -21.750	AVG DEW PRESS:	0.4000/ -0.0002
		TOTAL PRESS:	68.697 / -0.003


0.5970
UNIT 3
MASS
ANAL.
WT%/
DAY
LEGEND
= L
0.0000
0530/ 311
TIME
0945/ 311


77.069
UNIT 3
TEMPERATURE
°F
76.913
0530/ 311
TIME
0945/ 311


0.402
UNIT 3
AVG UPR PRESS
0.400
0530/ 311
TIME
0945/ 311


68.753
UNIT 3
PRESSURE
PSIA
68.697
0530/ 311
TIME
0945/ 311


6.8746
UNIT 3
MASS
LBM
X10^5
6.8710
0530/ 311
TIME
0945/ 311

AVG. DATA VALUES UNIT # 3

DATE	TIME	T(I)	P(I)	DT(I)	VP(I)	MASS(I)
311	0.00	77.069	68.352	0.000	0.401	687461.19
311	0.25	77.066	68.349	0.000	0.401	687432.38
311	0.32	77.067	68.348	0.000	0.401	687420.19
311	0.50	77.056	68.346	0.000	0.401	687410.06
311	0.75	77.038	68.342	0.000	0.401	687392.56
311	1.00	77.031	68.339	0.000	0.401	687372.06
311	1.25	77.023	68.334	0.000	0.402	687340.75
311	1.50	77.014	68.331	0.000	0.401	687321.38
311	1.75	77.003	68.329	0.000	0.401	687306.63
311	2.00	76.986	68.325	0.000	0.401	687296.94
311	2.25	76.982	68.323	0.000	0.400	687273.81
311	2.50	76.969	68.320	0.000	0.400	687260.56
311	2.75	76.962	68.316	0.000	0.401	687228.25
311	3.00	76.956	68.313	0.000	0.400	687213.06
311	3.25	76.945	68.310	0.000	0.400	687195.94
311	3.50	76.931	68.306	0.000	0.400	687174.75
311	3.75	76.929	68.304	0.000	0.400	687149.81
311	4.00	76.920	68.300	0.000	0.400	687125.38
311	4.25	76.913	68.297	0.000	0.400	687103.63

MASS POINT UNIT # 3

DATE	TIME	LAM	L95
311	0.00	0.0000	0.0000
311	0.25	0.0000	0.0000
311	0.32	0.4384	0.7872
311	0.50	0.3672	0.5085
311	0.75	0.3145	0.3987
311	1.00	0.2967	0.3458
311	1.25	0.3115	0.3460
311	1.50	0.3132	0.3370
311	1.75	0.3048	0.3240
311	2.00	0.2903	0.3111
311	2.25	0.2844	0.3018
311	2.50	0.2772	0.2932
311	2.75	0.2788	0.2922
311	3.00	0.2779	0.2892
311	3.25	0.2764	0.2862
311	3.50	0.2760	0.2845
311	3.75	0.2770	0.2845
311	4.00	0.2789	0.2857
311	4.25	0.2810	0.2873

APPENDIX D

INSTRUMENT SELECTION GUIDE CALCULATION

INSTRUMENT SELECTION GUIDE CALCULATION

A. TEST PARAMETERS

La = 0.25%/day

P = 68.6 psia

T = 538° R

T_{dp} = 74.4° F

t = 24 hours

B. INSTRUMENT PARAMETERS

1. Total Absolute Pressure

No. of Sensors = 2

Range: 0 - 100 psia

Sensor sensitivity error (E): 0.005 psia

Measurement system error (*e*):

Resolution: 0.0001 psia

Repeatability: 0.005 psia

$$e = +/- ((0.0001)^2 + (0.005)^2)^{1/2}$$

$$e = +/- 0.005001 \text{ psia}$$

$$e_p = +/- ((0.005)^2 + (0.005001)^2)^{1/2} /(2)^{1/2}$$

$$e_p = +/- 0.005001 \text{ psia}$$

2. Water Vapor Pressure

No. of Sensors = 10

Sensor sensitivity error (E): 0.1° F

Measurement system error (*e*):

Resolution: 0.01° F

Repeatability: 0.04° F

$$e = +/- ((0.01)^2 + (0.04)^2)^{1/2}$$

$$e = +/- 0.041° \text{ F}$$

At a dewpoint of 74.4° F, the equivalent water vapor pressure change (as determined from steam tables) is 0.0142 psia/° F.

$E = +/- 0.1° F (0.0142 psia/° F)$

$E = +/- 0.00142$ psia

$e = +/- 0.041° F (0.0142 psia/° F)$

$e = +/- 0.00058$ psia

$e_{pv} = +/- ((0.00142)^2 + (0.00058)^2)^{1/2} /(10)^{1/2}$

$e_{pv} = +/- 0.00048$ psia

3. Temperature

No. of Sensors = 24

Sensor sensitivity error (E): 0.01° F

Measurement system error (*e*):

Resolution: 0.01° F

Repeatability: 0.054° F

$e = +/- ((0.01)^2 + (0.054)^2)^{1/2}$

$e = /- 0.055° F = +/- 0.055° R$

$e_T = +/- ((0.01)^2 + (0.055)^2)^{1/2} /(24)^{1/2}$

$e_T = +/- 0.011° R$

4. Instrumentation Selection Guide Formula

$ISG = +/- 2400/t\ (2(e_p/P)^2 + 2(e_{pv}/P)^2 + 2(e_T/T)^2)^{1/2}$

$ISG = +/- (2400/24)\ (2(0.005001/68.6)^2 + 2(0.00048/68.6)^2 + 2(0.011/538)^2)^{1/2}$

$ISG = +/- 0.0108$ %/day

APPENDIX E

GENERAL PHYSICS ILRT COMPUTER PROGRAM DESCRIPTION

DESCRIPTION OF GENERAL PHYSICS ILRT COMPUTER PROGRAM

The following paragraphs describe the various features and attributes of the General Physics ILRT Computer Program and the process used to certify it for each application.

REDUNDANCY

The General Physics ILRT team was equipped with two fully operational IBM compatible microcomputers during the ILRT and for on site data reduction and analysis. The computer software and hardware interfaced directly with the ILRT Measurement System Data Acquisition System (Fluke 2285B).

Two computers were brought on site for 100% redundancy, as each computer and its software is capable of independently performing the ILRT. The General Physics ILRT Computer Software is also capable of accepting manual input of raw sensor data and performing all required sensor data conversions if the data logger should cease to function. Each computer was equipped with back-up disks in the unlikely event of a disk "crash."

SECURITY

The General Physics ILRT Computer Program is written in QUICK BASIC. QUICK BASIC is a high level programming language which combines programming ease with user oriented command functions to create an easy to use and understand program. In order to increase speed of operation the program was then compiled into an executable command file. Compiling was accomplished using the Quick Basic Compiler. In addition to execution speed, this had the added benefit of making the program more secure as compiled programs cannot be edited or changed. The program requires a password to change modes of operation, start times, or enter the data editing routine to safeguard the integrity of the raw data files.

FEATURES

The program itself is designed to be a menu driven program consisting of five separate, menu driven operating modes. These are the:

1. Pressurization Mode
2. Stabilization Mode
3. Test Mode
4. Verification Mode
5. Depressurization Mode

These modes also correspond to the phases of the ILRT. Menu driven means that the user is presented with a list of options that the program can perform and from which the user can choose. It allows for interactive information exchange between the user and the computer and prevents invalid information or user mistakes from crashing the program. Program organization consists of a master menu which controls access to the seven operating modes chained to the individual menus which control these modes. The data processing, information display capabilities and function of each mode is as follows:

1. Pressurization Mode: All data reduction, graphic displays of average temperature, dewpoint, and corrected pressure.
2. Stabilization Mode: All data reduction, automatic comparison of data against ANSI 56.8 and BN-TOP-1 temperature stabilization criteria, notification when criteria is met, graphic displays of average temperature, dewpoint, and corrected pressure.
3. Test Mode: All data reduction, calculation of leakage rates using mass point, total time and point-to-point analysis techniques, display of trend report information required by BN-TOP-1, graphic display of average temperature, dewpoint, pressure and mass, as well as graphic display of mass point measured leakage, 95% UCL; total time measured and calculated leakage and the total time leakage rate at the 95% UCL (as calculated by BN-TOP-1), including a superimposed acceptance criteria line).
4. Verification Test Mode: With input of imposed leakage in SCFM automatically calculates and displays on graph and trend report the acceptance criteria band, plus all graphics displays available in test mode.
5. Depressurization Mode: All data and graphics capabilities of Pressurization Mode.

Other reduction and analysis capabilities of the General Physics ILRT computer program include:

1. Containment total pressure conversion from counts to psia (if required), and averaging.

2. Containment drybulb temperature weighted averaging and conversion to absolute units.

3. Containment dewpoint temperature weighted averaging (conversion from Foxboro dewcell element temperature to dewpoint temperature if required) and conversion to partial pressure of water vapor (psia).

4. Data storage of ILRT measurement system inputs for each data point.

5. Weight (mass) point calculations using the ideal gas law.

6. Automated Data Acquisition and/or Manual Data Entry.

7. Sensor performance and deviation information for sensor failure criteria, graphic display of individual sensor performance for selected operating mode.

8. Calculation of ISG formula at beginning of test; acceptance criteria based on number of sensors remaining and actual test duration.

9. Computer System Error Functions automatically checks for error in incoming data, printer or disk drive faults.

The computer program used by General Physics has been previously certified for six tests at the San Onofre Nuclear Generating Station and over a dozen other ILRTs. The initial certification required verification of the program through hand calculations and an independent review by Bechtel Power Corporation.

After modification for the Crystal River Unit 3 ILRT was completed, a calibration set of raw data was used to verify the program calculations prior to usage. Additionally, once the computer was linked to the data acquisition system and a complete data stream was available, the input function of each mode of the program was verified by comparing the data acquisition system output to the computer printout data point summary. A data set of known values were manually entered to verify proper calculation of average temperatures and relative humidities using the installed volume weighting fractions.

APPENDIX F

LOCAL LEAKAGE RATE TEST SUMMARIES

LEAK RATE TESTING SUMMARY			
DATE	DESCRIPTION	AS FOUND TOTAL OF TYPE B & C (sccm)	AS LEFT TOTAL OF TYPE B & C (sccm)
10/30/87	RF 6 "As Left"	------	26,930.1
5/26/89	RCP Outage	58,290.8	40,076.7
6/13/89	Purge Valve Testing	40,076.7	37,583.7
6/30/89	As Found Purge Valve Testing	36,962.6	------
7/10/89	As Left Purge Valve Testing	------	37,417.7
8/28/89	As Found Purge Valve Testing	37,628.7	------
10/2/89	As Left Purge Valve Testing	------	37,672.7
11/16/89	Personnel Air Lock Testing	35,112.7	35,112.7
2/21/90	As Found & As Left Purge Valve Testing	36,176.7	35,348.7
6/14/90	RF 7 Testing	50,839.94	38,998.46
10/19/90	As Found & As Left Purge Valve Testing	38,920.46	39,204.46
12/17/90	As Found & As Left Purge Valve and Personnel Air Lock Testing	27,681.46	28,071.46
1/28/91	Update Total for Addition of Electrical Penetrations	28,464.43	28,464.43
6/10/91	Personnel Air Lock Testing	28,822.43	28,822.43
11/15/91	8M Outage Testing	45,699.57	46,958.27
11/19/91	Post Maintenance Testing of Personnel Air Lock	46,958.27	46,348.27

Note: 0.60 L_a = 265,286 sccm

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
0305	RB LEAK RATE	LRV-73	30.0	30.0	9576	PASS	LRV-72	35.0	35.0	9576	PASS	35	35	3/27/90
0306L	RB LEAK RATE	LRV-70	57.7	57.7	9576	PASS	LRV-71	59.8	59.8	9576	PASS	60	60	3/26/90
110 110	STATION AIR STATION AIR	SAV-24	98.9	98.9	4788	PASS	SAV-122 SAV-23	1701.1	1701.1	4788	PASS	1701	1701	3/17/90
110 110	STATION AIR STATION AIR	SAV-24	1442.0	1442.0	4788	PASS	SAV-122 SAV-23	6300.0	471.0	4788	FAIL	6300	1442	5/5/89
111	INSTRUMENT AIR						IAV-28	20.0	20.0	3192	PASS	20	20	3/17/90
111	INSTRUMENT AIR						IAV-28	20.0	20.0	3192	PASS	20	20	2/28/89
112	INSTRUMENT AIR						IAV-29	49.2	49.2	3192	PASS	49	49	3/17/90
112	INSTRUMENT AIR						IAV-29	43.8	43.8	3192	PASS	44	44	2/28/89
113	AIR HANDLING	AHV-1C	590.0	1002.0	2500	PASS	AHV-1D					590	1002	11/12/91
113	AIR HANDLING	AHV-1C	1185.0	590.0	2500	PASS	AHV-1D					1185	590	11/02/91
113	AIR HANDLING	AHV-1C		912.	2500	PASS	AHV-1D						912	12/16/90
113	AIR HANDLING	AHV-1C	925.0		2500	PASS	AHV-1D					925		12/12/90
113	AIR HANDLING	AHV-1C	657.0	913.0	2500	PASS	AHV-1D					657	913	10/12/90
113	AIR HANDLING	AHV-1C	891.0	888.0	2500	PASS	AHV-1D					891	888	6/11/90
113	AIR HANDLING	AHV-1C	988.0	1059.0	2500	PASS	AHV-1D					998	1059	9/29/89
113	AIR HANDLING	AHV-1C		988.0	2500	PASS	AHV-1D						988	9/2/89
113	AIR HANDLING	AHV-1C	993.0		2500	PASS	AHV-1D					993		8/27/89
113	AIR HANDLING	AHV-1C		1008.0	2500	PASS	AHV-1D						1008	7/3/89
113	AIR HANDLING	AHV-1C	972.0		2500	PASS	AHV-1D					972		6/29/89
113	AIR HANDLING	AHV-1C	2250.0	829.0	2500	PASS	AHV-1D					2250	829	6/12/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
113	AIR HANDLING	AHV-1C		2250.0	2500	PASS	AHV-1D						2250	5/25/89
113	AIR HANDLING	AHV-1C	1460.0		2500	PASS	AHV-1D					1460		2/27/89
116	RB LEAK RATE	LRV-45	41.0	41.0	3192	PASS	LRV-46	221.0	221.0	1596	PASS	221	221	10/26/91
116	RB LEAK RATE	LRV-45	2.0	2.0	3192	PASS	LRV-46	69.4	69.4	1596	PASS	69	69	3/27/90
116	RB LEAK RATE	LRV-45	20.0	20.0	3192	PASS	LRV-46	295.0	295.0	1596	PASS	295	295	3/15/89
117	DEMIN WATER	DWV-162			4788	PASS	DWV-160	258.0	700.0	4788	PASS	258	700	11/1/91
117	DEMIN WATER	DWV-162	2.0	2.0	4788	PASS	DWV-160	188.2	188.2	4788	PASS	188	188	4/3/90
117	DEMIN WATER	DWV-162	6570.0	2190.0	4788	FAIL	DWV-160	537.0	281.0	4788	PASS	6570	2190	3/30/89
121	RB LEAK RATE						LRV-50	331.0	331.0	12768	PASS			
121	RB LEAK RATE						LRV-36	324.0	324.0	12768	PASS			
121	RB LEAK RATE						LRV-90	128.7	128.7	4788	PASS			
121	RB LEAK RATE						LRV-89	124.1	124.1	4788	PASS	460	460	3/27/90
121	RB LEAK RATE						LRV-50	116.0	116.0	12768	PASS			
121	RB LEAK RATE						LRV-36	134.9	134.9	12768	PASS			
121	RB LEAK RATE						LRV-90	117.6	117.6	4788	PASS			
121	RB LEAK RATE						LRV-89	118.6	118.6	4788	PASS	254	254	3/15/89
122	RB LEAK RATE						LRV-88			4788	PASS			
122	RB LEAK RATE						LRV-87	15.0	117.6	4788	PASS	15	118	11/11/91
122	RB LEAK RATE						LRV-88	20.0	20.0	4788	PASS			
122	RB LEAK RATE						LRV-87	20.0	20.0	4788	PASS	20	20	3/26/90
122	RB LEAK RATE						LRV-88	42.6	42.6	4788	PASS			
122	RB LEAK RATE						LRV-87	51.6	51.6	4788	PASS	52	52	3/15/89
123	CORE FLOOD	CFV-20	3820.0	374.0	1596	FAIL	CFV-28	13.0	13.0	1596	PASS	3820	374	3/21/90
123	CORE FLOOD	CFV-20	1587.0	1587.0	1596	PASS	CFV-28	41.4	41.4	1596	PASS	1587	1587	3/14/89
124	CORE FLOOD	CFV-17	336.0	189.0	1596	PASS	CFV-27	20.0	20.0	1596	PASS	336	189	3/21/90

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
124	CORE FLOOD	CFV-17	202.0	202.0	1596	PASS	CFV-27	20.0	20.0	1596	PASS	202	202	3/14/89
125	RB LEAK RATE						LRV-94	665.0	665.0	4788	PASS			
125	RB LEAK RATE						LRV-93	655.0	655.0	4788	PASS			
125	RB LEAK RATE						LRV-92	87.0	87.0	4788	PASS			
125	RB LEAK RATE						LRV-91	65.0	65.0	4788	PASS	752	752	3/28/90
125	RB LEAK RATE						LRV-94	1536.0	1536.0	4788	PASS			
125	RB LEAK RATE						LRV-93	1575.0	1575.0	4788	PASS			
125	RB LEAK RATE						LRV-92	286.0	286.0	4788	PASS			
125	RB LEAK RATE						LRV-91	285.0	285.0	4788	PASS	1861	1861	3/15/89
202	RB LEAK RATE						LRV-44	69.6	1089.0	3192	PASS	70	1089	11/11/91
202	RB LEAK RATE						LRV-44	20.2	20.2	3192	PASS	20	20	3/24/90
202	RB LEAK RATE						LRV-44	20.0	20.0	3192	PASS	20	20	3/15/89
206	INDUST. COOLING						CIV-41	82.0	82.0	3990	PASS	82	82	3/23/90
206	INDUST. COOLING						CIV-41	300.0	300.0	3990	PASS	300	300	3/1/89
207	INDUST. COOLING						CIV-40	15.0	15.0	3990	PASS	15	15	3/27/90
207	INDUST. COOLING						CIV-40	20.0	20.0	3990	PASS	20	20	3/1/89
305	RB LEAK RATE	LRV-70	20.6	20.6	9576	PASS	LRV-72	27.7	27.7	9576	PASS	28	28	3/29/89
306L	RB LEAK RATE	LRV-73	47.5	47.5	9576	PASS	LRV-71	52.5	52.5	9576	PASS	52	52	3/30/89
306W	CONT MONITORING	WSV-32	21.0	21.0	798	PASS	WSV-33	19.4	19.4	798	PASS			
306W	CONT MONITORING	WSV-28	18.3	18.3	798	PASS	WSV-29	14.5	14.5	798	PASS			
306W	CONT MONITORING	WSV-26	14.9	14.9	798	PASS	WSV-27	14.8	14.8	798	PASS	54	54	3/28/90
306W	CONT MONITORING	WSV-32	20.0	20.0	798	PASS	WSV-33	20.0	20.0	798	PASS			
306W	CONT MONITORING	WSV-28	20.0	20.0	798	PASS	WSV-29	20.0	20.0	798	PASS			
306W	CONT MONITORING	WSV-26	20.0	20.0	798	PASS	WSV-27	20.0	20.0	798	PASS	60	60	3/17/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
314	MAIN STEAM						MSV-146	420.0	420.0	6384	PASS	420	420	10/19/91
314	MAIN STEAM						MSV-146	12050.0	2100.0	6384	FAIL	12050	2100	3/21/90
314	MAIN STEAM						MSV-146	1606.0	1606.0	6384	PASS	1606	1606	3/10/89
315	CONT MONITORING	WSV-3	91.3	91.3	1596	PASS	WSV-4	73.3	73.3	1596	PASS	91	91	4/5/90
315	CONT MONITORING	WSV-3	20.0	20.0	1596	PASS	WSV-4	20.0	20.0	1596	PASS	20	20	3/17/89
316	MAIN STEAM						MSV-114	1030.0	1030.0	2394	PASS	1030	1030	10/18/91
316	MAIN STEAM						MSV-114	5.0	5.0	2394	PASS	5	5	3/22/90
316	MAIN STEAM						MSV-114	20.0	20.0	2394	PASS	20	20	3/9/89
317	NITROGEN						NGV-81	750.0	750.0	2394	PASS	750	750	3/20/90
317	NITROGEN						NGV-81	362.0	362.0	2394	PASS	362	362	3/17/89
318	MAIN STEAM						MSV-128	20.0	20.0	6384	PASS	20	20	10/19/91
318	MAIN STEAM						MSV-128	20.0	20.0	6384	PASS	20	20	3/20/90
318	MIAN STEAM						MSV-128	20.0	20.0	6384	PASS	20	20	3/10/89
320	MAIN STEAM						MSV-132	20.0	20.0	2394	PASS	20	20	10/18/91
320	MAIN STEAM						MSV-132	1015.0	1015.0	2394	PASS	1015	1015	3/23/90
320	MAIN STEAM						MSV-132	312.0	312.0	2394	PASS	312	312	3/9/89
329	DECAY HEAT	DHV-93			3192	PASS	DHV-91	649.0	790.0	3192	PASS	649	790	11/1/91
329	DECAY HEAT	DHV-93	20.0	20.0	3192	PASS	DHV-91	20.0	20.0	3192	PASS	20	20	3/22/90
329	DECAY HEAT	DHV-93	20.0	20.0	3192	PASS	DHV-91	2.0	20.0	3192	PASS	20	20	4/3/89
332	CONT MONITORING	WSV-5	7.8	7.8	1596	PASS	WSV-6	23.9	23.9	1596	PASS	24	24	4/5/90
332	CONT MONITORING	WSV-5	20.0	20.0	1596	PASS	WSV-6	20.0	20.0	1596	PASS	20	20	3/17/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
333	MAKE UP	MUV-40	220.0	20.0	3900	PASS	MUV-49	1976.0	1976.0	3990	PASS			
333	MAKE UP	MUV-41	2340.0	1860.0	3990	PASS								
333	MAKE UP	MUV-505	353.0	23.8	4788	PASS						2913	1976	5/24/90
333	MAKE UP	MUV-40	160.0	175.3	3900	PASS	MUV-49	274.0	90.2	3990	PASS			
333	MAKE UP	MUV-41	100.0	256.0	3990	PASS								
333	MAKE UP	MUV-505	1857.0	1857.0	4788	PASS						2117	2288	5/10/89
339	WASTE DISPOSAL	WDV-3	1825.0	1178.0	6384	PASS	WDV-4	152.4	152.4	6384	PASS	1825	1178	6/7/90
339	WASTE DISPOSAL	WDV-3	2190.0	2190.0	6384	PASS	WDV-4	680.0	680.0	6384	PASS	2190	2190	3/21/89
347	SPENT FUEL	SFV-18			15960	PASS	SFV-19	13.6	13.6	15960	PASS	14	14	3/28/90
347	SPENT FUEL	SFV-18	62.7	62.7	15960	PASS	SFV-19	83.7	83.7	15960	PASS	84	84	3/11/89
349	WASTE DISPOSAL	WDV-60	227.0	1083.0	3192	PASS	WDV-61	234.0	234.0	3192	PASS	234	1083	5/9/90
349	WASTE DISPOSAL	WDV-60	20.0	20.0	3192	PASS	WDV-61	20.0	20.0	3192	PASS	20	20	3/21/89
350	CORE FLOOD	CFV-18	275.0	325.0	1596	PASS	CFV-26	172.0	172.0	1596	PASS	275	325	3/21/90
350	CORE FLOOD	CFV-18	649.0	649.0	1596	PASS	CFV-26	176.2	176.2	1596	PASS	649	649	3/14/89
351	CORE FLOOD	CFV-15	413.0	548.0	1596	PASS	CFV-29	431.0	431.0	2394	PASS			
351	CORE FLOOD	CFV-16	145.3	70.6	1596	PASS						558	619	3/21/90
351	CORE FLOOD	CFV-15	20.0	20.0	1596	PASS	CFV-29	20.0	20.0	2394	PASS			
351	CORE FLOOD	CFV-16	20.0	20.0	1596	PASS						40	40	3/11/89
352	CORE FLOOD	CFV-11	435.0	20.0	1596	PASS	CFV-42	640.0	20.0	1596	PASS			
352	CORE FLOOD	CFV-12	740.0	20.0	1596	PASS						1175	40	3/20/90
352	CORE FLOOD	CFV-11	20.0	20.0	1596	PASS	CFV-42	20.0	20.0	1596	PASS			
352	CORE FLOOD	CFV-12	20.0	20.0	1596	PASS						40	40	3/11/89
354	WASTE DISPOSAL	WDV-406	1130.0	237.0	2394	PASS	WDV-405	1172.0	227.0	2394	PASS	1172	237	5/25/90
354	WASTE DISPOSAL	WDV-406	1574.0	1574.0	2394	PASS	WDV-405	749.0	749.0	2394	PASS	1574	1574	3/20/89

LEAK RATE TESTING TRENDING PROGRAM
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(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
355	NITROGEN						NGV-62	1670.0	1670.0	2394	PASS	1670	1670	3/20/90
355	NITROGEN						NGV-62	677.0	677.0	2394	PASS	677	677	3/17/89
356	CONT MONITORING	WSV-1	16.0	16.0	1596	PASS	WSV-2	15.4	15.4	1596	PASS			
356	CONT MONITORING	WSV-34	16.1	16.1	798	PASS	WSV-35	15.7	15.7	798	PASS			
356	CONT MONITORING	WSV-30	16.0	16.0	798	PASS	WSV-31	15.6	15.6	798	PASS			
356	CONT MONITORING	WSV-38	15.7	15.7	798	PASS	WSV-39	15.8	15.8	798	PASS	64	64	3/28/90
356	CONT MONITORING	WSV-1	20.0	20.0	1596	PASS	WSV-2	20.0	20.0	1596	PASS			
356	CONT MONITORING	WSV-34	20.0	20.0	798	PASS	WSV-35	20.0	20.0	798	PASS			
356	CONT MONITORING	WSV-30	20.0	20.0	798	PASS	WSV-31	20.0	20.0	798	PASS			
356	CONT MONITORING	WSV-38	20.0	20.0	798	PASS	WSV-39	20.0	20.0	798	PASS	80	80	3/16/89
357	AIR HANDLING	AHV-1B	978.0	710.0	2550	PASS	AHV-1A					978	710	11/13/91
357	AIR HANDLING	AHV-1B	866.0	978.0	2550	PASS	AHV-1A					866	978	11/04/91
357	AIR HANDLING	AHV-1B		1317.0	2550	PASS	AHV-1A						1317	12/16/90
357	AIR HANDLING	AHV-1B	914.0		2550	PASS	AHV-1A					914		12/12/90
357	AIR HANDLING	AHV-1B	1003.0	1031.0	2550	PASS	AHV-1A					1003	1031	10/12/90
357	AIR HANDLING	AHV-1B	775.0	850.0	2550	PASS	AHV-1A					775	850	6/10/90
357	AIR HANDLING	AHV-1B	819.0	797.0	2500	PASS	AHV-1A					819	797	9/29/89
357	AIR HANDLING	AHV-1B		1143.0	2500	PASS	AHV-1A						1143	9/2/89
357	AIR HANDLING	AHV-1B	819.0		2500	PASS	AHV-1A					819		8/27/89
357	AIR HANDLING	AHV-1B		593.0	2500	PASS	AHV-1A						593	7/3/89
357	AIR HANDLING	AHV-1B	173.9		2500	PASS	AHV-1A					174		6/29/89
357	AIR HANDLING	AHV-1B	2010.0	938.0	2500	PASS	AHV-1A					2010	938	6/12/89
357	AIR HANDLING	AHV-1B		2010.0	2500	PASS	AHV-1A						2010	5/25/89
357	AIR HANDLING	AHV-1B	1017.0		2500	PASS	AHV-1A					1017		2/27/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
366	INDUST. COOLING						CIV-34	15.0	15.0	3990	PASS	15	15	3/23/90
366	INDUST. COOLING						CIV-34	100.0	100.0	3990	PASS	100	100	3/2/89
367	INDUST. COOLING						CIV-35	650.0	650.0	3990	PASS	650	650	3/23/90
367	INDUST. COOLING						CIV-35	326.0	326.0	3990	PASS	326	326	3/2/89
372	NITROGEN						NGV-82	37.0	37.0	1596	PASS	37	37	3/20/90
372	NITROGEN						NGV-82	167.4	167.4	2394	PASS	167	167	3/17/89
373	CORE FLOOD	CFV-19	1472.0	236.0	1596	PASS	CFV-25	190.4	190.4	1596	PASS	1472	236	3/21/90
373	CORE FLOOD	CFV-19	312.0	312.0	1596	PASS	CFV-25	470.0	470.0	1596	PASS	470	470	3/14/89
374	WASTE DISPOSAL	WDV-94	20.0	885.0	4788	PASS	WDV-62	20.0	20.0	4788	PASS	20	885	3/26/90
374	WASTE DISPOSAL	WDV-94	20.0	20.0	4788	PASS	WDV-62	255.0	255.0	4788	PASS	255	255	3/18/89
376	CONT MONITORING	WSV-41	7.3	7.3	798	PASS	WSV-40	8.1	8.1	798	PASS			
376	CONT MONITORING	WSV-42	5.2	5.2	798	PASS	WSV-43	7.0	7.0	798	PASS	15	15	3/28/90
376	CONT MONITORING	WSV-41	20.0	20.0	798	PASS	WSV-40	20.0	20.0	798	PASS			
376	CONT MONITORING	WSV-42	20.0	20.0	798	PASS	WSV-43	20.0	20.0	798	PASS	40	40	3/17/89
377	MAKE UP	MUV-260			1596	PASS	MUV-253	20.0	20.0	1596	PASS			
377	MAKE UP	MUV-261			1596	PASS								
377	MAKE UP	MUV-259			1596	PASS								
377	MAKE UP	MUV-258			1596	PASS						1451	1451	10/14/91
377	MAKE UP	MUV-260	146.7	1088.0	1596	PASS	MUV-253	564.0	564.0	1596	PASS			
377	MAKE UP	MUV-261	20.0	194.7	1596	PASS								
377	MAKE UP	MUV-259	2.0	20.0	1596	PASS								
377	MAKE UP	MUV-258	122.4	147.8	1596	PASS						564	1451	5/4/90
377	MAKE UP	MUV-260	65.2	20.0	1596	PASS	MUV-253	126.0	126.0	1596	PASS			
377	MAKE UP	MUV-261	20.0	20.0	1596	PASS								
377	MAKE UP	MUV-259	22.4	22.4	1596	PASS								
377	MAKE UP	MUV-258	411.0	411.0	1596	PASS						519	473	3/30/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
425	CHEM. ADDITION	CAV-433	32.0	32.0	598	PASS	CAV-435	30.0	30.0	598	PASS			
425	CHEM. ADDITION	CAV-434	250.0	250.0	598	PASS	CAV-436	250.0	250.0	598	PASS	282	282	3/22/90
425	CHEM. ADDITION	CAV-433	108.6	108.6	598	PASS	CAV-435	106.8	106.8	598	PASS			
425	CHEM. ADDITION	CAV-434	109.9	109.9	598	PASS	CAV-436	109.2	109.2	598	PASS	219	219	3/8/89
427	MAIN STEAM						MSV-130	605.0	605.0	4788	PASS	605	605	10/17/91
427	MAIN STEAM						MSV-130	200.0	200.0	4788	PASS	200	200	3/19/90
427	MAIN STEAM						MSV-130	106.2	106.2	4788	PASS	106	106	3/6/89
428	MAIN STEAM						MSV-148	1255.0	1255.0	4788	PASS	1255	1255	10/17/91
428	MAIN STEAM						MSV-148	345.0	345.0	4788	PASS	345	345	3/19/90
428	MAIN STEAM						MSV-148	882.0	882.0	4788	PASS	882	882	3/6/89
430	FIRE SERVICE	FSV-262	1400.0	1400.0	6384	PASS	FSV-261	1850.0	1850.0	6384	PASS	1850	1850	3/19/90
430	FIRE SERVICE	FSV-262	25.4	25.4	6384	PASS	FSV-261	40.5	40.5	6384	PASS	40	40	3/25/89
439	CHEM. ADDITION	CAV-126			598	PASS	CAV-2	760.0	210.0	1596	PASS			
439	CHEM. ADDITION	CAV-1			598	PASS	CAV-431	20.0	20.0	598	PASS			
439	CHEM. ADDITION	CAV-3			598	PASS	CAV-432	20.0	20.0	598	PASS			
439	CHEM. ADDITION	CAV-429	129.0	129.0	598	PASS								
439	CHEM. ADDITION	CAV-430	14.0	14.0	598	PASS						800	356	10/17/91
439	CHEM. ADDITION	CAV-126	20.0	47.4	598	PASS	CAV-2	20.0	20.0	1596	PASS			
439	CHEM. ADDITION	CAV-1	20.0	96.4	598	PASS	CAV-431	20.0	20.0	598	PASS			
439	CHEM. ADDITION	CAV-3	20.0	68.9	598	PASS	CAV-432	20.0	20.0	598	PASS			
439	CHEM. ADDITION	CAV-429	48.0	48.0	598	PASS								
439	CHEM. ADDITION	CAV-430	260.0	260.0	598	PASS						368	521	4/4/90
439	CHEM. ADDITION	CAV-126	100.0	20.0	598	PASS	CAV-2	412.0	412.0	1596	PASS			
439	CHEM. ADDITION	CAV-1	1878.0	20.0	598	FAIL	CAV-431	1194.0	580.0	598	FAIL			
439	CHEM. ADDITION	CAV-3	2670.0	190.0	598	FAIL	CAV-432	10200.0	136.0	598	FAIL			
439	CHEM. ADDITION	CAV-429	100.0	100.0	598	PASS								
439	CHEM. ADDITION	CAV-430	100.0	100.0	598	PASS						11806	1128	4/23/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE C LLRT (valves, flanges)

		INBOARD ISOLATION VALVES (Leakage in sccm)					OUTBOARD ISOLATION VALVES (Leakage in sccm)					PENETRATION PATH LEAKAGE (sccm)		
PENETRATION	SYSTEM	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	VALVE #	LEAKAGE AS FOUND	LEAKAGE AS LEFT	ACTION VALUE	STATUS	AS FOUND VALUE	AS LEFT VALUE	ACTUAL DATE
440	CHEM. ADDITION	CAV-4	225.0	313.0	598	PASS	CAV-6	950.0	950.0	1596	PASS	950	950	3/24/90
440	CHEM. ADDITION	CAV-4	20.0	20.0	598	PASS	CAV-6	20.0	20.0	1596	PASS	20	20	3/8/89
441	CHEM. ADDITION	CAV-5	1037.0	360.0	598	FAIL	CAV-7	976.0	976.0	1596	PASS	1037	976	3/23/90
441	CHEM. ADDITION	CAV-5	227.0	227.0	598	PASS	CAV-7	649.0	649.0	1596	PASS	649	649	3/8/89

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE B LLRT (Resilient seals, gaskets, sealant compunds, expandable bellows and flexible seal assemblies)

PENETRATION	DESCRIPTION	MEASURED VALUES AS FOUND	STATUS	AS-LEFT	STATUS	TEST TYPE	ACCEPTANCE CRITERIA ACTION VALUE (sccm)	ACTUAL DATE
348	FUEL TRANSFER TUBE GASKET - 3B	20	PASS	20	PASS	INLK	100	3/1/89
436	FUEL TRANSFER TUBE GASKET - 3A	20	PASS	20	PASS	INLK	100	3/1/89
120	SG CHEMICAL CLEANING GASKETS	48	PASS	48	PASS	INLK	100	3/1/89
119	SG CHEMICAL CLEANING GASKETS	20	PASS	20	PASS	INLK	100	3/28/89
EHRS	EQUIPMENT HATCH RESILIENT SEALS	212	PASS	5	PASS	INLK	500	5/23/89
RAX-2	EQUIPMENT HATCH	10240	PASS	10240	PASS	INLK	20721	5/24/89
RAX-1	PERSONNEL HATCH	1940	PASS	1940	PASS	INLK	20721	5/26/89
RAX-1	PERSONNEL HATCH	8500	PASS	8500	PASS	INLK	20721	11/15/89
RAX-2	EQUIPMENT HATCH	1120	PASS	1120	PASS	INLK	20721	11/16/89
134	LOW VOLTAGE DC INSTRUMENT CONTROL RODS	2	PASS	2	PASS	INLK	100	4/18/90
135	RB LIGHTS SMALL AC-DC MOTORS	2	PASS	2	PASS	INLK	100	4/18/90
301	CRD POWER SUPPLY	20	PASS	20	PASS	INLK	100	4/18/90
302	CRD POWER SUPPLY	20	PASS	20	PASS	INLK	100	4/18/90
303	CRD POWER SUPPLY	20	PASS	20	PASS	INLK	100	4/18/90
309	VENT FAN 3C	20	PASS	20	PASS	INLK	100	4/18/90
127	CRANE/ELEVATOR POWER SUPPLY	6	PASS	6	PASS	INLK	100	4/19/90
130	MISC. INSTRUMENTATION	6	PASS	6	PASS	INLK	100	4/19/90
133	MISC. INSTRUMENTATION	5	PASS	5	PASS	INLK	100	4/19/90
208	RCP-3B1 POWER SUPPLY	2	PASS	2	PASS	INLK	100	4/19/90
209	RCP-3B1 POWER SUPPLY	4	PASS	4	PASS	INLK	100	4/19/90
210	RCP-3B2 POWER SUPPLY	4	PASS	4	PASS	INLK	100	4/19/90
211	RCP-3B2 POWER SUPPLY	4	PASS	4	PASS	INLK	100	4/19/90

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE B LLRT (Resilient seals, gaskets, sealant compunds, expandable bellows and flexible seal assemblies)

PENETRATION	DESCRIPTION	MEASURED VALUES AS FOUND	STATUS	AS-LEFT	STATUS	TEST TYPE	ACCEPTANCE CRITERIA ACTION VALUE (sccm)	ACTUAL DATE
212	LOW VOLTAGE DC INSTRUMENT CONTOL RODS	4	PASS	4	PASS	INLK	100	4/19/90
213	LOW VOLTAGE DC INSTRUMENT CONTOL RODS	4	PASS	4	PASS	INLK	100	4/19/90
214	LOW VOLTAGE DC INSTRUMENT CONTOL RODS	2	PASS	2	PASS	INLK	100	4/19/90
215	LOW VOLTAGE DC INSTRUMENT CONTOL RODS	2	PASS	2	PASS	INLK	100	4/19/90
307	CRD POWER SUPPLY	20	PASS	20	PASS	INLK	100	4/19/90
308	ES A-B CONTROL CIRCUIT	20	PASS	20	PASS	INLK	100	4/19/90
101	PZR. HEATER POWER SUPPLY	6	PASS	6	PASS	INLK	100	4/20/90
102	PZR. HEATER POWER SUPPLY	5	PASS	5	PASS	INLK	100	4/20/90
103	PZR. HEATER POWER SUPPLY	2	PASS	2	PASS	INLK	100	4/20/90
104	E.S. "B" CONTROL CIRCUITS	4	PASS	4	PASS	INLK	100	4/20/90
126	VENT FAN 3B	3	PASS	3	PASS	INLK	100	4/20/90
128	THERMOCOUPLES	2	PASS	2	PASS	INLK	100	4/20/90
129	MISC. INSTRUMENTATION	2	PASS	2	PASS	INLK	100	4/20/90
132	MISC. INSTRUMENTATION	5	PASS	5	PASS	INLK	100	4/20/90
401	RCP-3A2 POWER SUPPLY	2	PASS	2	PASS	INLK	100	4/20/90
402	RCP-3A2 POWER SUPPLY	4	PASS	4	PASS	INLK	100	4/20/90
403	RCP-3A1 POWER SUPPLY	6	PASS	6	PASS	INLK	100	4/20/90
404	RCP-3A1 POWER SUPPLY	2	PASS	2	PASS	INLK	100	4/20/90
405	INCORE INSTRUMENTATION	20	PASS	20	PASS	INLK	100	4/20/90
407	INCORE & OUT OR CORE INSTRUMENTATION	20	PASS	20	PASS	INLK	100	4/20/90
408	IN-CON COAX CABLES	20	PASS	20	PASS	INLK	100	4/20/90
409	THERMOCOUPLES	20	PASS	20	PASS	INLK	100	4/20/90

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

TYPE B LLRT (Resilient seals, gaskets, sealant compunds, expandable bellows and flexible seal assemblies)

PENETRATION	DESCRIPTION	MEASURED VALUES				TEST TYPE	ACCEPTANCE CRITERIA ACTION VALUE (sccm)	ACTUAL DATE
		AS FOUND	STATUS	AS-LEFT	STATUS			
410	ES "A" CONTROL CIRCUITS	20	PASS	20	PASS	INLK	100	4/20/90
411	ES "A" CONTROL CIRCUITS	20	PASS	20	PASS	INLK	100	4/20/90
412	VENT FAN 3A	20	PASS	20	PASS	INLK	100	4/20/90
406	ELECTRICAL PENETRATION	40	PASS	40	PASS	INLK	100	4/25/90
413	THERMOCOUPLES	2	PASS	2	PASS	INLK	100	4/25/90
RAX-1	PERSONNEL HATCH	8500	PASS	1042	PASS	INLK	20721	6/12/90
RAX-2	EQIPMENT HATCH	1120	PASS	12380	PASS	INLK	20721	6/13/90
119	SG CHEMICAL CLEANING GASKETS	62	PASS	20	PASS	INLK	100	6/1/90
120	SG CHEMICAL CLEANING GASKETS	87	PASS	27	PASS	INLK	100	6/4/90
348	FUEL TRANSFER TUBE GASKET - 3B	15	PASS	20	PASS	INLK	100	6/8/90
436	FUEL TRANSFER TUBE GASKET - 3A	7	PASS	20	PASS	INLK	100	6/8/90
EHRS	EQUIPMENT HATCH RESILIENT SEALS	20	PASS	20	PASS	INLK	500	6/12/90
RAX-2	EQUIPMENT HATCH	982	PASS	982	PASS	INLK	20721	12/10/90
RAX-1	PERSONNEL HATCH	1022	PASS	1022	PASS	INLK	20721	12/11/90
RAX-1	PERSONNEL HATCH	1404	PASS	1404	PASS	INLK	20721	6/5/91
RAX-2	EQUIPMENT HATCH	958	PASS	958	PASS	INLK	20721	6/6/91
EHRS	EQUIPMENT HATCH RESILIENT SEALS	20	PASS	170	PASS	INLK	500	11/4/91
348	FUEL TRANSFER TUBE GASKET - 3B	20	PASS	20	PASS	INLK	100	10/13/91
436	FUEL TRANSFER TUBE GASKET - 3A	20	PASS	20	PASS	INLK	100	10/13/91
119	SG CHEMICAL CLEANING GASKETS	20	PASS	20	PASS	INLK	100	10/13/91
120	SG CHEMICAL CLEANING GASKETS	20	PASS	20	PASS	INLK	100	10/13/91
EHRS	EQUIPMENT HATCH RESILIENT SEALS	170	PASS	362	PASS	INLK	500	11/13/91

LEAK RATE TESTING TRENDING PROGRAM
FOR FLORIDA POWER CORPORATION - CRYSTAL RIVER UNIT 3
(2ND INTERVAL)

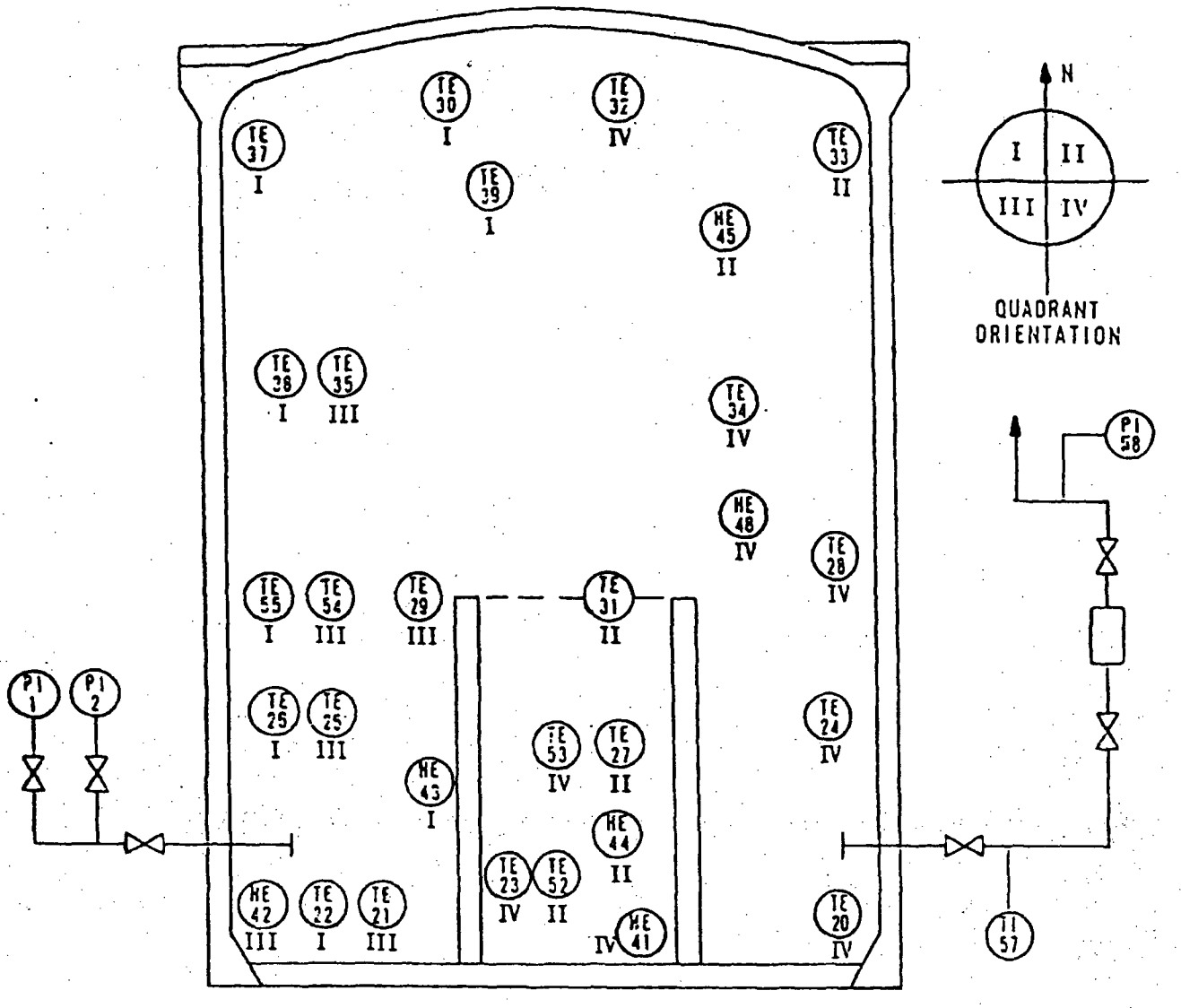
TYPE B LLRT (Resilient seals, gaskets, sealant compunds, expandable bellows and flexible seal assemblies)

PENETRATION	DESCRIPTION	MEASURED VALUES				TEST TYPE	ACCEPTANCE CRITERIA ACTION VALUE (sccm)	ACTUAL DATE
		AS FOUND	STATUS	AS-LEFT	STATUS			
RAX-1	PERSONNEL HATCH	3780	PASS	3170	PASS	INLK	20721	11/16/91
RAX-2	EQUIPMENT HATCH	14800	PASS	14800	PASS	INLK	20751	11/13/91

APPENDIX G

SENSOR LOCATIONS AND VOLUME FRACTIONS

APPENDIX A
SCHEMATIC ARRANGEMENT OF TEST INSTRUMENTATION



INSTALLED CONSTANTS

RTD WEIGHT FACTORS

RTD 1	WEIGHT FACTOR	= 0.036800
RTD 2	WEIGHT FACTOR	= 0.036800
RTD 3	WEIGHT FACTOR	= 0.036700
RTD 4	WEIGHT FACTOR	= 0.013300
RTD 5	WEIGHT FACTOR	= 0.058800
RTD 6	WEIGHT FACTOR	= 0.058800
RTD 7	WEIGHT FACTOR	= 0.058800
RTD 8	WEIGHT FACTOR	= 0.016500
RTD 9	WEIGHT FACTOR	= 0.054700
RTD 10	WEIGHT FACTOR	= 0.054700
RTD 11	WEIGHT FACTOR	= 0.063800
RTD 12	WEIGHT FACTOR	= 0.054700
RTD 13	WEIGHT FACTOR	= 0.063700
RTD 14	WEIGHT FACTOR	= 0.036100
RTD 15	WEIGHT FACTOR	= 0.036100
RTD 16	WEIGHT FACTOR	= 0.036100
RTD 17	WEIGHT FACTOR	= 0.036100
RTD 18	WEIGHT FACTOR	= 0.036100
RTD 19	WEIGHT FACTOR	= 0.036000
RTD 20	WEIGHT FACTOR	= 0.036000
RTD 21	WEIGHT FACTOR	= 0.016500
RTD 22	WEIGHT FACTOR	= 0.013500
RTD 23	WEIGHT FACTOR	= 0.054600
RTD 24	WEIGHT FACTOR	= 0.054600

RTD WEIGHTING FACTOR SUM		= 1.000000

PRESSURE GAUGE WEIGHT FACTORS

PRESS. GAUGE # 1	WEIGHT FACTOR	= 0.5000
PRESS. GAUGE # 2	WEIGHT FACTOR	= 0.5000

PRESS. GAUGE WEIGHTING FACTOR SUM		= 1.0000

DEW CELL WEIGHT FACTORS

DEW CELL 1	WEIGHT FACTOR	= 0.027000
DEW CELL 2	WEIGHT FACTOR	= 0.110300
DEW CELL 3	WEIGHT FACTOR	= 0.176400
DEW CELL 4	WEIGHT FACTOR	= 0.033000
DEW CELL 5	WEIGHT FACTOR	= 0.126700
DEW CELL 6	WEIGHT FACTOR	= 0.126700
DEW CELL 7	WEIGHT FACTOR	= 0.126600
DEW CELL 8	WEIGHT FACTOR	= 0.091100
DEW CELL 9	WEIGHT FACTOR	= 0.091100
DEW CELL 10	WEIGHT FACTOR	= 0.091100

DEW CELL WEIGHTING FACTOR SUM		= 1.000000

CONTAINMENT VOLUME	= 2000000
LA	= 0.25

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TENDON SURVEILLANCE REQUIREMENTS—AVERAGE TENDON FORCE *

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Several documents currently provide requirements for containment tendon surveillance programs in the U.S. These are: (1) USNRC Regulatory Guide 1.35, Proposed Revision 3; (2) USNRC Proposed Regulatory Guide 1.35.1; (3) ASME Code Section XI, proposed Subsection IWX; and (4) the USNRC Standard Technical Specification for Tendon Surveillance. This paper addresses the aspect of these documents which deals with acceptance criteria for the tendon lift-off forces.

Proposed Rev. 3 to Reg. Guide 1.35 discusses the need for comparing, for individual tendons, the measured and predicted lift-off forces. Such a comparison is intended to detect any abnormal tendon force loss which might occur. Recognizing that there are uncertainties in the prediction of tendon losses, proposed Guide 1.35.1 has allowed specific tolerances on the fundamental losses. Thus, the lift-off force acceptance criteria for individual tendons appearing in Reg. Guide 1.35, Proposed Rev. 3, is stated relative to a lower bound predicted tendon force, which is obtained using the "plus" tolerances on the fundamental losses.

There is an additional acceptance criterion for the lift-off forces which is not specifically addressed in these two Reg. Guides; however, it is included in a proposed Subsection IWX to ASME Code Section XI. This criterion is based on the overriding requirement that the magnitude of prestress in the containment structure be sufficient to meet the minimum prestress design requirements. This design requirement can be expressed as an average tendon force for each group of vertical, hoop, or dome tendons. For the purpose of comparing the actual tendon forces with the required average tendon force, the lift-off forces measured for a sample of tendons within each group can be averaged to construct the average force for the entire group. However, the individual lift-off forces must be "corrected" (normalized) prior to obtaining the sample average. This paper derives the correction factor to be used for this purpose.

1. Introduction

The content of this paper addresses nuclear power plant concrete containments which use large post tensioned tendons to stress the concrete to specified compressive stress levels. These specified stresses are a result of the design requirements for the containment, such as those specified in Article CC-3000 of the ASME Code for Concrete Containments [1]. In practice, two or three different groups of tendons are used to achieve this condition. Independent groups of vertical, hoop and dome tendons have been used in the past. More recent post tensioned containments employ two basic tendon groups, consisting of inverted U-shaped tendons for the dome and wall in conjunction with hoop tendons in the wall.

The stressing force in each tendon after seating or anchoring is referred to as its "lock-off" force. This force is usually between 0.70 F_{pu} and 0.75 F_{pu}, F_{pu} being the specified minimum ultimate tensile strength of the tendon times the tendon area. After each tendon is stressed, predictable losses of force occur, which are different for each tendon. There is a corresponding decrease in the compressive stresses in the containment wall and dome. Tendon surveillances are scheduled and implemented periodically to measure the lift-off forces in sample tendons selected from each group. The measured force is compared with that predicted for each sample tendon to determine if an abnormal force loss has occurred. Such an occurrence might signal a general degrading condition affecting other tendons, or it may be unique to the particular tendon. The extent to which the situation should be evaluated depends on how much less the measured force is from that predicted. The U.S. regulatory requirements for tendon surveillances and recommended procedures for calculating tendon losses

* Presented at Session J of the 6th International Conference on Structural Mechanics in Reactor Technology, August 20, 1981.

are given, respectively, in USNRC Regulatory Guide 1.35, Proposed Revision 3 [2] and in USNRC Proposed Regulatory Guide 1.35.1 [3].

The compressive stresses in the containment wall, and dome are a function of the *average* tendon force for each group of wall and dome tendons rather than being a function of the individual tendon forces which comprise the group. The individual forces represent a variation about the average force. This variation is assumed to be random. This implies that there would be only a local distribution of consecutive tendons with an average force below the group average.

The overriding requirement for the tendons is that they always produce compressive stresses in the containment which do not fall below their minimum required values. Recognizing this, it is important to use the forces measured from the sample of tendons within each group to determine what the *average force of all the tendons within the group* is expected to be. However, the average force of the sample tendons within a group is not expected to be indicative of the group average unless two conditions are met: (1) the sample tendons had an average lock-off force at original stressing equal to the group average lock-off force, and (2) the stressing sequences for the sample tendons are symmetrically distributed about the mid sequence. Purposely selecting tendons which meet these two criteria for each surveillance removes the randomness in their selection. Hence, it is desirable to provide a calculational procedure which would allow the forces measured for a random sample of tendons within a group to be used to obtain the average force for the entire group. The development of this procedure is the primary purpose of this paper. Prior to this, however, it is necessary to review the theory for predicting the tendon losses.

2. Concrete strains and stress relaxation

Predictable decreases in the tendon forces result from contractional strains in the concrete, which cause the tendons to shorten after they are stressed; and relaxation of the stresses in the tendon, with no accompanying tendon shortening. The concrete strains result from (1) the elastic shortening of the concrete due to stressing of the tendons; (2) shrinkage of the concrete occurring after tendon stressing; and (3) creep of the concrete resulting from the concrete compressive stress produced by the stressed tendons.

As a material property, creep is a function of (1) the age of the concrete at loading; (2) the magnitude of the compressive stresses resulting from loading; (3) the time after loading; and (4) the temperature of the concrete. In general, concrete shrinkage can result from both drying and autogeneous volume changes. Stress relaxation of the tendon material is a function of (1) the initial stress level; (2) the temperature, and (3) the time after stressing. Elastic shortening of the concrete during stressing causes the greatest elastic shortening of the first tendons stressed within a group and the least for the last tendons stressed. The determination of these properties is discussed in Proposed Reg. Guide 1.35.1 [3].

For the purpose of calculating tendon losses in containments, the creep (ϵ_{cr}) and shrinkage (ϵ_{sh}) strains of the concrete are assumed to affect all tendons within a group equally. Functionally, they are

$$\epsilon_{cr} = \epsilon_{cr}(f_c, \tau - \bar{\tau}_s) \tag{1}$$

and

$$\epsilon_{sh} = \epsilon_{sh}(\tau) - \epsilon_{sh}(\bar{\tau}_s), \tag{2}$$

where

f_c is the compressive stress which causes the creep,

$\bar{\tau}_s$ denotes the duration from the average concrete placement date (of the wall or dome) to the average stressing date (of the vertical and hoop tendons in the wall, or the dome tendons),

τ is the time of interest, measured from the average concrete placement date; $\tau \geq \bar{\tau}_s$.

Thus, $\tau - \bar{\tau}_s$ represents the time of interest after the average stressing date of the tendon group.

Returning to eq. (1), the creep strain property is usually taken to be linearly proportional to the stress f_c. Consequently, the creep strain, ϵ_{cr}, can be expressed in terms of a so-called specific creep strain, ϵ_{cr}^{sp}, which has units of inches per inch per psi:

$$\epsilon_{cr} = f_c\left[\epsilon_{cr}^{sp}(\tau - \bar{\tau}_s)\right]. \tag{3}$$

For an arbitrary tendon i which is stressed as part of stressing sequence n of a total of N sequences for the tendon group, the elastic shortening strain is

$$\epsilon_{es}^{i} = \epsilon_{es}^{T}\left[\frac{N-n}{N}\right], \tag{4}$$

where ϵ_{es}^{T} is the total elastic concrete strain after all tendons within the group are stressed.

The stress relaxation, SR, is usually expressed as a percent of its initial stress. For tendon i, SR is functionally,

$$\mathrm{SR}_i = \mathrm{SR}_i\left(f_{s0}^{i}, T_i, \tau - \tau_{si}\right). \tag{5}$$

This relationship indicates that the stress relaxation

is a function of (1) the initial stress in the tendon, f'_{s0}, (2) its temperature T_i, and (3) the time of interest after stressing the tendon, $\tau - \tau_{si}$. Unlike the creep property of concrete, the stress loss due to relaxation of the steel is not linearly proportional to its initial stress. The effect of the initial stress and temperature is illustrated in fig. 1.

From any curve in fig. 1, it is evident that for times greater than 1 year (8760 h), a ±2 month variation results in small differences in stress relaxation. In practice, the first tendon surveillance is scheduled one year after the Structural Integrity Test (SIT) of the containment, and the SIT usually does not take place for several months or more after the post tensioning is complete. Considering this in conjunction with the fact that the post tensioning of a group of tendons is completed within 2 to 4 months, allows $\bar{\tau}_s$ to be used for all tendons within a group rather than the τ_{si} for each tendon. In other words, for the purpose of calculating stress relaxation, it is sufficiently accurace to assume that all tendons within a group are stressed on the average stressing date for the group. Thus,

$$SR_i = SR_i(f'_{s0}, T_i, \tau - \bar{\tau}_s). \tag{6}$$

From fig. 1, the effect of initial stress and temperature is rather dramatic. The initial stress levels of 0.70 F_{pu} and 0.75 F_{pu} could represent the range of lock-off forces for actual tendons. Regarding the applicability of data at temperatures of 68°F and 104°F, the containment is subjected to thermal conditions which probably produce tendon temperatures ranging much lower than 68°F (after stressing, but prior to plant start-up) to 90°F or 100°F (in adjacent building penetration areas). The usual practice is to use stress relaxation data developed at standard conditions of 0.70 F_{pu} and 70 ± 2°F. Sometimes these data are scaled up to represent historical variations in the property of the material or to account for the higher levels of initial stress and temperatures discussed above. Nevertheless, one stress relaxation curve is applied for all the tendons; that is, $SR_i = SR$. Now the stress relaxation involves only time:

$$SR = SR(\tau - \bar{\tau}_s). \tag{7}$$

It is within the framework of this current practice that the expression for the correction to the individual tendon forces is derived.

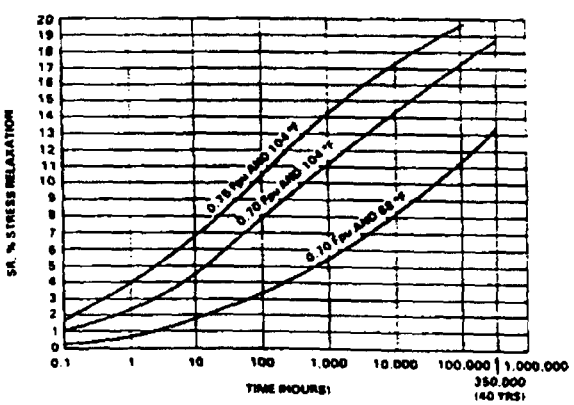


Fig. 1. Effect of initial stress and temperature on relaxation.

3. Correction factor

It is possible to rewrite the time-dependent functional relationships of the previous secton by defining a time, t, as the time of interest after the average stressing date of the tendon group. That is, $t = \tau - \bar{\tau}_s$. Hence,

$$\begin{aligned} \epsilon_{cr} &= f_c\,\epsilon_{cr}^{sp}(t), \\ \epsilon_{sh} &= \epsilon_{sh}(t + \bar{\tau}_s) - \epsilon_{sh}(\bar{\tau}_s), \\ SR &= SR(t). \end{aligned} \tag{8}$$

Consider the ith tendon, which was originally stressed as part of the nth stressing sequence out of a total of N stressing sequences for the tendon group. The force at any time t after the average stressing date is denoted as $F_i(t)$. This force is equal to the original stressing force for tendon i, $F_i(0)$, minus the sum of its individual force losses, ΔF. These are:

$$\begin{aligned} \Delta F^i_{es} &= \epsilon^T_{es}\left[\frac{N-n}{N}\right] E_T A_T = \epsilon^T_{es} E_T A_T \left[\frac{N-n}{N}\right] \\ &\equiv \Delta F^T_{es}\left[\frac{N-n}{N}\right], \\ \Delta F^i_{cr} &= f_c\left[\epsilon^{sp}_{cr}(t)\right] E_T A_T \equiv \Delta F_{cr}(t), \\ \Delta F^i_{sh} &= \left[\epsilon_{sh}(t + \bar{\tau}_s) - \epsilon_{sh}(\bar{\tau}_s)\right] E_T A_T \equiv \Delta F_{sh}(t), \\ \Delta F^i_{sr} &= F_i(0)\left[\frac{SR(t)}{100}\right], \end{aligned} \tag{9}$$

where E_T is Young's modulus for the tendon, and A_T is the tendon area.

Thus, the force in tendon i at time t after the average stressing date is

$$\begin{aligned} F_i(t) = F_i(0) - F_i(0)\left[\frac{SR(t)}{100}\right] - \Delta F^T_{es}\left[\frac{N-n}{N}\right] \\ - \Delta F_{cr}(t) - \Delta F_{sh}(t). \end{aligned} \tag{10}$$

From eq. (10), the factors which can make the force in tendon i unique from other tendons within the group are its force at original stressing and its stressing sequence. It is possible to add or subtract forces to tendon i which will correct its force, $F_i(t)$, for known differences between tendon i and the average tendon. The average tendon is a hypothetical tendon which would have an original stressing force equal to the average of the original stressing forces for all the tendons within the group, and it would have been stressed in the middle of the N sequences. The force in this average tendon at any time t is denoted as $F_{ave}(t)$. Actually, $F_{ave}(t)$ represents the expected average of the lift-off forces measured for all the tendons within the group at time t. Thus, $F_{ave}(t)$ is

$$F_{ave}(t) = F_{ave}(0) - F_{ave}(0)\left[\frac{SR(t)}{100}\right] - \Delta F_{es}^{T}\left[\frac{N-1}{2N}\right] - \Delta F_{cr}(t) - \Delta F_{sh}(t). \quad (11)$$

In eq. (11), the average elastic shortening loss term is obtained by averaging the elastic shortening losses for all N stressing sequences within the group, i.e.,

$$\left(\sum_{n=1}^{N} \Delta F_{es}^{T}\left[\frac{N-n}{N}\right]\right)/N = \Delta F_{es}^{T}\left[\frac{N-1}{2N}\right]. \quad (12)$$

Now, determine the force correction, C_i, which when added to $F_i(t)$ will make the tendon force equal to $F_{ave}(t)$:

$$F_i(t) + C_i = F_{ave}(t). \quad (13)$$

Substituting the expressions for $F_i(t)$ and $F_{ave}(t)$ given by eq. (10) and eq. (11), respectively, and solving for C_i, results in

$$C_i(t) = [F_{ave}(0) - F_i(0)]\left[1 - \frac{SR(t)}{100}\right] + \Delta F_{es}^{T}\left[\frac{N-2n+1}{2N}\right]. \quad (14)$$

Reviewing the terms in $C_i(t)$:

$[F_{ave}(0) - F_i(0)]$ is the group average lock-off force at original stressing minus the lock-off force for the specific tendon.

Table 1
Symmetrical distribution of n and $F_i(0)$

Tendon surveillance at $t = t^*$ years after initial stressing
At initial stressing: $F_{ave}(0) = 1438$ kips, $\Delta F_{es}^{T} = 30$ kips, $N = 21$.
At $t = t^*$: $SR(t^*) = 6\%$; therefore, $[1 - SR(t^*)/100] = 0.94$,
$C_i(t^*) = [F_{ave}(0) - F_i(0)][1 - SR(t^*)/100] + \Delta F_{es}^{T}[(N - 2n + 1)/2N]$.

Tendon	n	$F_i(0)$ (kips)	$F_{ave}(0) - F_i(0)$ (kips) (1)	$\frac{N-2n+1}{2N}$ (2)	$C_i(t^*)$ (kips) (3)	Measured LOF (kips) (4)	Normalized LOF = (3)+(4) (kips)
1	1	1438	0	0.476	14.3	1263	1277.3
2	21	1403	35	−0.476	18.6	1259	1277.6
3	3	1473	−35	0.381	−21.5	1299	1277.5
4	19	1410	28	−0.381	14.9	1263	1277.9
5	5	1466	−28	0.286	−17.7	1295	1277.3
6	17	1420	18	−0.286	8.3	1269	1277.3
7	7	1456	−18	0.190	−11.2	1288	1276.8
8	15	1430	8	−0.190	1.8	1276	1277.8
9	9	1446	−8	0.095	−4.6	1282	1277.4
10	13	1438	0	−0.095	−2.9	1280	1277.1
AVE	11	1438	0	0	0	1277	1277

Assume: Measured LOF = Predicted LOF − eq. (10),
$\Delta F_{cr}(t^*) + \Delta F_{sh}(t^*) = 60$ kips.
Eq. (10): $F_i(t^*) = F_i(0)\,[0.94] - 30[(N-n)/N] - 60$ kips.
Eq. (11): $F_{ave}(t^*) = 1277$ kips.

SR(t) is stress relaxation (percent) which occurs at time t after initial stressing and is determined from the property data.

ΔF_{es}^{T} is the total elastic shortening tendon force loss and is a constant.

n is the stressing sequence comprising the specific tendon.

N is the total number of stressing sequences for the group of tendons which comprise the specific tendon.

4. Examples

Three examples demonstrate the application of the correction factor given by eq. (14) to a sample of 10 surveillance tendons with hypothetical lift-off forces (LOF) measured at time t^* after initial stressing. The example in table 1 assumes that for the 10 sample tendons their original stressing sequences and stressing forces are symmetrically distributed about the average values of $n = 11$ and $F_{ave}(0) = 1438$ kips. The example further assumes that each LOF measured at the surveillance is equal to its predicted value. The symmetry assumption results in a condition in which the average measured LOF for the 10 sample tendons, before normalizing, is equal to the average force for all the tendons in the group (1277 kips), as would be expected. In addition from table 1, since the measured LOF for each tendon happens to equal that predicted, then the normalized force for each tendon is equal to the average value of force for the entire group.

Table 2 is a case where the original stressing sequences and forces for the 10 sample tendons are not symmetrical about the group average values. Consequently, the sample tendons and their surveillance LOF's would not be expected to be representative of the entire group of tendons. Here the average measured LOF (1263 kips) is not equal to the value for $F_{ave}(t^*)$ of 1277 kips. However, since the measured LOF happens to equal that predicted for each tendon, each normalized force is equal to the group average value of 1277 kips.

Table 3 is similar to table 2 but is for a condition more likely to be encountered in an actual surveillance. The sample tendons are not representative of the entire group in regards to their original stressing sequences and forces; and the measured LOF's do not happen to

Table 2
Unsymmetrical distribution

Tendon surveillance at $t = t^*$ years after initial stressing
At initial stressing: $F_{ave}(0) = 1438$ kips, $\Delta F_{es}^{T} = 30$ kips, $N = 21$.
At $t = t^*$: SR(t^*) = 6%; therefore, $[1 - \mathrm{SR}(t^*)/100] = 0.94$.
$C_i(t^*) = [F_{ave}(0) - F_i(0)][1 - \mathrm{SR}(t^*)/100] + \Delta F_{es}^{T}[(N - 2n + 1)/2N]$.

Tendon	n	$F_i(0)$ (kips)	$F_{ave}(0) - F_i(0)$ (kips) (1)	$\frac{N-2n+1}{2N}$ (2)	$C_i(t^*)$ (kips) (3)	Measured LOF (kips) (4)	Normalized LOF = (3) + (4) (kips)
1	5	1403	35	0.286	41.5	1236	1277.5
2	3	1415	23	0.381	33.0	1244	1277
3	10	1418	20	0.048	20.2	1257	1277.2
4	19	1430	8	−0.381	−3.9	1281	1277.1
5	7	1425	13	0.190	17.9	1260	1277.9
6	11	1417	21	0	19.7	1258	1277.7
7	15	1403	35	−0.190	27.2	1250	1277.2
8	4	1450	−12	0.333	−1.3	1279	1277.7
9	5	1414	24	0.286	31.2	1246	1277.2
10	20	1470	−32	−0.429	−43.0	1320	1277
AVE	9.9	1425	13.5	0.052	14.3	1263	1277

Assume: Measured LOF = Predicted LOF – eq. (10).
$\Delta F_{cr}(t^*) + \Delta F_{sh}(t^*) = 60$ kips.
Eq. (10): $F_i(t^*) = F_i(0)\,[0.94] - 30[(N - n)/N] - 60$ kips.
Eq. (11): $F_{ave}(t^*) = 1277$ kips.

Table 3
Measured LOF

Tendon surveillance at $t = t^*$ years after initial stressing
At initial stressing: $F_{ave}(0) = 1438$ kips, $\Delta F_{es}^{T} = 30$ kips, $N = 21$.
At $t = t^*$: $SR(t^*) = 6\%$; therefore, $[1 - SR(t^*)/100] = 0.94$,
$C_i(t^*) = [F_{ave}(0) - F_i(0)][1 - SR(t^*)/100] + \Delta F_{es}^{T}[(N - 2n + 1)/2N]$.

Tendon	n	$F_i(0)$ (kips)	$F_{ave}(0) - F_i(0)$ (kips) (1)	$\frac{N-2n+1}{2N}$ (2)	$C_i(t^*)$ (kips) (3)	Measured LOF (kips) (4)	Normalized LOF = (3)+(4) (kips)
1	5	1403	35	0.286	41.5	1245	1286.5
2	3	1415	23	0.381	33.0	1240	1273.0
3	10	1418	20	0.048	20.2	1320	1340.2
4	19	1430	8	−0.381	−3.9	1250	1246.1
5	7	1425	13	0.190	17.9	1285	1302.9
6	11	1417	21	0	19.7	1230	1249.7
7	15	1403	35	−0.190	27.2	1295	1322.2
8	4	1450	−12	0.333	−1.3	1287	1285.7
9	5	1414	24	0.286	31.2	1310	1341.2
10	20	1470	−32	−0.429	−43.0	1300	1257.0
AVE	9.9	1425	13.5	0.052	14.3	1276	1290

agree with their predicted values. The average normalized force of 1290 kips is greater than the predicted group average of 1277 kips, which means that on the average the sample tendons did not lose as much force as predicted. Nevertheless, the surveillance tendons are intended to represent a statistical sample of all the tendons in the group, and on this basis 1290 kips would be the average force expected to exist for the entire tendon group at time t^*.

5. Summary and conclusions

During each tendon surveillance, it is necessary to compare to average tendon lift-off force for each tendon group (vertical, hoop, and dome tendons each constitute a tendon group) with the minimum average tendon force required by the design. The lift-off forces measured for a sample of tendons within each group can be used to construct the average force for the entire group if the individual lift-off forces are corrected prior to obtaining the sample average. This correction is necessary in order to remove known force differences among tendons resulting from differences in original stressing lock-off force and stressing sequence. If these differences were to remain uncorrected, the sample average force would not be indicative of the group average force.

The correction factor, $C_i(t)$, given by eq. (14) is added to each tendon life-off force within the sample prior to obtaining the average tendon force for the sample. From eq. (14), it is seen that $C_i(t)$ could be different for each tendon; it is different for each surveillance; and it may be positive or negative.

References

[1] Code for Concrete Reactor Vessels and Containments, American Concrete Institute Standard 359 and American Society of Mechanical Engineers Boiler and Pressure Vessel Code, Section III, Division 2 (1980 Edition).

[2] Inservice Inspection of Ungrouted Tendons in Prestressed Concrete Containments, Proposed Revision 3 to Regulatory Guide 1.35, U.S. Nuclear Regulatory Commission (April 1979).

[3] Determining Prestressing Forces For Inspection of Prestressed Concrete Containments, Proposed Regulatory Guide 1.35.1, U.S. Nuclear Regulatory Commission (April 1979).

DATA SHEET 6

PRESTRESS FORCE CONFIRMATION TEST

DOME TENDONS

INSPECTION PERIOD #2

TENDON				LIFT-OFF CONDITION						LOCK-OFF			REACTOR BLDG TEMP °F		DATE INSP.	INSP. BY	
I.D.	LOCATION	PREVIOUS FORCE (kips)	EXPECTED LIFT-OFF FORCE (kips)	CAGE PRESS. (Ksi)	FORCE (kips)	FORCE AVG. OF 2 ENDS (kips)	WIRE FORCE	SHIM THICKNESS (in.) PREVIOUS	SHIM THICKNESS (in.) ORIGINAL	CAGE PRESS. (Ksi)	FORCE (kips)	FINAL SHIM THICKNESS (in.)	INT.	EXT.		INITIALS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1. D331	1	—	—	6.8	1454	1460.6	9.07	6	6	LIFT OFF		6	71	76	4-24-80	DCS	161
	5	—		6.9	1467			6 3/4	6 3/4	ONLY		6.75					
2. D323	1	—	—	7.2	1542	1525.5	9.47	7	7	LIFT OFF		7	74	78	4-28-80	DCS	161
	5	—		7.1	1509			6 3/4	6 3/4	ONLY		6.76					
3. D208	3	—	—	7.6	1623	1593.5	9.89	6 3/4	6 3/4	7.6	1623	6.75	72	81	4-29-80	DCS	161
	1	—		7.3	1564			6 5/8	6 5/8	7.3	1564	6.625					
4. D140	5	—	—	7.3	1551	1587	9.73	6 5/8	6 5/8	LIFT OFF		6.625	74	77	4-30-80	DCS	163
	3	—		7.6	1623			6 1/8	6 1/8	ONLY		6.125					
5. D122	5	—	—	7.6	1628	1646.5	10.1	7 1/4	7 1/4	LIFT OFF		7.25	71	82	5-2-80	DCS	163
	3	—		7.8	1665			7	7	ONLY		7					
6. —	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
	—	—		—	—			—	—	—	—	—					

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-B)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 \times \text{Column 4 of Data Sheet 1}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicted wire force shown on Fig. 1 at time of inspection.

LEGEND

LOCATION: 1 to 6 Number of buttress nearest to end of tendon.
SHIM THICKNESS: Clear distance between bearing plate and stressing washer.
PREVIOUS: At time of installation or previous surveillance.
ORIGINAL: At time of starting current surveillance.

Contractor Review by: [signature] Date: 7-25-80

P.P.C. Approval by: _____ Date: _____

DATA SHEET 7

PRESTRESS FORCE CONFIRMATION TEST

VERTICAL TENDONS

INSPECTION PERIOD #2

Only 1 lift off

TENDON				LIFT-OFF CONDITION						LOCK-OFF			REACTOR BLDG TEMP °F		DATE INSP.	INSP. BY	
I.D.	LOCATION	PREVIOUS FORCE (kips)	EXPECTED LIFT-OFF FORCE (kips)	GAGE PRESS. (Ksi)	FORCE (kips)	FORCE AVG. OF 2 ENDS (kips)	WIRE FORCE	SHIM THICKNESS (in.) PREVIOUS	SHIM THICKNESS (in.) ORIGINAL	GAGE PRESS. (Ksi)	FORCE (kips)	FINAL SHIM THICKNESS (in.)	INT.	EXT.		INITIALS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1. 34V1	T	—	—	7.4	1569	1569	9.625	T 13 1/8 B 4	T 13 1/8 B 4	LIFT-OFF ONLY		T 13 1/8 B 4	71	80	3/27/80	DCS	163
2. 23V5	T	—	—	7.5	1580	1580	9.693	T 14 1/2 B 4	T 14 1/2 B 4	LIFT-OFF ONLY		T 14 1/2 B 4	71	80	3/28/80	DCS	163
3. 12V12	T	—	—	7.8	1718	1718	10.607	T 15 3/8 B 4	T 15 3/8 B 4	LIFT-OFF ONLY		T 15 3/8 B 4	72	81	4/3/80	DCS	162
4. 56V1	T	—	—	7.7	1707	1707	10.472	T 14 B 4	T 14 B 4	7.7	1707	T 14 B 4	70	84	4/2/80	DCS	163
5. 56V20	T	—	—	7.6	1630	1630	10.0	T 15 B 4	T 15 B 4	LIFT-OFF ONLY		T 15 B 4	70	81	4/1/80	DCS	163

162, 1 removed

Force/wire = 10.54 K

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-8)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 2}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicted wire force shown on Fig. 2 at time of inspection.

LEGEND

LOCATION: T or B - top or bottom (vertical tendon).

SHIM THICKNESS: Clear distance between bearing plate and stressing washer.

PREVIOUS: At time of installation or previous surveillance.

ORIGINAL: At time of starting current surveillance.

Contractor Review by: B J Raffenberger Date: 7-25-80

F.P.C. Approval by: _____ Date: _____

DATA SHEET 2

PRESTRESS FORCE CONFIRMATION TEST

VERTICAL TENDONS

INSPECTION PERIOD #2

TENDON				LIFT-OFF CONDITION						LOCK-OFF			REACTOR BLDG TEMP °F		DATE INSP.	INSP. BY	
I.D.	LOCATION	PREVIOUS FORCE (kips)	EXPECTED LIFT-OFF FORCE (kips)	CAGE PRESS. (Ksi)	FORCE (kips)	FORCE AVG. OF 2 ENDS (kips)	WIRE FORCE	SHIM THICKNESS (in.) PREVIOUS	SHIM THICKNESS (in.) ORIGINAL	CAGE PRESS. (Ksi)	FORCE (kips)	FINAL SHIM THICKNESS (in.)	INT.	EXT.		INITIALS	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1. 45V6	T	—	—	7.5	1685	1685	10.40	T 14 3/8 B 4	T 14 3/8 B 4	LIFT-OFF ONLY		T 14 3/8 B 4	72	81	4/11/80	DCS	162
2. 12V20	T	—	—	8.0	1740	1740	10.67	T 15 B 4	T 15 B 4	LIFT-OFF ONLY		T 15 B 4	71	78	4/11/80	DCS	163
3.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
4.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
5.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-9)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 2}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspection) X Ave. predicated wire force shown on Fig. 2 at time of inspection.

LEGEND

LOCATION: T or B - top or bottom (vertical tendon).
SHIM THICKNESS: Clear distance between bearing plate and stressing washer.
PREVIOUS: At time of installation or previous surveillance.
ORIGINAL: At time of starting current surveillance.

Contractor Review by: [signature] Date: 7-25-80

F.P.C. Approval by: _____ Date: _____

DATA SHEET 8

PRESTRESS FORCE CONFIRMATION TEST

HOOP TENDONS

INSPECTION PERIOD #2

TENDON I.D. (1)	LOCATION (2)	PREVIOUS FORCE (kips) (3)	EXPECTED LIFT-OFF FORCE (kips) (4)	LIFT-OFF CONDITION GAGE PRESS. (Ksi) (5)	FORCE (kips) (6)	FORCE AVG. OF 2 ENDS (kips) (7)	WIRE FORCE (8)	SHIM THICKNESS (in.) PREVIOUS (9)	SHIM THICKNESS (in.) ORIGINAL (10)	LOCK-OFF GAGE PRESS. (Ksi) (11)	FORCE (kips) (12)	FINAL SHIM THICKNESS (in.) (13)	REACTOR BLDG TEMP °F INT. (14)	REACTOR BLDG TEMP °F EXT. (15)	DATE INSP. (16)	INSP. BY INITIALS (17)
1. 13H22	1 S	—	—	7.4	1569	1572	9.644	7	7	LIFT-OFF ONLY		7	71	68	4/16/80	DCS
	3 F	—	—	7.5	1575			7 7/8	7 7/8	"	"	7 7/8			4/17/80	
2. 13H32	1 S	—	—	7.6	1591	1610.5	9.94	7 1/2	7 1/2	7.6	1591	7 1/2	72	77	4/17/80	DCS
	3 F	—	—	7.6	1630			7 1/2	7 1/2	7.6	1630	7 1/2				
3. 13H43	1 S	—	—	7.6	1591	1583	9.77	8 1/8	8 1/8	LIFT OFF ONLY		8 1/8	73	80	4/18/80	DCS
	3 F	—	—	7.5	1575			7	7	"	"	7				
4. 51H10	5 F	—	—	7.3	1553	1572	9.76	6 1/4	6 1/4	LIFT OFF ONLY		6 1/4	71	85	5/6/80	DCS
5. 51H23	1 S	—	—	7.6	1591	1528	9.37 ✓	6 3/8	6 3/8	"	"	6 3/8	72	80	5/5/80	DCS
	5 F	—	—	7.5	1580			7 1/4	7 1/4	LIFT OFF ONLY		7 1/4			4/24/80	
6. 51H37	1 S	—	—	6.8	1496	1566.5	9.73	7 1/4	7 1/4	"	"	7 1/4	71	81	4/24/80	DCS
	5 F	—	—	7.6	1591			6 3/4	6 3/4	LIFT OFF ONLY		6 3/4				
7. 53H24	1 S	—	—	7.2	1542	1533	9.41 ✓	7	7	"	"	7	71	82	4/22/80	DCS
	5 F	—	—	7.0	1498			6 7/8	6 7/8	"	"	6 7/8				
8. 53H28	3 S	—	—	7.4	1548	1480	8.77 ✓	6 7/8	6 7/8	"	"	6 7/8	70	79	4/22/80	DCS
	5 F	—	—	6.5	1353			7	7	"	"	7				
9. 53H44	3 S	—	—	6.9	1467	1621.5	9.95	5 7/8	5 7/8	"	"	5 7/8	73	77	4/22/80	DCS
	5 F	—	—	7.5	1553			6 3/4	6 3/4	"	"	6 3/4				
10. 64H42	3 S	—	—	7.9	1620	1547.5	9.49 ✓	6 1/8	6 1/8	"	"	6 1/8	72	77	4/23/80	DCS
	(4) F	—	—	7.0	1492			7 1/2	7 1/2	"	"	7 1/2				
	6 S	—	—	7.5	1603			7	7	"	"	7				

NOTE A:
FORCE CALCULATION: (1) Force @ Lift-off = Jack Pressure x Jack Piston Area
OR: (2) Determine force from calibration curve

NOTE B:
Reactor Building internal temperature will be read using CI-274-TE or CI-275-TE (temperature read at Johnson Panel 11-8)

NOTE C:
Wire Force (Column 8) is defined as follows:

$$W.F. = \frac{\text{Column 7}}{163 - \text{Column 4 of Data Sheet 3}}$$

NOTE D:
Expected lift-off force (column 4) is defined as follows: No. of effective wires at installation (or previous inspectio X Ave. predicted wire force shown on Fig. 3 at time of inspection.

LEGEND

LOCATION: 1 to 6 - Number of buttress nearest to end of tendon.

SHIM THICKNESS: Clear distance between bearing plate and stressing washer.

PREVIOUS: At time of installation or previous surveillance.

ORIGINAL: At time of starting current surveillance.

Contractor Review by: [signature] 7-25-80

F.P.C. Approval by: _____ Date: _____

SUMMARY OF LIFT-OFF FORCES

TABLE 1

CRYSTAL RIVER UNIT 3

TENDON NUMBER	END DESIGNATION	ALLOWABLE LIFT-OFF FORCE (KIPS) MAXIMUM	MINIMUM	10TH YEAR SURVEILLANCE LIFT-OFF FORCE (KIPS)	AVERAGE (KIPS)
64H19	Field	1721	1249	1446	
64H19	Shop			1493	1470
13H20	Field	1721	1249	1460	
13H20	Shop			1451	1456
51H26	Field	1721	1249	1334	
51H26	Shop			1487	1411
13H40	Field	1721	1249	1558	
13H40	Shop			1383	1471
51H41	Field	1721	1249	1346	
51H41	Shop			1377	1362
D105	Field	1721	1249	1413	
D105	Shop			1492	1453
D212	Field	1721	1249	1260	
D212	Shop			1292	1276
D328	Field	1721	1249	1602	
D328	Shop			1635	1619
12V1	Field	1721	1249		
12V1*	Shop			1535	1535
34V4	Field				
34V4*	Shop	1721	1249	1623	1623
56V2	Field				
56V2*	Shop	1721	1249	1648	1648

*Lift-off occurring at Shop end only

TP417ds

V. TENDON LIFTOFFS AND DETENSIONING

A liftoff is performed on each surveillance tendon to monitor the force exerted by the tendon onto the structure. PSC Procedure SQ 9.0 (Volume 2, Section 9, Appendix F) details the steps to be taken to perform a liftoff. The results are documented on Data Sheet SQ 9.0 and are summarized in Table VIII.

It should be noted that performing a liftoff has only a localized effect on a tendon; therefore, it is acceptable to use the same jacks for both ends of a tendon by executing the liftoff on separate occasions.

Vertical tendon liftoffs were found to be above the base value except for 12V1 which was above 95% of base, and all dome liftoff averages were above the base value.

Horizontal liftoffs revealed two isolated areas 42H30 to 42H36 inclusive and 51H26, 51H27 where average tendon liftoffs were between 90% and 95% of base value. One tendon 42H35 was found to be below 90% and detensioned for continuity test per FPC requirement. This continuity test revealed that all of the wires were continuous, one wire was removed for testing and the tendon restored to base value -0% +6%. All other tendons found between 90 and 95% of base value were subsequently restored per procedure to base value -0% +6%.

These low liftoff results were documented on NCR's -010, 011, 012,.013, and 014 for 42H30 - 36 and NCR 005 for 51H26.

All other tendon liftoffs were either above base value or 95% of base value and therefore acceptable.

The average normalized liftoff for each group, vertical, dome and horizontal, exceeded the minimum required and is acceptable.

After completion of liftoffs, protruding wires were found to tendons 51H26(1), 51H27(2) and 62H46(2). These wires, once removed, were found to have broken behind the anchorhead. No corrosion was found to indicate wire failure due to deterioration and it is suspected that slight tendon head rotation while setting back down sheared the wires against the shims. In all cases the broken wires were on the outer corner edge of the tendon bundle and no gauge movement was noted to indicate failures during liftoff. These wires were probable "pinched" during original installation and additional work on these tendons has broken the wires. NCR's FN604-003,007 and 015 recorded these occurrences.

PSC Precision Surveillance Corporation

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
12V1	SHOP/TOP	162	8833	4390	1471	1471	1530	1453	1377	-9	YES
23V2	SHOP/TOP	163	8778	4820	1609	1609	1482	1408	1333	37	YES
61V21	SHOP/TOP	163	8833	4550	1525	.1525	1482	1408	1334	38	YES
D113	SHOP/ 2	163	8778	4267.5	1424.7	1427	1369	1301	1232	-35	YES
	FIELD/ 6	163	8833	4265	1429						YES
D115	SHOP/ 2	163	8778	4062.5	1356	1380	1347	1280	1213	-12	YES
	FIELD/ 6	163	8833	4190	1404						YES
D212	SHOP/ 1	162	8833	3820	1280	1335	1317	1252	1186	15	YES
	FIELD/ 3	162	8778	4160	1389						YES
D304	SHOP/ 4	163	8778	4810	1605	1598	1397	1327	1258	-64	YES
	FIELD/ 2	162	8833	4748	1591						YES
D311	SHOP/ 4	163	8778	4220	1409.5	1408	1335	1269	1202	0	YES
	FIELD/ 2	163	8833	4200	1407						YES

PSC Precision Surveillance Corporation

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
42H18	SHOP/ 4	163	8778	4690	1565	1476	1495	1420	1346	-56	YES
	FIELD/ 2	163	8833	4137	1386.5						YES
42H29	SHOP/ 4	163	8778	4500	1502	1448	1445	1373	1300	-7	YES
	FIELD/ 2	163	8833	4160	1394						YES
42H30	SHOP/ 4	163	8778	4355	1454	1389	1469	1396	1322	-32	NO
	FIELD/ 2	163	8833	3950	1324						NO
42H31	SHOP/ 4	163	8778	4100	1369	1338	1460	1387	1314	-21	NO
	FIELD/ 2	163	8833	3900	1307						NO
42H32	SHOP/ 4	163	8778	4320	1442	1355.5	1452	1380	1307	-15	NO
	FIELD/ 2	163	8833	3785	1269						NO
42H33	SHOP/ 4	163	8778	4490	1499	1361	1474	1400	1326	-35	NO
	FIELD/ 2	163	8833	3650	1223						NO
42H34	SHOP/ 4	163	8778	4240	1415	1377.5	1452	1380	1307		NO
	FIELD/ 2	163	8833	4000	1340						NO

PSC Precision Surveillance Corporation

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
42H35	SHOP/ 4	163	8778	4110	1372	1296.5	1455	1382	1309	-17	NO
	FIELD/ 2	163	8833	3693	1221						NO
42H36	SHOP/ 4	163	8778	4490	1499	1408	1503	1428	1353	-65	NO
	FIELD/ 2	163	8833	3930	1317						NO
42H37	SHOP/ 4	163	8778	4310	1439	1401.5	1452	1379	1306	-14	YES
	FIELD/ 2	163	8833	4070	1364						YES
42H44	SHOP/ 4	163	8778	4510	1505	1471.5	1427	1356	1285	10	YES
	FIELD/ 2	163	8833	4291	1438						YES
51H25	SHOP/ 1	163	8833	4090	1370.5	1363	1401	1331	1261	38	YES
	FIELD/ 5	163	8778	4060	1355.5						YES
51H26	SHOP/ 1	163	8833	4190	1403.5	1320	1514	1438	1363	-75	NO
	FIELD/ 5	163	8778	3705	1237						NO
51H27	SHOP/ 1	163	8833	3787	1269	1265.5	1368	1300	1231	71	NO
	FIELD/ 5	163	8778	3780	1262						NO

PSC Precision Surveillance Corporation

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
51H28	SHOP/ 1	163	8833	4445	1489.5	1450.5	1518	1442	1367	80	YES
	FIELD/ 5	163	8778	4230	1412						YES
53H2	SHOP/ 5	163	9501	4400	1624	1611	1424	1353	1281	12	YES
	FIELD/ 3	163	9501	4330	1598						YES
53H46	SHOP/ 5	163	8833	4340	1454	1459.5	1472	1399	1325	-35	YES
	FIELD/ 3	163	8778	4390	1465						YES
62H41	SHOP/ 2	163	8778	4230	1412	1426	1422	1351	1280	16	YES
	FIELD/ 6	163	8833	4297.5	1440						YES
62H46	SHOP/ 2	163	8778	4280	1429	1485	1465	1392	1318	-27	YES
	FIELD/ 6	163	8833	4600	1541						YES

V. TENDON LIFTOFFS AND DETENSIONING

A liftoff is performed on each surveillance tendon to monitor the force exerted by the tendon onto the structure. PSC Procedure SQ 9.0 (Volume 2, Section 9, Appendix F) details the steps to be taken to perform a liftoff. The results are documented on Data Sheet SQ 9.0 and are summarized in Table VIII.

It should be noted that performing a liftoff has only a localized effect on a tendon; therefore, it is acceptable to use the same jacks for both ends of a tendon by executing the liftoff on separate occasions.

All dome tendon liftoffs were found to be above base value and acceptable. Vertical tendon liftoffs were found to be above the base value except for 12V01 which was between 90% and 95% of base requiring adjacent tendons to be tested. The adjacent tendons were both between base value and 95% and therefore acceptable. Tendon 12V01 was retensioned to base value -0%,+6% per procedure and left as acceptable. Vertical tendon average (allowing for removal of tendons exhibiting anchorhead rotation) was above the required minimum and acceptable. The low liftoff result for 12V01 was documented on NCR FN750-016.

Horizontal liftoffs revealed one isolated area 46H30 to 46H38 inclusive where tendon liftoffs were between 90% and 95% of base value, one tendon, 46H36, was found to be below 90% of base value . After testing, all the tendons in this area were subsequently restored per procedure to base value -0% +6%. Of the other horizontal tendons tested (6 total) two were found above base value and four were found to be between base value and 95%. After removal of horizontal tendons that exhibited anchorhead rotation, average normalized horizontal liftoffs were above the required minimum and deemed acceptable.

During liftoff, rotation of the anchorhead was noted to tendon D339. During subsequent detensioning (as scheduled) a broken wire was discovered at the field end. This wire, once removed, was found to have broken behind the anchorhead. No corrosion was found to indicate wire failure due to deterioration and it is suspected that the tendon head rotation sheared the wires against the shims. The broken wire was on the outer corner edge of the tendon bundle and no gauge movement was noted to indicate failure during liftoff. This wire was probable "pinched" during original installation and additional work on this tendon resulted in the wire finally breaking. NCR FN750-004 recorded this occurrence.

PSC Precision Surveillance Corporation

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0
TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
12V01	SHOP/TOP	161	8783	4360	1446	1446	1528	1451	1375	-9	NO
12V02	SHOP/TOP	163	8783	4660	1546	1546	1599	1519	1439	-80	YES
23V24	SHOP/TOP	163	8783	4587	1521.8	1521.8	1527	1451	1374	-9	YES
45V14	SHOP/TOP	163	8833	4650	1552	1552	1580	1501	1422	-61	YES
61V08	SHOP/TOP	163	8783	4450	1476	1476	1494	1419	1344	23	YES
46H21	SHOP/ 6	163	8783	4166.6	1381.4	1388	1446	1374	1302	-12	YES
	FIELD/ 4	162	8833	4180	1394.7						
46H29	SHOP/ 6	159	8783	4060	1345.9	1407.1	1427	1356	1284	8	YES
	FIELD/ 4	159	8833	4400	1468.3						
46H30	SHOP/ 6	162	8783	4200	1392.6	1355.6	1442	1370	1298	-8	NO
	FIELD/ 4	161	8833	3953	1318.7						
46H31	SHOP/ 6	163	8783	4073	1350.2	1343.3	1456	1383	1311	-22	NO
	FIELD/ 4	161	8833	4006	1336.5						
46H32	SHOP/ 6	162	8783	4180	1385.9	1366.8	1455	1382	1308	-22	NO
	FIELD/ 4	163	8833	4040	1347.8						

PSC Precision Surveillance Corporation

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
46H33	SHOP/ 6	163	8783	4200	1392.6	1357.8	1450	1378	1305	-17	NO
	FIELD/ 4	163	8833	3966	1323.1						
46H34	SHOP/ 6	162	8783	4200	1392.6	1424.7	1521	1445	1369	-86	NO
	FIELD/ 4	163	8833	4366	1456.9						
46H35	SHOP/ 6	163	8783	4240	1405.9	1376.8	1459	1386	1313	-25	NO
	FIELD/ 4	163	8833	4040	1347.8						
46H36	SHOP/ 6	163	8783	4080	1352.5	1343.5	1497	1422	1348	-63	NO
	FIELD/ 4	163	8833	4000	1334.5						
46H37	SHOP/ 6	162	8783	3700	1225.7	1293.45	1414	1343	1272	20	NO
	FIELD/ 4	161	8833	4080	1361.2						
46H38	SHOP/ 6	163	8783	4093	1356.9	1353.4	1459	1380	1307	-19	NO
	FIELD/ 4	162	8833	4046	1349.9						
46H39	SHOP/ 6	163	8783	4146	1374.6	1356.2	1410	1339	1269	23	YES
	FIELD/ 4	163	8833	4010	1337.8						

PSC Precision Surveillance Corporation

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

TABLE VIII: SUMMARY OF DATA SHEETS SQ 9.0 - TENDON LIFTOFFS

TENDON	END	EFFECT. WIRES	JACK No.	PRESS.	LIFTOFF	AVE. LIFTOFF	BASE VALUE	95% BASE	90% BASE	NORMALIZING FACTOR	ACCEPT
53H16	SHOP/ 5	163	8752	4560	1498.2	1475.4	1496	1422	1347	-63	YES
	FIELD/ 3	163	8783	4380	1452.7						
62H02	SHOP/ 6	163	8752	4473	1469.4	1551.6	1466	1393	1319	-33	YES
	FIELD/ 2	163	8833	4970	1633.9						
62H09	SHOP/ 2	163	8752	4346	1427.3	1431.8	1420	1349	1278	13	YES
	FIELD/ 6	163	8752	4373	1436.3						
D126	SHOP/ NEAR 3	163	8833	4180	1394.7	1376.9	1345	1278	1211	-18	YES
	FIELD/ NEAR 5	163	8783	4100	1359.2						
D212	SHOP/ NEAR 1	162	8783	3813	1263.4	1292.2	1311	1246	1180	15	YES
	FIELD/ NEAR 3	162	8833	3960	1321.1						
D339	SHOP/ NEAR 5	163	8783	4560	1512.8	1507.3	1439	1367	1295	-111	YES
	FIELD/ NEAR 1	163	8833	4500	1501.8						

8.0 TENDON LIFTOFFS

8.1 MONITOR TENDON FORCES

8.1.1 A liftoff is defined as the force required to lift the anchor head off the shim stack and is representative of the force held by that tendon. A liftoff is performed on each physical surveillance tendon to monitor the force exerted by the tendon onto the structure. PSC Procedure SQ 9.0 in Appendix F details the steps taken to perform a liftoff. The results were documented on Data Sheet SQ 9.0 and are summarized in Tables 40 thru 45.

8.1.1.1 It should be noted that performing a liftoff has only a localized effect on a tendon; therefore, it is acceptable to use the same jack for both ends of a tendon by executing the liftoff on separate occasions.

8.1.2 All of the vertical and dome tendon liftoffs were found to be above the minimum design and above 95% Predicted Force as required by IWL-3221.1. Three of the five horizontal surveillance tendons were found to be below 95% Predicted Force but above 90% Predicted Force. The liftoff requirement stated in IWL is:

Tendon forces are acceptable if:

(a) The average of all measured tendon forces, including those measured in IWL-3221.1(b)(2), for each type of tendon is equal to or greater than the minimum required prestress specified at the anchorage for that type of tendon;

(b) The measured force in each individual tendon is not less than 95% of the predicted force unless the following conditions are satisfied:

(1) the measured force in not more than one tendon is between 90% and 95% of the predicted force;

(2) The measured forces in two tendons located adjacent to the tendon in IWL-3221.1(b)(1) are not less than 95% of the predicted forces; and

(3) The measured forces in all the remaining sample tendons are not less than 95% of the predicted force.

8.1.3 Based upon the unacceptable horizontal tendon liftoffs, adjacent tendons were monitored for force until an acceptable liftoff reading was obtained on both sides of the selected tendon. 13H36 required testing of 5 adjacent tendons, 46H21 and 62H30 also required testing of five adjacent tendons. Of these tendons, six were above 95%, five were between 95% and 90% and four fell just below 90%. All tendons below 95% were restored to Predicted Force – 0%, + 6% and locked off. The restoration of these tendons is summarized in Table 46.

8.1.4 The average of the As-Found normalized liftoff values was above the minimum requirement, despite the low liftoffs, and deemed acceptable per PSC Procedure SQ9.0 Section 10.4.

8.1.4.1 The average normalized tendon force in Unit 3 for each group and their respective minimum design are:

Vertical Tendon:	Group Average = 1535.2 Kips	Minimum Design = 1149 Kips
Hoop Tendon:	Group Average = 1347.4 Kips	Minimum Design = 1252 Kips
Dome Tendon:	Group Average = 1367.3 Kips	Minimum Design = 1215 Kips

8.1.4.1.1 As depicted above, all group averages are above the required group minimum and are therefore acceptable. The actual values for each tendon and its corresponding group are summarized in Table 47.

8.1.5 Upon completion of the liftoff, a visual verification is performed to identify any changes in the condition of the tendon end. No additional or broken wires were noted during or after liftoffs.

TABLE 40: VERTICALS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
12V01	TOP	14.75	161	8784	1559.95	1559.95	1525	1449	1372	NO	0	YES
	BOT	4.00	158	N/A	N/A							
45V20	TOP	12.50	163	8780	1456.80	1456.80	1507	1432	1357	NO	0	YES
	BOT	4.00	163	N/A	N/A							
61V08	TOP	13.00	163	8784	1505.98	1505.98	1491	1416	1342	NO	0	YES
	BOT	4.00	163	N/A	N/A							
61V17	TOP	12.00	161	8784	1580.18	1580.18	1498	1423	1348	NO	0	YES
	BOT	4.00	163	N/A	N/A							

TABLE 41: HOOPS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
13H36	BT 1	6.50	163	8784	1344.08	1385.23	1484	1410	1336	YES	5	NO
	BT 3	7.25	163	8780	1426.63							
42H46	BT 2	5.75	163	8784	1546.46	1558.63	1456	1383	1310	NO	0	YES
	BT 4	6.00	163	8780	1570.80							
46H21	BT 4	5.75	163	8780	1319.34	1330.02	1441	1369	1297	YES	5	NO
	BT 6	6.00	163	8784	1340.71							
51H34	BT 1	8.00	163	8784	1532.96	1464.70	1487	1413	1339	NO	0	YES
	BT 5	7.00	163	8780	1396.45							
62H30	BT 2	6.75	163	8784	1249.64	1290.84	1413	1342	1272	YES	5	NO
	BT 6	6.75	163	9501	1332.05							

TABLE 42: DOMES – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	# OF ADJACENTS MONITORED	AS-FOUND ACCEPTANCE
D129	BT 3	6.25	162	8780	1289.16	1289.64	1287	1223	1159	NO	0	YES
	BT 5	6.00	161	8784	1290.12							
D212	BT 1	6.38	162	8784	1259.76	1277.81	1305	1240	1175	NO	0	YES
	BT 3	6.50	162	8780	1295.87							
D238	BT 4	7.00	163	8780	1527.21	1511.53	1348	1281	1213	NO	0	YES
	BT 6	6.00	163	8784	1495.86							

TABLE 43: 13H36 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
13H33	BT 1	7.00	163	8784	1310.35	1306.46	1366	1298	1229	NO	YES
	BT 3	6.75	163	8780	1302.57						
13H34	BT 1	7.00	163	8784	1350.83	1368.61	1475	1402	1328	YES	NO
	BT 3	7.00	163	8780	1386.39						
13H35	BT 1	6.56	163	8784	1249.64	1244.25	1373	1304	1235	YES	NO
	BT 3	6.38	162	8780	1238.87						
13H37	BT 1	6.88	163	8784	1367.69	1289.87	1368	1299	1231	YES	NO
	BT3	5.75	163	8780	1212.05						
13H38	BT 1	6.50	163	8784	1411.54	1395.05	1444	1372	1300	NO	YES
	BT 3	7.00	163	8780	1378.57						

TABLE 44: 46H21 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
46H19	BT 4	7.00	163	8780	1352.87	1358.61	1402	1332	1262	NO	YES
	BT 6	7.50	163	8784	1364.35						
46H20	BT 4	6.75	160	8780	1269.04	1298.13	1467	1394	1321	YES	NO
	BT 6	7.25	163	8784	1327.22						
46H22	BT 4	5.75	163	8780	1315.98	1311.48	1488	1412	1337	YES	NO
	BT 6	6.38	163	8784	1306.98						
46H23	BT 4	6.00	161	8780	1336.10	1329.97	1425	1354	1283	YES	NO
	BT 6	5.75	163	8784	1323.85						
46H24	BT 4	6.75	163	8780	1419.92	1425.85	1472	1398	1325	NO	YES
	BT 6	7.50	163	8784	1431.78						

TABLE 45: 62H30 ADJACENTS – SQ9.0 – MONITORING TENDON FORCE

TENDON	END	SHIM STACK HEIGHT (in)	EFFECTIVE WIRES	JACK I.D.	LIFT-OFF (Kips)	AALV (kips)	B.V.P.F. (KIPS)	95% B.V.P.F. (KIPS)	90% B.V.P.F. (KIPS)	ADJACENTS REQUIRED	AS-FOUND ACCEPTANCE
62H29	BT 2	6.50	163	8780	1366.28	1369.63	1421	1350	1279	NO	YES
	BT 6	6.38	163	9501	1372.98						
62H31	BT 2	6.25	163	8780	1269.04	1269.04	1475	1401	1328	YES	NO
	BT 6 *	6.00	163	N/A	N/A						
62H32	BT 2	7.00	163	8780	1332.75	1332.75	1455	1382	1310	YES	NO
	BT 6 *	6.50	163	N/A	N/A						
62H33	BT 2	6.19	163	8780	1242.22	1313.39	1461	1388	1315	YES	NO
	BT 6	6.50	162	8784	1384.56						
62H34	BT 2	7.00	163	8780	1393.10	1378.71	1432	1360	1289	NO	YES
	BT 6	6.75	162	8784	1364.32						

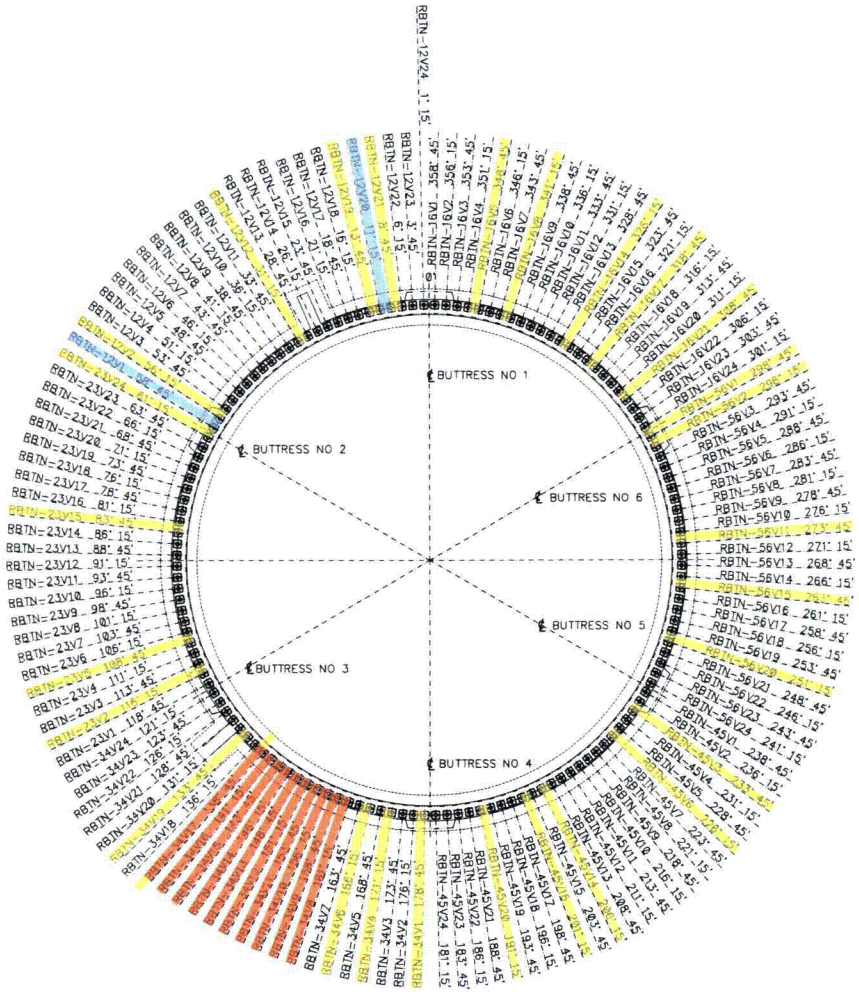
* TENDON NOT ACCESSABLE AT BUTTRESS 6.

TABLE 46 ADJACENTS – TENDON FORCE RESTORATION

TENDON	END	AS-FOUND LIFTOFF			RESTORATION			B.V.P.F. (KIPS)	% VARIATION ABOVE B.V.P.F	ACCPETABLE ?
		JACK	LIFT-OFF (kips)	AALV (kips)	JACK	LIFT-OFF (kips)	AALV (kips)			
13H34	BT 1	8784	1350.83	1368.61	8784	1479.00	1508.13	1475	+2.2%	YES
	BT 3	8780	1386.39		8780	1537.27				
13H35	BT 1	8784	1249.64	1244.25	8784	1411.54	1417.40	1373	+3.2%	YES
	BT 3	8780	1238.87		8780	1423.27				
13H36	BT 1	8784	1344.08	1385.23	8784	1546.46	1555.27	1484	+4.8%	YES
	BT 3	8780	1426.63		8780	1564.09				
13H37	BT 1	8784	1367.69	1289.87	8784	1394.68	1415.68	1368	+3.5%	YES
	BT 3	8780	1212.05		8780	1436.69				
46H20	BT 4	8780	1269.04	1298.13	8780	1486.98	1494.79	1467	+1.9%	YES
	BT 6	8784	1327.22		8784	1502.61				
46H21	BT 4	8780	1319.34	1330.02	8780	1503.74	1501.49	1441	+4.2%	YES
	BT 6	8784	1340.71		8784	1499.24				
46H22	BT 4	8780	1315.98	1311.48	8780	1567.45	1538.40	1486	+3.5%	YES
	BT 6	8784	1306.98		8784	1509.35				
46H23	BT 4	8780	1336.10	1329.97	8780	1486.98	1481.30	1425	+4.0%	YES
	BT 6	8784	1323.85		8784	1475.62				
62H30	BT 2	8784	1249.64	1290.84	8780	1443.39	1467.71	1413	+3.9%	YES
	BT 6	9501	1332.05		9501	1492.04				
62H31	BT 2	8780	1269.04	1269.04	8780	1486.98	1486.98	1475	+0.8%	YES
	BT 6 *	N/A	N/A		N/A	N/A				
62H32	BT 2	8780	1332.75	1332.75	8780	1497.04	1497.04	1455	+2.9%	YES
	BT 6 *	N/A	N/A		N/A	N/A				
62H33	BT 2	8780	1242.22	1313.39	8780	1486.98	1494.79	1461	+2.3%	YES
		8784	1384.56		8784	1502.61				

* TENDON NOT ACCESSABLE AT BUTTRESS 6 – RESTORATION ONE END ONLY.

KEY NO.:



VERTICAL TENDON LAYOUT PLAN

REFERENCE VENDOR DRAWINGS (PRESCON CORPORATION)

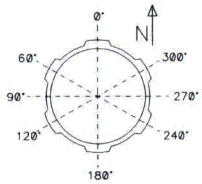
5EX7-003-P-1	0'- 60'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-2	60'-120'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-3	120'-180'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-4	180'-240'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-5	240'-300'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-6	300' - 0'	FROM EL. 80'-6" TO EL. 142'-0".
5EX7-003-P-7	VERTICAL ANCHOR LAYOUT AT EL 80'-6"	
5EX7-003-P-14	0'- 60'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-15	60'-120'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-16	120'-180'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-17	180'-240'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-18	240'-300'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-19	300' - 0'	FROM EL. 142'-0" TO EL. 192'-0".
5EX7-003-P-32	0'- 60'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-33	60'-120'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-34	120'-180'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-35	180'-240'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-36	240'-300'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-37	300' - 0'	FROM EL. 192'-0" TO EL. 232'-0".
5EX7-003-P-38	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-39	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-40	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-41	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-42	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")
5EX7-003-P-43	VERTICAL TENDON PLACEMENT	(EL. 232'-0" TO EL. 267'-6")

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 8TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD.	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	L.S.M.		2/19/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

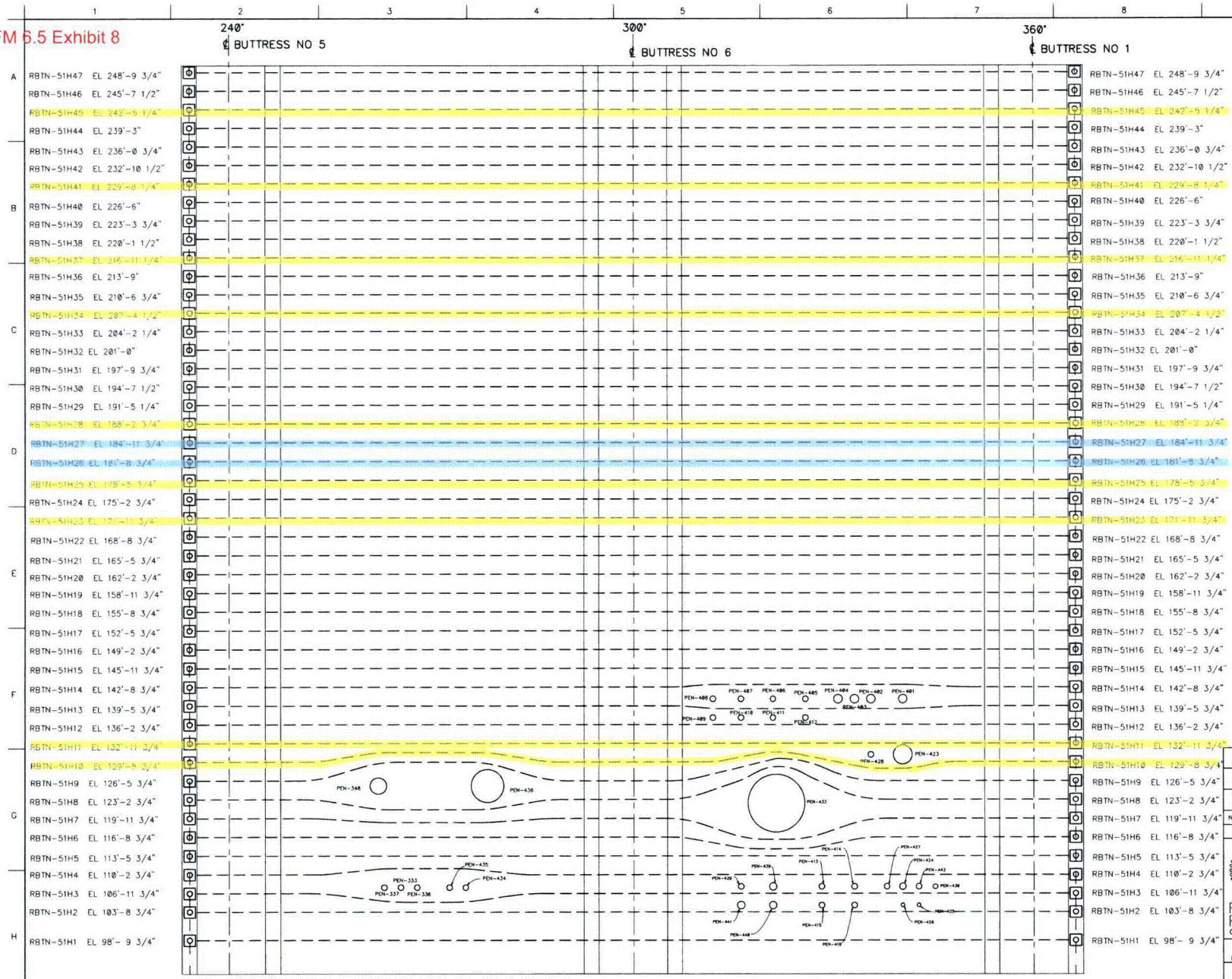
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION VERTICAL TENDON LAYOUT

DRAWN	CHKD.	APRVD.	DATE	SCALE
J.C.	CAB	CAB	08/31/98	1/16"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-004	1

FILE: S425004.DWG



KEY NO.:

REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)

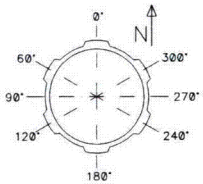
5EX7-003-P-12 240° TO 300°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-13 300° TO 360°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-24 240° TO 300°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-25 300° TO 360°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-30 240° TO 300°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-31 300° TO 360°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 4TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	LSM		2/10/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

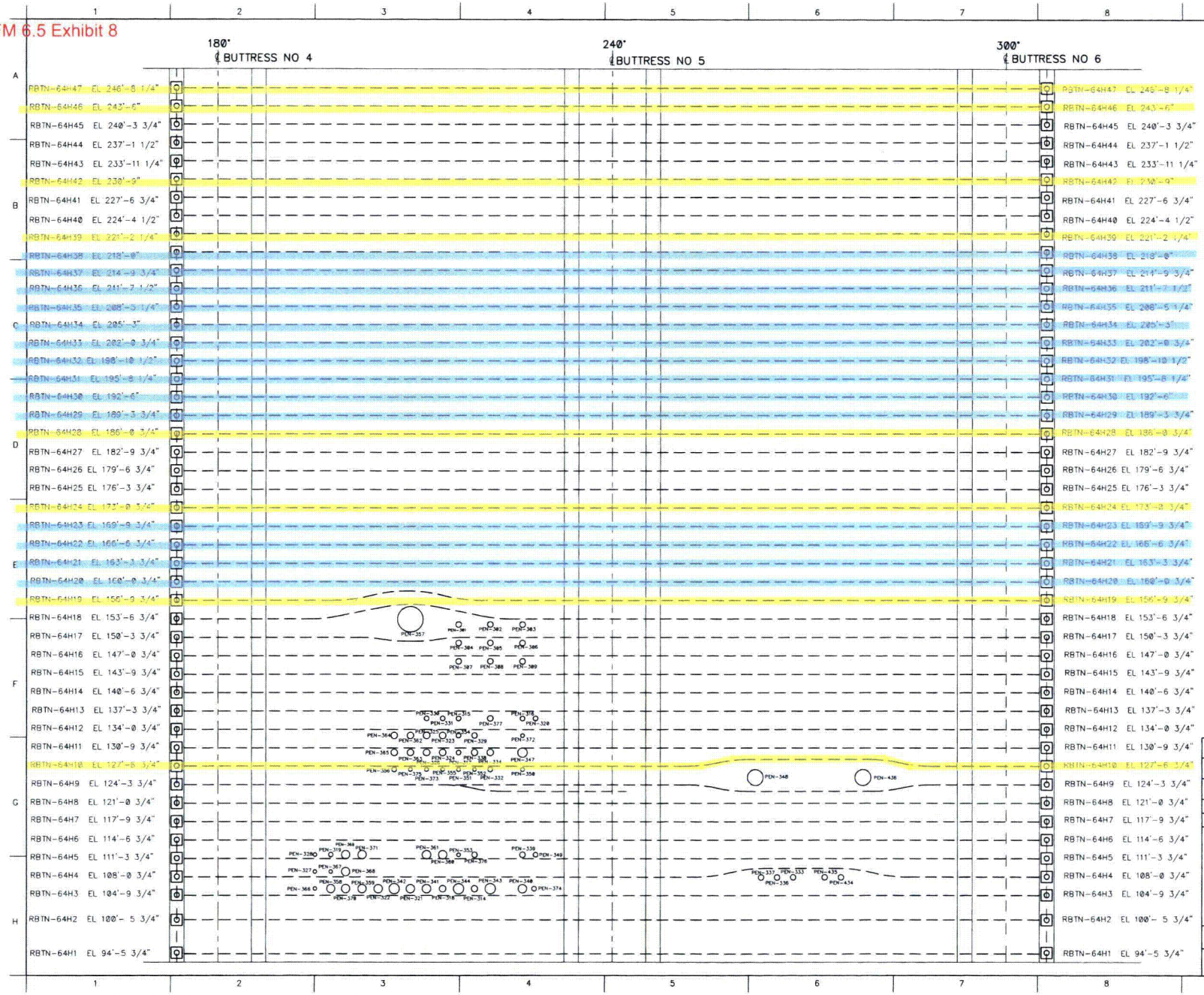
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "51" LAYOUT

DRAWN	CHKD.	APRVD.	DATE	SCALE
D.C.	CAS	CAS	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-009	1

FILE: S425009.DWG



REFERENCE VENDOR DWGS. (PRESCON CORPORATION)

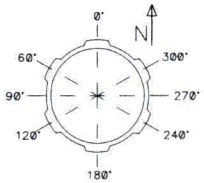
5EX7-003-P-11 180° TO 240°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-12 240° TO 300°	HOOP TENDON PLACEMENT EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-23 180° TO 240°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-24 240° TO 300°	HOOP TENDON PLACEMENT EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-29 180° TO 240°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-30 240° TO 300°	HOOP TENDON PLACEMENT EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 5TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR	DATE
1	ISSUED PER DCN 99-016	MAD	LSM		8/24/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

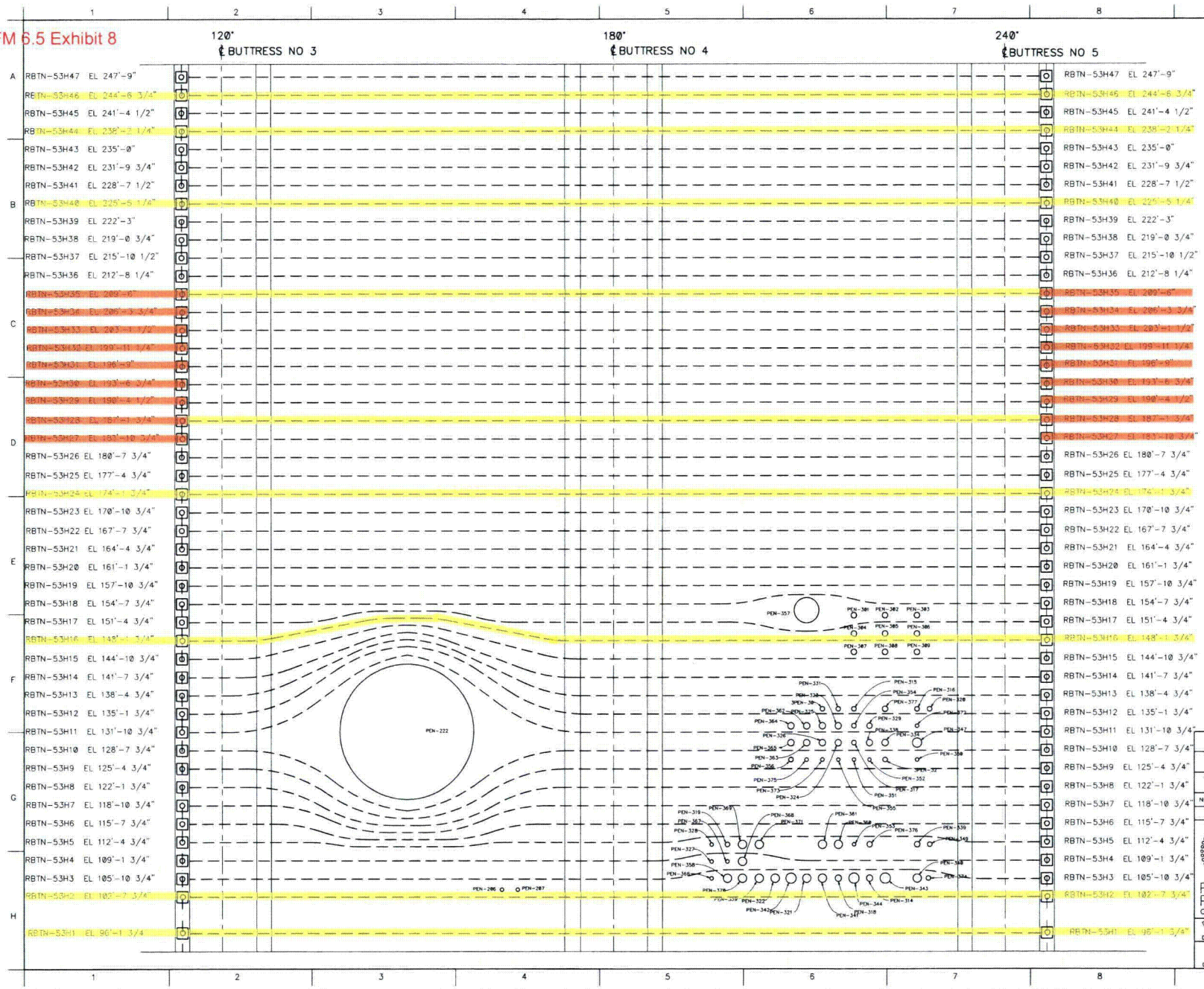
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "64" LAYOUT

DRAWN	CHKD.	APRVD.	DATE	SCALE
J.C.	CAS	CAS	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-008	1

FILE S425008.DWG



REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)

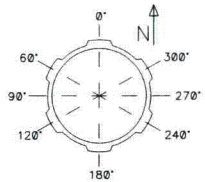
5EX7-003-P-10	HOOP TENDON PLACEMENT	120° TO 180° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-11	HOOP TENDON PLACEMENT	180° TO 240° EL. 94'-5 3/4" TO 143'-9 3/4"
5EX7-003-P-22	HOOP TENDON PLACEMENT	120° TO 180° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-23	HOOP TENDON PLACEMENT	180° TO 240° EL. 143'-9 3/4" TO 198'-10 1/2"
5EX7-003-P-28	HOOP TENDON PLACEMENT	120° TO 180° EL. 198'-10 1/2" TO 248'-9 1/4"
5EX7-003-P-29	HOOP TENDON PLACEMENT	180° TO 240° EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 8TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	L.Sm		3/24/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

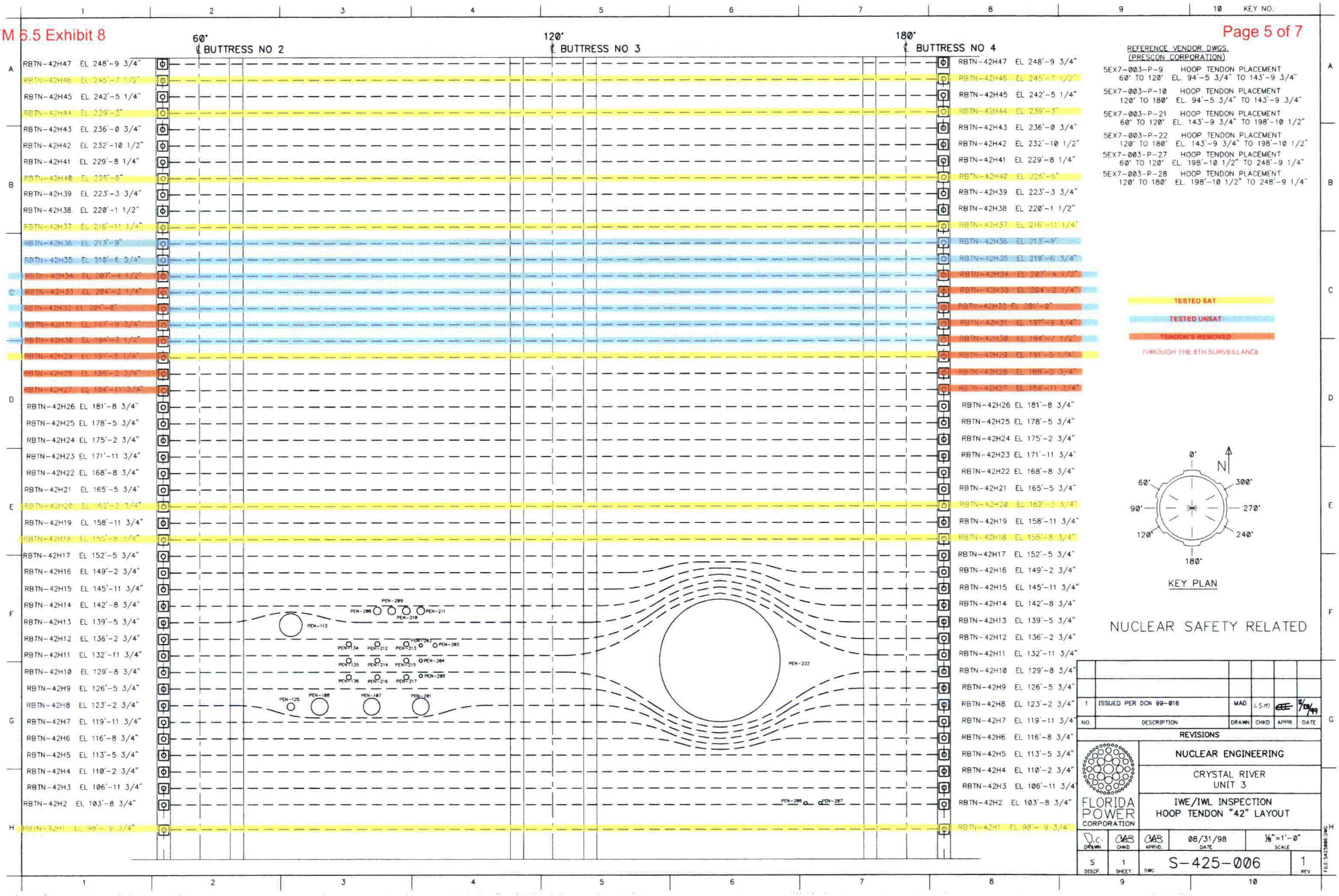
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "53" LAYOUT

DRAWN	CHKD	APRVD.	DATE	SCALE
D.C.	CAS	CAS	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-007	1

FILE S-425-007.DWG



REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)

5EX7-003-P-9 HOOP TENDON PLACEMENT
60° TO 120° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-10 HOOP TENDON PLACEMENT
120° TO 180° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-21 HOOP TENDON PLACEMENT
60° TO 120° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-22 HOOP TENDON PLACEMENT
120° TO 180° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-27 HOOP TENDON PLACEMENT
60° TO 120° EL. 198'-10 1/2" TO 248'-9 1/4"

5EX7-003-P-28 HOOP TENDON PLACEMENT
120° TO 180° EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 8TH SURVEILLANCE

KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR	DATE
1	ISSUED PER DCN 99-016	MAD	LSM	EEE	8/13/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

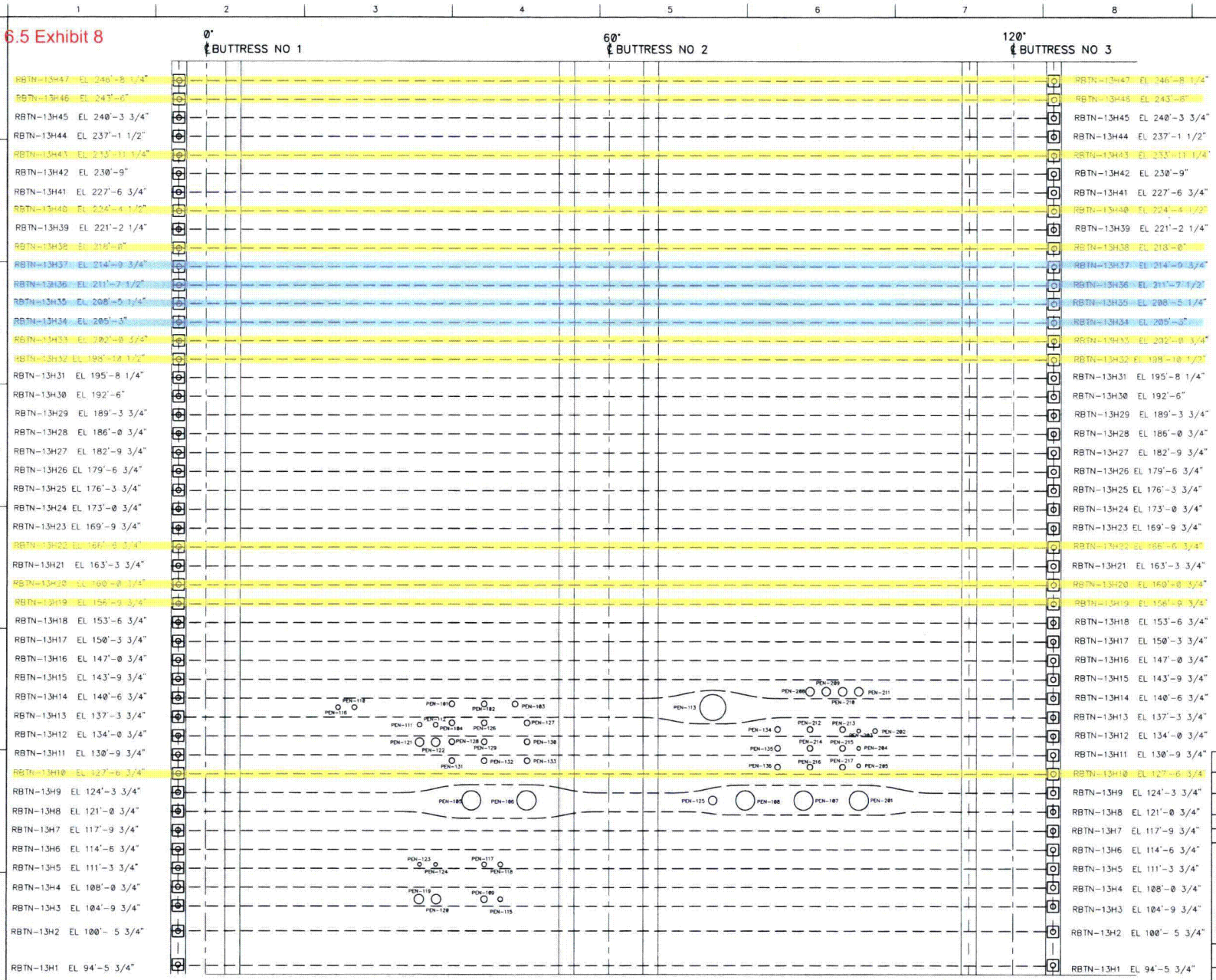
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "42" LAYOUT

DRAWN	CHKD	APRVD.	DATE	SCALE
D.C.	OAS	OAS	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-006	1

FILE: S-425-006.DWG



REFERENCE VENDOR DWGS.
(PRESCON CORPORATION)

5EX7-003-P-8 HOOP TENDON PLACEMENT
0° TO 60° EL. 94'- 5 3/4" TO 143'-9 3/4"

5EX7-003-P-9 HOOP TENDON PLACEMENT
60° TO 120° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-20 HOOP TENDON PLACEMENT
0° TO 60° EL 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-21 HOOP TENDON PLACEMENT
60° TO 120° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-26 HOOP TENDON PLACEMENT
0° TO 60° EL. 198'-10 1/2" TO 248'-9 1/4"

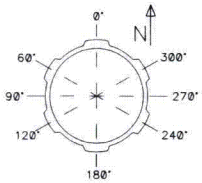
5EX7-003-P-27 HOOP TENDON PLACEMENT
60° TO 120° EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 8TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	LSM		2/25/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

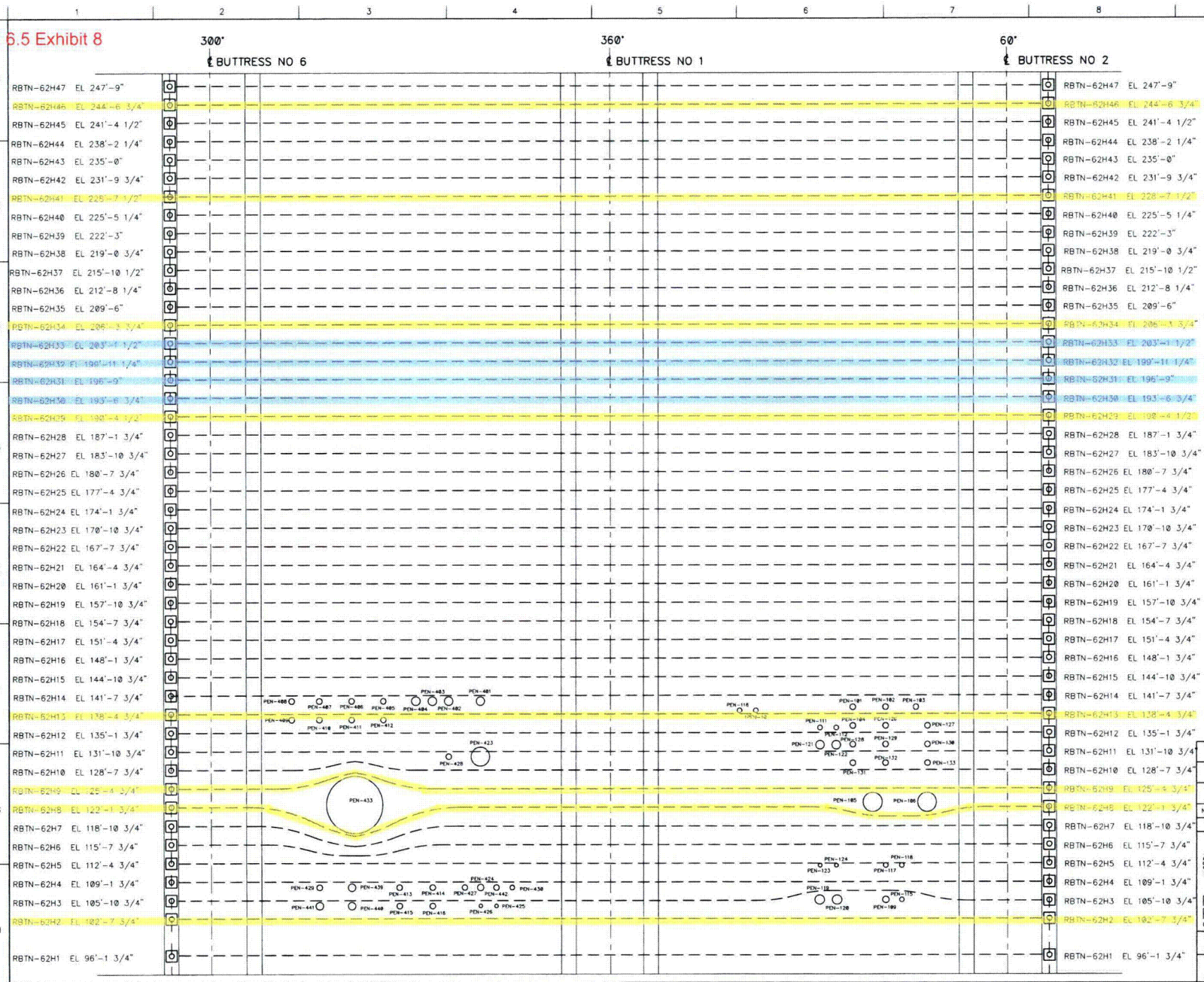
CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "13" LAYOUT

DRAWN	CHKD.	APRVD.	DATE	SCALE
J.C.	CAS	CAS	08/31/98	1/8=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-005	1

FILE S425005.DWG



REFERENCE VENDOR DWGS. (PRESCON CORPORATION.)

5EX7-003-P-8 HOOP TENDON PLACEMENT 0° TO 60° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-13 HOOP TENDON PLACEMENT 300° TO 360° EL. 94'-5 3/4" TO 143'-9 3/4"

5EX7-003-P-20 HOOP TENDON PLACEMENT 0° TO 60° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003P-25 HOOP TENDON PLACEMENT 300° TO 360° EL. 143'-9 3/4" TO 198'-10 1/2"

5EX7-003-P-26 HOOP TENDON PLACEMENT 0° TO 60° EL. 198'-10 1/2" TO 248'-9 1/4"

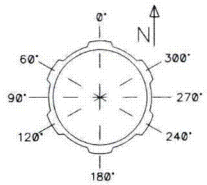
5EX7-003-P-31 HOOP TENDON PLACEMENT 300° TO 360° EL. 198'-10 1/2" TO 248'-9 1/4"

TESTED SAT

TESTED UNSAT

TENDON'S REMOVED

THROUGH THE 8TH SURVEILLANCE



KEY PLAN

NUCLEAR SAFETY RELATED

NO.	DESCRIPTION	DRAWN	CHKD	APPR.	DATE
1	ISSUED PER DCN 99-016	MAD	LSM	CEE	7/19/99

REVISIONS

FLORIDA POWER CORPORATION

NUCLEAR ENGINEERING

CRYSTAL RIVER UNIT 3

IWE/IWL INSPECTION HOOP TENDON "62" LAYOUT

DRAWN	CHKD.	APRVD.	DATE	SCALE
D.C.	CAB	CAB	08/31/98	1/8"=1'-0"

DISCP.	SHEET	DWG.	REV.
S	1	S-425-010	1

FILE: S425010.DWG

VIII. COMPARISON WITH ORIGINAL INSTALLATION DATA

A comparison of the liftoff forces from this surveillance to the original installation lock-off forces is made in an effort to detect any evidence of system degradation. The lock-off forces are compared in order to detect any abnormal force loss which would possibly indicate an underestimation of the creep, shrinkage and/or elastic shortening effects in the Containment Building.

The losses for the tendon groups were found to be 9.14% for the vertical tendons, 15.81% for the horizontal tendons and 14.34% for the dome tendons. Based upon the results from other facilities these losses are as expected for a containment of this age and do not indicate any degradation of the system.

A regression analysis was conducted on each of the tendon groups and the graphs are shown on the following pages along with the input data for force, test dates and age (time stressed). All three analysis show each group remaining above the minimum requirements well beyond the next surveillance period. Projections to 40 years after installation (38 years of plant life) show a vertical value of 1516 kips against a minimum requirement of 1149 kips. A horizontal projection of 1374 kips against a minimum of 1252 kips and a dome projection of 1373 kips with a minimum requirement of 1215 kips. Due to large scatter in the as found one and three year horizontal liftoff values they were removed from the computation. This is acceptable due to the large number of data points available and the weighting in the analysis for latter data points

A review of previous surveillance data indicated that the current common dome tendon was in fact retensioned during the tenth year and a new common tendon should be selected. In addition, the vertical tendon was retensioned during this surveillance and this group should also have a new common tendon selected. With only two points to plot (sixteenth year and twenty-fifth) the horizontal common tendon projection does not have enough points to provide extensive indications of trend. However, current value remains slightly (less than 1%) below the regression curve.

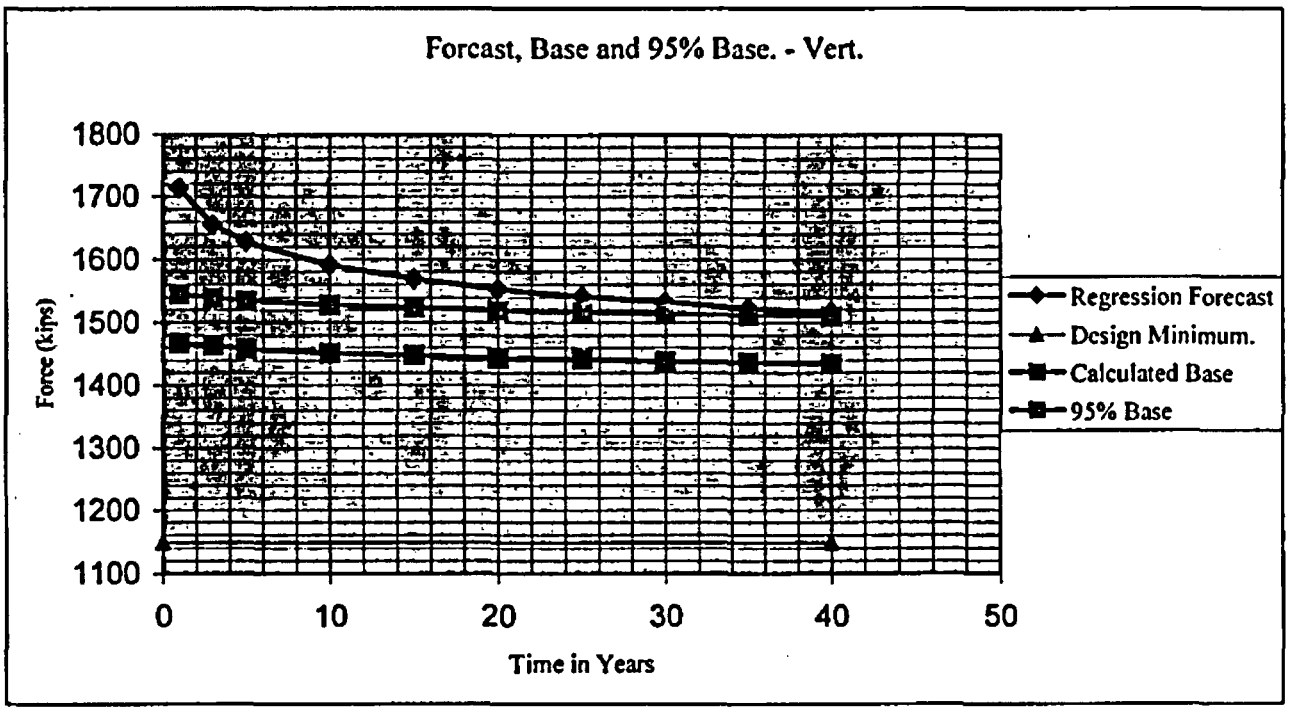
Analysis of the regression curves, required minimum design forces and Crystal River base value calculations brought into question the "low" values found on several horizontal tendons, both during this surveillance, and the previous one. Acceptable normalized group averages, and ultimately the regression curve, was obtained despite nine of the horizontal tendons and one of the vertical tendons being below the expected base value at liftoff (subsequently retensioned to base -0% +6%). This base value is calculated by Florida Power to determine expected liftoff forces based upon a theoretical series of losses evaluated in 1980, which, based upon the collected data from this surveillance, appear to be underestimated. Liftoffs falling below 95% of the expected value require additional adjacent liftoffs to determine the extent of the lower than expected forces.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

VIII. COMPARISON WITH ORIGINAL INSTALLATION DATA

An evaluation of the base values being used to determine acceptable liftoffs seemed to reveal large differences for each group. A plot was made of each group to show forecasted regression projection, base value, 95% of base value (which determines an increase in scope) and the design minimum.



The vertical graph shows the 40 year regression analysis forecast tendon force (shown in dark blue) of 1510 kips at about the same value as the calculated base line (1516 kips) with a minimum design value of 1149 kips. A base value at this level would cause an increase in scope for tendons falling 5% beyond projected, however, these tendons could still be almost 350 kips above minimum requirements. The base line value should be an indication of significant deterioration and at this time appears to be too high for vertical tendons.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

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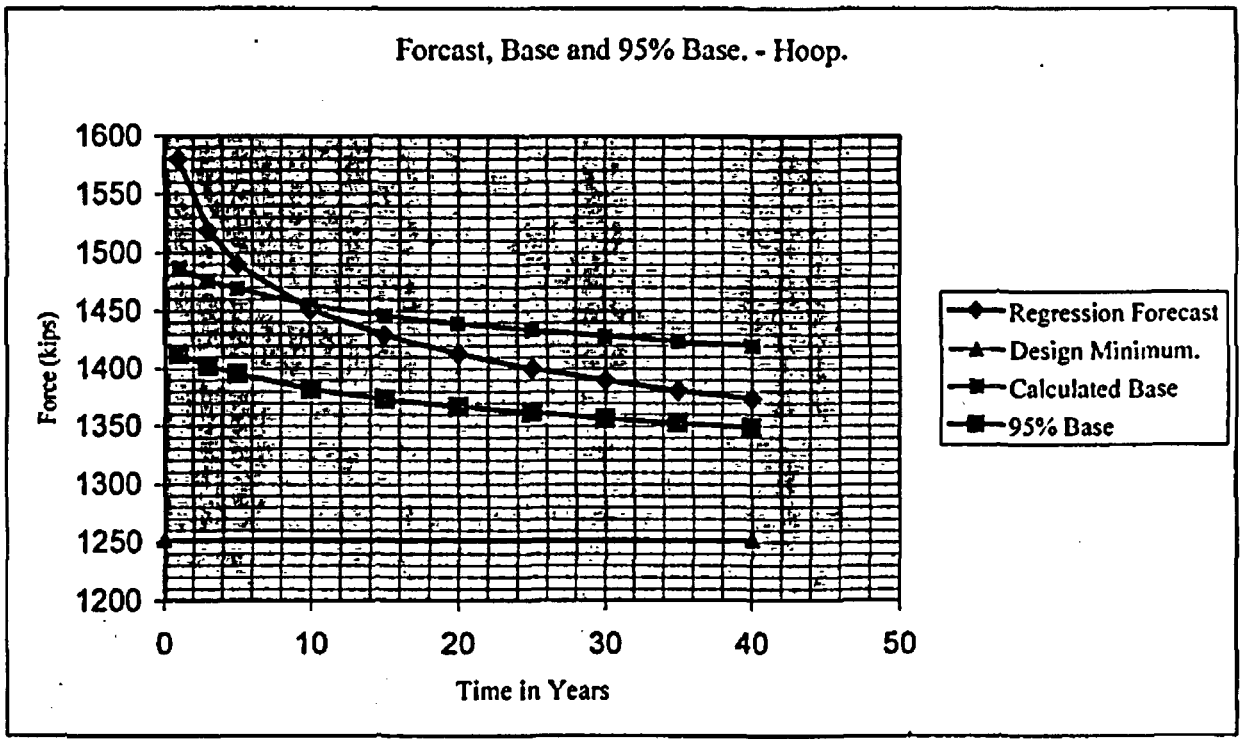
VIII. COMPARISON WITH ORIGINAL INSTALLATION DATA



Similarly with horizontal tendons. The base line at 40 years (1420 kips) is already above the regression line for the horizontal group which has projected below this point from year 10. This regression line at 40 years of 1374 kips is still 120 kips above the required minimum of 1252 kips. The inflated base line could result in additional scope for tendons falling as little as 2 % below the regression curve.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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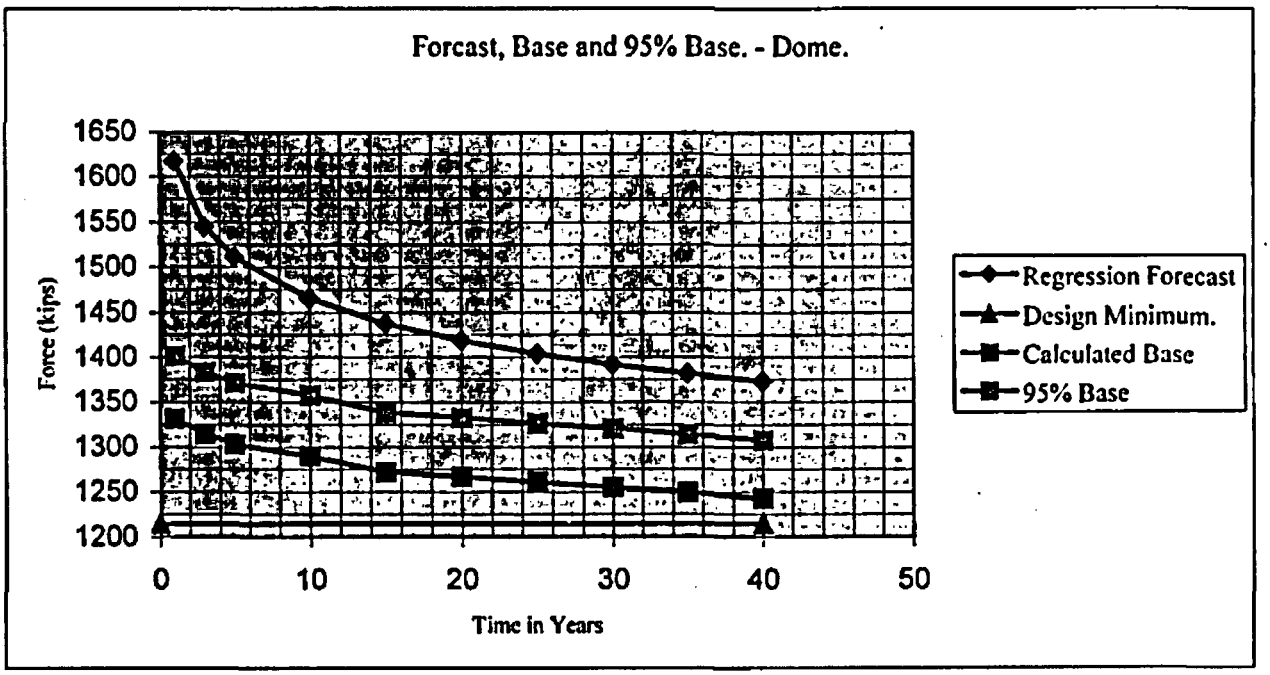
VIII. COMPARISON WITH ORIGINAL INSTALLATION DATA



Dome projections appear to be far more realistic with a regression forecast of 1373 kips, a base value of 1308 kips and a design minimum of 1215 kips. This allows the base to be at a limit to signal tendons with potential deficiencies in sufficient time for corrective action without causing a continual increase in scope, or the possibility of falling below the design minimum.

Initial review of the Crystal River calculations used in both the 6th and 7th surveillance projections would appear to indicate relaxation values based on an operating temperature of 68^{0}F. It is quite conceivable that actual containment temperatures, particularly above roof level in summer may reach twice that level with a subsequent increase in relaxation.

Having reviewed the as found liftoffs, the regression analysis, and the current method of calculating expected tendon forces it is our recommendation that base values for future vertical and horizontal surveillances be adjusted to a more realistic relaxation value. In addition, the regression curve should be considered with the base value set to signal abnormal results allowing investigation or remedial action to tendons performing well below the norm. The regression curve produced during the next surveillance will be used to confirm that the group averages are performing as expected and will still provide acceptable values beyond the current life of the plant.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

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TABLE XII: COMPARISON OF ORIGINAL LOCKOFF FORCES TO AS FOUND FORCES

TENDON	LIFTOFF FORCE		LOSS	PERCENTAGE	AVERAGE
	ORIGINAL	@ 25 YEARS	(kips)	%	PERCENTAGE
12V01	1675	1446	229	13.67	
12V02	1699	1546	153	9.01	
23V24	1634	1522	112	6.85	9.14
45V14	1697	1552	145	8.54	
61V08	1598	1476	122	7.63	
46H21	1653	1388	265	16.03	
46H30	1641.5	1356	285.5	17.39	
46H31	1654.5	1343	311.5	18.83	
46H32	1635.5	1367	268.5	16.42	
46H33	1648.5	1358	290.5	17.62	
46H34	1702	1425	277	16.27	
46H35	1654.5	1377	277.5	16.77	15.81
46H36	1677.5	1344	333.5	19.88	
46H37	1657	1293	364	21.97	
46H38	1635	1353	282	17.25	
46H39	1601	1356	245	15.30	
53H16	1638.5	1475	163.5	9.98	
62H02	1633	1552	81	4.96	
62H09	1639	1432	207	12.63	
D126	1634	1377	257	15.73	
D212	1600	1292	308	19.25	14.34
D339	1639	1507	132	8.05	

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25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
12V02	1546	11/26/01	10/14/74	27.118
23V24	1521.8	11/27/01	10/7/74	27.14
45V14	1552	9/10/01	10/3/74	26.936
61V08	1476	9/7/01	10/10/74	26.909
23V02	1609	11/27/97	10/2/74	23.153
61V21	1525	12/20/97	9/19/74	23.251
34V06	1590	11/8/93	10/11/74	19.076
56V15	1541	11/24/93	9/20/74	19.178
61V14	1587	11/9/93	10/11/74	19.079
34V04	1623	11/2/87	10/8/74	13.067
56V02	1648	10/29/87	10/14/74	13.04
12V01	1315	10/9/81	9/13/74	7.071
34V06	1600	10/6/81	10/11/74	6.987
34V19	1640	10/07/81	10/01/74	7.016
45V16	1575	10/06/81	10/03/74	7.008
56V11	1565	10/06/81	9/20/74	7.004
61V05	1519	10/09/81	9/13/74	7.071

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

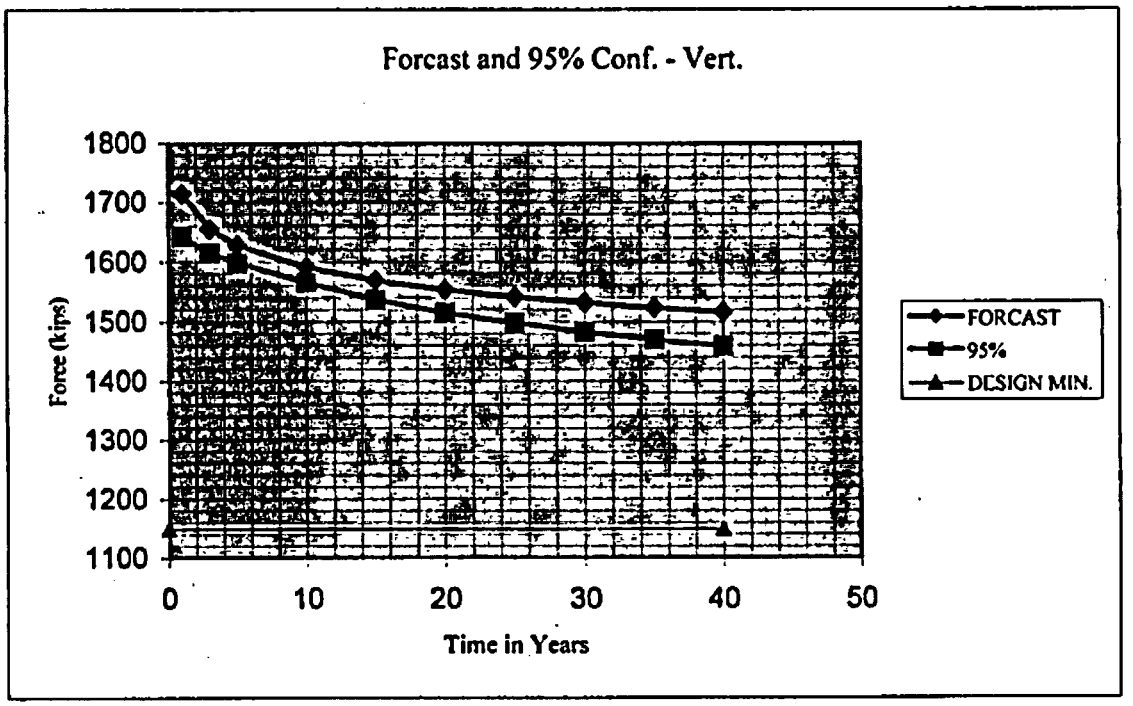
REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
34V01	1569	3/27/80	9/11/74	5.542
23V05	1580	3/28/80	9/4/74	5.564
12V12	1718	4/3/80	10/15/74	5.468
56V01	1707	4/3/80	8/30/74	5.594
56V20	1630	4/1/80	10/9/74	5.479
45V06	1685	4/11/80	10/2/74	5.525
12V20	1740	4/11/80	1/28/75	5.205
12V20	1785	12/12/77	1/28/75	2.874
23V15	1589.5	12/12/77	9/23/74	3.218
34V06	1590	12/8/77	10/11/74	3.159
45V03	1678	12/9/77	9/30/74	3.191
56V01	1718.5	12/9/77	8/30/74	3.277
12V19	1589.5	12/13/77	9/9/74	3.26
12V21	1632.5	12/13/77	9/10/74	3.257

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

REGRESSION CURVE



YEARS	FORCAST (kips)	95% CONFIDENCE.
1	1714	1642
3	1655	1615
5	1628	1599
10	1591	1565
15	1569	1537
20	1553	1515
25	1541	1498
30	1532	1483
35	1523	1470
40	1516	1459

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25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power A Progress Energy Company

REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
46H21	1388	10/3/01	2/7/75	26.654
46H30	1355.6	10/22/01	2/12/75	26.69
46H31	1343.3	10/13/01	2/13/75	26.663
46H32	1366.8	10/13/01	2/27/75	26.621
46H33	1357.8	10/12/01	2/13/75	26.66
46H34	1424.7	10/10/01	2/27/75	26.613
46H35	1376.8	10/9/01	2/14/75	26.649
46H36	1343.5	10/6/01	2/27/75	26.602
46H37	1293.5	10/9/01	2/17/75	26.64
46H38	1353.4	10/11/01	2/26/75	26.619
46H39	1356.2	10/11/01	2/18/75	26.643
53H16	1475.4	11/11/01	3/25/75	26.63
62H02	1551.6	11/9/01	3/7/75	26.673
62H09	1431.8	11/23/01	1/31/75	26.814
42H18	1476	11/13/97	3/4/75	22.692
42H29	1448	11/25/97	2/12/75	22.784
42H30	1389	11/24/97	2/28/75	22.733
42H31	1338	11/22/97	2/13/75	22.772
42H32	1355.5	11/13/97	2/28/75	22.703
42H33	1361	11/22/97	2/14/75	22.769
42H34	1377.5	11/24/97	2/28/75	22.733
42H35	1296.5	11/25/97	2/14/75	22.778
42H36	1408	11/25/97	2/27/75	22.739
42H37	1401.5	11/26/97	2/17/75	22.772

PSC Precision Surveillance Corporation

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
42H44	1471.5	11/12/97	2/26/75	22.706
51H25	1363	11/10/97	1/14/75	22.823
51H26	1320	11/5/97	3/19/75	22.657
51H27	1265.5	11/9/97	1/8/75	22.837
51H28	1450.5	11/11/97	3/18/75	22.649
53H02	1611	1/14/98	3/27/75	22.798
53H46	1459.5	11/12/97	3/12/75	22.668
62H41	1426	12/5/97	2/18/75	22.793
62H46	1485	11/20/97	2/25/75	22.731
35H01	1572	1/3/94	1/24/75	18.944
42H01	1560	1/3/94	1/29/75	18.93
46H21	1425	12/7/93	2/7/75	18.831
46H28	1375	11/22/93	2/28/75	18.728
46H29	1300	11/19/93	2/12/75	18.767
46H30	1382	11/23/93	2/12/75	18.778
46H47	1468	12/14/93	2/20/75	18.811
62H08	1435	12/29/93	3/6/75	18.812
64H19	1470	10/28/87	2/6/75	12.724
13H20	1456	10/16/87	3/19/75	12.575
51H26	1411	10/28/87	3/19/75	12.608
13H40	1471	10/19/87	3/11/75	12.605
51H41	1362	10/27/87	1/3/75	12.815

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25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
62H34	1546	10/12/81	2/28/75	6.589
13H46	1546	10/13/81	3/10/75	6.591
13H19	1424	10/13/81	1/17/75	6.739
51H26	1424	10/14/81	3/19/75	6.57
42H20	1544	10/14/81	3/3/75	6.613
51H45	1492	10/15/81	12/30/74	6.793
42H40	1466	10/15/81	2/26/75	6.63
35H35	1328	10/20/81	1/7/75	6.602
35H40	1458	10/21/81	3/12/75	6.605
46H10	1478	11/11/81	3/7/75	6.678

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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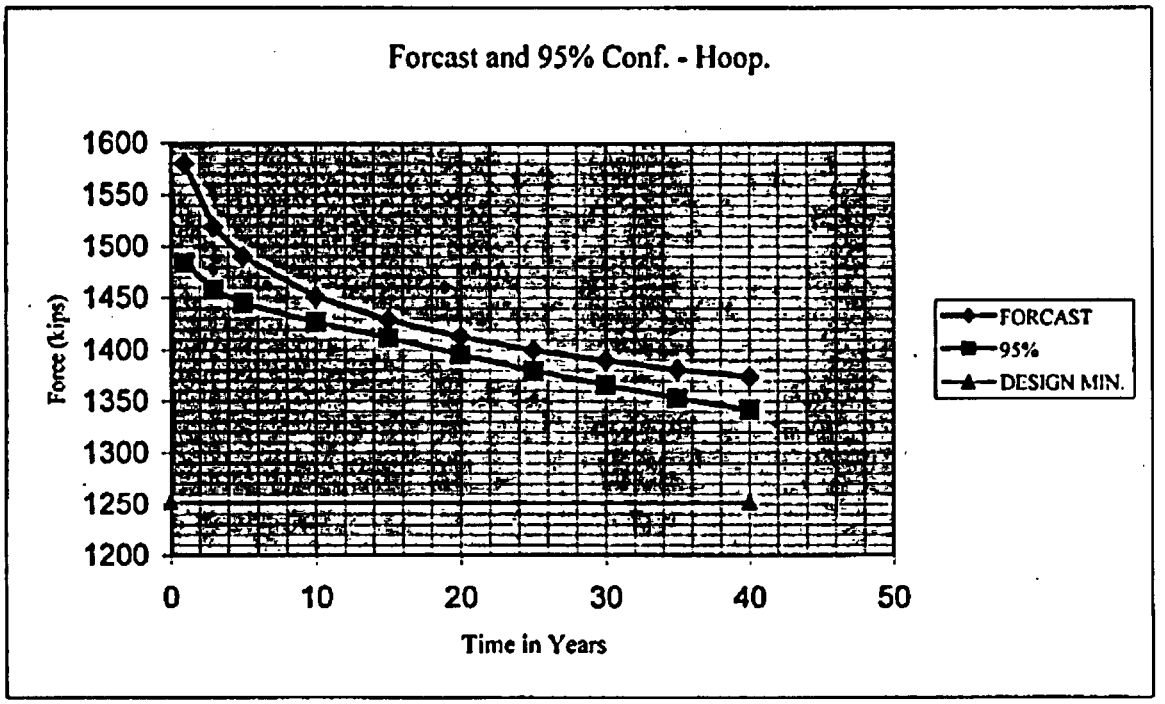
REGRESSION CURVE



YEARS	FORCAST (kips)	95% CONFIDENCE.
1	1580	1484
3	1519	1458
5	1490	1445
10	1451	1427
15	1429	1412
20	1413	1396
25	1400	1380
30	1390	1366
35	1381	1353
40	1374	1342

PSC Precision Surveillance Corporation

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
D126	1376.9	9/26/01	12/3/74	26.814
D339	1507.3	9/18/01	3/31/75	26.467
D113	1427	12/6/97	12/9/74	22.992
D115	1380	12/7/97	3/25/75	22.702
D304	1598	12/7/97	12/6/74	23.003
D311	1408	11/23/97	11/11/74	23.033
D215	1518	11/9/93	11/4/74	19.014
D224	1425	11/17/93	12/3/74	18.956
D231	1335	12/3/93	11/12/74	19.058
D105	1453	10/23/87	11/22/74	12.917
D212	1276	10/26/87	12/3/74	12.895
D328	1276	10/27/87	12/5/74	12.892
D123	1304	11/4/81	11/8/74	6.989
D212	1338	10/26/81	12/3/74	6.895
D215	1594	10/27/81	11/4/74	6.978
D322	1494	10/29/81	12/2/74	6.906
D329	1506	10/20/81	11/19/74	6.918

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
A Progress Energy Company

REGRESSION ANALYSIS DATA

TENDON NUMBER	TENDON FORCE	TEST DATE	ORIGINAL STRESS	AGE (TIME STRESSED)
D331	1460.5	4/24/80	10/25/74	5.499
D323	1525.5	4/28/80	11/8/74	5.473
D208	1593.5	4/29/80	12/4/74	5.403
D140	1587	5/2/80	12/4/74	5.411
D122	1546.5	4/30/80	12/2/74	5.411
D139	1590	2/3/78	11/15/74	3.217
D215	1644	2/3/78	11/4/74	3.248
D221	1511	1/12/78	11/20/74	3.143
D228	1524	1/11/78	12/2/74	3.108
D234	1513	1/11/78	12/5/74	3.099
D340	1562	1/13/78	12/4/74	3.108

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power
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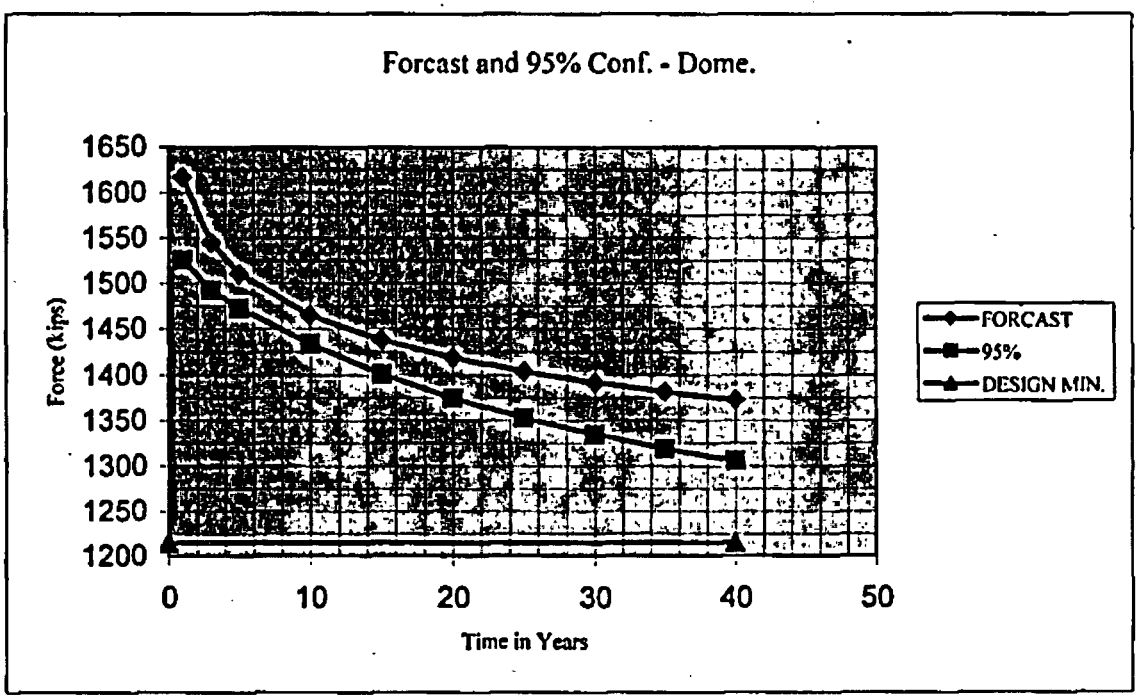
REGRESSION CURVE

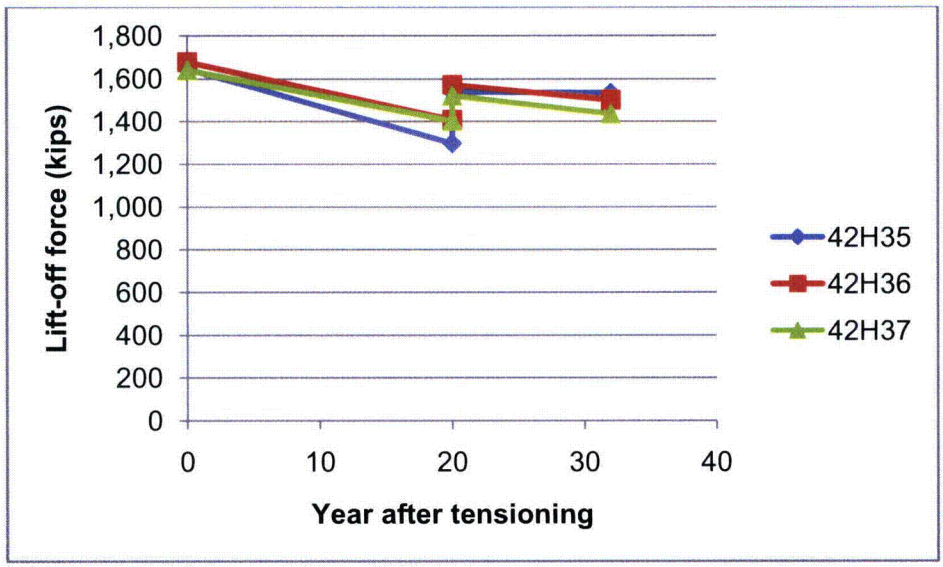


YEARS	FORCAST (kips)	95% CONFIDENCE.
1	1617	1526
3	1545	1493
5	1511	1473
10	1465	1434
15	1438	1401
20	1419	1375
25	1404	1353
30	1392	1335
35	1382	1319
40	1373	1306

Loss of tendon force 42

Lift-off forces on hoop tendons, here is a chart for tendons 42H35, 42H36, and 42H37.

All three are Hoop tendons (Horizontal tendons) and run between buttresses 4 and 2. They are at approximate elevation 210' (42H35), 213' (42H36), and 216' (42H37) (hoop tendons are labeled from 1 to 47 from bottom to top).



Tendon 42H35 lift-off value at 20 years was not acceptable and the tendon was re-tensioned.

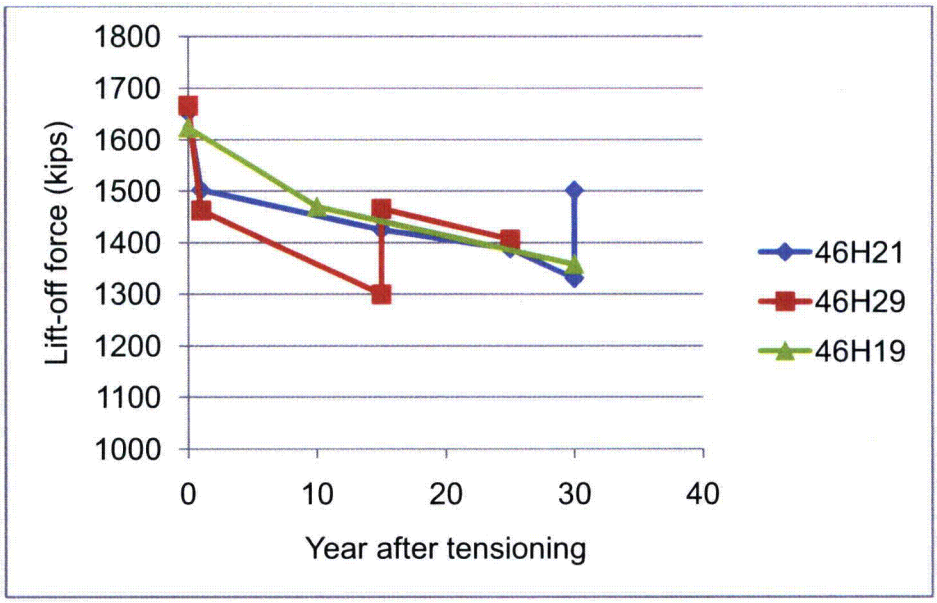
Tendon 42H36 lift-off value at 20 years was not acceptable and the tendon was re-tensioned.

Tendon 42H37 lift-off value at 20 years was not acceptable and the tendon was re-tensioned.

Loss of tendon force

As a follow-up to the data sent earlier on the lift-off forces on hoop tendons, here is a chart for tendons 46H19, 46H21, and 46H29.

All three are Hoop tendons (Horizontal tendons) (hence the name xxHxx) and run between buttresses 4 and 6 (hence the name 46xxx). They are at approximate elevation 156' (46H19), 163' (46H21), and 189' (46H29) (hoop tendons are labeled from 1 to 47 from bottom to top).



Tendon 46H29 lift-off value at 15 years was not acceptable and the tendon was re-tensioned.

Tendon 46H21 lift-off value at 30 years was not acceptable and the tendon was re-tensioned.

Tendon 46H19 lift-off values were always acceptable.

Loads and stresses from Hoop tendons

A. Tendon force at 1,635 kips

The loads and stresses generated by the hoop tendon forces are calculated based on the following:

- Hoop Tendon Force — F_{tendon} = 1,635,000 lbf
- Hoop Tendon Centerline Radius — r = 812.375 in
- Wall Inside Radius — r_i = 780 in
- Wall Outside Radius — r_o = 822 in
- Height of Containment Cylinder — h = 157 ft = 1,884 in
- Number of Hoop Tendons Though Wall Section — n_H = 94 tendons

A.1 Average hoop stress

The simplest way to determine the average hoop stress in the concrete containment is to divide the average force from hoop tendons by the area of concrete the force is applied to.

The average vertical distance between hoop tendons is (13" + 26") / 2 = 19.5".

The width of the concrete wall is 42".

$$\sigma_h = \frac{F_{tendon}}{42 * 19.5} = 1{,}996\, psi$$

A.2 Radial force per unit height

There are two approaches to calculate the radial force per unit height

A.2.1 Using the containment height and number of tendons

The radial force per unit height is equal to

$$F_h = \frac{F_{tendon}}{H} * \#_{tendon} = 978\ \frac{\text{kips}}{\text{ft}}$$

A.2.2 Using the number of tendons per unit height in that part of the containment wall

On one bay, the "close" tendons are separated by 12.75 in and the "far" tendons are separated by 25.5 in. This is equivalent to 2 tendons per 38.25 in, or 94 tendons per 1,797.75 in, or 94 tendons per 149.8 ft. The difference with 157 ft (and case A.1.1) is that there are fewer tendons at the bottom of the wall.

For our purpose, it is therefore better to calculate the radial force per unit height as

$$F_h = \frac{F_{tendon}}{38.25\ in} * 2\ tendons * 12\ \frac{\text{in}}{\text{ft}} = 1{,}025\ \frac{\text{kips}}{\text{ft}}$$

A.3 Radial force per unit circumferential length

The radial force per unit circumferential length is equal to

$$F_r = \frac{F_{tendon}}{r} = 2{,}012\ \frac{\text{lbf}}{\text{in}}$$

A.4 Average radial pressure

A.4.1 Using full height and number of tendons

The average radial pressure due to the hoop tendon forces is

$$P_r = \frac{F_r}{\frac{h}{n_H}} = \frac{2012}{\frac{1884}{94}} = 100.4\ \text{psi}$$

A.4.2 Using the number of tendons per unit height in that part of the containment wall

Alternately, the average radial pressure can be calculated using

$$P_r = \frac{F_h}{12 * 780\ in} = 109.5\ \text{psi}$$

A.5 Average hoop stress

This is a check on the calculation done in A.1 above.

A.5.1 Using full height and number of tendons

The average hoop stress is then

$$\sigma = \frac{P_r \frac{r_i + r_o}{2}}{r_o - r_i} = \frac{100.4 \frac{780 + 822}{2}}{822 - 780} = 1{,}915\ \text{psi}$$

A.5.2 Using the number of tendons per unit height in that part of the containment wall

The average hoop stress is then

$$\sigma = \frac{P_r \frac{r_i + r_o}{2}}{r_o - r_i} = \frac{109.5 \frac{780 + 822}{2}}{822 - 780} = 2{,}089\ \text{psi}$$

B. <u>End of life tendon force of 1,325 kips</u>

When using the end-of-life tendon force of 1,325 kips, we get the following results

B.1 Radial force per unit height

B.1.1 Using the containment height and number of tendons

The radial force per unit height is equal to

$$F_h = \frac{F_{tendon}}{H} * \#_{tendon} = 793\ \frac{\text{kips}}{\text{ft}}$$

B.1.2 Using the number of tendons per unit height in that part of the containment wall

$$F_h = \frac{F_{tendon}}{38.25\ in} * 2\ tendons * 12\ \frac{\text{in}}{\text{ft}} = 831\ \frac{\text{kips}}{\text{ft}}$$

Note the FSAR specified prestress level of 829 kips / ft.

B.2 Radial force per unit circumferential length

The radial force per unit circumferential length is equal to

$$F_r = \frac{F_{tendon}}{r} = 1{,}632\ \frac{\text{lbf}}{\text{in}}$$

B.3 Average radial pressure

B.3.1 Using full height and number of tendons

The average radial pressure due to the hoop tendon forces is

$$P_r = \frac{F_r}{\frac{h}{n_H}} = \frac{1632}{\frac{1884}{94}} = 81.4\ \text{psi}$$

B.3.2 Using the number of tendons per unit height in that part of the containment wall

Alternately, the average radial pressure can be calculated using

$$P_r = \frac{F_h}{12 * 780\ in} = 88.8\ \text{psi}$$

The accident pressure is 55 psi.

The ratio of P_r over 55 psi is $\frac{88.8}{55} = 1.61$.

B.4 Average hoop stress

B.4.1 Using full height and number of tendons

The average hoop stress is

$$\sigma = \frac{P_r \frac{r_i + r_o}{2}}{r_o - r_i} = \frac{81.4 \frac{780 + 822}{2}}{822 - 780} = 1{,}552 \text{ psi}$$

B.4.2 Using the number of tendons per unit height in that part of the containment wall

The average hoop stress is

$$\sigma = \frac{P_r \frac{r_i + r_o}{2}}{r_o - r_i} = \frac{88.8 \frac{780 + 822}{2}}{822 - 780} = 1{,}694 \text{ psi}$$

C. Conclusion

With the accident pressure at 55 psi, the ratio of P_r over 55 psi is approximately 1.61. This is a large value when compared to other Nuclear Power Plants that are using post-tensioned concrete containments.

Progress Energy

NUCLEAR OPERATIONS ENGINEERING
CRYSTAL RIVER UNIT 3

DESIGN BASIS DOCUMENT
FOR THE

CONTAINMENT

SYSTEM CODE: N/A
TAB: 1/1

ISSUE DATE: 11/8/85

	Revision 3	Revision 4	Revision 5	Revision 6	
Date	03-09-01	09-18-01	04-26-07	09-24-08	
Design Engineer	R. P. Schmiedel	R. P. Schmiedel	P. Winters	Emin Ertatto	
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REVISION LOG

Revision/Date	Description
0 / 11-8-85	Initial Issue
1 / 07-25-94	Complete re-issue and incorporation of Temporary Change #296 as shown by revision bars.
2 / 11-18-99	Incorporated Temporary change #539 and #954. Text from T.C. # 539 was not incorporated due to being superseded by T.C. # 954.
3 / 01-02-00	Incorporated Temporary change #1180 as shown by revision bars.
4 / 09-18-01	Incorporated Temporary change #1115 as shown by revision bars.
5 / 04-26-07	Incorporated Engineering Change 66751R0 as indicated by the change bars on pages 14 and 25.
6 / 09-29-08	Incorporated Engineering Change 71342 as indicated by the change bars on page 12.

DESIGN BASES INDEX
FOR
CONTAINMENT

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DEFINITION

The Containment Structure is classified as a Class I structure because:

1. Its failure might cause or increase the severity of a loss-of-coolant accident (LOCA).
2. Its failure might result in an uncontrolled release of radioactivity.
3. It is vital to safe shutdown and isolation of the reactor.

In addition, the Containment Structure provides shielding from the fission products which could be airborne in the building under accident conditions.

The containment is composed of those elements listed in the Table of Contents for this Design Basis Document.

The Reactor Building is a concrete structure with a cylindrical wall, a flat foundation mat, and a shallow dome roof. The foundation slab is reinforced with conventional mild-steel reinforcing. The cylindrical wall is prestressed with a post-tensioning system in the vertical and horizontal (hoop) directions. The dome roof is prestressed utilizing a three-way post-tensioning system. The inside surface of the reactor building is lined with a carbon steel liner to ensure a high degree of leak tightness during operating and accident conditions. Nominal liner plate thickness is 3/8 inch for the cylinder and dome and 1/4 inch for the base.

The foundation mat is bearing on competent bearing material and is 12-1/2 feet thick with a 2 feet thick concrete slab above the bottom liner plate. The cylindrical portion has an inside diameter of 130 feet, wall thickness of 3 feet 6 inches, and a height of 157 feet from the top of the foundation mat to the spring line. The shallow dome roof has a large radius of 110 feet, a transition radius of 20 feet 6 inches, and a thickness of 3 feet.

MATERIALS

Materials are generally chosen on the basis of their ability to satisfy the following criteria:

a. Load carrying capacity.
b. Resistance to deterioration or corrosion.
c. Economy.
d. Availability.
e. Tolerance of radioactivity.
f. Sufficient stiffness to remain within allowable limits of deflection.
g. Aesthetics.

In specific circumstances a variety of other factors could require consideration.

PARAMETER	SOURCE	REASON
Concrete	The following G/C, Inc. specifications define the requirements for the properties of the structural and fill concrete and, as such, are relevant to all data entries under "Concrete." 1. SP-5569 2. SP-5618 These specifications are listed for reference only.	The following generally recognized codes and standards are relevant to and the basis for selection of the properties of concrete cited in this section: 1. ACI 318-63, "Building Code Requirements for Reinforced Concrete." 2. ACI 301-66, "Specification for Structural Concrete." 3. ACI Manual of Concrete Practice - Recommended Practices.
Strength Structural concrete for the base mat, containment vessel shell, and equipment access shield structure f'_c = 5000 psi		Concrete is an economical, easily obtainable material capable of satisfying design requirements. A strength level of 5000 psi is required to withstand the large forces associated with reinforced concrete prestressed concrete containment structures.
Structural concrete for application other than the Containment shell – f^1_c= 3000 psi	See Page 2, "Concrete," for the Source of the requirements cited on this page.	A strength level of 3000 psi is the most commonly specified value for conventionally reinforced concrete structures.
Fill concrete for use in the foundation subgrade f'_c = 1500 psi		Fill concrete is unreinforced and is required to serve only as a bearing medium equivalent to bedrock.

PARAMETER	SOURCE	REASON
Unit Weight - 150 pcf		Typical density of concrete. It is an average value used for design purposes and includes a reasonable allowance for the weight of reinforcing steel. It does not necessarily reflect the actual density of the concrete produced for the project. The resulting error is small and, if anything, conservative.
Poisson's Ratio – 0.2		Average value traditionally utilized in the design of shell structures.
Maximum Slump 3" for 5000 psi concrete 4" for all other concrete		Limits on slump are imposed to ensure that the concrete properties assumed by the design are actually realized and that the concrete remains durable and functional for the lifetime of the plant.
Maximum Placing Temperatures 70°F for 5000 psi concrete 90°F for all other concrete		Limitations on temperature are imposed for the same reasons slump limitations are specified.
Portland Cement ASTM C150 Type II	See Page 2, "Concrete," for the Source of the requirements identified for Concrete Aggregates.	ASTM C150 cement is required for conformance to ACI 301. Type II cement is chosen primarily to minimize heat development, and the subsequent volume changes and cracking during hydration of the cement.
Concrete Aggregates ASTM C33 with minor modifications		Conformance to ASTM C33 is required by ACI 301. Refer to the cited G/C, Inc. specifications for the exceptions to the requirements to ASTM C33.
Maximum size: Typically: 1 1/2" Where specified: 3/4"		Greatest economy is achieved using 1 1/2" aggregate; but 3/4" size is occasionally called for by drawings to ensure adequate, void-free placement, especially in areas of rebar congestion.

PARAMETER	SOURCE	REASON
Reinforcing Steel		
Bars		
Original Construction ASTM A615 Grade 40 Repair of Delaminated Dome ASTM A615 Grade 60	The following G/C, Inc. specifications define the requirements for steel reinforcement for structural concrete: 1. SP-5646 2. SP-5648 The specifications are listed for reference only.	Intermediate grade billet steel reinforcement chosen because: a. Conforms to ACI 318, adherence to which is required by 10CFR50.55a. b. Economical, available material capable of satisfying design requirements.
Cadweld Reinforcing Steel Splices For splices of reinforcing bars larger than #11.	G/C, Inc. Struc. Specs. SP-5646 SP-5648 (for reference only).	Regulatory Guide 1.10, "Mechanical (Cadweld) Splices in Reinforcing Bars of Category I Concrete Structures." (formerly Safety Guide 1.10)
Prestressing Material		
Conduit (General) - 10 psig hydrostatic pressure capacity - galvanized steel - capable of supporting 200 pound man - sufficient size to accommodate a 163 wire tendon	The following G/C, Inc. specifications pertain to the following entries for conduit and are listed here for reference only: 1. RO-3040 2. SP-5844	All conduit must be capable of withstanding internal pressures due to injection of corrosion inhibiting grease. All conduit galvanized to prevent corrosion and further assure containment of grease. All conduit must be capable of withstanding unanticipated loads during installation and construction.
Rigid Conduit - Used in vertical and hoop tendons in cylindrical walls. - Round, mechanical welded tubing - ASTM A513-69 - 0.065" minimum wall thickness - 5 1/4" O.D. - 5" I.D.	See "Conduit (General)" for the Source of requirements cited on this page.	Most economical material available to withstand loads due to concrete placement and also due to the internal pressure exerted by the injection of corrosion inhibiting grease.

PARAMETER	SOURCE	REASON
Flexible Conduit - Used around penetrations in wall of containment. - Minimum 22 gauge - 5 1/4" O.D. - 5" I.D.		Flexible conduit specified in order to permit economical and efficient field fabrication and fitting.
Schedule 40 Conduit Used in foundation mat and containment dome. - ASTM A53-70, Type E or S Steel pipe Grade A for mat Grade B for dome	See "Conduit (General)" on Page 5 for the Source of requirements cited on this page.	Structural design material to ensure that dome conduit system is capable of supporting the dome liner under concrete placement loads. This conduit is, therefore, load carrying such that Grade B material (fy = 60 ksi) is specified. In the base mat the schedule 40 conduit (pipe) is the transition material between the trumpet in the base mat and the rigid conduit in the cylindrical wall. This pipe is not required to carry structural load, such that Grade A material (fy = 48 ksi) is considered adequate.
Tendon Wire ASTM A421-65 Type BA	Tendon wire is specified in G/C, Inc. Specification SP-5583 and is listed here for reference only.	Steel conforming to ASTM A421 is the standard material specified throughout the industry for use as a buttonheaded tendon wire. The steel used for this project is the Japanese equivalent of that material.
f_y = 240 ksi		Exceptionally high strength is required in order to develop the required level of prestress.
- Relaxation = 4%	See "Tendon Wire" on Page 6 for the Source of the requirement cited on this page.	Relaxation is a loss of stress when a wire is prestressed and maintained at a constant strain for an extended time. The degree to which this happens varies with the steel and is, therefore, specified by the steel supplier. That value must be known in order to evaluate the effective prestress over the life of the plant.

PARAMETER	SOURCE	REASON
Tendons - 163 wire Area - 9.723 in^2	G/C, Inc. Specification SP-5583 (for reference only).	The tendon comprised of 163 - 7mm wires is approximately equivalent to the 170-0.25 in. wire tendons typically being utilized in the industry at the time of plant design. See page 19 for a summary of prestress forces in each of the three tendon groups.
Anchorage Components Bearing plate - ASTM A533 - Grade B - Class 2	Prescon Shop Drawings.	Utilized on the basis of recommendations from Prescon Corp., the supplier of the prestressing system.
Shims - Modified Armco VNT or like material Stressing End Washer - Alloy steel forging	PEERE # 0987	
Tendon Grease Shop application: Visconorust 3001A Field application: Visconorust 2090P Visconorust 2090P-2	G/C, Inc. Specification SP-5583 (for reference only).	Visconorust 3001A was the state-of-the-art tendon grease for the prevention of corrosion of prestressing wires. The 3001A material was used as a shop-applied coating. The 2090P and 2090P-2 were used to field coat the inside of the conduit as well as to serve as a bulk filler after tendon installation. Other Visconorust formulations compatible with those noted are used during outages when tendon surveillance is carried out.
Foundation Bearing Material	The basic source for all criteria relating to foundation design parameters is: Woodward-Clyde & Assoc., "Summary of Foundation Investigation Evaluation and Construction for Crystal River Unit 3."	

PARAMETER	SOURCE	REASON
Primarily 1500 psi fill concrete placed over competent existing limerock. A 1.5' to 3' layer of crushed limerock was used sparingly to permit dewatering during placement of fill concrete.	1. Letter FPC-438, dated 12/2/68 from D. A. Skilton (G/C) to R. B. McKnight (FPC), "Comparative Analysis of 12'-6" & 22'-0" Thick Reactor Building Mats and Foundation Treatment." 2. Letter dated 12/12/68 from R. B. McKnight to D. A. Skilton, "Reactor Building Foundation."	Fill concrete strength and deformation properties equal or exceeding those of the existing sound bedrock.
Coefficient of Subgrade Reaction/Modulus of Deformation Variable – See Reason	G/C, Inc. Struc. Calc. FC 1.01.3/1118.	Parameters required for dynamic analysis of the foundation mat. Values vary with contact area between underside of foundation mat and the subgrade.
Poisson's Ratio - 0.33	1. G/C, Inc. Struc. Calc. FC 1.01.1/0B. 2. Woodward-Clyde Report, Section 4.2.0, Table II.	Foundation parameter required for finite element analysis.
Bearing Capacity - 8 ksf	Woodward-Clyde Report, Section 4.2.0, page 29.	Applicable to static loading conditions.
Density of Rock - 129.8 pc	G/C, Inc. Struc. Calc. FC 1.01.1/OD.	Parameter required for finite element analysis of foundation mat.

DESIGN CONDITIONS

Loads - This listing includes all loads applied to any portion of the containment shell including the protective retaining wall and the base mat. Not all of these loads, however, are applied to any particular portion of it. For instance, wind and tornado loads are not experienced directly by the base mat nor hydrostatic pressure by the dome. The effects of forces not applied directly are, however, felt as boundary condition moments and forces applied at the jointure of adjacent elements. Indirectly applied loads, therefore, are included in appropriate load combinations.

General Design Criterion No. 2, Federal Register dated 7/11/67, Part 50, Appendix A, "Performance Standards," requires consideration of forces resulting from natural phenomena such as earthquakes, tornadoes, flooding, wind, hurricane and other local site affects. These forces are considered in this section.

The loads listed represent input to design calculations. They do not necessarily represent working level or ultimate capacities.

PARAMETER	SOURCE	REASON
Dead Load (D) Reinforced concrete - 150 pcf	FSAR Section 5.2.1.2.2 and Figure 5.2. (for reference only).	The weight of the completed structure and of the facilities supported by it.
Weight of equipment and interior structures - 35446 kips, not including refueling water - 38566 kips, including refueling water	G/C, Inc. Struc. Calcs. FC 1.01.3/1101 through FC 1.01.3/1109. Major equipment data source: B&W Dwg. 112798E/4	Weights shown do not include the weight of the base mat nor the 2'-0" thick base mat floor slab. Weights of interior structures determined using dimension from preliminary layout drawings.
Weight of shell - 58631 kips	G/C, Inc. Struc. Calc. FC 1.01.3/1114.	Weight of shell based on available data on preliminary layout drawings.
Weight of base mat - 35600 kips	G/C, Inc. Struc. Calc. FC 1.01.3/1116.	Weight of 147'-0" diameter, 12'-6" thick mat.
Live Load (L) Base mat floor, 200 psf	G/C, Inc. Struc. Calc. FC 1.01.3/1106.	Allows for existence of miscellaneous, undefined equipment on mat (inside the Reactor Building).
Hydrostatic Load (G)		
Normal groundwater level, El. 90'-0"	1. G/C, Inc. Struc. Calcs. FC 1.01.1/OC and FC 1.01.2/1. 2. FSAR Section 2.5.3.5 (for reference only).	Water pressure acting on the protective retaining wall which is attached to the perimeter of the foundation mat and on the underside of the mat.

PARAMETER	SOURCE	REASON
Maximum groundwater level, El. 118'-6"	1. G/C, Inc. Struc. Calc. FC 1.01.2/1. 2. FSAR Section 2.4.2.2 (for reference only).	This is also plant grade. The protective retaining wall (top at El. 119'-0") is, therefore, designed for near full hydrostatic head.
Lateral Soil Pressure (H) Equivalent fluid pressure, 40 pcf	1. Woodward-Clyde and Assoc. Report, Page 31. 2. G/C, Inc. Struc. Calc. FC 1.01.2/2. 3. Letter FPC-190, dated 4/1/68, R. L. Gerhart (G/C) to R. B. McKnight (FPC), "Reactor Building Retaining Wall."	Active earth pressure acting on protective retaining wall.
Surcharge load - 376 psf	Same sources as for equivalent fluid pressure.	Uniform load due to 10'-0" height of backfill adjacent to protective retaining wall. Backfill assumed to weigh 112.8 pcf.
Internal Pressure (P)		
Hydrogen Detonation Original: 14.7 psia Initial, H_2 added: 17.48 psia Von-Neuman Shock: 366 psia Impulse: 1635 psia C-J plane: 191 psia Equilibrium: 96.6 psia	GAI Memorandum from R. A. Putman to R. E. Vaughn, Subject - CR3 Hydrogen Detonation, Final Report, June 11, 1982. G/C, Inc. Struc. Calcs. for W.O. 04-4762-124.	Hydrogen detonation evaluation was performed in 1982 in order to check the ability of the Reactor Building to perform its containment function for a hydrogen detonation loading. Such loads were not considered in the original design of the plant.
Accidental Spray Actuation - 2.5 psig (Suction on interior of containment).	FSAR Section 5.2.1.2.7 (for reference only). Undocumented input from Babcock and Wilcox.	The 2.5 psig pressure drop is associated with the sudden cooling effect in the interior of the airtight containment following accidental actuation of the Reactor Building Spray System.
Additionally –6.0 psig (Suction on interior of containment).	Calculation S-00-0006	Total suction pressure including operating pressure range and BS cooling effects.

PARAMETER	SOURCE	REASON
Tornado Differential Pressure - 3 psi	FSAR Section 5.2.1.2.6 (for reference only).	A suction experienced by the outside of the Containment Structure corresponding to the drop in atmospheric pressure characteristic of the center vortex of a tornado. The pressure occurs because the Containment Structure is airtight and there is no opportunity for contained air to escape and reach equilibrium with the outside.
Test Pressure - 63.3 psig	FSAR Sections 5.2.1.2.1 and 5.6.1 (for reference only).	USAES Safety Guide 18, "Structural Acceptance Test for Concrete Primary Reactor Containments" requires testing at 1.15 times accident pressure. Confirmation of containment integrity to assure structural response of principal strength elements was consistent with design. Test pressure imposed loads similar to those which would be experienced in the event of a LOCA or SSE.

PARAMETER	SOURCE	REASON
Accident - 55 psig	1. B&W Internal Memoranda, I. T. Putney to H. E. Flora, a. Metropolitan Edison Company, Reactor Building Dome and Wall, Temperature Profile Following a 36 inch I.D. Pipe Double Ended Rupture, 4/13/67. b. Reactor Building Analysis - Effect of Core Flooding Tanks on Reactor Building Pressure, 7/20/67. 2. B&W Internal Memoranda a. I. T. Putney to R. E. Wascher, "Reactor Building Analysis - Effect of Emergency Core Cooling on Post Accident Pressure," 2/13/68. b. C. E. Barksdale to B.B. Cardwell, Florida Power Corp. - "Reactor Building Pressure Test," 4/19/69. c. G. F. Glei to Distribution, Florida Power Corp. - "Final Safety Analysis Report," 2/26/70. 3. Letter from C. E. Barksdale of B&W to E. R. Hottenstein of GAI, "CR-3 Reactor Building Analysis," 4/22/70. (GAI-409). 4. Letter from L. Sack of GAI to F. Norman of B&W, "CR-3 FSAR," 5/5/70. (B&W-343).	Pressure inside containment resulting from a worst-case LOCA analysis by B&W.
Wind Load (W)		
Basic wind velocity - 110 mph at 30' above grade	1. G/C, Inc. Struc. Calc. FC 1.01.3/162. 2. FSAR Section 5.2.1.2 (for reference only).	ASCE Paper No. 3269, "Wind Forces on Structures," Vol. 126, 1961, Figure 1(b) for: a. 30' above grade b. Crystal River site
Wind velocity at 166'-10" above grade (top of containment building) - 179 mph	G/C, Inc. Struc. Calc. FC 1.01.3/162.	ASCE Paper No. 3269, page 1139.

PARAMETER	SOURCE	REASON
Wind pressure - 0.568 psi applied uniformly over the entire height of the structure	G/C, Inc. Struc. Calc. FC 1.01.3/162.	ASCE Paper No. 3269, page 1164, Table 4(f). (q = 0.002558 V2).

Note: Design wind pressure exceeds the requirements of:
1. Southern Standard Building Code, 1965 Edition, Section 1205.
2. ANSI A58.1 – 1955, "Building Code Requirements for Minimum Design Loads in Buildings and Other Structures."

Tornado Wind Load (Ww) Tangential velocity - 300 mph Equivalent wind pressure - 230.22 psf	FSAR Section 5.2.1.2.6 (for reference only). G/C, Inc. Struc. Calc. FC 1.01.3/160.	ASCE Paper No. 3269, Page 1129.

Tornado Missile Load (Wm)

NOTE: Consideration of the tornado missile load did not include the postulation of such loads in design load combinations. Rather, capability to withstand the local effects of such impact was considered to have been demonstrated by comparison with the analysis carried out for Three Mile Island for aircraft impact. The containments for the two plants were almost identical, and the aircraft impingement load was found by inspection to be significantly more severe than that associated with the postulated tornado missiles.

The missiles considered were:	FSAR Section 5.2.1.2.6 pertains to the entire entry on tornado missiles (for reference only).	Origin of tornado missile postulation is not known. However, the spectrum of tornado missiles for Crystal River Unit 3 are similar to that currently specified in:
Utility pole length - 35'-0" diameter - 14" density- 50 pcf velocity - 150 mph max. static load - 148 kips	Three Mile Island FSAR, Sec. 5.2.1.2.6.	a. Standard Review Plan 3.5.3, "Barrier Design Procedures." b. Standard Review Plan 3.5.1.4, "Missiles Generated by Natural Phenomena."
Automobile weight - 1 ton velocity - 150 mph		
Seismic Operating Basis Earthquake (OBE) - 0.05 g, maximum horizontal ground motion acceleration - 0.033 g, maximum vertical ground motion acceleration.	1. Final Report by Weston-Geophysical Research, Inc., "Seismicity Analysis and Response Spectra for the Proposed Crystal River Nuclear Power Plant," June 27, 1967.	1. Acceleration for OBE is twice the ground acceleration which would have been felt at the plant site as a result of the Charleston, South Carolina earthquake of August 31, 1886.

PARAMETER	SOURCE	REASON
Safe Shutdown Earthquake (SSE) - 0.10 g, maximum horizontal ground motion acceleration. - 0.067 g, maximum vertical ground motion acceleration.	2. FSAR Section 2.5.4.1 (for reference only). 3. G/C, Inc. Struc. Calcs. FC 1.01.3/1000 through FC 1.01.3/1100.	2. Relationship between earthquake intensity and ground acceleration as given in "Nuclear Reactors and Earthquake," TID-7024, USAEC.
Seismic Criteria a. SSE = 2 x OBE b. Vertical accel. - 2/3 of horizontal accel.		3. 0.10g is the minimum acceptable SSE ground motion acceleration according to current criteria.
Thermal (T) Temperatures during normal operation and as the result of a LOCA are shown on the following table.	1. FSAR for Three Mile Island Unit 1, Section 5.2.1.2.9 and Section 5.2.1.1.10. 2. FSAR Section 5.2.1.2.8 (for reference only). 3. See page 14 of 55 under Accident Pressure.	The operating and accident temperature profiles through the containment wall which were derived and utilized for Three Mile Island Unit 1 were utilized for Crystal River Unit 3 because of the similarity in containments and in NSSS systems and because use of temperature profiles for an area with more severe winter temperatures would be conservative.
Temperatures resulting from hydrogen detonation are shown on the following table.	GAI Memorandum from R.A. Putnam to R. E. Vaughn, Subject - CR3 Hydrogen Detonation, Final Report, June 11, 1982.	This analysis was not performed for the original design of the containment.

DESIGN TEMPERATURES

	INSIDE	OUTSIDE
Winter Normal Operation - Buttress - Wall	102°F 99°F	30°F 37°F
Winter Start-up - Buttress - Wall	102°F 99°F	26°F 28°F
Winter Shutdown - Buttress - Wall	102°F 99°F	32°F 37°F
Winter Accident - Buttress - Wall	158°F 158°F	32°F 37°F
Hydrogen Detonation - Shell	2965°F	

Prestress Force

See next page

PRESTRESS FORCE							
	VERTICAL	HOOP	DOME		SOURCE		
					Vert	Hoop	Dome
Pattern	144 tendons	94 hoops 3 tendons per hoop	3 sets of 35 tendons	2 sets of 6 tendons	3	8	6, 10
Radius	807.375'	812.375'	720.375'	720.375'	3	7	6
Spacing	35.23"	13"	30"	30"	3	5	4
Prestress Level Specified	457 K/ft	829 K/ft**	820 K/ft	--	1	1	1
Immediate (80% GUTS)*	1868 K/ tendon	1868 K/ tendon	1868 K/ tendon	--	9	9	9
Lockoff	1635 K/ tendon	1635 K/ tendon	1635 K/ tendon	646 K/ tendon	9	9	9, 10
Min. Req'd at 40 years	1149 K/ tendon	1252 K/ tendon	1215 K/ tendon	--	2	2	2, 10

** 415K/ft for lower 10 feet of wall
* GUTS = Guaranteed Ultimate Tensile Strength = 2335K/tendon
(A = 9.723 in2, fu = 240 ksi)

Sources:
1. SP-5583
2. Memo: J.F. Fulton to J.C. Herr, "CR3 Tendon Surveillance - FSAR Technical Specification 4.6.1.6 - Required Minimum Average Tendon Force for the Repaired Dome", 2/15/80, plus attached calculations for W.O. 04-4762-099.
3. G/C, Inc. Structural Calculation FC 1.01.7/2
4. G/C, Inc. Structural Calculation FC 1.01.7/50
5. Prescon Shop Drawings
6. G/C, Inc. Structural Calculation FC 1.01.17/0
7. G/C, Inc. Structural Calculation FC 1.01.8/30
8. G/C, Inc. Structural Calculation FC 1.01.8/4
9. ACI 318-63, Sec. 2606.
10. G/C, Inc. Report, "Reactor Building Dome Delamination, Final Report," December 10, 1976.

Reason:
The prestress forces provided in the vertical, dome, and hoop directions are sufficient to eliminate tensile stresses in the shell due to membrane forces resulting from design loads. Prestress losses due to such factors as shrinkage, concrete creep, steel relaxation, elastic shortening of the concrete, and friction were considered in the determination of prestress levels.

PARAMETER	SOURCE	REASON
Analysis		
1. Static a. Analysis of the overall structure insofar as it can be considered a thin, elastic shell of revolution. - Kalnins Program for the exact numerical solution of the general bending theory of shells.	1. FSAR Section 5.2.4.1.1 (for reference only). 2. Journal of Applied Mechanics, Vol.31, 1964, pages 467 to 476.	Permits realistic analysis of containment when exposed to large variety of loading conditions, all relatively quickly and at reasonable cost.
b. Analysis of discontinuities at large openings. - Finite element computer analysis using FELAP, a program of Franklin Institute Research Labs.	1. FSAR for Three Mile Island, Unit 1, Appendix 5C, Docket No.50-289. 2. FSAR Section 5.2.4.1.1 (for reference only).	Localized effects of large openings in the shell require independent analysis. An exact solution as for a shell of revolution is not possible.
c. Thermal loading of the shell in localized areas. - A.K. Maghdi and E.C. Eringen, "Stress Distribution in a Cylindrical Shell with a Circular Cut Out," Ingeniev - Archiv, August, 1964. - G.N. Savin, "Stress Concentration Around Holes"	1. FSAR Section 5.2.4.1.1 (for reference only). 2. FSAR for Three Mile Island, Unit 1, Section 5.2.4.1.1.	This analysis was applicable only to localized applications of significant temperature variations. Thermal loads on the structure as a whole were considered with the Kalnins analysis.
d. Hydrogen Detonation - A preliminary analysis to determine if pressure capacity was at least twice the applied load.	G/C, Inc. Struc. Calcs. FC 4762-124-1/3 through FC 4762-124-1/6.	A simplified static analysis is excessively conservative but can be done relatively quickly. If such an analysis could have demonstrated sufficient capacity, no further analysis would have been needed. The "twice the load" criteria allows for the affect of dynamic load application. Dynamic analysis found to be necessary. See following material.

PARAMETER	SOURCE	REASON
2. Dynamic (seismic) a. Superposition of normal modes of free vibration, as determined by Kalnin's program in order to determine response of shell to an earthquake. Damping factor for shell = 2% of critical damping. Responses due to vertical and horizontal input combined by absolute sums.	1. FSAR Sections 5.4.5.1 and 5.2.4.1.2 (for reference only). 2. A. Kalnins, "On Free and Forced Vibration of Rotationally Symmetric Layered Shells," Journal of Applied Mechanics," December 1965.	Provides exact prediction of complete spectrum of natural frequencies of the shell.
b. Elasto plastic analysis of hydrogen detonation loads to determine capability of structure to withstand imposed loads.	G/C, Inc. Struc. Calcs. FC 4762-124-1/6 through FC 4762-124-1/55.	Assumptions 1. Tendon capacity = 90% of ultimate strength, 216 ksi. 2. Consider contribution of liner and reinforcement. 3. 1/2 of tendon losses occur by plant startup. 4. Concrete cracks at tensile stress of $3\sqrt{f'_c}$
	GAI Memorandum from T. D. Biss to G. Sayer, Subject - CR3 High Point Vent System - Hydrogen Detonation Evaluation, and attached final report on "Structural Evaluation of Hydrogen Detonation," 7/19/82.	Conclusion Building capable of withstanding detonation conditions without compromising the liner capacity.
<u>Design of Mild Steel Reinforcement</u>		
1. Allowable concrete stress a. Membrane tension - 212 psi for factored loads when temperature effects excluded; 424 psi when temperature effects included.	FSAR Section 5.2.3.3.1 (for reference only) ACI 318-63, Section 2605, "Building Code Requirements for Reinforced Concrete". ACI 505-54, "Specification for the Design and Construction of Reinforced Concrete Chimneys."	Allowable stresses need to be defined in order to apply Working Stress Design methods.
b. Membrane tension not allowed for unfactored loads.	FSAR Sec. 5.2.3.3.1 (for reference only).	Tension at unfactored load levels could result in undesirable cracking. Such tension limited by application of sufficient prestress.

PARAMETER	SOURCE	REASON
c. Shear - If membrane stress is tensile or low level compressive (less than 100 psi) design for shear provisions of ACI 318-63, Ch. 17.	1. G/C, Inc. Struc. Calcs. FC 1.01.4/52 through FC 1.01.4/65. 2. FSAR Sec. 5.2.3.3.1 (for reference only).	ACI 318-63, Section 1701, provides a specific formula defining allowable shear in members subject to axial tension.
If membrane compression exceeds 100 psi, design for shear provisions of ACI 318-63, Chapter 26 for pre-stressed concrete.	FSAR Sec. 5.2.3.3.1 (for reference only).	ACI 318-63, Section 2610, defines allowable shear stress in concrete under axial compression.
2. Capacity reduction factor (Ø) for tensile membrane stresses - 0.95. Other Ø factors in accordance with ACI 318-63.	ACI 318-63, Section 1504.	Use of capacity reduction factors introduces necessary conservatism by preventing consideration of 100% of member capacity to carry loads.
3. Provide mild steel reinforcement to: a. Carry localized moments and shears at openings, discontinuities, and changes of section.	1. FSAR Section 5.2.5.2.1 (for reference only). 2. G/C, Inc. Struc. Calc. FC 1.01.4/40-106.	The prestress loads are membrane forces and are considered to neutralize tensile membrane forces due to design loads. Where localized shears and moments exist, conventional reinforcement must be provided.
	G/C, Inc. Struc. Calc. FC 1.01.4/14A.	Much of the conventional reinforcement was specified on the basis of the design for Three Mile Island, Unit 1, which was known to be subject to more severe loads (aircraft impact, steeper thermal gradients). This action was taken in order to meet FPC schedule requirements.
b. Reinforce for effects of temperature variations and shrinkage of concrete: Provide area of reinforcement equal to 0.15% of the gross cross sectional area of the concrete on the exposed face.	G/C, Inc. Struc. Calcs. FC 1.01.4/68 and FC 1.01.3/75.	Required to control cracking.
c. Limit tensile stresses	FSAR Section 5.2.3.3.1 (for reference only).	Control cracking

PARAMETER	SOURCE	REASON
d. Limit compressive strain when concrete stress exceeds 0.45 f'_c under temporary conditions.	ACI 318-63, Section 2605.	Prevent short term overstress of the concrete.
e. Provide the tensile load carrying capacity at openings which would have been provided by the concrete had there been no openings.	G/C, Inc. Struc. Calc. FC 1.01.4/18.	This occurs only under application of 1.5 times accident pressure. Without the extra reinforcement, sufficient capacity would not be provided.
f. Provide reinforcement to carry polar crane loads.	G/C, Inc. Struc. Calc. FC 1.01.4/30.	Crane girder loads are not considered in the analysis of the shell. Reinforcement required must be added to the design.
4. Assume cracked sections in design of steel reinforcement.	FSAR Sec. 5.2.3.3.1 (for reference only).	Concrete must be considered to have no tensile capacity.
5. Load capacity – upper limit of elastic behavior: a. Steel – guaranteed minimum yield strength. b. Concrete - per ACI 318-63. c. Limited by need to maintain liner strains to less than 0.005"/inch.	FSAR Section 5.2.5.2.1 (for reference only).	Such limitations are necessary to assure structural integrity and strain compatibility.
ACCEPTANCE CRITERIA		
Load Combinations For Containment Shell $C = 0.95D \pm W$ $C = 0.95D \pm E$ $C = 0.95D + F_i$	1. ACI 318-63, Part IV-B, "Structural Analysis and Proportioning of Members - Ultimate Strength Design".	Loads which could be experienced during construction.

PARAMETER	SOURCE	REASON
$C = 0.95D + F_o$ $C = 0.95D + F_o + T_o$ $C = 0.95D + F_o - P_s + T_o$ $C = 0.95D + F_o \pm W$ $C = 0.95D + F_o \pm E$ $C = 0.95D + F_o \pm W + T_o$ $C = 0.95D + F_o \pm E + T_o$ $C = 0.95D + F_o - P_s \pm W + T_o$ $C = 0.95D + F_o - P_s \pm E + T_o$ $C = 0.95D + F_o \pm W_w + W_p + T_o$ $C = 0.95D + F_o \pm W_w + T_o$	2. FSAR Table 5.3 (for reference only). 3. Three Mile Island FSAR, Table 5.2, Docket No. 50-289.	Loads which could be experienced during normal operating conditions.
$C = 0.95D + F_a + 1.15P$ * $C = 0.95D + F_a + 1.5P + T_a$ * $C = 0.95D + F_a \pm 1.25W + 1.25P + T_a$ * $C = 0.95D + F_a \pm 1.25E + 1.25P + T_a$ * $C = 0.95D + F_a \pm E' + P + T_a$ * $C = 0.95D + F_a \pm 2W + P + T_a$	G/C, Inc. Structural Calcs. FC 1.01.3 and FC 1.01.4.	Loads which could be experienced during accident conditions.

* Controlling Load Combinations

PARAMETER	SOURCE	REASON
Where: C = Required load capacity of section. D = Dead load of structure. P = Design accident pressure load. P_s = Pressure due to accidental spray actuation. W_p = Internal pressure due to tornado (vacuum). W = Wind load based on design wind. W_w = Wind load based on tornado. E = Seismic load based on 0.05g ground motion. E' = Seismic load based on 0.10g ground motion. F_i = Initial prestress. F_o = Prestress during operation. F_a = Prestress during accident. T_o = Operating temperature. T_a = Accident temperature.	(See page 22, Load Combination for Containment Shell.)	The loads listed, which are reflected in the preceding load combinations, were considered in the design of the shell as contributors to the membrane loads. Application of the other loads listed in the Design Condition Section of this Design Basis Document resulted in formation of flexural and shear stresses which were considered independently as discontinuity loads rather than as part of a load combination. The required reinforcement was added to the design as necessary. Therefore, the effects of discontinuity loads were additive to the affects of the most severe membrane forces in a given location.

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment - General		
GEOMETRY		
Radius, 73'- 6 3/8" Thickness, 12'- 6" Bearing Elev., 80'- 6"	1. G/C, Inc. Struc. Calcs. to evaluate 12'-6" and 22'-0" thick base mats: FC 1.01.1/0A through FC 1.01.1/OH and FC 1.01.1/1 through FC 1.01.1/124. 2. G/C, Inc. Concrete Outline Drawings (for reference only). 3. Report by H. Yang on "Comparison of Results Between Kalnin's and Finite Element Computer Programs." (Filed at end of FC 1.01.1 Structural calculations.)	1. Dimensions established on the basis of B&W requirements and recommendations and on the results of an extensive study investigating, optimum mat thickness. It was concluded that even though excavation was greater than anticipated and large amounts of fill concrete were required, it was not desirable to increase mat thickness beyond 12'-6". 2. Letter FPC-438, dated 12/2/68 from D. A. Skilton (G/C) to R. B. McKnight (FPC), "Comparative Analysis of 12'-6" and 22'-0" Thick Reactor Building Mats and Foundation Treatment."
DESIGN CONDITION		
Loads		
See Containment - General		
Analysis		
Kalnin's computer programs as described under Containment - General, "Analysis" for both static and dynamic loads.		
Shear stress determined using both Kalnin's analysis and hand calculations.	G/C, Inc. Struc. Calcs. FC 1.01.3/600 through FC 1.01.3/615.	Concrete not capable of carrying imposed shear stresses without benefit of large quantities of reinforcing steel.
Design		
Ultimate strength design for factored loads; working stress design for service loads.	G/C, Inc. Struc. Calc. FC 1.01.3.	ACI 318-63, Part IV B

PARAMETER	SOURCE	REASON
ACCEPTANCE CRITERIA		
Load Combinations	G/C, Inc. Struc. Calcs. FC 1.01.3/0 through FC 1.01.3/1125.	
Refer to Containment - General		

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment –General		
GEOMETRY		
Top of slab, El. 119.0' Wall thickness, 2'-0" Slab thickness, 0'-9" Height of wall, 25'-6"	G/C, Inc. Structural Dwgs: Wall Drawing SC-421-002, Slab Drawings SC-421-011 and SC-421-014 (for reference only).	Dimensions established by structural design and by the postulated maximum water level at Elev. 118.5'.
DESIGN CONDITION		
Loads		
See also Containment - General		
Design		
Working Stress Design using:		
1. ACI 318-63, "Building Code Requirements for Reinforced Concrete."	G/C, Inc. Struc. Calc. FC 1.01.2/1-52.	The retaining wall is a conventional reinforced concrete structure and subject to standard industry design procedures.
2. "Moments and Reactions for Rectangular Plates," U.S. Dept. of the Interior, Bureau of Reclamation, P. 10 and P. 36.	G/C, Inc. Struc. Calc. FC 1.01.2/2.	Analysis of two-way load carrying capacity of wall using shear and moment coefficients.
ACCEPTANCE CRITERIA		
Load Combinations		
C = D + G + H Where: D = Dead Load of Structure G = Hydrostatic Load H = Soil Load	G/C, Inc. Struc. Calc. FC 1.01.2/1 and 2.	Two loading conditions considered: 1. Groundwater level at Elev. 70'-0" and 10'-0" of surcharge. 2. Maximum water level at Elev. 118'-6" and no surcharge.
NOTE: Lateral pressure due to soil plus hurricane flood water controls design.		

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment – General		
GEOMETRY	G/C, Inc. Structural Drawing SC-421-001 (for reference only).	Provide physical access to base anchorage plate of vertical tendons.
DESIGN CONDITIONS		
See Containment – General		
ACCEPTANCE CRITERIA		
See Containment – General		

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment – General		
GEOMETRY Wall Thickness, 3'-6" Inside Diameter, 130'-0" Height to Springline, 157'-0" Prestressing Vertical tendons, 144 @ 2.94' spacing and on 67'-3-3/8" radius Hoop tendons, 282 @ 1.08' spacing on radius of 67'-8-3/8"	1. Concrete Outline Dwg. SC-421-031. 2. Stretch Outline Dwgs. SC-421-032 SC-421-033. 3. Sections & Details Dwgs. SC-421-036 SC-421-043 SC-421-047. 4. Prestressing Dwgs. SC-421-048 SC-421-049. 5. Prescon Drawings.	Geometry is established by equipment space requirements, including that required for maintenance and access and by the magnitude of design loads, which dictate member size and arrangement.
Buttress	1. G/C, Inc. Struc. Calcs. FC 1.01.4/1 through FC 1.01.4/10. 2. G/C, Inc. Struc. Calcs. FC 1.01.8/1 through FC 1.01.8/55.	Geometry is established to accommodate the space requirements of the prestressing system.
DESIGN CONDITIONS		
Prestressing		
1. Account for: - interrelationship between: creep and shrinkage of concrete. Shrinkage strain: 0.0001 inch/inch Creep strain: (inch/inch/psi) Vert., .000162 Hoop, 0.000401 Dome, 0.000416 - prestress level - modulus of elasticity of concrete	G/C, Inc. Struc. Calcs. FC 1.01.7/25 through FC 1.01.7/56.	"Report on Recommended Concrete Creep and Shrinkage Values for Computing Prestressing Values," Morris Schupack & Associates, June 1968 (Prepared for Jersey Central Power & Light). The parameters listed vary in magnitude with the existing levels of pressure and temperature to which they are exposed. For instance, when the containment vessel is forced to expand due to internal pressure, the tendons are stretched and prestress levels are increased.

	PARAMETER	SOURCE	REASON
2.	Capacity of liner to resist additional prestress limited to 1.2 x f_y = 36 ksi.	G/C, Inc. Struc. Calc. FC 1.01.7/8 and 9.	The liner undergoes the same deformation as the concrete shell. Its resistance to such deformation is limited by its yield strength which is assumed to be 20% greater than the guaranteed minimum liner yield strength.
3.	Limit concrete tensile stress due to membrane loads to 200 psi.	G/C, Inc. Struc. Calc. FC 1.01.7/9.	ACI 318-63, Sec. 2605 limits tensile stress in unreinforced concrete to 1 $3\sqrt{f'c}$ Reinforcement provided to carry discontinuity stresses; prestressing system carries membrane stresses.
4.	Design anchorage zones for: a. bearing b. spalling c. tensile splitting d. transfer of unbalanced tendon forces	1. Analysis and design of tendon anchorage zones, GAI Report 1730, 1970. 2. G/C, Inc. Struc. Calcs. FC 1.01.7/56a through FC 1.01/7/57 and FC 1.01.8/52 through FC 1.01.8/55. 3. G/C, Inc. Struc. Calc. FC 1.01.7/16. 4. G/C, Inc. Struc. Calcs. FC 1.01.3/303-315.	Extremely high stresses in the anchorage zone require special consideration.
5.	Design parameters a. coefficient of tendon friction, 0.16 b. wobble coefficient, 0.0003	FSAR Sec. 5.2.5.2.1.1.c (for reference only). G/C, Inc. Struc. Calc. FC 1.01.7/16.	Friction and wobble coefficients were specified by Prescon for the BBRV multi-wire tendon system. Tests have shown the friction coefficient to be closer to 0.08 but use of 0.16 is conservative. The 0.0003 wobble coefficient is still representative of industry practice.
	c. max. allowable stress in tendon - less than 70% of minimum guaranteed ultimate strength.	G/C, Inc. Struc. Calc. FC 1.01.7/16.	As required by Section 2606 of ACI 318-63.
6.	Draping around major openings - establish forces radial to opening.	G/C, Inc. Struc. Calcs. FC 1.01.15/1 through FC 1.01.15/46 and FC 1.01.16/1.	A draping pattern was required which allowed tendons to pass around openings, but such that the radial pressure exerted in a direction toward the opening was minimal.

PARAMETER	SOURCE	REASON
Loads		
See also Containment – General		
Crane Loads Bridge Wt., 284.45K Trolley Wt., 147.00K Live Load, 360.00K	G/C, Inc. Struc. Calc. FC 1.01.9/1.	Reflects 5% increase in "approximate" loads provided by Whiting.
Crane Bracket Loads Vertical, 280K Radial, 65.6K Circum., 145.5K	1. G/C, Inc. Struc. Calcs. FC 1.01.9/1 through FC 1.01.9/5. 2. AISC Specification for Design, Fabrication, and Erection of Structural Steel for Buildings, 1969, Sec. 1.3.3 and 1.3.4.	Includes application of factors for impact and development of horizontal runway forces.
Objectives Provide reinforcement for local loads:		Refer to Containment - General in this DBD under "Design Condition - Design of Mild Steel Reinforcement."
1. Provide sufficient reinforcement around openings to replace the tensile load carrying capacity of the concrete which was removed by the openings, but not less than that provided for TMI Unit 1.	G/C, Inc. Struc. Calcs. FC 1.01.4/14 through FC 1.01.4/24.	
2. Design for full plastic moment capacity of pipes penetrating the containment wall.	G/C, Inc. Struc. Calc. FC 1.01.12/25.	The plastic moment capacity is an upper limit on the load capable of being transferred by the pipe to the containment shell.
3. At crane girder brackets: a. Design for lateral force for two wheels acting at one point. b. Consider longitudinal force to act on one wheel.	G/C, Inc. Struc. Calcs. FC 1.01.4/30 through FC 1.01.4/39.	Vertical force assumed to be carried by liner. Bracket load distributed over 5'-0" length of wall. Loads applied with sufficient eccentricity to account for erection tolerances in liner plate location and wall thickness.

PARAMETER	SOURCE	REASON
4. Haunch a. Critical loading combinations (1) $0.95D + F_o + 1.5P + T_a$ (2) $0.95D + F_o$	1. G/C, Inc. Struc. Calcs. FC 1.01.3/200-216. 2. G/C, Inc. Struc. Calcs. FC 1.01.4/40 through FC 1.01.4/116. 3. TMI Calculations (Computer Analysis, dated 6/27/69).	Haunch is thickened and heavily reinforced in order to provide sufficient capacity to transfer both membrane and discontinuity loads from the cylindrical walls into the base mat.
b. Provide sufficient reinforcement to carry the moment resulting from yielding the liner under accident temperature. Consider liner yield stress of 36 ksi.	G/C, Inc. Struc. Calc. FC 1.01.4/47.	Capability of the liner to induce moments in the wall as the result of its elongation under high temperature exposure are limited by its elastic properties.
c. Invoke ultimate shear provisions of ACI 318-63, Chapter 17.	1. G/C, Inc. Struc. Calc. FC 1.01.4/65. 2. G/C, Inc. Struc. Calc. FC 1.01.7/8.	Design for shear is dependent on the axial force existing in the member. In this case compressive stress was always less than 100 psi such that Chapter 17 provisions apply.
d. Shear transferred from wall to mat through large shear key.	G/C, Inc. Struc. Calc. FC 1.01.4/40-44.	Shear key provides positive means of shear transfer.

ACCEPTANCE CRITERIA

Load Combinations

See also Containment General

Controlling load combination for maximum crane bracket load. C = D + L + E'	G/C, Inc. Struc. Calcs. FC 1.01.9/3-5.	The loads imposed by the crane bracket are not membrane loads such that the critical load combinations for the shell are not necessarily the same as those for an attachment to the shell.

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment – General		
GEOMETRY		
Inner radius, 20'-6" Height (spring line to top surface), 17'-6" Offset at spring line, 2'-4" Spring line location, El. 250'-0"	Pouring Sequence Dwg. SC-421-336. Stretch Outline Dwgs. SC-421-331 through SC-421-333. Concrete Outline Dwgs. SC-421-041 and SC-421-042. Dome Tendon Template Dwgs. S-521-025 and S-521-026. Plans and Sections Dwgs. SC-421-301 through SC-421-324. Details Dwgs. SC-421-325 SC-421-326 SC-421-328 SC-421-329 SC-421-330 SC-421-335.	The ring girder contains the terminations for two of the three tendon systems and is, therefore, a highly critical element of the containment. Dome tendon anchorage geometry is highly complex and is established by the arrangement of dome tendons and by the need to also accommodate vertical tendons.
DESIGN CONDITION		
Utilize design for TMI Unit 1 except where specific calculations for CR-3 indicate need for greater reinforcement.	1. G/C, Inc. Struc. Calcs. FC 1.01.5/61-78. 2. Three Mile Island Unit 1 Structural Calculations: TMI-RBG-1, 2 & 3.	Use of TMI calculations is appropriate because of similarities in geometry and loads.
Check principle stresses to ensure reinforcement is located to intercept all possible cracks.	G/C, Inc. Struc. Calcs. FC 1.01 5/79-85.	Proper orientation of shear reinforcement is dependent on magnitude and orientation of applied loads.
Tendon Anchorage		
a. Reinforce for: - crack control - bursting - spalling	G/C, Inc. Struc. Calcs. FC 1.01.5/100 through FC 1.01.5/114a.	Ensuring design adequacy in anchorage zones is a complex task and requires consideration of recommendations from each of the following references:

PARAMETER	SOURCE	REASON
b. Provide reinforcing so as to not prevent effective placement and consolidation of concrete.	Good engineering practice.	1. Guyon, "Prestressed Concrete." 2. Leonhardt, "Prestressed Concrete - Design and Construction." 3. Zielinski & Rowe, Research Report. 4. S.J. Taylor, "Anchorage Bearing Stresses," Paper No. 49, ICE Conference, London 1967. 5. Burns & Rowe, TMI PSAR Unit 2 6. Iyengar, ASCE Journal, March 1971. 7. P. Gergely, M.A. Sozen, C.P. Siess, "Civil Engineering Studies - Structural Series", No. 271, Chapter 4.

PARAMETER	SOURCE	REASON
ACCEPTANCE CRITERIA		
Load Combinations		
See Containment – General		
MATERIALS		
See Containment - General		
GEOMETRY		
Ellipsoidal Dome Short Radius, 20'-6" Long Radius, 110'-0" Thickness, 3'-0"	1. G/C, Inc. Struc. Calcs. FC 1.01.17/1-63 2. Outline & Embedded Steel Dwg. - SC-421-046. 3. Reinforcement Dwgs. - SC-421-045 SC-421-341 SC-421-342 SC-421-343 SC-421-344 SC-421-345. 4. Repair Drawing - SC-421-050. 5. Pouring Sequence Drawing - SC-421-337.	The dome for CR-3 containment is similar to the design for the TMI Unit 1 project.
Tendons, 3 layers of 41 each @ 30" plan spacing.	Prescon Drawing Sheet D-12, Detail # P10A.	
DESIGN CONDITION		
Loads		
See Containment - General		
Design		
Design of concrete dome is identical to that for TMI Unit 1:		
1. Derivations of equation for tendons forces, stress in the tendons.	TMI-DT-1 to 75.	Develop geometry.
2. Dome reinforcement.	TMI-DR-1 to 6.	
3. Utilization of liner and conduit to carry construction loads.	G/C, Inc. Struc. Calcs. FC 1.01.20/1-42.	Facilitate construction by eliminating falsework to support concrete placement.

PARAMETER	SOURCE	REASON
Delamination Repair		
Design bases differ from the original as follows:	Final Report, "Reactor Building Dome Delamination, December 10, 1976. This report is the source document for all material presented here under "Delamination Repair."	Existing strength levels rather than minimum specified strengths were used in the evaluation of the dome following delamination.
1. Concrete compressive strengths: old, 5000 psi new, 6000 psi		
2. Allowable membrane compression stress in concrete: old, 2250 psi new, 2700 psi		
3. Allowable membrane tensile stress in concrete under factored loads: old, 212 psi new, 0		The evaluation of the delaminated dome presumed that the concrete had no tensile capacity.
4. Allowable extreme fiber tension stress under factored loads: old, 424 psi new, 0		
5. Allowable compressive strain in liner: old, not specified new, ASME Sec. III, Div. 2	(See page 42, Delamination Repair.)	Allowable liner strains vary, according to the ASME Code, with the loading combination. The allowable strain is generally 0.002"/inch for non-accident conditions and 0.005"/inch for accident conditions.
6. Allowable tension stress in liner: old, f_y new, ASME Sec. III, Div. 2 – stress corresponding to allowable strain.		

PARAMETER	SOURCE	REASON
Controlling Load Combinations U = 1.0D + 1.0F U = 1.0D + 1.0F + 1.0 T_o U = 1.0D + 1.0F + 1.15P + 1.0 T_t U = 1.0D + 1.0F + 1.5P + T_a U = 1.0D + 1.0F + 1.0T_a Where: D = Dead Load F = Prestress Force T_o = Operating Temperature T_a = Accident Temperature T_t = Test Temperature P = Accident Pressure	Final Report, "Reactor Building Dome Delamination," December 10, 1976, Table 2.3.	These load combinations were found to be critical.
Purpose of Analysis Demonstrate safety and serviceability of the structure.	Final Report, "Reactor Building Dome Delamination," December 10, 1976.	
Analytical Methods Kalnin's Static Computer Program	Final Report, "Reactor Building Dome Delamination," December 10, 1976.	Method used for original analysis.
Results of Analysis Structure, as repaired, is safe and functional.	Final Report, "Reactor Building Dome Delamination," December 10, 1976.	Analyses concluded that the delaminated structure was not capable of carrying all design loads and that repairs would be appropriate to do so.

ACCEPTANCE CRITERIA

See Containment - General

PARAMETER	SOURCE	REASON
MATERIALS	FSAR Sec. 5.2.2.4.1 (for reference only).	Conformance to: "Safety Standard for Design, Fabrication and Maintenance of Steel Containment Structures for Stationary Nuclear Power Reactors," ASA N6.2, 1965
Plate ASTM A283 Grade C f_y = 30 ksi in most areas	1. G/C, Inc. Specification SP-5566 (for reference only). 2. FSAR Sec. 5.2.2.4 (for reference only).	ASTM A283 is a carbon steel plate material intended for general application where availability and economy rather than material properties are of greatest significance.
ASTM A516 Grade 60 or 70 for: 1. Thickened plate around crane girder brackets 2. Liner reinforcement around penetrations.		ASTM A516 is a higher strength material produced for improved toughness and good weldability. These properties are important where this material is used.
Rolled sections		
ASTM A36 for: 1. Liner attachments 2. Anchors for polar crane supports 3. Test channels 4. Stiffeners	1. G/C, Inc. Specification SP-5566 (for reference only). 2. FSAR Sec. 5.2.2.4 (for reference only).	Rolled sections are most readily available in ASTM A36 material, the standard structural steel material.
Welding E70XX electrodes	1. G/C, Inc. Specification SP-5566 (for reference only). 2. FSAR Sec. 5.2.2.4 (for reference only).	Required by ASME Boiler and Pressure Vessel Code and by AISC Specification.
GEOMETRY Thickness Base liner and sump, 1/4"	G/C, Inc. Structural Drawings S-521-017 S-521-018 S-521-030.	Liner thickness determined by loads experienced during operating or accident conditions.
Main liner, 3/8"	FSAR Sec. 5.2.2.4 (for reference only).	
Knuckle plate, 3/4"	G/C, Inc. Struc. Calc. FC 1.01.2.3.	

PARAMETER	SOURCE	REASON
Inside diameter, 130'-0" Cylinder height, 157'-0" Ellipsoidal dome Short radius, 20.5' Long radius, 110.0'	FSAR Sec. 5.2.5.2.2 (for reference only).	Liner geometry is a function of overall containment geometry.
Haunch dimensions Height, l0'-0" Base thickness, 2'-0" Radius at top, 20'-0" Knuckle plate radius, 10"	1. G/C, Inc. Struc. Calcs. FC 1.01.4/11 through FC 1.01.4/13. 2. G/C, Inc. Struc. Drawing SC-421-031 (for reference only).	Based on Three Mile Island dimensions.
DESIGN CONDITIONS		
Loads		
Dead Load of Liner Erection Loads Wind Loads 100 psf load on liner (prior to placement of dome concrete).	G/C, Inc. Specification SP-5566 (for reference only).	Liner required to be self-supporting during construction period prior to placement of containment shell concrete.
Design pressure, 55 psig Design temp., 281°F	FSAR Sec. 5.2.5.2.2 (for reference only).	Parameters specified by B&W as a result of their LOCA analyses.
Operating pressure, +1 to -1 psig Operating temp., Inside +90° to 110°F Outside +25° to 100°F	FSAR Sec. 5.2.5.2.2 (for reference only). FSAR Sec. 5.2.5.2.2 (for reference only).	
Design vacuum, 2.5 psig	FSAR Sec. 5.2.5.2.2 (for reference only).	
	FSAR Sec. 5.2.5.2.2 (for reference only).	Occurring as the result of an accidental actuation of the Reactor Building Spray System.
DESIGN CONDITIONS		
1. Anchor to shell to ensure composite action and prevent buckling of liner.	TMI Calculation 18.00.	Details of liner anchorage for CR-3 are identical to those for TMI 1.
2. Analyze as flat plate fixed against rotation at stiffener angles.	1. FSAR Section 5.2.4.2 (for reference only). 2. TMI Calculations.	Conservative, relatively simple analysis.

PARAMETER	SOURCE	REASON
3. Space stiffener angles so that critical buckling stress exceeds yield strength.	1. FSAR Section 5.2.5.2.2 (for reference only). 2. G/C, Inc. Struc. Calcs. FC 1.01.13/0-37.	Buckling cannot occur.
4. Evaluate stress concentration at openings and reinforce as necessary. Replace lost metal area as required by ASME Unfired Pressure Vessels Code.	1. ASME Unfired Pressure Vessel Code. 2. FSAR Sec. 5.2.5.2.2 (for reference only).	In accordance with Levy, McPherson, & Smith, "Reinforcement of a Small Circular Hole in a Plate Sheet Under Tension," Journal of Applied Mechanics, June 1948.
5. Provide compressible material at knuckle plate.	FSAR Sec. 5.2.4.2.1 (for reference only).	Absorbs strains from DBA conditions.
6. Design liner/ anchor welds to fail before liner is breached.	FSAR Sec. 5.2.5.2.2 (for reference only).	This is a fail-safe condition to assure no loss of containment.
7. Support dead and wind loads during erection period.	G/C, Inc. Struc. Calcs. FC 1.01.14/65-86.	Analysis carried out by Chicago Bridge and Iron.
ACCEPTANCE CRITERIA		
Strain not exceeding 0.005 in/in, nor that corresponding to minimum yield strain.	FSAR Sec. 5.2.5.2.1 (for reference only).	Ensures ductility and leak tightness. This number corresponds to the current requirement under accident conditions specified by the ASME Boiler and Pressure Vessel Code.
Liner leak rate at 55 psig pressure: 0.25%/24 hours	1. G/C, Inc. Specification SP-5566 (for reference only). 2. FSAR Sec. 5.2.5.2.2 (for reference only).	

PARAMETER	SOURCE	REASON
MATERIALS		
Attachment Plates	G/C, Inc. Specification SP-5566 (for reference only).	
Pipes f 4" O.D.		
SA-240, Type 304 S_u, 75 ksi S_y, 30 ksi S_m, 20 ksi S_v, 52.5 ksi	G/C, Inc. Struc. Calc. FC 1.01.12/4.	Stainless steel plate for application to unfired pressure vessels.
Pipes F 4" O.D.		
SA-516, Grade 60 or 70 S_u, 60 ksi S_y, 32 ksi S_m, 20 ksi S_v, 42 ksi	G/C, Inc. Struc. Calc. FC 1.01.12/3, 4.	Weldable, carbon steel. Provides an austenitic weld requiring no heat treatment. Residual stresses are tolerable.
Sleeves		
(Including personnel and equipment hatches) 1. SA-516, Grade 60 or 70 2. SA-333, Grade I S_u, 55 ksi S_y, 30 ksi S_m, 18.3 ksi S_v, 38.5 ksi	FSAR Sec. 5.2.2.4 (for reference only). G/C, Inc. Struc. Calc. FC 1.01.12/4.	1. SA-516 used for fabricated sleeves. 2. Both SA-333 and SA-516 are medium strength steels with desirable toughness properties.
Sleeve material conforms to SA-300 for notch toughness.	1. FSAR Section 5.2.2.4 (for reference only). 2. G/C, Inc. Specification SP-5566 (for reference only).	Provides notch toughness requirements for pressure vessel steel, potentially subject to low temperatures.
Process Pipe		
SA 106, Grade B S_u, 60 ksi S_y, 35 ksi S_m, 20 ksi S_v, 42 ksi	G/C, Inc. Struc. Calc. FC 1.01.12/5.	Typical process pipe materials. It is the process pipe which imposes the load on the penetrations.
SA 312, Type 316 S_u, 75 ksi S_y, 30 ksi S_m, 20 ksi S_v, 52.5 ksi	G/C, Inc. Struc. Calc. FC 1.01.12/5.	

PARAMETER	SOURCE	REASON
Electrical Penetration Assemblies		
Canister: SA 333, Grade I Header Plate: SA 240, Grade 304 Weld Ring: SA 516, Grade 70	1. FSAR Sec. 5.2.2.4 (for reference only). 2. G/C, Inc. Struc. Calc. FC 1.01.12/3.	All tough, weldable materials.
Insulation Unibestos	G/C, Inc. Specification SP-5566 (for reference only).	Used on hot penetrations to insulate concrete and to prevent localized high stresses due to thermal affects.
GEOMETRY		
Equipment Hatch I.D., 22'-4"	FSAR Sec. 5.2.5.2.3.3 (for reference only).	Equipment hatch sized to permit removal of steam generator and reactor vessel head.
Sleeves, Schedule 80 (with exceptions) O.D., 12" to 18"	G/C, Inc. Specification SP-5566 (for reference only).	
Personnel Air Locks (2) I.D., 10'-0"		Personnel access hatches are a standard size typical for nuclear plant containment.
DESIGN CONDITION General	FSAR Sec. 5.2.2.4.1 (for reference only).	1. According to "Safety Standard for Design, Fabrication, and Maintenance of Steel, Containment Structures for Stationary Nuclear Power Reactors," ASA N6.2, 1965 2. ASME Nuclear Vessels Code for Class B Vessels
Loads from Piping Penetrations for Designing Liner and Shell		
Full plastic moment capacity of the process pipe to ensure that piping penetrations and attachments to liner are stronger than the pipe itself.	1. FSAR Sec. 5.2.5.2.3 (for reference only). 2. G/C, Inc. Struc. Calc. FC 1.01.12/1.	The plastic moment capacity of the process pipe is the largest load it is capable of transferring to the liner and shell.

PARAMETER	SOURCE	REASON
M = ZS_u V = PA T = RAF where: M = Design Moment V = Design Shear T = Design Torsional Moment Z = Plastic Section Modulus of Process Pipe P = Design Internal Pressure for Process Pipe A = Flow Area of Process Pipe S_u = Ultimate Tensile Strength R = Mean Radius of Process Pipe F = Ultimate Shear Strength = $0.7S_u$		
Test Pressure		
63.3 psi (1.15 x containment design pressure) on air lock, and mechanical and electrical penetration annulus areas except 69 psi on air locks between doors.	1. G/C, Inc. Specification SP-5566 (for reference only). 2. Safety Guide 1.18 (currently Regulatory Guide 1.18, USNRC).	All pressure boundaries must be demonstrated to be air tight.
Other Criteria	G/C, Inc. Struc. Calcs. FC 1.01.14/0 through FC 1.01.14/44.	
Closed piping systems that penetrate containment shall have relief devices to minimize the possibility of excess pressure if the fluid is heated and expands during accident scenarios, i.e., LOCA/MSLB.	1. MAR 96-10-04-01, RB Containment Expansion Chambers 2. MAR 98-08-02-01, Replace Rupture Disc with Relief Valves.	Generic Letter 96-06: Assurance of Equipment Operability and Containment Integrity During Design-Basis Accident Conditions.
Reinforce around penetrations by replacing cut out area of 3/8" liner plate.	1. ASME Boiler and Pressure Vessel Code. 2. G/C, Inc. Specification SP-5566 (for reference only).	As required for Three Mile Island Unit 1.

PARAMETER	SOURCE	REASON
Lowest service metal temperatures a. inside containment, 120°F. b. outside containment, +25°F.	G/C, Inc. Specification SP-5566 (for reference only).	
Design of Personnel Air Locks and Equipment Access Hatch		
	1. G/C, Inc. Struc. Calc. FC 1.01.14. 2. FSAR Sec. 5.2.5.2.3.1 for reference only).	In accordance with ASME Boiler and Pressure Vessel Code, Section III for Class B Vessels.
Design of Outage Equipment Hatch		
	1. Calc S-99-0351 2. FSAR Sec. 5.2.5.2.3.1 (for reference only).	In accordance with ASME Boiler and Pressure Vessel Code, Section VIII. (no stamp required).
Analysis		
Use Kalnin's computer program for axisymmetric shells of revolution.	G/C, Inc. Struc. Calc. FC 1.01.12/6.	Simple, familiar analysis providing reliable results.
ACCEPTANCE CRITERIA		
Average membrane (local and general) stress $\leq$ 1.5 S_y or 1.8 S_m, whichever is greater - to be checked at discontinuities.	1. G/C, Inc. Struc. Calc. FC 1.01.12/5. 2. FSAR Section 5.2.2.4.1 for reference only).	As required by the ASME Boiler and Pressure Vessel Code, Section III, Class B.
Bending stress $\leq$1.5 S_y or 1.8 S_m, whichever is greater - to be checked away from discontinuities.		

PARAMETER	SOURCE	REASON
Shear stress $\leq 0.7\ S_u$ where: S_u = Ultimate Tensile Strength S_y = Yield Strength S_m = Design Stress Intensity S_v = Ultimate Shear Strength as defined by the ASME Code.		

PARAMETER	SOURCE	REASON
MATERIALS		
See Containment - General	G/C, Inc. Struc. Calc. FC 1.01.24/1.	
GEOMETRY		
3'-0" roof slab and walls	G/C, Inc. Structural Drawings SC-421-043 and SC-421-047.	
DESIGN CONDITION		
Loads See Containment - General	G/C, Inc. Struc. Calcs. FC 1.01.24/1 through FC 1.01.24/19.	Primary purpose of structure is to protect personnel access from tornado missile impact.
Missile load		
Equivalent static force of 270 kips.	1. G/C, Inc. Struc. Calc. FC 4.01.1/1-18. 2. DBD for Major Class I Structures, "Loads-Tornado Missile."	Simplified, conservative means of considering impact load.
ACCEPTANCE CRITERIA		
$U = W_m$ $U = D + W_w$ Where: D = Dead Load W_w = Tornado Wind W_m = Tornado Missile Load	G/C, Inc. Struc. Calcs. FC 1.01.24/1 through FC 1.01.24/19.	See "Containment - General" in this DBD.

PARAMETER	SOURCE	REASON
MATERIAL		
Concrete Anchors Nelson Studs	G/C, Inc. Struc. Calc. FC 1.01.6/1A.	Economical method for anchoring plates to concrete members prior to concrete placement.
Skin ASTM A36	G/C, Inc. Struc. Dwg. S-521-051 (for reference only).	Economical, readily available material.
Stiffeners ASTM A36	G/C, Inc. Struc. Dwg. S-521-051 (for reference only).	Standard material for structural shapes.
GEOMETRY		
1/4" plate Rectangular tube stiffeners	1. G/C, Inc. Struc. Calcs. FC 1.01.6/1A and FC 1.01.6/5. 2. G/C, Inc. Struc. Dwg. S-521-051 (for reference only).	Conventional plate thickness for applications to ducts of this size.
DESIGN CONDITION		
Loads		
Wind		
0 - 50' 50 psf 50 - 150' 75 psf 150 - 400' 110 psf	G/C, Inc. Struc. Calc. FC 1.01.6/1.	Loads derived from ASCE Paper No. 3269, "Wind Forces on Structures," Vol. 126, 1961.
Seismic See Containment - General	G/C, Inc. Struc. Calc. FC 1.01.6/6.	Seismic loads found to be negligible.
Internal Pressure 45 psf (8" H_20)	G/C, Inc. Struc. Calc. FC 1.01.6/1.	HVAC requirement.
ACCEPTANCE CRITERIA		
Max. Allow. Deflection, 1/4" Allowable stresses on steel as defined by AISC Specification.	G/C, Inc. Struc. Calcs. FC 1.01.6/1 through FC 1.01.6/9.	Specification of a maximum allowable deflection of 1/4" is based on reasonable engineering judgment based on past experience with similar structures.

TENDON WIRE TEST RESULTS

INSPECTION PERIOD ONE

	TENDON WIRE SAMPLE NO. (1)	LOCATION FROM END OF WIRE (2)	YIELD STRESS (ksi) (3)	ULTIMATE STRESS (ksi)	PERCENT ELONGATION	COMMENT
	DOME					
1.						
2.						
3.						
	VERTICAL					
1.	45V3	6-12 Ft.	228.2	251.7	Over 4%	Accept
2.	45V3	30-37 FT	227.8	252.1	Over 4%	Accept
3.	45V3	175-181 FT	229.7	255.0	Over 4%	Accept
	HOOP					
1.						
2.						
3.						

NOTES:
(1) See Steps 6.2.5.1 and 6.2.5.3.
(2) The end starts from the end of zero length as indicated on Data Sheet 4.
(3) The yield stress is defined as the stress at 1% elongation, i.e., 192,000 psi minimum.

Prepared by: _____ Date: _____

Contractor Review by: _____ Date: _____

F.P.C. Approval by: _____ Date: _____

DATA SHEET 5

TENDON WIRE TEST RESULTS

INSPECTION PERIOD #2

TENDON WIRE SAMPLE NO. (1)	LOCATION FROM END OF WIRE (2)	YIELD STRESS (ksi) (3)	ULTIMATE STRESS (ksi)	PERCENT ELONGATION	COMMENTS
DOME D208					
1. SHOP	0	215	263	6.25	N/A
2. MIDDLE	60	225	264	8.13	N/A
3. FIELD	120	211	252	6.88	N/A
VERTICAL 56V1					
1. SHOP	0	213	251	8.75	N/A
2. MIDDLE	75	216	254	8.13	N/A
3. FIELD	150	217	253	9.38	No HANDLING MARKS WITHIN GAGE LENGTH
HOOP 13H32					
1. SHOP	0	223	253	8.75	N/A
2. MIDDLE	150	219	249	6.25	N/A
3. FIELD	300	226	257	6.25	N/A

NOTES:
(1) See Steps 6.2.5.1 and 6.2.5.3.
(2) The end starts from the end of zero length as indicated on Data Sheet 4.
(3) The yield stress is defined as the stress at 1% elongation, i.e., 192,000 psi minimum.

Prepared by: W.A. Jemian Date: 28 JUNE 80

Contractor Review by: BJ Raffensperger Date: 7-25-80

F.P.C. Approval by: _____ Date: _____

3. Laboratory analysis on twenty-two samples of the filler grease disclosed that the grease was free of unacceptable nitrate, chloride, sulfide or water contamination.

3.4 Tendon Lift-Off Force

1. Lift-off force measurements were made on ten horizontal, plus six dome, plus three upper vertical tendon ends. All lift-off measurements were within the procedure specified acceptance criteria. Refer to Table 1.

   One end lift-off measurement was used for the vertical tendons.

3.5 Tendon Detensioning/Retensioning and Wire Tests

1. Broken, damaged or slipped wires were not noted during wire inspection operations on surveillance tendons 13H40, 56V2 and D105. None of the surveillance tendons exhibited lift-off forces above or below the procedure specified maximum or minimum. The ±3% (of initial) lift-off criteria was met and was deemed acceptable.

2. The visual inspection of the three removed tendon wires showed no significant signs of corrosion or damage. There were minor handling marks from the extraction tool.

3. Three wire samples were removed. The samples were measured, tagged and wrapped. They were then sent to Professional Service Industries, (PSI), Pittsburgh, Pennsylvania for testing. The samples were cut into three coupons (one at each end and at mid-length) and subjected to breaking tests per ASTM 421. The wire coupons showed tensile strengths in excess of 240 ksi minimum required.

4. The "as found" elongation for the three surveillance tendons differed from the "proportioned" original elongation. Horizontal tendon 13H40 "shop-end" was 7.2% above; dome tendon D105 "field-end" was 17.8% above; and vertical tendon 56V2 was 9.5% below the respective proportioned original elongations. The procedure specified acceptable criteria is ± 5%. See Table 2.

Crystal River Unit 3 Post-Tensioning System:
5th In-Service Tendon Surveillance Test Report: Revision 0

TABLE 7: SUMMARY OF TENDON WIRE TENSILE TEST RESULTS

TENDON NUMBER	WIRE SAMPLE LOCATION	YIELD STRENGTH (ksi @ 1% Ext)	ULTIMATE TENSILE STRENGTH (ksi)	PERCENT ELONGATION	LOCATION OF WIRE FAILURE (in)
D231 RANDOM WIRE	SHOP	219.0	243.0	6.3	1.0 *
	CENTER	219.0	239.0	6.4	5.3 *
	FIELD	221.0	244.0	6.2	0.5 *
46H47 RANDOM WIRE	SHOP	226.0	251.0	8.5	0.3 *
	CENTER	225.0	252.0	7.8	0.3 *
	FIELD	227.0	253.0	8.1	4.5 *
56V15 RANDOM WIRE	SHOP	212.0	244.0	7.8	8.5 *
	CENTER	216.0	243.0	6.5	2.0 *
	FIELD	212.0	243.0	8.7	8.5 *
56V15 NON TENSION WIRE	SHOP	220.0	245.0	8.5	7.5 *
	CENTER	216.0	243.0	7.9	1.6 *
	FIELD	215.0	243.0	8.6	2.0 *
46H29 RANDOM WIRE	SHOP	227.0	253.0	7.4	0.2 *
	CENTER	226.0	253.0	7.1	0.2 *
	FIELD	229.0	254.0	7.5	3.0 *
46H29 BROKEN WIRE 1 OF 3	SHOP	217.0	242.0	8.3	7.8 *
	CENTER	217.0	242.0	8.7	0.5 *
	FIELD	214.0	242.0	8.5	8.5 *
46H29 BROKEN WIRE 2 OF 3	SHOP	221.0	253.0	8.5	8.8 *
	CENTER	227.0	252.0	8.5	8.9 *
	FIELD	227.0	252.0	8.5	3.3 *
46H29 BROKEN WIRE 3 OF 3	SHOP	222.0	245.0	7.8	8.5 *
	CENTER	219.0	242.0	8.7	8.5 *
	FIELD	215.0	240.0	7.5	0.5 *
ACCEPTANCE CRITERIA		204.0 (min)	240.0 (min)	4.0 (min)	N/A

* Distance From Moving Jaw

Crystal River Unit 3 Post-Tensioning System:
5th In-Service Tendon Surveillance Test Report: Revision 0

TABLE 7: SUMMARY OF TENDON WIRE TENSILE TEST RESULTS

TENDON NUMBER	WIRE SAMPLE LOCATION	YIELD STRENGTH (ksi @ 1% Ext)	ULTIMATE TENSILE STRENGTH (ksi)	PERCENT ELONGATION	LOCATION OF WIRE FAILURE (in)
D231 RANDOM WIRE	SHOP	219.0	243.0	6.3	1.0 *
	CENTER	219.0	239.0	6.4	5.3 *
	FIELD	221.0	244.0	6.2	0.5 *
46H47 RANDOM WIRE	SHOP	226.0	251.0	8.5	0.3 *
	CENTER	225.0	252.0	7.8	0.3 *
	FIELD	227.0	253.0	8.1	4.5 *
56V15 RANDOM WIRE	SHOP	212.0	244.0	7.8	8.5 *
	CENTER	216.0	243.0	6.5	2.0 *
	FIELD	212.0	243.0	8.7	8.5 *
56V15 NON TENSION WIRE	SHOP	220.0	245.0	8.5	7.5 *
	CENTER	216.0	243.0	7.9	1.6 *
	FIELD	215.0	243.0	8.6	2.0 *
46H29 RANDOM WIRE	SHOP	227.0	253.0	7.4	0.2 *
	CENTER	226.0	253.0	7.1	0.2 *
	FIELD	229.0	254.0	7.5	3.0 *
46H29 BROKEN WIRE 1 OF 3	SHOP	217.0	242.0	8.3	7.8 *
	CENTER	217.0	242.0	8.7	0.5 *
	FIELD	214.0	242.0	8.5	8.5 *
46H29 BROKEN WIRE 2 OF 3	SHOP	221.0	253.0	8.5	8.8 *
	CENTER	227.0	252.0	8.5	8.9 *
	FIELD	227.0	252.0	8.5	3.3 *
46H29 BROKEN WIRE 3 OF 3	SHOP	222.0	245.0	7.8	8.5 *
	CENTER	219.0	242.0	8.7	8.5 *
	FIELD	215.0	240.0	7.5	0.5 *
ACCEPTANCE CRITERIA		204.0 (min)	240.0 (min)	4.0 (min)	N/A

* Distance From Moving Jaw

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

VI. WIRE INSPECTION AND TESTING

One wire was scheduled for removal from each detensioned tendon for visual inspection and tensile testing. PSC Procedure SQ 10.3 outlines the details involved with the wire testing and the data was recorded on Data Sheets SQ 10.2 and SQ 10.3 with the results summarized in Table X.

All wire diameters were within the acceptance criteria of 0.27559 ± 0.002". The corrosion condition of all samples was level 1 - "bright metal; no visible oxidation" and the Ultimate Strength exceeded the minimum strength criteria of 240,000 psi (240 ksi) for all wire samples tested.

PSC Precision Surveillance Corporation

20TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

Florida Power CORPORATION

TABLE X: SUMMARY OF DATA SHEETS SQ 10.2 & 10.3 - VISUAL INSPECTION AND TENSILE TESTING OF WIRE

TENDON	SAMPLE No.	CORROSION LEVEL	SAMPLE LOCATION (FT)	DIAMETER (IN)	YIELD STRENGTH (PSI)	ULTIMATE STRENGTH (PSI)	ACCEPTABLE
61V21	1	1	20 - 29	0.275	210,770	249,197	YES
	2	1	90 - 99	0.275	210,251	251,793	YES
	3	1	170 - 179	0.275	209,212	242,966	YES
D304	1	1	20 - 29	0.2755	213,614	244,138	YES
	2	1	60 - 69	0.2755	213,614	241,552	YES
	3	1	100 - 109	0.2755	217,236	250,864	YES
42H35	1	1	20 - 29	0.276	210,286	241,219	YES
	2	1	70 - 79	0.276	210,802	246,375	YES
	3	1	140 - 149	0.276	212,864	253,077	YES
51H26	1	1	10 - 19	0.2745	210,512	254,293	YES
	2	1	70 - 79	0.2745	209,990	248,560	YES
	3	1	140 - 149	0.2745	216,766	243,869	YES
51H26	1A	1	10 - 19	0.2745	215,202	250,645	YES
	2A	1	70 - 79	0.2745	214,160	253,251	YES
	3A	1	146 - 155	0.2745	220,415	257,942	YES
62H41	1	1	20 - 29	0.2755	211,545	247,760	YES
	2	1	70 - 79	0.2755	213,614	245,173	YES
	3	1	140 - 149	0.2755	214,390	241,552	YES

VI. WIRE INSPECTION AND TESTING

One wire was scheduled for removal from each detensioned tendon for visual inspection and tensile testing. PSC Procedure SQ 10.3 outlines the details involved with the wire testing and the data was recorded on Data Sheets SQ 10.2 and SQ 10.3 with the results summarized in Table X.

All wire diameters were within the acceptance criteria of 0.27559" ± 0.002". The corrosion condition of all samples was level 1 - "Bright metal, no visible oxidation", or level 2 - "Metal reddish brown color; no pitting". Also, the ultimate strength exceeded the minimum strength criteria of 240,000 psi (240 ksi) for all samples tested.

25TH YEAR SURVEILLANCE OF THE POST-TENSIONING SYSTEM AT THE CRYSTAL RIVER NUCLEAR PLANT UNIT 3

TABLE IX: SUMMARY OF DATA SHEETS SQ 10.2 & 10.3 - VISUAL INSPECTION AND TENSILE TESTING OF WIRE

TENDON	SAMPLE No.	CORROSION LEVEL	SAMPLE LOCATION (FT)	DIAMETER (IN)	YIELD STRENGTH (PSI)	ULTIMATE STRENGTH (PSI)	ACCEPTABLE
45V14	1	2	20 - 29	.275	226,477	267,691	YES
	2	2	90 - 99	.275	224,249	266,020	YES
	3	2	170 - 179	.275	228,148	265,184	YES
53H16	1	1	10 - 19	.275	227,312	272,146	YES
	2	1	70 - 79	.275	231,211	266,298	YES
	3	1	140 - 149	.275	233,160	272,703	YES
D339	1	1	20 - 29	.275	230,097	265,463	YES
	2	1	50 - 59	.275	231,489	257,944	YES
	3	1	90 - 99	.275	230,097	265,184	YES

9.0 WIRE INSPECTION AND TESTING

9.1 One tendon from each group (Vertical, Hoop, Dome) was completely detensioned. A single wire was removed from each detensioned tendon for inspection and testing. Each removed wire was examined over its entire length for corrosion and mechanical damage. Three samples from each wire were tested for diameter, yield strength, ultimate tensile strength and elongation. PSC Procedures SQ 10.2 and SQ 10.3 outline the details and acceptance criteria pertaining to the wire removal and testing. All data was recorded on Data Sheets SQ 10.2 and SQ 10.3 and the results summarized in Table 48.

9.1.1 All wire diameters were within the acceptance criteria of 0.2756 ± 0.002".

9.1.2 The corrosion level for all of the test wires were:

1 - Bright metal; no visible oxidation.

9.1.3 No mechanical damage was noted on any of the wires.

9.1.4 The yield strength of the wires tested exceeded the minimum acceptance criteria of 192,000 psi at 1% elongation. The lowest recorded yield strength was 225,678 psi.

9.1.5 The Ultimate Strength of the wires tested exceeded the minimum strength criteria of 240,000 psi on all samples. The lowest recorded ultimate strength was 257,305 psi.

9.1.6 The percent elongation at sample failure exceeded the required minimum of 4.0% on all samples tested. The recorded elongation on the samples varied from 4.5% to 5.3%.

TABLE 48: SQ10.2 & SQ10.3 – VISUAL INSPECTION AND TENSILE TESTING OF WIRE

TENDON	SAMPLE NUMBER	CORROSION LEVEL	SAMPLE LOCATION (ft)	DIAMETER (in.)	YIELD STRENGTH (ksi)	ULTIMATE STRENGTH (ksi)	ELONGATION (%)	ACCEPT?
51H34	1	1	10'-20'	.276	227.805	259.164	4.6	YES
	2	1	70'-80'	.276	226.210	262.353	5.1	YES
	3	1	140'-150'	.276	225.678	260.227	4.8	YES
61V17	1	1	10'-20'	.275	230.535	263.194	4.6	YES
	2	1	90'-100'	.275	229.464	263.194	5.0	YES
	3	1	170'-180'	.275	230.000	265.871	5.3	YES
D238	1	1	10'-20'	.275	230.000	260.517	4.7	YES
	2	1	50'-60'	.275	229.464	257.305	4.5	YES
	3	1	100'-110'	.275	228.393	263.194	5.0	YES

Historical SEEK data - CR3	
RAN:	76000-0609
DOCNO:	TRL4, RPT
DATE:	12/07/1976
TITLE:	TRAILER FOUR DOCUMENTATION, MISCELLANEOUS ENGINEERING INFORMATION, REACTOR CONTAINMENT, STRUCTURAL INTEGRITY TEST
VEND:	G15000, GILBERT ASSOCIATES INC, GAI, 312637
LOC:	TSC VAULT, ROW 5, SHELF 6D, BOX 462
RETEN:	LIFE OF POLICY + 10

ENCLOSURE 2

FLORIDA POWER CORPORATION
QUALITY ASSURANCE RECORD
TRANSMITTAL

ATTENTION: RECORDS MANAGEMENT SECTION (NR2A)
CRYSTAL RIVER UNIT NO. 3

DOCUMENTS TRANSMITTED:

GP 2-21-12

Title: Reactor Containment Bldg. Structural Integrity Test

Vend: Gilbert

The Quality Assurance Records listed above are hereby transmitted for inclusion in the Plant Quality File.

These records are complete and in compliance with the requirement of Florida Power Corporation's Quality Program.

John G. Couch DATE 9/18/9-
Responsible Supervisor/Designee

RECEIPT ACKNOWLEDGEMENT BY:

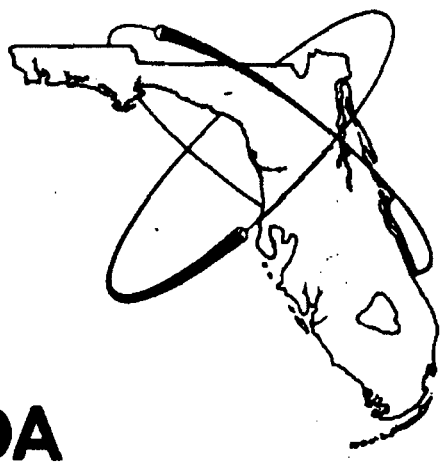
DATE
Manager, Nuclear Information Resources/Designee

FUTURE RETENTION OF THESE RECORDS IS THE RESPONSIBILITY OF RECORDS MANAGEMENT.

Gen. PL. 2-21-12
Ship 41 Dwr. 10

CRYSTAL RIVER UNIT 3
NUCLEAR GENERATING PLANT

REACTOR CONTAINMENT BUILDING
STRUCTURAL INTEGRITY TEST



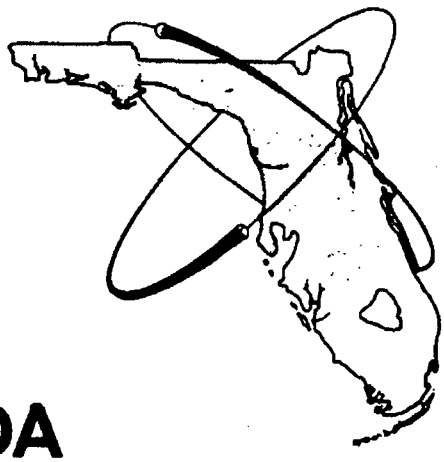
PREPARED FOR:

FLORIDA
POWER
CORPORATION

Gilbert/Commonwealth
ENGINEERS/CONSULTANTS Reading,PA/Jackson,MI

CRYSTAL RIVER UNIT 3
NUCLEAR GENERATING PLANT

REACTOR CONTAINMENT BUILDING
STRUCTURAL INTEGRITY TEST



PREPARED FOR:

FLORIDA
POWER
CORPORATION

Gilbert/Commonwealth
ENGINEERS/CONSULTANTS Reading,PA/Jackson,MI

DECEMBER 7, 1976 GAI REPORT NO. 1930

CRYSTAL RIVER UNIT THREE

NUCLEAR GENERATING PLANT

REACTOR CONTAINMENT BUILDING

STRUCTURAL INTEGRITY

TEST

FLORIDA POWER CORPORATION

Gilbert Associates, Inc.
P. O. Box 1498
Reading, Pennsylvania

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1.0 PURPOSE

This report presents a detailed description of the Structural Integrity Test (SIT) performed on the Crystal River Unit 3 Nuclear Generating Plant (CR3) reactor containment building during October and November 1976. During the SIT the reactor containment building was subjected to a maximum internal pressure of 63.3 psig. Figure 8 of Enclosure 1 presents dates, times and pressures for the SIT.

Conclusions related to the SIT are based on the observations and measurements made during the test and documented in this report.

2.0 SYNOPSIS

Measurements and observations recorded during the SIT have been evaluated and compared with predictions of the expected structural behavior during the test. The data confirmed the expected behavior. It is concluded that the CR3 reactor containment building, including the repaired dome, satisfies the requirements of the design criteria.

Test instrumentation performed reasonably well and most of the recorded data are considered to be valid. The few minor discrepancies in the data are noted and discussed in Section 11.0 of this report. The number of discrepancies was small compared to the amount of the data recorded during the test.

There was no evidence of structural instability during the test. Whitewashed areas and other areas which were inspected for cracks confirmed the predictions that minimal cracking would occur in the cylinder portion of the containment and that dome surface crack patterns would be regular and uniform during the test. Strains and displacements were generally less than the theoretical and limit values, indicating that the analysis of the test condition was conservative.

3.0 THE CONTAINMENT STRUCTURE

3.1 STRUCTURE DESCRIPTION

The containment structure is a post-tensioned concrete structure with cylindrical walls, a flat foundation mat and a shallow dome. The cylindrical walls are prestressed in the vertical and hoop directions. The dome is prestressed using a three-way post-tensioning system. In addition to the prestress, mild steel reinforcing was placed in the cylinder and dome.

The inside surface of the building is lined with a carbon steel liner to ensure leak tightness. The liner shell thickness is for the most part 3/8 inch. The base liner is 1/4 inch thick. The liner in transition between the base liner and cylinder wall is 3/4 inch thick.

The foundation mat slab is reinforced with conventional mild steel reinforcing. The mat bears on competent material and is 12.5 feet thick with a concrete slab 2 feet thick above the bottom liner plate.

The cylinder has an inside diameter of 130 feet, a thickness of 3 feet - 6 inches and a height of 157 feet from the top of the foundation slab to the spring line. The dome has a major radius of 110 feet, a transition radius of 20 feet - 6 inches and a thickness of 3 feet.

Two large openings are provided for access into the containment structure: one is a 22 foot - 4 inch inside diameter opening for the equipment access hatch; the other, a 10 foot inside diameter opening for the personnel lock. Penetrations for main steam, feedwater, purge air, other mechanical process piping and electrical cables are also

provided in the cylinder wall. Drawings and a description of the containment structure are provided in the CR3 Final Safety Analysis Report (FSAR) and "Reactor Building Dome Delamination" report.

3.2 MATERIALS

3.2.1 Liner

The basic liner plate conforms to ASTM A283-67, Grade C. Thickened portions of the liner at the crane girder and reinforcing around penetrations conform to ASME-ASTM SA516 Grade 60 or 70.
Non-accessible liner seams are covered with A36 steel test channels to permit leak testing. Penetration sleeves through the containment barrier consist of material conforming to ASME-ASTM SA-333, Grade 1 and SA-300.

3.2.2 Mild Steel Reinforcement

Mild steel reinforcement in the cylinder, dome, and reinforcement in the mat conforms to ASTM A-615-68, Grade 40 and Grade 60. The reinforcing steel in the cylinder and dome provides capacity for bending and shear. The mat reinforcing steel provides capacity in tension, bending and shear.

No. 14 and 18 bars were spliced with Cadwelds capable of developing the ultimate strength of the bars. Bars of size number 11 or smaller were lap spliced, except for some of the reinforcement in the ring girder and repaired dome which were Cadwelded.

3.2.3 Concrete

The concrete mix used in the cylinder, dome and mat was designed to develop a minimum of 5000 psi compressive strength in 28 days. The in place strength of the dome concrete, based on the tests of concrete cores, is in excess of 6000 psi. Admixtures were used for air entrainment and water reduction.

3.2.4 Tendons

The prestressing used for the reactor containment building is the BBRV system utilizing a maximum of 163, 7 mm diameter wires. These wires conform to ASTM A-421-65 Type BA with a guaranteed ultimate tensile strength of 240,000 psi and use the BBRV button head system for end anchorages. Tendons are encased in galvanized steel conduits.

Tendons and included anchorages are coated with a temporary corrosion inhibitor for protection prior to bulk filling of the conduits.

3.3 DESIGN

The methods and assumptions used for the design of the structure are described in the FSAR and the "Reactor Building Dome Delamination" report.

4.0 CONSTRUCTION METHODS

The containment liner for the cylinder and dome was erected independently of placement of the concrete shell. Survey techniques were used to ascertain actual liner dimensions after construction.

Mild steel reinforcement for the cylinder is located on both faces with tendon conduits in between. Outside face concrete forms were tied to the liner on approximately 6 foot centers.

Dome tendon conduits (5" diameter Schedule 40 pipe) were pre-bent and spliced as required to span from one anchorage assembly to the other for each tendon location. Dome concrete was not placed until tendon conduits, trumpets, anchor plates and reinforcing bars were installed.

Tendons were stressed after the cylindrical wall and dome concrete has been placed and cured. Vertical tendons were stressed first. The stressing operation started at four positions along the circumference of the cylinder. The sequence of stressing vertical tendons was approximately symmetrical with respect to the cylindrical wall circumference. After completion of the vertical tendons, the hoop tendons were stressed in a sequence so as to minimize stress concentration in the shell. Then the dome tendons were stressed. For a description of the dome tendon stressing sequence see the "Reactor Building Dome Delamination" report.

5.0 CONTAINMENT DOME REPAIR

A complete history and documentation of the CR3 dome repair are presented in the "Reactor Building Dome Delamination" report. This document has been filed with the Nuclear Regulatory Commission (NRC).

6.0 TEST REQUIREMENTS

6.1 PRELIMINARY SAFETY ANALYSIS REPORT

The CR3 Preliminary Safety Analysis Report (PSAR), Section 5.6 and Appendix 5F, Reactor Building Instrumentation, provided background information on initial commitments to the NRC on the subject of instrumentation to be used and measurements to be made during the SIT.

6.2 FINAL SAFETY ANALYSIS REPORT

Appendix 5A of the CR3 FSAR provides a description of commitments for the SIT.

6.3 REACTOR BUILDING DOME DELAMINATION

In order to ascertain that the repaired CR3 dome would function as intended, additional instrumentation was provided in excess of that defined in the FSAR. The additional instrumentation is described in the "Reactor Building Dome Delamination" report.

6.4 REGULATORY REQUIREMENTS

Prior to performing the SIT a comparison was made between the test requirements given in Appendix 5A of the FSAR and those required by Regulatory Guide 1.18, "Structural Acceptance Test for Concrete Primary Reactor Containment." The differences between these two documents were found to be minor and the intent of Regulatory Guide 1.18 had been met.

Appendix J of the "Reactor Building Dome Delamination" report contains the correspondence between the NRC and Florida Power Corporation (FPC) concerning instrumentation of the dome for the SIT.

7.0 TEST PROCEDURES

7.1 GENERAL DESCRIPTION

The SIT procedure was developed such that the response of the reactor containment building would be measured as it was subjected to internal pressures from 0 psig to 63.3 psig and back to 0 psig. The maximum test pressure, 63.3 psig, was 15 percent in excess of the design pressure, 55 psig, derived from the postulated maximum loss of coolant accident.

Pressurization and depressurization were accomplished in stages to permit readings and measurements at the following pneumatic pressure levels: 0 psig, 12 psig, 35 psig, 45 psig, 55 psig, 63.3 psig, 55 psig, 45 psig, 35 psig, 12 psig and 0 psig. The 12 psig level readings were added during the test, at the request of Mr. W. Swan, NRC, I&E Division. When a data acquisition pressure level was reached, the pressure was held for one hour prior to acquiring data to permit the structure to adjust to the applied pressure.

During the pressurization phase and after the hold period was maintained at a data acquisition pressure level, the following measurements were recorded:

a. Cylinder and dome displacements.

b. Strain measurements of reinforcing bars and the liner.

c. Crack patterns and crack width for whitewash areas.

d. General inspection of accessible exterior portions of the structure for cracking and possible interferences.

During the depressurization phase only items 1 and 2 above were recorded. At the final zero pressure level all data was recorded.

A description of the instrumentation used to measure the structural response and the measurements and observations made during the SIT are included in Enclosure 1.

Measurements and observations at each pressure level were compared with predicted results and evaluated prior to pressurizing or depressurizing to the next level.

Predicted displacements and strains are described in Section 10.0. The evaluation of test results is included as Section 11.0 of this report.

7.2 PREPARATION

A detailed test procedure was written prior to beginning the test. A checklist of items which were signed off before pressurization began included the following:

a. Instruments necessary for measurements and equipment necessary for pressurization of the reactor containment building was available.

b. Auxiliary equipment necessary for taking measurements was available.

c. Prerequisite testing had been accomplished.

d. Possible interferences had been investigated.

e. Interior temperature of the reactor containment building had been stabilized.

f. Accessible exterior surfaces of the reactor containment building, tendon anchorage inspection areas and crack pattern areas had been inspected for cracks.

g. Exclusion areas had been established.

8.0 INSTRUMENTATION

8.1 GENERAL DESCRIPTION

Measurement and observation of the behavior of the reactor containment building during the test were accomplished using the following:

a. Displacement measurements

   Linear Potentiometers (LP).

b. Strain measurements

   1. Linear strain gages.
   2. Rosette strain gages.
   3. Ail Tech concrete strain gages.

c. Concrete crack measurements

   Optical comparators.

d. Miscellaneous

   1. Electronic readout instruments for LP's and strain gages.
   2. Thermocouples.

The location and identification of the instrumentation used for each measurement is presented in Enclosure 1.

Installation of the instruments and the data acquisition system are also discussed in Enclosure 1.

8.2 CONCRETE CRACK MEASUREMENTS

The accessible exterior surfaces of the reactor containment building were visually inspected for cracks and crack patterns before and during the test. Observed cracks were charted; with the size of any cracks equal or exceeding .01 inches in width noted.

Approximately 1600 square feet of the exterior surface of the reactor containment building was whitewashed for measurement of spacing and width of cracks to confirm that the magnitude of local strains was not excessive. Whitewash areas were as follows:

a. An area of the structure approximately 6 feet wide extending from dome apex, across the top of the ring girder and down its side to a point 6 feet below it.

b. An area 6 feet by 6 feet on the cylinder at elevation 174'-0".

c. An area 6 feet by 10 feet at the base of the cylinder.

d. An area of approximately 28 feet by 32 feet at one upper quadrant of the equipment access opening.

A one foot by one foot grid system was laid out on each whitewashed area. Platforms were provided for access and protective covers shielded the areas from adverse weather. Cracks were plotted for each pressure level when pressurizing and at 0 psig after completion of the pressure test.

The crack pattern charts are presented in Appendix D of Enclosure 1 to this report.

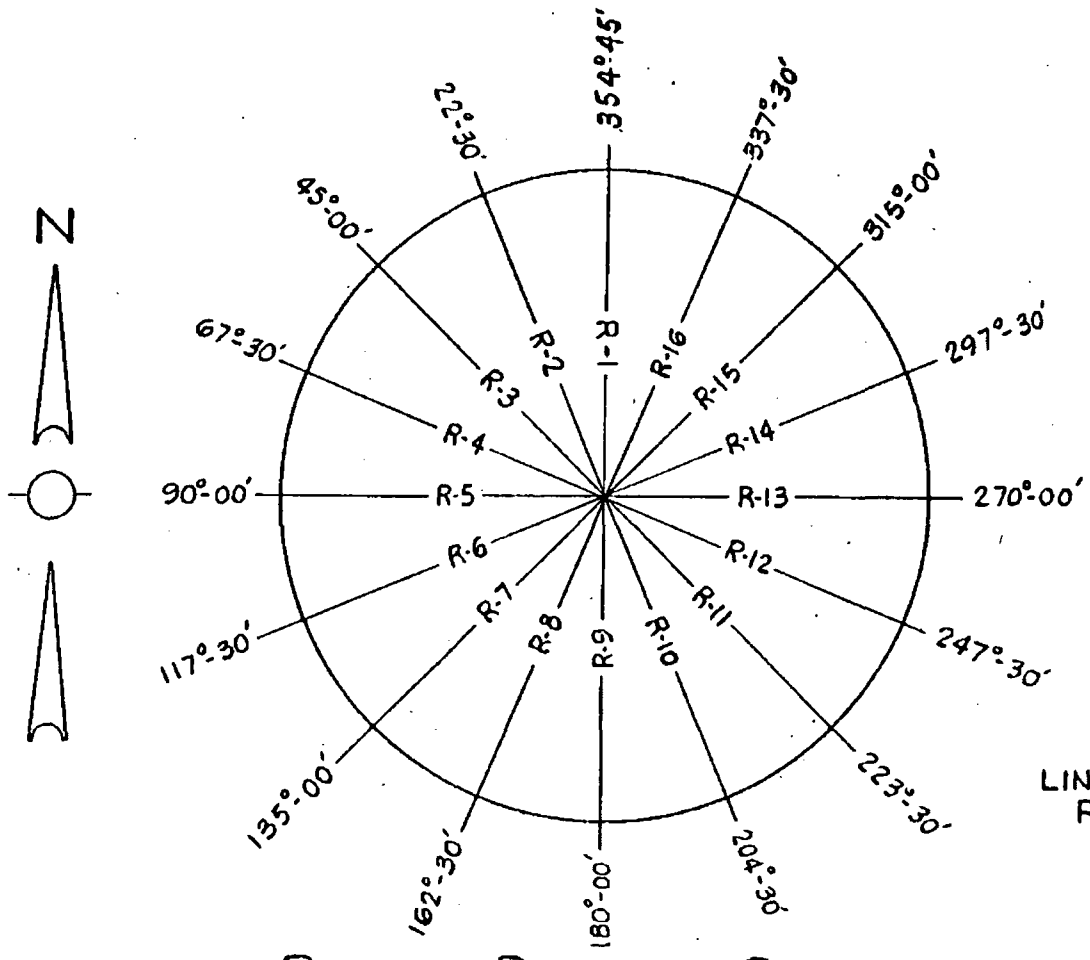
The general condition of a group of selected tendon anchorages was reported in the same manner as the crack patterns. The anchors inspected are listed on page 17 of Enclosure 1.

The reports at each pressure level are included in Appendix D of Enclosure 1.

9.0 AS BUILT CONDITIONS

A survey of the "as built" conditions of the reactor containment building was performed. This included a survey of the liner radius at several elevations as shown on Figure 9.1.

ELEVATION	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8	R-9	R-10	R-11	R-12	R-13	R-14	R-15	R-16
245.15'	64.884	64.815	64.773	64.933	64.843	64.831	64.812	64.898	65.004	64.700	64.762	64.794	65.012	65.063	65.052	64.963
196.00'	64.829	64.780	64.855	64.807	64.930	64.763	64.722	64.768	64.944	64.790	64.737	64.757	65.082	65.089	65.106	64.866
162.00'	64.787	64.745	64.807	64.818	64.880	64.833	64.760	64.703	65.005	64.800	64.781	64.747	65.026	65.062	64.987	64.927
123.00'	64.823	64.813	64.763	64.878	64.693	64.862	64.724	65.000	64.969	64.643	64.797	64.732			65.130	64.953
104.00'	64.896	64.626	64.833	64.818	64.880	64.776	64.693	64.979	64.974	64.693	64.724	64.711			65.081	64.875



LINER ℄ RADIUS
R = 65.000'

PLAN OF REACTOR BUILDING

FIGURE 9.1

10.0 CALCULATED RESPONSE

10.1 GENERAL DESCRIPTION

The reactor containment building was analyzed prior to the SIT for the 63.3 psig internal pressure load case.

The analyses took into account the actual strength of the concrete based on test cylinder results. The concrete modulus of elasticity (E) used was:

$E = 4.0 \times 10^6$ Ksi Instantaneous Loads

$E = 2.7 \times 10^6$ Ksi Present Prestress Losses

The value of Poisson's ratio (μ) used was:

$\mu = .17$

The following properties were assumed for the liner:

$E = 30 \times 10^6$

$\mu = 0.27$

Two separate analyses were performed to obtain theoretical (predicted) values for the various test parameters. The general structure was modeled for the KALNINS STATIC computer program. This program was used for the analysis and the design of the reactor containment building and was considered to be accurate for predictions of the overall behavior of the structure.

A second analysis was performed using a finite element program to provide a more accurate prediction of test parameters around thickened local portions of the shell which could not be modeled using KALNINS STATIC computer program. These portions included the

buttresses, equipment access hatch and personnel access hatch. The model included the entire cylindrical portion of the shell from the top of the mat to the spring line.

10.2 DISPLACEMENTS

Predicted and limiting displacements for each radial and vertical measurement point are given in Table 10.1. Pressure versus displacement plots for the data acquired during the SIT are presented in Appendix B of Enclosure 1. The predicted displacement at 63.3 is indicated by a circle, obtained from the analyses described in Section 10.1 proportioned linearly between 0.0 and 63.3 psig. The line labeled "LIMIT" includes an increase over the theoretical value to account for the precision of instruments, accuracy of readings, accuracy of loads and analytical techniques, and construction variables. Variables concerning instrumentation and measurements are discussed in the text of Enclosure 1.

The "LIMIT" at 63.3 psig was calculated by increasing the "theoretical displacement" by 25%, plus 0.005 inches which was the full range accuracy of the instruments used. These values were "rounded off" to the nearest 0.005 inches.

For example, if the "theoretical displacement" at 63.3 psig were .200 inches, the "LIMIT" includes 0.005 inches for the measurement accuracy and 25 percent of 0.20 inches, or 0.05 inches, for the analytical modeling:

$$.200 + .05 + .005 = .255 \text{ inches}$$

10.3 CONCRETE CRACK PATTERNS

Stress cracking in the cylinder from the applied pressure loading was not anticipated due to the residual compressive stress remaining in the shell at 63.3 psig. It was expected that existing shrinkage cracks would enlarge slightly in width and propagate in length during reactor containment building pressurization.

In the dome cap where prestressing was minimal, a pattern of regularly spaced cracks was anticipated. The width of the cracks was expected to be small due to the presence of non-prestressed reinforcing steel.

TABLE 10.1

Displacement Acceptance Criteria

Gage ID	Measurement	Theoretical Displacement (inches)	Limiting Displacement (inches)	Tolerance (inches)
1, 2, 3	Radial	0.010	0.020	0.010
4, 5, 6	Radial	0.090	0.115	0.025
7, 8, 9	Radial	0.205	0.260	0.055
10, 11, 12	Radial	0.200	0.255	0.055
13, 14, 15	Radial	0.205	0.260	0.055
16, 17, 18	Radial	0.160	0.205	0.045
19, 20, 21	Radial	0.060	0.080	0.020
22, 23, 24	Radial	-0.025	-0.040	-0.015
25, 26, 27	Radial	-0.055	-0.070	0.015
28, 29, 30	Vertical	0.215	0.275	0.060
34	Vertical	0.905	1.135	0.230
35	Radial	0.10	0.130	0.030
35	Vertical	0.10	0.130	0.030
36	Radial	0.08	0.105	0.025
36	Vertical	0.10	0.130	0.030
37	Radial	0.12	0.155	0.035
37	Vertical	0.10	0.130	0.030
38	Radial	0.115	0.150	0.035
38	Vertical	0.10	0.130	0.030
39	Radial	0.115	0.150	0.035
39	Vertical	0.10	0.130	0.030

TABLE 10.1

Displacement Acceptance Criteria (Cont'd)

Gage ID	Measurement	Theoretical Displacement (inches)	Limiting Displacement (inches)	Tolerance (inches)
40	Radial	0.11	0.140	0.030
40	Vertical	0.10	0.130	0.030
41	Radial	0.11	0.140	0.030
41	Vertical	0.10	0.130	0.030
42	Radial	0.11	0.140	0.030
42	Vertical	0.10	0.130	0.030
43	Radial	0.090	0.120	0.030
43	Vertical	0.105	0.135	0.030
44	Radial	0.090	0.120	0.030
44	Vertical	0.105	0.135	0.030
45	Radial	0.095	0.125	0.030
45	Vertical	0.110	0.140	0.030
46	Radial	0.100	0.130	0.030
46	Vertical	0.11	0.140	0.030
47	Radial	0.105	0.135	0.030
47	Vertical	0.115	0.150	0.035
48	Radial	0.110	0.140	0.030
48	Vertical	0.120	0.155	0.035
128, 129, 130	Radial	0.040	0.055	0.015
128, 129, 130	Vertical	0.365	0.460	0.095
164, 165, 166	Vertical	0.900	1.130	0.230

11.0 EVALUATION OF DATA

11.1 DISPLACEMENT AND STRAIN DATA

Enclosure 1 contains computer printouts, sketches and data collected during the SIT. It also contains an explanation of the types of instruments used and their locations.

11.2 CONTAINMENT WALL DISPLACEMENTS

11.2.1 Vertical Displacements

Vertical displacements for the containment wall were measured at 3 azimuths, 90 degrees, 200 degrees and 334 degrees, at the ring girder, elevation 267'-6", (Enclosure 1, Appendix B, Figure 21 and Table 23). These displacements were regular with the difference between the readings at 63.3 psig being .021 inches. The displacements were less than the predicted displacement which was .215 inches with a limiting value of .275 inches. The actual values at 63.3 psig were .171 inches (at 90 degrees); .180 inches (at 200 degrees); and .192 inches (at 334 degrees). The residual deformations were small and when converted to equivalent stress values, the maximum was less than 50 psi.

11.2.2 Radial Displacements

Radial displacements for the containment wall were measured at 3 azimuths, 90 degrees, 200 degrees, and 334 degrees at 9 elevations (see Enclosure 1, Appendix B, Figure 21 and Table 24). Figures 9, 10, and 11 of Enclosure 1 show plots of these displacements at various pressure levels and Appendix B shows plots of individual gage points. These displacements are regular and in good agreement with each other and with the predicted values. Table 11.1 indicates the values of the displacement at 63.3 psig.

The major variation appears to be due to a greater resistance to rotation of the ring girder than was predicted. Although the structure at 270'-8" was predicted to move outward due to rotation, (the top of the cylinder moves in) it actually moved slightly inward. This would indicate that the ring girder is stiffer in relation to the dome than assumed in making the calculations. No adverse affect on either the dome, ring girder or cylinder can be attributed to this.

Radial displacements for each elevation were generally less than limiting values. Although some of the smaller displacements exceeded the limiting value, these were small in the absolute sense and no adverse effects can attributed to them.

11.3 CONTAINMENT WALL STRAINS

The strains for the containment wall were measured with gages attached to the liner (Enclosure 1, Appendix A, Figure 18 and Table 12) and to reinforcing bars in the area of the dome cylinder transition (Enclosure 1, Appendix A, Figure 13 and Tables 6 through 11). The strains around openings and penetrations will be discussed in later sections.

On Page 19 of Enclosure 1, under TEST RESULTS, some of the specific problems resulting from the long delay between gage placement and actual testing are discussed. Some of the gages appear to have excessive "shake down" values, that is gage adjustment during the initial loading from 0 to 63.3 psig. Although these readings were not excessive in most cases, the value for strain change for the "second loading", that is from 63.3 to 0 psig is considered more accurate and is used in most cases for comparisons.

11.3.1 Hoop Strains

Table 11.2 indicates the actual and predicted values of hoop strains in microinches per inch. When two gages exist for a point, the result closest to the predicted value is reported in these tables. Results indicate low strains which are reasonably consistent with the predicted values. The strains at the upper elevations reflect lower values which are consistent with deflection readings.

11.3.2 Meridional Strains

Table 11.3 presents values of meridional strains. As with the hoop strains, the meridional strains were small. In this case the actual rotational behavior of the ring girder is strongly registered in very large relative differences between predicted and measured values in the upper elevations. The negative strains which would have resulted from the inward rotation of the top of the ring girder are positive due to the relative outward rotation. No detrimental effects are attributed to this difference in expected and actual behavior.

11.3.3 Liner Strains

The strains for the liner in the hoop and meridional directions are reported as part of Section 11.3.1 and 11.3.2. The gages used to measure these strains were Rosette type and are described on page 23 of Enclosure 1. The values of recorded strain are found in Table 12 of Enclosure 1, Appendix A. Figure 20 of Appendix A illustrates how the Rosette readings are reduced to maximum, minimum and shear strains. These values are given in tabular form by gage number under LINER GAGES in Appendix A. Also included is the stress computed from these values. All the values computed are small with the exception

of gage 71 and this gages behavior would indicate at least one of its elements is malfunctioning. There is no indication of detrimental strains in the liner.

11.4 DOME DISPLACEMENTS AND STRAINS

11.4.1 Vertical Displacements

Vertical displacements for the dome were measured at the apex and at horizontal distances from the apex of approximately 29' (the fourth spray ring), 49' (elevation 270'-8") and 56' (elevation 267'-6"). The results of the measurements are given in Enclosure 1, Appendix B, Table 23. The predicted values which include the wall deformation are included in Table 10.1. Data for individual gage locations are plotted in Enclosure 1, Appendix B. The displacement data are uniform, close to predicted values and within the "LIMIT" shown in each figure. The residual displacements at the end of the SIT were less than 15% of the maximum reading which is within the expected performance for this type of structure.

11.4.2 Dome Strains

Additional gages were added to permit more complete evaluation of strains during the SIT. Enclosure 1 describes these gages and Figures 14 and 19 of Appendix A indicate plan and through thickness locations. Tables A and B of Appendix A provide a listing of the gage numbers at each location. Tables 13, 14 and 15 indicate the meridional strains at each location and Tables 16, 17 and 18 the hoop strains.

Because of the different type gages used; SR4 strain gages attached to reinforcing, AIL TECH concrete strain gages and Rosette gages attached to the liner, variations in the readings were expected. Table 11.4 compares the strains at the four through thickness locations with predicted values. The strains are low and although variable indicate a reasonable correlation with predicted values. No detrimental effects are indicated by any of the results.

In addition to measurements in the membrane direction, a series of radial bars were instrumented in order to confirm that little or no radial tension or deformation was taking place during the SIT. Tables 19 through 21 present radial strain results. The strains are too small to allow valid numerical comparisons. For example, a strain of 50 microinches per inch would correspond to less than 1500 psi stress in the radial reinforcing.

11.5 EQUIPMENT HATCH DISPLACEMENTS AND STRAINS

The displacements recorded at the equipment hatch are given in Enclosure 1, Appendix B, Tables 25 and 26, and are plotted on individual graphs in that Appendix. The locations of the measurement points are shown in Figure 23. The vertical displacements are all less than predicted. They tend to be more erratic than the radial gage readings during pressurization and depressurization although this may be due to the very small values being recorded. The radial displacements tend to follow the predicted slopes more closely with gages 38, 39, and 40 indicating slightly greater displacements than the limiting values set at 63.3 psig. However, the excess is slight and the instrument recovery was good with no indication of detrimental effects.

Strain results for the equipment hatch are presented in Enclosure 1, Appendix A, Tables 1 and 2. The meridional strains like the vertical displacements tend to be erratic. However, all values are quite small (maximum compression of 115 microinches per inch and a maximum tension of 100 microinches per inch). This would reflect a maximum steel stress of 3,400 psi.

11.6 PENETRATION STRAINS

The Rosette type strain gages were located on the metal liner at the main steam line penetration, the feedwater line penetration and at one spare penetration. Figures 15, 16, 17, and 18 indicate the location of the penetrations and the gages. Enclosure 1, Appendix A, Figure 20 illustrates how the gage readings were reduced to maximum, minimum, and shear strain values. This appendix also includes the strain values and their equivalent stresses for each of the penetrations. Several of the gages appear to have malfunctioning elements and did not record data which corresponded to the physical response of the structure. However, these gages (96, 98, 99, 100, 101, 102, 104, 105, 71, and 163) do not negate the results.

11.7 TENDON ANCHORAGES

No special instrumentation or surveillance of tendon anchorages was conducted during the test. Experience indicates that load cells installed under the button heads and strain gages placed on the bearing plates would not aid in the evaluation of the containment structure. This is due to the fact that the strains recorded would

be caused by the increase in tendon force resulting from the pressure loading. This increase amounts to only a small percentage of the total force in the tendon.

Visual inspection of the concrete at specified anchorage zones was accomplished prior to the start of the test, at each pressurization level and at the final zero. The results are reported in Appendix D on Data Sheet 6, TENDON ANCHORAGE OBSERVATION. No unusual cracking, bearing plate displacement or other unexpected occurrences were observed during the test.

11.8 CRACK PATTERNS

The results of the observation for cracking are shown in the crack pattern figures of Appendix D and confirm the original predictions.

The absence of stress cracking provides direct evidence that residual compression stress existed in this cylindrical shell at the peak pressure of 63.3 psig. The uniform nature of the cracks in the new dome cap at 63.3 psig, as well as the subsequent closing of these cracks with the removal of the pressure load indicate that the dome was responding elastically.

Existing shrinkage cracks were observed to enlarge slightly in width and length during the test. Some new hairline cracks did appear which were not initially observed. In all cases, crack patterns were random except in the dome cap. Crack widths were less than .01 inches at peak pressure in all areas except in the dome cap.

In addition to the inspections in white wash areas, other areas in reactor containment building were inspected for cracks during the test. This inspection included accessible areas of the containment such as the dome and the intersection of the buttress and cylinder.

TABLE 11.1

Radial Displacement @ Peak Pressure (63.3 psig)
(inches)

Elevation (feet)	Predicted Value Theoretical	Predicted Value Limiting	Observed Values 90°	Observed Values 200°	Observed Values 334°	Average Value
98	.01	.02	.031	.038	.036	.035*
108	.09	.115	.124	.106	.098	.109
140	.205	.260	.175	.244	.211	.210
172	.200	.255	.171	.205	.195	.190
204	.205	.260	.087	.138	.127	.117
236	.160	.205	.062	.114	.076	.084
246	.060	.080	-.042	.026	.039	.005
253	-.025	-.040	-.053	.011	-.007	-.016
267-6	-.055	-.070	-.114	-.071	-.081	-.088*
270-8	.040	.055	-.120	-.004	-.007	-.043*

*Value exceeds or varies in sign from predicted.

TABLE 11.2

Containment Wall Hoop Strains (63.3 psig)
(μ inches/inch)

Elevation (feet)	Predicted Value	Actual Difference 90°	200°	333°	Average
172	167	200	*	163	181
204	88	220	249	*	235
244	152	146	153	123	141
249	181	69	148	151	123
254	229	*	79	51	65
200	223	89	89	87	88
266	405	46	58	125	77
268	391	102	112	102	106

*Malfunctioning Gage.

TABLE 11.3

Containment Wall Meridional Strains (63.3 psig)
(μ inches/inch)

Elevation	Predicted Value	Actual Difference 90°	200°	333°	Average
172	252	143	73	50	88
204	258	59	109	167	109
244	106	*	84	120	102
249	28	15	48	103	55
255	-62	156	166	179	167
260	-79	118	192	148	153
266	-104	*	359	307	333
268	94	320	*	269	295

*Malfunctioning Gage

TABLE 11.4

Dome Strains (63.3 psig)
(μ inches/inch)

Location		Predicted Value	Actual Difference 75°	165°	255°	345°	Average
15' from apex	1 H	324	-	321	210	-	265
	M	313	-	205	182	-	199
	2 H	324	-	194	237	-	215
	M	317	-	236	294	-	265
	3 H	324	-	*	*	-	*
	M	320	-	*	137	-	137
	4 H	324	-	240	280	-	260
	M	343	-	*	253	-	253
30' from apex	1 H	492	431	-	-	420	426
	M	354	533	-	-	617	575
	2 H	461	483	-	-	606	545
	M	348	265	-	-	364	315
	3 H	431	*	-	-	*	*
	M	343	*	-	-	*	*
	4 H	231	227	-	-	170	199
	M	298	217	-	-	193	205
45' from apex	1 H	497	108	346	242	104	200
	M	220	200	144	255	414	253
	2 H	465	185	297	215	453	287
	M	199	78	136	236	158	152
	3 H	433	*	103	*	83	93
	M	178	*	*	*	*	*
	4 H	241	163	163	230	243	200
	M	48	57	280	40	167	131

*Malfunctioning Gage.

12.0 STRUCTURAL INTEGRITY TEST CONCLUSIONS

The summary of Enclosure 1, page 31 provides an excellent statement of the engineering conclusions of the test. These are as follows:

a. The overall response of the structure was well substantiated. The displacements observed were uniform between identical points on various azimuths. The displacements observed were within predicted values and were typical of displacements measured on other similar structures. The recovery observed was within limits one would normally expect for a structure of this type.

b. Cracking observed on the dome was slightly greater than would normally be expected in a prestressed dome but substantially less and of a smaller magnitude than could be expected in a reinforced dome. The crack widths (under 0.01 inches) were such that they did not substantially increase steel stresses in the dome. The fact that at atmospheric pressure the cracks closed indicated that the structure was still within the elastic range.

c. The strains recorded for the reinforcing steel were well within the elastic range of this material. This indicates that the structure could undergo more deformation before any significant signs of distress would appear.

It is concluded that the structural response of the Crystal River Unit 3 Nuclear Generating Plant reactor containment building was satisfactory during the SIT and demonstrates its capability to withstand postulated pressure loads.

ENCLOSURE 1

Wiss, Janney, Elstner and Associates

STRUCTURAL RESPONSE OF SECONDARY CONTAINMENT DURING STRUCTURAL INTEGRITY TEST AT CRYSTAL RIVER PLANT - UNIT 3

FOR

FLORIDA POWER CORPORATION

WJE NO. 71465

November 23, 1976

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EQUIPMENT HATCH RADIAL DISPLACEMENT	- LOCATION 46	- AZIMUTH 150	ELEV. 155'-0"	B-59
EQUIPMENT HATCH VERTICAL DISPLACEMENT	- LOCATION 46	- AZIMUTH 150	ELEV. 155'-0"	B-60
EQUIPMENT HATCH RADIAL DISPLACEMENT	- LOCATION 47	- AZIMUTH 150	ELEV. 159'-0"	B-61
EQUIPMENT HATCH VERTICAL DISPLACEMENT	- LOCATION 47	- AZIMUTH 150	ELEV. 159'-0"	B-62
EQUIPMENT HATCH RADIAL DISPLACEMENT	- LOCATION 48	- AZIMUTH 150	ELEV. 163'-0"	B-63
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Wiss, Janney, Elstner and Associates

STRUCTURAL RESPONSE OF SECONDARY CONTAINMENT

DURING STRUCTURAL INTEGRITY TEST AT

CRYSTAL RIVER PLANT - UNIT 3

FOR

FLORIDA POWER CORPORATION

November 23, 1976

SCOPE

The structural behavior study described hereunder was performed during the structural integrity test of the secondary containment vessel, Unit No. 3, Crystal River, Florida. Wiss, Janney, Elstner and Associates were retained by Florida Power Corporation to install the prescribed instrumentation, monitor the response of the instruments, conduct crack surveys prior to and during structural integrity testing, and to report on the results of this structural behavior study.

The location of test instrumentation was planned by Gilbert Associates, Incorporated. The work was performed in accordance with Gilbert Associates, Inc. Specifications No. SP5971 and No. SP-6488. All installation was performed or supervised by WJE personnel. That part of the work normal to their skills (routine installation of electrical lead wire, welding, etc.) was performed by site craft labor.

OBJECTIVES

The instrumentation was planned to serve two purposes. First, the satisfactory response of the structure to specific test pressures; second, confirmation of the criteria assumed in the structural design.

DESCRIPTION OF THE SECONDARY CONTAINMENT

The reactor building is a reinforced concrete structure composed of a cylindrical wall with a flat foundation mat and a shallow dome roof. The sidewalls rise 157 ft from the top of the base mat (Elev. 93'-0") to the springline of the dome (Elev. 250'-0"). The sidewalls are 3 ft 6 in. thick and the dome is 3 ft 0 in. thick. The cylinder walls are prestressed with a post-tensioning system in the vertical and horizontal directions.

Major discontinuities occur in the structure at the following locations:

A. At Azimuth 150°, thickened boss area around equipment hatch opening, Centerline Elevation 132 ft 0 in.

B. At Azimuth 323°, a thickened boss area around the personnel lock, Centerline Elevation 122 ft 7 in.

C. At electrical and pipe penetrations. These areas are not thickened.

The interior wall of the containment vessel is lined with a 3/8 in. thick steel plate, continuously welded to form an airtight seal.

The dome roof is prestressed utilizing a three-way post-tensioning system. A major portion of the concrete above the top layer of prestressing tendons is essentially a non-prestressed conventionally reinforced section. This section is connected to the prestressed dome portion by a series of radial anchors. The radial anchors are #6, Grade 60 reinforcing bars, hooked into the top portion of the concrete. The Reactor Building Cross Section is shown in Fig. 1.

TEST PROGRAM

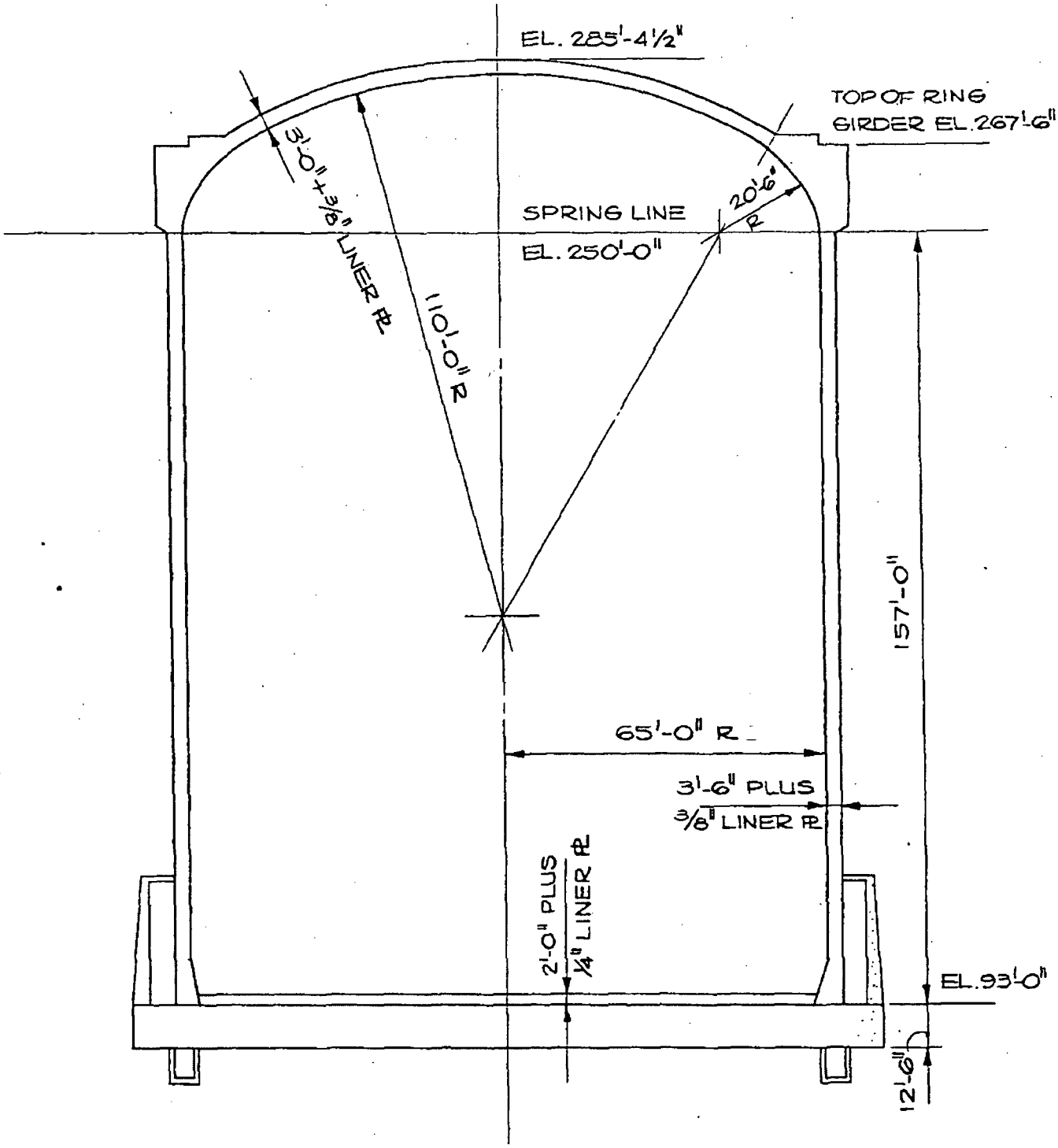
Test instrumentation was located to yield the following information:

1. Radial displacement of the wall from Elevation 98 ft 0 in. to Elevation 270 ft 0 in. on Azimuths 90°, 200° and 333° - 55'.

2. Vertical growth of the cylinder and dome displacements of the structure.

3. Radial and vertical displacements around the equipment hatch.

4. Hoop and Meridional strains in the reinforcing steel around the equipment hatch.



REACTOR BUILDING - CROSS SECTION

FIGURE 1

5. Hoop and Meridional strains in the reinforcing steel at the ring beam on Azimuths 90°, 200° and 333° - 55'.

6. Liner strains on the cylinder wall at Elevations 172 ft and 204 ft at Azimuths 90°, 200° and 333° - 55'.

7. Liner strains around the Main steam penetration, Feedwater penetration and Spare penetration.

8. Hoop and Meridional strains in reinforcing steel of the new dome concrete.

9. Strains in the radial anchor bars connecting in the new and old dome concrete.

10. Hoop and Meridional strains in the dome concrete below the prestressing tendons.

11. Hoop and Meridional strain on the liner plate of the dome.

12. Ambient temperatures at Elevations 267'-6", 194'-0" and 122'-0" on Azimuth 90° and at Elevations 267'-6", 172'-0", 122'-0" on Azimuth 200°.

13. Crack patterns at the following locations:

a) The discontinuity at the equipment hatch

b) On the cylinder wall near the base slab on Azimuth 270° at Elevation 93'-0"

c) On the cylinder wall, at Elevation 172'-0" on Azimuth 270°

d) On the ring beam and dome on Azimuth 200° 6 ft below the ring beam and continuing to the apex of the dome.

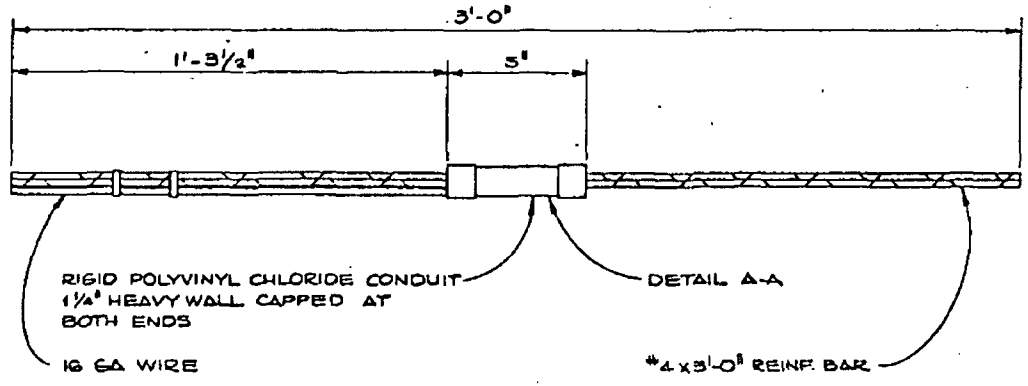
e) Both ends of the twenty-one surveillance tendons.

In addition to the instrumentation above, a continuous visual inspection of the entire structure was made to monitor major cracking which might occur.

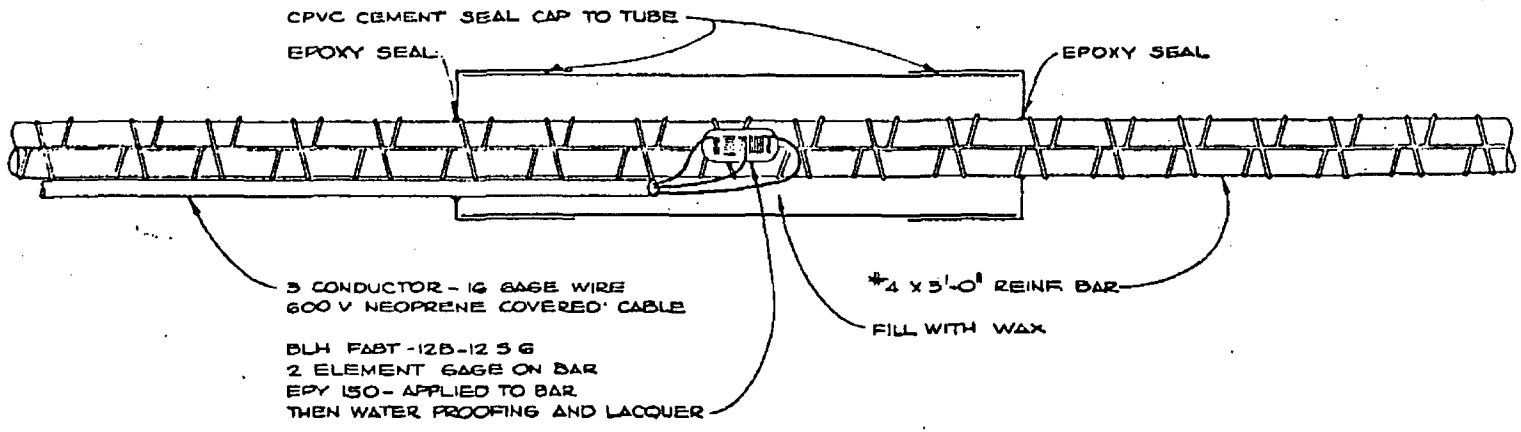
All whitewashed areas were protected from the elements with Visqueen tents.

STRAIN GAGE INSTRUMENTATION

Strain information was obtained by mounting electrical resistance strain gages directly to the main reinforcing or to sister bars which were subsequently installed at the proper locations. Electrical resistance strain gages mounted on reinforcing bars or sister bars were



REINFORCING BAR STRAIN GAGE ASSEMBLY- DUMMY



DETAIL A-A

FIGURE 2

two-element (temperature-compensating) SR4, encapsulated gages. The following types were used

1. SR4-BLH Type FABT-28-12S6
2. SR4-MM Type EA-06-125-TA-120

Sister bars were fabricated using 3 ft sections of #4 reinforcing bar. The strain gages were attached to the bar using BLH-EPY150 epoxy. After the lead wires were attached, the installation received a layer of silicone lacquer and two overlays of epoxy. The entire installation was then encased in rigid polyvinyl chloride conduit, which was subsequently filled with wax. (Fig. 2)

To verify the adequacy of each assembly, each instrumented bar was continuously submerged in water for a minimum of 48 hours. After soaking the resistance to ground was checked. Any installation showing a resistance to ground of less than 1000 megohms was deemed to be defective and was not used in the structure. The sister bar assemblies discussed above were fabricated at the laboratories of WJE and shipped to the site for incorporation in the structure.

Installation of the fabricated units consisted of wiring the "gaged" bar to the appropriate reinforcing bar in the structure. The lead wires were then run to the exterior wall where they were terminated in a junction box.

Strain gages were applied directly to the main reinforcing steel at Locations 35 through 69. (A sister bar was also used at each location. The term sister bar and dummy bar are interchangeable terms). The field installation of these gages consisted of attaching the strain

gage with EPY 150, attaching the lead wires, coating the installation with silicone lacquer and finishing with two coats of epoxy.

Strain gages attached to the steel liner were SR4 -Type FABR-50-12S9 three-element rosettes. Liner gages were attached with EPY 150. The gages were then waterproofed as described previously.

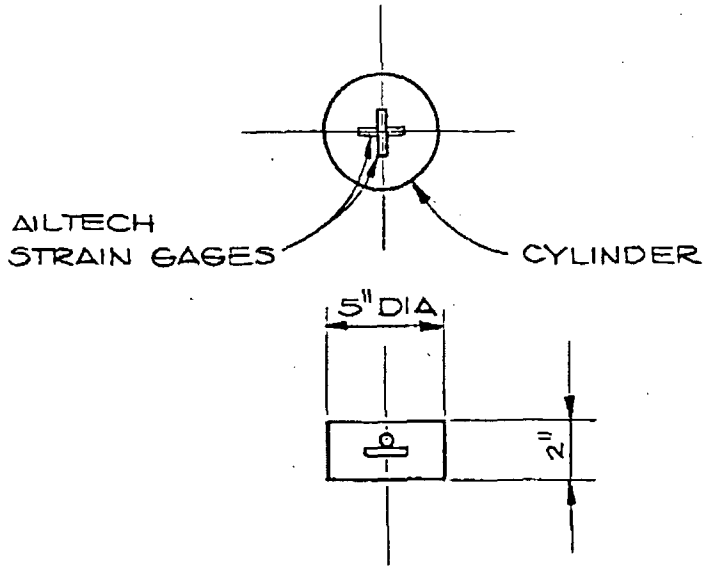
Concrete strains in the lower portion of the dome were monitored with concrete embedment gages. The gages used were Model CG129 manufactured by AIL TECH, Inc. The gages were cast in 5 in. by 2 in. waffers at the WJE labroatory. Because these gages were to be installed prior to removal of the top concrete, it was deemed practical to provide a package that needed only to be grouted in the proper location. The gage system was sent to the field where it was installed in a 6 in. core hole, which had been drilled at the proper locations. (See Fig. 3).

DISPLACEMENT INSTRUMENTATION

Radial displacements from Elevation 98 to 270'-8" and all vertical measurements (except equipment hatch verticals) were obtained using invar wire extensometers.

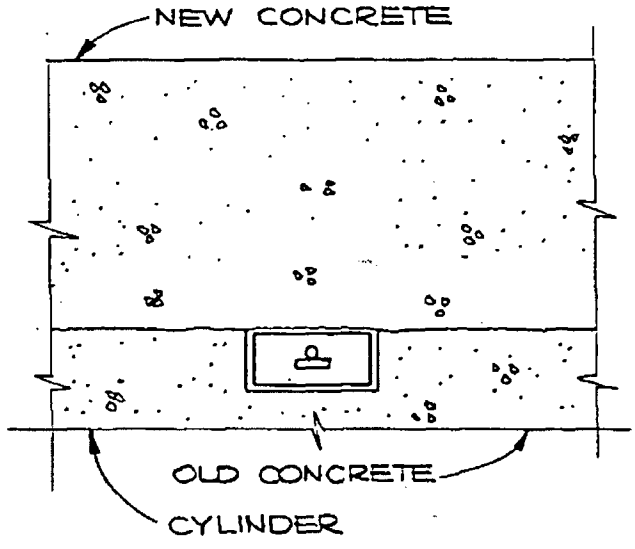
The invar wire extensometers were located entirely within the structure, and were connected to an external power supply and readout equipment by electrical leads which extended through penetrations in the cylinder wall.

Each installation consisted of a extensometer and a invar wire spanning the distance to be measured. One end (the "dead" end) was fixed to the steel liner, and the "live" end of the wire was attached



TYPICAL WAFFER INSTALLATION

GAGES 133, 137, 141, 145, 150, 154, 158, 162



TYPICAL INSTALLATION FOR CONCRETE GAGES AT DOME

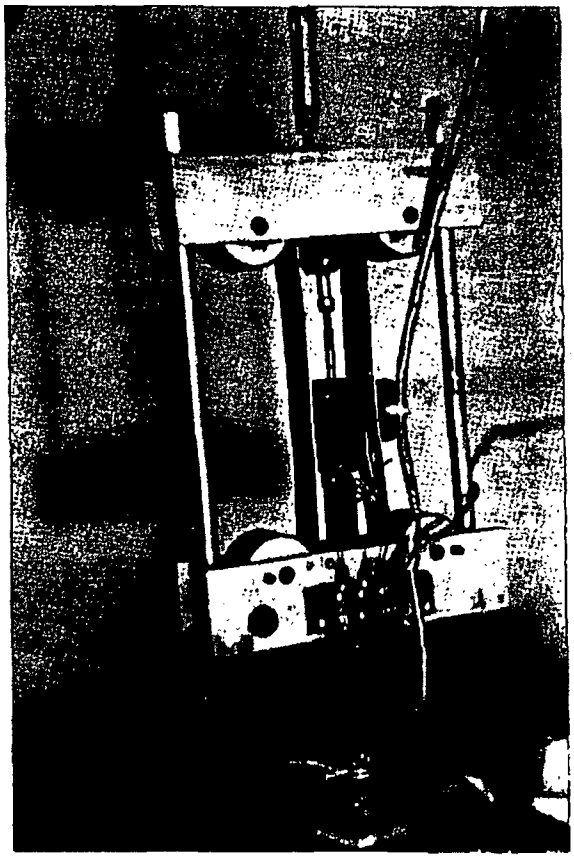
FIGURE 3

to a spring-loaded frame which was attached to rigid supports or interior walls in the direction of measurement. Deformations of the structure were measured with a linear potentiometer mounted in each frame. (The spring and potentiometer arrangement is shown in Fig. 4). The potentiometers are of the infinite resolution type with a total resistance of about 2000 ohms. A constant voltage of 1.5615 volts was applied to each potentiometer. At each measurement, voltage is measured between the movable contact point and one end of the resistor. The voltage changes are recorded on the external readout system.

Radial measurements above Elevation 172'-0" were made by bringing the invar wire diagonally down from the point of measurement to a fixed point on the operating floor. Additional vertical measurements were made at these same locations. The true radial movement was then calculated using the diagonal radial growth and the vertical movement at each location.

Prior to shipment to the field, all the frames were calibrated in our laboratory. In addition all instruments were calibrated in place. The field calibration provided verification that each unit was accurrate to $\pm$ 0.005 inches.

Vertical measurements at the equipment hatch were made using spring-loaded linear potentiometers. The potentiometers were mounted on a rigid frame in close proximity to the containment wall. The potentiometer plunger rested on clip angles welded to the containment liner. Field calibration of these units was performed as previously described.



INVAR WIRE EXTENSOMETER

FIGURE 4

TEMPERATURE INSTRUMENTATION

Temperatures of the containment wall were measured at six locations using Leeds and Northrup Company Type J, #14 AWG Iron-Constantine wire. The temperatures were monitored using a Leeds and Northrup Speedomax Model J-6000 strip chart recorder.

DATA ACQUISITION SYSTEM

A computer based automatic data acquisition system was set up to obtain and process all the strain and deformation measurements during the test. The test station was located just outside the personnel lock and all results were made available to GAI engineers present at the test site.

The data acquisition system consisted of a Vidar Autodata Eight data logger interfaced with a Hewlett-Packard HP 9830 desk computer. The system is shown schematically in Fig. 5. The Vidar Autodata Eight is a microprocessor-controlled system used to read raw analog data from input transducers and transform it into digital form. The system included three Vidar Scanners equipped to handle up to 800 input channels. The Autodata Eight is connected to the HP 9830 computer via EIA Standard RS-232-C Serial interface. The HP 9830 is a stand-alone desk computer with 15808 bytes of Read/Write memory. The computer output is printed on a thermal printer at the rate of 250 lines per minute. The computer was set up to scan at the rate of one channel per second. The data was stored on a magnetic tape cassette for permanent record and further processing.

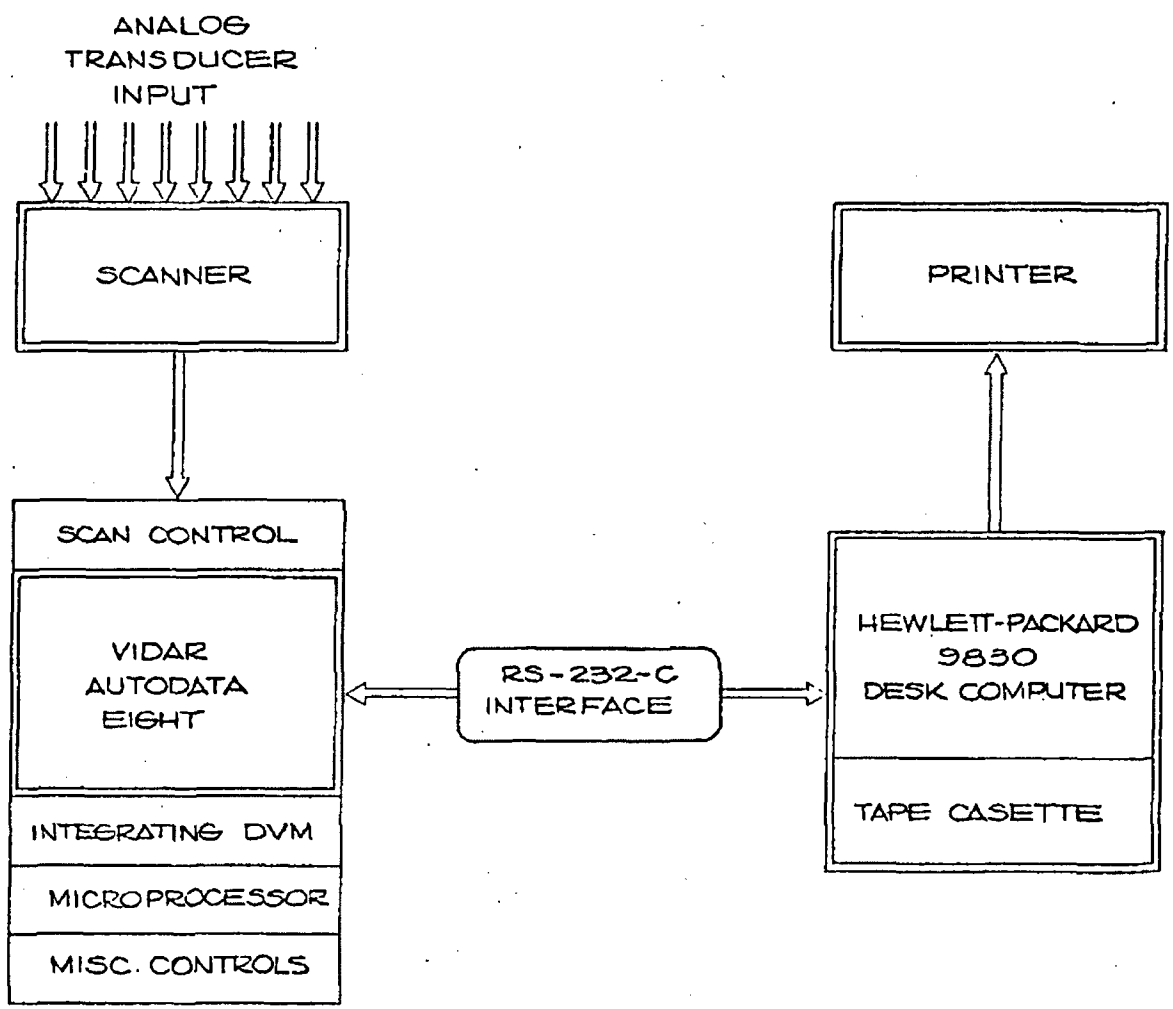
All data acquisition functions were initiated and controlled from the HP 9830 computer. The data was recorded for 489 input channels. At any pressure level the operator was required only to key in the current pressure and execute the start command. The computer was programmed to initiate the scan and check each channel for overload and store all the voltage readings along with pressure, time of scan on the tape cassette. After all the data was collected, the program would compute the incremental strains or deformations for each gage using the original "zero" pressure reading and the necessary calibration factors. The results were printed in a page format and were submitted to GAI engineers. The data acquisition system would read 489 channels, process the data and print it in proper format in approximately 20 minutes. A sample output of the results is shown in Appendix E.

The reliability and accuracy of the acquired data were checked, where applicable, using a resistor calibration box. The calibrator incorporates a precision resistor of known magnitude which, when switched into the system, produces a known voltage change. Any significant deviation from the theoretical voltage change would indicate a malfunction in the system.

The data acquisition system is shown in Fig. 6.

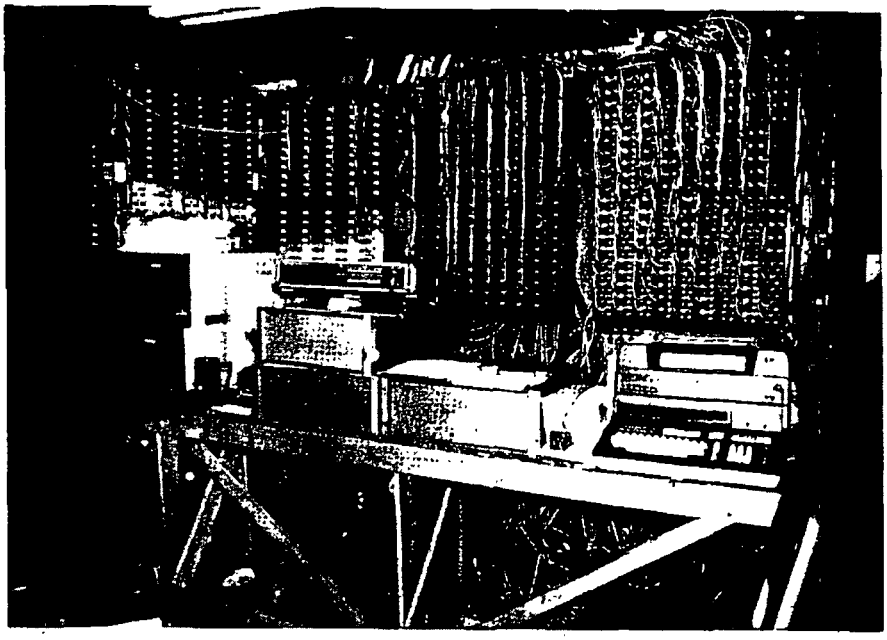
CRACK INSPECTION

Prior to the structural integrity test, the entire structure was surveyed for cracks. The survey was made from scaffolding, roof tops



DATA ACQUISITION SYSTEM

FIGURE 5



DATA ACQUISITION ROOM

FIGURE 6

and accessible walkways. Crack widths observed during the pressure test were measured using a 6X comparator.

Visual observations of the total exterior surface were made at designated pressures during the test (35, 45, 55, 63.3 psig).

The following tendon anchors were inspected for concrete crack development at the same pressure levels as above:

D 121	12V20	13H10
D 140	23V15	13H19
D 203	34V6	13H37
D 215	45V3	51H30
D 324	56V1	51H41
D 339		53H17
		53H32
		53H47
		62H11
		64H21

Both shop and field buttonheaded ends were checked. The inspection of the tendon ends was made from sky climbers, skip box and platforms positioned at the proper locations.

Fig. 7A and B shows, respectively, a typical platform for dome tendon inspection and the dome with its protective cover over the crack inspection area.

STRUCTURAL INTEGRITY TEST

The structural integrity test was performed prior to the integrated leak rate test. Complete sets of data, were made at five pressure increments during the loading cycle and at four pressure increments during depressurization (i.e., 12, 35, 45, 55, 63.3 55, 45, 35, 12 psig) and finally at return to atmospheric pressure. Detailed

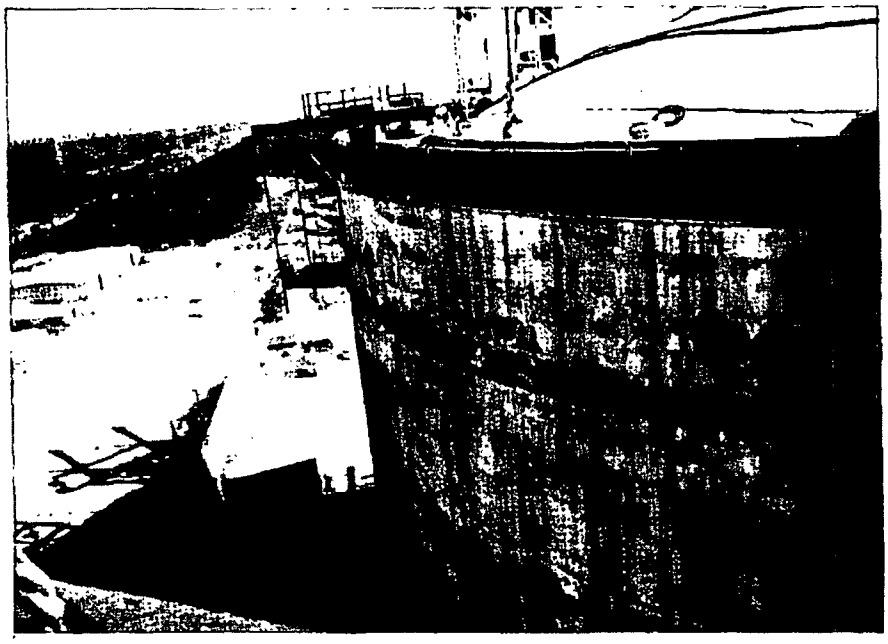


FIGURE 7a

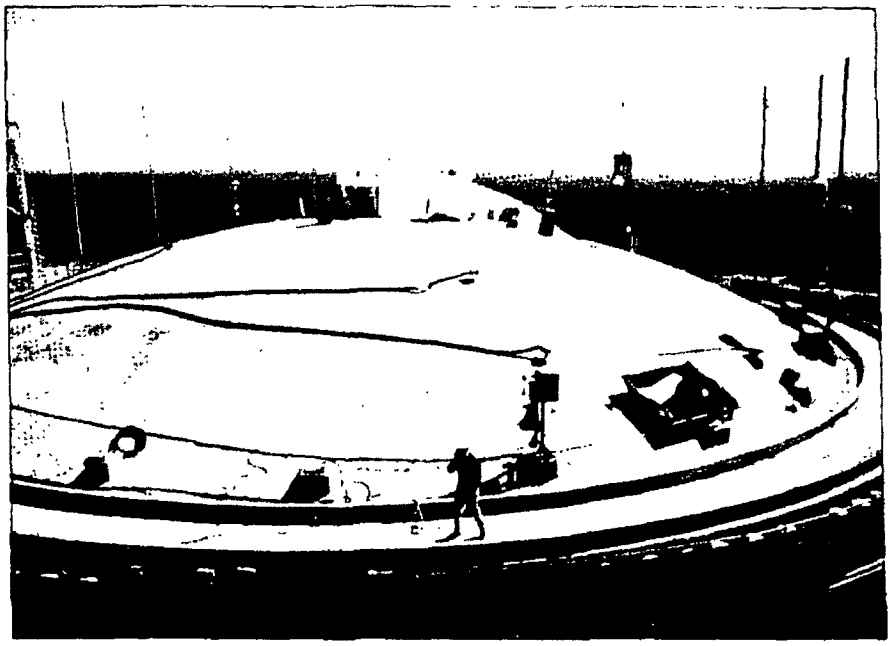


FIGURE 7b

crack inspections were made during pressurization at 35, 45, 25, 63.3 psig and at atmospheric pressure.

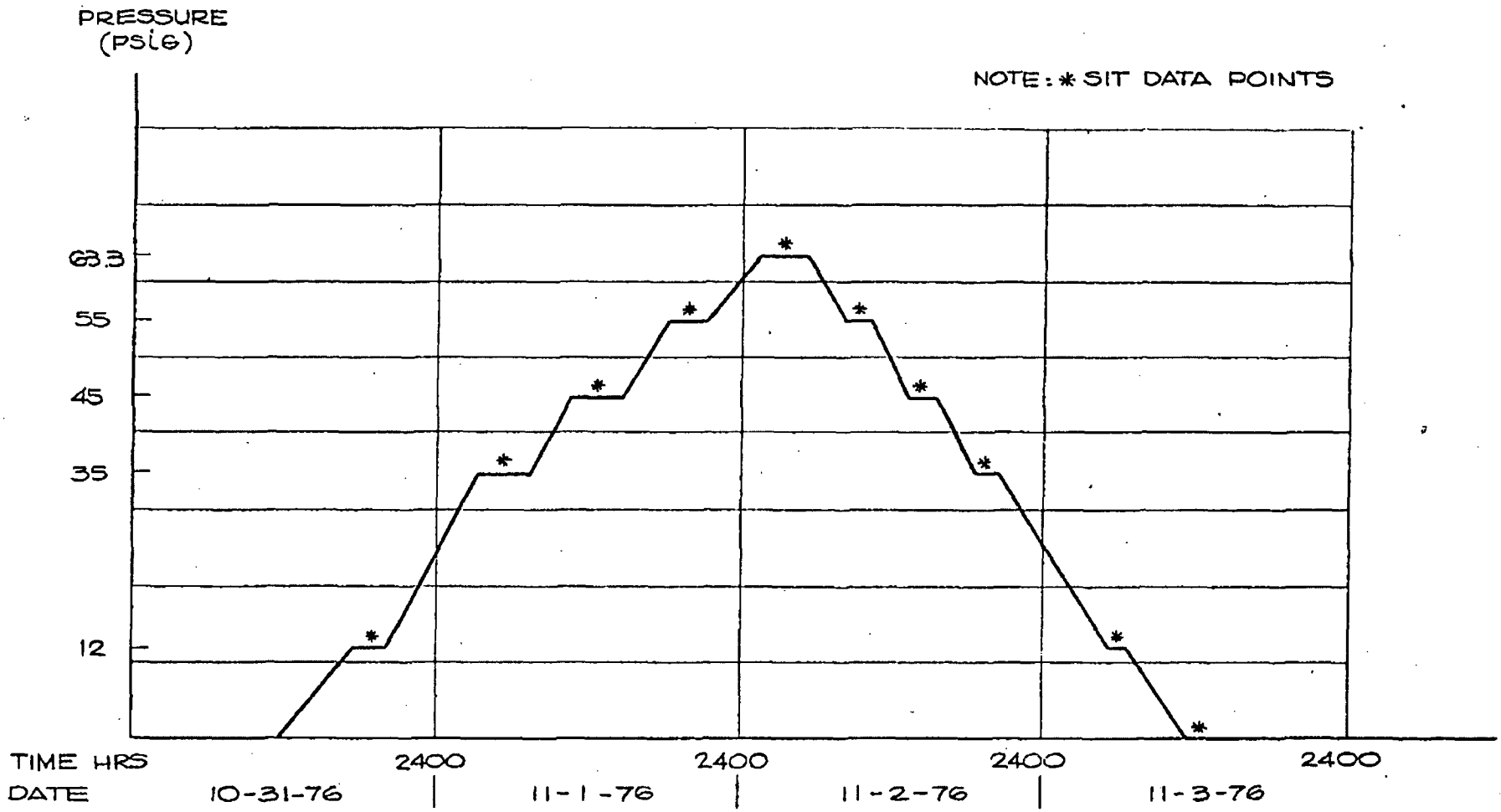
During pressurization and depressurization all data points were read and printed out every 5 psi. The data was obtained "on the run" (pressurization was not stopped). These intermediate readings allowed GAI engineers to monitor the structural response throughout the test. At those designated test points i.e., 35, 45 etc., pressurization (or depressurization) was stopped and the structure was allowed to stabilize for one hour. Readings and crack inspections were not started until this one hour stabilization period had passed. (Additional readings were obtained immediately upon reaching each plateau). All readings were reduced and submitted to Gilbert Associate engineers for their review before proceeding to the next pressure level. Only those readings obtained at designated hold points have been incorporated in the tabulated data.

The structural integrity test started on October 31, 1976 at 1103 hours and officially ended on November 3, 1976 at 1208 hours. A time-pressure curve is presented in Fig. 8.

TEST RESULTS

Stresses In Reinforcing Steel

Two-element strain gages were mounted directly on the main steel and on redundant sister bars at the same location. This procedure was used for all locations around the equipment hatch and ring girder (Gage Nos. 35 through 69). The gage locations are shown on Figs.12 and 13 in Appendix A.



PRESSURE VERSUS TIME, STRUCTURAL INTEGRITY TEST

FIGURE 8

Hoop and meridional steel strains in the repaired portion of the dome were monitored using two independent sister bars, at each location, wired to the main steel. The typical gage locations are shown in Fig. 14 Appendix A. Table A, Appendix A identifies the gages.

Strains in the radial anchors were measured using field installed strain gages on each bar. Redundancy for each anchor was obtained by instrumenting the next closest anchor, i.e., Location L20N17 the parent bar, Gage No. 171 and Location L 21N18 is redundant. The typical gage locations are shown in Fig. 14 of Appendix A. Identification of the gage numbers is shown in Table A and B of Appendix A.

A total of 220 gages were installed on reinforcing bars. (This number represents 110 measuring points). The following gages exhibited excessive drift and instability, and have been excluded from this report.

41M*	49M	65M	59H
42M	56M	65M*	61H
45M	57M	66M	62H
47M	58M	67H	63H
35H	59M	67H*	64H
36H	62M	69M	65H
38H	63M	69M*	68H
45H	64M	55H	69H
			69H

*Redundant Gages

The exclusion of these gages in no way negates the results obtained from the remaining gages. Due to the redundancy of the gages, a complete response picture was obtained.

The total number of gages listed above exhibit a mortality rate in excess of what would normally be expected on an installation of this type. A number of circumstances are believed to be contributing factors

in this mortality rate. The original SIT was scheduled for mid April. At this time all gages already installed were terminated with temporary wiring to the data acquisition center. In checking the gages at this time it was found that five years after the original installation only ten (10) were suspect. Approximately four days prior to the test date problems in the dome were discovered. Between May and October major repairs were made to the dome. Although every possible precaution was taken to protect wiring, damage did occur, due to the extent of the repair. It is the writer's opinion that the high loss of gages can be attributed to moisture reaching the gages through breaks or burns in the lead wire. It is also the writer's opinion that the losses which were observed were well below those which could have been expected under these conditions.

Steel strains measured throughout the structure were low, 200 microinches or less. Maximum strains observed in the repaired portion of the dome was 794 microinches, with the majority of strain 500 microinches or less.

At completion of the test a review was made of gages showing inconsistencies with other gages in certain groups. It was suspected that Gages 131H, 152H, 157M, 157H, 149M and 149H had been wired wrong causing a sign reversal. This sign reversal has been corrected in this report. It was also suspected that Gage 144M had been interchanged with Gage 143M and that Gage 144H had been interchanged with Gage 143H*. These gages have been interchanged for this report.

Stresses In Liner Plate

Strain gages were located around the main steam penetration, feedwater penetration and a spare penetration. The location of these gages are shown in Figs. 15, 16 and 17 in Appendix A. Additional gages were located on the cylinder wall at Azimuths 90°, 200°, and 333° - 55' at Elevations 172 ft and 204 ft. Fig. 18 shows the location of these gages.

Liner strains were measured at locations corresponding to measurements made on the main reinforcing steel in the dome.Typical locations of these installations are shown in Fig. 14 of Appendix A. Table A of Appendix A, lists actual gage numbers and locations.

Where applicable, the strain data obtained from each element of the rosette have been reduced to determine the principal stresses at each gage location. A Modulus of Elasticity of 29 x 10^6 was used in the calculations. Fig. 20 indicates the key to the direction of the major and minor principal stresses and maximum and minimum shears as related to the vertical and horizontal direction of the rosette. All these stresses are shown in Appendix A.

The maximum principal stresses found in the liner plate appear reasonable. In most cases, the orientation was found to be close to the hoop disection.

During the course of the test, single elements of rosettes 93, 97, 103, 106 and 107 exhibited unstable readings. These gages have therefore not been included in the rosette reduction program. Rosette No. 92 exhibited a false reading at 55 psi on depressurization, subsequently, this reading has been eliminated from the program.

Stresses In Concrete

Hoop and meridional strains were monitored in that portion of the original concrete not removed during the repair of the dome. The locations correspond to measurements made on the main steel. Fig. 19 in Appendix A, show the location of these gages.

Gages 133, 137M, 141M, 145M and 150M showed excessive drift and have not been included in the tabulated data. In general, the concrete strains were low, 137 microstrain being the maximum observed. Most of the concrete strains were less than 100 microstrain at peak pressure.

The data for these gages are presented in Tables 14 through 19 in Appendix A.

RADIAL DISPLACEMENT OF CYLINDER WALL

Radial displacements of the cylinder wall were measured with invar wire extensometers at Azimuths 90°, 200° and 335°. At each Azimuth, instruments were at elevations shown on Fig. 21 of Appendix B. Table 24 of Appendix B provides the deflections observed during the test. The individual deflection plots are also presented in Appendix B. Radial displacements of the cylinder wall have been plotted for each Azimuth. Figs. 9, 10 and 11 show the radial displacement of each wall for the pressure cycle only.

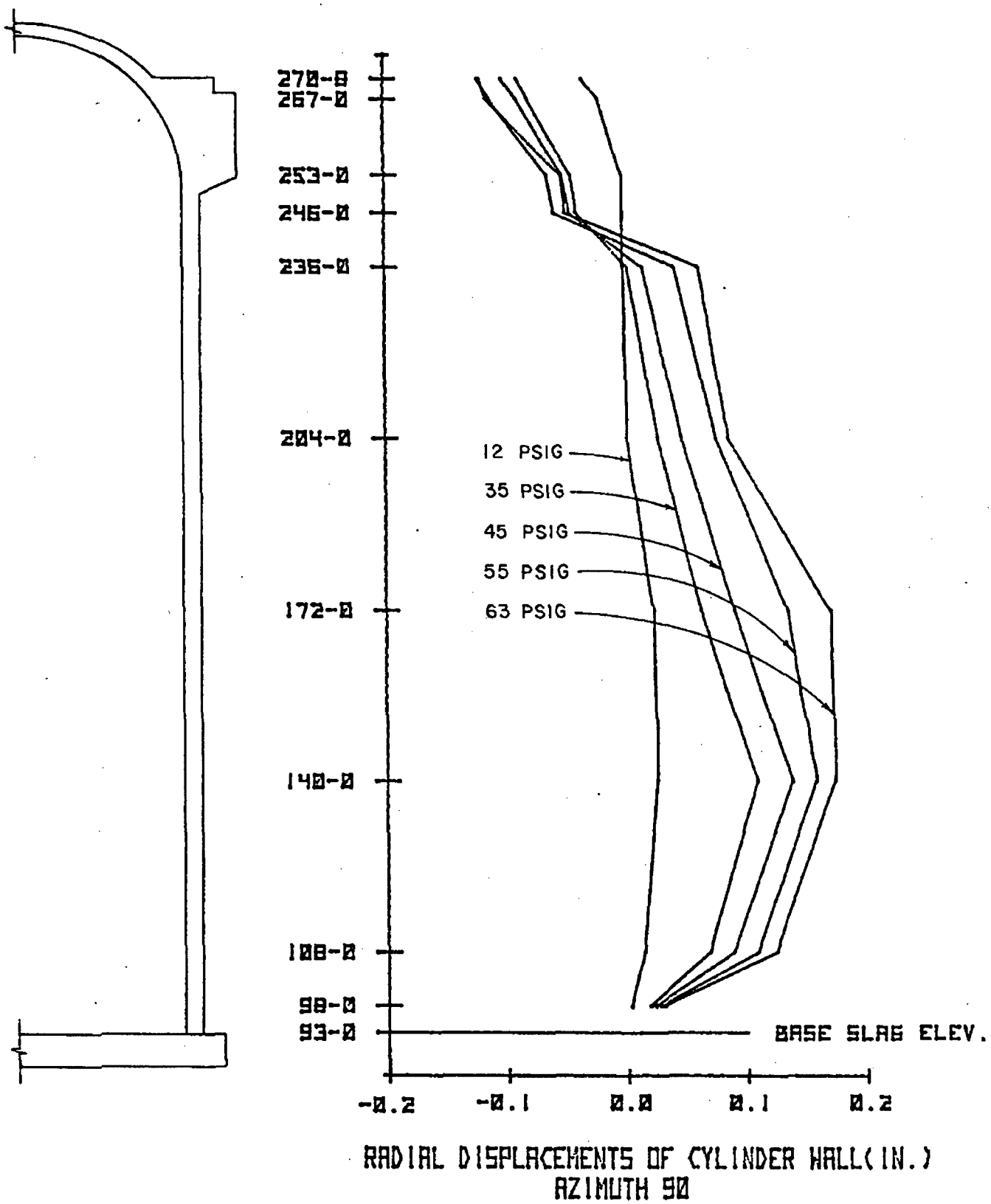

270-0
267-0
253-0
246-0
236-0
204-0
172-0
140-0
108-0
98-0
93-0
12 PSIG
35 PSIG
45 PSIG
55 PSIG
63 PSIG
BASE SLAB ELEV.
-0.2
-0.1
0.0
0.1
0.2
RADIAL DISPLACEMENTS OF CYLINDER WALL(IN.)
AZIMUTH 90

FIGURE 9

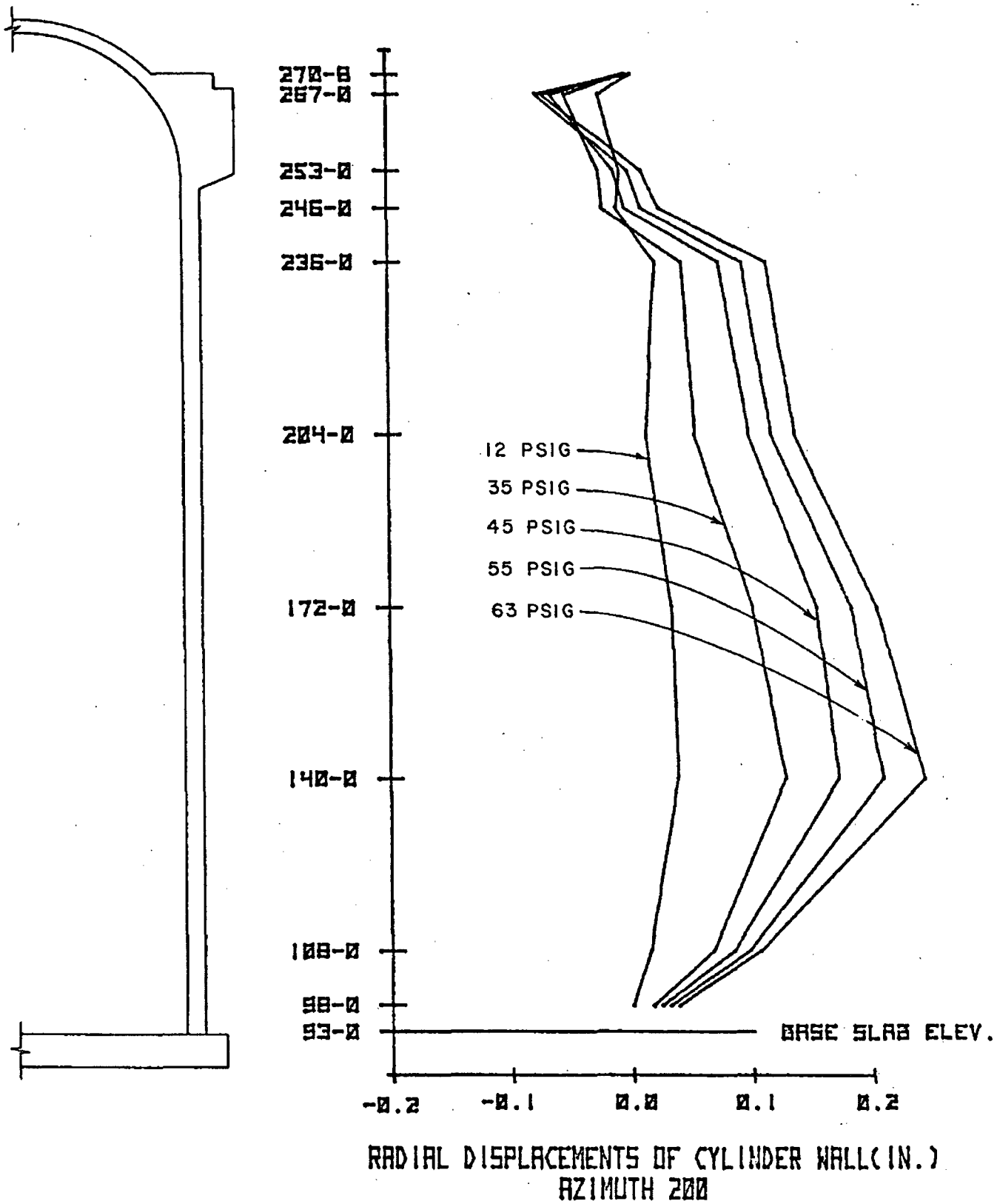

270-0
267-0
253-0
246-0
236-0
204-0
172-0
140-0
108-0
98-0
93-0
12 PSIG
35 PSIG
45 PSIG
55 PSIG
63 PSIG
BASE SLAB ELEV.
-0.2
-0.1
0.0
0.1
0.2
RADIAL DISPLACEMENTS OF CYLINDER WALL(IN.)
AZIMUTH 200

FIGURE 10

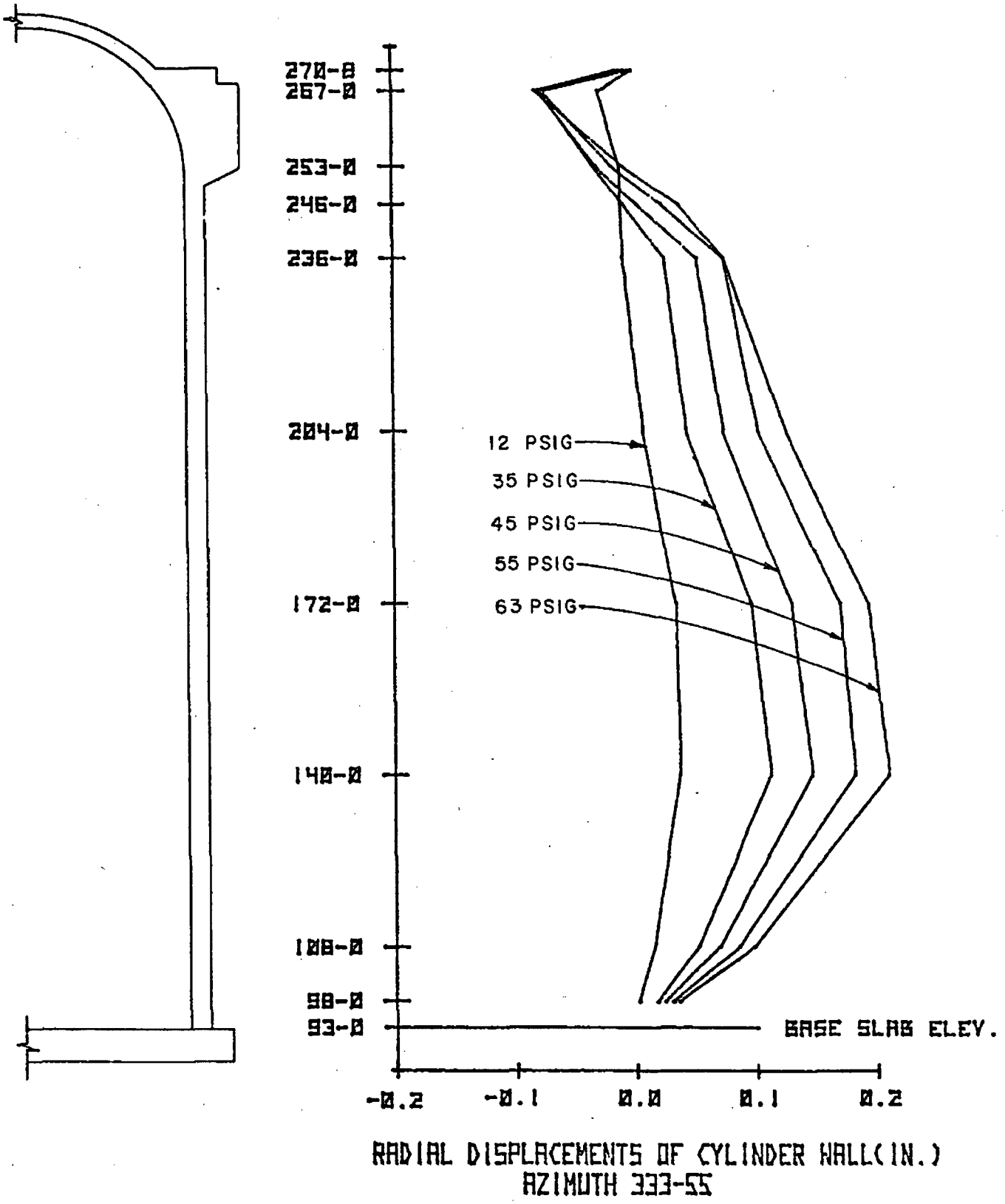

270-0
267-0
253-0
246-0
236-0
204-0
172-0
140-0
108-0
98-0
93-0
12 PSIG
35 PSIG
45 PSIG
55 PSIG
63 PSIG
BASE SLAB ELEV.
-0.2
-0.1
0.0
0.1
0.2
RADIAL DISPLACEMENTS OF CYLINDER WALL(IN.)
AZIMUTH 333-55

FIGURE 11

CYLINDER GROWTH AND DOME DISPLACEMENTS

The vertical growth of the cylinder was measured relative to the base slab on three Azimuth, i.e., 90°, 200° and 333°. The displacement of the apex of the dome was measured relative to the operating floor. Fig. 22 of Appendix B shows the location of vertical measurements.

Vertical growth of the dome, observed, was between 80% and 83% of the predicted displacements at all locations. The instantaneous recovery, measured after a one hour hold at zero pressure, was 85% or better for all points. Additional recovery could be expected if readings could have been obtained at a later time.

The test data has been tabulated in Table 23 of Appendix B and deflection plots have also been included in Appendix B.

EQUIPMENT HATCH DISPLACEMENTS

The vertical and radial growth around the equipment hatch were measured at the locations shown in Fig. 23 of Appendix B. Gage 43V was inspected after the test and found to have been reverse mounted, causing a sign reversal. This sign reversal has been corrected in this report.

Radial and vertical deflections measured around the equipment hatch were small and in the range normally expected for this region.

The displacements have been tabulated and are shown on Tables 25 and 26 in Appendix B. The deflection plots corresponding to this data is also presented in Appendix B.

TEMPERATURE RESULTS

Thermocouples were installed at locations shown in Fig. 24 of Appendix C. Table 1 of Appendix C provides actual temperatures recorded during the test. The temperatures were normal during the test with daylight temperature ranging between 75° and 80°, and evening temperature ranging between 50° and 65°.

CRACK PATTERNS

The total structure was surveyed prior to the structural integrity test to reveal cracking which existed. The structure was again surveyed at each pressure level during the test to determine any major cracking which may have occurred. The following areas were whitewashed for detailed crack survey:

1. The discontinuity at the equipment hatch.
2. On the cylinder wall near the base slab on Azimuth 270° Elevation 93'-0".
3. On the cylinder wall at Azimuth 240°, Elevation 172'-0".
4. On the ring beam and dome, a 6 ft wide band starting six feet below the ring beam and continuing to the apex of the dome.
5. Both ends of the twenty-one surveilance tendons. (These were not whitewashed).

Pretest Survey

The pretest survey revealed only minor shrinkage cracks. These cracks were under 0.005 inches in width and were located primarily in

thickened section of the structure, i.e., bossed areas and buttresses. The repaired dome showed no visible cracks. The feathered edge in the repaired concrete interface with the old concrete was visible but no cracking could be seen.

The tendon anchorages were generally free of cracks. Cracks which were observed, were less than 0.005 inches with the exception of D203F which showed that the construction joint was open more than 0.01 inches.

DEVELOPMENT OF CRACKS DURING TEST

The cylinder walls remained relatively free of cracks during the test. The inspection area at Elevation 172 did not develop any cracks during the test. The equipment hatch area developed a hairline crack at 63.3 psig which closed completely upon returning to atmospere.

The area at the base slab and cylinder wall intersection developed cracking at 45 psig and had a well defined crack by 63.3 psig. The width of the cracks were all less than 0.005 inches in width. All the cracks observed at 63.3 psig closed upon return to atmospheric pressure.

No cracking was detected in the ring beam and wall junction, the ring beam proper or the first 14 ft of the dome during the test. Initial cracking of the dome was observed at 35 psig and appeared as meridional cracks on approximately 24 in. centers. At the 45 psig inspection additional meridional cracking had occurred and radial cracks were beginning to form. At 63.3 psig a well defined system

of cracks was observed. Meridional crack had a spacing of about 18 inches and radial crack spacing was about 24 inches. The majority of cracks observed were measured as hairline, less than 0.005 inches in width. Isolated cracks were observed that exceeded 0.01 inches for extremely short lengths. One crack on the dome, was observed to be 0.015 inches in width over a 16 in. length. Upon return to zero the cracks had closed and could not be seen.

Appendix D contains detailed crack drawing of the areas inspected.

Tendon anchorage in general performed well. The inspection sheets have been included in Appendix D.

SUMMARY

Interpretation of the data in light of design concepts is not within the scope of this report. However, we feel that a comparison of the response of this structure with the performance of numerous reinforced and prestressed concrete structure which we have observed under many types of test loading justifies the following general commentary regarding the behavior of this structure under the application of the test loading.

1) The overall response of the structure was well substantiated. The displacements observed were uniform between identical points on various Azimuths. The displacements observed were within predicted values and were typical of displacements measured on other similar structures. The recovery observed

1) Continued

was within limits one would normally expect for a structure of this type.

2) Cracking observed on the dome was slightly greater than would normally be expected in a prestressed dome but substantially less and of a smaller magnitude than could be expected in a reinforced dome. The crack widths (under 0.01 inches) were such that they did not substantially increase steel stresses in the dome. The fact that at atmospheric pressure the cracks closed indicated that the structure was still within the elastic range.

3) The strains recorded for the reinforcing steel were well within the elastic range of this material. This indicates that the structure could undergo more deformation before any significant signs of distress would appear.

Respectfully submitted,

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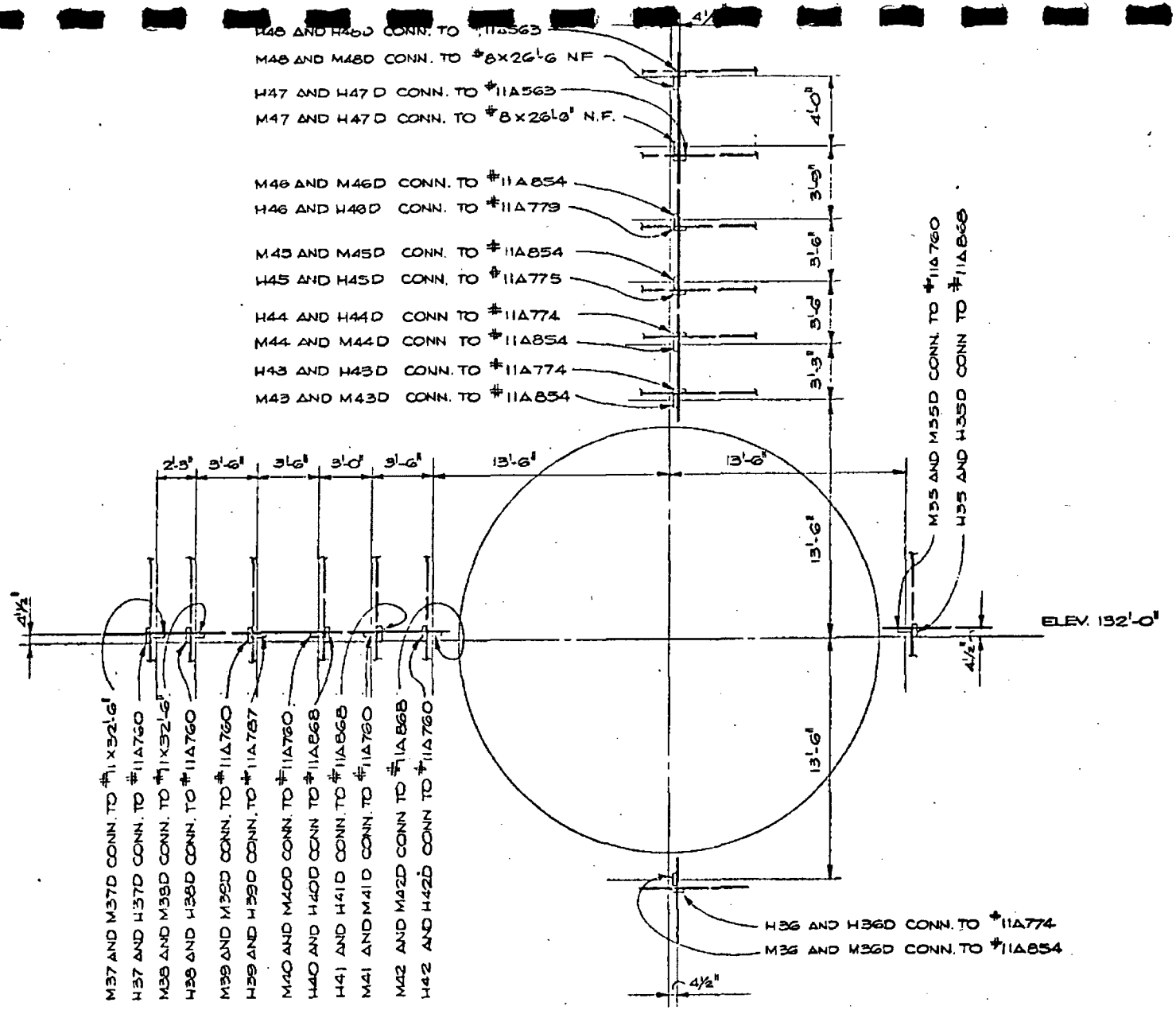
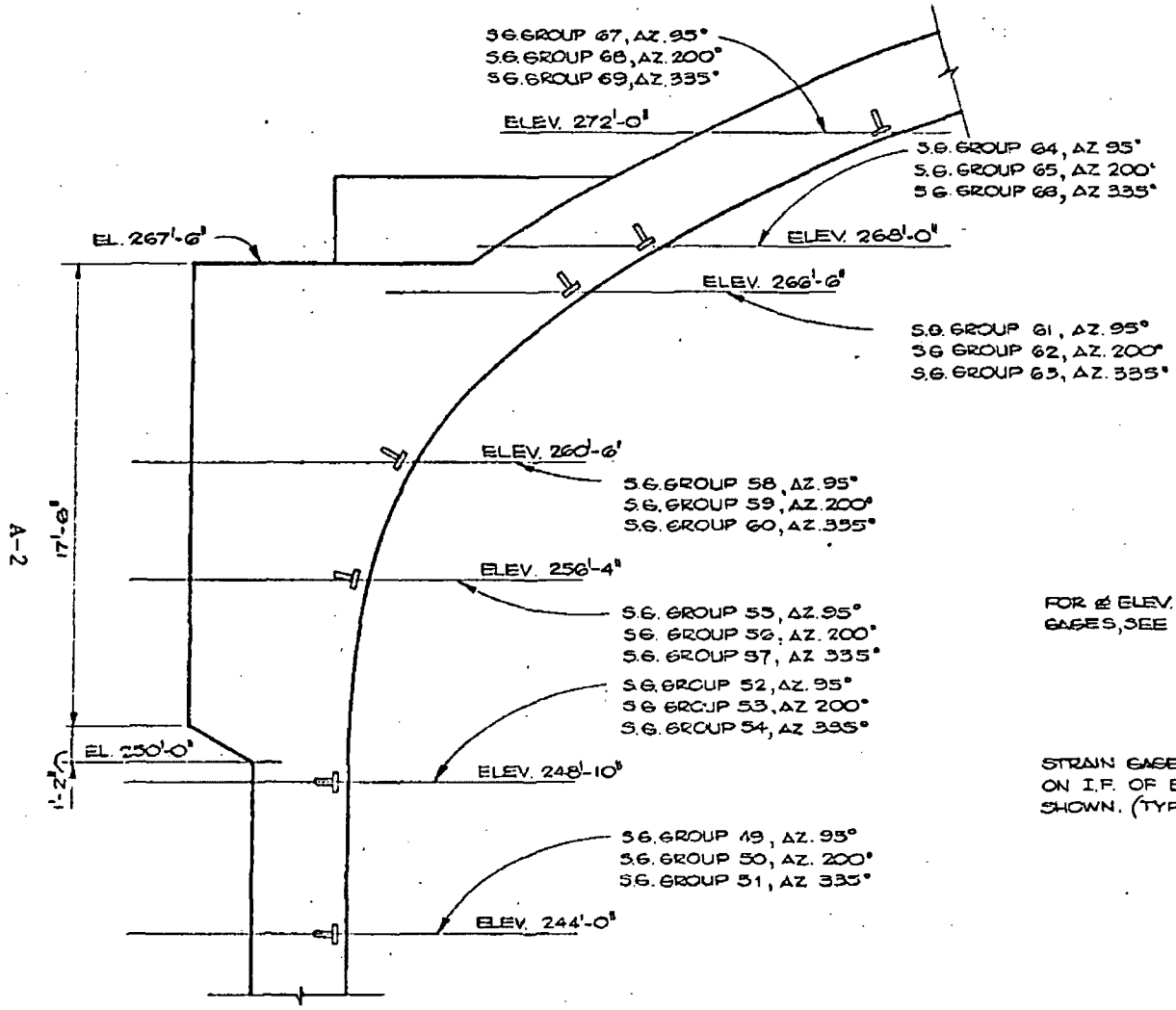
APPENDIX A

STRAIN DATA



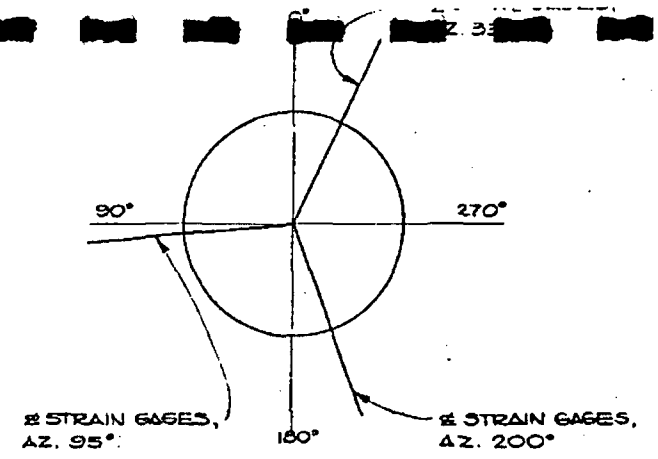
EQUIPMENT ACCESS OPENING
STRAIN GAGE REINFORCING BAR LOCATION

FIGURE 12

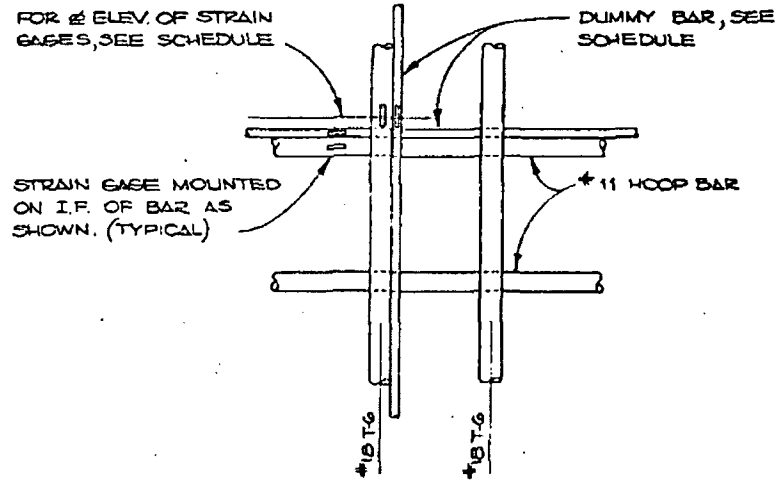


STRAIN GAGE (S.G.) GROUP LOCATIONS

SEE LOCATION SCHEDULE FOR EACH STRAIN GAGE



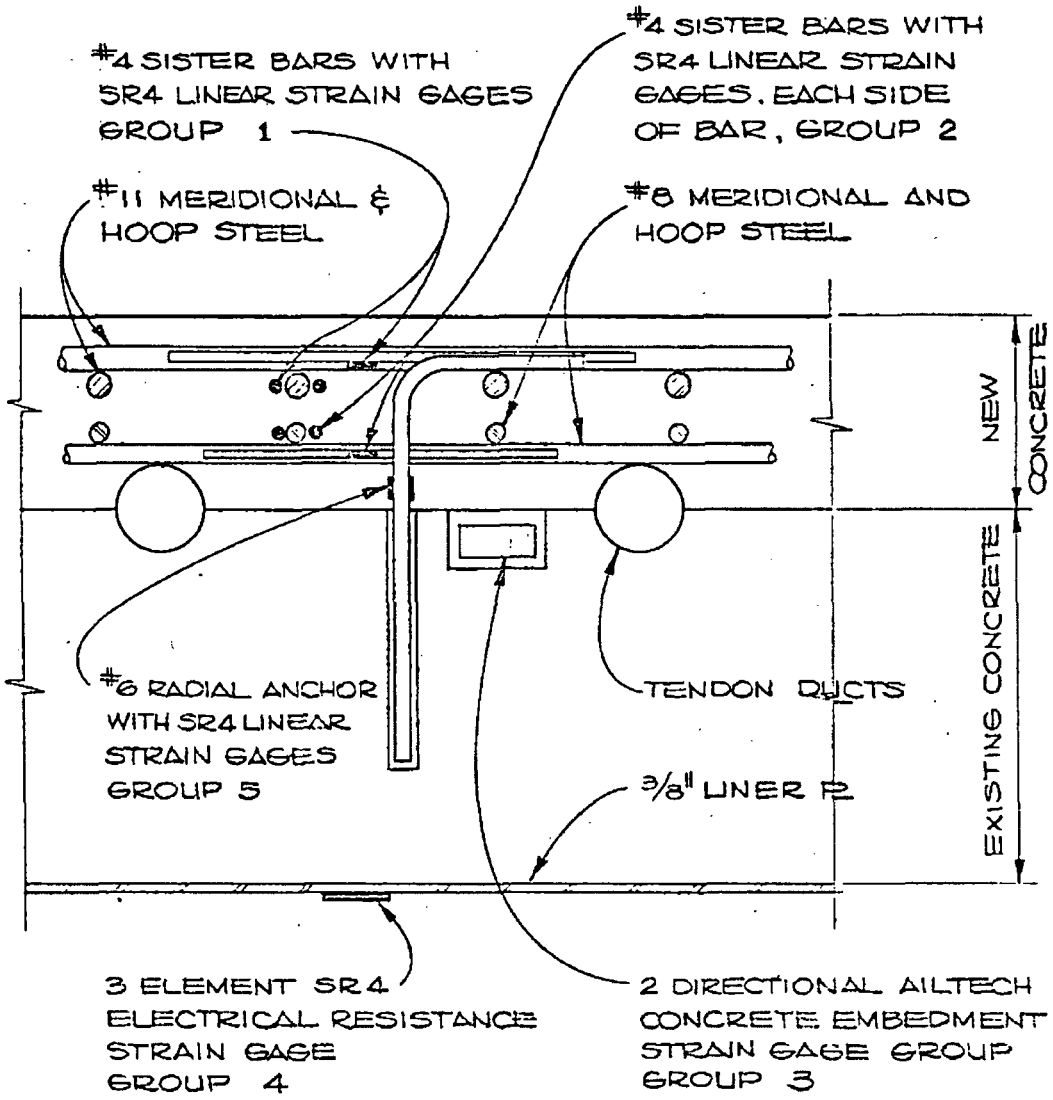
STRAIN GAGE LOCATION PLAN



STRAIN GAGE MOUNTING DETAIL

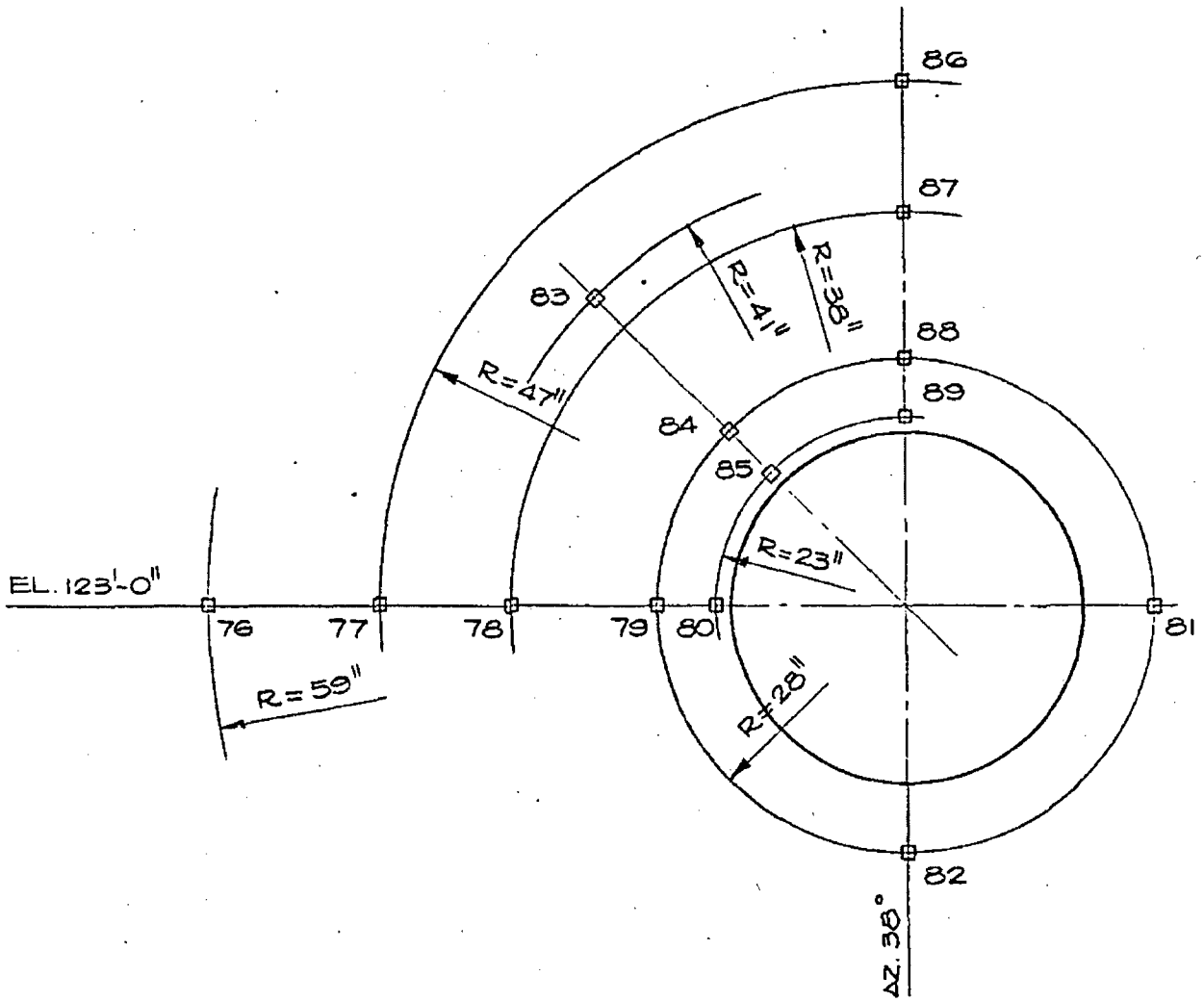
(TYPICAL)

FIGURE 13



TYPICAL SECTION AT INSTRUMENTATION LOCATION

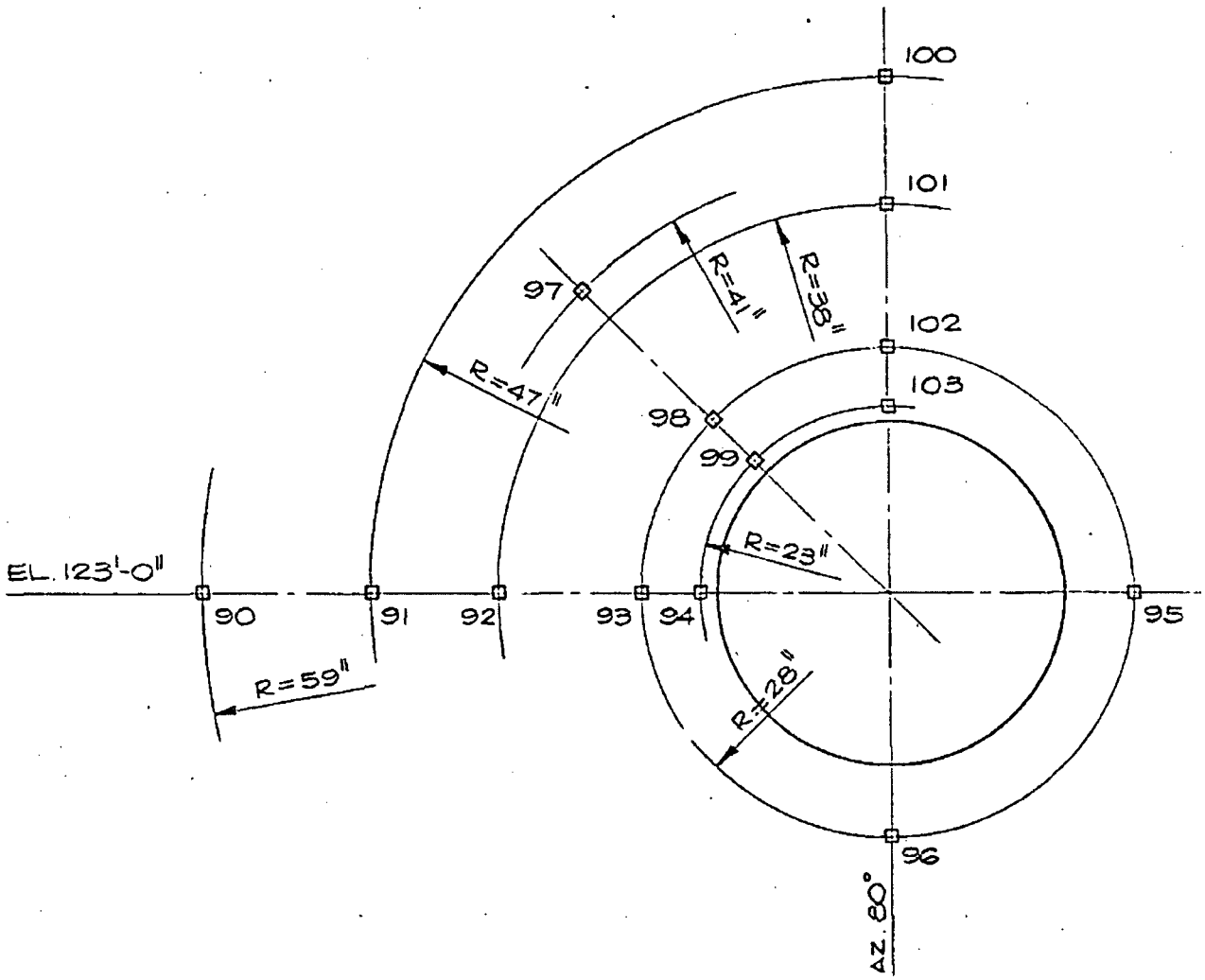
FIGURE 14



ROSETTE GAGE LOCATION

INTERIOR FACE, MAIN STEAM PENETRATION

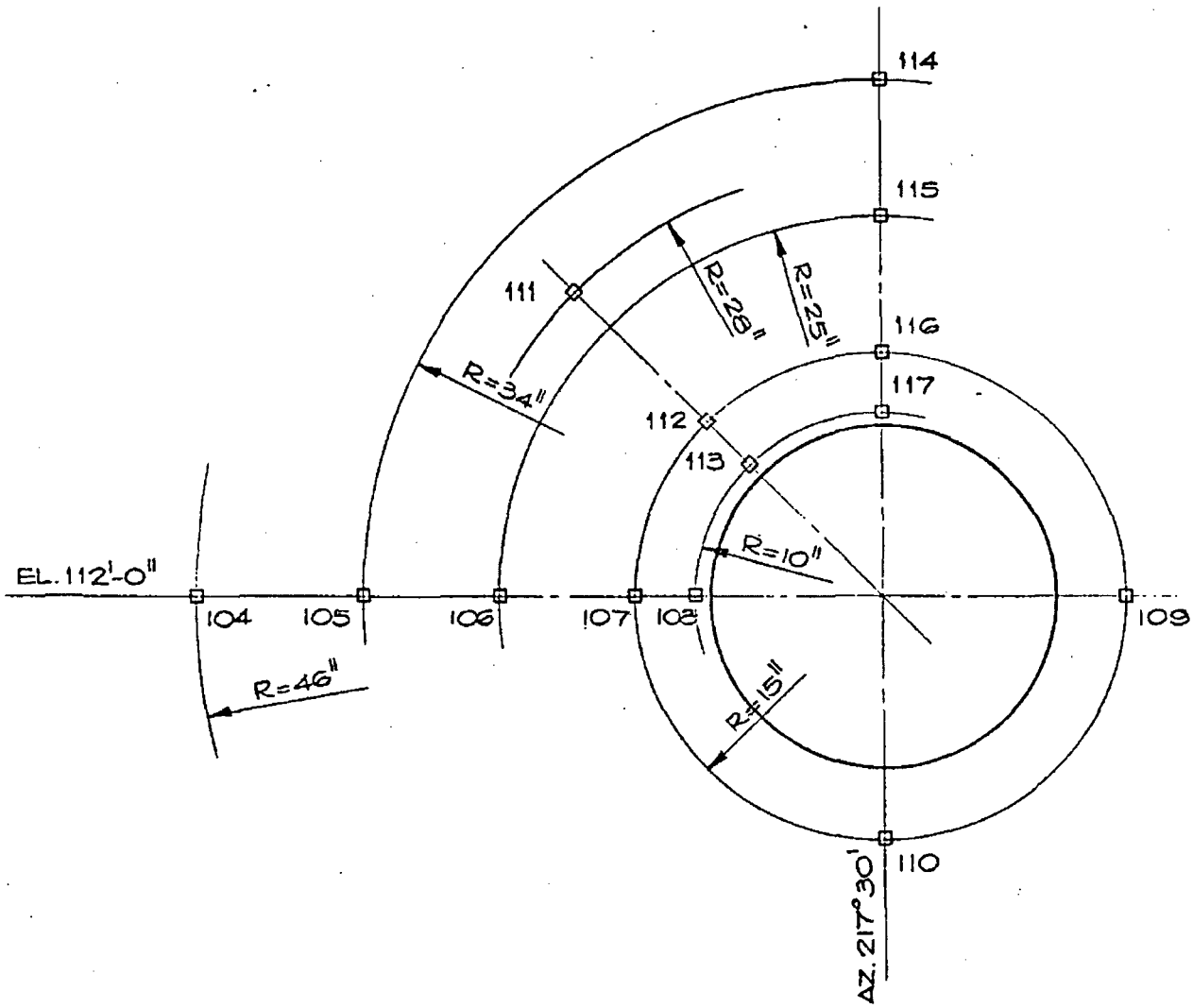
FIGURE 15



ROSETTE GAGE LOCATION

INTERIOR FACE, FEEDWATER PENETRATION

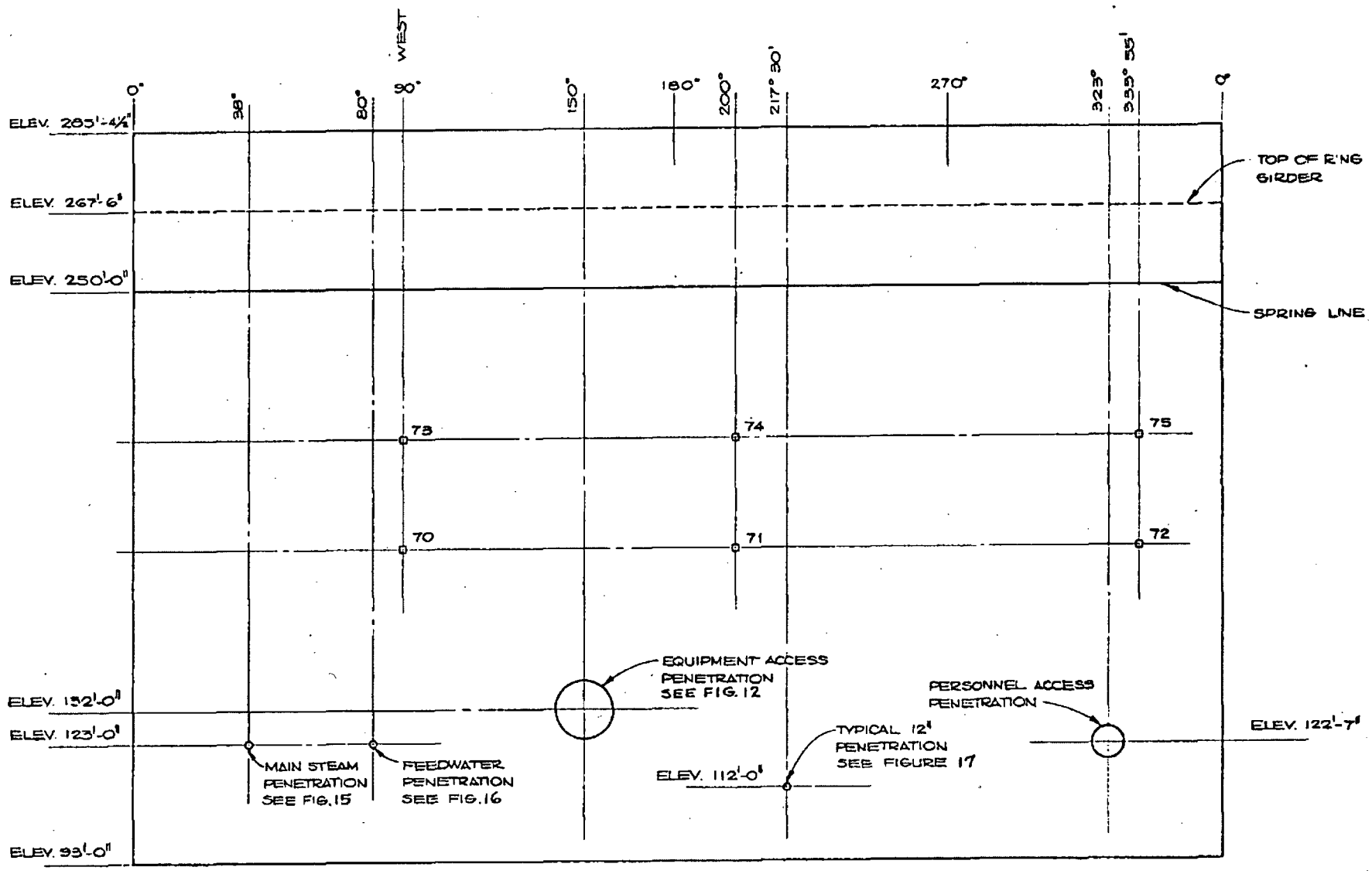
FIGURE 16



ROSETTE GAGE LOCATION

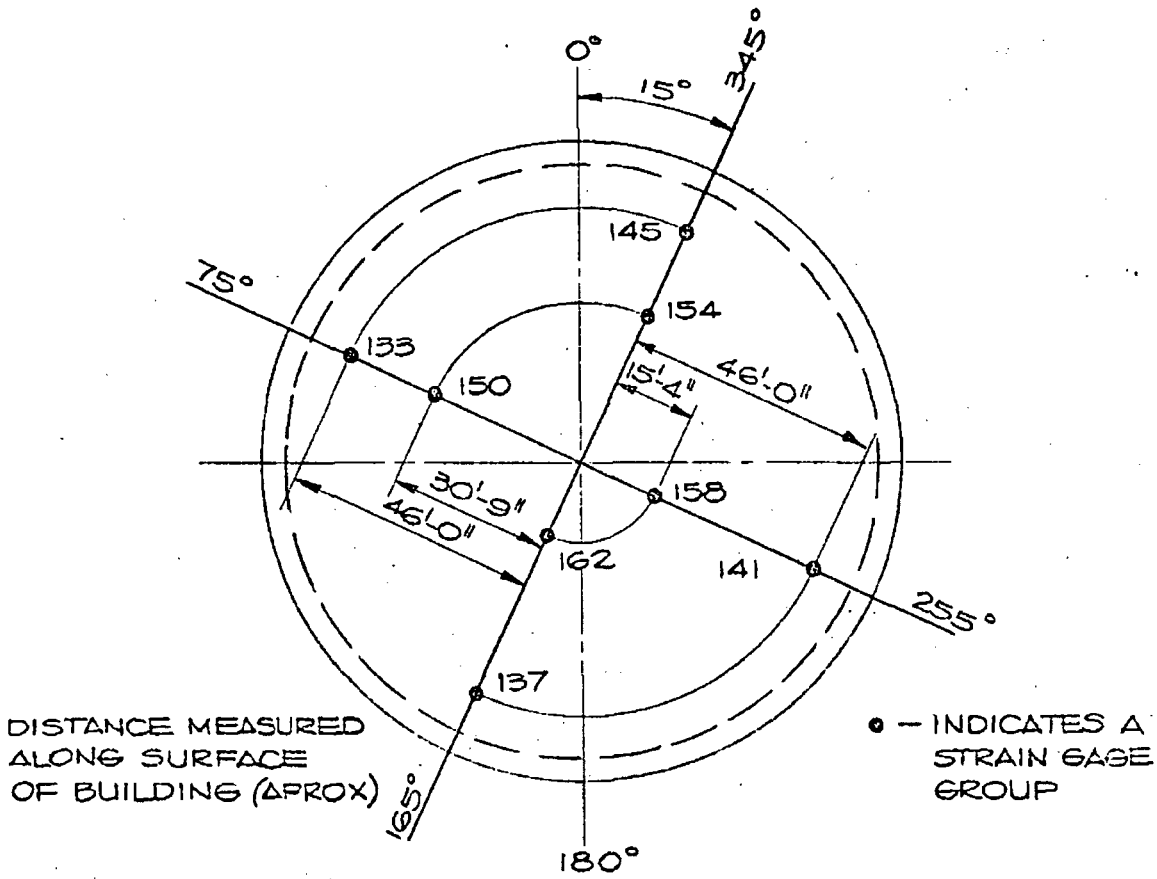
SPARE PENETRATION, INTERIOR FACE

FIGURE 17



ROSETTE LOCATIONS ON WALL

FIGURE 18



CONCRETE GAGE LOCATIONS
AT DOME

FIGURE 19

TABLE A

DOME STRAIN INSTRUMENTATION

Gage No.	Radius Ft	Azimuth Deg.	Group	Notes
131	45	75	1	Hoop & merid. reinforcing strain
132			2	Hoop & merid. reinforcing strain
133			3	Hoop & merid. conc. strain
134			4	Hoop & merid. liner strain
167			5	Radial anchor strain
135	45	165	1	Hoop & merid reinforcing strain
136			2	Hoop & merid. reinforcing strain
137			3	Hoop & merid. conc. strain
138			4	Hoop & merid. liner strain
169			5	Radial anchor strain
139	45	255	1	Hoop & merid. reinforcing strain
140			2	Hoop & merid. reinforcing strain
141			3	Hoop & merid. conc. strain
142			4	Hoop & merid. liner strain
168			5	Radial anchor strain
143	45	345	1	Hoop & merid. reinforcing strain
144			2	Hoop & merid. reinforcing strain
145			3	Hoop & merid. conc. strain
146			4	Hoop & merid. liner strain
170			5	Radial anchor strain
148	30	75	1	Hoop & merid. reinforcing strain
419			2	Hoop & merid. reinforcing strain
150			3	Hoop & merid. concrete strain
151			4	Hoop & merid. liner strain
171			5	Radial anchor strain
152	30	345	1	Hoop & merid. reinforcing strain
153			2	Hoop & merid. reinforcing strain
154			3	Hoop & merid. concrete strain
155			4	Hoop & merid. liner strain
172			5	Radial anchor strain
156	15	255	1	Hoop & merid. reinforcing strain
157			2	Hoop & merid. reinforcing strain
158			3	Hoop & merid. concrete strain
159			4	Hoop & merid. liner strain
173			5	Radial anchr strain
160	15	165	1	Hoop & merid. reinforcing strain
161			2	Hoop & merid. reinforcing strain
162			3	Hoop & merid. conc. strain
163			4	Hoop & merid. liner strain
174			5	Radial anchor strain

TABLE B

INSTRUMENTED RADIAL ANCHOR LOCATIONS

Gage No.	Bar No.	Radius Ft	Azimuth Deg.
167	L30N15	45	75
167*	L31N16	45	75
169	L8S4	45	165
169*	L6S4	45	165
168	R30S16	45	255
168*	R32S17	45	255
170	R8N3	45	345
170*	R10N3	45	345
171	L20N17	30	75
171*	L21N18	30	75
172	R6N9	30	345
172*	R4N9	30	345
173	R11S19	15	255
173*	R12S19	15	255
174	L3S15	15	165
174*	L1S15	15	165

TABLE 1

EQUIPMENT HATCH MERIDIONAL STRAINS (MICROIN./IN.)

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
35M	0	8	82	-31	531	572	541	-74	167	-72	-159
35M*	0	-3	49	54	118	154	141	41	64	5	-33
36M	0	-3	13	5	41	46	41	-3	21	3	-8
36M*	0	-10	-3	44	-136	-141	-126	51	-36	41	59
42M*	0	3	33	97	-105	-92	-90	95	-13	49	54
43M	0	-3	15	0	74	90	87	0	36	-3	-15
43M*	0	15	21	23	56	77	79	23	23	23	28
43M	0	-3	15	0	74	90	87	0	36	-3	-15
43M*	0	15	21	23	56	77	79	23	23	23	28
44M	0	-44	-13	26	-169	-149	-133	10	-197	3	-5
44M*	0	-18	-13	21	-146	-149	-136	28	-44	28	49
45M*	0	-13	3	-3	28	49	54	-23	5	-8	-13
46M	0	-33	-23	26	-103	-133	-85	-21	-49	-15	-5
46M*	0	-28	8	-8	-26	8	18	-31	-10	5	-8
47M*	0	-23	36	23	74	118	115	-10	31	-5	-33
48M	0	13	33	5	138	156	141	-5	46	-8	-33
48M*	0	-41	5	41	-179	-156	-141	28	-49	28	36
42M*	0	3	33	97	-105	-92	-90	95	-13	49	54
41M	0	21	33	44	77	79	74	38	23	8	3
40M	0	-254	-26	115	-241	-38	-297	138	-505	113	228
40M*	0	-62	0	36	5	-5	-23	23	-10	-33	-54
39M	0	-92	-56	0	-95	-95	-95	-3	-72	-54	-56
39M*	0	21	67	72	118	154	149	67	69	21	0
38M	0	-141	-62	-77	-287	-138	-210	-44	-287	-208	-200
38M*	0	-38	-13	69	-115	-138	-146	69	-62	23	33
37M	0	-74	-44	51	-128	-146	-154	36	-197	-195	-87
37M*	0	-5	-23	44	-128	-151	-167	49	-85	5	31

* INDICATES REDUNDANT GAGE

TABLE 2

EQUIPMENT HATCH HOOP STRAINS (MICROIN./IN.)

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
35H*	0	-15	-5	28	-72	-69	-67	15	-33	15	33
36H*	0	21	64	44	172	208	205	38	92	13	-18
42H	0	5	13	5	26	31	38	0	21	13	8
42H*	0	23	15	0	59	56	59	8	31	3	-8
43H	0	46	97	64	195	246	244	56	126	46	18
43H*	0	8	46	64	69	97	87	62	51	28	15
43H	0	46	97	64	195	246	244	56	126	46	18
43H*	0	8	46	64	69	97	87	62	51	28	15
44H	0	-15	-28	59	-177	-215	-231	69	-77	18	49
44H*	0	5	13	51	-15	-23	-26	51	0	18	21
45H*	0	-67	15	18	-110	-56	-46	-38	-44	28	13
46H	0	-21	10	23	-49	-33	-33	3	-28	8	3
46H*	0	-46	0	21	-95	-79	-85	-38	-87	-44	-54
47H	0	8	18	38	3	3	3	41	5	13	10
47H*	0	-13	46	85	-15	15	10	54	5	31	18
48H	0	-31	28	74	-82	-56	-74	41	-18	28	5
48H*	0	5	77	56	110	156	141	33	64	23	-15
42H	0	5	13	5	26	31	38	0	21	13	8
42H*	0	23	15	0	59	56	59	8	31	3	-8
41H	0	72	121	-54	492	597	595	-36	259	-3	-85
41H*	0	-13	3	18	-21	-13	-3	8	-3	13	18
40H	0	-18	-13	10	-67	-62	-62	-5	-33	0	10
40H*	0	-23	-10	13	-59	-62	-56	0	-28	5	8
39H	0	8	49	49	72	100	100	44	54	21	0
39H*	0	-59	-31	33	-126	-118	-118	13	-77	-15	0
38H*	0	41	154	174	246	331	295	167	156	62	10
37H	0	-146	-103	62	-338	-354	-374	41	-213	-62	-28
37H*	0	292	359	405	41	256	231	41	51	-69	-118

* INDICATES REDUNDANT GAGE

TABLE 3

MAIN STEAM LINE PENETRATION STRAINS (MICROIN./IN.)

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.00
GAGE											
76H	0	-110	-87	-63	-7	3	-23	-63	0	-80	-77
76D	0	-113	-140	-133	-97	-100	-123	-150	-107	-117	-63
76M	0	-70	-17	40	97	120	100	57	13	-73	-47
77H	0	-37	177	207	293	317	293	233	377	127	-40
77D	0	3	100	120	163	180	160	130	183	83	7
77M	0	-87	-30	-33	17	23	-3	-33	93	-27	-90
78H	0	-27	-23	-17	-3	10	-13	-30	-43	-37	-10
78D	0	-33	17	43	90	110	70	37	43	-13	-40
78M	0	-7	-3	40	87	120	57	3	-57	-53	-23
79H	0	13	163	200	260	290	273	220	267	137	30
79D	0	1000	667	1000	667	667	333	667	667	667	667
79M	0	27	70	67	70	63	57	63	37	30	30
80H	0	-60	-20	-20	23	40	20	-17	60	-10	-67
80D	0	-37	13	23	57	70	53	20	73	7	-50
80M	0	3	47	60	77	87	73	57	53	17	-7
81H	0	-47	0	3	53	67	50	13	77	3	-60
81D	0	-20	20	30	57	63	47	27	53	7	-33
81M	0	-3	50	-130	-83	33	20	10	17	-83	-73
82H	0	-3	53	77	110	123	100	77	87	67	20
82D	0	3	57	83	107	117	103	80	90	37	-7
82M	0	0	-333	0	0	0	-333	0	0	0	0
83H	0	-667	-333	-333	-1000	-333	-667	-333	-333	-667	0
83D	0	-333	-333	-667	-667	-667	-667	-667	-333	-667	-667
83M	0	-667	-333	-333	-333	-667	-667	-667	-333	-333	-333
84H	0	-333	-667	-667	-667	-333	-667	-667	-333	-1000	-667
84D	0	-333	-667	-333	-667	-667	-667	-333	-333	-333	-1000
84M	0	333	0	0	333	-333	-333	333	333	0	0
85H	0	0	-333	0	-333	0	-333	-333	0	-333	0
85D	0	-333	-333	-333	-667	-667	-667	-667	-667	-667	-667
85M	0	0	0	0	-333	-333	0	0	333	0	-333
86H	0	-333	-667	-667	-1000	-667	0	-667	-333	-667	-667
86D	0	-333	-333	-333	-333	-333	0	-333	0	-333	-333
86M	0	-667	-333	-667	-667	-333	-667	-667	0	-667	-667
87H	0	0	0	0	0	-333	-333	0	0	0	-333
87D	0	333	-333	-333	-333	-333	0	-333	-333	0	-667
87M	0	0	-333	-333	-333	0	-333	-333	-667	-333	-333
88H	0	-333	0	-333	-333	-333	-667	-333	0	-333	-667
88D	0	0	-333	-667	-333	0	-333	-333	-333	-333	-333
88M	0	-333	0	0	-333	-333	-333	0	0	-333	-333
89H	0	-333	-333	-667	-333	-333	-333	-667	-667	-667	-667
89D	0	-333	-333	-333	-667	-333	-667	-333	-333	-333	-667
89M	0	-333	0	0	0	0	0	-333	0	-333	-667

TABLE 4

FEEDWATER LINE PENETRATION STRAINS (MICROIN./IN.)

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.00
GAGE											
90H	0	-667	-333	-667	-667	-1000	-1333	-1000	-667	-667	-1000
90D	0	-667	-1000	-667	-1000	-667	-667	-667	-667	-667	-1000
90M	0	0	-333	0	0	0	0	0	0	0	-333
91H	0	-333	0	-333	0	0	333	0	0	0	0
91D	0	333	0	0	-333	-333	333	0	333	0	-333
91M	0	-333	-667	-1000	-667	-667	-667	-333	-333	-333	-667
92H	0	0	-667	-667	-667	-333	-333	-667	-333	0	-667
92D	0	-667	-1000	-667	-667	-667	-1000	-667	-667	-667	-1000
92M	0	-333	-667	-667	-1000	-1000		-667	-333	-667	-667
93H	0	-333	0	-333	-333	-333	1333	-333	-333	-667	-667
93M	0	333	0	-333	0	333	-333	0	333	0	0
94H	0	333	-333	-333	0	-333	-333	-333	333	-333	-667
94D	0	-50	17	7	33	53	40	13	63	3	-60
94M	0	-27	43	43	77	90	73	47	93	27	-33
95H	0	-33	37	40	63	83	70	47	97	27	-33
95D	0	-33	97	100	137	153	140	120	167	103	33
95M	0	-27	33	40	67	87	70	47	90	17	-37
96H	0	-333	-667	-667	-667	-667	-667	-667	-333	-333	-667
96D	0	-333	-333	-333	-667	-333	-333	-667	-333	-333	-333
96M	0	0	-333	-333	-333	-1000	-667	-667	-1000	-1000	-667
97D	0	0	-333	-667	-667	0	-667	-667	0	-667	-333
97M	0	0	-333	-333	-333	-333	0	-333	-333	-333	-333
98H	0	-333	0	0	0	0	0	-333	0	-333	-333
98D	0	-667	-667	-667	-333	-667	0	-333	-333	-667	-667
98M	0	-667	-667	-667	-667	-667	-667	-1000	-333	-667	-1000
99H	0	333	0	0	0	0	0	0	333	0	0
99D	0	-333	-667	-667	-667	-667	-667	-667	-667	-667	-667
99M	0	-333	-667	-667	-667	-667	-667	-667	-1000	-667	-667
100H	0	-333	0	0	-333	-333	0	-333	0	-667	-333
100D	0	667	667	-1000	-667	-333	0	-667	-667	-333	-333
100M	0	333	333	0	0	333	333	333	0	0	0
101H	0	0	-333	-667	-333	-333	-333	-333	-333	0	0
101D	0	-667	-1000	-667	-667	-333	-667	-667	-667	-667	-667
101M	0	-333	-667	-333	-333	-667	-333	-333	0	-333	-333
102H	0	0	-333	333	0	333	667	0	333	0	0
102D	0	-667	-667	-667	-667	-333	-667	-667	-333	-667	-667
102M	0	57	23	-47	-33	50	20	0	20	-7	-37
103H	0	-333	0	-333	-333	0	-333	-333	0	-333	-333
103D	0	0	-333	-333	-333	0	-333	-333	-333	-333	-333

TABLE 5

SPARE PENETRATION STRAINS (MICROIN./IN.)

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
104H	0	-333	-333	0	0	-333	-333	-333	-333	-333	-667
104D	0	-333	-333	-667	-333	-333	0	-333	-333	-333	-667
104M	0	-333	-333	-667	-333	0	-333	-333	-667	-667	-667
105H	0	0	-333	0	-333	-333	-667	-333	-333	-333	-667
105D	0	-667	-667	-333	-667	-667	-667	-1000	-667	-1000	-1000
105M	0	-333	-333	-333	-333	0	-333	0	0	-333	-333
106D	0	57	113	137	150	147	143	133	90	60	60
106M	0	-87	-37	-27	10	50	30	0	77	0	-83
107H	0	-27	30	50	70	83	73	63	87	43	3
107D	0	-7	43	63	87	103	93	73	73	23	-17
108H	0	-23	30	50	73	97	83	60	83	30	-13
108D	0	27	67	77	107	110	113	117	80	77	70
108M	0	33	77	97	113	113	107	100	67	43	37
109H	0	-47	13	27	57	83	63	40	80	3	-63
109D	0	-123	-63	-53	0	37	10	-27	90	-17	-127
109M	0	-40	10	23	47	63	53	33	73	23	-27
110H	0	-137	-33	-13	57	117	70	13	153	-10	-160
110D	0	-50	-7	0	27	47	37	20	77	20	-43
110M	0	-153	-70	-63	-7	50	13	-37	117	-23	-173
111H	0	-53	27	40	83	113	80	43	80	-10	-110
111D	0	-20	20	23	37	43	33	30	47	27	-3
111M	0	-93	3	0	37	83	43	3	100	-7	-123
112H	0	-57	30	60	107	143	110	67	127	3	-93
112D	0	-37	-13	-10	-3	7	-3	-13	27	-7	-43
112M	0	-90	-3	17	77	107	83	53	137	30	-50
113H	0	-20	70	93	133	170	147	110	133	30	-47
113D	0	-113	-100	-137	-90	-53	-83	-103	27	-60	-140
113M	0	-27	13	20	33	47	37	20	50	0	-40
114H	0	-10	80	103	143	173	147	110	127	30	-40
114D	0	-143	-73	-83	-33	0	-27	-60	93	-43	-157
114M	0	-57	-10	-3	27	43	23	0	57	-33	-107
115H	0	-20	67	87	127	157	137	100	133	37	-33
115D	0	-47	10	13	37	40	37	23	83	27	-27
115M	0	-23	30	40	67	87	77	60	90	30	-10
116H	0	-3	70	93	130	150	130	107	113	43	-13
116D	0	-20	3	7	23	27	23	17	43	13	-10
116M	0	-107	-33	-43	7	43	13	-23	100	-20	-130
117H	0	3	80	100	130	150	133	113	117	47	-7
117D	0	-57	-10	-20	7	13	-7	-33	30	-47	-117
117M	0	-53	23	30	70	107	80	53	120	20	-53

TABLE 6

CYLINDER WALL AND DOME JUNCTION MERIDIONAL STRAINS (MICROIN./IN.)
AZIMUTH 90

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
70M	0	-27	-10	-3	30	50	30	7	43	-33	-93
73M	0	-57	-3	7	50	53	50	50	97	43	-7
49M*	0	15	82	115	-54	6	3	74	-10	-31	18
52M	0	49	-62	-90	-408	-367	-405	-154	-392	-82	-90
52M*	0	-18	54	56	-26	18	23	3	-10	13	3
55M	0	-28	-100	-18	-454	-410	-405	-10	-485	6	-3
55M*	0	-44	15	103	-110	-105	-105	97	-49	54	51
58M*	0	44	82	97	128	146	128	100	92	46	28
61M	0	-18	-26	-49	38	38	2315	2531	2661	2495	2523
61M*	0	18	-5	-5	23	18	23	8	13	-21	38
64M	0	126	215	265	328	346	331	303	197	-503	64
64M*	0	0	0	0	0	0	0	0	0	0	0
67M	0	0	0	0	0	0	0	0	0	0	0
67M*	0	-18	54	59	-8	31	51	-13	-28	8	-3

* INDICATES REDUNDANT GAGE

TABLE 7

CYLINDER WALL AND DOME JUNCTION MERIDIONAL STRAINS (MICROIN./IN.)
AZIMUTH 200

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.40	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
71M	0	-3	33	43	70	80	70	63	80	30	7
74M	0	-27	20	43	87	100	90	90	143	57	-10
50M	0	-10	72	62	69	126	105	31	49	31	-10
50M*	0	-21	49	13	3	54	38	-44	-31	0	-31
53M	0	-13	46	8	10	51	44	-23	5	23	3
53M*	0	-33	64	-21	5	67	26	-62	0	21	-36
56M*	0	38	95	133	149	182	162	133	108	46	15
59M*	0	18	105	110	141	174	138	105	90	23	-18
62M*	0	62	192	231	282	341	282	236	182	44	-18
65M	0	0	0	0	0	0	0	0	0	0	0
65M*	0	0	0	0	0	0	0	0	0	0	0
68M	0	5	31	18	-10	3	13	-10	-28	-10	5
68M*	0	-36	13	5	-33	-13	3	-36	-23	-10	-23

* INDICATES REDUNDANT GAGE

TABLE 6

CYLINDER WALL AND DOME JUNCTION RESIDUAL STRAINS (MICROIN./IN.)
AZIMUTH 333-55

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.40	19.11	2.41	9.25	14.39	19.56	6.00	12.08
GAGE											
72M	0	-17	10	20	40	40	33	30	47	17	-10
75M	0	-67	-133	-133	-133	-100	-100	-133	-100	-100	-67
51M	0	31	100	110	108	141	120	79	67	44	21
51M*	0	28	151	164	167	226	192	100	121	54	-8
54M	0	13	18	72	31	15	46	-44	-20	-100	-104
54M*	0	26	103	100	85	121	105	40	51	38	10
57M*	0	46	144	200	230	236	245	215	159	97	56
60M	0	33	87	115	138	162	140	126	92	38	13
60M*	0	38	115	149	179	210	185	154	121	49	8
63M*	0	69	187	210	282	392	362	300	244	136	85
66M	0	0	0	0	0	0	0	0	0	0	0
66M*	0	41	144	187	236	267	220	190	149	44	-3
69M*	0	0	0	0	0	0	0	0	0	0	0

* INDICATES REDUNDANT GAGE

TABLE 9

CYLINDER WALL AND DOME JUNCTION DOOR STRAINS (MICROIN./IN.)
AZIMUTH 90

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
70H	0	-140	-73	-87	-7	30	-23	-70	83	-63	-170
73H	0	33	100	130	177	197	100	160	133	63	23
49H	0	110	228	190	221	287	256	177	95	51	0
49H*	0	-23	123	131	54	144	133	49	44	31	-3
52H	0	-28	62	38	-5	49	38	-18	8	10	-15
52H*	0	3	87	69	21	74	69	13	-3	-56	5
55H*	0	0	-256	-256	513	256	0	513	2564	513	1026
58H	0	0	-38	-51	-51	-69	-59	-31	-31	-3	10
58H*	0	-8	-49	-33	-28	-46	-30	-5	-23	26	44
61H*	0	62	185	241	310	354	315	274	213	95	31
64H	0	0	0	0	0	0	0	0	0	0	0
64H*	0	-3	-59	-64	-67	-87	-72	-33	-36	-10	15
67H	0	0	0	0	0	0	0	0	0	0	0
67H*	0	0	0	0	0	0	0	0	0	0	0

* INDICATES REDUNDANT GAGE

TABLE 10

CYLINDER WALL AND DOME JUNCTION HOOP STRAINS (MICROIN./IN.)
AZIMUTH 200

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
71H	0	333	667	333	-333	-667	-1000	-1667	-1333	-2333	-2666
74H	0	-10	73	110	180	207	173	150	180	37	-43
50H	0	-36	69	8	-3	64	21	-100	-62	-46	-118
50H*	0	-3	103	59	77	149	118	18	33	38	-5
53H	0	-618	-867	-367	-638	-674	-438	-508	-679	-669	-526
53H*	0	-15	49	13	21	64	28	-21	8	18	-15
56H	0	-28	-44	-62	-56	-62	-67	-54	-10	-26	-38
56H*	0	-3	-44	-44	-49	-67	-56	-31	-31	-5	13
59H*	0	-5	-49	-51	-56	-67	-64	-36	-21	3	23
62H*	0	-44	-151	-118	-154	-208	-182	-182	-190	-174	-149
65H	0	0	0	0	0	0	0	0	0	0	0
65H*	0	-10	-72	-69	-82	-100	-77	-44	-46	-8	13
68H	0	0	0	0	0	0	0	0	0	0	0
68H*	0	62	82	138	77	123	182	10	33	-74	82

* INDICATES REDUNDANT GAGE

TABLE 11

CYLINDER WALL AND DOME JUNCTION HOOP STRAINS (MICROIN./IN.)
AZIMUTH 333-55

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
72H	0	-37	27	43	97	117	87	50	80	-7	-47
75H	0	-90	-103	-113	-83	-80	-97	-107	-33	-67	-70
51H	0	23	95	87	85	118	97	46	51	31	-5
51H*	0	54	167	172	131	185	172	69	64	54	21
54H	0	36	95	318	13	192	231	131	172	95	41
54H*	0	36	131	123	79	126	113	36	36	44	38
57H	0	-15	-44	-56	-59	-64	-64	-51	-28	-15	-15
57H*	0	26	54	-41	-51	-64	-72	44	21	3	-13
60H	0	28	-100	-118	-138	-182	-126	-192	-141	-49	-82
60H*	0	-8	-51	-51	-62	-74	-62	-38	-31	-5	13
63H*	0	-10	-62	-74	-85	-105	-87	-51	-54	-10	21
66H	0	-256	-256	-256	256	0	256	256	256	256	0
66H*	0	-21	-69	-85	-82	-90	-77	-46	-36	-8	13
69H	0	0	0	0	0	0	0	0	0	0	0
69H*	0	0	0	0	0	0	0	0	0	0	0

* INDICATES REDUNDANT GAGE

TABLE 12

WALL LINER STRAINS (MICROIN./IN.)

PRESSURE(PSIG)			0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE			10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME			8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE	AZ.	ELEV.											
70H	90	172-0	0	-140	-73	-87	-7	30	-23	-70	83	-63	-170
70D			0	-73	-37	-37	13	33	3	-30	47	-57	-113
70M			0	-27	-10	-3	30	50	30	7	43	-33	-93
71H	200	172-0	0	333	667	333	-333	-667	-1000	-1667	-1333	-2333	-2666
71D			0	-7	63	53	87	100	77	53	67	-3	-37
71M			0	-3	33	43	70	80	70	63	80	30	7
72H	333-55	172-0	0	-37	27	43	97	117	87	50	80	-7	-47
72D			0	-47	3	10	50	70	50	27	73	0	-43
72M			0	-17	10	20	40	40	33	30	47	17	-10
73H	90	204-0	0	33	100	130	177	197	180	160	133	63	23
73D			0	-33	27	40	97	117	93	70	120	13	-50
73M			0	-57	-3	7	50	53	50	50	97	43	-7
74H	200	204-0	0	-10	73	110	180	207	173	150	180	37	-43
74D			0	-83	-3	17	90	117	77	50	177	0	-117
74M			0	-27	20	43	87	100	90	90	143	57	-10
75H	333-55	204-0	0	-90	-103	-113	-83	-80	-97	-107	-33	-67	-70
75D			0	-93	-60	-60	-7	20	37	43	183	103	67
75M			0	-67	-133	-133	-133	-100	-100	-133	-100	-100	-67

TABLE 13

DOME MERIDIONAL STRAINS (MICROIN./IN.)
RADIUS 45 FEET

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 75											
131M	0	-24	-272	-279	-77	-292	-146	115	162	-90	253
131M*	0	-23	-121	-155	-145	-200	-183	-104	-100	-46	8
132M*	0	-1	73	87	62	74	78	51	28	13	0
134M	0	7	-3	7	27	37	37	37	7	-10	3
AZIMUTH 255											
139M	0	32	281	281	336	487	400	229	222	119	35
139M*	0	27	109	114	115	255	227	126	128	83	28
140M	0	29	163	212	228	358	321	217	176	99	49
140M*	0	28	113	150	142	236	223	155	124	73	36
142M	0	7	3	13	33	40	40	47	23	13	10
AZIMUTH 165											
135M	0	13	117	112	92	137	127	49	51	21	-29
135M*	0	-3	105	112	81	144	138	49	55	31	-27
136M	0	26	109	123	109	136	126	81	51	9	-23
136M*	0	14	96	119	105	136	128	81	51	17	-18
138M	0	80	120	157	153	167	170	173	87	100	213
AZIMUTH 345											
143M	0	-37	-259	-277	-290	-414	-377	-274	-206	-105	-54
143M*	0	-40	-115	-227	-323	-562	-491	-304	-267	-154	-67
144M	0	38	131	131	129	158	142	72	67	23	-37
144M*	0	41	117	140	136	162	147	105	74	24	-18
146M	0	37	97	117	137	167	153	140	97	53	50

* INDICATES REDUNDANT GAGE

TABLE 14

DOME MERIDIONAL STRAINS (MICROIN./IN.)
RADIUS 30 FEET

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	5.00	12.08
GAGE											
AZIMUTH 75											
148M	0	38	499	538	636	794	676	395	346	126	-9
148M*	0	-33	387	360	322	533	460	79	-10	-151	-251
149M	0	14	129	212	209	265	249	179	135	79	46
149M*	0	36	218	315	346	442	408	317	251	141	79
151M	0	60	117	160	190	217	210	207	140	127	120
AZIMUTH 345											
152M	0	-96	-453	-509	-554	-617	-570	-474	-349	-109	18
152M*	0	-47	-628	-724	-877	-1049	-872	-549	-440	-177	-45
153M	0	65	63	264	545	399	271	686	758	458	483
153M*	0	37	232	267	290	364	344	276	231	127	67
154M	0	-37	0	-13	10	13	-3	-20	43	-17	-70
155M	0	47	103	147	173	193	183	163	100	63	53

* INDICATES REDUNDANT GAGE

TABLE 15

DOME MERIDIONAL STRAINS (MICROIN./IN.)
RADIUS 15 FEET

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 255											
156M	0	29	108	108	92	118	112	46	46	15	-31
156M*	0	23	83	73	73	182	176	71	106	108	56
157M	0	-28	-118	-195	-201	-258	-244	-179	-131	-64	-27
157M*	0	-32	-117	-218	-219	-294	-279	-217	-162	-85	-47
158M	0	-20	57	87	117	137	120	83	127	20	-50
159M	0	33	120	160	213	253	230	197	163	73	30
AZIMUTH 165											
160M	0	-18	-123	-124	-112	-205	-190	-91	-88	-40	15
160M*	0	-19	-81	-376	-399	-533	-456	-221	-186	-85	-14
161M	0	-31	-117	-150	-158	-237	-227	-174	-128	-72	-36
161M*	0	-40	-121	-415	-426	-520	-463	-326	-209	-74	-21
162M	0	-7	0	-3	0	-3	-3	-3	17	-7	-23
163M	0	2913	-1766	-1357	-857	-823	-820	-847	-1470	-1037	-1000

* INDICATES REDUNDANT GAGE

TABLE 16

DOME HOOP STRAINS (MICROIN./IN.)
RADIUS 45 FEET

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 75											
131H	0	18	-86	-77	-49	-108	-96	-13	-28	-13	23
131H*	0	6	-87	-86	-54	-79	-82	-24	-29	-17	15
132H	0	-31	-131	-164	-151	-185	-172	-117	-85	-35	5
132H*	0	-33	-141	-162	-162	-199	-176	-121	-79	-19	19
133H	0	-17	0	-7	-3	3	-7	-17	10	-7	-33
134H	0	-7	40	73	127	163	137	110	93	13	-20
AZIMUTH 255											
139H	0	6	131	117	128	242	200	95	105	67	14
139H*	0	3	101	74	79	94	83	14	32	19	-13
140H	0	24	136	153	169	215	183	129	105	50	17
140H*	0	-4	47	58	46	53	58	19	5	-1	-19
141H	0	-73	-50	-67	-43	10	-60	-73	-100	-140	-113
142H	0	-60	63	87	187	230	180	123	220	47	-37
AZIMUTH 165											
135H	0	-29	260	218	245	346	285	82	115	72	-12
135H*	0	-24	171	209	200	305	281	141	150	109	44
136H	0	-13	187	247	218	297	281	168	118	72	40
136H*	0	-9	86	197	177	259	250	165	114	67	36
137H	0	-43	40	47	73	103	70	40	87	0	-67
138H	0	23	137	177	240	280	250	210	203	97	43
AZIMUTH 345											
143H	0	-33	-59	-38	-35	-59	-37	-22	-41	-19	3
143H*	0	-14	-74	-96	-82	-104	-101	-71	-42	-15	1
144H	0	14	358	336	372	453	385	222	204	118	58
144H*	0	15	304	354	355	427	382	249	186	104	64
145H	0	-37	20	50	67	83	63	33	87	3	-53
146H	0	-37	83	113	197	243	203	137	200	50	-50

* INDICATES REDUNDANT GAGE

TABLE 17

DOME HOOP STRAINS (MICROIN./IN.)
RADIUS 30 FEET

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 75											
148H	0	-22	-168	-168	-213	-351	-310	-167	-182	-103	-12
148H*	0	0	-324	-372	-353	-431	-355	-146	-151	-47	45
149H	0	-26	-326	-442	-465	-605	-546	-378	-278	-124	-47
149H*	0	-40	-286	-363	-395	-483	-442	-327	-245	-103	-35
150H	0	-50	-40	-37	-27	-13	-20	-33	20	-27	-77
151H	0	13	103	137	193	227	217	197	197	133	90
AZIMUTH 345											
152H	0	35	345	404	509	612	495	288	265	112	6
152H*	0	27	210	244	308	420	353	182	163	68	-15
153H	0	55	381	518	585	606	583	624	553	426	368
153H*	0	31	324	459	508	632	560	383	274	122	55
154H	0	-17	43	50	67	77	63	47	73	3	-40
155H	0	-3	60	93	133	170	153	133	127	50	10

* INDICATES REDUNDANT GAGE

TABLE 18

DOME HOOP STRAINS (MICROIN./IN.)
RADIUS 15 FEET

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 255											
156H	0	-18	-227	-222	-251	-321	-274	-127	-122	-60	-3
156H*	0	-33	-106	-113	-123	-164	-155	-85	-94	-59	-4
157H	0	36	-50	68	88	79	68	72	42	-26	-55
157H*	0	27	126	162	162	194	188	146	119	77	45
158H	0	-20	10	0	10	17	7	-13	40	-7	-60
159H	0	43	120	160	207	240	223	203	160	87	57
AZIMUTH 165											
160H	0	-12	-97	-135	-114	-205	-201	-109	-103	-59	-4
160H*	0	-32	-91	-135	-115	-210	-194	-97	-92	-45	6
161H	0	-27	-183	-265	-294	-400	-369	-276	-195	-90	-44
161H*	0	-36	-99	-151	-149	-237	-227	-173	-121	-63	-29
162H	0	-33	-30	-33	-20	-20	-30	-37	7	-30	-70
163H	0	37	113	150	217	280	337	323	280	467	487

* INDICATES REDUNDANT GAGE

TABLE 19

DOME RADIAL STRAINS (MICROIN./IN.)
RADIUS 45 FEET

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 75											
167R	0	8	27	18	23	28	27	18	13	22	35
167R*	0	-2	12	8	10	10	10	12	13	-168	-152
AZIMUTH 255											
168R	0	3	-3	-7	-8	-5	2	5	-7	13	27
168R*	0	0	2	3	12	13	25	38	72	95	105
AZIMUTH 165											
169R	0	-12	-30	-32	-40	-43	-38	-30	-20	-7	-2
169R*	0	-18	-15	-23	-15	-12	-17	-18	-10	-8	-2
AZIMUTH 345											
170R	0	8	-5	-2	-17	-22	-7	3	-13	15	32
170R*	0	-8	12	27	28	62	83	75	60	77	82

* INDICATES REDUNDANT GAGE

TABLE 20

DOME RADIAL STRAINS (MICROIN./IN.)
RADIUS 30 FEET

PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 75											
171R	0	-22	-25	-25	-28	-20	-12	-12	7	33	42
171R*	0	-13	-22	-23	-33	-32	-25	-20	-15	5	12
AZIMUTH 345											
172R	0	-3	-2	-5	-3	-3	-2	-3	3	12	18
172R*	0	-17	12	22	28	57	77	75	80	103	113

* INDICATES REDUNDANT GAGE

TABLE 21

DOME RADIAL STRAINS (MICROIN./IN.)
RADIUS 15 FEET

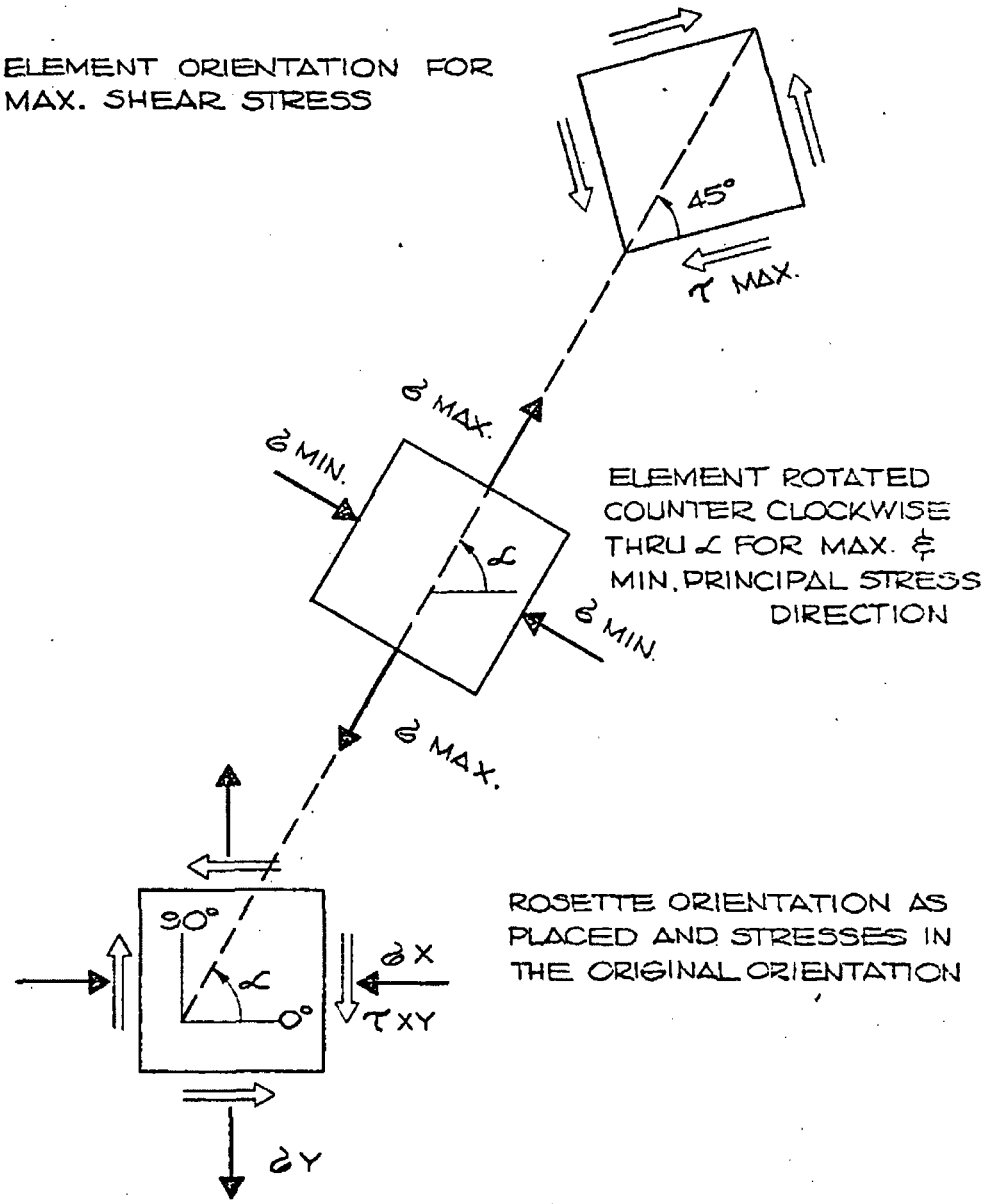
PRESSURE (PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
AZIMUTH 255											
173R	0	-12	17	12	27	37	30	18	37	45	48
173R*	0	-28	-28	-27	-33	-35	-32	-37	-5	-8	-13
AZIMUTH 165											
174R	0	572	625	663	658	660	668	667	675	693	700
174R*	0	-13	-17	-13	-23	-23	-15	-8	3	15	27

* INDICATES REDUNDANT GAGE

TABLE 22

DOME LINER STRAINS (MICROIN./IN.)

PRESSURE(PSIG)	0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE	10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME	8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE											
134M	0	7	-3	7	27	37	37	37	7	-10	3
134D	0	-23	-80	-83	-80	-80	-70	-50	-37	-23	-3
134H	0	-7	40	73	127	163	137	110	93	13	-20
142M	0	7	3	13	33	40	40	47	23	13	10
142D	0	-10	-63	-67	-63	-70	-50	-27	-33	-20	7
142H	0	-60	63	87	187	230	180	123	220	47	-37
138M	0	80	120	157	153	167	170	173	87	100	213
138D	0	70	97	120	187	227	227	317	160	127	133
138H	0	23	137	177	240	260	250	210	203	97	43
146M	0	37	97	117	137	167	153	140	97	53	50
146D	0	20	23	33	37	40	53	67	47	50	50
146H	0	-37	83	113	197	243	203	137	200	50	-50
151M	0	60	117	160	190	217	210	207	140	127	120
151D	0	-7	83	117	170	210	187	143	173	77	20
151H	0	13	103	137	193	227	217	197	197	133	50
155M	0	47	103	147	173	193	103	163	100	63	53
155D	0	390	-183	-140	-63	50	63	33	10	47	30
155H	0	-3	60	93	133	170	153	133	127	50	10
159M	0	33	120	160	213	253	230	197	163	73	30
159D	0	-57	57	97	177	240	200	137	200	33	-63
159H	0	43	120	160	207	240	223	203	160	87	57
163M	0	2913	-1766	-1357	-857	-823	-820	-847	-1470	-1037	-1000
163D	0	183	-2086	-2046	-1703	-1423	-1153	-1193	-1230	-190	-210
163H	0	37	113	150	217	280	337	323	280	467	487



ROSETTE DATA OUTPUT KEY

FIGURE 20

MAIN STEAM LINE PENETRATION

ROSETTE NUMBER 76

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-59	-121	61	-3043	-4414	685	24.70
35.00	43	-147	190	-21	-4260	2119	34.19
45.00	121	-144	264	2465	-3432	2948	33.50
55.00	196	-106	302	5228	-1499	3364	34.98
63.30	234	-110	344	6388	-1279	3834	35.08
55.00	211	-135	346	5447	-2272	3859	34.56
45.00	155	-162	317	3397	-3673	3535	33.88
35.00	120	-107	227	2808	-2256	2532	43.32
12.00	-37	-117	80	-2281	-4071	895	42.62
0.00	-47	-77	30	-2218	-2891	337	3.17

ROSETTE NUMBER 77

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	8	-131	139	-1001	-4108	1553	34.48
35.00	180	-33	213	5418	657	2380	7.24
45.00	211	-38	249	6368	812	2778	7.76
55.00	294	16	277	9512	3330	3091	1.72
63.30	317	23	294	10321	3763	3279	1.95
55.00	294	-4	298	9332	2681	3326	2.89
45.00	237	-37	273	7191	1094	3048	6.34
35.00	386	84	302	13098	6371	3364	-10.02
12.00	134	-34	167	3936	206	1865	11.75
0.00	11	-141	152	-1000	-4386	1693	35.38

ROSETTE NUMBER 78

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	3	-36	39	-257	-1124	434	29.52
35.00	18	-45	63	153	-1258	705	-35.78
45.00	54	-31	85	1431	-465	948	-24.09
55.00	108	-24	132	3199	253	1473	-23.52
63.30	136	-6	142	4278	1107	1585	-19.64
55.00	81	-38	119	2229	-434	1331	-27.05
45.00	39	-66	105	623	-1728	1176	-35.78
35.00	44	-144	187	16	-4158	2087	42.96
12.00	-12	-78	65	-1134	-2594	730	37.63
0.00	8	-41	49	-149	-1232	541	-37.03

MAIN STEAM LINE PENETRATION

ROSETTE NUMBER 79

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	1000	-960	1960	22688	-21031	21860	-44.81
35.00	669	-435	1104	17145	-7479	12312	42.58
45.00	1002	-736	1738	24912	-13865	19389	42.80
55.00	676	-346	1021	18224	-4554	11389	39.64
63.30	680	-326	1006	18537	-3900	11218	38.49
55.00	365	-35	400	11300	2370	4465	28.62
45.00	672	-389	1062	17708	-5972	11840	40.76
35.00	679	-376	1055	18053	-5488	11770	38.71
12.00	669	-502	1171	16518	-9614	13066	42.39
0.00	667	-607	1273	15444	-12958	14201	45.00

ROSETTE NUMBER 80

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	4	-61	65	-443	-1904	730	7.37
35.00	47	-20	67	1296	-191	744	0.00
45.00	60	-20	80	1724	-67	895	-2.38
55.00	77	23	55	2684	1458	613	-7.02
63.30	88	39	49	3165	2082	541	-7.97
55.00	74	19	55	2546	1320	613	-7.02
45.00	57	-17	73	1646	11	818	0.00
35.00	74	40	34	2727	1968	379	39.35
12.00	17	-10	27	445	-168	307	-7.02
0.00	-4	-69	66	-787	-2251	732	11.98

ROSETTE NUMBER 81

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-3	-47	44	-540	-1532	496	-6.50
35.00	50	-0	51	1604	467	569	5.65
45.00	51	-178	229	-65	-5182	2558	27.23
55.00	84	-114	198	1587	-2830	2209	23.18
63.30	71	29	43	2547	1595	476	19.33
55.00	54	16	38	1874	1026	424	18.94
45.00	27	-3	30	820	147	337	41.83
35.00	77	16	61	2619	1248	685	6.26
12.00	24	-104	127	-236	-3077	1420	23.56
0.00	-33	-101	68	-2003	-3520	758	39.35

MAIN STEAM LINE PENETRATION

ROSETTE NUMBER 82

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	4	-7	11	49	-187	118	-35.78
35.00	136	-416	552	352	-11951	6151	22.74
45.00	97	-21	118	2906	269	1319	24.79
55.00	130	-20	151	3962	595	1683	21.61
63.30	144	-21	165	4398	711	1843	20.86
55.00	192	-425	617	2055	-11720	6887	22.72
45.00	95	-18	113	2851	325	1263	23.69
35.00	107	-20	127	3216	375	1420	23.56
12.00	67	-0	67	2128	634	747	2.86
0.00	29	-9	39	848	-19	434	-29.52

ROSETTE NUMBER 83

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-333	-1000	667	-20181	-35051	7435	45.00
35.00	-333	-333	0	-13808	-13808	0	45.00
45.00	-0	-667	667	-6373	-21243	7435	45.00
55.00	-333	-1000	667	-20181	-35051	7435	0.00
63.30	-264	-736	471	-15455	-25970	5257	-22.50
55.00	-667	-667	0	-27616	-27616	0	45.00
45.00	-264	-736	471	-15455	-25970	5257	-22.50
35.00	-333	-333	0	-13808	-13808	0	45.00
12.00	-264	-736	471	-15455	-25970	5257	22.50
0.00	360	-694	1054	4852	-18660	11756	-35.78

ROSETTE NUMBER 84

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	471	-471	943	10515	-10515	10515	22.50
35.00	138	-805	943	-3293	-24323	10515	22.50
45.00	-0	-667	667	-6373	-21243	7435	0.00
55.00	540	-874	1414	8868	-22676	15772	22.50
63.30	-0	-667	667	-6373	-21243	7435	45.00
55.00	-264	-736	471	-15455	-25970	5257	22.50
45.00	360	-694	1054	4852	-18660	11756	9.22
35.00	471	-471	943	10515	-10515	10515	22.50
12.00	27	-1027	1054	-8956	-32468	11756	-9.22
0.00	412	-1079	1491	2817	-30434	16626	31.72

MAIN STEAM LINE PENETRATION

ROSETTE NUMBER 85

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	333	-333	667	7435	-7435	7435	45.00
35.00	69	-402	471	-1647	-12162	5257	22.50
45.00	333	-333	667	7435	-7435	7435	45.00
55.00	-0	-667	667	-6373	-21243	7435	45.00
63.30	360	-694	1054	4852	-18660	11756	-35.78
55.00	360	-694	1054	4852	-18660	11756	35.78
45.00	360	-694	1054	4852	-18660	11756	35.78
35.00	1016	-683	1700	25860	-12052	18956	39.35
12.00	360	-694	1054	4852	-18660	11756	35.78
0.00	360	-694	1054	4852	-18660	11756	-35.78

ROSETTE NUMBER 86

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-264	-736	471	-15455	-25970	5257	22.50
35.00	-264	-736	471	-15455	-25970	5257	-22.50
45.00	-333	-1000	667	-20181	-35051	7435	45.00
55.00	-306	-1360	1054	-22764	-46276	11756	-35.78
63.30	-264	-736	471	-15455	-25970	5257	-22.50
55.00	138	-805	943	-3293	-24323	10515	22.50
45.00	-333	-1000	667	-20181	-35051	7435	45.00
35.00	69	-402	471	-1647	-12162	5257	-22.50
12.00	-333	-1000	667	-20181	-35051	7435	45.00
0.00	-333	-1000	667	-20181	-35051	7435	45.00

ROSETTE NUMBER 87

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	333	-333	667	7435	-7435	7435	45.00
35.00	69	-402	471	-1647	-12162	5257	-22.50
45.00	69	-402	471	-1647	-12162	5257	-22.50
55.00	69	-402	471	-1647	-12162	5257	-22.50
63.30	69	-402	471	-1647	-12162	5257	22.50
55.00	-0	-667	667	-6373	-21243	7435	45.00
45.00	69	-402	471	-1647	-12162	5257	-22.50
35.00	-0	-667	667	-6373	-21243	7435	0.00
12.00	69	-402	471	-1647	-12162	5257	22.50
0.00	-0	-667	667	-6373	-21243	7435	45.00

MAIN STEAM LINE PENETRATION

ROSETTE NUMBER 88

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-0	-667	667	-6373	-21243	7435	45.00
35.00	333	-333	667	7435	-7435	7435	45.00
45.00	360	-694	1054	4852	-18660	11756	35.78
55.00	-333	-333	0	-13808	-13808	0	45.00
63.30	-0	-667	667	-6373	-21243	7435	45.00
55.00	-264	-736	471	-15455	-25970	5257	-22.50
45.00	69	-402	471	-1647	-12162	5257	22.50
35.00	333	-333	667	7435	-7435	7435	45.00
12.00	-333	-333	0	-13808	-13808	0	45.00
0.00	-264	-736	471	-15455	-25970	5257	-22.50

ROSETTE NUMBER 89

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-333	-333	0	-13808	-13808	0	45.00
35.00	69	-402	471	-1647	-12162	5257	22.50
45.00	-0	-667	667	-6373	-21243	7435	0.00
55.00	360	-694	1054	4852	-18660	11756	35.78
63.30	69	-402	471	-1647	-12162	5257	22.50
55.00	360	-694	1054	4852	-18660	11756	35.78
45.00	-264	-736	471	-15455	-25970	5257	-22.50
35.00	-0	-667	667	-6373	-21243	7435	0.00
12.00	-264	-736	471	-15455	-25970	5257	-22.50
0.00	-667	-667	0	-27616	-27616	0	45.00

FEEDWATER LINE PENETRATION

ROSETTE NUMBER 90

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	138	-805	943	-3293	-24323	10515	22.50
35.00	333	-1000	1333	1062	-28678	14870	45.00
45.00	138	-805	943	-3293	-24323	10515	22.50
55.00	412	-1079	1491	2817	-30434	16626	31.72
63.30	27	-1027	1054	-8956	-32468	11756	9.22
55.00	-0	-1333	1333	-12746	-42487	14870	0.00
45.00	27	-1027	1054	-8956	-32468	11756	9.22
35.00	138	-805	943	-3293	-24323	10515	22.50
12.00	138	-805	943	-3293	-24323	10515	22.50
0.00	-195	-1138	943	-17101	-38131	10515	22.50

ROSETTE NUMBER 91

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	333	-1000	1333	1062	-28678	14870	45.00
35.00	138	-805	943	-3293	-24323	10515	22.50
45.00	79	-1412	1491	-10991	-44242	16626	31.72
55.00	-0	-667	667	-6373	-21243	7435	0.00
63.30	-0	-667	667	-6373	-21243	7435	0.00
55.00	540	-874	1414	8868	-22676	15772	22.50
45.00	69	-402	471	-1647	-12162	5257	22.50
35.00	360	-694	1054	4852	-18660	11756	35.78
12.00	69	-402	471	-1647	-12162	5257	22.50
0.00	-0	-667	667	-6373	-21243	7435	0.00

ROSETTE NUMBER 92

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	360	-694	1054	4852	-18660	11756	-35.78
35.00	-333	-1000	667	-20181	-35051	7435	45.00
45.00	-667	-667	0	-27616	-27616	0	45.00
55.00	-598	-1069	471	-29263	-39778	5257	22.50
63.30	-333	-1000	667	-20181	-35051	7435	0.00
55.00							
45.00	-667	-667	0	-27616	-27616	0	45.00
35.00	-0	-667	667	-6373	-21243	7435	45.00
12.00	138	-805	943	-3293	-24323	10515	-22.50
0.00	-333	-1000	667	-20181	-35051	7435	45.00

FEEDWATER LINE PENETRATION

ROSETTE NUMBER 94

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	425	-118	543	12409	294	6057	-24.24
35.00	103	-393	496	-470	-11543	5536	-20.32
45.00	97	-387	484	-613	-11400	5394	-19.42
55.00	77	-0	77	2450	726	862	3.72
63.30	153	-396	549	1086	-11166	6126	-19.79
55.00	135	-395	530	527	-11297	5912	-19.95
45.00	103	-390	492	-445	-11430	5493	-19.75
35.00	390	36	354	12783	4891	3946	-23.65
12.00	85	-392	477	-1029	-11675	5323	-20.52
0.00	79	-779	859	-4921	-24076	9578	-21.24

ROSETTE NUMBER 95

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-25	-35	9	-1138	-1348	105	22.50
35.00	97	-27	123	2826	74	1376	44.23
45.00	100	-20	120	2995	319	1338	45.00
55.00	137	-7	143	4292	1094	1599	-44.33
63.30	153	17	137	5046	1996	1525	-44.30
55.00	140	0	140	4461	1338	1561	45.00
45.00	120	-27	147	3569	297	1636	45.00
35.00	167	20	147	5504	2229	1637	43.70
12.00	103	-60	164	2723	-927	1825	43.25
0.00	33	-103	137	75	-2975	1525	44.30

ROSETTE NUMBER 96

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	69	-402	471	-1647	-12162	5257	22.50
35.00	-264	-736	471	-15455	-25970	5257	-22.50
45.00	-264	-736	471	-15455	-25970	5257	-22.50
55.00	-264	-736	471	-15455	-25970	5257	22.50
63.30	-306	-1360	1054	-22764	-46276	11756	35.78
55.00	-333	-1000	667	-20181	-35051	7435	45.00
45.00	-667	-667	0	-27616	-27616	0	45.00
35.00	-195	-1138	943	-17101	-38131	10515	22.50
12.00	-195	-1138	943	-17101	-38131	10515	22.50
0.00	-333	-1000	667	-20181	-35051	7435	45.00

FEEDWATER LINE PENETRATION

ROSETTE NUMBER 98

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-264	-736	471	-15455	-25970	5257	-22.50
35.00	138	-805	943	-3293	-24323	10515	-22.50
45.00	138	-805	943	-3293	-24323	10515	-22.50
55.00	-0	-667	667	-6373	-21243	7435	0.00
63.30	138	-805	943	-3293	-24323	10515	-22.50
55.00	138	-805	943	-3293	-24323	10515	22.50
45.00	-195	-1138	943	-17101	-38131	10515	22.50
35.00	69	-402	471	-1647	-12162	5257	-22.50
12.00	-264	-736	471	-15455	-25970	5257	-22.50
0.00	-333	-1000	667	-20181	-35051	7435	0.00

ROSETTE NUMBER 99

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	471	-471	943	10515	-10515	10515	-22.50
35.00	138	-805	943	-3293	-24323	10515	-22.50
45.00	138	-805	943	-3293	-24323	10515	-22.50
55.00	138	-805	943	-3293	-24323	10515	-22.50
63.30	138	-805	943	-3293	-24323	10515	-22.50
55.00	138	-805	943	-3293	-24323	10515	-22.50
45.00	138	-805	943	-3293	-24323	10515	-22.50
35.00	412	-1079	1491	2817	-30434	16626	-13.28
12.00	138	-805	943	-3293	-24323	10515	-22.50
0.00	138	-805	943	-3293	-24323	10515	-22.50

ROSETTE NUMBER 100

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	745	-745	1491	16626	-16626	16626	-31.72
35.00	694	-360	1054	18660	-4852	11756	-35.78
45.00	1000	-1000	2000	22305	-22305	22305	45.00
55.00	360	-694	1054	4852	-18660	11756	35.78
63.30	471	-471	943	10515	-10515	10515	22.50
55.00	402	-69	471	12162	1647	5257	22.50
45.00	745	-745	1491	16626	-16626	16626	31.72
35.00	667	-667	1333	14870	-14870	14870	45.00
12.00	-0	-667	667	-6373	-21243	7435	0.00
0.00	69	-402	471	-1647	-12162	5257	22.50

FEEDWATER LINE PENETRATION

ROSETTE NUMBER 101

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	360	-694	1054	4852	-18660	11756	-35.78
35.00	27	-1027	1054	-8956	-32468	11756	-35.78
45.00	-264	-736	471	-15455	-25970	5257	22.50
55.00	-0	-667	667	-6373	-21243	7435	45.00
63.30	-264	-736	471	-15455	-25970	5257	22.50
55.00	-0	-667	667	-6373	-21243	7435	45.00
45.00	-0	-667	667	-6373	-21243	7435	45.00
35.00	360	-694	1054	4852	-18660	11756	35.78
12.00	360	-694	1054	4852	-18660	11756	-35.78
0.00	360	-694	1054	4852	-18660	11756	-35.78

ROSETTE NUMBER 102

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	724	-667	1391	16689	-14341	15515	43.83
35.00	387	-697	1084	5666	-18507	12086	35.39
45.00	975	-689	1664	24495	-12620	18558	-38.40
55.00	633	-667	1300	13813	-15194	14503	-44.27
63.30	735	-352	1087	20069	-4190	12129	-37.45
55.00	1404	-717	2121	37877	-9432	23655	-36.12
45.00	667	-667	1333	14870	-14870	14870	45.00
35.00	710	-357	1067	19219	-4582	11900	-36.46
12.00	660	-667	1327	14658	-14934	14796	-44.86
0.00	630	-667	1297	13708	-15227	14467	-44.19

SPARE PENETRATION

ROSETTE NUMBER 104

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-333	-333	0	-13808	-13808	0	45.00
35.00	-333	-333	0	-13808	-13808	0	45.00
45.00	138	-805	943	-3293	-24323	10515	-22.50
55.00	69	-402	471	-1647	-12162	5257	-22.50
63.30	69	-402	471	-1647	-12162	5257	22.50
55.00	-0	-667	667	-6373	-21243	7435	45.00
45.00	-333	-333	0	-13808	-13808	0	45.00
35.00	-264	-736	471	-15455	-25970	5257	22.50
12.00	-264	-736	471	-15455	-25970	5257	22.50
0.00	-667	-667	0	-27616	-27616	0	45.00

ROSETTE NUMBER 105

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	360	-694	1054	4852	-18660	11756	-35.78
35.00	-0	-667	667	-6373	-21243	7435	45.00
45.00	69	-402	471	-1647	-12162	5257	-22.50
55.00	-0	-667	667	-6373	-21243	7435	45.00
63.30	360	-694	1054	4852	-18660	11756	35.78
55.00	-264	-736	471	-15455	-25970	5257	22.50
45.00	683	-1016	1700	12052	-25860	18956	39.35
35.00	360	-694	1054	4852	-18660	11756	35.78
12.00	333	-1000	1333	1062	-28678	14870	45.00
0.00	27	-1027	1054	-8956	-32468	11756	35.78

ROSETTE NUMBER 108

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	41	-31	71	1003	-588	796	-18.70
35.00	80	26	54	2809	1610	599	-14.87
45.00	97	50	47	3564	2512	526	-4.07
55.00	117	69	48	4402	3330	536	-16.85
63.30	115	95	19	4566	4133	217	-15.48
55.00	117	73	43	4420	3451	485	-28.76
45.00	122	38	84	4246	2382	932	-30.69
35.00	85	65	19	3324	2890	217	15.48
12.00	77	-4	81	2423	614	905	-40.27
0.00	75	-52	127	1899	-932	1416	-33.40

SPARE PENETRATION

ROSETTE NUMBER 109

PRESSURE. (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	37	-123	160	-9	-3581	1786	43.81
35.00	87	-63	150	2157	-1190	1673	-44.36
45.00	103	-53	157	2783	-712	1748	-44.39
55.00	104	-0	104	3298	982	1158	-42.24
63.30	111	35	76	3886	2190	848	-37.37
55.00	107	10	97	3500	1333	1084	-42.05
45.00	100	-27	127	2934	104	1415	-43.49
35.00	90	63	27	3482	2869	307	37.98
12.00	45	-18	63	1258	-153	705	35.78
0.00	39	-129	167	3	-3731	1867	38.67

ROSETTE NUMBER 110

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-50	-240	191	-3879	-8134	2127	42.49
35.00	-3	-100	97	-1056	-3224	1084	33.92
45.00	7	-84	92	-567	-2609	1021	28.44
55.00	57	-7	63	1743	328	707	1.51
63.30	133	34	99	4557	2347	1105	-23.86
55.00	70	13	58	2368	1084	642	-5.00
45.00	29	-52	81	417	-1383	900	25.85
35.00	196	74	122	6956	4228	1364	-36.28
12.00	21	-54	75	141	-1522	831	39.85
0.00	-43	-290	247	-4149	-9659	2755	43.45

ROSETTE NUMBER 111

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-16	-130	114	-1767	-4308	1271	34.72
35.00	28	2	25	904	338	283	11.60
45.00	40	-0	41	1281	376	452	4.73
55.00	93	27	66	3222	1749	736	-22.50
63.30	155	41	114	5345	2802	1272	-37.37
55.00	95	28	67	3307	1802	753	-28.55
45.00	44	2	42	1437	496	470	9.22
35.00	134	46	89	4720	2736	992	38.50
12.00	27	-43	70	436	-1127	782	-43.64
0.00	-3	-230	227	-2301	-7365	2532	43.32

SPARE PENETRATION

ROSETTE NUMBER 112

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-33	-114	81	-2139	-3936	898	32.78
35.00	45	-18	63	1254	-149	701	-29.00
45.00	91	-15	106	2769	406	1181	-32.93
55.00	188	-5	192	5943	1652	2145	-40.51
63.30	245	5	239	7849	2507	2671	-40.60
55.00	198	-4	202	6255	1754	2250	-41.20
45.00	134	-14	147	4128	843	1642	-42.40
35.00	237	27	210	7799	3109	2345	43.64
12.00	44	-10	54	1290	91	599	30.13
0.00	-36	-107	71	-2173	-3764	796	-26.30

ROSETTE NUMBER 113

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	67	-113	180	1042	-2975	2009	-43.94
35.00	186	-103	289	4949	-1497	3223	-39.35
45.00	253	-140	394	6737	-2042	4389	-39.63
55.00	264	-97	361	7476	-572	4024	-36.95
63.30	281	-65	346	8347	628	3859	-34.56
55.00	275	-92	367	7889	-294	4092	-36.28
45.00	239	-109	348	6579	-1194	3887	-37.52
35.00	169	14	154	5519	2075	1722	-28.67
12.00	91	-61	153	2327	-1085	1706	-39.35
0.00	53	-140	193	362	-3953	2157	44.01

ROSETTE NUMBER 114

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	79	-146	225	1127	-3889	2508	-39.01
35.00	152	-82	235	4066	-1167	2617	-33.72
45.00	194	-94	287	5274	-1132	3203	-34.10
55.00	217	-47	264	6464	578	2943	-31.88
63.30	235	-18	253	7306	1670	2818	-29.52
55.00	213	-43	255	6366	676	2845	-30.55
45.00	182	-72	255	5122	-565	2843	-32.22
35.00	127	57	70	4579	3016	782	1.36
12.00	51	-54	105	1098	-1236	1167	-26.38
0.00	16	-163	179	-1036	-5040	2002	-34.10

SPARE PENETRATION

ROSETTE NUMBER 115

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	3	-47	50	-339	-1456	559	-43.09
35.00	91	6	85	2950	1054	948	-32.22
45.00	118	8	110	3854	1393	1231	-32.49
55.00	164	30	134	5501	2508	1496	-31.72
63.30	210	33	178	7022	3058	1982	-33.40
55.00	183	31	152	6117	2720	1699	-33.40
45.00	140	20	120	4654	1974	1340	-35.28
35.00	147	76	71	5421	3830	796	-26.30
12.00	41	26	15	1547	1215	166	-31.72
0.00	-9	-34	25	-614	-1181	283	11.60

ROSETTE NUMBER 116

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	7	-117	125	-886	-3670	1392	17.06
35.00	72	-35	108	1959	-441	1200	-8.09
45.00	96	-46	141	2614	-542	1578	-7.51
55.00	145	-8	153	4533	1128	1703	-18.06
63.30	185	9	176	5967	2041	1963	-26.35
55.00	147	-4	151	4659	1279	1690	-19.82
45.00	111	-28	139	3279	173	1553	-10.52
35.00	170	43	127	5839	2998	1420	-42.00
12.00	43	-20	63	1191	-224	707	1.51
0.00	13	-157	170	-1075	-4862	1893	23.30

ROSETTE NUMBER 117

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	17	-67	85	-88	-1983	948	-24.09
35.00	120	-16	136	3654	627	1514	-32.66
45.00	157	-27	184	4743	642	2050	-33.81
55.00	198	2	196	6329	1956	2187	-36.09
63.30	245	11	234	7926	2706	2610	-39.67
55.00	223	-10	233	7016	1822	2597	-38.38
45.00	204	-37	241	6139	765	2687	-37.79
35.00	207	30	177	6873	2931	1971	44.46
12.00	114	-48	162	3190	-428	1809	-40.27
0.00	60	-120	179	759	-3245	2002	-37.47

ROSETTE NUMBER 70

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-26	-141	115	-2169	-4736	1284	-5.00
35.00	-10	-74	64	-1011	-2441	715	-4.49
45.00	-3	-87	85	-916	-2812	948	-5.65
55.00	30	-7	37	894	73	411	-2.60
63.30	52	28	24	1925	1389	268	16.85
55.00	30	-23	53	733	-457	595	0.00
45.00	7	-70	77	-456	-2168	856	-1.24
35.00	89	37	52	3204	2043	581	-19.90
12.00	-31	-65	34	-1619	-2385	383	14.53
0.00	-89	-174	85	-4506	-6402	948	-12.78

ROSETTE NUMBER 71

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	405	-75	481	12198	1472	5363	-22.78
35.00	777	-77	854	24026	4971	9528	-21.08
45.00	386	-10	396	12221	3383	4419	-21.48
55.00	166	-429	594	1175	-12084	6630	-23.64
63.30	249	-836	1084	-55	-24247	12096	-23.25
55.00	296	-1226	1523	-2280	-36244	16982	-22.68
45.00	415	-2018	2432	-6080	-60337	27129	-22.33
35.00	363	-1616	1980	-3877	-48042	22082	-22.23
12.00	496	-2799	3295	-10954	-84460	36753	-22.09
0.00	530	-3190	3720	-13608	-96581	41487	-22.03

ROSETTE NUMBER 72

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-4	-49	45	-606	-1603	499	31.72
35.00	35	1	34	1142	377	383	-30.47
45.00	56	7	49	1861	763	549	-30.85
55.00	102	35	67	3583	2078	753	-16.45
63.30	118	39	78	4120	2370	875	-6.13
55.00	88	32	57	3121	1850	635	-10.28
45.00	57	23	33	2029	1285	372	-26.57
35.00	83	44	39	3057	2190	434	15.48
12.00	18	-8	25	490	-76	283	11.60
0.00	-5	-52	47	-645	-1702	528	19.64

LINER GAGES

ROSETTE NUMBER 73

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	38	-62	100	631	-1597	1114	-12.85
35.00	104	-8	112	3252	752	1250	-11.38
45.00	136	0	136	4344	1317	1514	-12.34
55.00	179	48	131	6156	3234	1461	-7.37
63.30	197	53	144	6787	3569	1609	-3.32
55.00	183	46	137	6292	3236	1528	-9.22
45.00	170	40	130	5804	2895	1454	-16.24
35.00	134	96	38	5188	4340	424	7.63
12.00	95	12	82	3129	1290	920	-37.98
0.00	69	-52	120	1689	-998	1343	-37.79

ROSETTE NUMBER 74

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	47	-84	131	702	-2221	1462	-41.35
35.00	103	-10	113	3197	669	1264	-30.96
45.00	145	8	137	4707	1645	1531	-30.47
55.00	197	70	127	6944	4103	1420	-21.44
63.30	218	89	129	7795	4908	1444	-17.25
55.00	201	63	138	6993	3915	1539	-26.43
45.00	196	44	152	6670	3272	1699	-33.40
35.00	185	138	47	7225	6169	528	19.64
12.00	94	-1	95	2998	869	1065	38.95
0.00	65	-118	183	937	-3146	2042	39.75

ROSETTE NUMBER 75

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	-59	-97	38	-2821	-3669	424	26.06
35.00	-58	-179	120	-3558	-6245	1343	37.79
45.00	-59	-187	128	-3679	-6539	1430	40.51
55.00	-4	-213	209	-2152	-6823	2335	38.09
63.30	20	-200	221	-1264	-6192	2464	42.40
55.00	37	-233	270	-1062	-7085	3011	44.65
45.00	44	-284	328	-1316	-8626	3655	42.67
35.00	186	-319	504	2864	-8387	5626	41.20
12.00	104	-271	375	728	-7632	4180	42.45
0.00	67	-203	270	131	-5842	3011	-44.65

ROSETTE NUMBER 134

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	24	-24	49	541	-541	541	37.03
35.00	119	-82	201	3005	-1487	2246	-38.79
45.00	168	-88	255	4507	-1193	2850	-37.44
55.00	241	-88	329	6844	-492	3668	-36.15
63.30	291	-91	382	8399	-114	4256	-35.31
55.00	251	-78	329	7258	-78	3668	-36.15
45.00	202	-55	257	5908	168	2870	-36.72
35.00	147	-47	194	4233	-90	2161	-31.72
12.00	29	-26	55	684	-546	615	-32.49
0.00	4	-21	25	-62	-628	283	-11.60

ROSETTE NUMBER 142

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	11	-64	75	-273	-1936	831	-13.28
35.00	135	-68	202	3638	-877	2258	-36.38
45.00	172	-72	245	4799	-657	2728	-36.28
55.00	300	-80	379	8784	329	4228	-33.07
63.30	361	-91	452	10632	553	5040	-32.57
55.00	285	-65	349	8452	661	3895	-33.19
45.00	203	-33	236	6155	888	2633	-35.53
35.00	305	-62	367	9134	946	4094	-28.30
12.00	83	-23	105	2418	67	1176	-35.78
0.00	17	-44	61	133	-1238	685	-20.30

ROSETTE NUMBER 138

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	85	18	67	2893	1388	753	-16.45
35.00	161	96	65	6047	4586	730	-37.63
45.00	214	119	95	7969	5840	1065	-38.95
55.00	241	152	89	9139	7155	992	-6.50
63.30	280	167	114	10518	7985	1266	1.68
55.00	253	167	87	9666	7733	967	11.31
45.00	318	65	253	10758	5122	2818	40.83
35.00	205	85	120	7350	4663	1343	7.21
12.00	127	70	57	4706	3440	633	-43.32
0.00	213	43	170	7215	3417	1899	-1.68

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ROSETTE NUMBER 146

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	42	-42	84	932	-932	932	-14.31
35.00	157	23	134	5223	2234	1494	42.14
45.00	197	33	163	6586	2942	1822	44.42
55.00	300	33	267	9880	3928	2976	-38.50
63.30	374	36	339	12270	4714	3778	-38.46
55.00	306	51	255	10231	4544	2843	-39.35
45.00	210	67	143	7329	4131	1599	44.33
35.00	262	34	228	8688	3601	2544	-31.53
12.00	54	49	5	2193	2088	53	22.50
0.00	71	-71	141	1577	-1577	1577	-22.50

ROSETTE NUMBER 151

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	86	-13	98	2617	421	1098	30.85
35.00	137	83	55	5170	3944	613	37.98
45.00	182	115	67	6897	5392	753	34.89
55.00	213	170	43	8424	7455	485	-42.80
63.30	234	209	25	9466	8899	283	-33.40
55.00	240	186	54	9437	8238	599	-41.44
45.00	260	143	117	9660	7048	1306	42.55
35.00	197	140	58	7615	6331	642	5.00
12.00	183	77	107	6577	4193	1192	-43.21
0.00	191	19	173	6275	2424	1925	40.00

ROSETTE NUMBER 155

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	391	-347	738	9132	-7337	8235	-43.06
35.00	348	-184	532	9314	-2548	5931	42.66
45.00	381	-141	523	10801	-859	5830	42.07
55.00	371	-64	435	11205	1498	4853	42.36
63.30	314	49	264	10474	4577	2948	42.47
55.00	274	62	212	9339	4607	2366	40.93
45.00	264	32	232	8731	3558	2587	41.28
35.00	218	9	208	7019	2371	2324	-41.32
12.00	69	45	24	2615	2079	268	28.15
0.00	53	10	43	1796	827	485	2.20

ROSETTE NUMBER 159

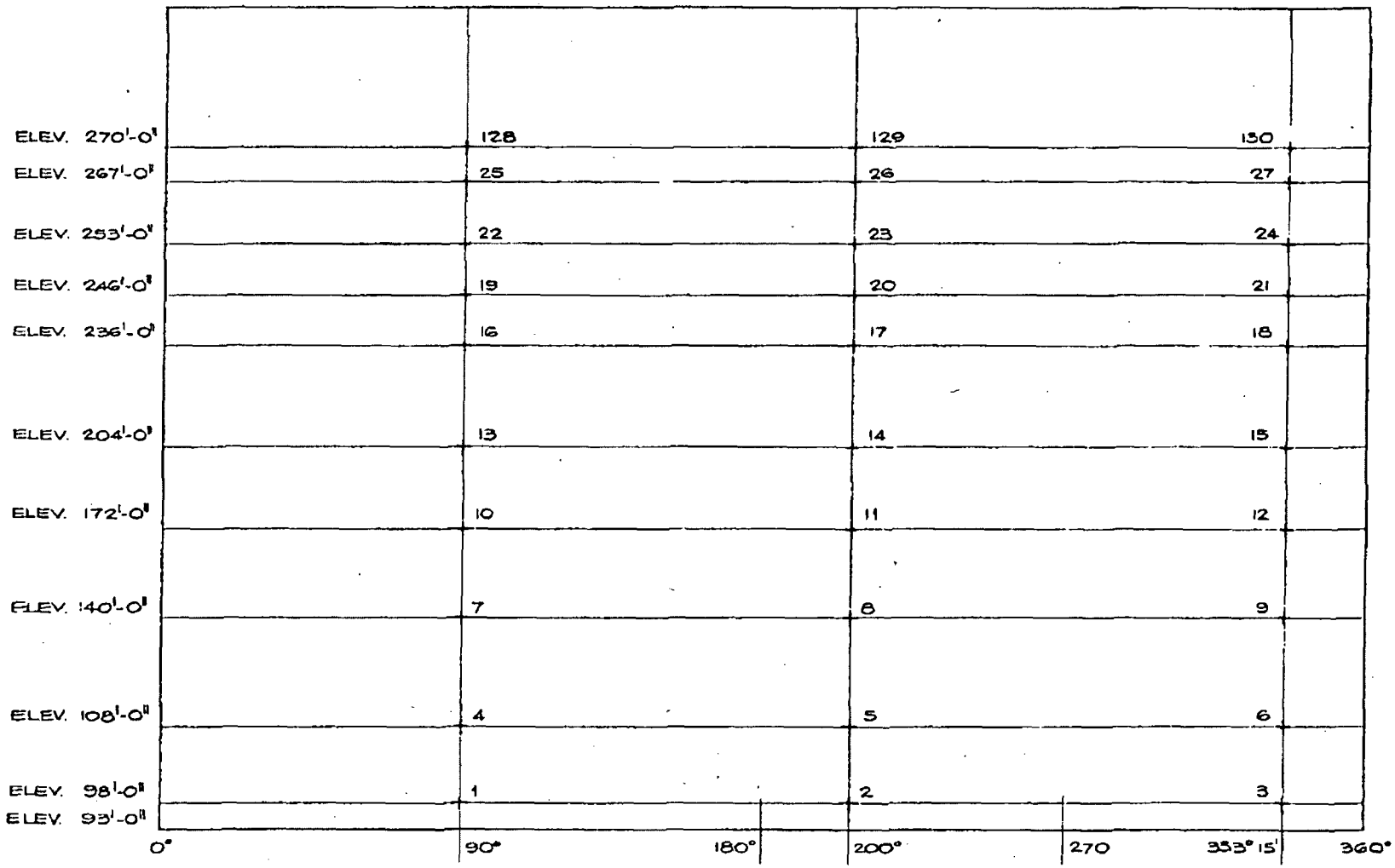
PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	133	-57	190	3710	-534	2122	-43.49
35.00	183	57	127	6384	3558	1413	45.00
45.00	223	97	127	8041	5215	1413	45.00
55.00	243	176	67	9446	7952	747	42.14
63.30	256	237	19	10428	10008	210	22.50
55.00	254	200	54	9989	8790	599	41.44
45.00	263	137	127	9700	6870	1415	-43.49
35.00	200	123	77	7553	5841	856	-43.76
12.00	127	33	94	4365	2262	1051	-40.93
0.00	151	-64	215	4193	-603	2398	-41.44

ROSETTE NUMBER 163

PRESSURE (PSIG)	STRAINS (MICROIN./IN.) MAX	MIN	SHEAR	STRESSES (PSI) MAX	MIN	SHEAR	ANGLE (DEG)
0.00	0	0	0	0	0	0	0.00
12.00	3408	-458	3866	104222	17980	43121	20.96
35.00	745	-2398	3144	820	-69308	35064	-26.64
45.00	1025	-2231	3256	11323	-61308	36316	-31.22
55.00	1164	-1804	2967	19841	-46352	33096	-34.40
63.30	1005	-1548	2554	17230	-39737	28484	-32.20
55.00	838	-1321	2159	14071	-34092	24082	-28.80
45.00	838	-1362	2200	13699	-35378	24538	-28.94
35.00	486	-1676	2162	-532	-48763	24115	-17.98
12.00	473	-1043	1515	5094	-28706	16900	3.60
0.00	488	-1001	1489	5981	-27245	16613	1.80

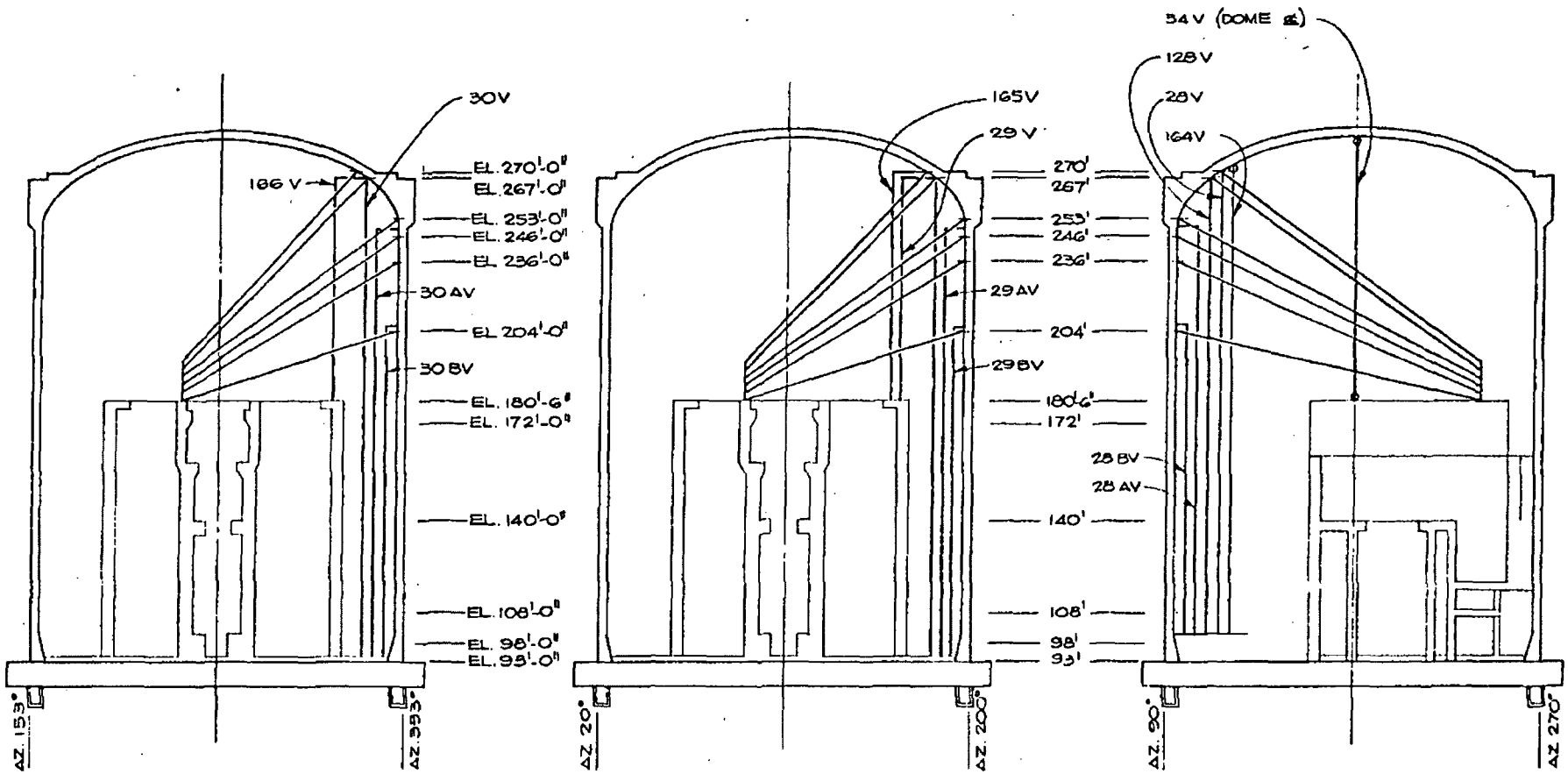
APPENDIX B

DISPLACEMENTS



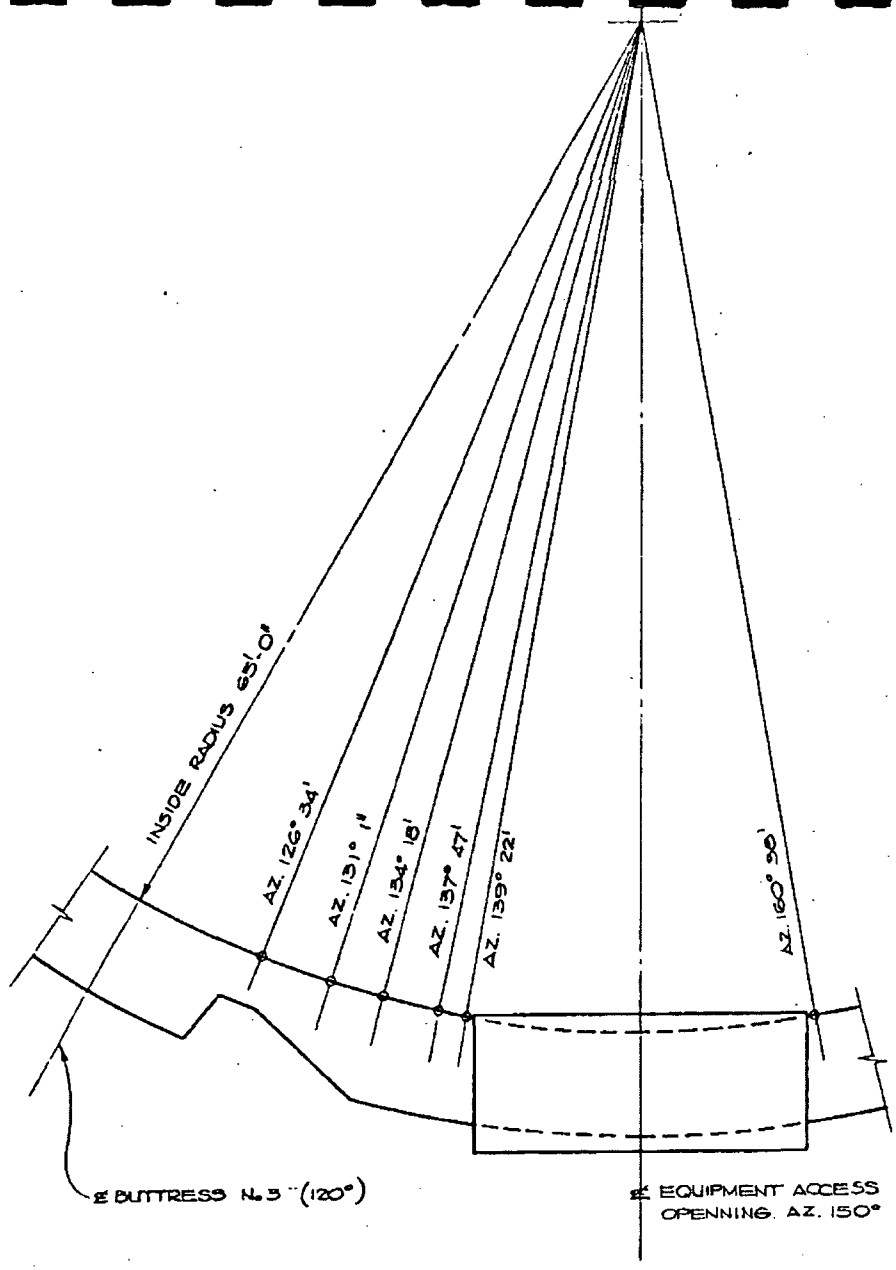
RADIAL DISPLACEMENTS - CYLINDER WALL

FIGURE 21

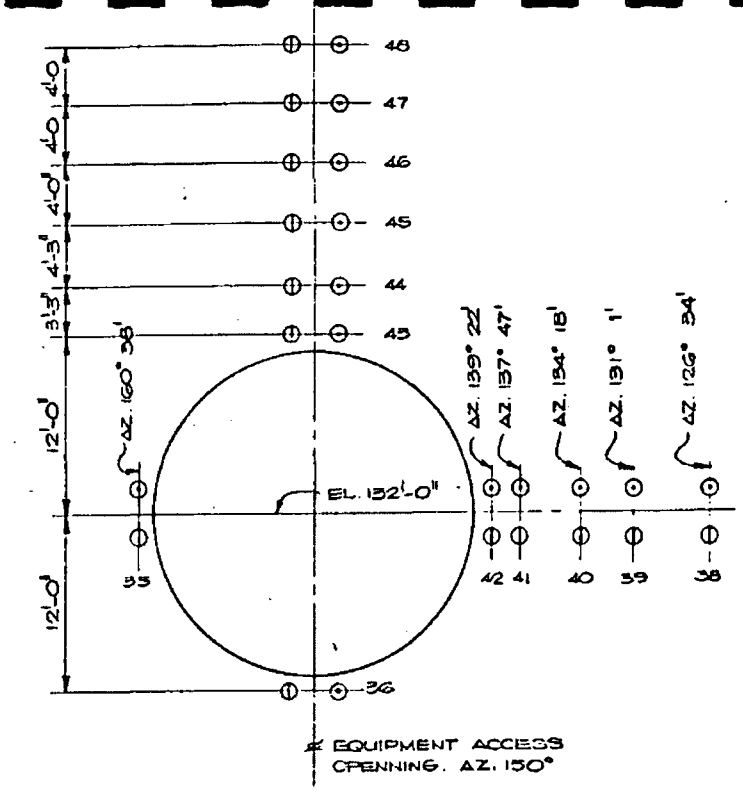


CYLINDER WALL DISPLACEMENTS

FIGURE 22



PLAN VIEW
INSTRUMENTATION FOR EQUIPMENT ACCESS
ELEVATION 132'-0"



LEGEND:

⊙ – LP (RADIAL); ⦶ – LP (VERTICAL)

ELEVATION VIEW
INSIDE FACE,

FIGURE 23

TABLE 23

VERTICAL DISPLACEMENTS (IN.)

PRESSURE(PSIG)		0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE		10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME		8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE	ELEV.*											
		AZIMUTH 90										
28V	270-8	0.000	0.023	0.097	0.118	0.168	0.171	0.163	0.158	0.129	0.061	0.026
128V	267-6	0.000	0.044	0.167	0.215	0.278	0.297	0.276	0.249	0.205	0.093	0.040
164V	4TH SP RNG	0.000	0.103	0.374	0.492	0.632	0.745	0.677	0.567	0.458	0.199	0.073
34V	DOME APEX	0.000	0.116	0.376	0.499	0.635	0.750	0.665	0.557	0.448	0.190	0.058
		AZIMUTH 200										
29V	270-8	0.000	0.025	0.095	0.133	0.180	0.196	0.186	0.169	0.130	0.047	0.014
129V	267-6	0.000	0.045	0.151	0.210	0.272	0.316	0.294	0.257	0.206	0.084	0.027
165V	4TH SP RNG	0.000	0.093	0.354	0.472	0.605	0.715	0.666	0.559	0.451	0.200	0.079
34V	DOME APEX	0.000	0.116	0.376	0.499	0.635	0.750	0.665	0.557	0.448	0.190	0.058
		AZIMUTH 333-55										
30V	270-8	0.000	0.029	0.096	0.127	0.166	0.192	0.182	0.159	0.128	0.056	0.020
130V	267-6	0.000	0.044	0.157	0.210	0.266	0.308	0.289	0.249	0.201	0.090	0.035
166V	4TH SP RNG	0.000	0.081	0.359	0.481	0.620	0.731	0.672	0.559	0.473	0.212	0.087
34V	DOME APEX	0.000	0.116	0.376	0.499	0.635	0.750	0.665	0.557	0.448	0.190	0.058

* VERTICAL DISPLACEMENTS ARE FROM BASE SLAB
ELEV. 93-0 TO ELEV. SHOWN

TABLE 24

CYLINDER WALL RADIAL DISPLACEMENTS (IN.)

PRESSURE(PSIG)		0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE		10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME		8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE	ELEV.											
		AZIMUTH 90										
1	98-0	0.000	0.003	0.019	0.024	0.028	0.031	0.030	0.026	0.022	0.012	0.007
4	108-0	0.000	0.015	0.069	0.089	0.109	0.124	0.115	0.096	0.079	0.036	0.014
7	140-0	0.000	0.026	0.110	0.139	0.159	0.175	0.163	0.132	0.107	0.043	0.007
10	172-0	0.000	0.024	0.064	0.092	0.136	0.171	0.171	0.165	0.139	0.068	0.035
13	204-0	0.000	0.002	0.028	0.048	0.077	0.087	0.088	0.080	0.062	0.005	-0.022
16	236-0	0.000	-0.001	0.003	0.016	0.042	0.062	0.064	0.064	0.044	-0.001	-0.026
19	246-0	0.000	-0.001	-0.039	-0.045	-0.059	-0.049	-0.047	-0.046	-0.043	-0.022	-0.013
22	253-0	0.000	-0.002	-0.044	-0.051	-0.064	-0.053	-0.051	-0.050	-0.046	-0.029	-0.028
25	267-0	0.000	-0.020	-0.079	-0.089	-0.111	-0.114	-0.107	-0.101	-0.076	-0.052	-0.038
126	270-8	0.000	-0.034	-0.088	-0.101	-0.121	-0.120	-0.099	-0.077	-0.072	-0.057	-0.047
		AZIMUTH 200										
2	98-0	0.000	0.000	0.017	0.024	0.031	0.038	0.038	0.038	0.038	0.031	0.024
5	108-0	0.000	0.015	0.067	0.084	0.097	0.106	0.103	0.092	0.082	0.039	0.013
8	140-0	0.000	0.039	0.128	0.173	0.210	0.244	0.237	0.206	0.168	0.080	0.035
11	172-0	0.000	0.034	0.102	0.155	0.184	0.205	0.186	0.178	0.138	0.053	0.015
14	204-0	0.000	0.014	0.054	0.099	0.116	0.138	0.136	0.130	0.097	0.028	-0.001
17	236-0	0.000	0.022	0.044	0.075	0.094	0.114	0.097	0.091	0.066	0.013	-0.008
20	246-0	0.000	-0.010	-0.021	-0.002	0.011	0.026	0.027	0.028	0.038	0.024	0.010
23	253-0	0.000	-0.007	-0.025	-0.012	0.000	0.011	0.012	0.014	0.019	0.006	0.003
26	267-0	0.000	-0.024	-0.052	-0.064	-0.076	-0.071	-0.062	-0.046	-0.008	0.048	0.053
129	270-8	0.000	0.003	-0.001	-0.003	-0.002	-0.004	0.015	0.018	0.021	0.026	0.027
		AZIMUTH 333-55										
3	98-0	0.000	0.002	0.018	0.024	0.031	0.036	0.036	0.036	0.032	0.020	0.015
6	108-0	0.000	0.016	0.052	0.069	0.085	0.098	0.092	0.080	0.065	0.028	0.008
9	140-0	0.000	0.037	0.113	0.147	0.183	0.211	0.194	0.166	0.134	0.056	0.015
12	172-0	0.000	0.034	0.098	0.131	0.171	0.195	0.179	0.164	0.134	0.059	0.020
15	204-0	0.000	0.008	0.044	0.074	0.104	0.127	0.127	0.127	0.101	0.038	0.008
18	236-0	0.000	-0.008	0.026	0.054	0.076	0.076	0.078	0.082	0.090	0.045	0.023
21	246-0	0.000	-0.010	-0.007	0.005	0.024	0.039	0.042	0.047	0.055	0.026	0.017
24	253-0	0.000	-0.011	-0.032	-0.029	-0.016	-0.007	-0.004	0.001	0.011	0.011	0.008
27	267-0	0.000	-0.028	-0.077	-0.078	-0.075	-0.081	-0.071	-0.049	-0.019	0.019	0.029
130	270-8	0.000	0.000	-0.014	-0.011	-0.002	-0.007	-0.002	0.007	0.005	0.002	0.000

TABLE 25

EQUIPMENT HATCH VERTICAL DISPLACEMENTS (IN.)

PRESSURE(PSIG)			0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE			10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME			8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE	AZ.	ELEV.											
48V	150	163-0	0.000	-0.002	0.048	0.054	0.061	0.051	0.051	0.057	0.054	0.036	0.023
47V	150	159-0	0.000	-0.003	0.065	0.075	0.085	0.067	0.067	0.073	0.069	0.042	0.027
46V	150	155-0	0.000	0.000	0.065	0.073	0.084	0.065	0.067	0.071	0.072	0.049	0.033
45V	150	151-0	0.000	-0.003	0.041	0.044	0.050	0.038	0.041	0.045	0.044	0.028	0.017
44V	150	147-0	0.000	-0.004	0.055	0.059	0.066	0.051	0.054	0.061	0.060	0.041	0.028
43V	150	144-0	0.000	-0.003	0.038	0.040	0.047	0.035	0.037	0.041	0.040	0.028	0.021
35V	160	132-0	0.000	0.001	0.026	0.030	0.035	0.036	0.035	0.034	0.030	0.016	0.010
36V	150	120-0	0.000	-0.003	0.020	0.023	0.026	0.024	0.026	0.026	0.025	0.013	0.007
42V	139	132-0	0.000	0.000	0.024	0.028	0.032	0.032	0.032	0.032	0.032	0.032	0.026
41V	137	132-0	0.000	0.000	0.026	0.030	0.034	0.033	0.033	0.033	0.030	0.019	0.013
40V	134	132-0	0.000	0.001	0.028	0.033	0.038	0.038	0.037	0.036	0.033	0.019	0.013
39V	131	132-0	0.000	0.001	0.025	0.029	0.033	0.035	0.035	0.035	0.032	0.020	0.015
38V	126	132-0	0.000	-0.001	0.021	0.024	0.028	0.027	0.027	0.027	0.026	0.016	0.011

TABLE 26

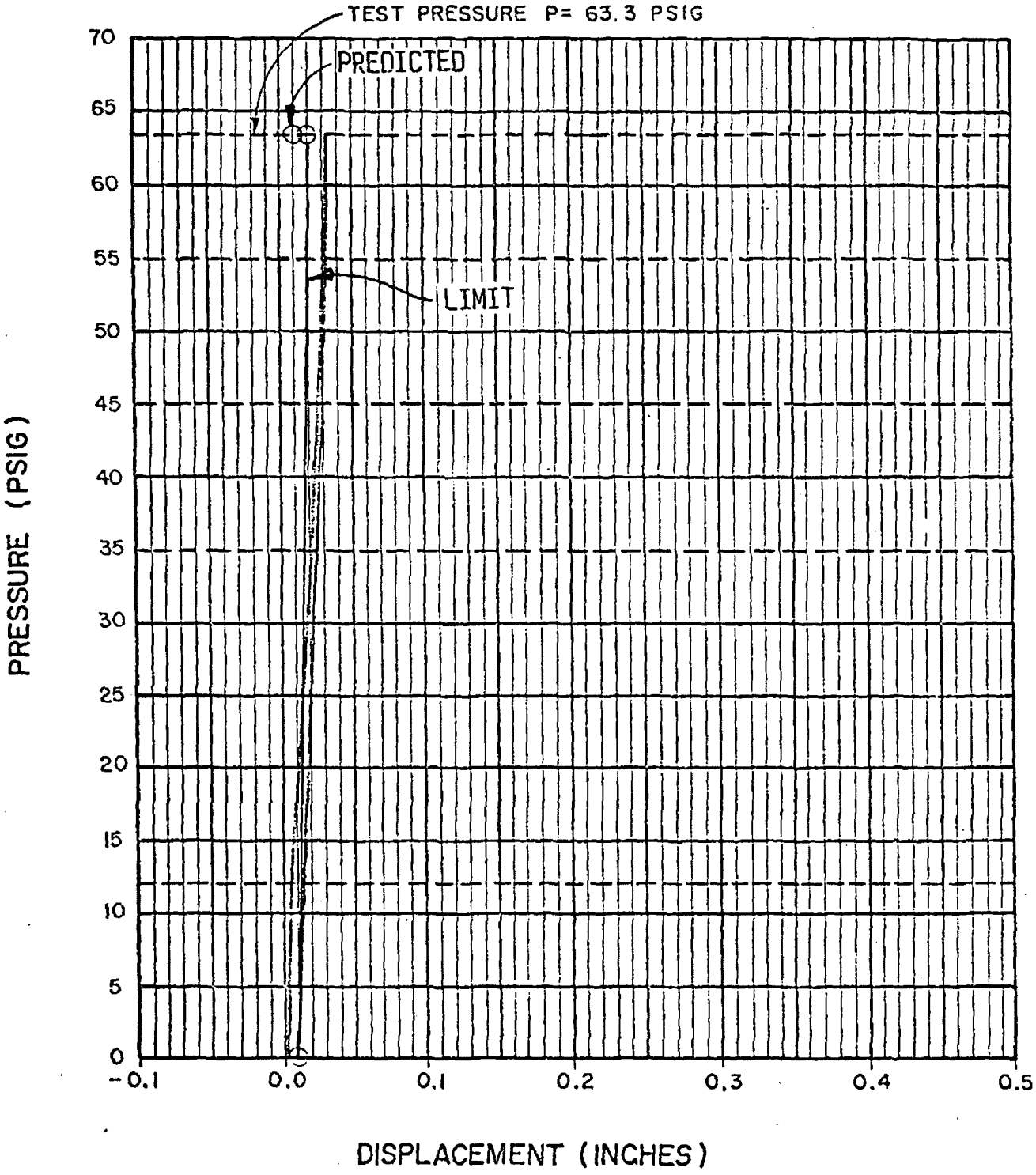
EQUIPMENT HATCH RADIAL DISPLACEMENTS (IN.)

PRESSURE(PSIG)			0.00	12.00	35.00	45.00	55.00	63.30	55.00	45.00	35.00	12.00	0.00
DATE			10/31	10/31	11/1	11/1	11/1	11/2	11/2	11/2	11/2	11/3	11/3
TIME			8.19	18.02	4.04	11.48	19.11	2.41	9.25	14.39	19.58	6.00	12.08
GAGE	AZ.	ELEV.											
35	160	132-0	0.000	0.022	0.057	0.071	0.097	0.110	0.096	0.084	0.071	0.037	0.019
36	150	120-0	0.000	0.010	0.041	0.050	0.065	0.069	0.061	0.055	0.050	0.029	0.019
42	139	132-0	0.000	0.022	0.059	0.068	0.094	0.108	0.091	0.074	0.062	0.033	0.014
43	150	144-0	0.000	0.008	0.026	0.028	0.044	0.049	0.044	0.039	0.034	0.012	0.003
42	139	132-0	0.000	0.022	0.059	0.068	0.094	0.108	0.091	0.074	0.062	0.033	0.014
41	137	132-0	0.000	0.020	0.062	0.072	0.097	0.109	0.095	0.078	0.066	0.033	0.015
40	134	132-0	0.000	0.025	0.079	0.095	0.128	0.145	0.134	0.113	0.097	0.055	0.031
39	131	132-0	0.000	0.032	0.089	0.108	0.139	0.157	0.142	0.120	0.103	0.053	0.024
38	126	132-0	0.000	0.038	0.110	0.138	0.182	0.208	0.189	0.159	0.136	0.068	0.030
43	150	144-0	0.000	0.008	0.026	0.028	0.044	0.049	0.044	0.039	0.034	0.012	0.003
44	150	147-0	0.000	0.009	0.025	0.026	0.043	0.047	0.047	0.044	0.038	0.018	0.009
45	150	151-0	0.000	0.015	0.032	0.035	0.054	0.057	0.052	0.050	0.043	0.020	0.009
46	150	155-0	0.000	0.018	0.044	0.048	0.070	0.071	0.060	0.058	0.052	0.022	-0.005
47	150	159-0	0.000	0.017	0.041	0.047	0.073	0.077	0.073	0.070	0.060	0.028	0.013
48	150	163-0	0.000	0.025	0.052	0.061	0.094	0.101	0.086	0.081	0.069	0.028	0.010

REACTOR BLDG. LOCATION RADIAL

LOCATION No. 1 CHANNEL 417 INSTRUMENT No. 24

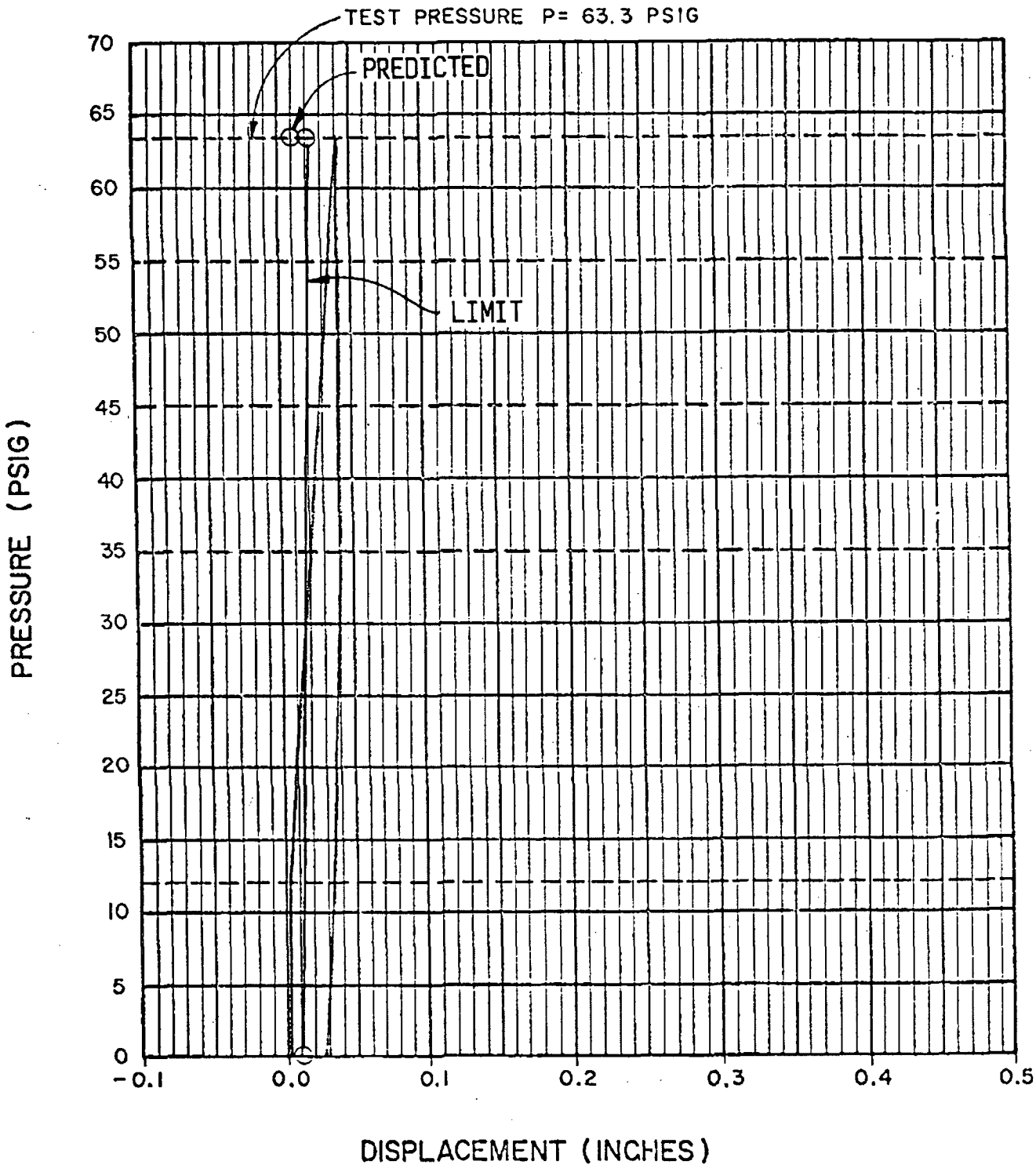
AZIMUTH 90 ELEVATION 98-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 2 CHANNEL 427 INSTRUMENT No. 64

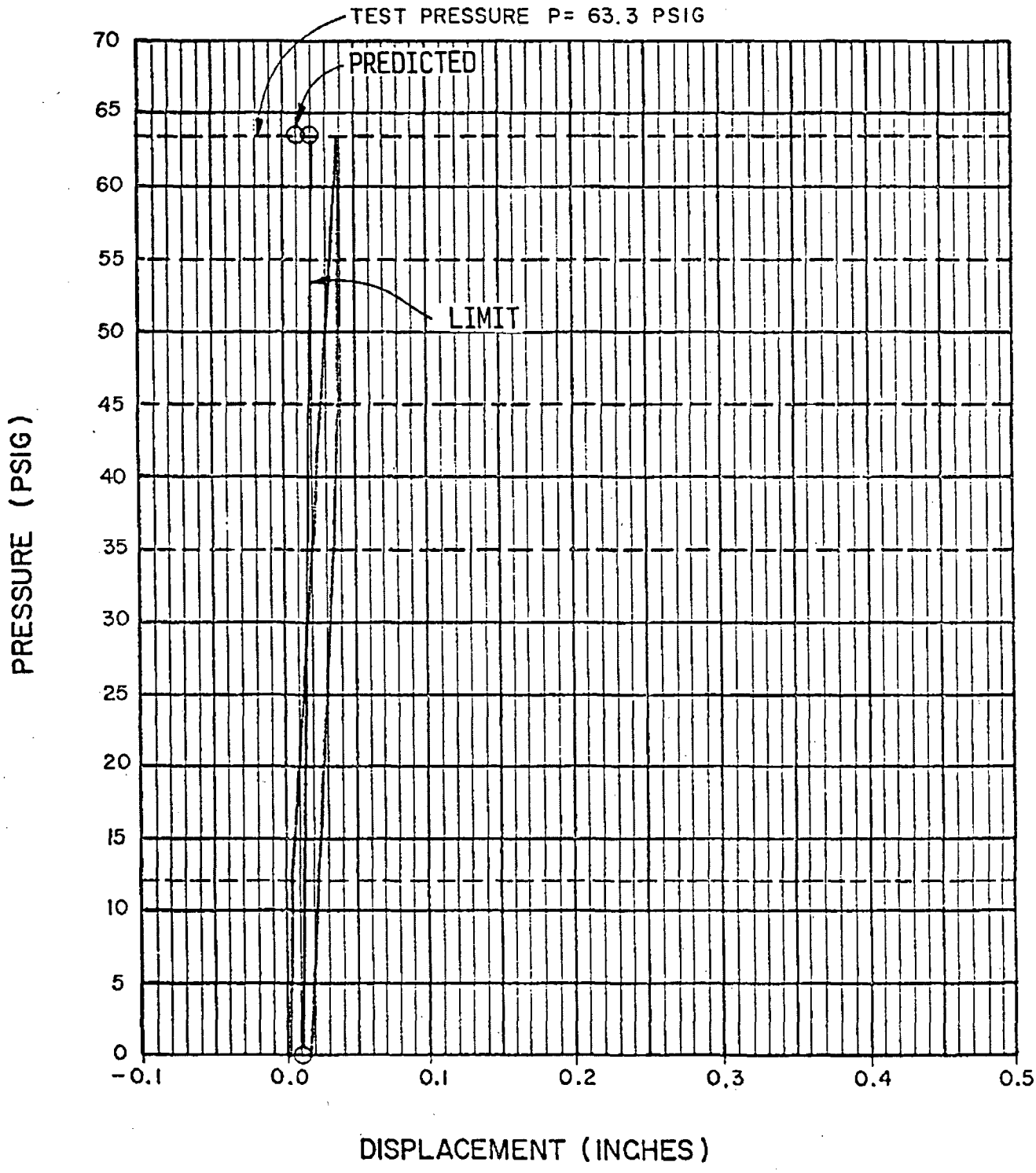
AZIMUTH 200 ELEVATION 98-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 3 CHANNEL 437 INSTRUMENT No. 70

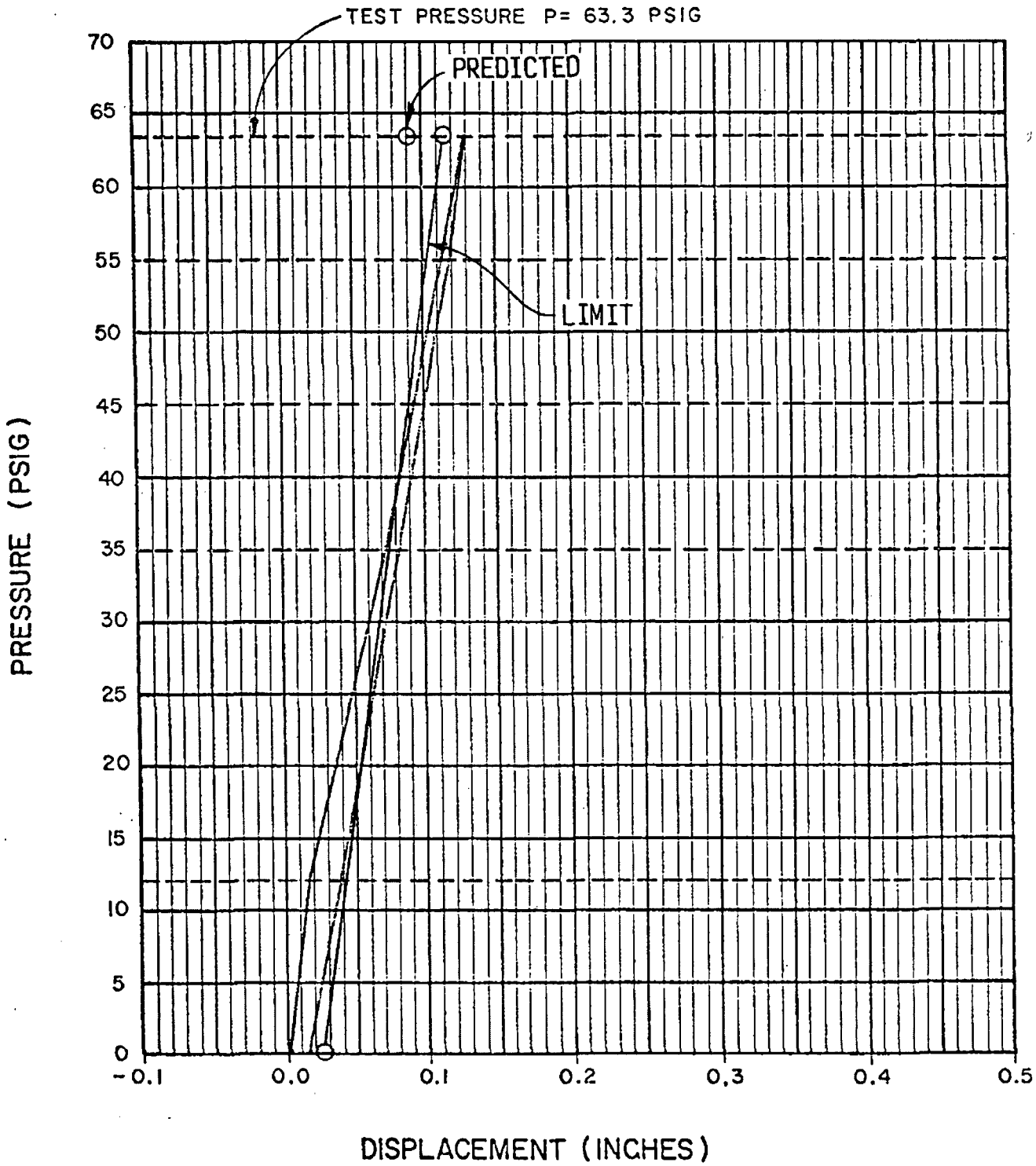
AZIMUTH 330-55 ELEVATION 98-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 4 CHANNEL 418 INSTRUMENT No. 42

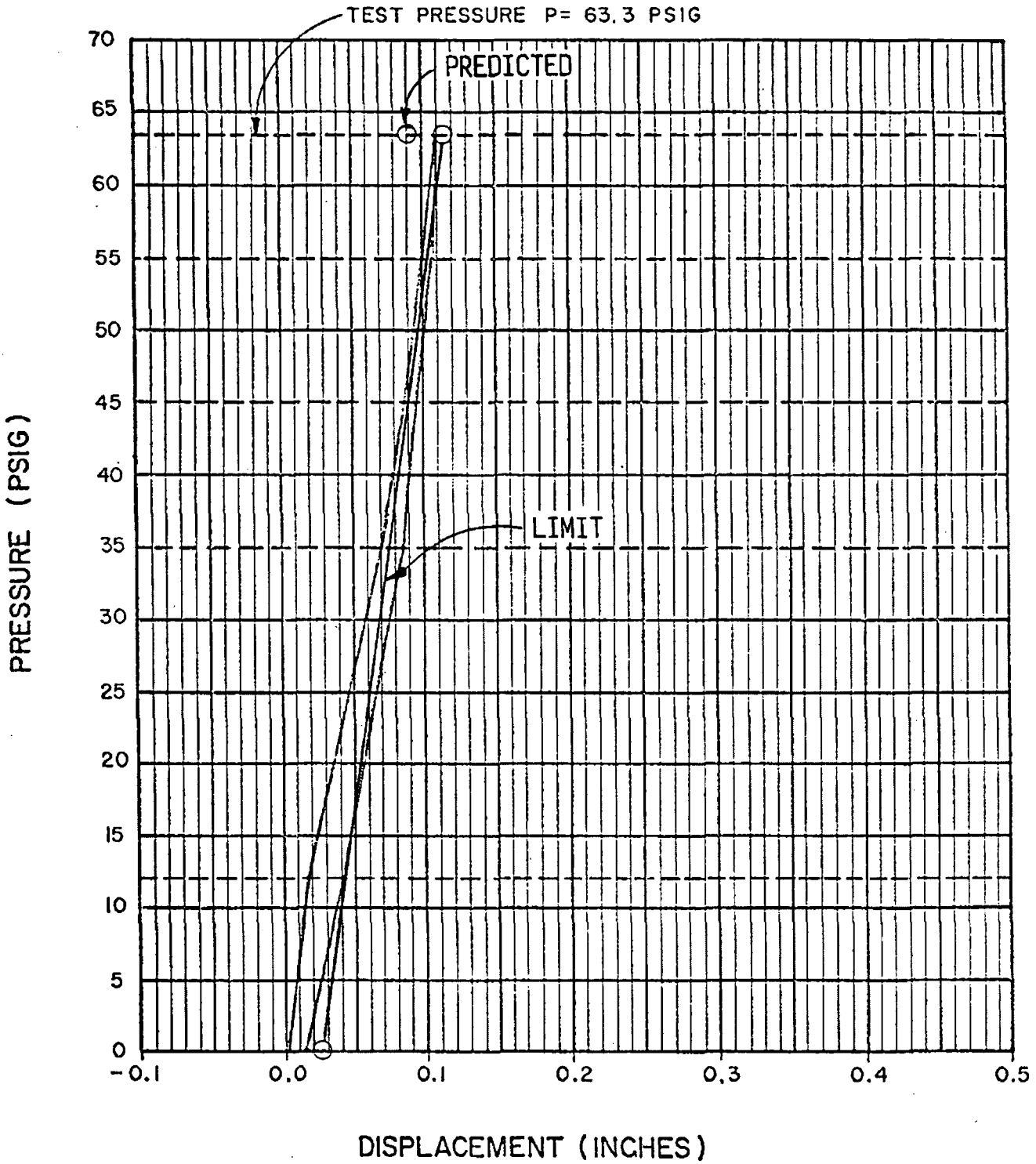
AZIMUTH 90 ELEVATION 108-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 5 CHANNEL 428 INSTRUMENT No. 17

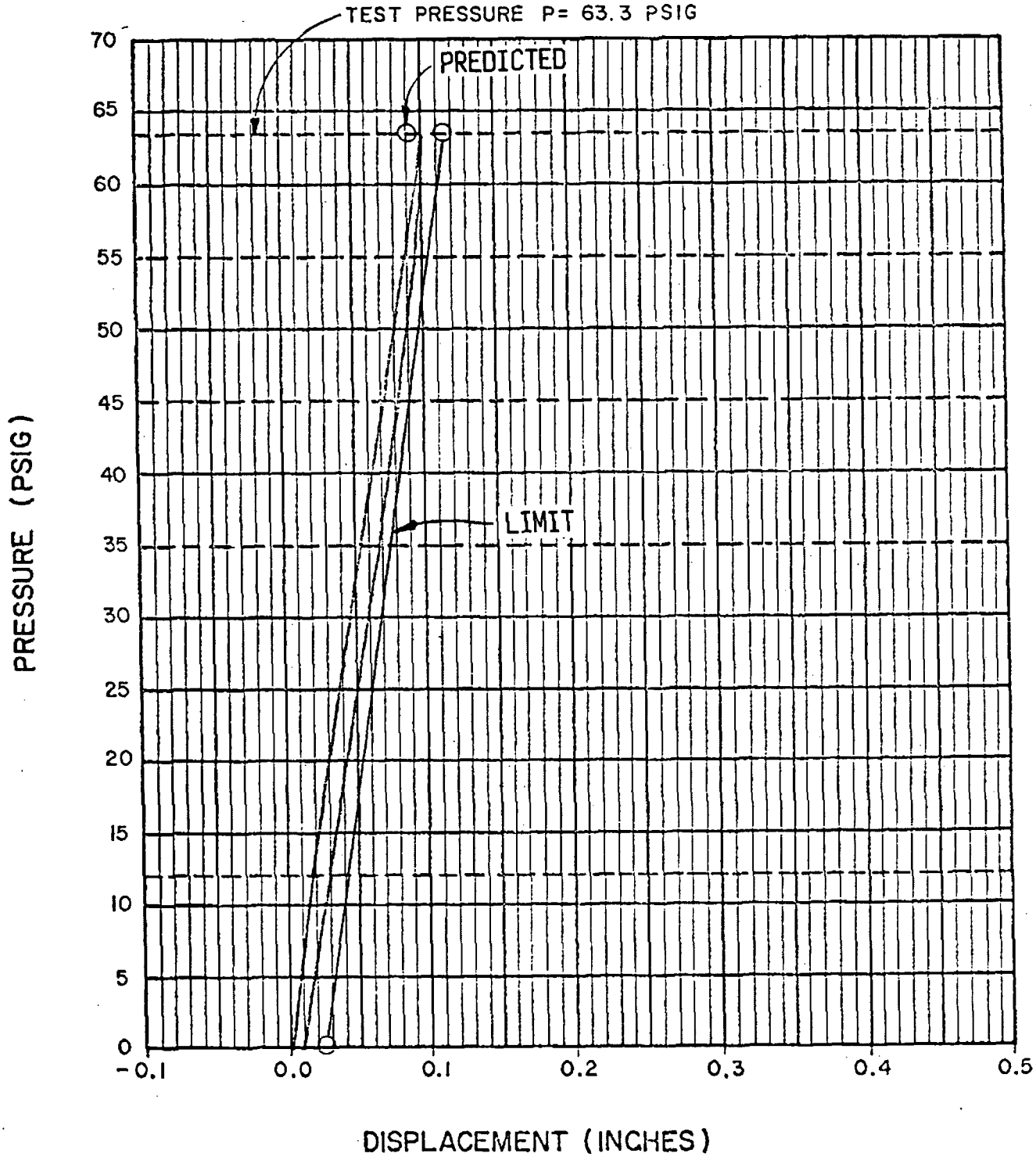
AZIMUTH 200 ELEVATION 108-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 6 CHANNEL 438 INSTRUMENT No. 98

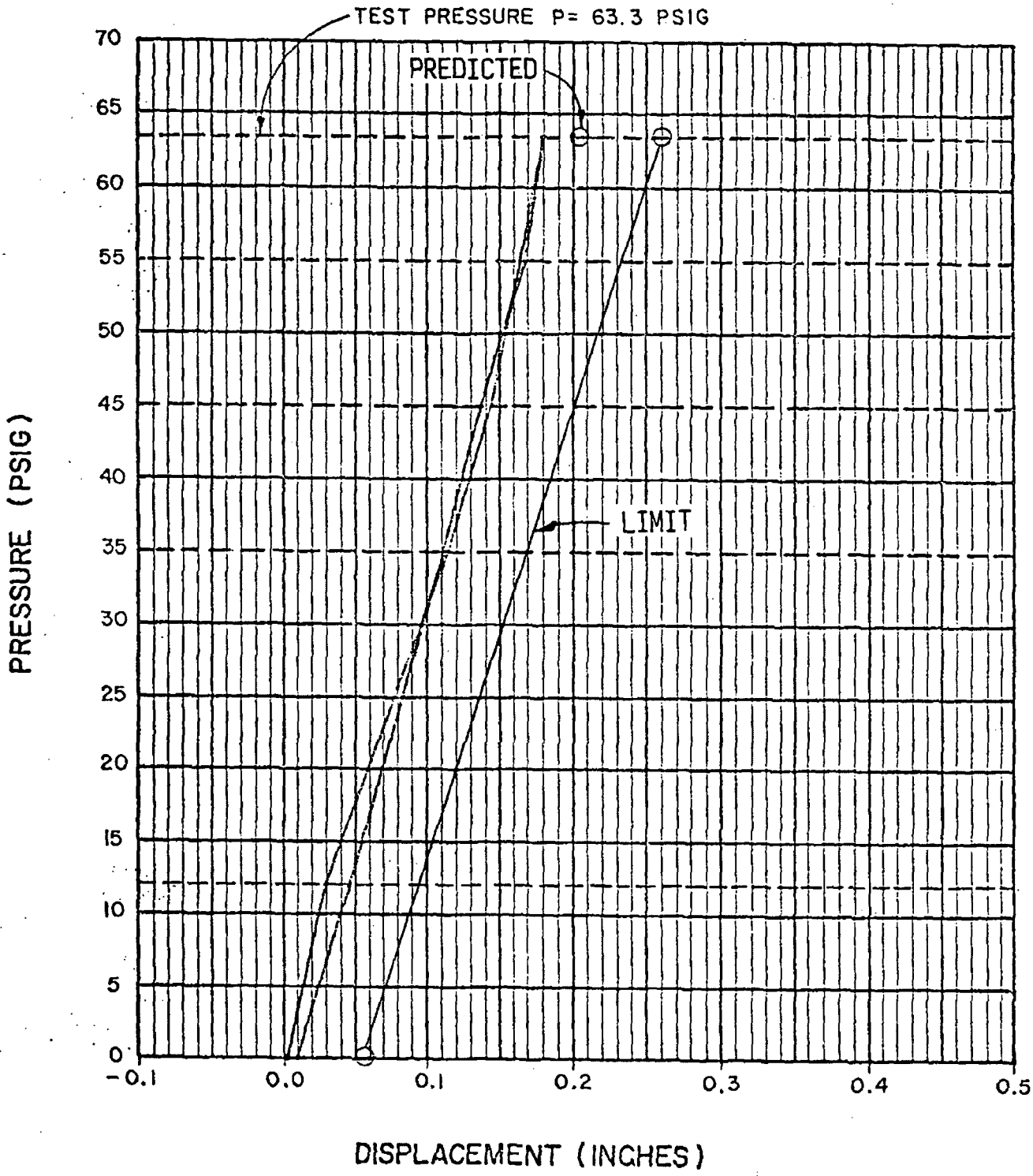
AZIMUTH 333-55 ELEVATION 108-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 7 CHANNEL 419 INSTRUMENT No. 91

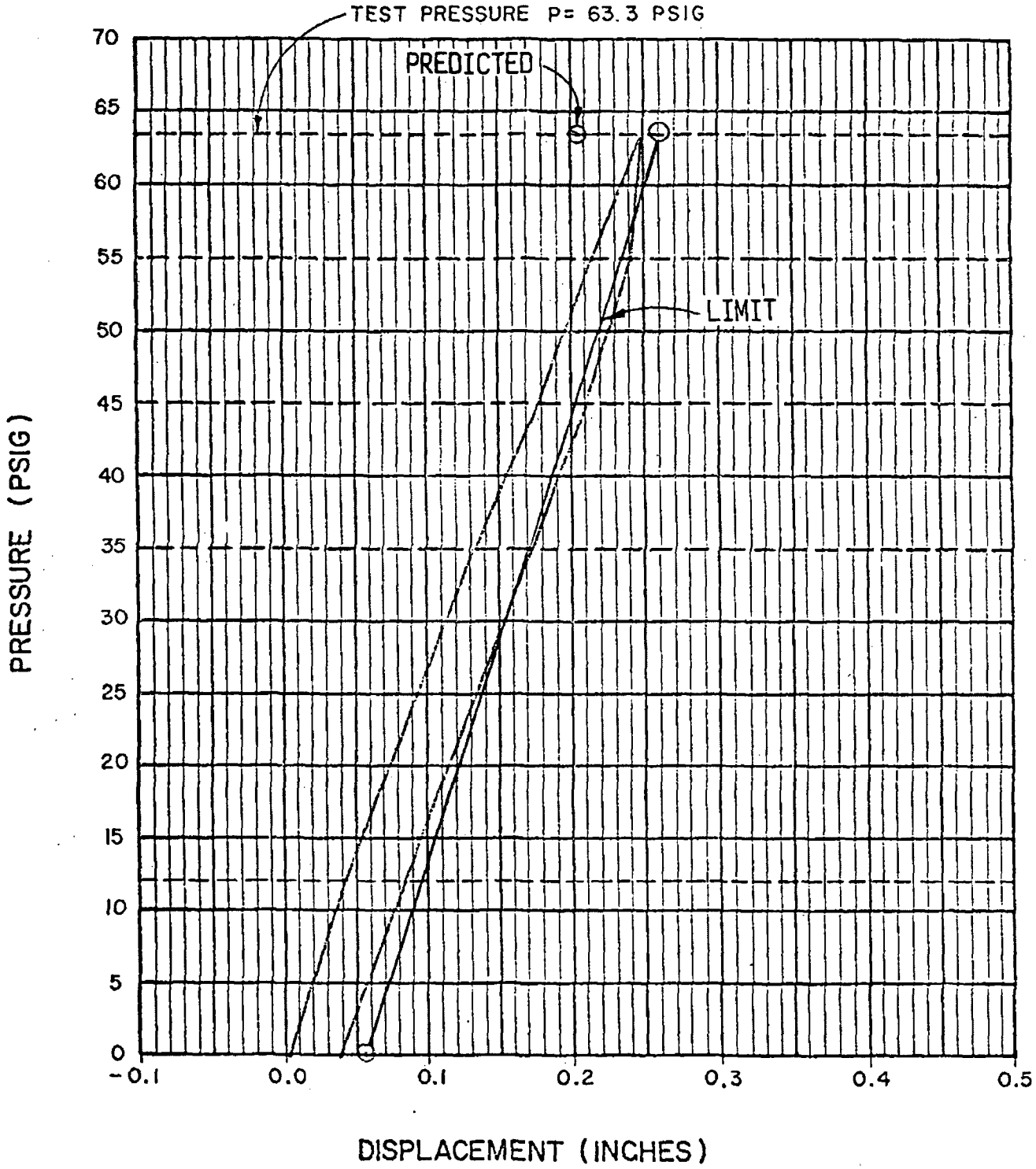
AZIMUTH 90 ELEVATION 140-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 8 CHANNEL 429 INSTRUMENT No. 54

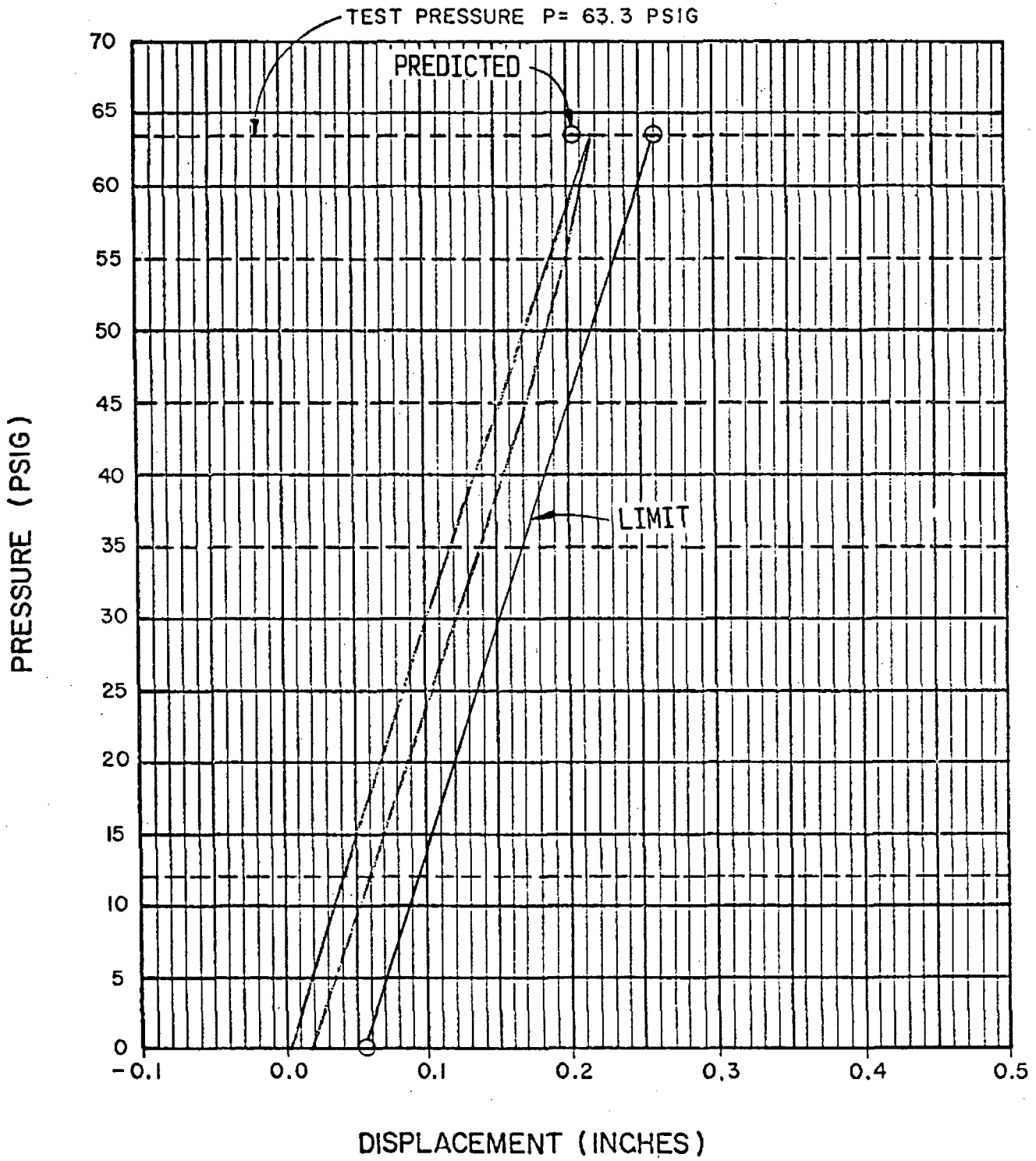
AZIMUTH 200 ELEVATION 140-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 9 CHANNEL 439 INSTRUMENT No. 57

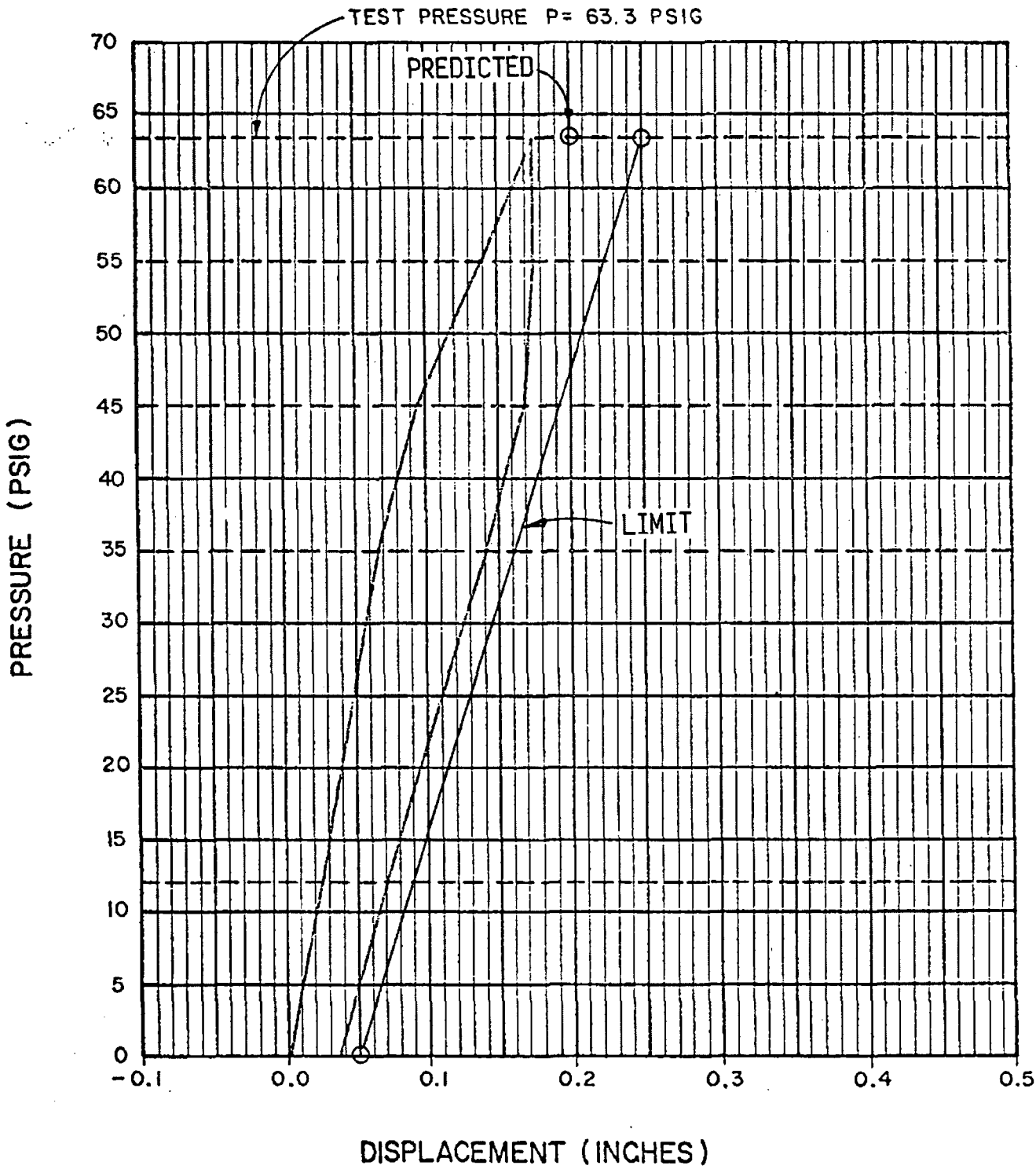
AZIMUTH 333-55 ELEVATION 140-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 10 CHANNEL 420 INSTRUMENT No. 14

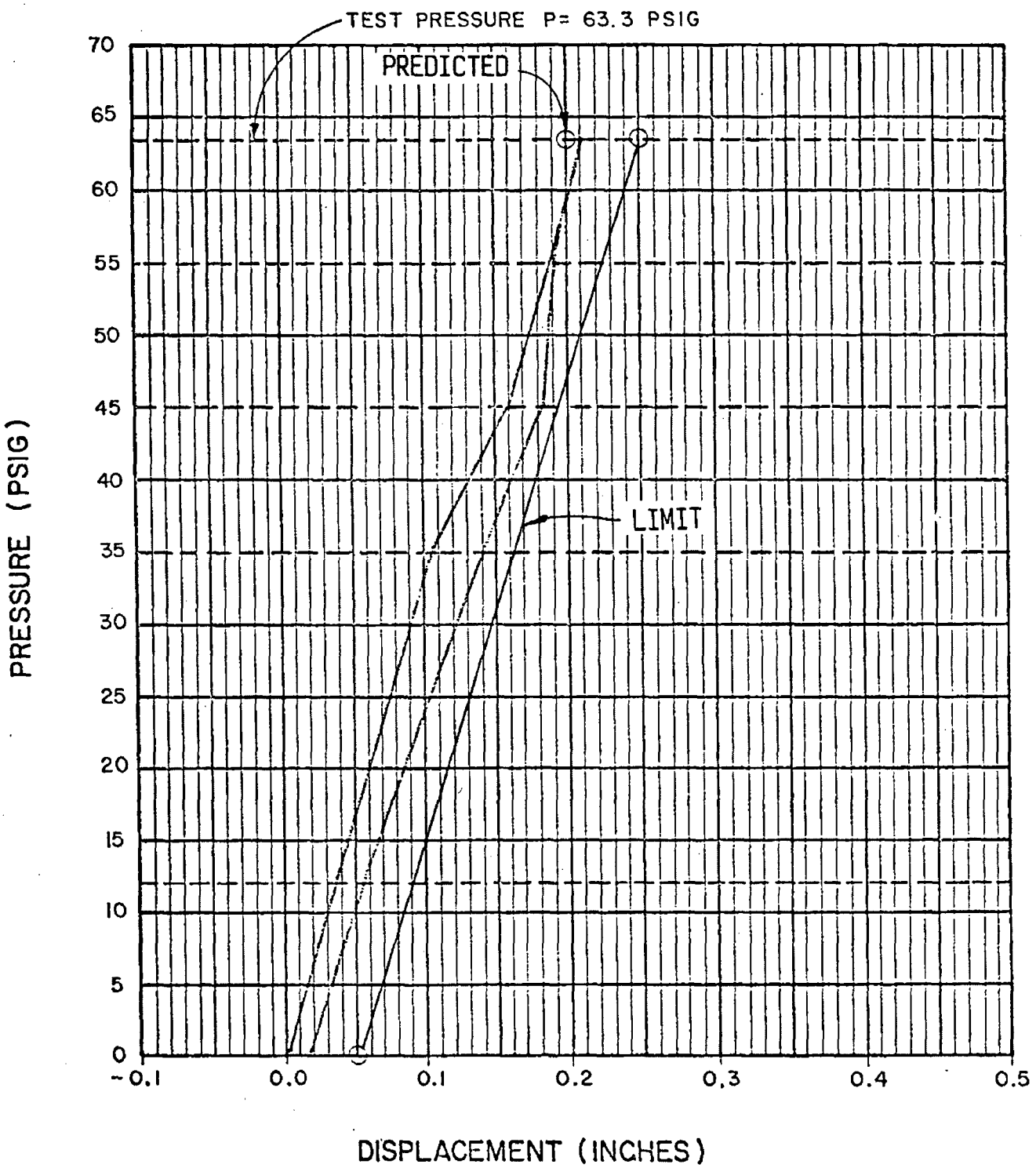
AZIMUTH 90 ELEVATION 172-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 11 CHANNEL 430 INSTRUMENT No. 60

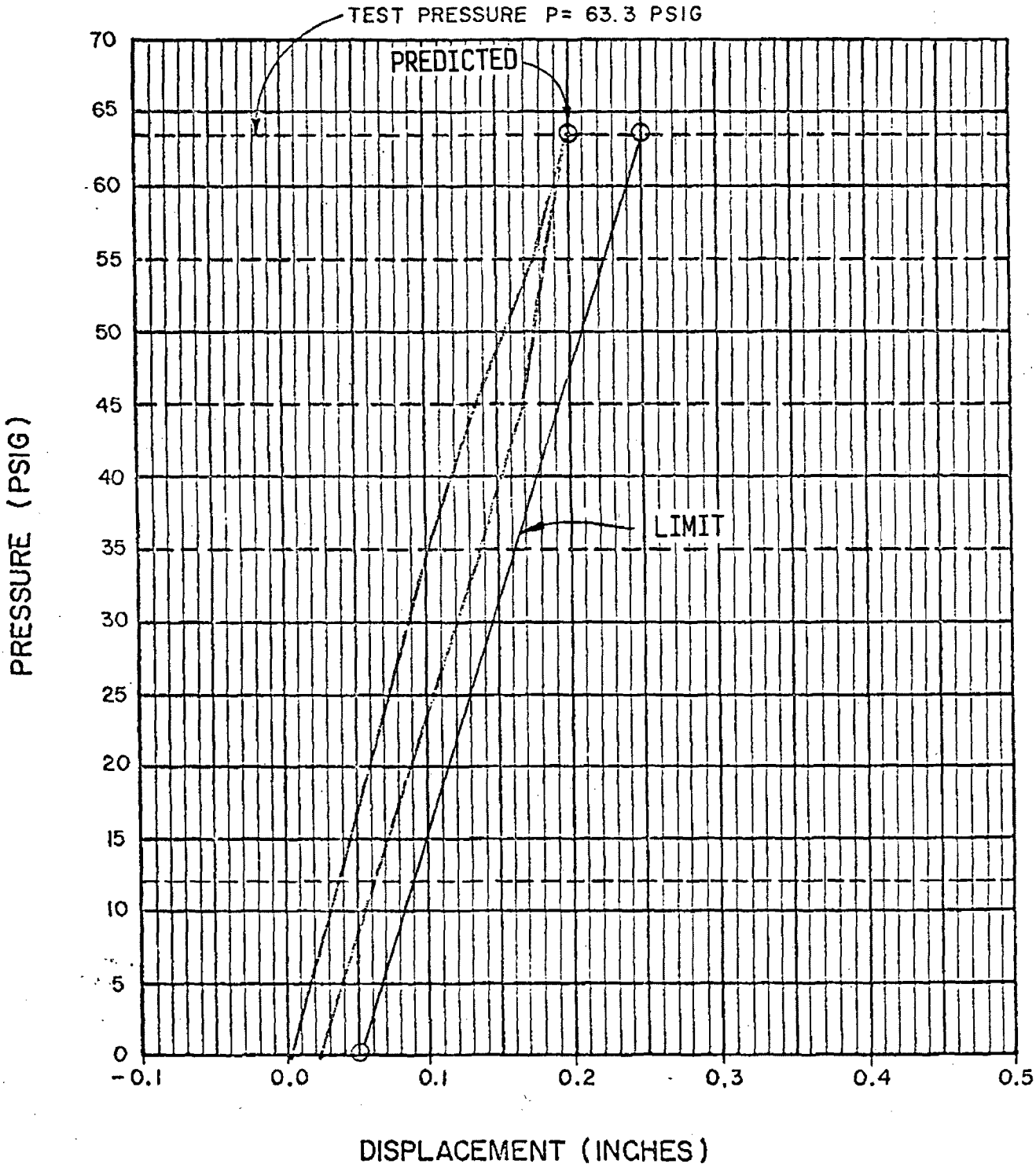
AZIMUTH 200 ELEVATION 172-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 12 CHANNEL 440 INSTRUMENT No. 87

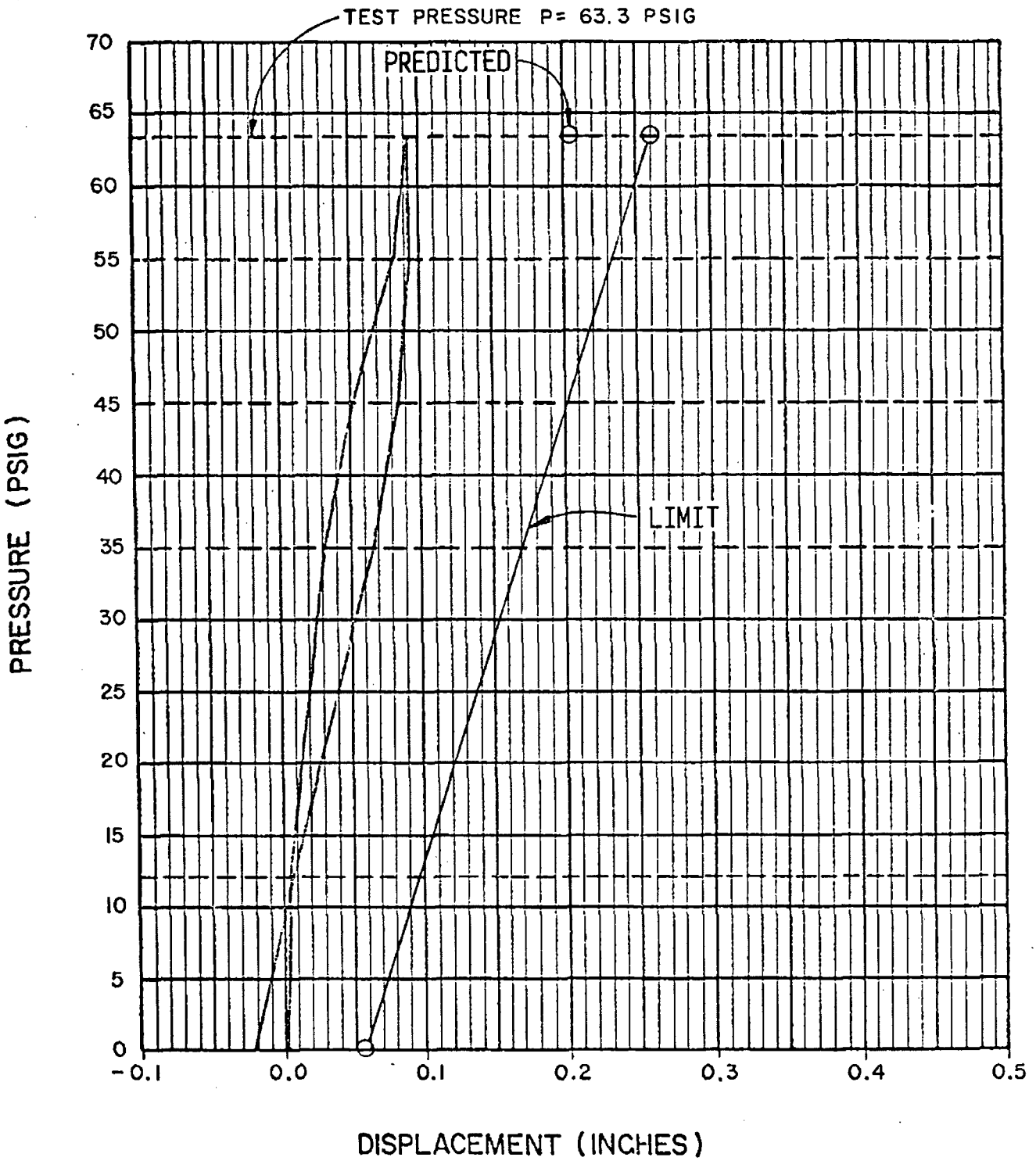
AZIMUTH 333-55 ELEVATION 172-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 13 CHANNEL 421 INSTRUMENT No. 55

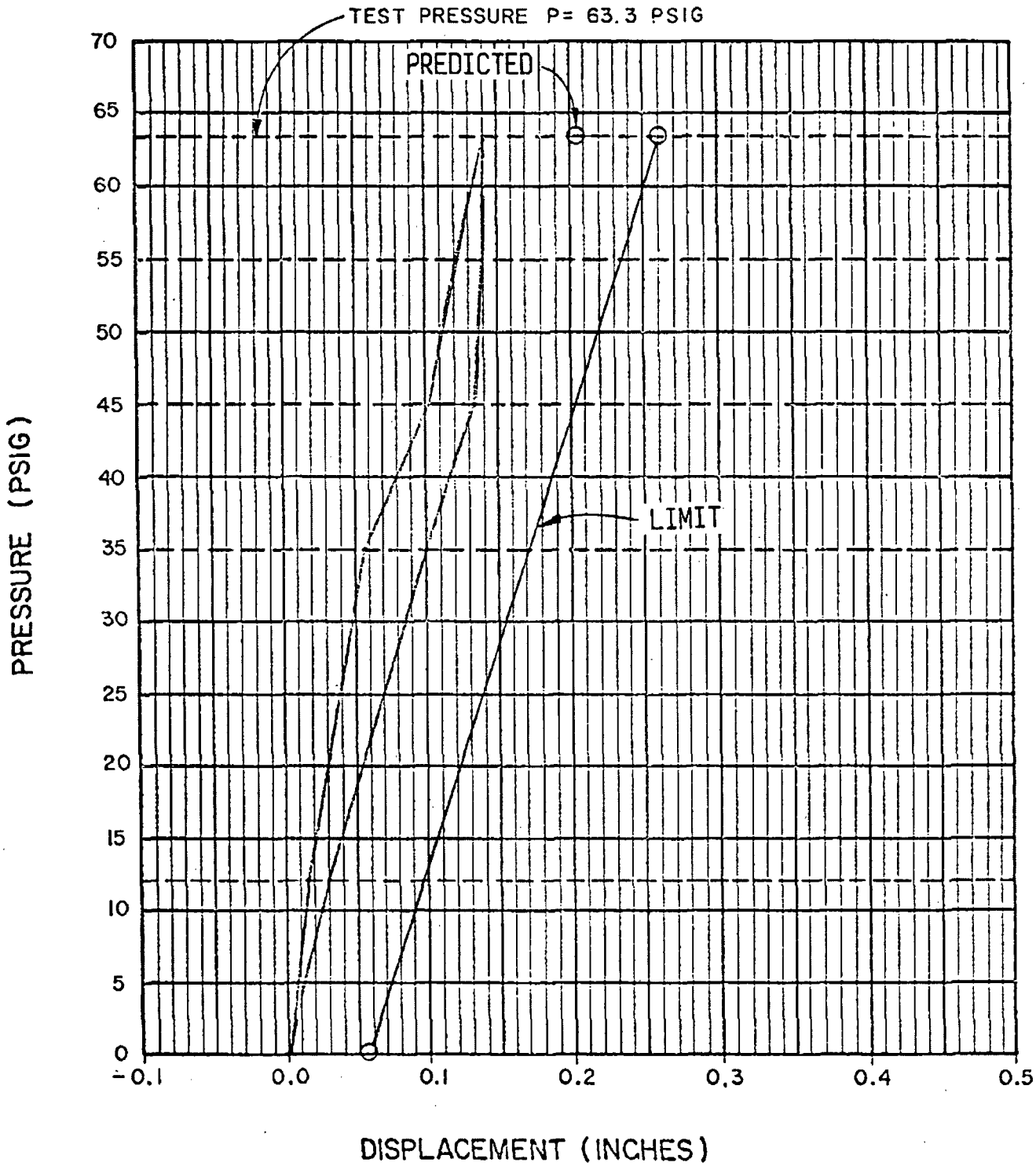
AZIMUTH 90 ELEVATION 204-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 14 CHANNEL 431 INSTRUMENT No. 73

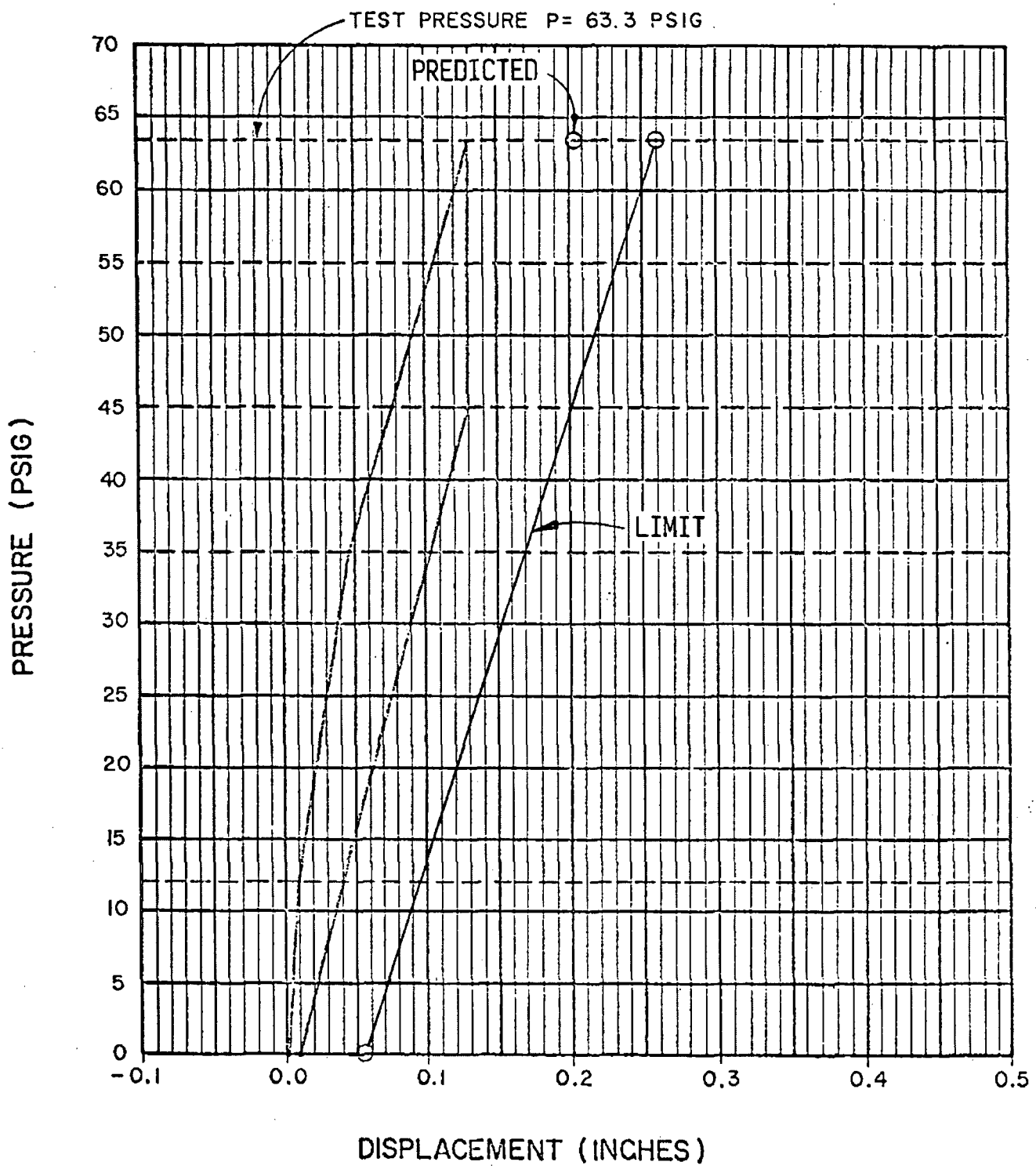
AZIMUTH 200 ELEVATION 204-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 15 CHANNEL 441 INSTRUMENT No. 83

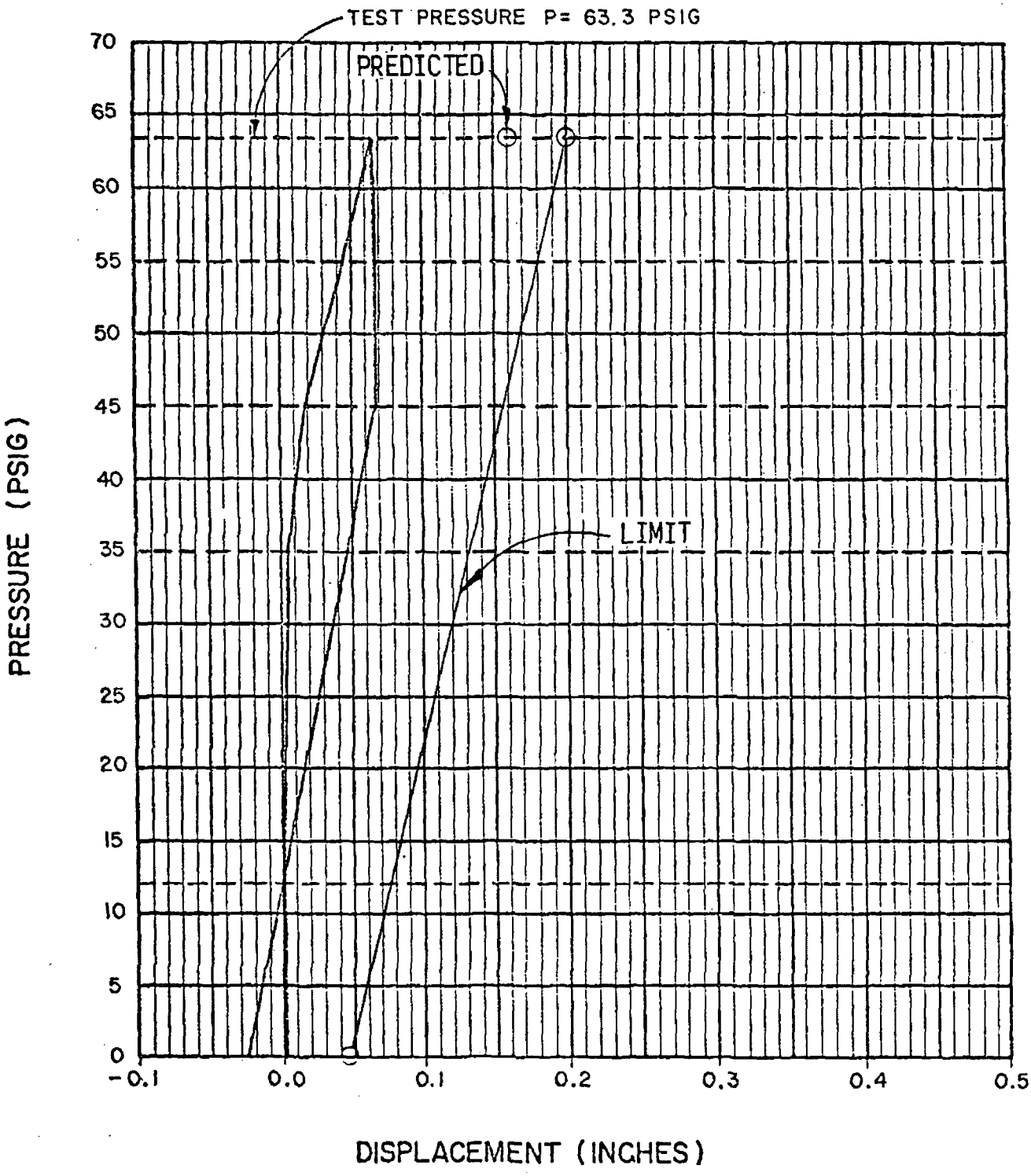
AZIMUTH 333-55 ELEVATION 204-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 16 CHANNEL 422 INSTRUMENT No. 95

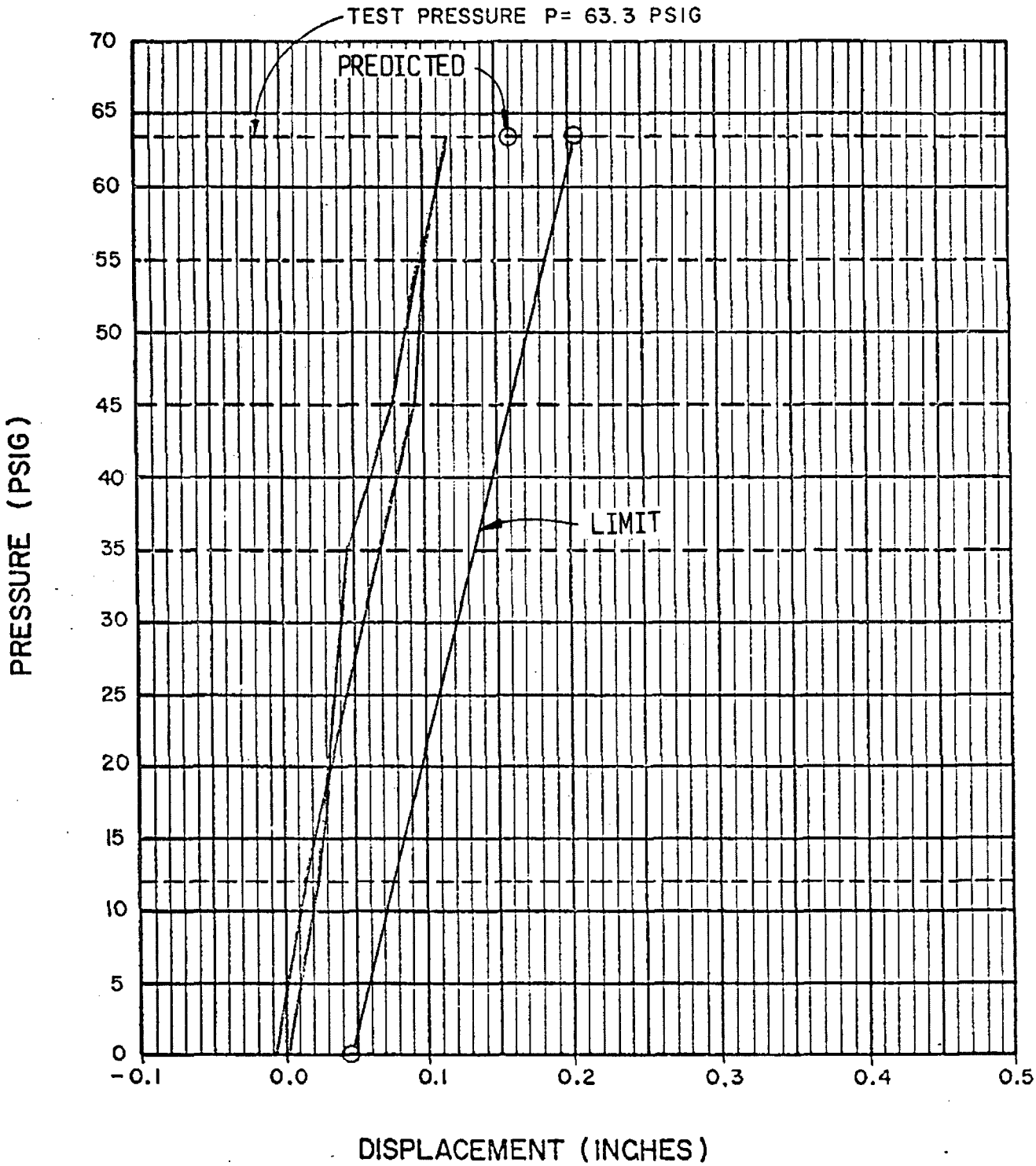
AZIMUTH 90 ELEVATION 236-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 17 CHANNEL 432 INSTRUMENT No. 16

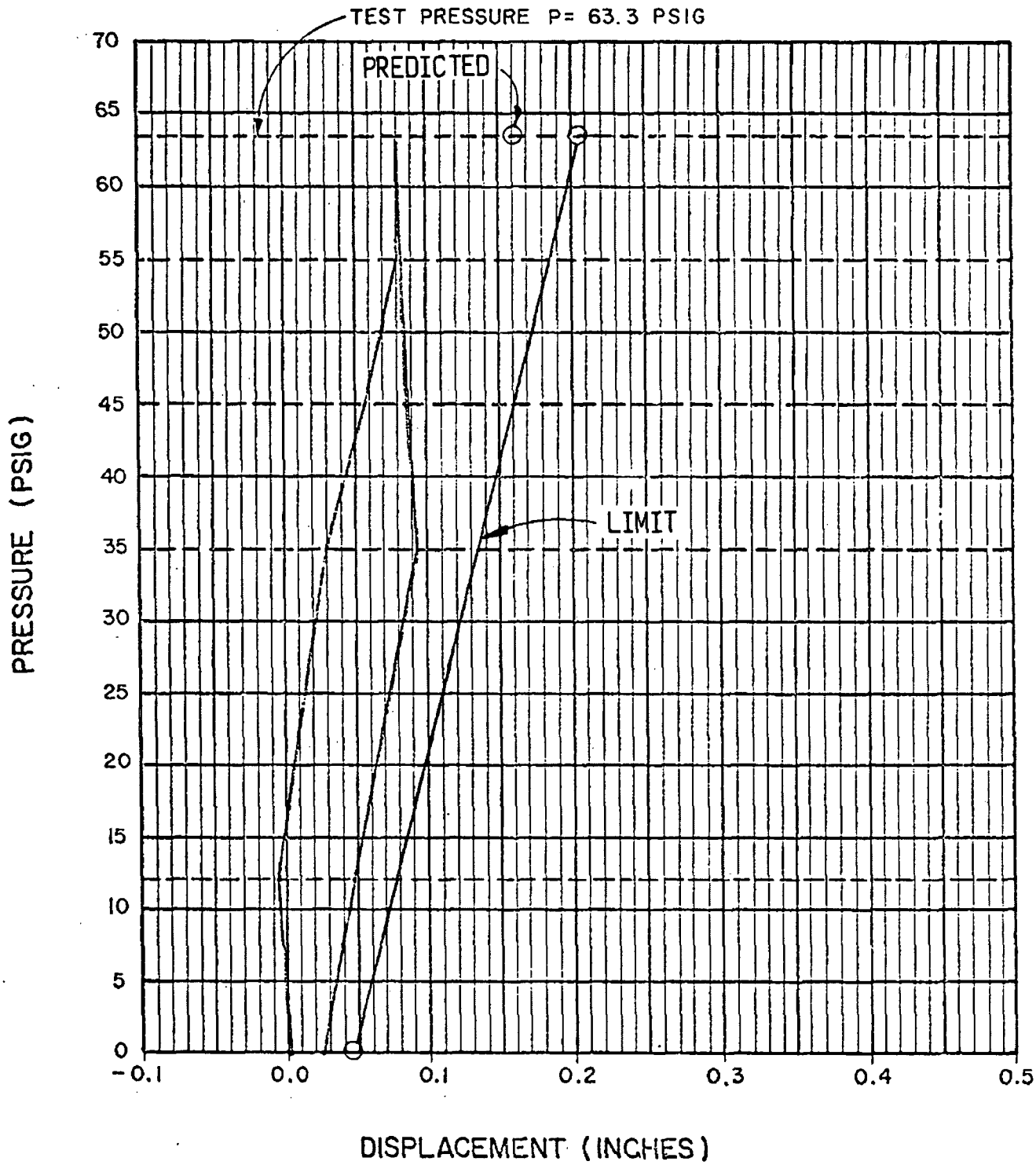
AZIMUTH 200 ELEVATION 236-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 18 CHANNEL 442 INSTRUMENT No. 78

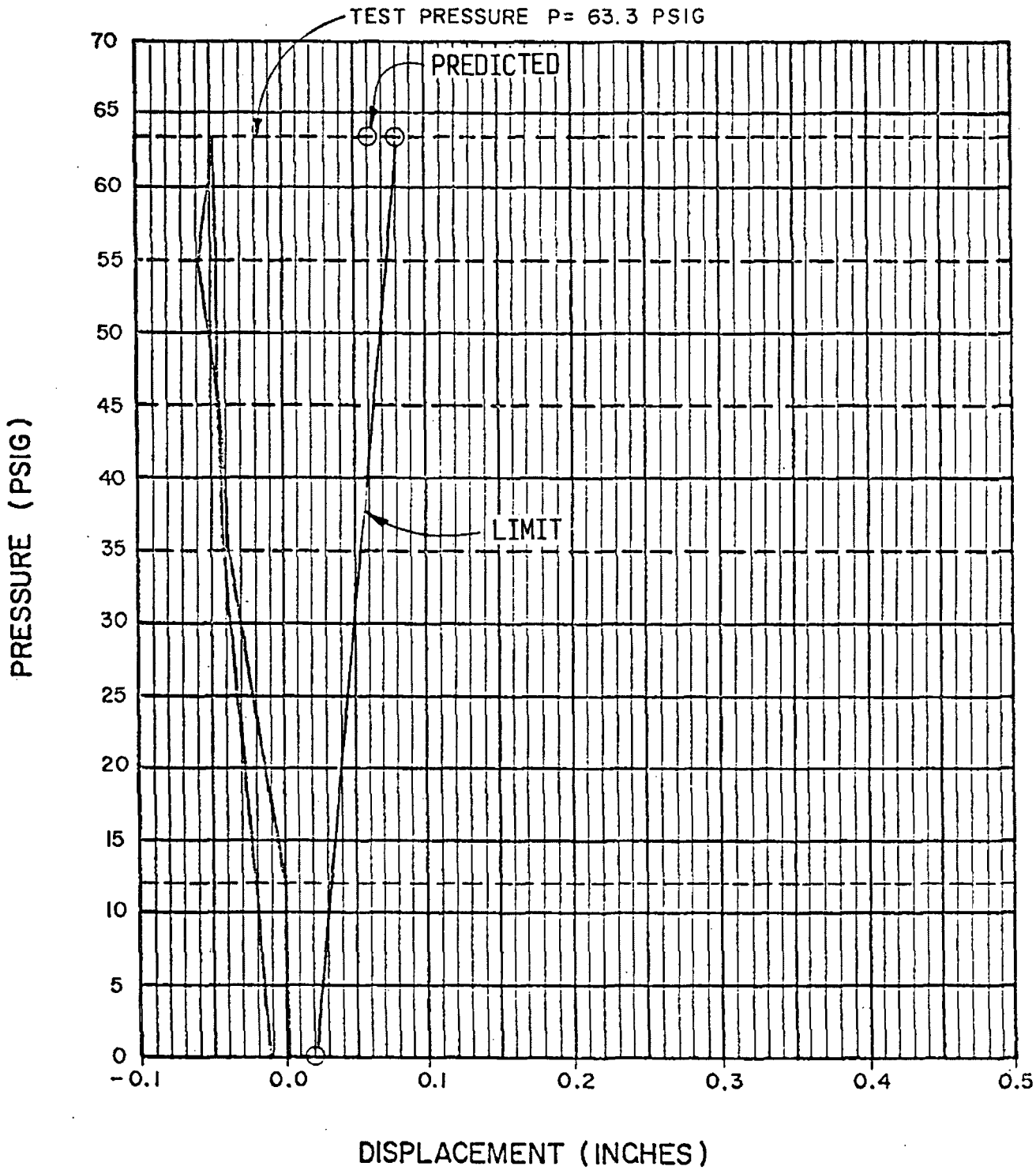
AZIMUTH 333-55 ELEVATION 236-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 19 CHANNEL 423 INSTRUMENT No. 58

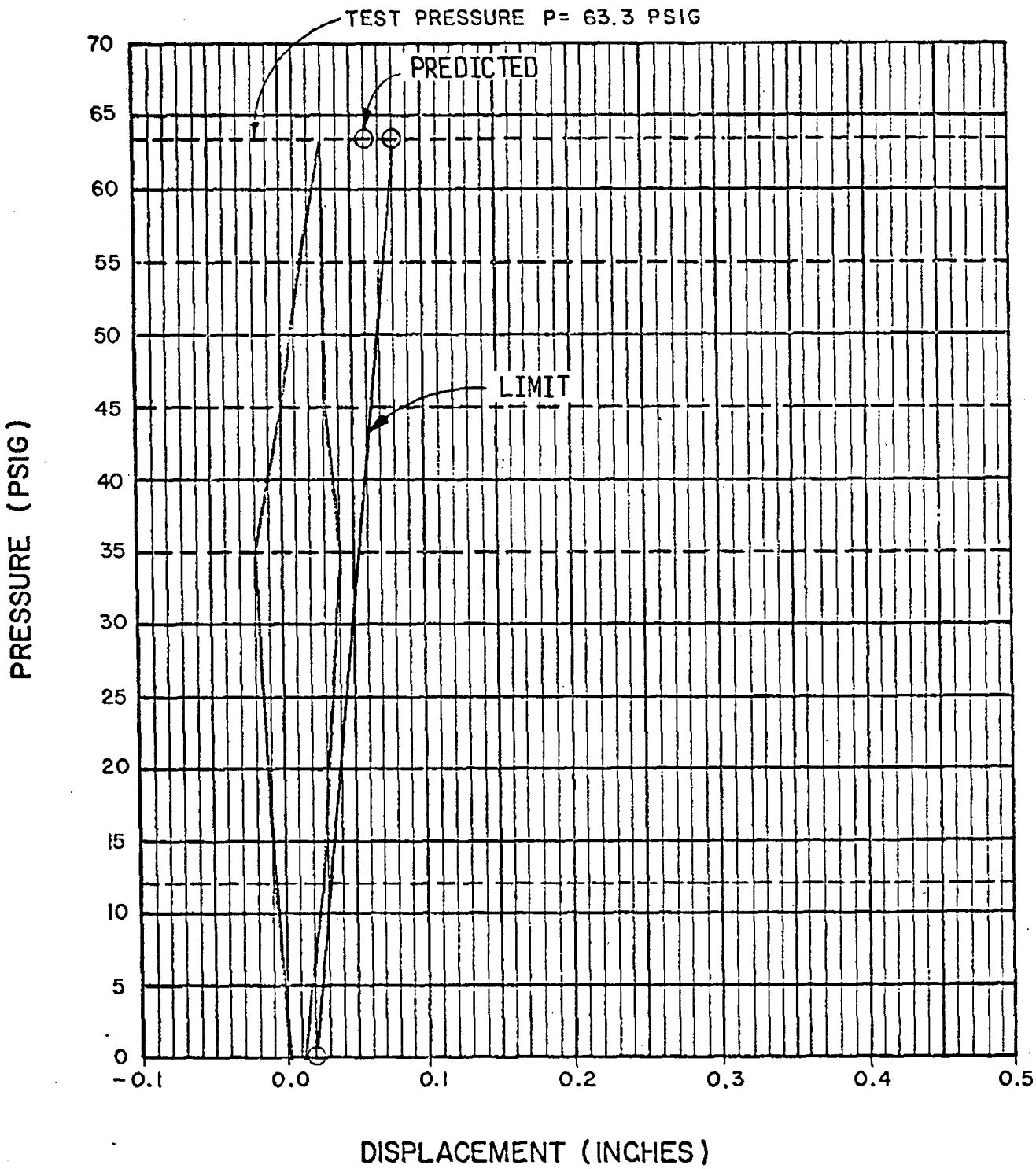
AZIMUTH 90 ELEVATION 245-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 20 CHANNEL 433 INSTRUMENT No. 75

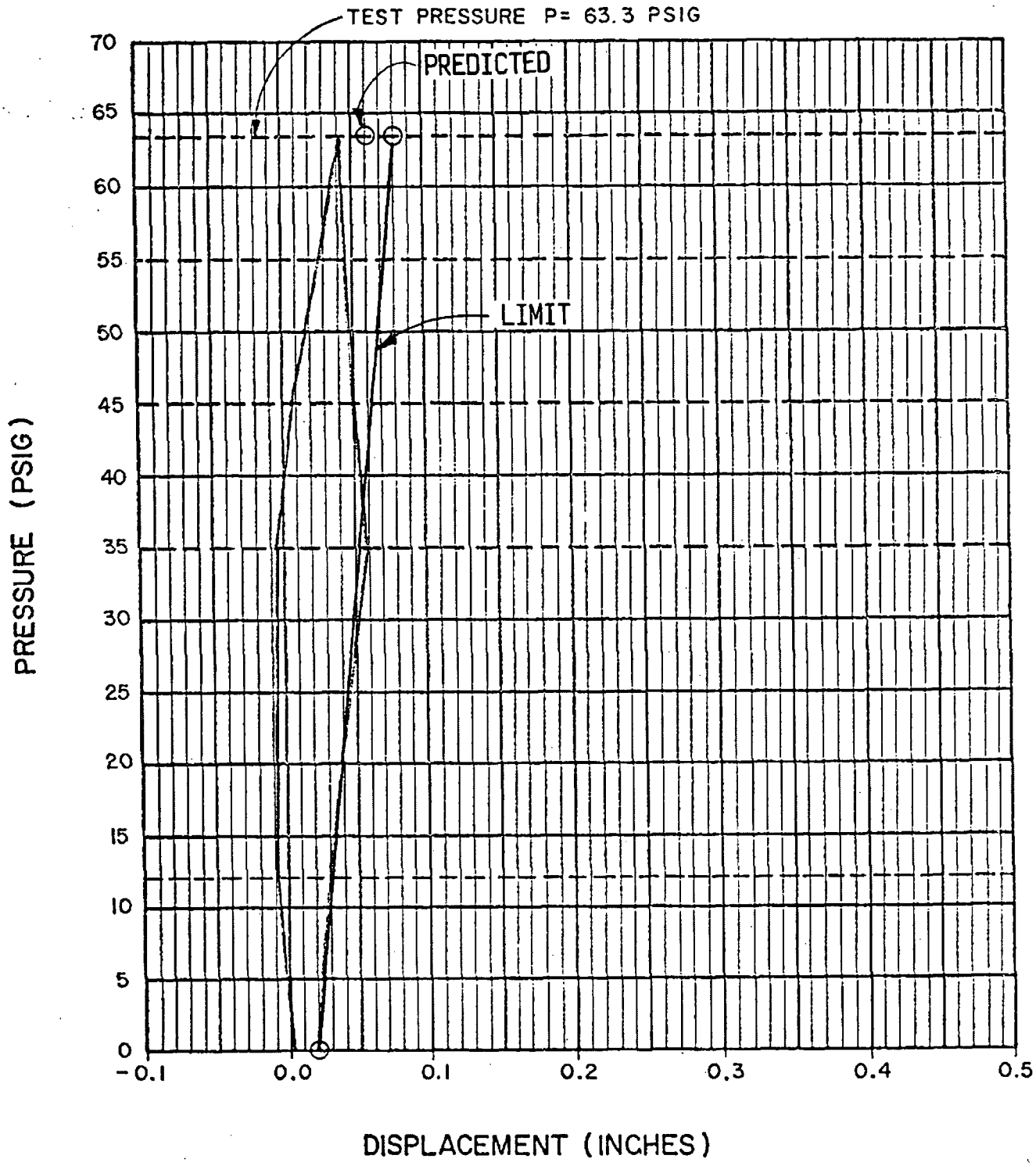
AZIMUTH 200 ELEVATION 246-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 21 CHANNEL 443 INSTRUMENT No. 66

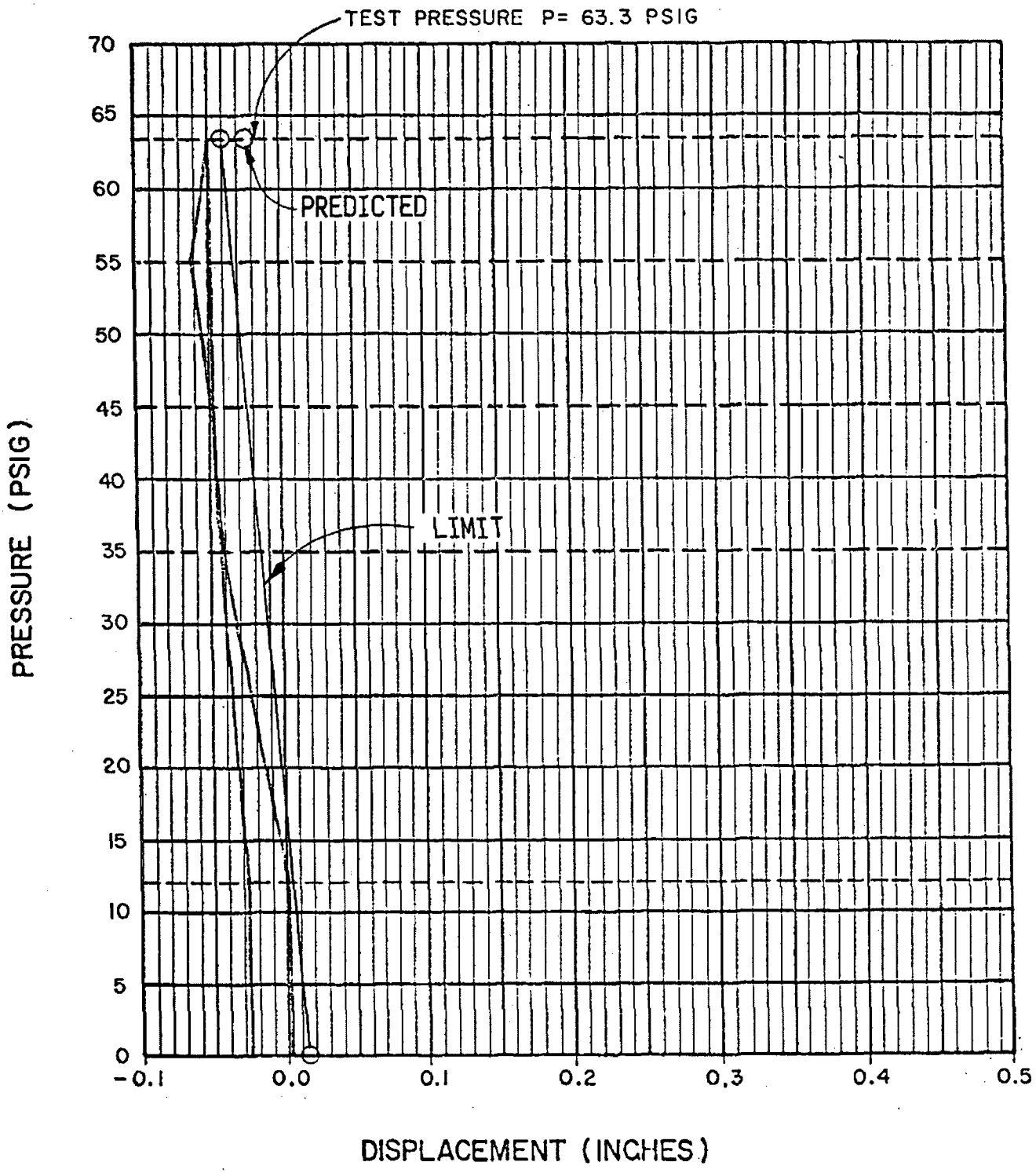
AZIMUTH 333-55 ELEVATION 246-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 22 CHANNEL 424 INSTRUMENT No. 83

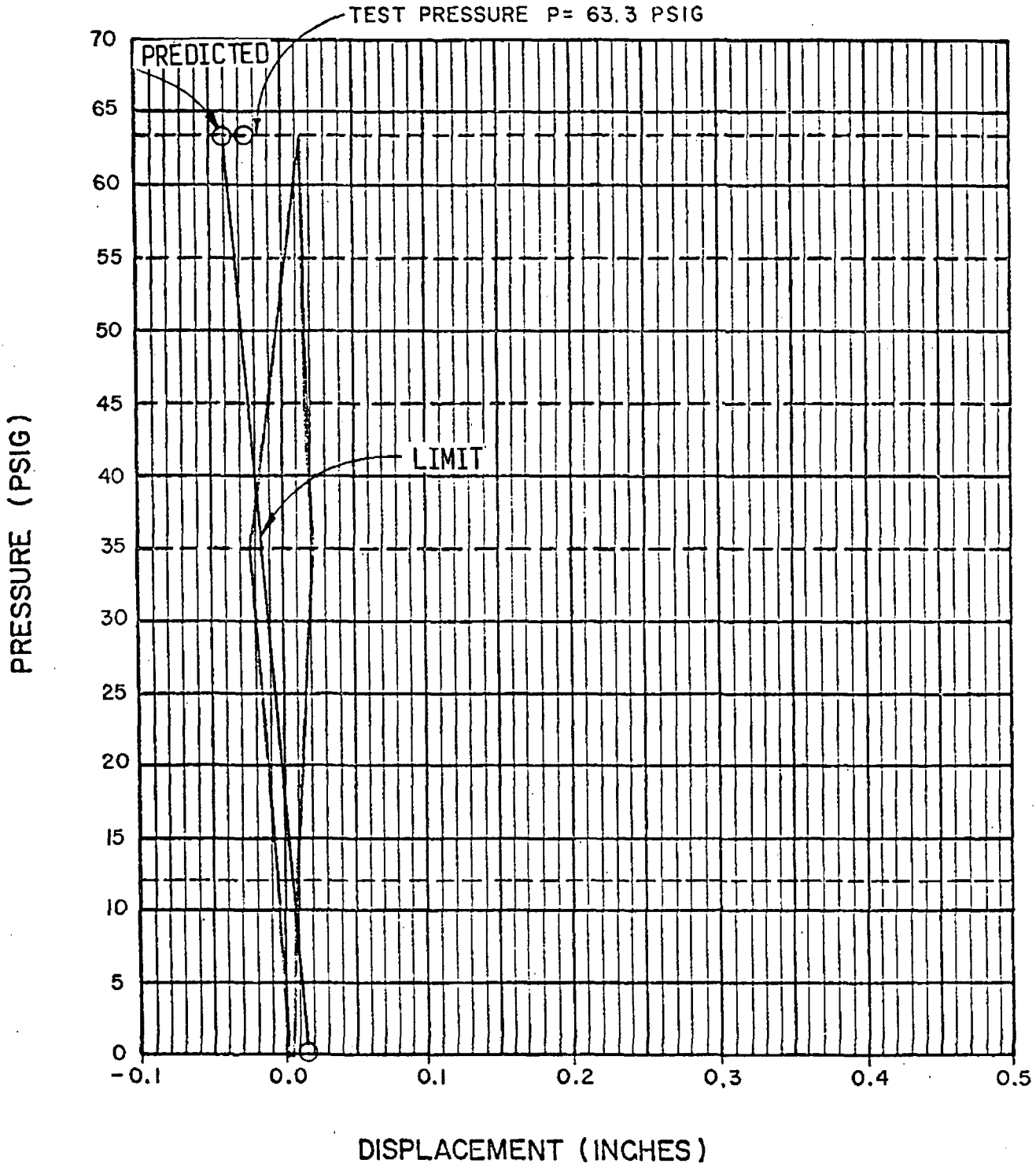
AZIMUTH 90 ELEVATION 253-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 23 CHANNEL 434 INSTRUMENT No. 21

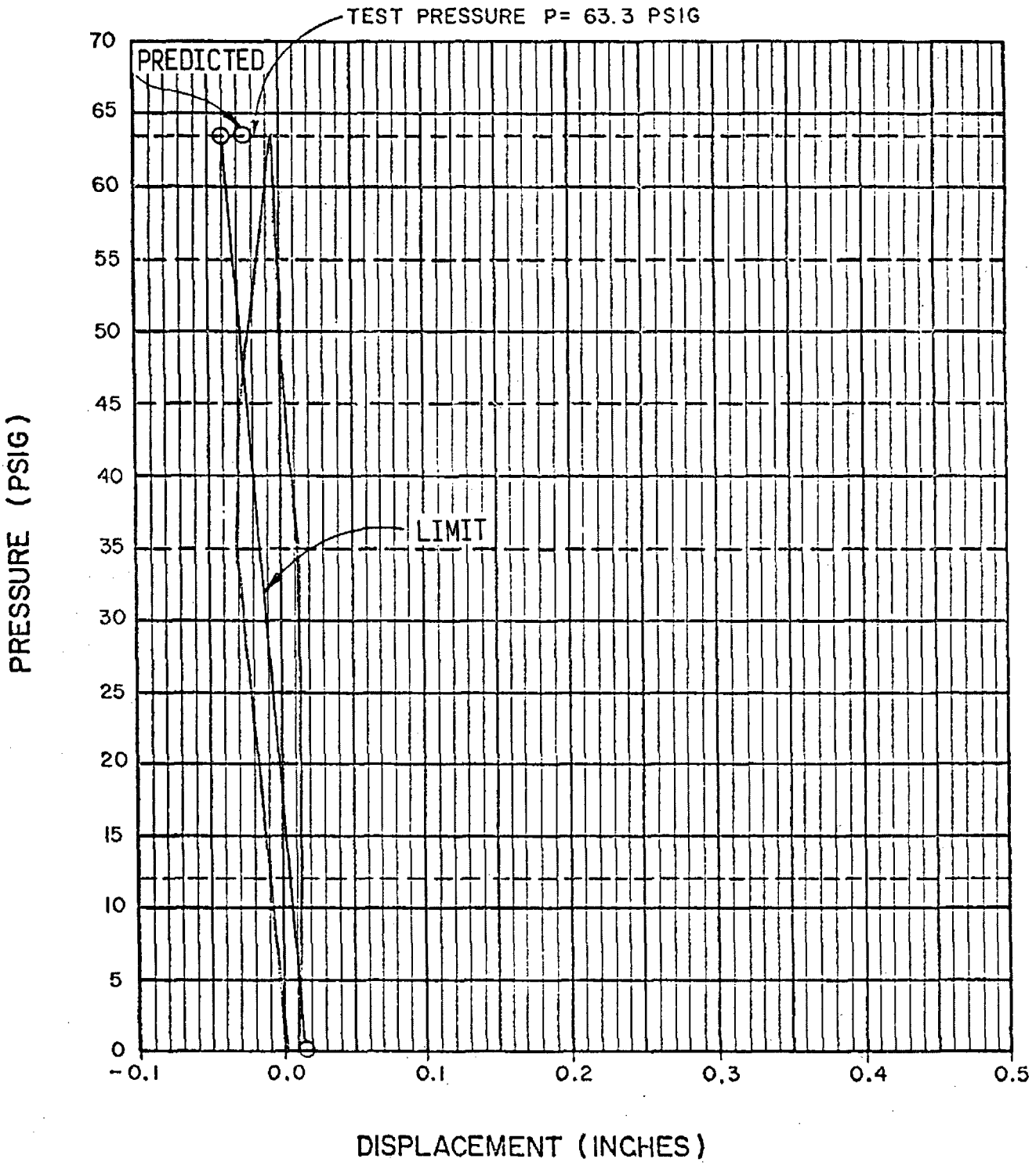
AZIMUTH 200 ELEVATION 253-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 24 CHANNEL 444 INSTRUMENT No. 74

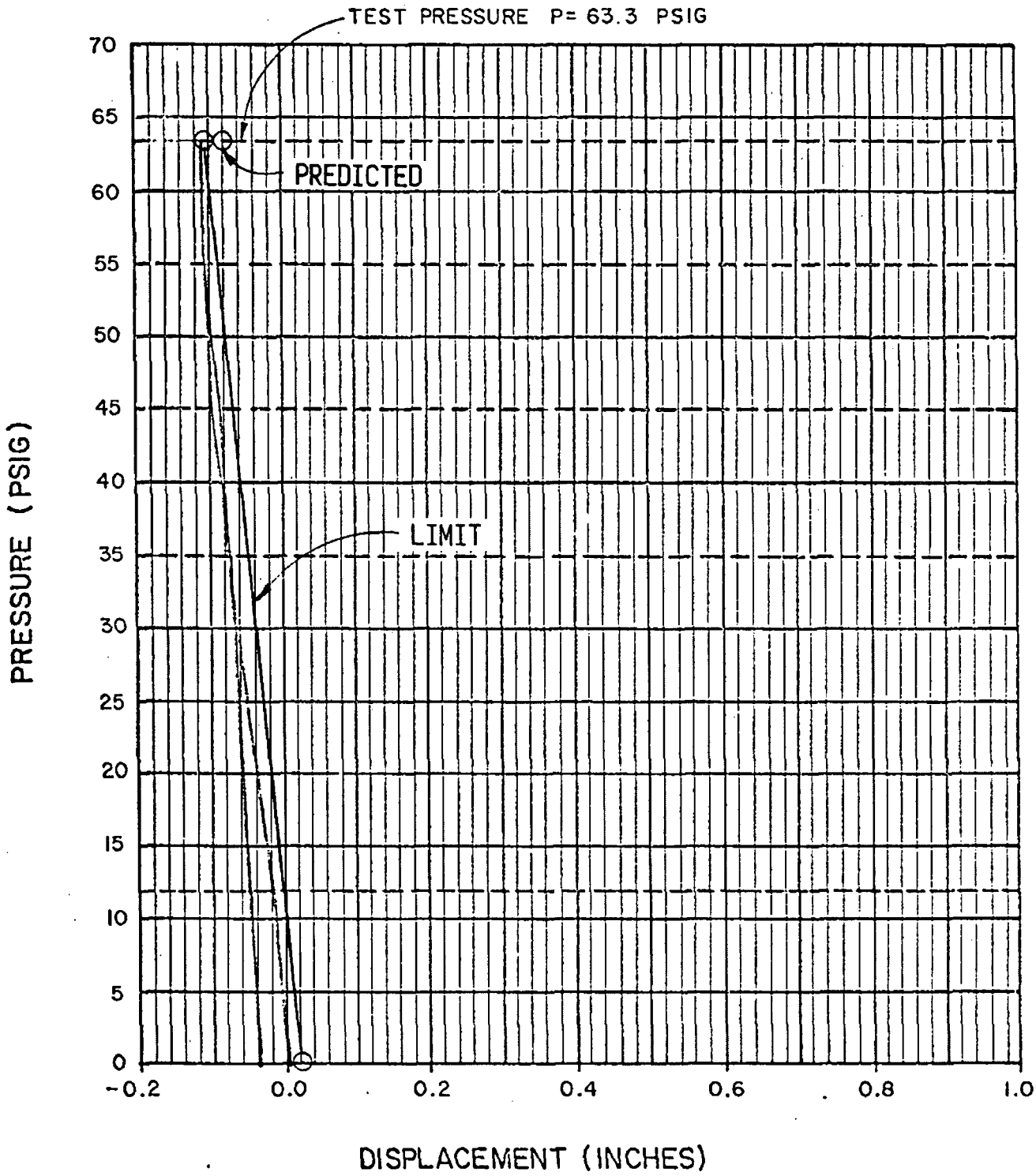
AZIMUTH 333-55 ELEVATION 253-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 25 CHANNEL 425 INSTRUMENT No. 92

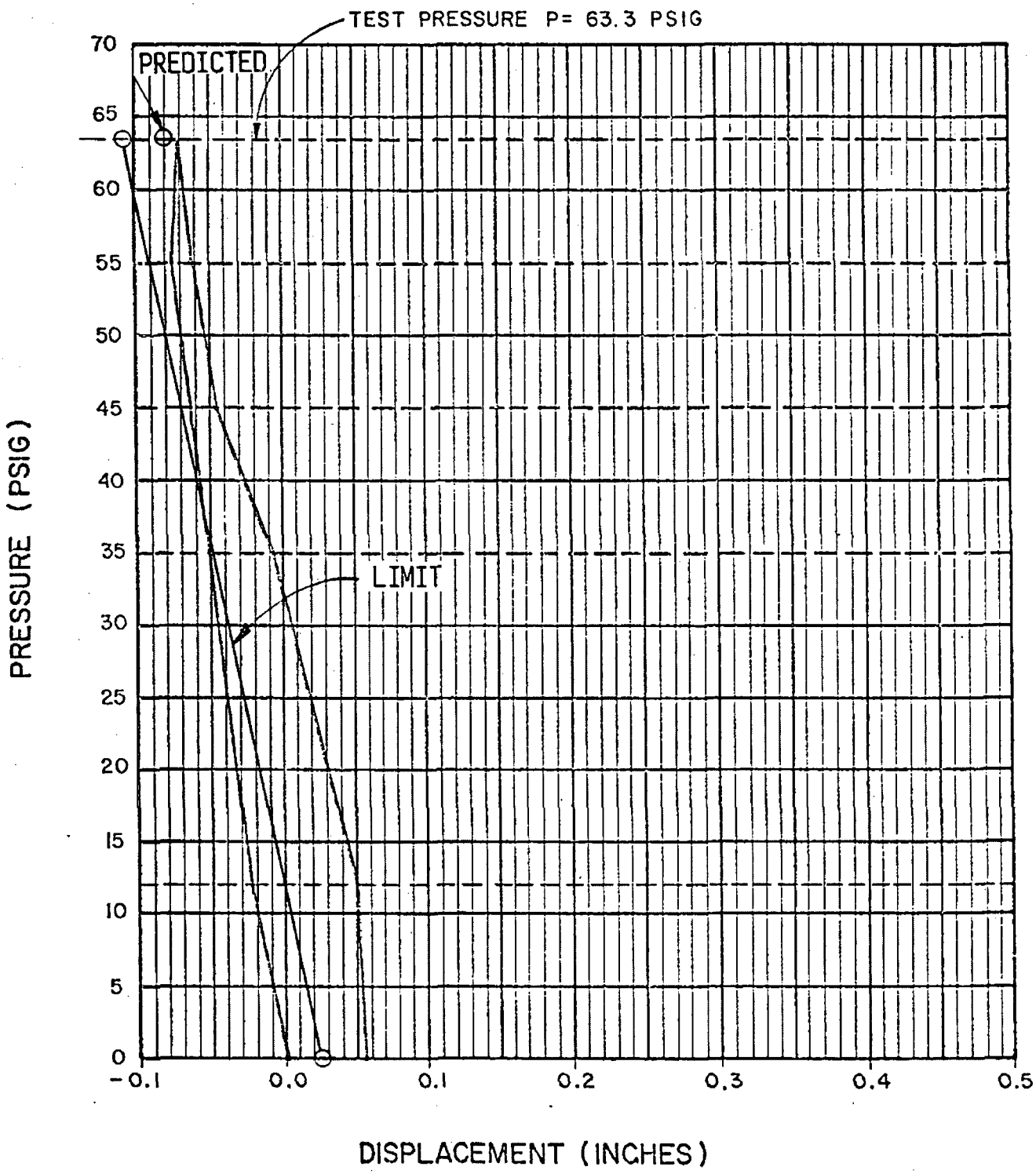
AZIMUTH 90 ELEVATION 267-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 26 CHANNEL 435 INSTRUMENT No. 18

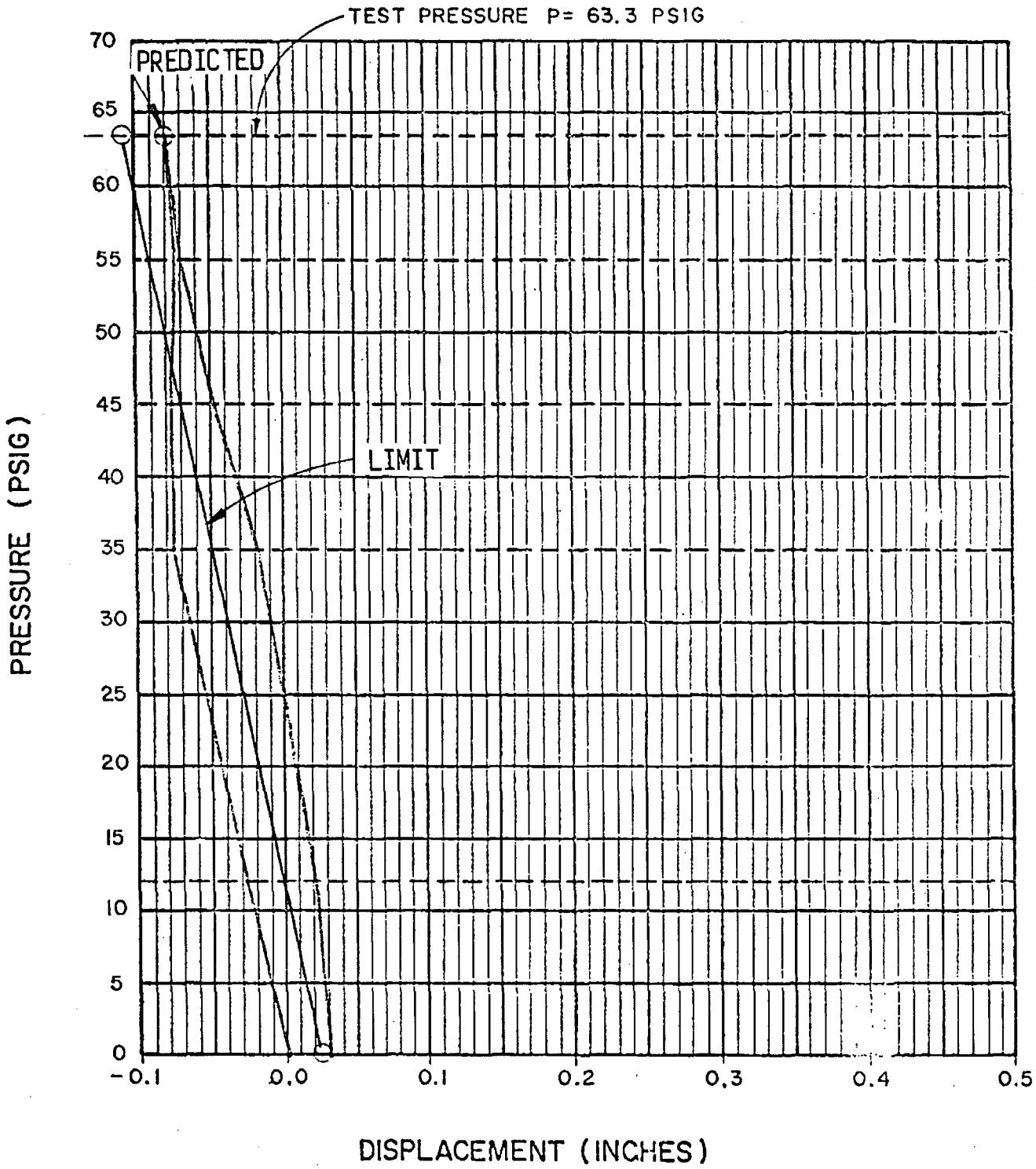
AZIMUTH 200 ELEVATION 267-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 27 CHANNEL 445 INSTRUMENT No. 82

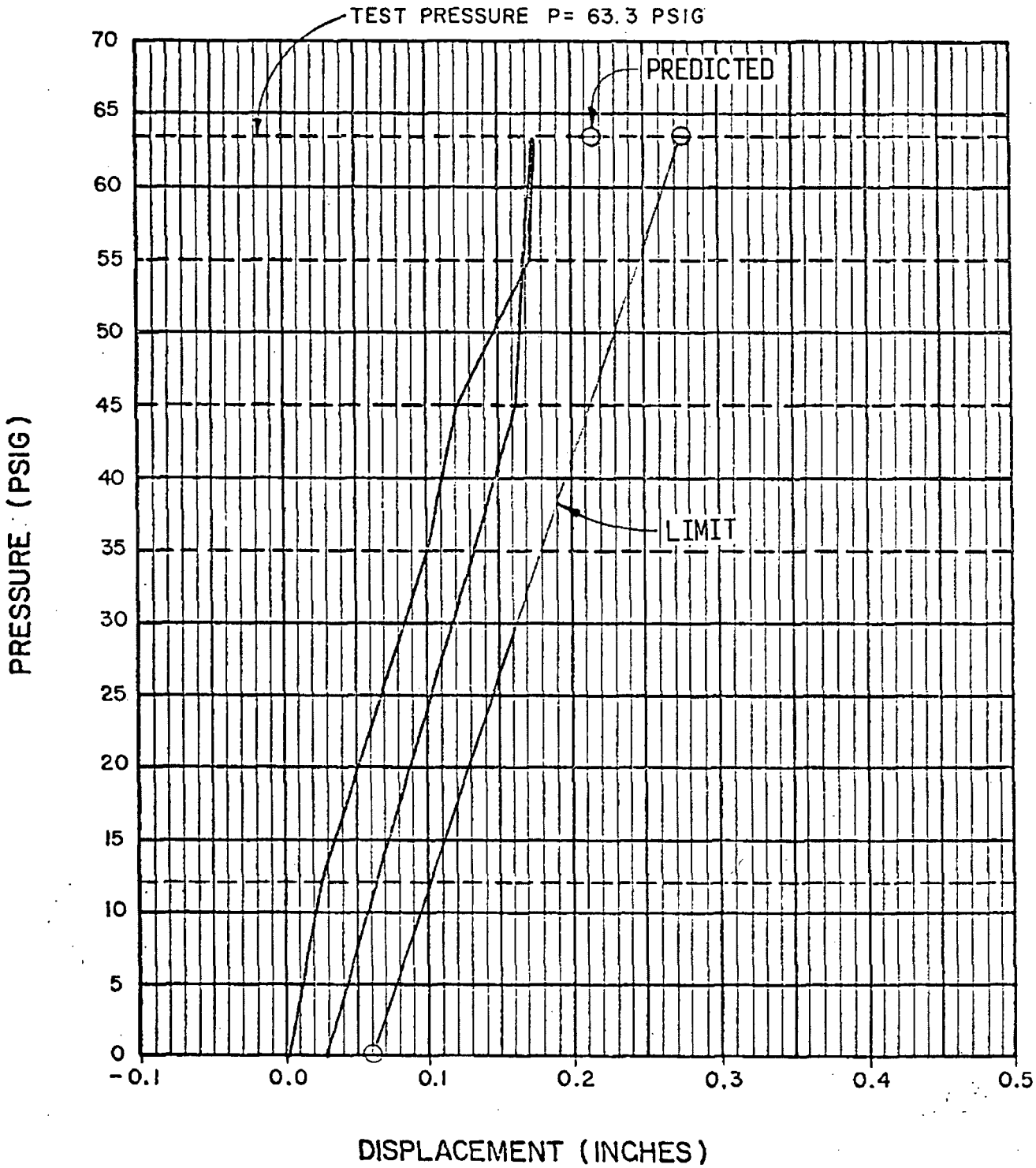
AZIMUTH 333-55 ELEVATION 267-0



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 28 CHANNEL 401 INSTRUMENT No. 72

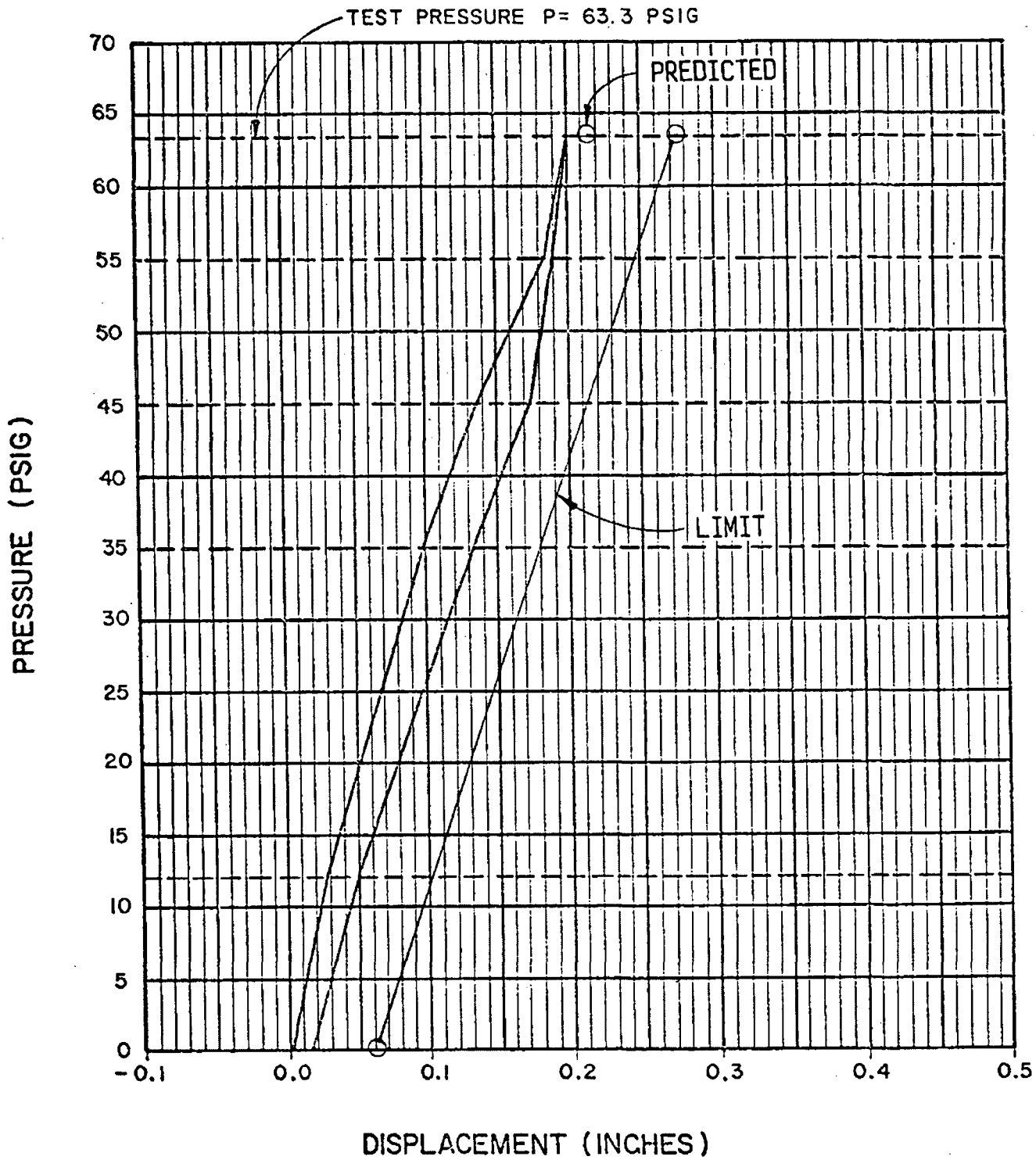
AZIMUTH 90 ELEVATION 270-8



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 29 CHANNEL 407 INSTRUMENT No. 61

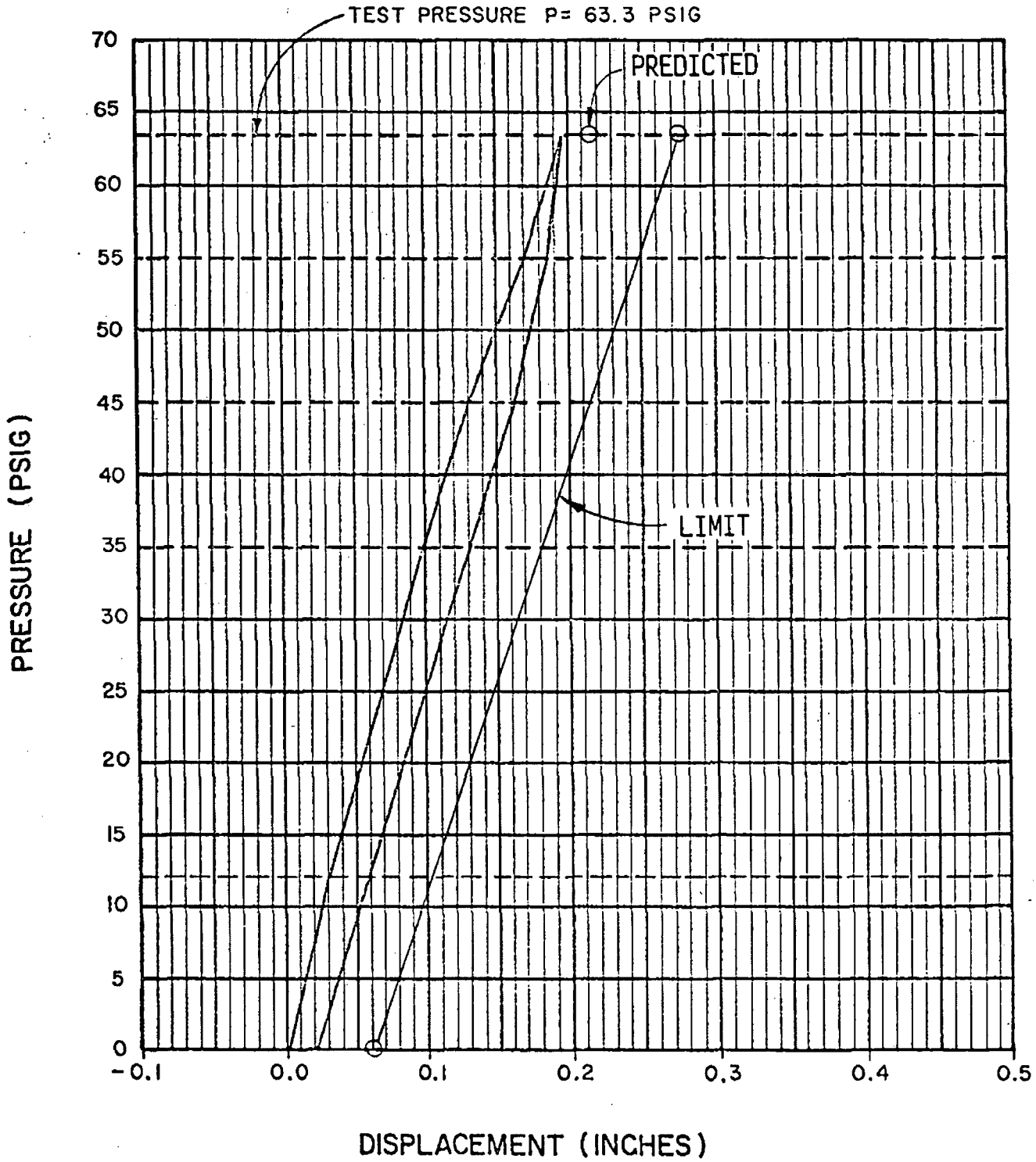
AZIMUTH 200 ELEVATION 270-B



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 30 CHANNEL 412 INSTRUMENT No. 90

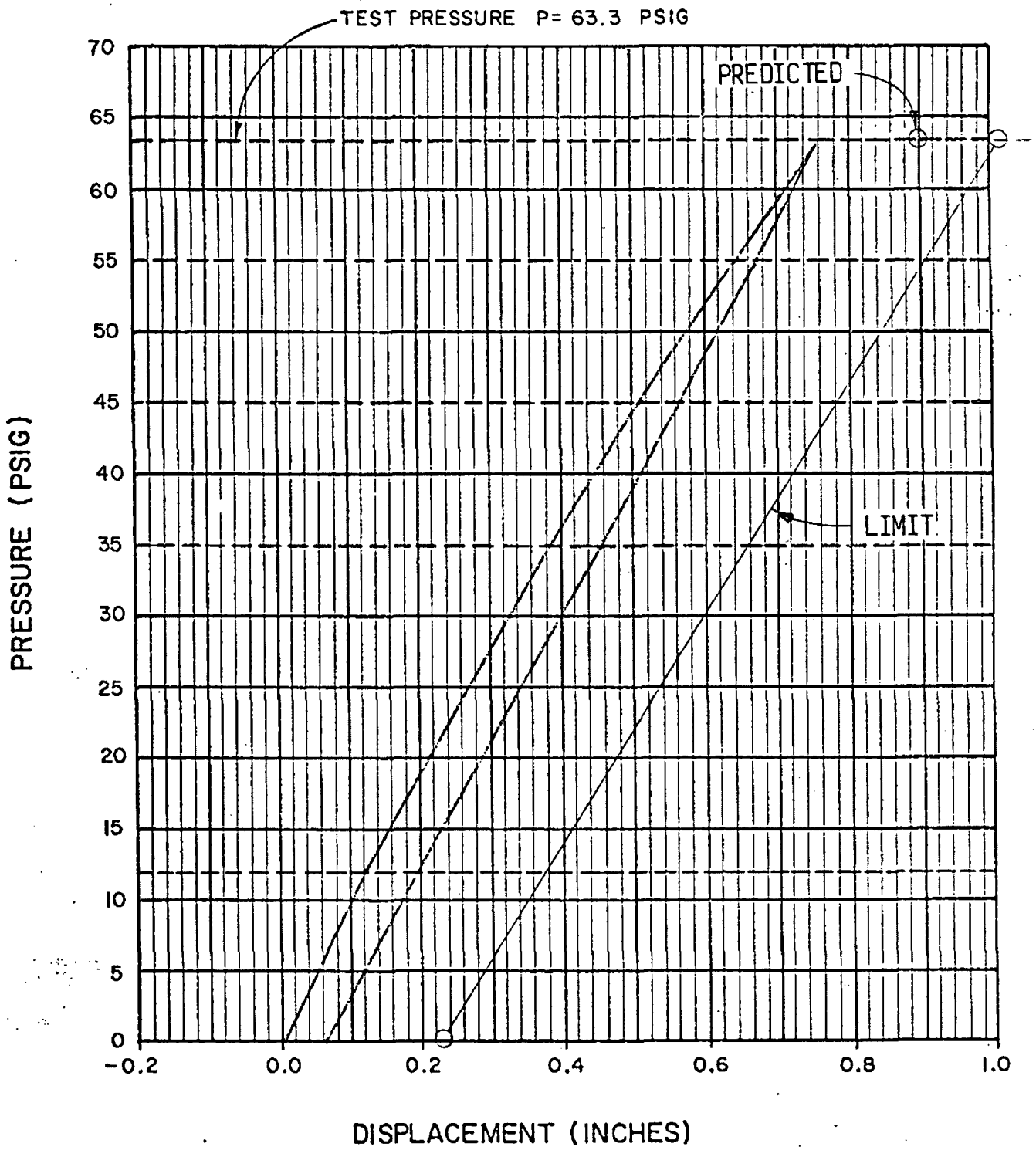
AZIMUTH 330-55 ELEVATION 270-8



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 34 CHANNEL 404 INSTRUMENT No. 13

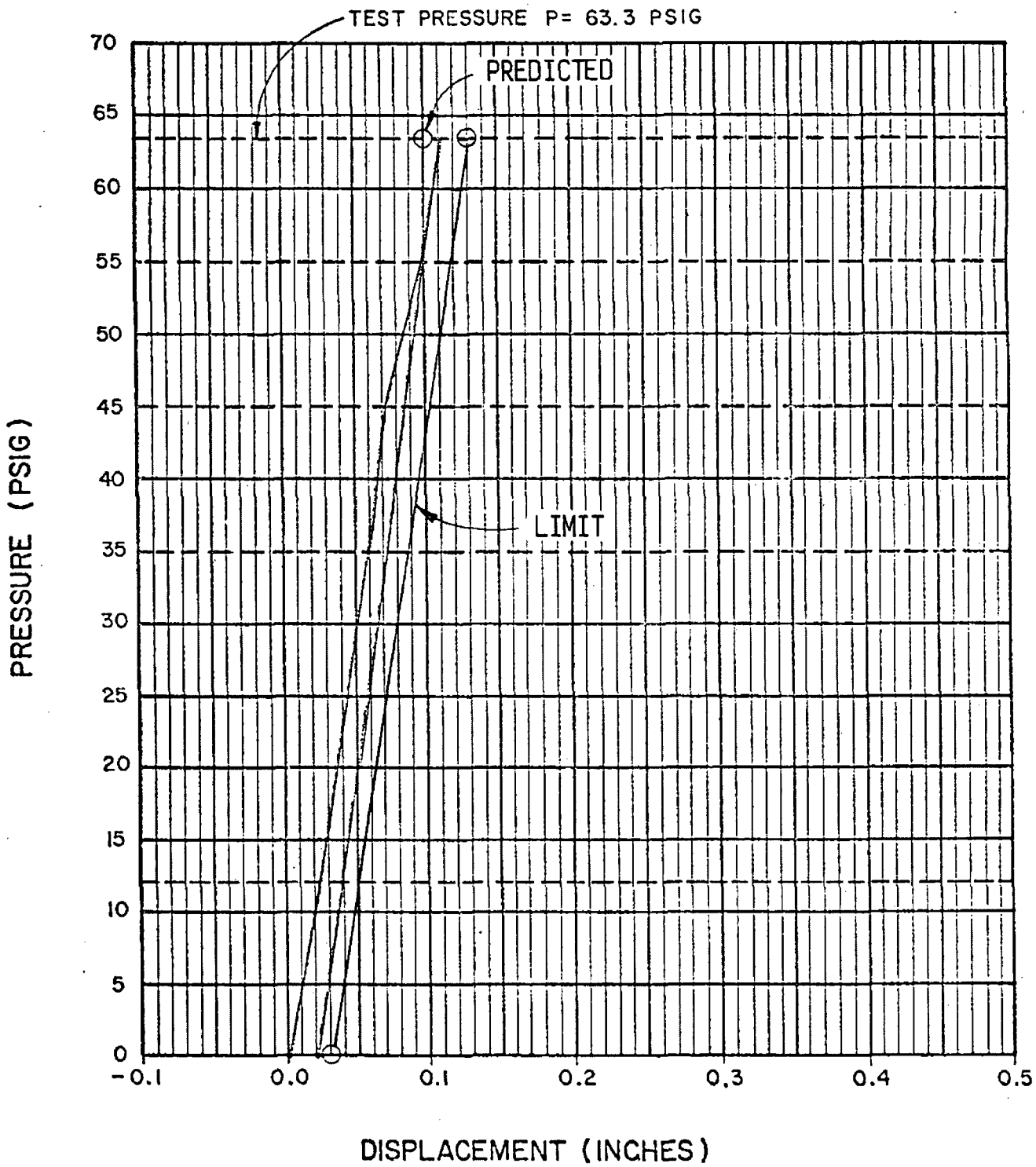
AZIMUTH _____ ELEVATION DOME APEX



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 35 CHANNEL 451 INSTRUMENT No. 53

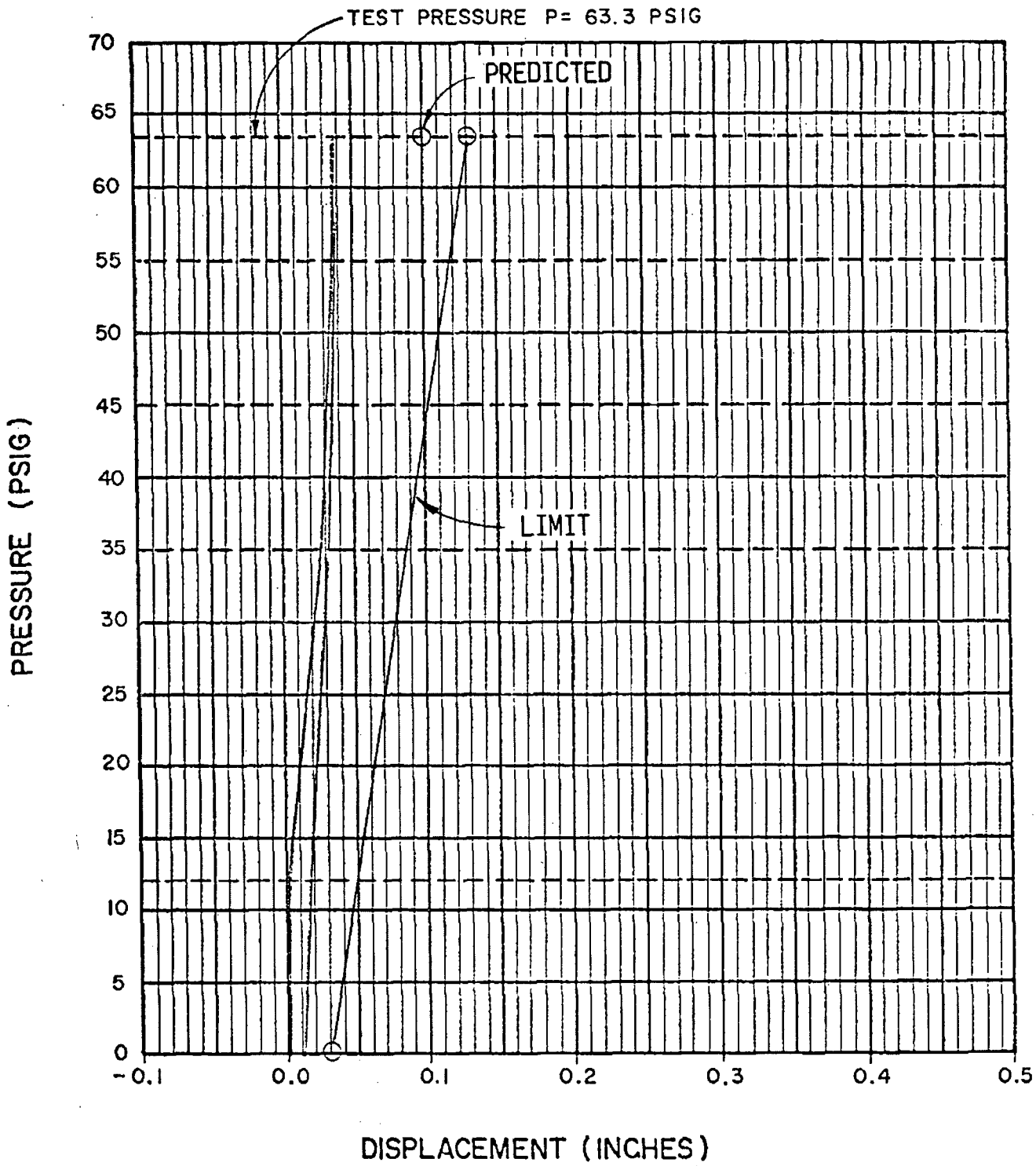
AZIMUTH 160 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 35 CHANNEL 453 INSTRUMENT No. 77

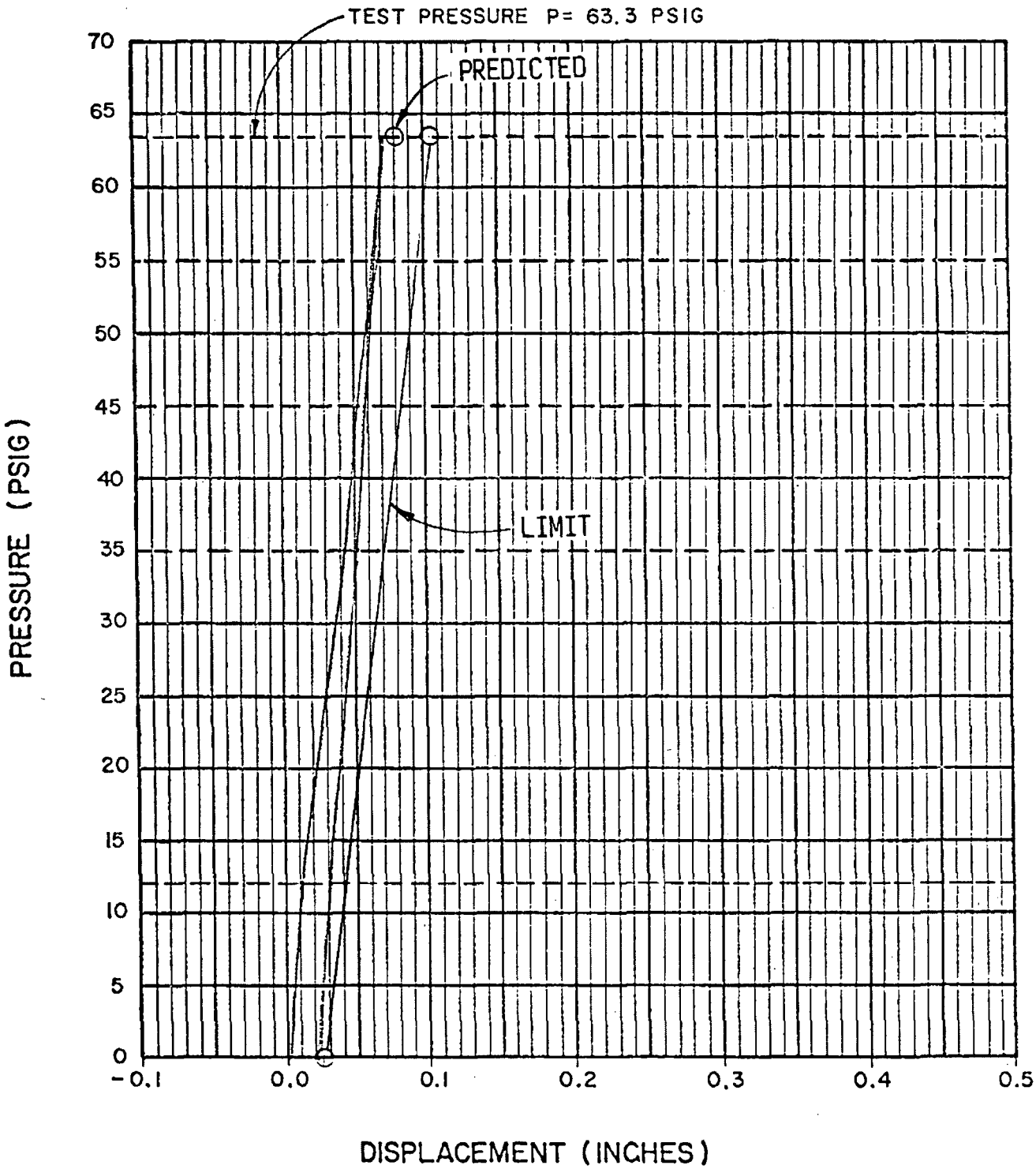
AZIMUTH 160 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 36 CHANNEL 462 INSTRUMENT No. 93

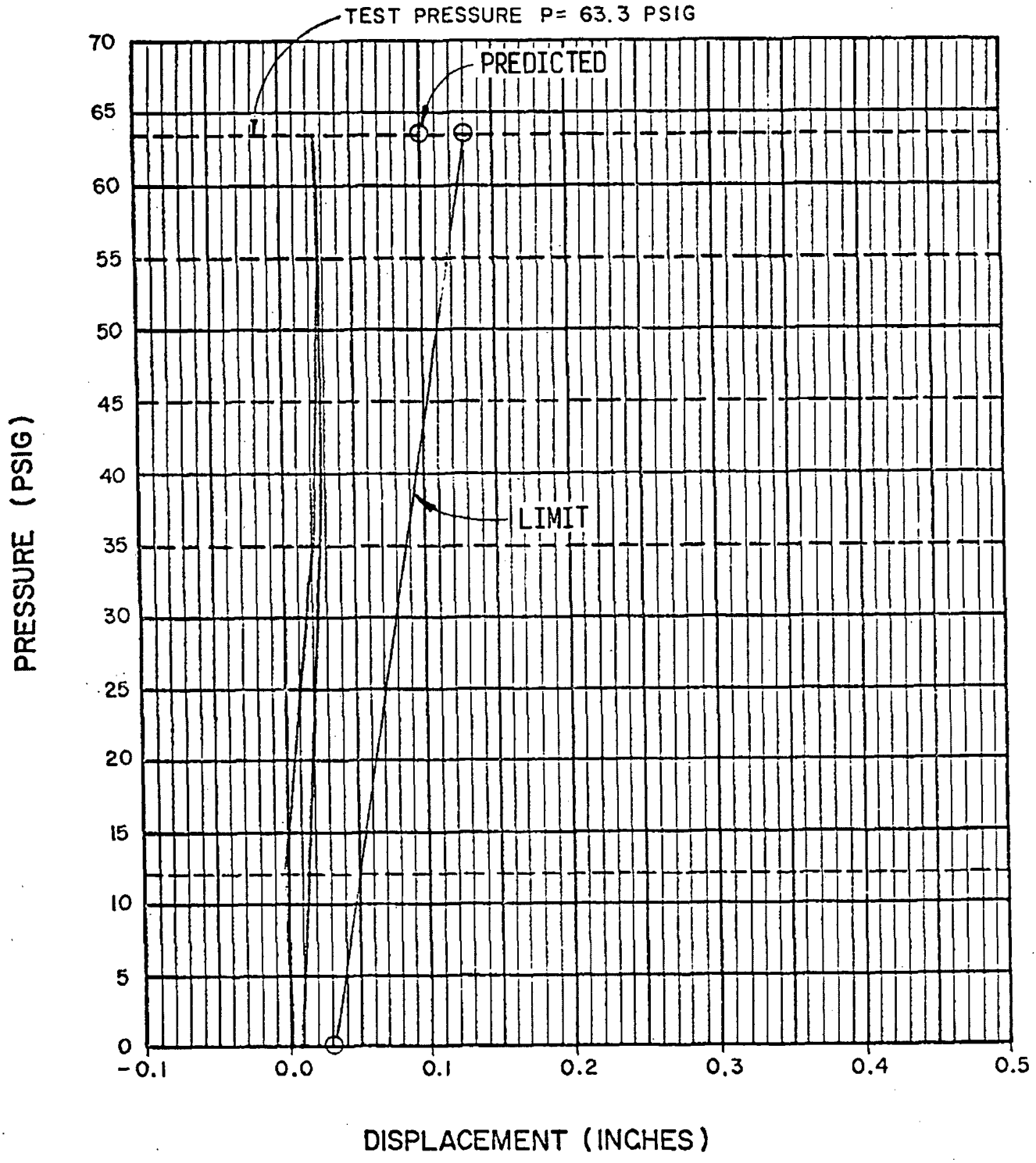
AZIMUTH 150 ELEVATION 120-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 36 CHANNEL 454 INSTRUMENT No.

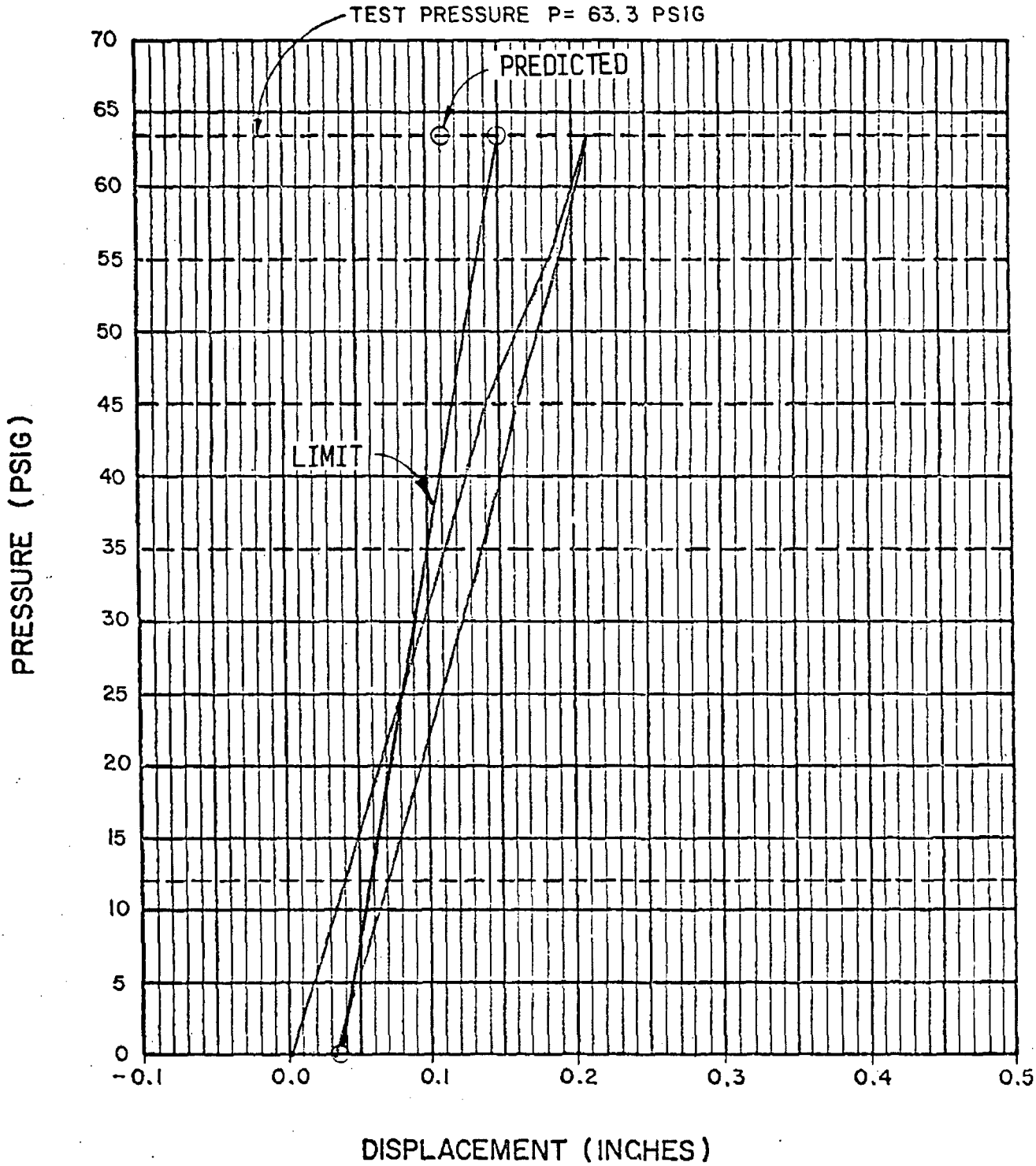
AZIMUTH 150 ELEVATION 120-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 38 CHANNEL 468 INSTRUMENT No. 19

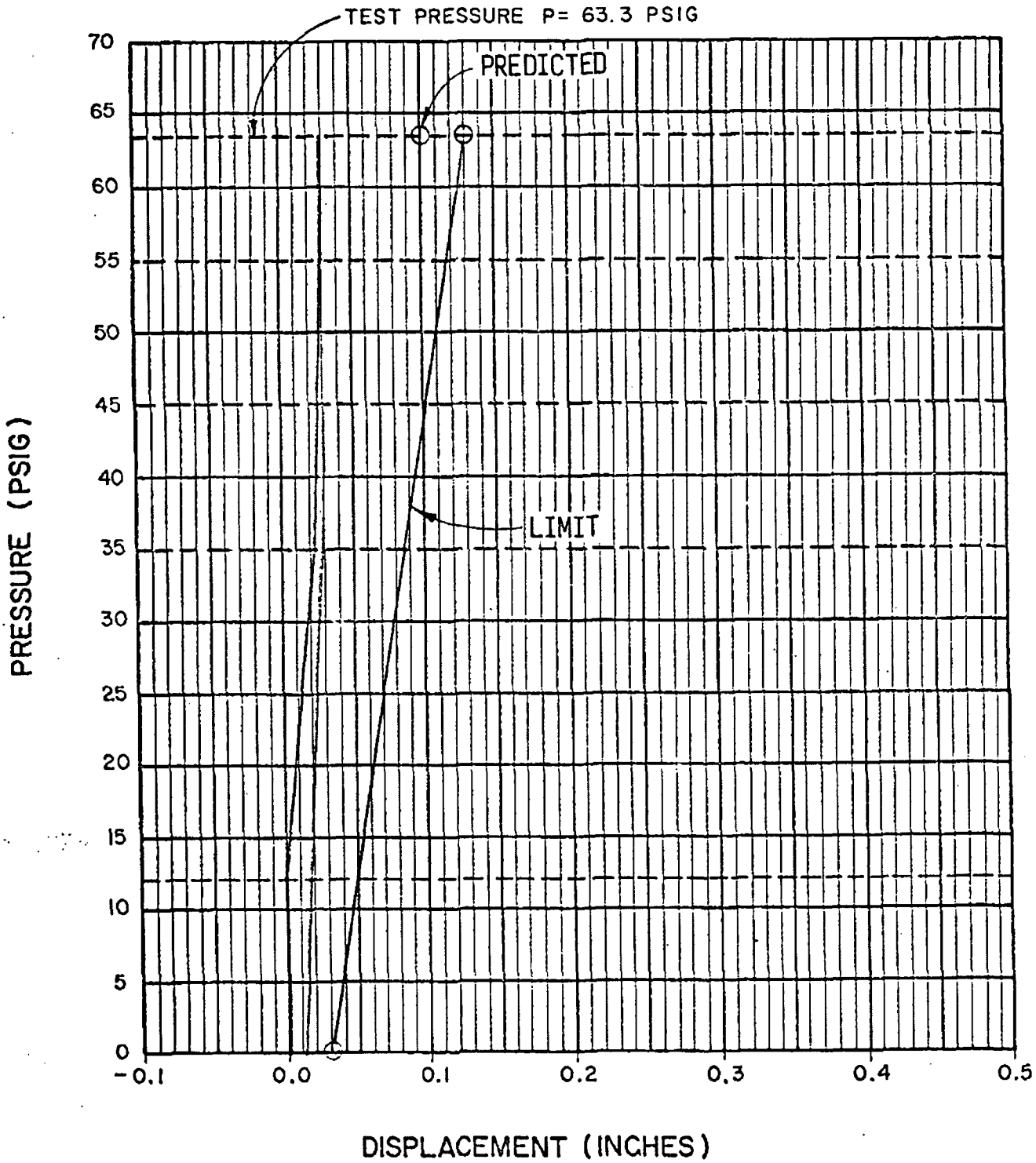
AZIMUTH 126 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 38 CHANNEL 459 INSTRUMENT No. 71

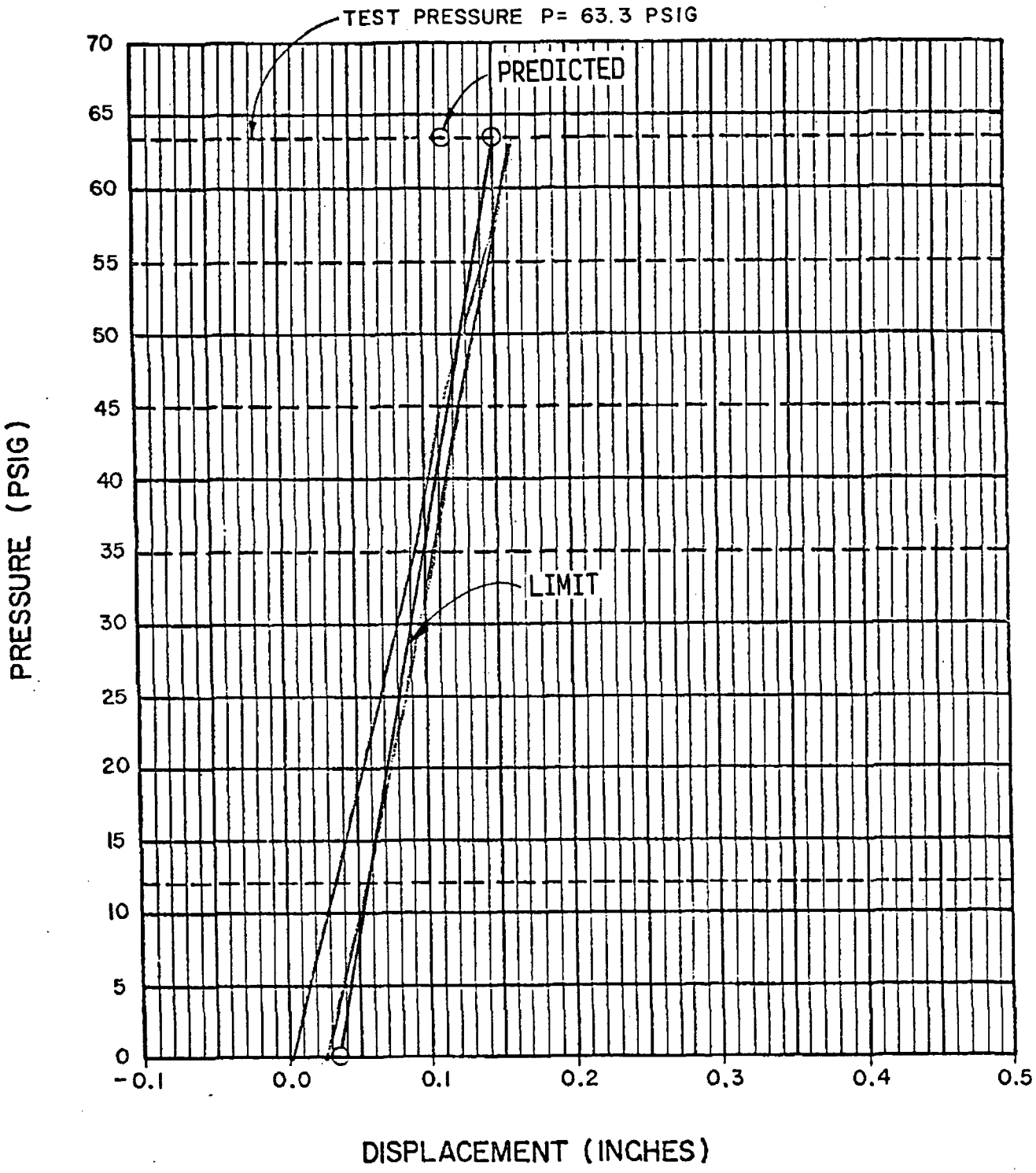
AZIMUTH 126 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 39 CHANNEL 467 INSTRUMENT No. 84

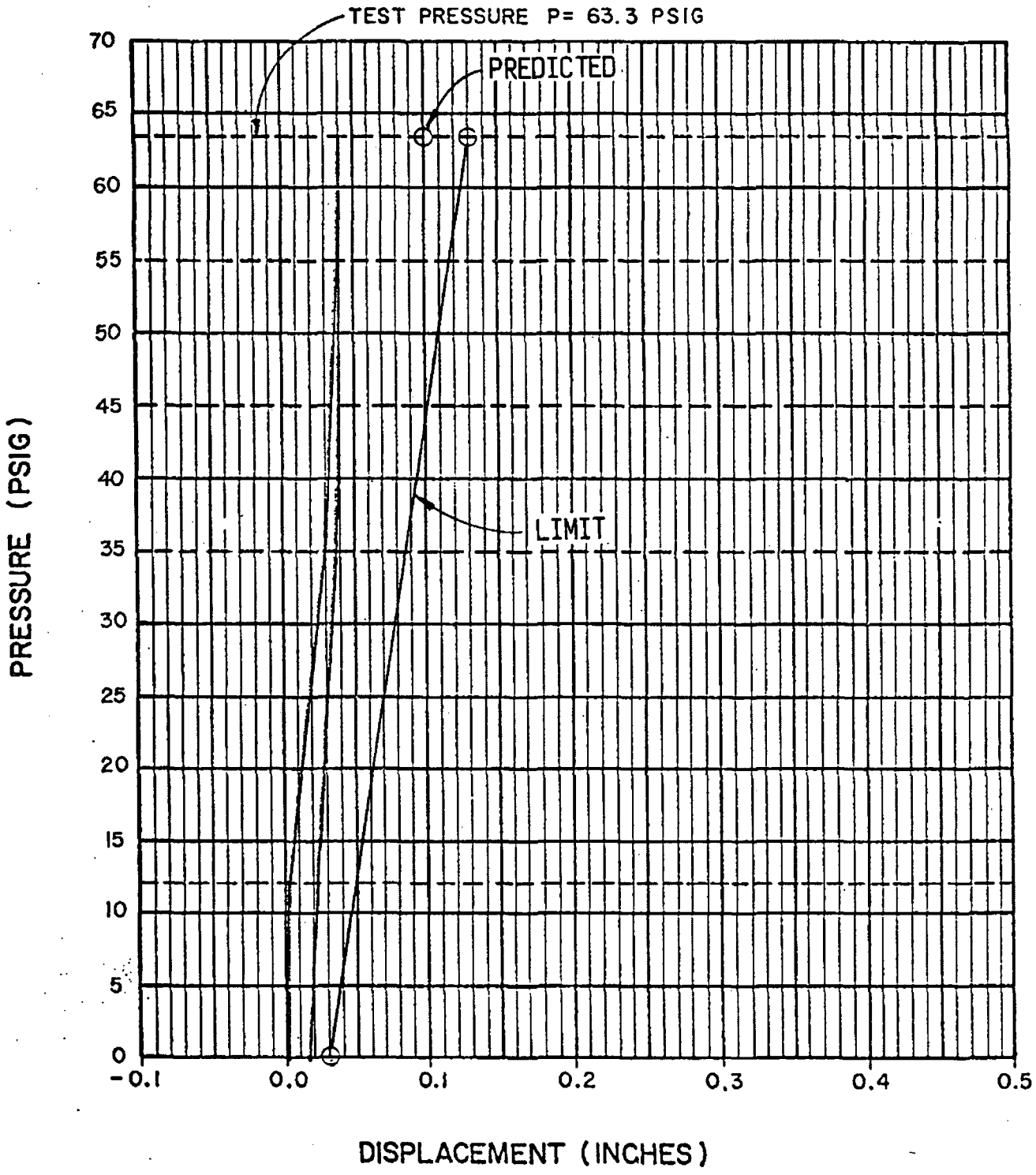
AZIMUTH 131 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 39 CHANNEL 458 INSTRUMENT No. 15

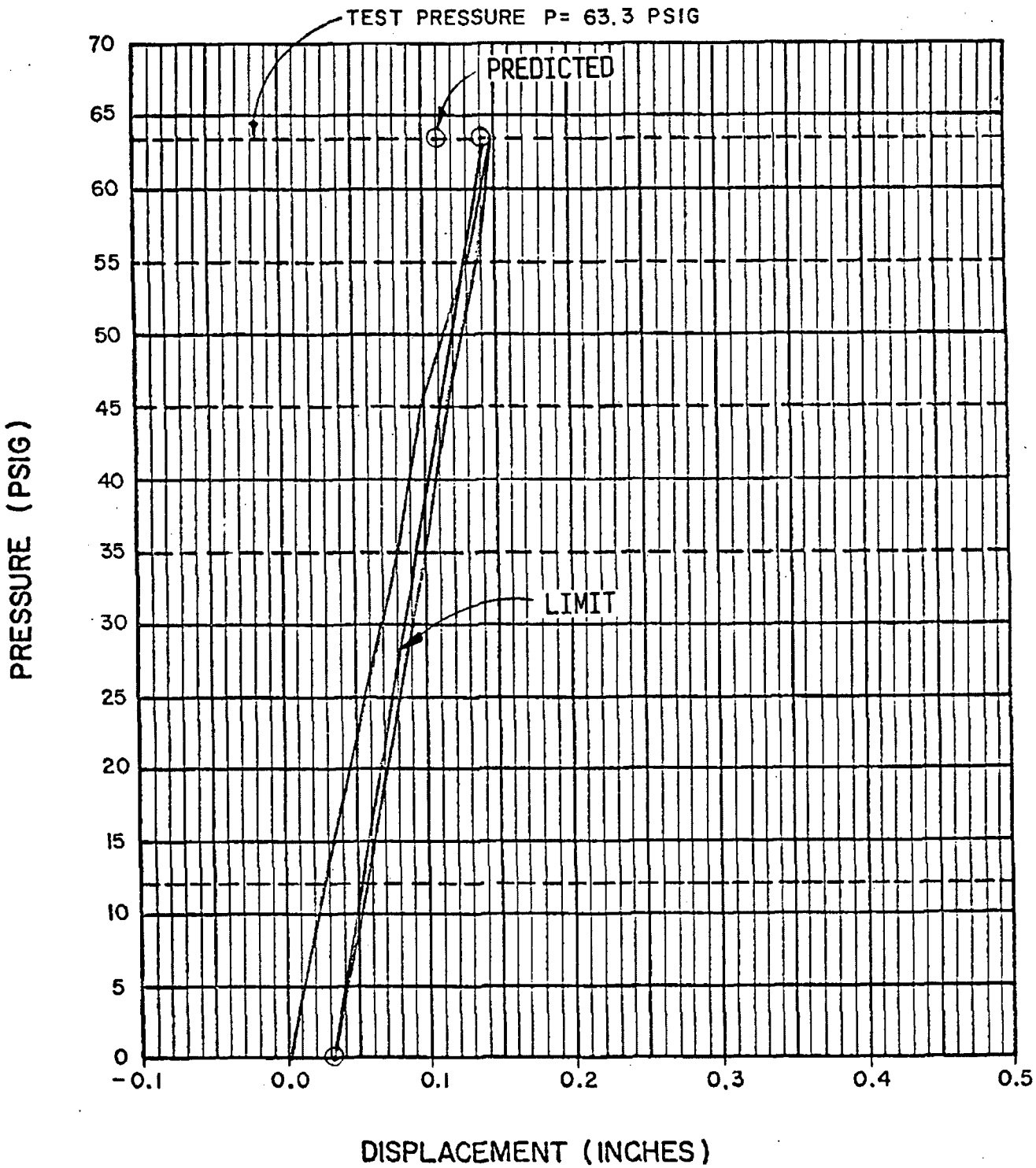
AZIMUTH 131 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 40 CHANNEL 466 INSTRUMENT No. 68

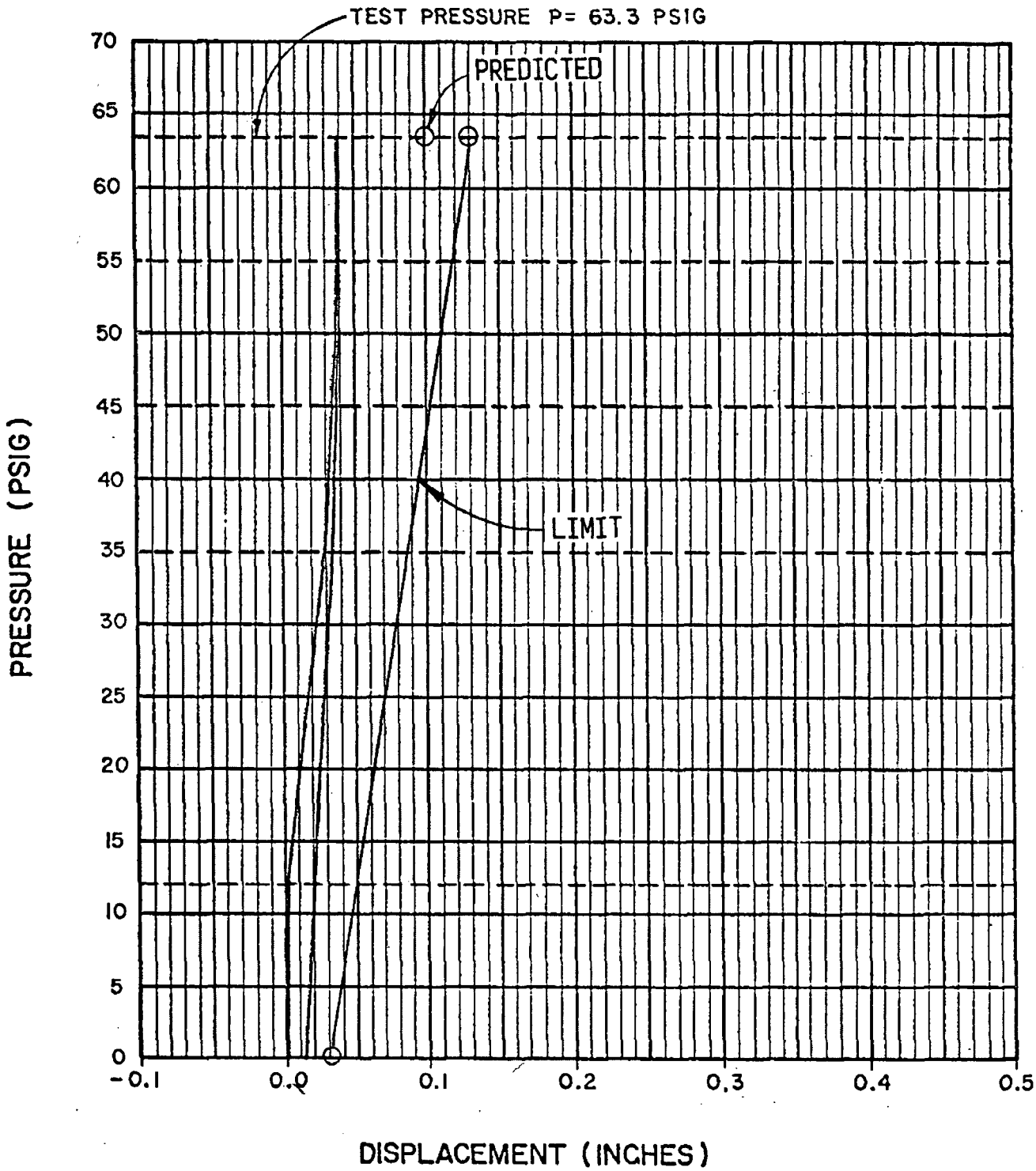
AZIMUTH 134 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 40 CHANNEL 457 INSTRUMENT No. 40

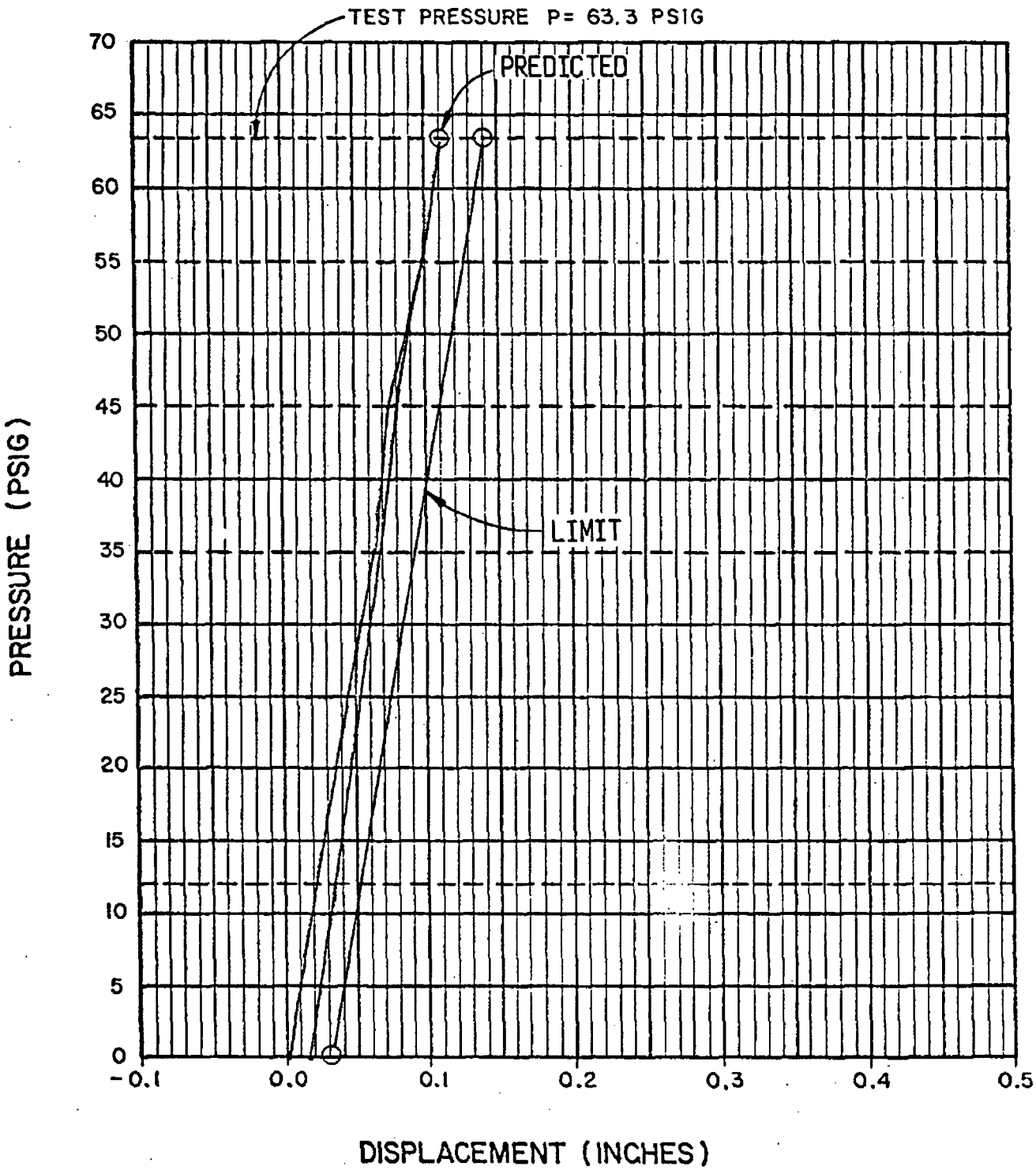
AZIMUTH 134 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 41 CHANNEL 465 INSTRUMENT No. 29

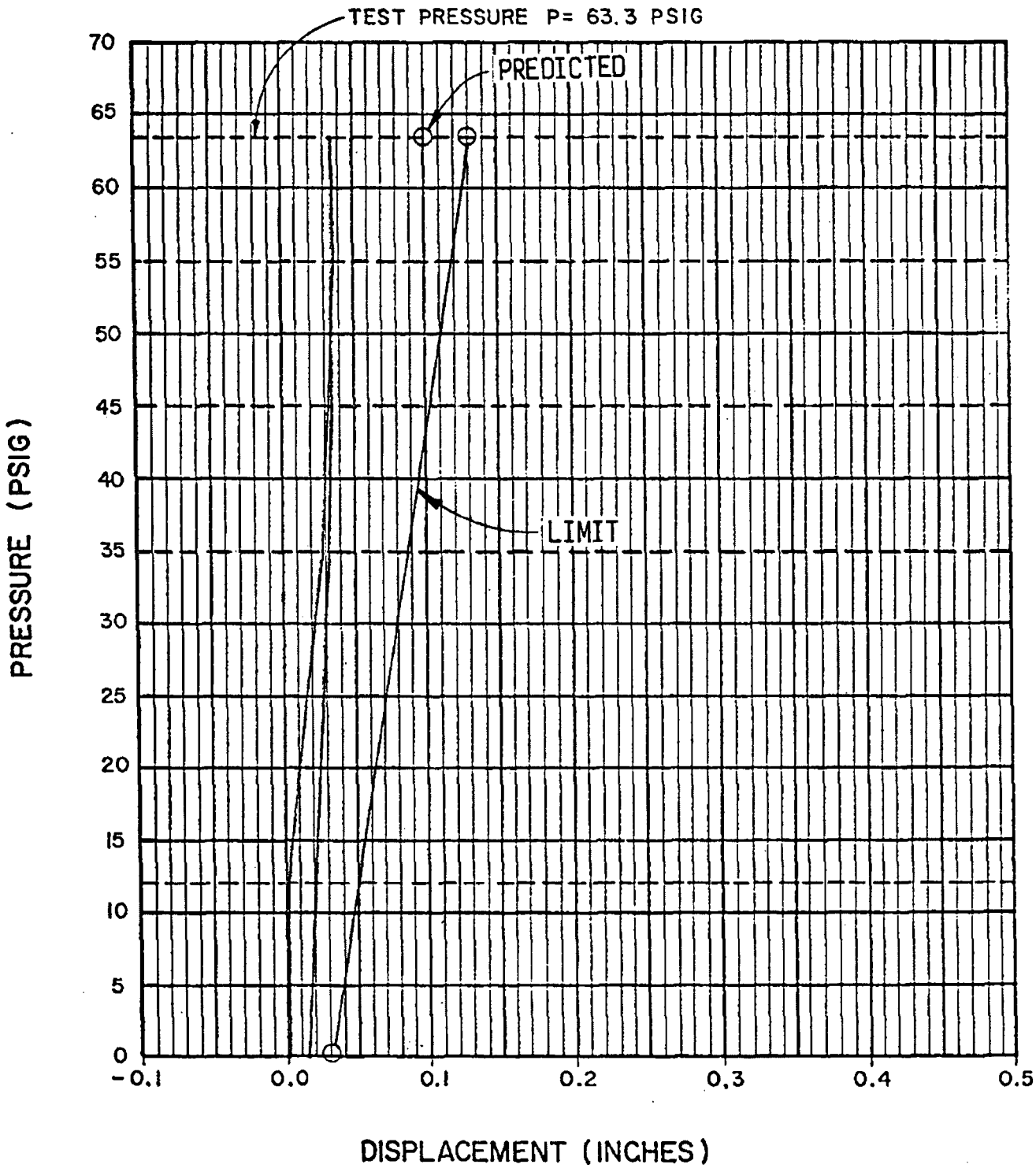
AZIMUTH 137 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 41 CHANNEL 456 INSTRUMENT No. 10

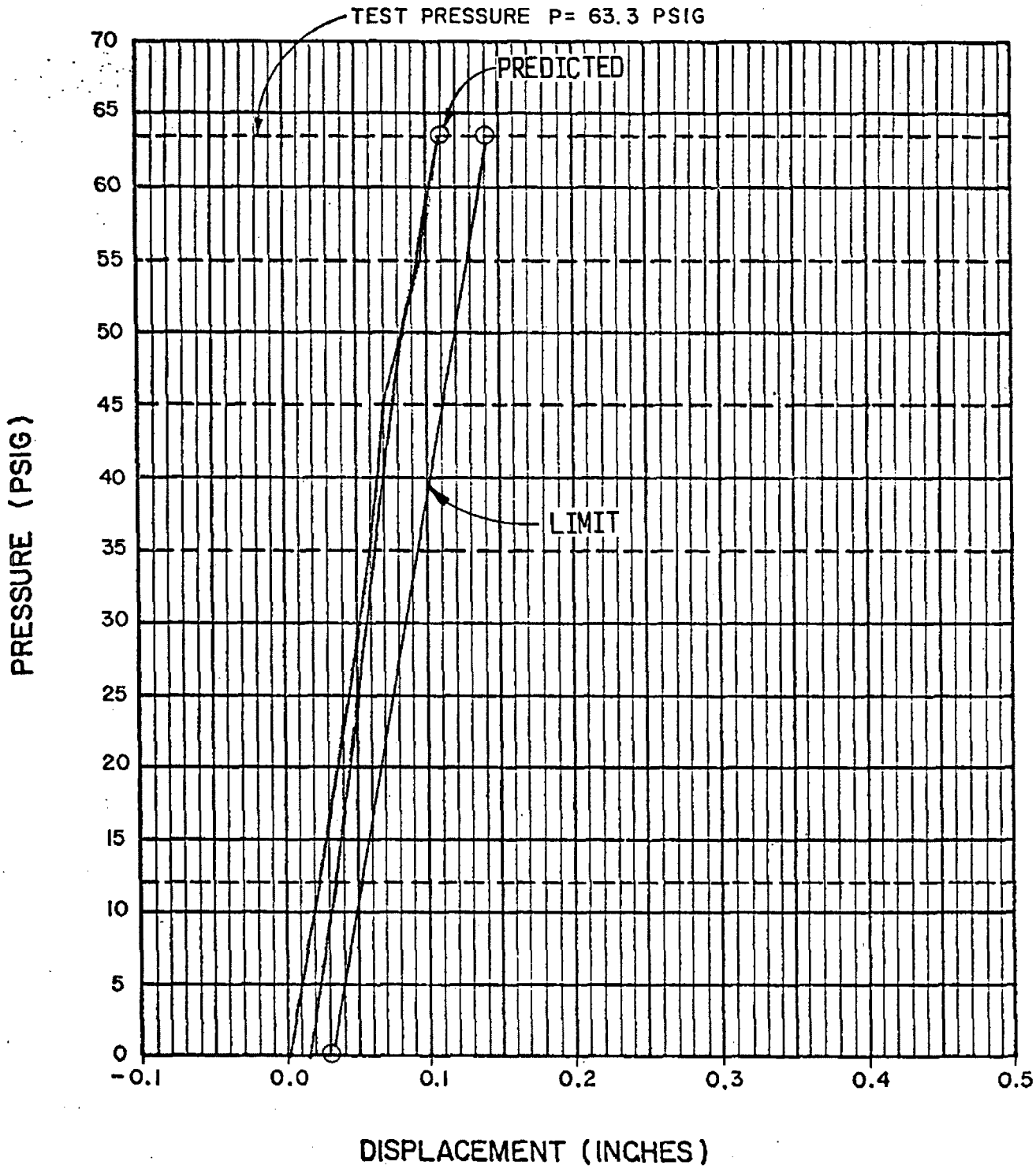
AZIMUTH 137 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 42 CHANNEL 463 INSTRUMENT No. 67

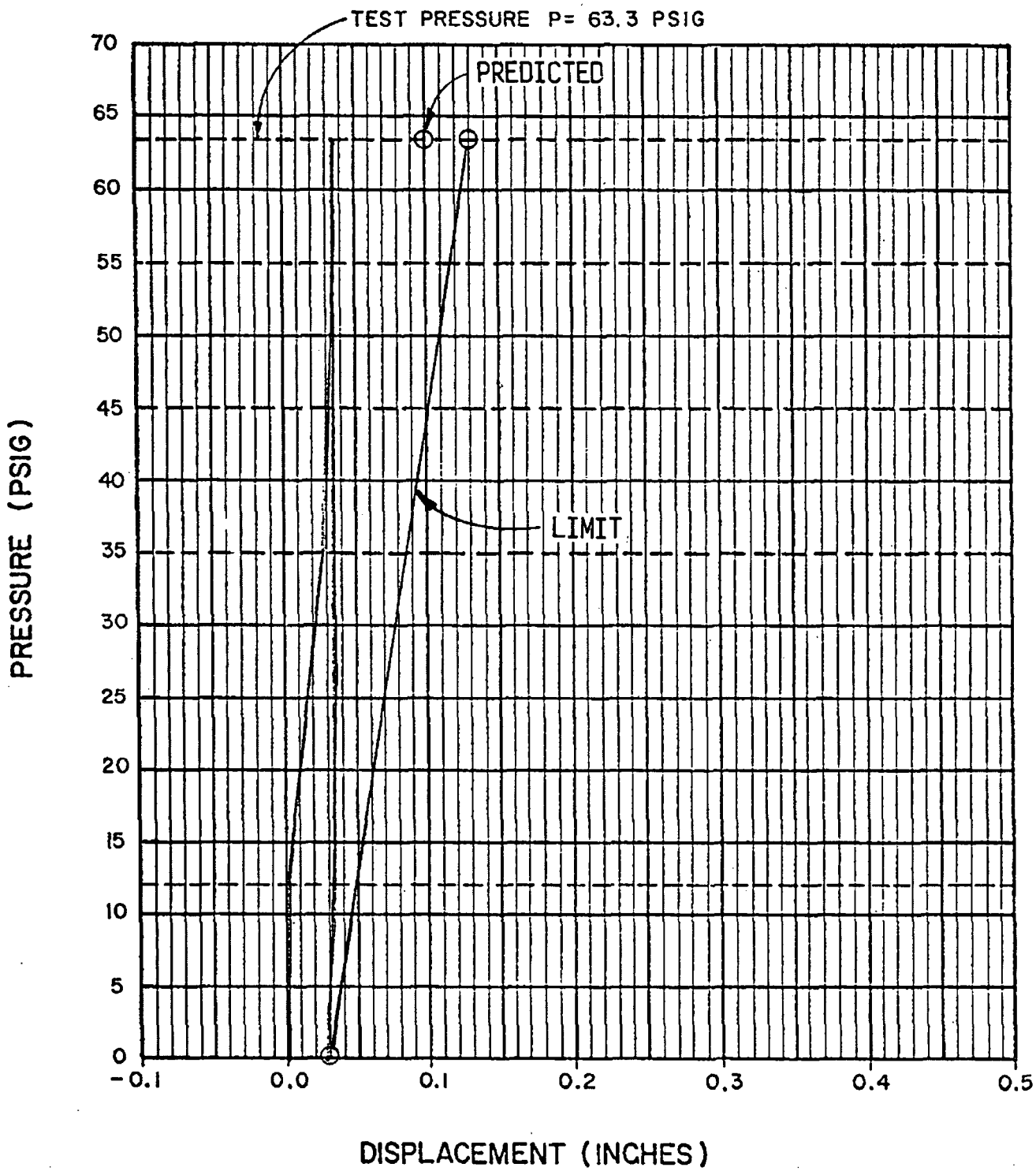
AZIMUTH 139 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 42 CHANNEL 455 INSTRUMENT No. 79

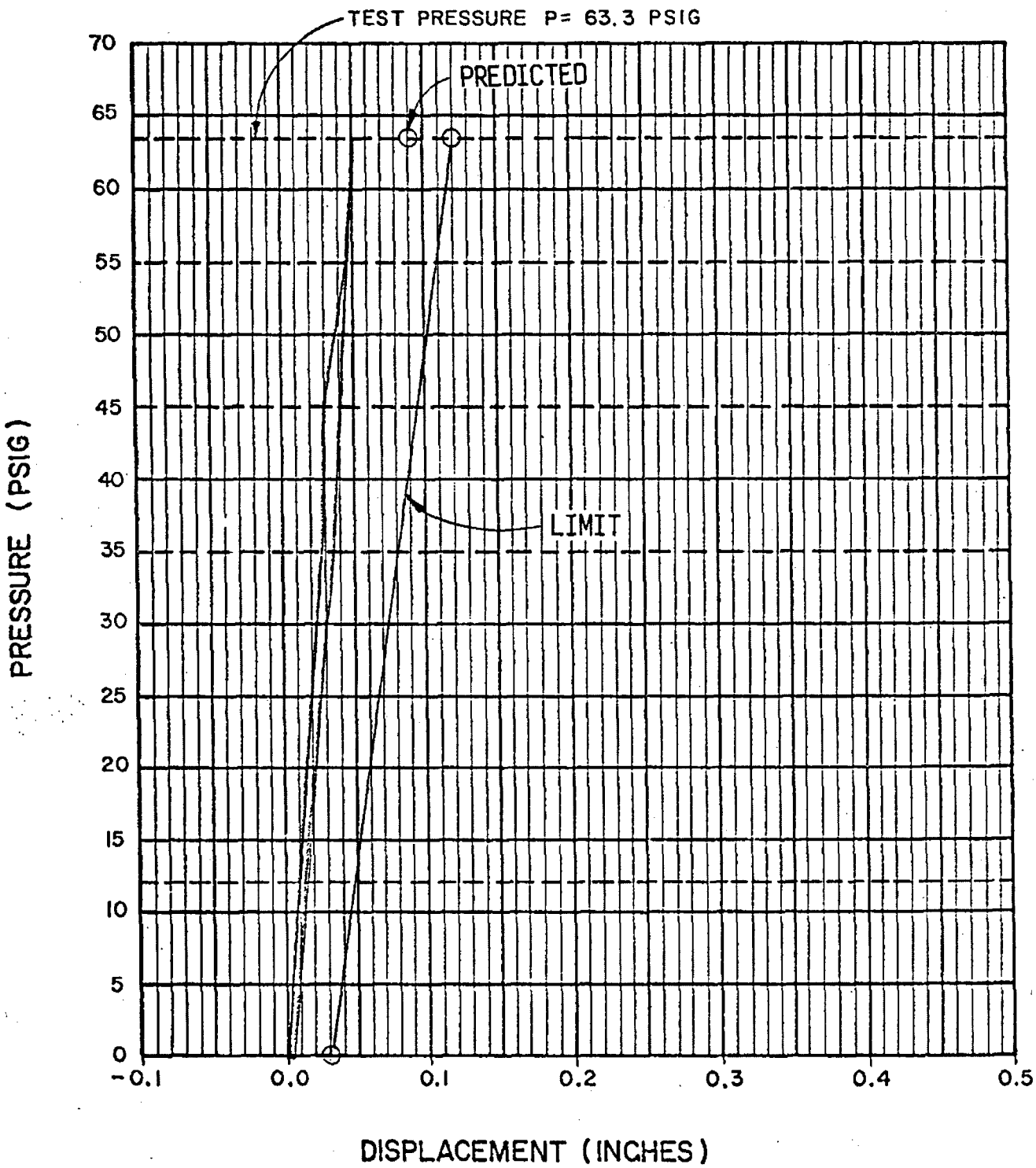
AZIMUTH 139 ELEVATION 132-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 43 CHANNEL 464 INSTRUMENT No. 99

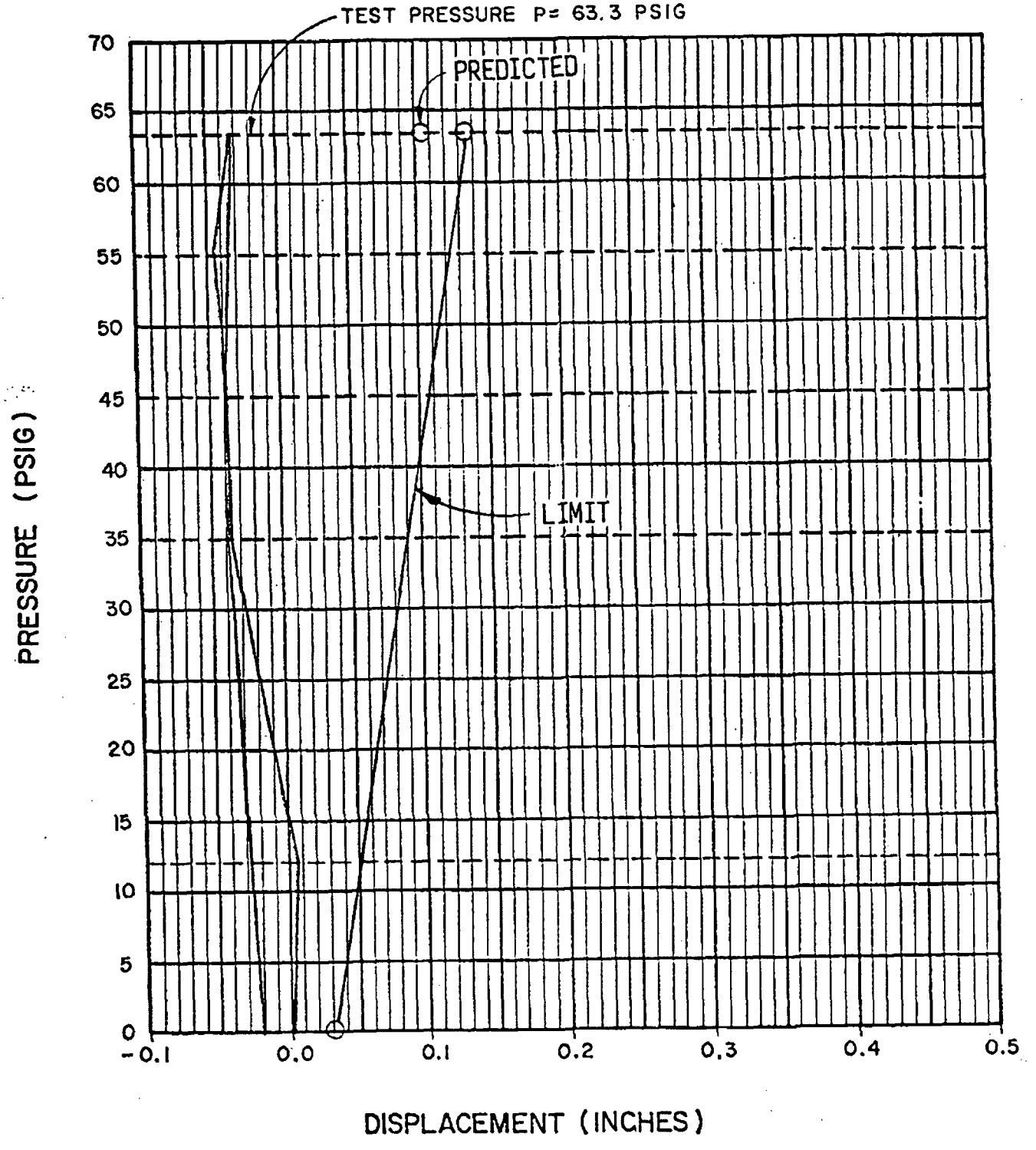
AZIMUTH 150 ELEVATION 144-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 43 CHANNEL 452 INSTRUMENT No.

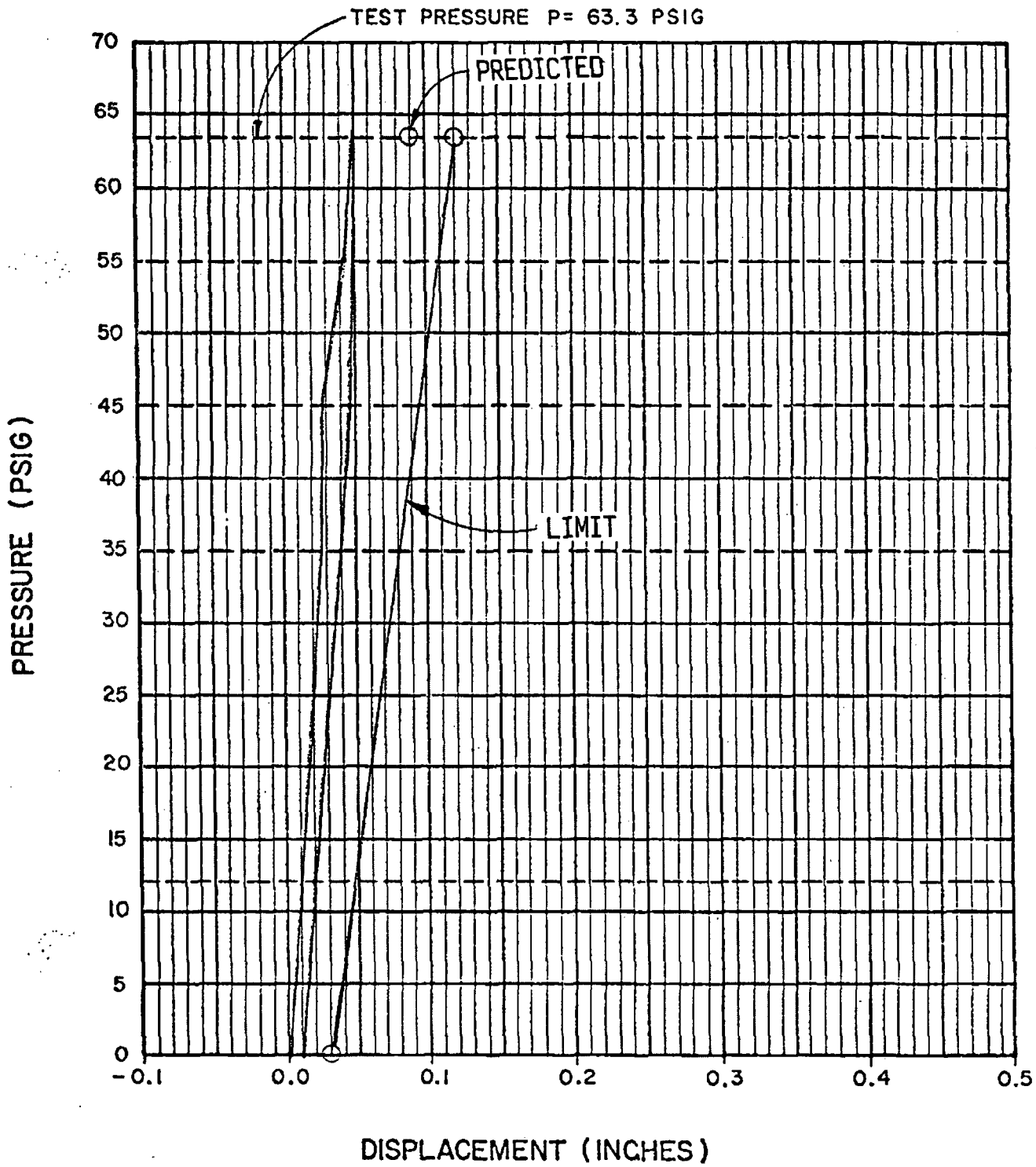
AZIMUTH 150 ELEVATION 144-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 44 CHANNEL 470 INSTRUMENT No. 86

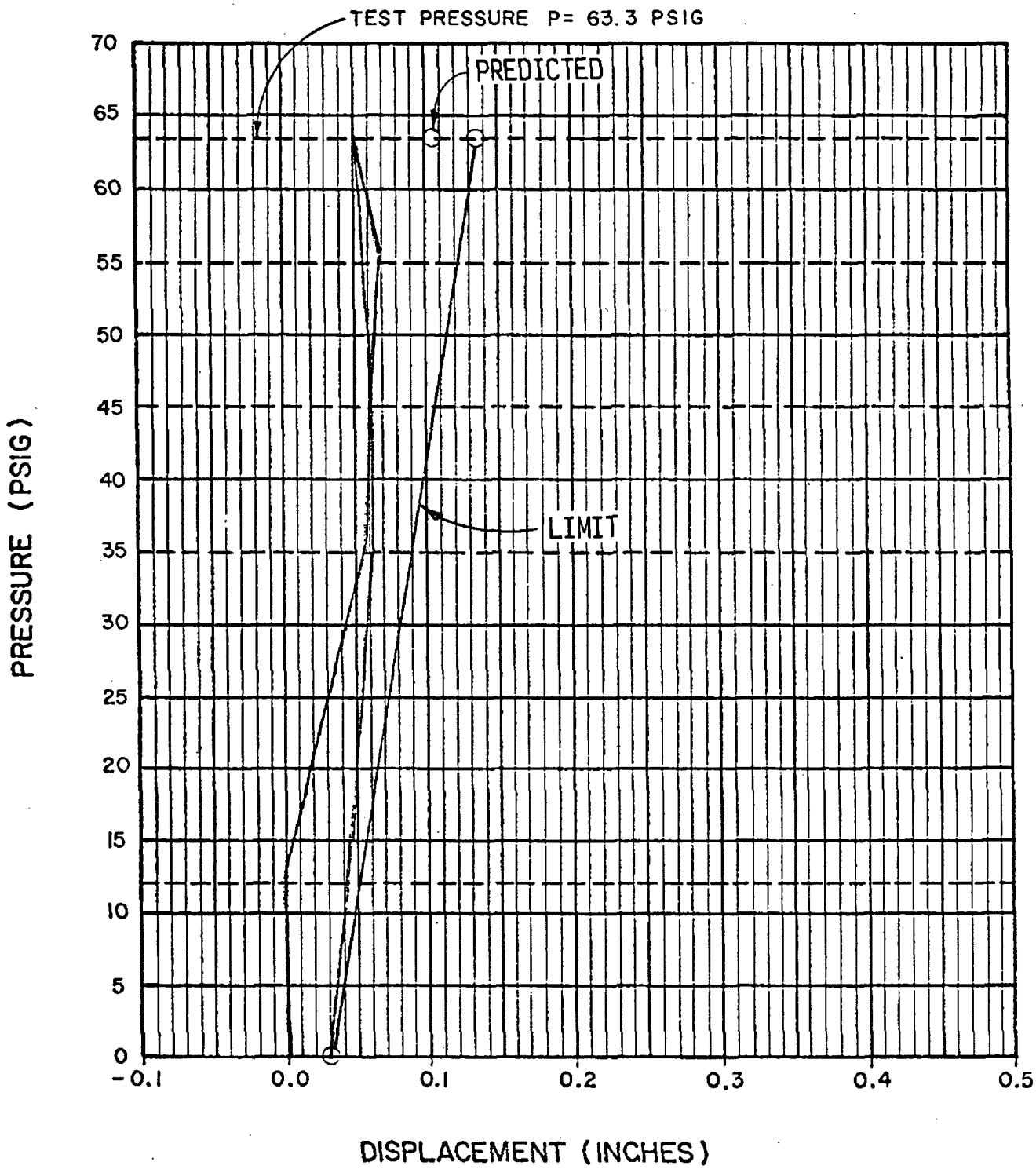
AZIMUTH 150 ELEVATION 147-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 44 CHANNEL 451 INSTRUMENT No.

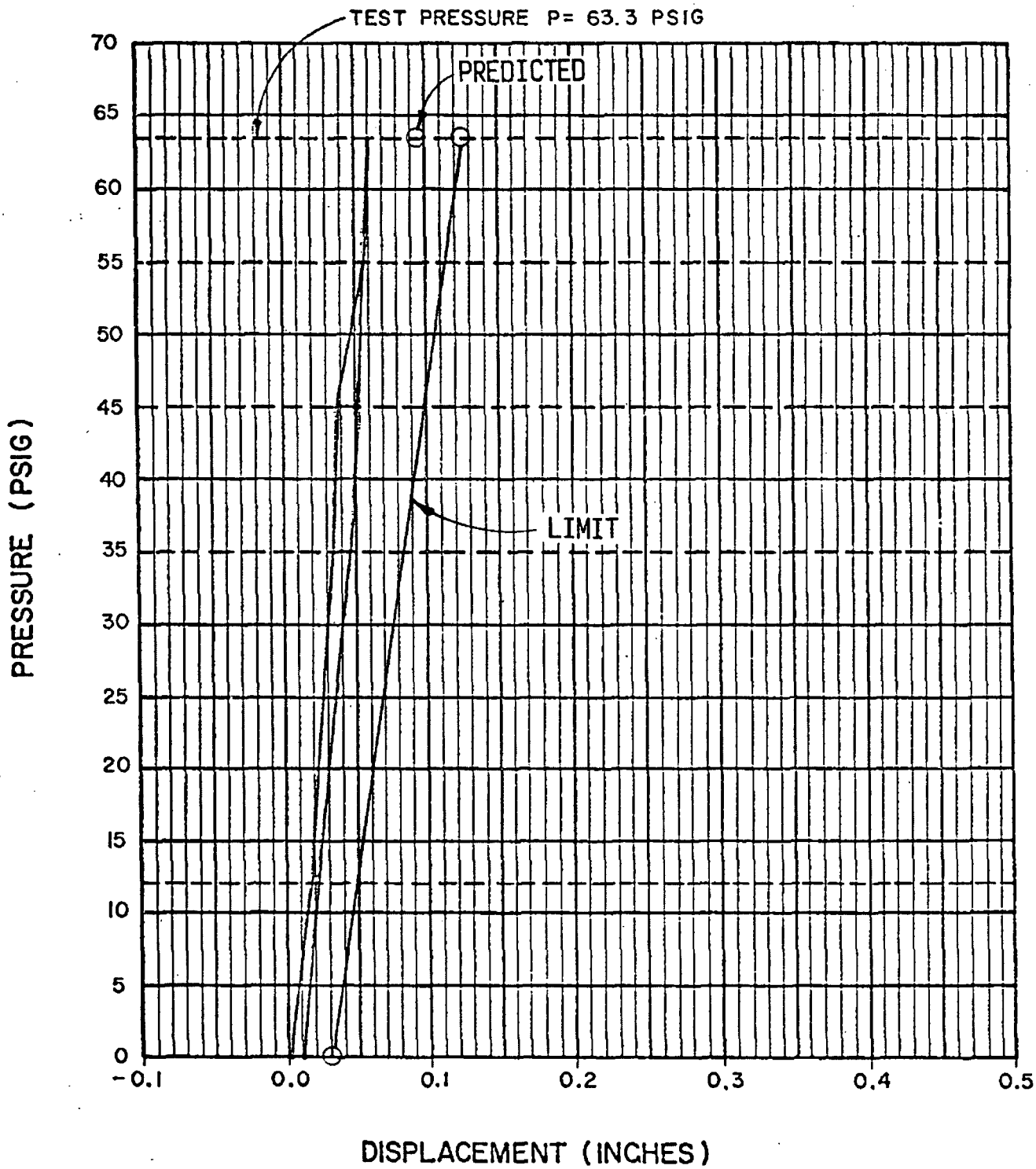
AZIMUTH 150 ELEVATION 147-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 45 CHANNEL 471 INSTRUMENT No. 38

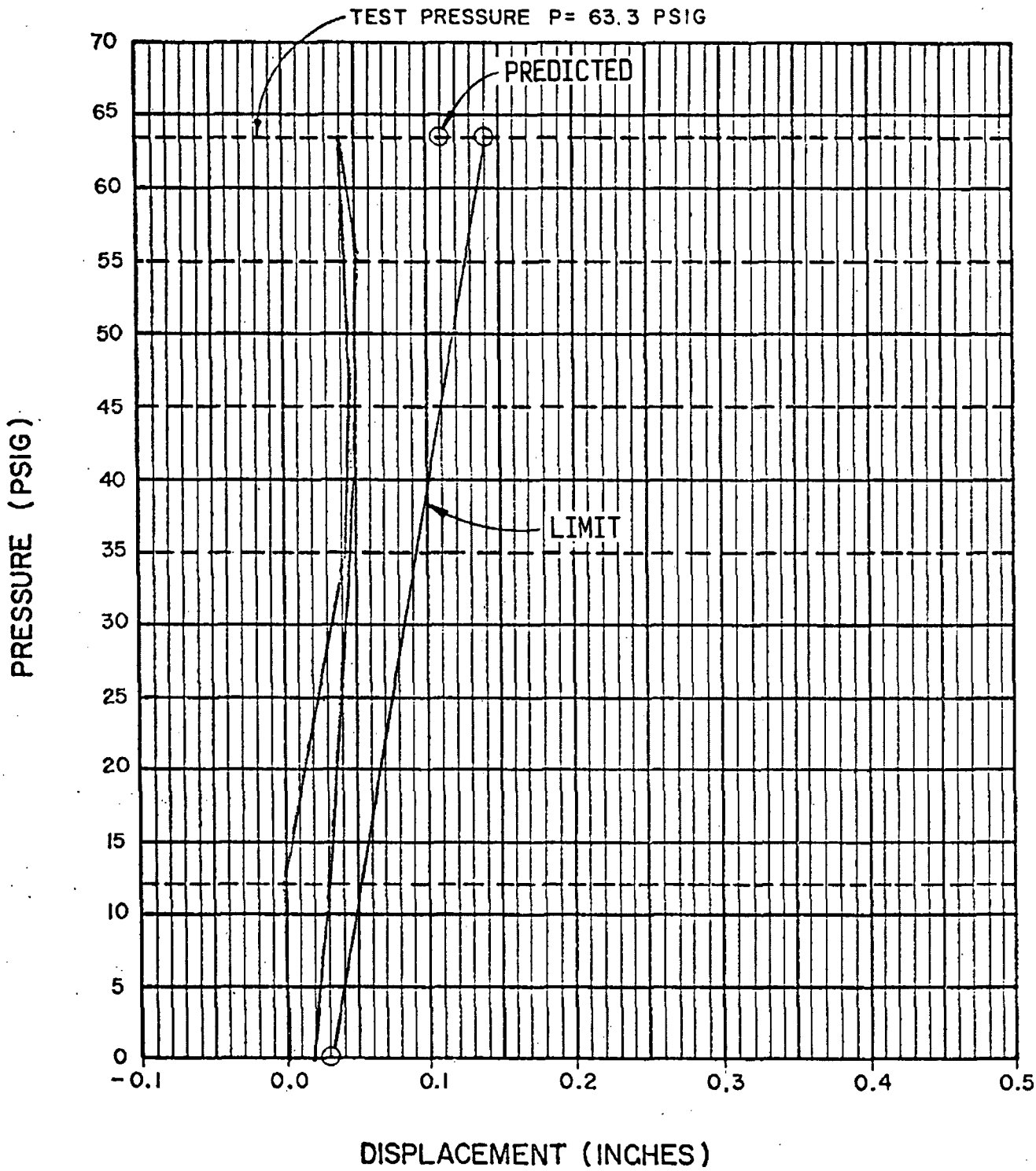
AZIMUTH 150 ELEVATION 151-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 45 CHANNEL 450 INSTRUMENT No.

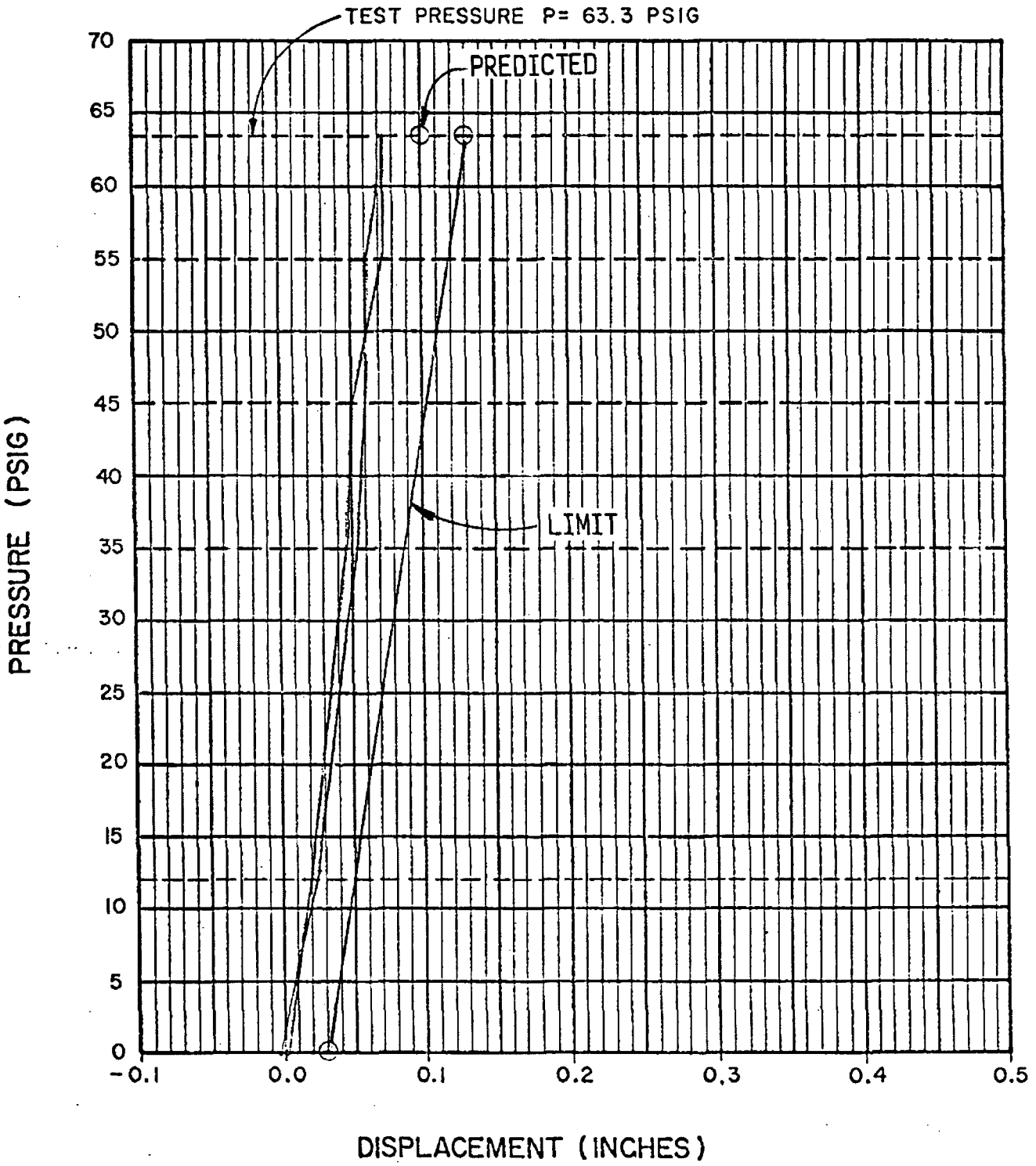
AZIMUTH 150 ELEVATION 151-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 45 CHANNEL 472 INSTRUMENT No. 25

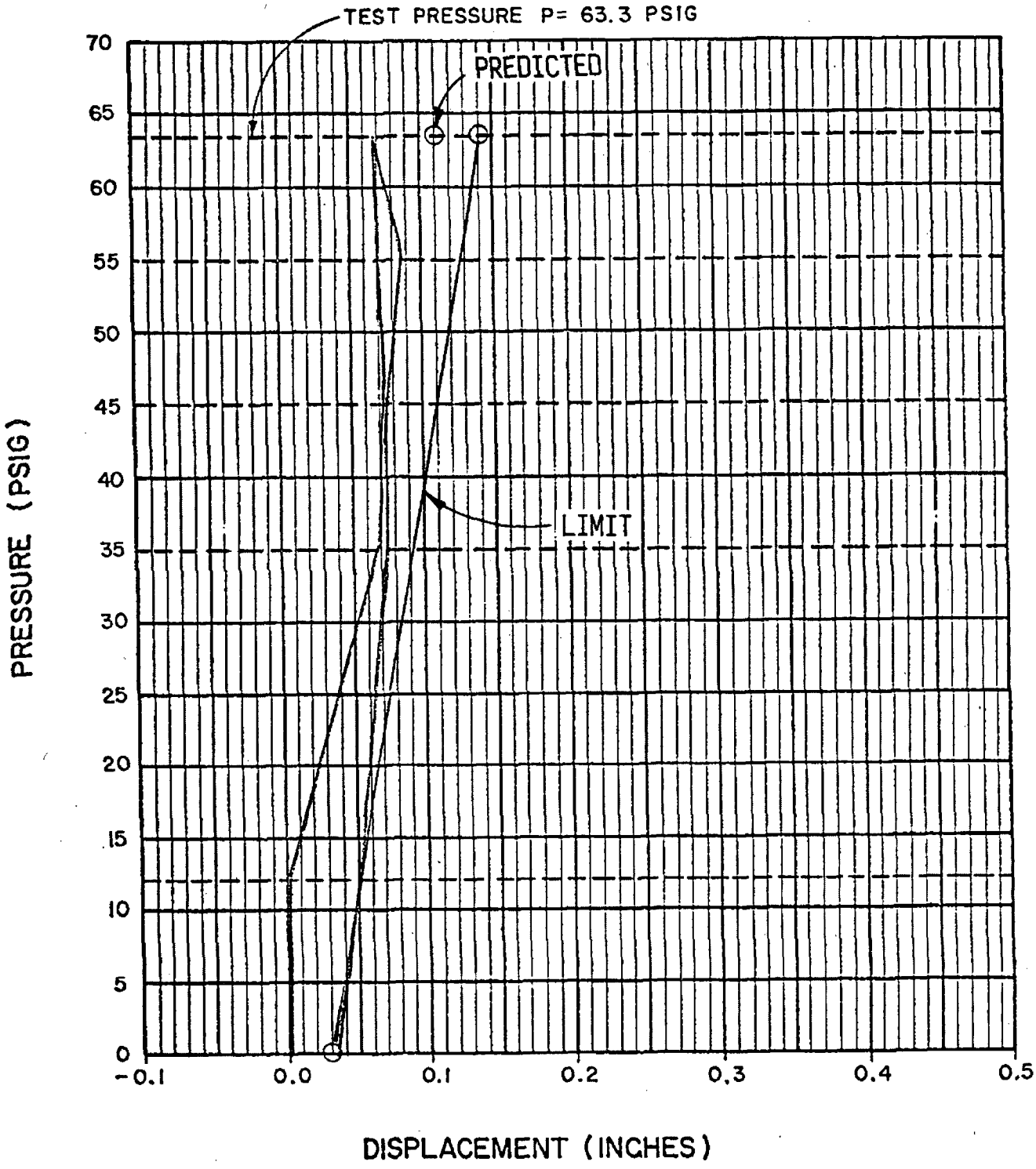
AZIMUTH 150 ELEVATION 155-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 46 CHANNEL 449 INSTRUMENT No.

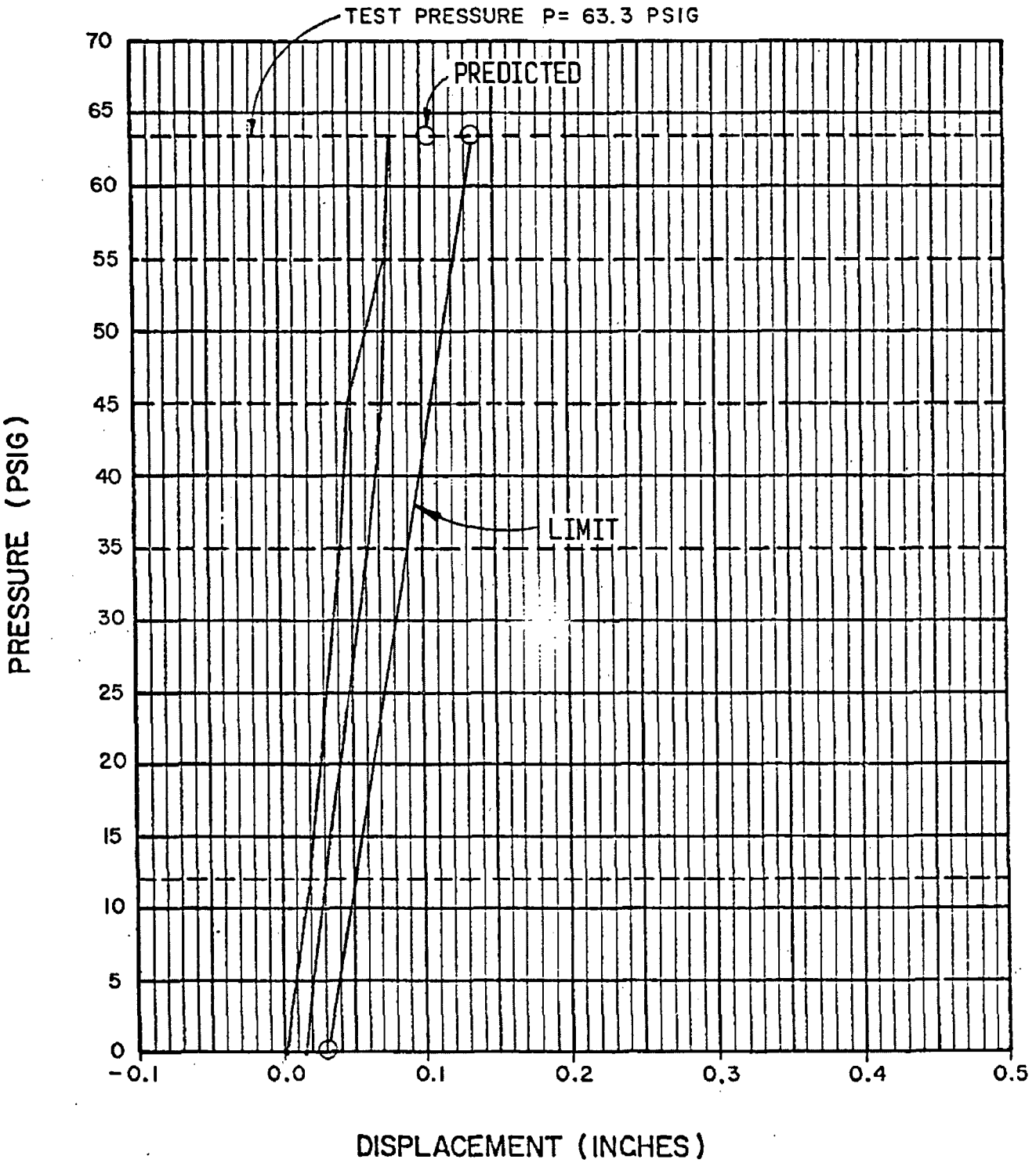
AZIMUTH 150 ELEVATION 155-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 47 CHANNEL 473 INSTRUMENT No. 76

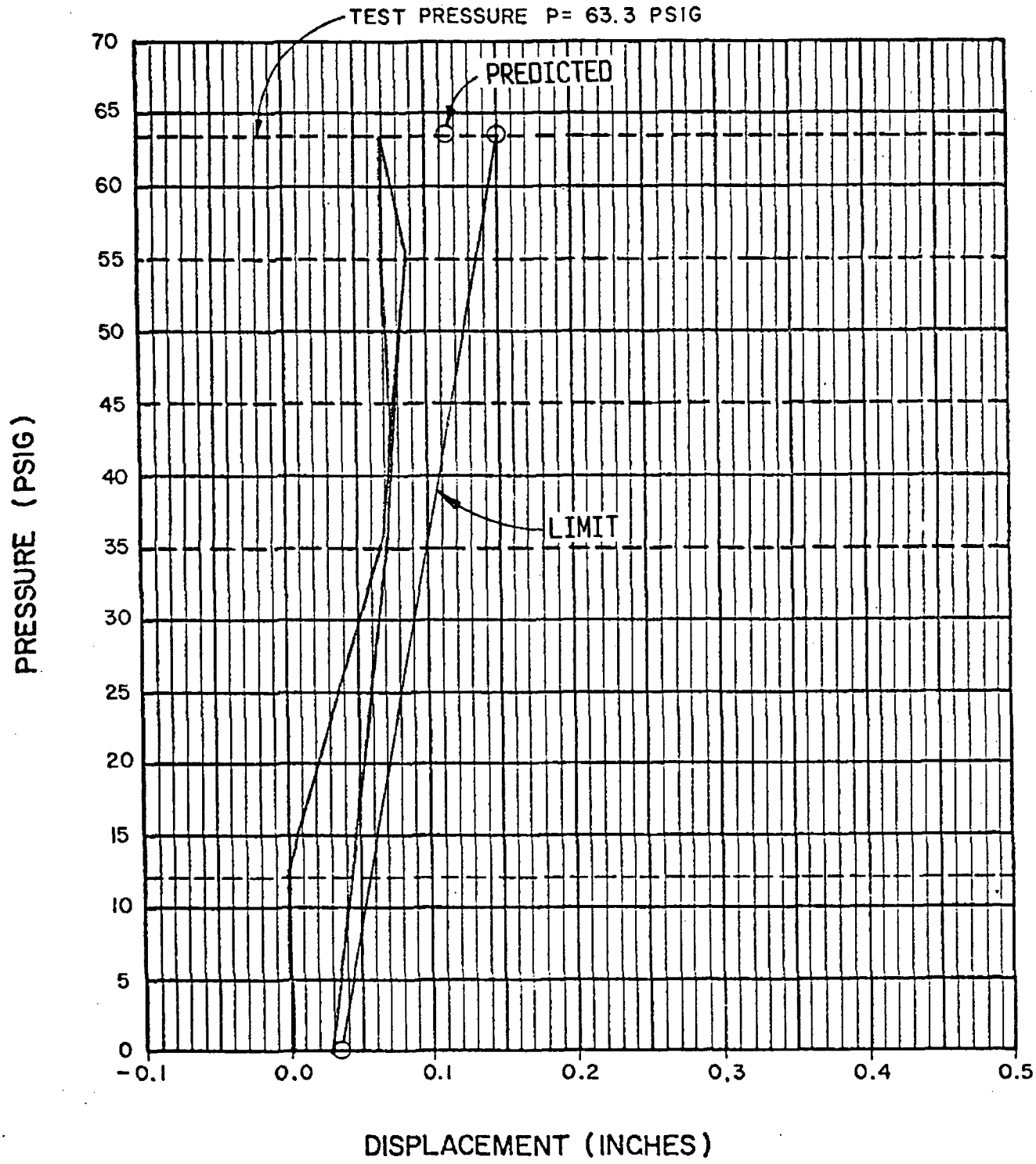
AZIMUTH 150 ELEVATION 159-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 47 CHANNEL 448 INSTRUMENT No.

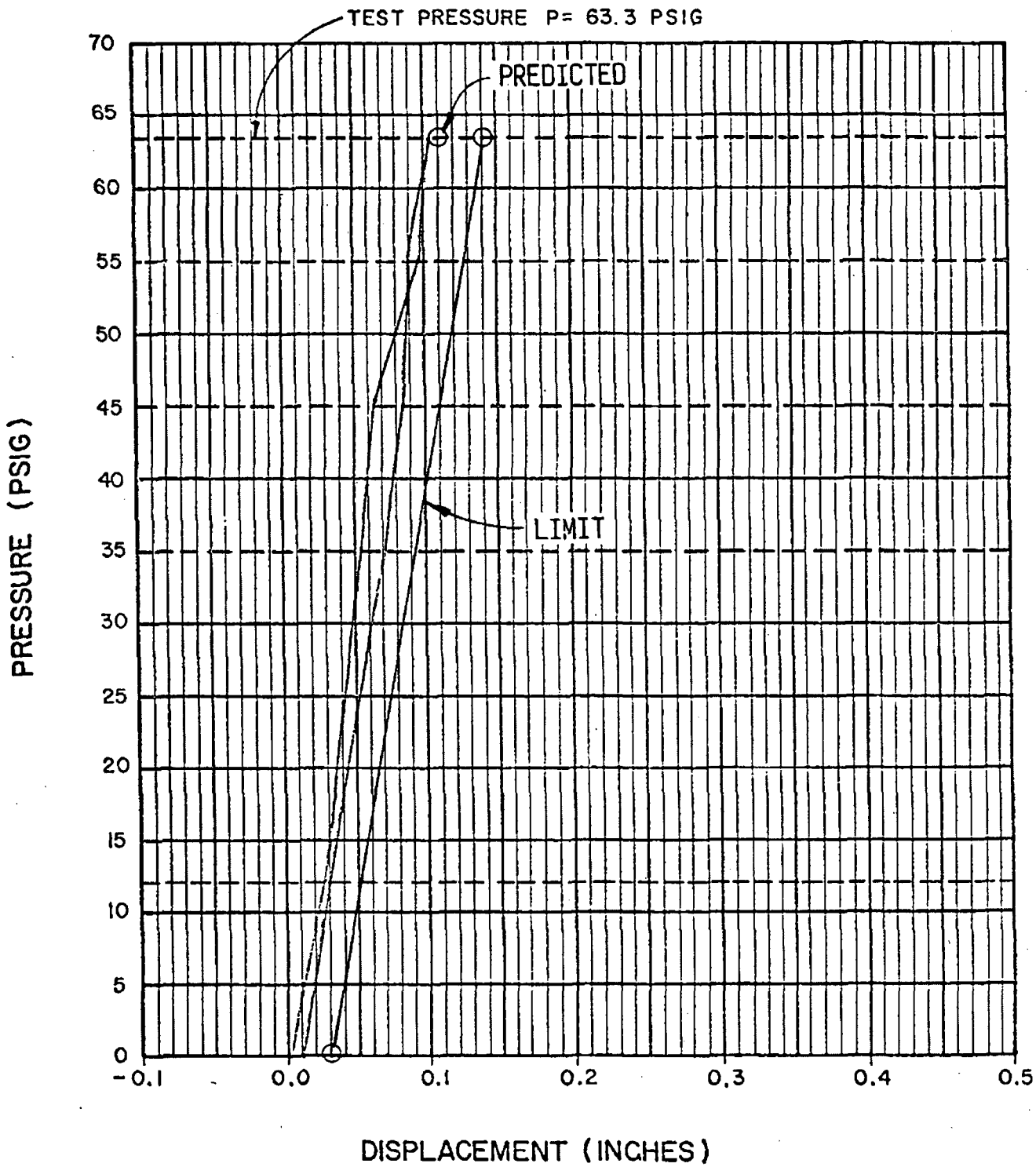
AZIMUTH 150 ELEVATION 159-0



REACTOR BLDG. LOCATION EQUIP. HATCH RADIAL

LOCATION No. 48 CHANNEL 474 INSTRUMENT No. 63

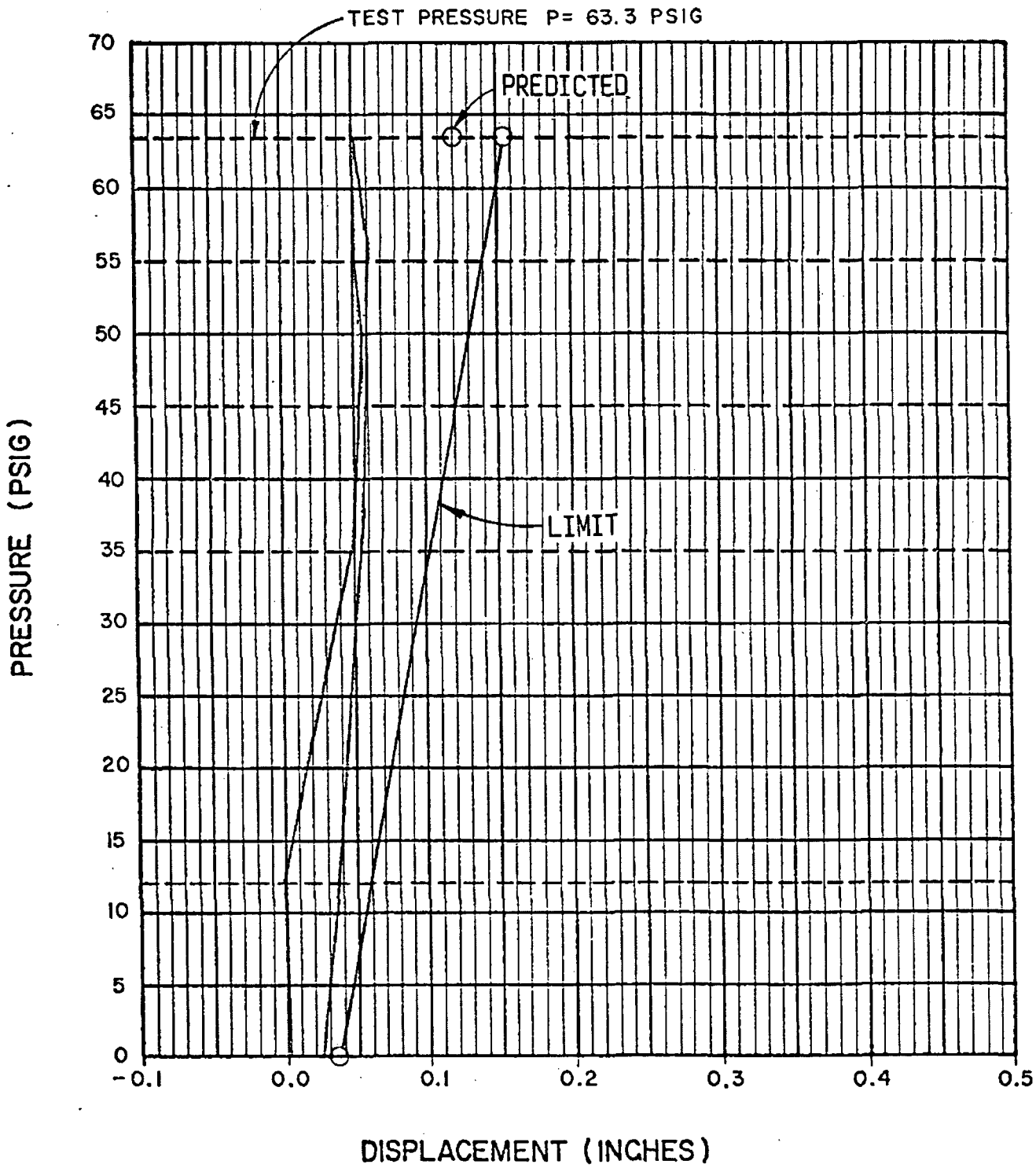
AZIMUTH 150 ELEVATION 163-0



REACTOR BLDG. LOCATION EQUIP. HATCH VERTICAL

LOCATION No. 48 CHANNEL 447 INSTRUMENT No.

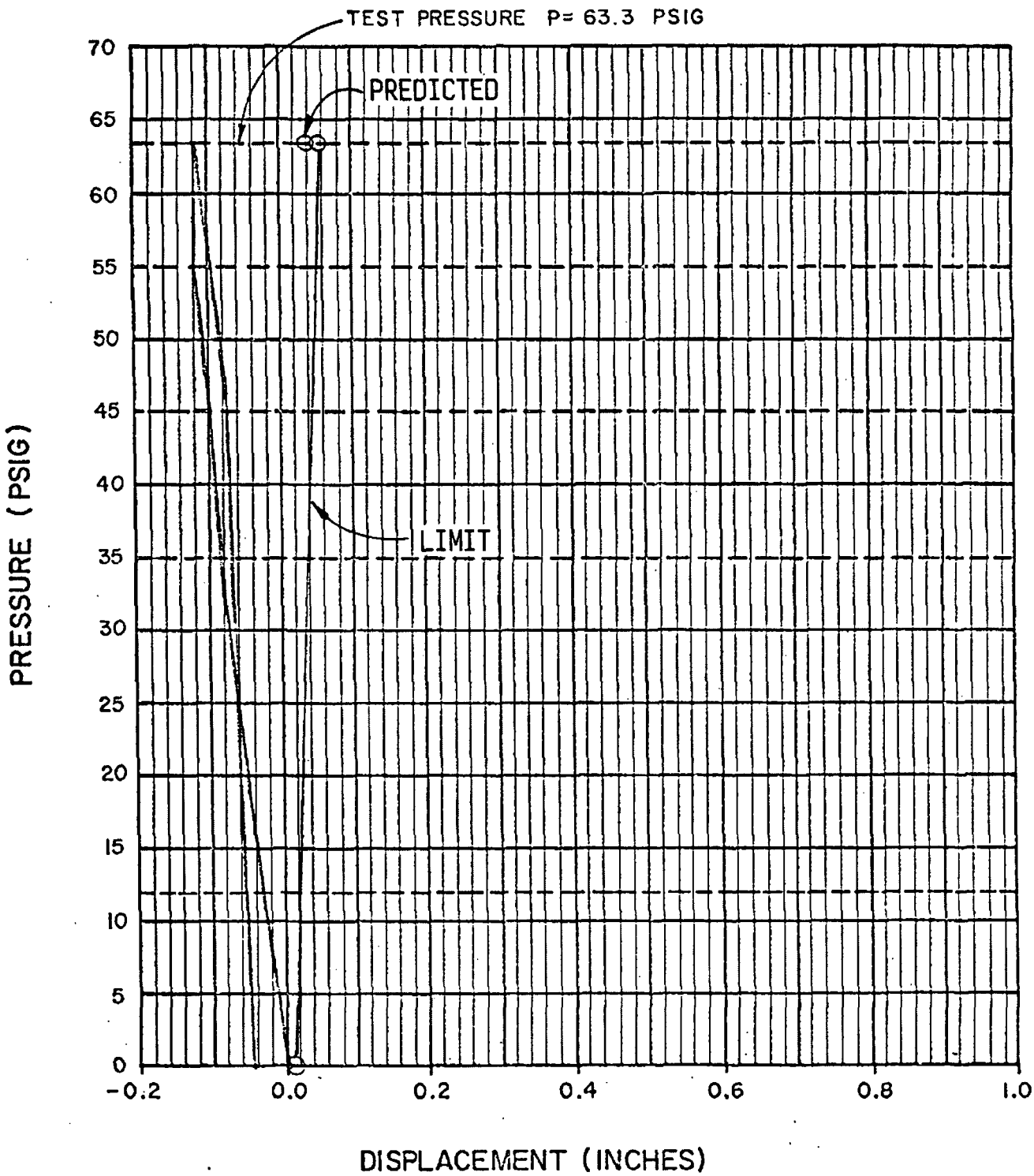
AZIMUTH 150 ELEVATION 163-0



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 128 CHANNEL 426 INSTRUMENT No. 94

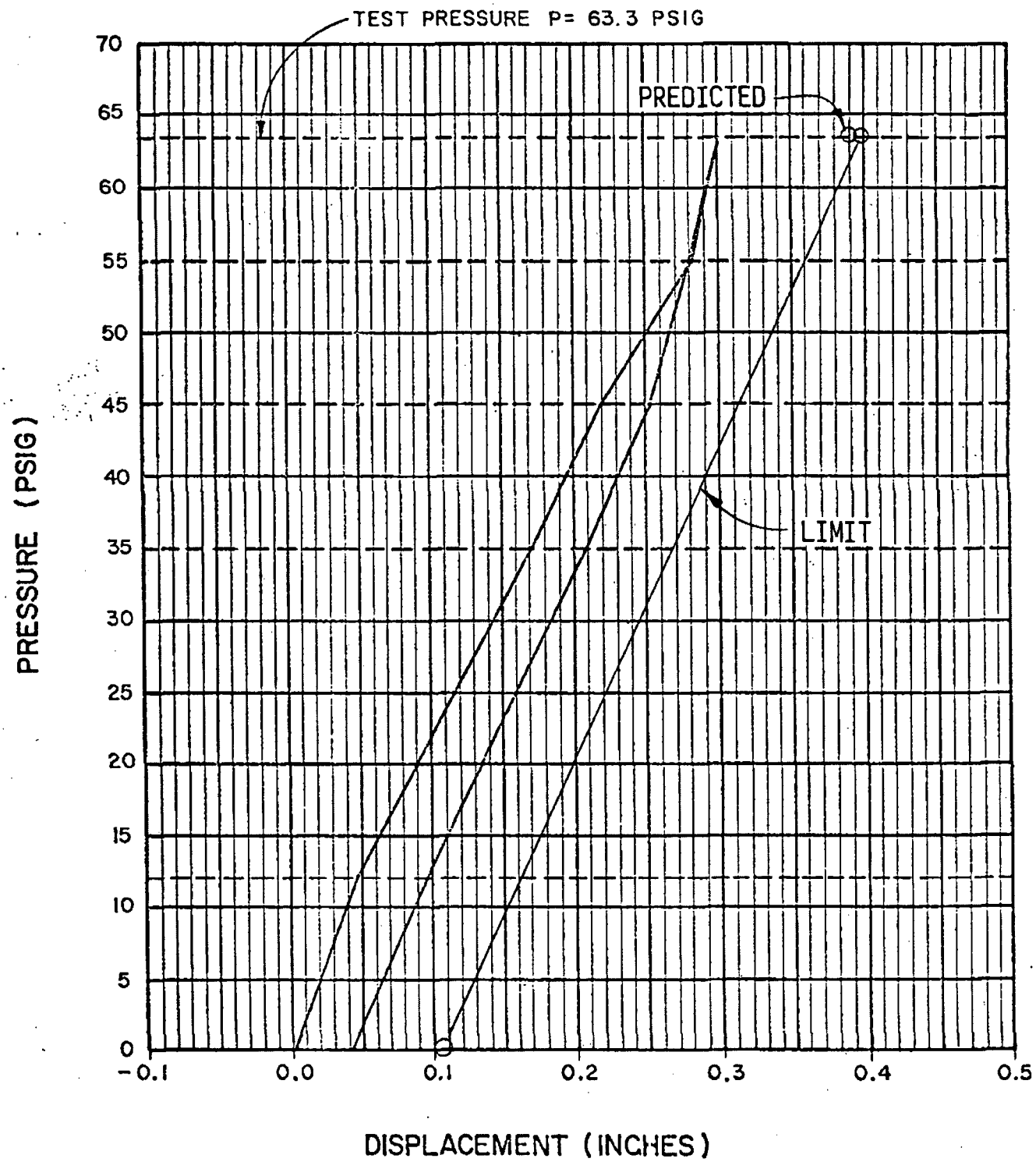
AZIMUTH 90 ELEVATION 270-8



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 128 CHANNEL 402 INSTRUMENT No. 26

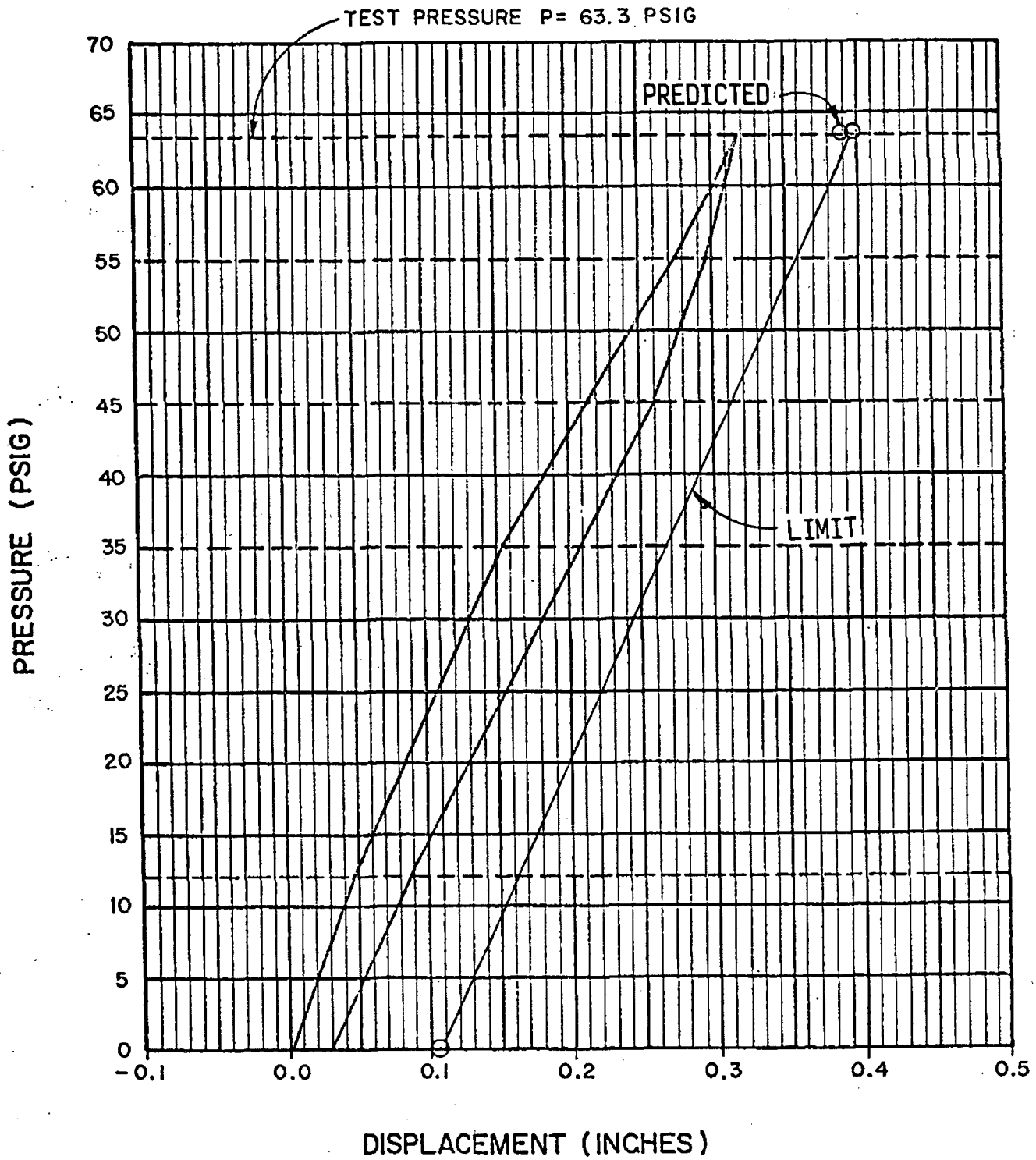
AZIMUTH 90 ELEVATION 267-6



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 129 CHANNEL 408 INSTRUMENT No. 80

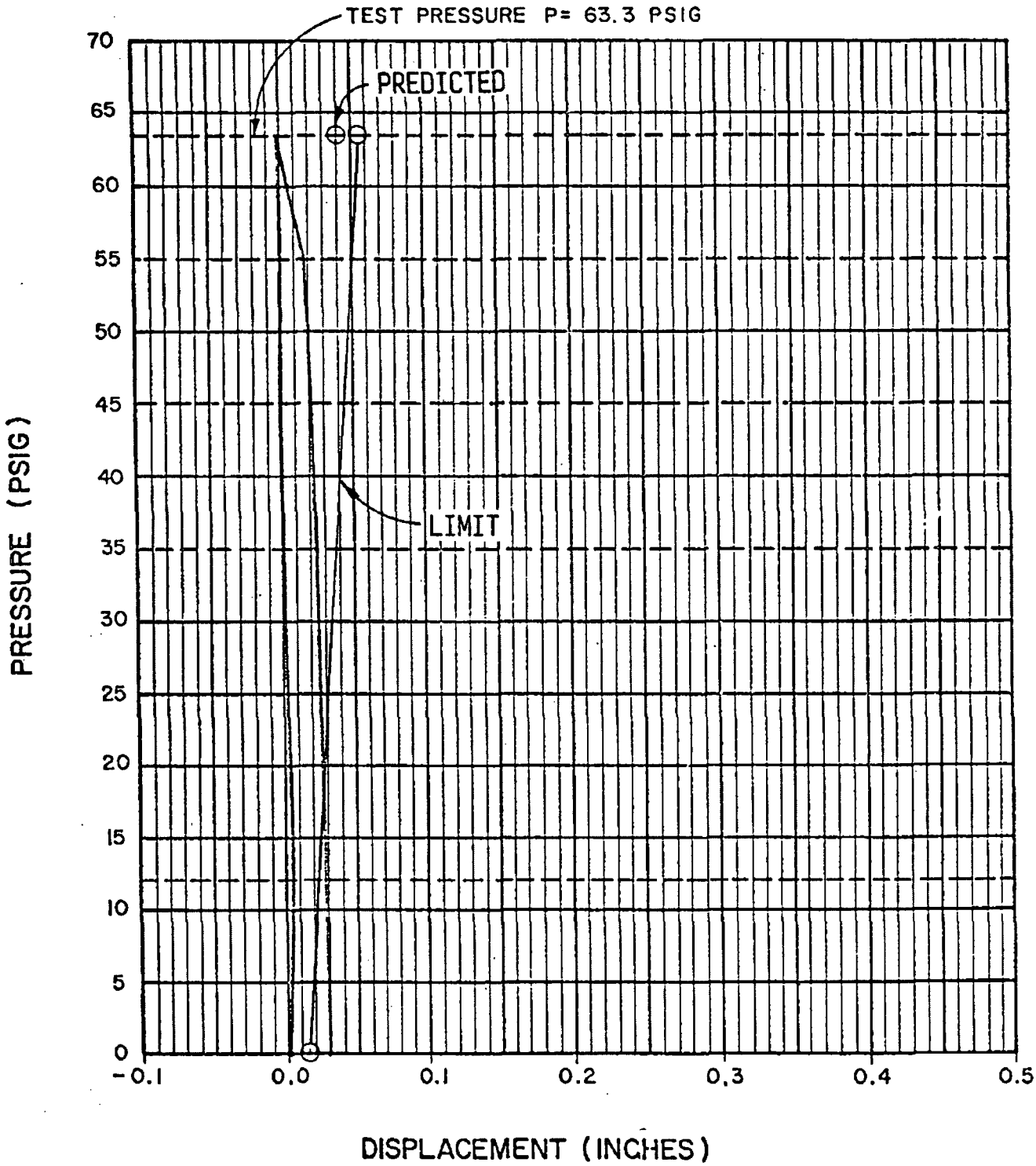
AZIMUTH 200 ELEVATION 167-6



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 129 CHANNEL 436 INSTRUMENT No. 96

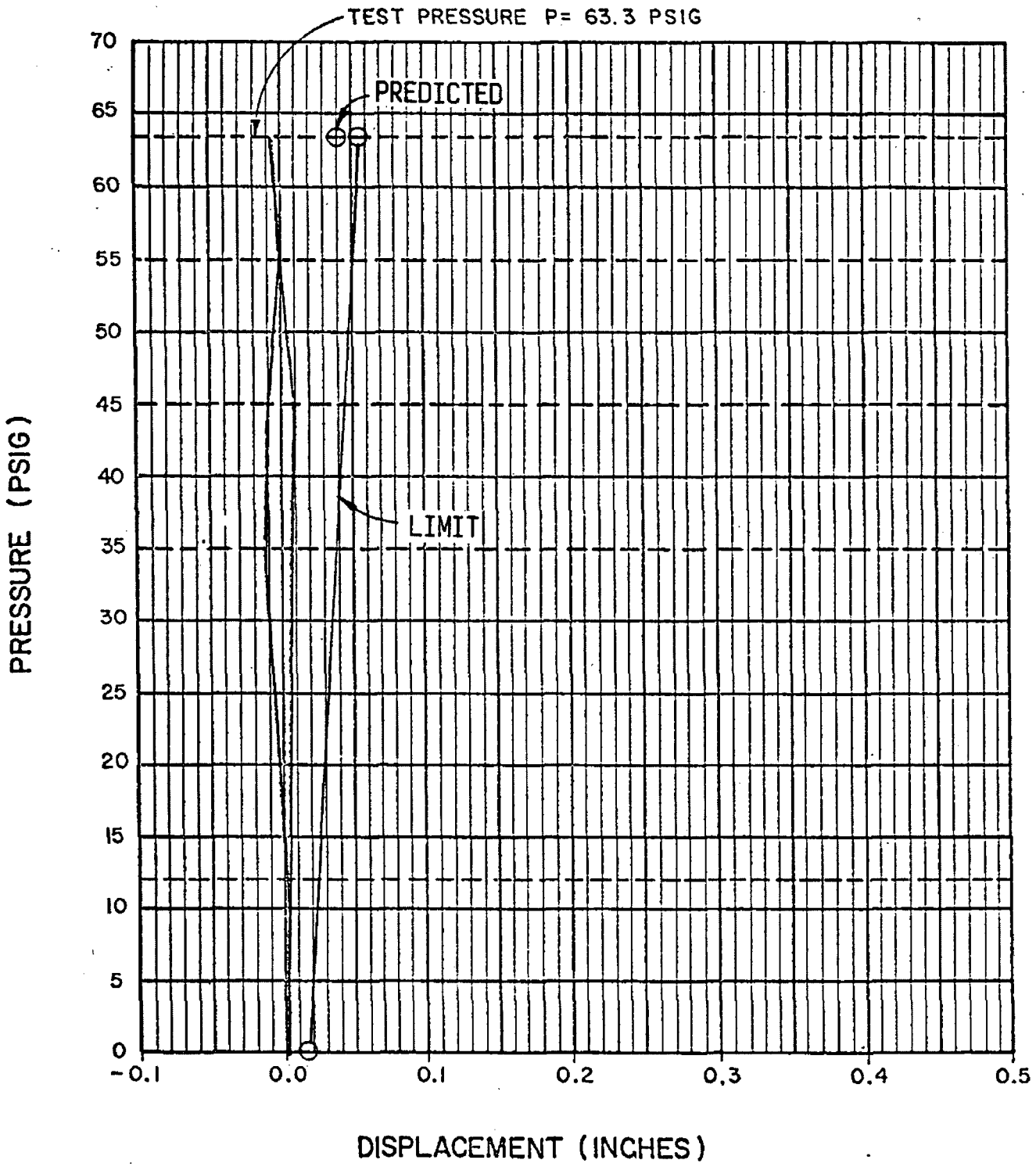
AZIMUTH 200 ELEVATION 270-B



REACTOR BLDG. LOCATION RADIAL

LOCATION No. 130 CHANNEL 446 INSTRUMENT No. 88

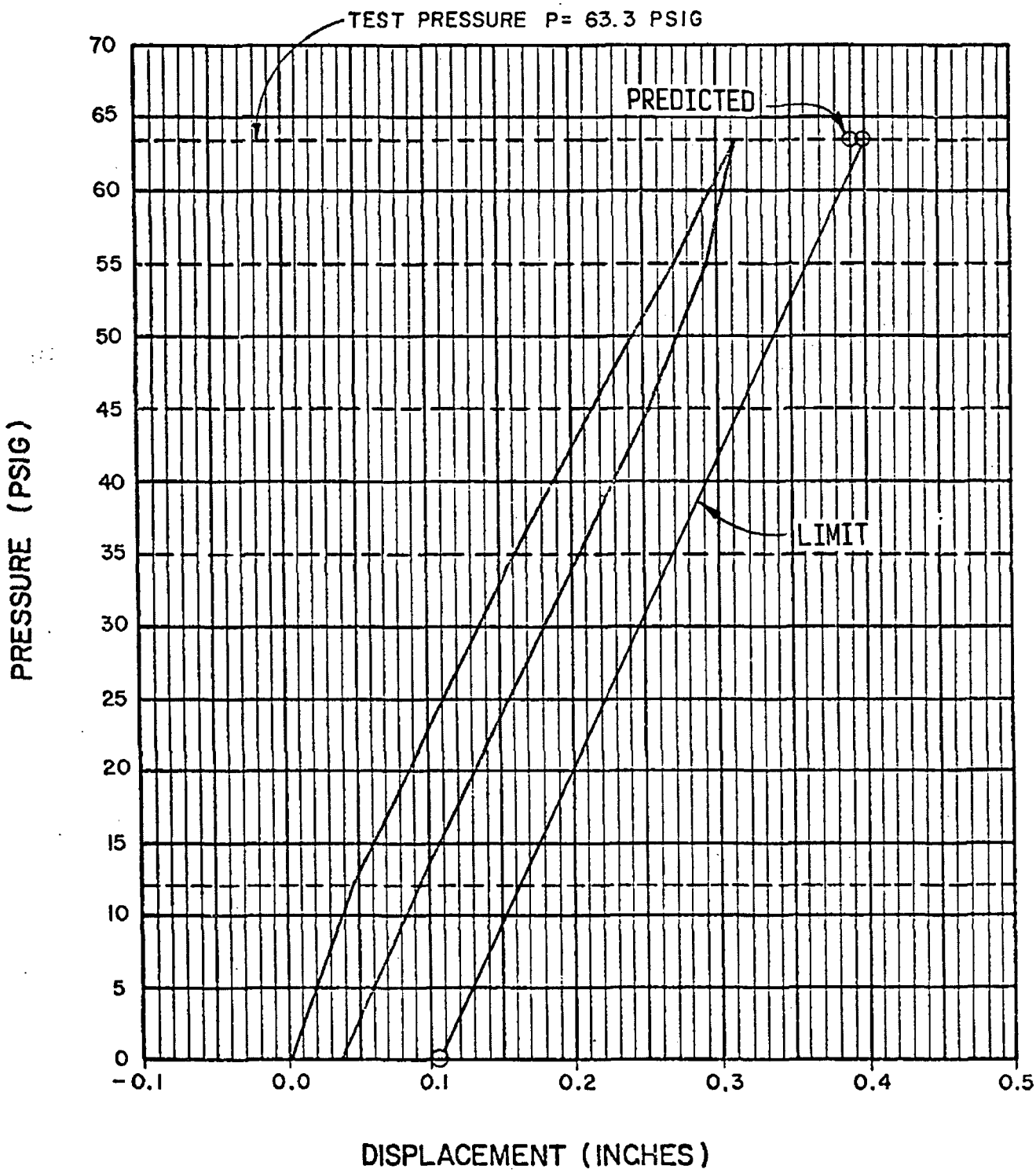
AZIMUTH 333-55 ELEVATION 270-0



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 130 CHANNEL 413 INSTRUMENT No. 81

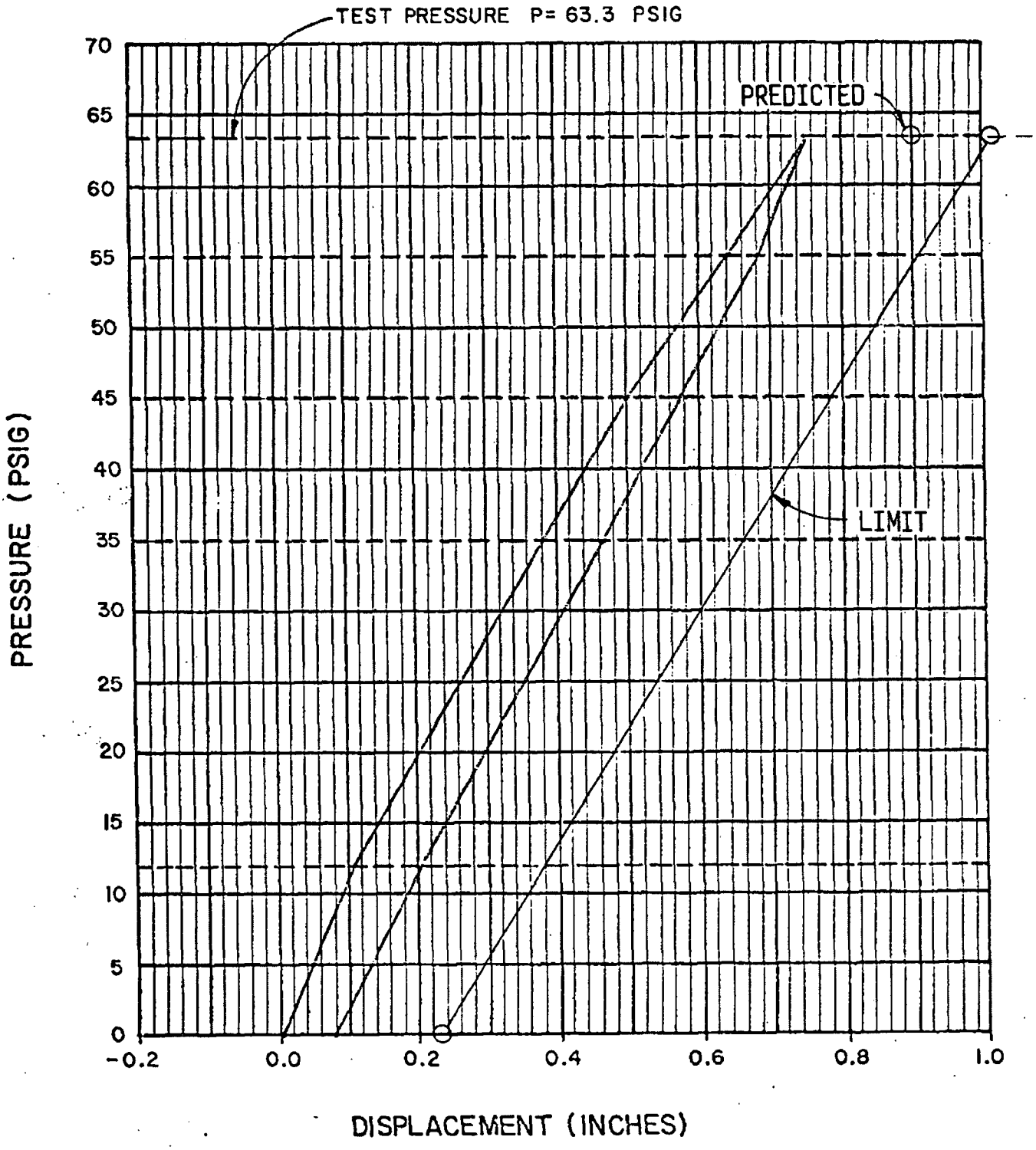
AZIMUTH 333-55 ELEVATION 267-6



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 164 CHANNEL 403 INSTRUMENT No. 69

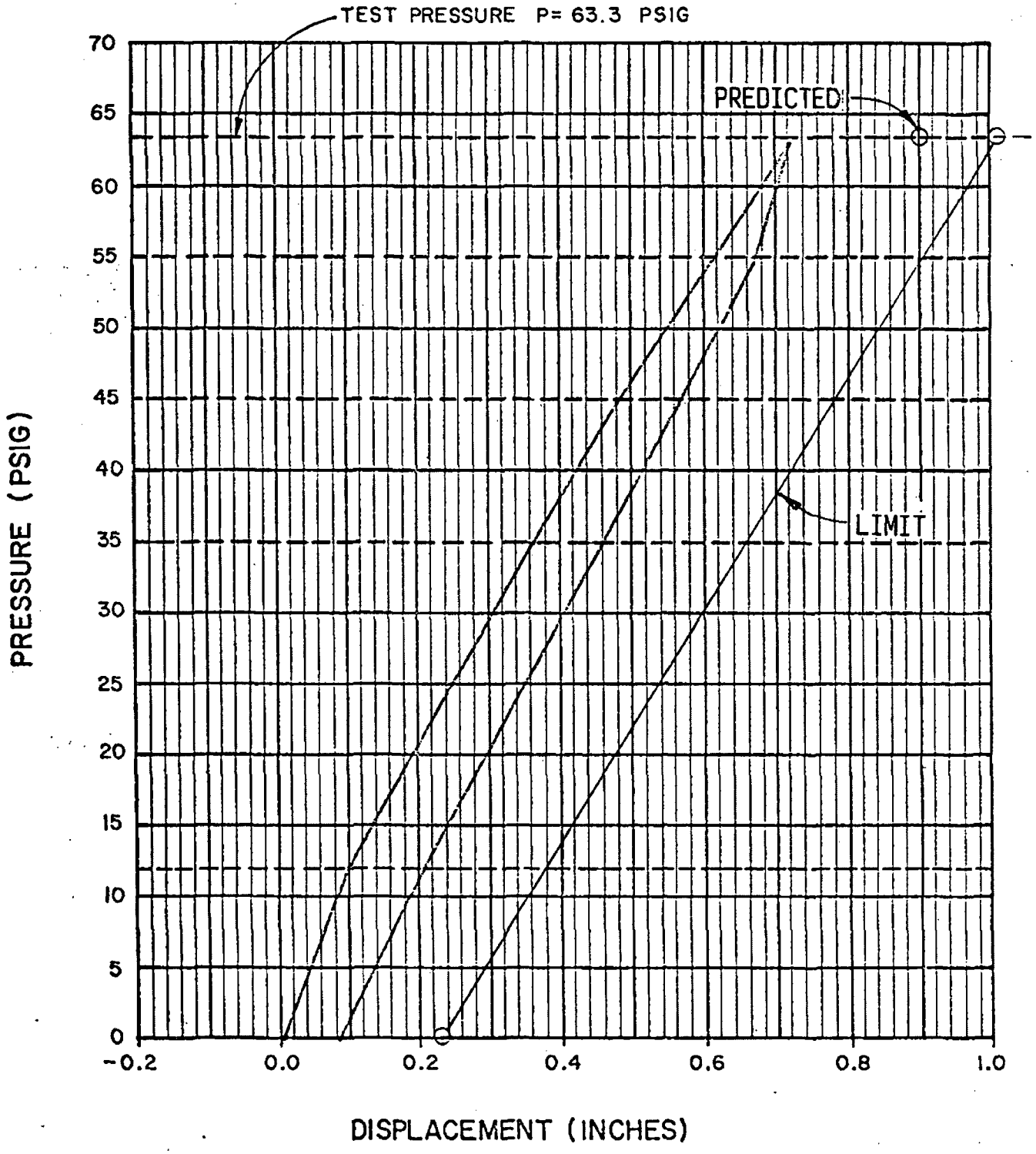
AZIMUTH 90 ELEVATION 4TH SPRAY RING



REACTOR BLDG. LOCATION VERTICAL

LOCATION No. 165 CHANNEL 409 INSTRUMENT No. 33

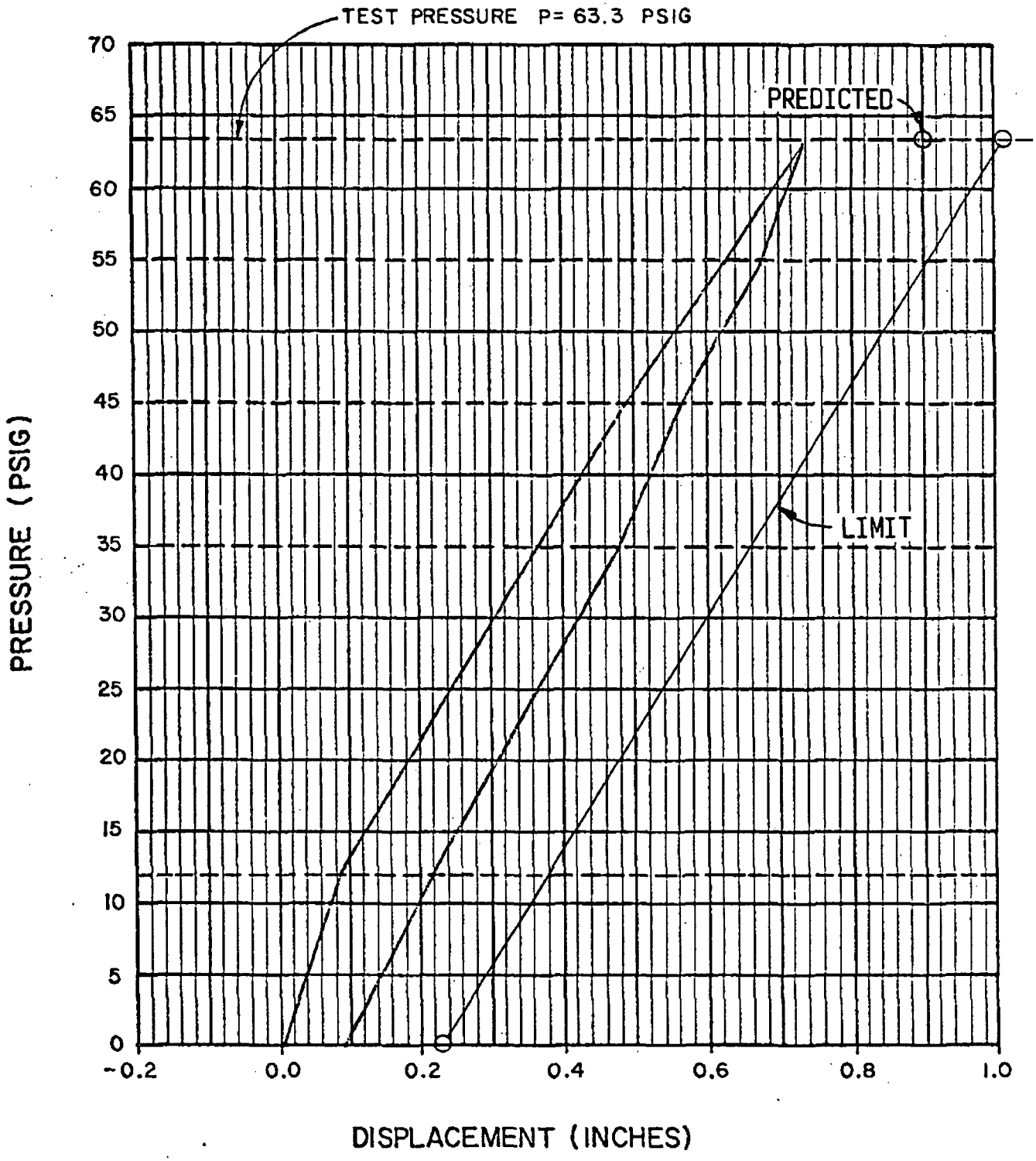
AZIMUTH 200 ELEVATION 4TH SPRAY RING



REACTOR BLDG. LOCATION VERTICAL

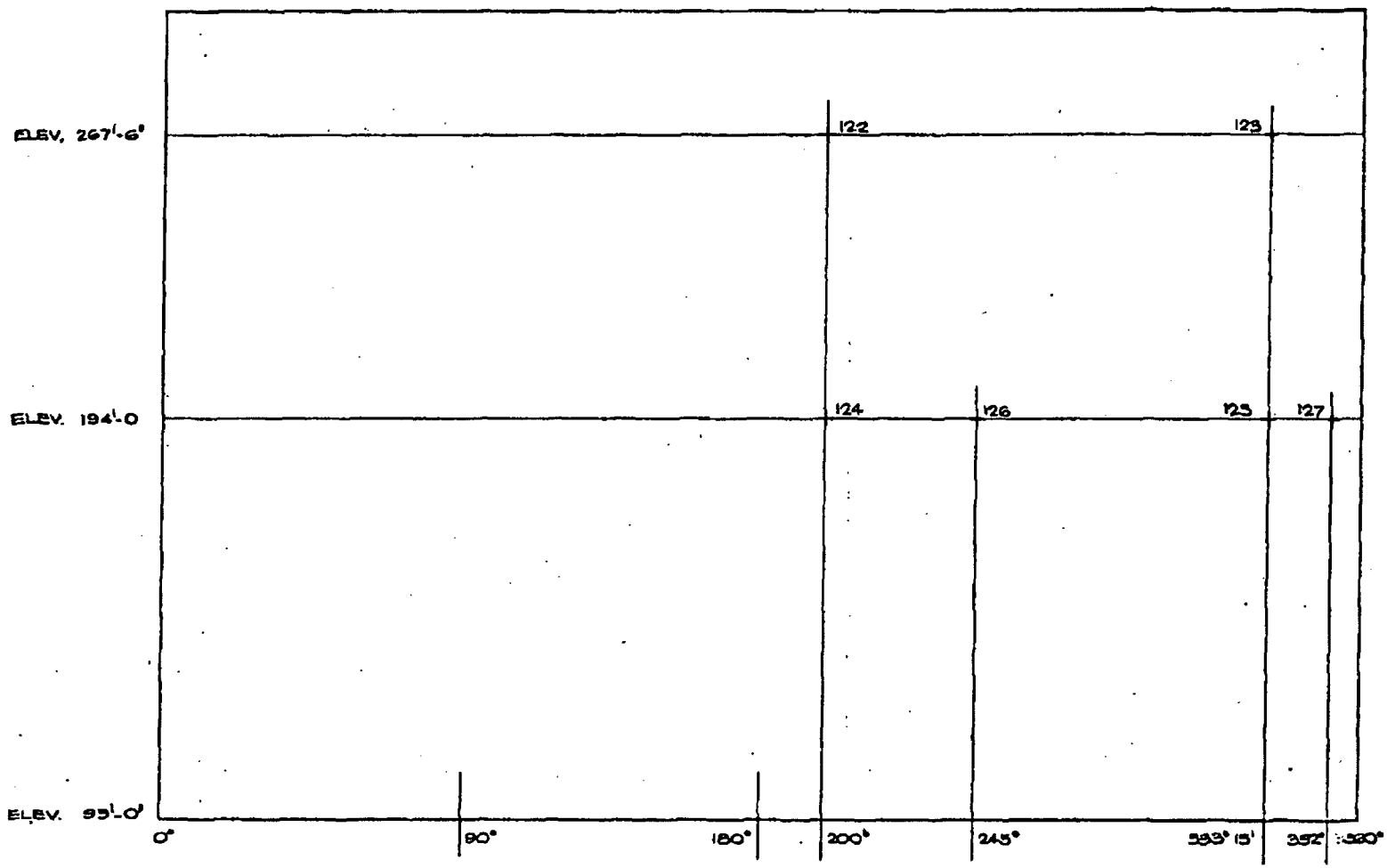
LOCATION No. 166 CHANNEL 414 INSTRUMENT No. 23

AZIMUTH 333-55 ELEVATION 4TH SPRAY RING



APPENDIX C

TEMPERATURE DATA



AMBIENT TEMPERATURE - CYLINDER WALL

FIGURE 24

TEMPERATURE READINGS

DATA SHEET 2

PAGE 1 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
10-31-76	1013	0	TC 122	64°F	NBB 10-31-76	
10-31-76	1013	0	TC 123	76°F	NBB 10/31/76	
10-31-76	1013	0	TC 124	72°F	NBB 10-31-76	
10-31-76	1013	0	TC 125	82°F	NBB 10-31-76	
10-31-76	1013	0	TC 126	72°F	NBB 10-31-76	
10-31-76	1013	0	TC 127	70°F	NBB 10-31-76	
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BY: NBB/RCL

10/31/76

T.S. Signoff

TP 7 1 150 1 0

C-2

11-5-75

TEMPERATURE READINGS

DATA SHEET 2

PAGE 2 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-1-76	0410	35	TC122	50°F	[illegible] 11-1-76	
			TC123	56°F	[illegible] 11-1-76	
			TC124	60°F	[illegible] 11-1-76	
			TC125	58°F	[illegible] 11-1-76	
			TC126	73°F	[illegible] 11-1-76	
11-1-76	0410	35	TC127	63°F	[illegible] 11-1-76	
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BY: [illegible]

11/1/76

T.S. Signoff [illegible]

TP 7 1 150 1 0

C-3

11-5-75

TEMPERATURE READINGS

DATA SHEET 2

PAGE 3 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-1-76	1340	45	TC 122	75°F	NBB 11-1-76	
11-1-76	1340	45	TC 123	64°F	NBB 11-1-76	
11-1-76	1340	45	TC 124	73°F	NBB 11-1-76	
11-1-76	1340	45	TC 125	103°F	NBB 11-1-76	
11-1-76	1340	45	TC 126	70°F	NBB 11-1-76	
11-1-76	1340	45	TC 127	64°F	NBB 11-1-76	
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BY: NBB Beck

11/1/76

T.S. Signoff

TP 7 1 150 1 0

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11-5-75

TEMPERATURE READINGS

DATA SHEET 2

PAGE 4 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-1-76	1911	55.0	TC122	65°F	[illegible] 11-1-76	
			TC123	66°F	[illegible] 11-1-76	
			TC124	71°F	[illegible] 11-1-76	
			TC125	69°F	[illegible] 11-1-76	
			TC126	72°F	[illegible] 11-1-76	
11-1-76	1911	55.0	TC127	66°F	[illegible] 11-1-76	
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BY: [illegible] 11-1-76

T.S. Signoff [illegible]

TP 7 1 150 1 0

11-5-75

TEMPERATURE READINGS

DATA SHEET 2

PAGE 5 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-2-76	0240	63.3	TC122	58	[illegible] 11-2-76	
			TC123	58	[illegible] 11-2-76	
			TC124	66	[illegible] 11-2-76	
			TC125	69	[illegible] 11-2-76	
			TC126	79	[illegible] 11-2-76	
11-2-76	0240	63.3	TC127	66	[illegible] 11-2-76	
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BY: [signature]
11-2-76

T.S. Signoff [signature]

TP 7 1 150 1 0 C-6 11-5-75

TEMPERATURE READINGS

DATA SHEET 2

PAGE 6 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-2-76	0930	55 PSIG	TC 122	63	[illegible] 11-2-76	
			TC 123	78	[illegible] 11-2-76	
			TC 124	64	[illegible] 11-2-76	
			TC 125	84	[illegible] 11-2-76	
			TC 126	71	[illegible] 11-2-76	
11-2-76	0930	55 PSIG	TC 127	68	[illegible] 11-2-76	
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BY: [illegible]

11-2-76

T.S. Signoff [illegible]

TEMPERATURE READINGS

DATA SHEET 2

PAGE 7 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-2-76	1445	45 PSIG	TC 122	82°F	[illegible] 11-2-76	
			TC 123	76°F	[illegible] 11-2-76	
			TC 124	89°F	[illegible] 11-2-76	
			TC 125	88°F	[illegible] 11-2-76	
			TC 126	70°F	[illegible] 11-2-76	
11-2-76	1445	45 PSIG	TC 127	69°F	[illegible] 11-2-76	
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BY: [signature]

11-2-76

T.S. Signoff [signature]

TEMPERATURE READINGS

DATA SHEET 2

PAGE 8 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-2-76	2000	35 PSIG	TC 122	64°F	[illegible] 11-2-76	
			TC123	64°F	[illegible] 11-2-76	
			TC124	73°F	[illegible] 11-2-76	
			TC125	69°F	[illegible] 11-2-76	
			TC126	70°F	[illegible] 11-2-76	
11-2-76	2000	35 PSIG	TC127	70°F	[illegible] 11-2-76	
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BY: [illegible]
11-2-76

T.S. Signoff [illegible]
11-3-76

TEMPERATURE READINGS

DATA SHEET 2

PAGE 9 OF 9

DATE	TIME	TEST PRESSURE	LOCATION	TEMP.	INITIAL/DATE	NOTES
11-3-76	0600	12 PSIG	TC122	61 °F	Kit 11-3-76	
			TC123	66 °F	Kit 11-3-76	
			TC124	69 °F	Kit 11-3-76	
			TC125	64 °F	Kit 11-3-76	
			TC126	72 °F	Kit 11-3-76	
11-3-76	0600	12 PSIG	TC127	67 °F	Kit 11-3-76	
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BY: Kit Kiton

11-3-76

T.S. Signoff Kit Kiton

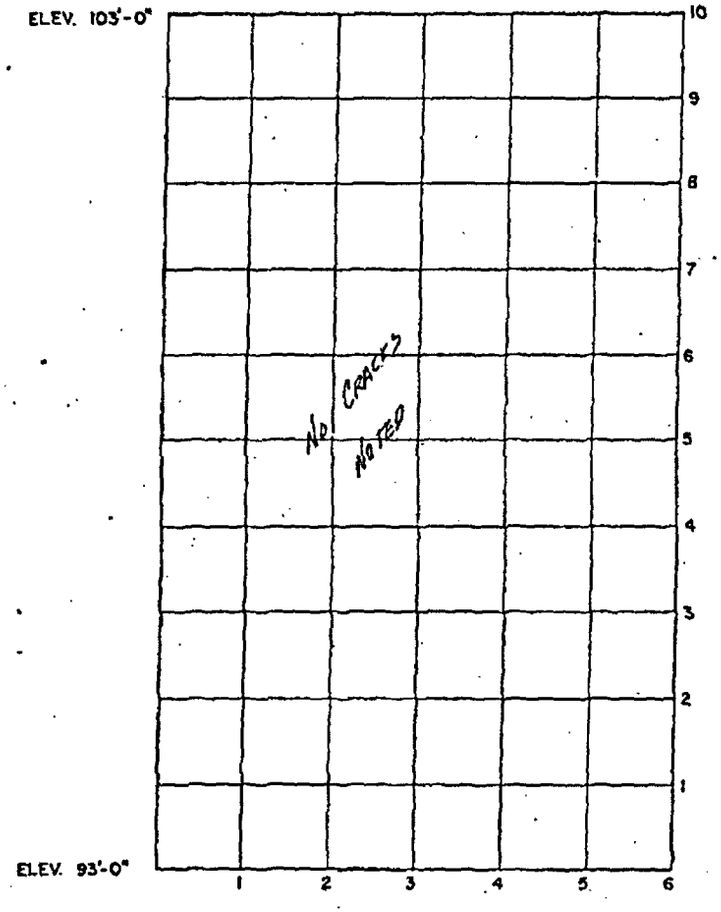
APPENDIX D

CRACK INSPECTION

Wiss, Janney, Elstner and Associates

AREA NO. 118

BASE SLAB AND CYLINDER

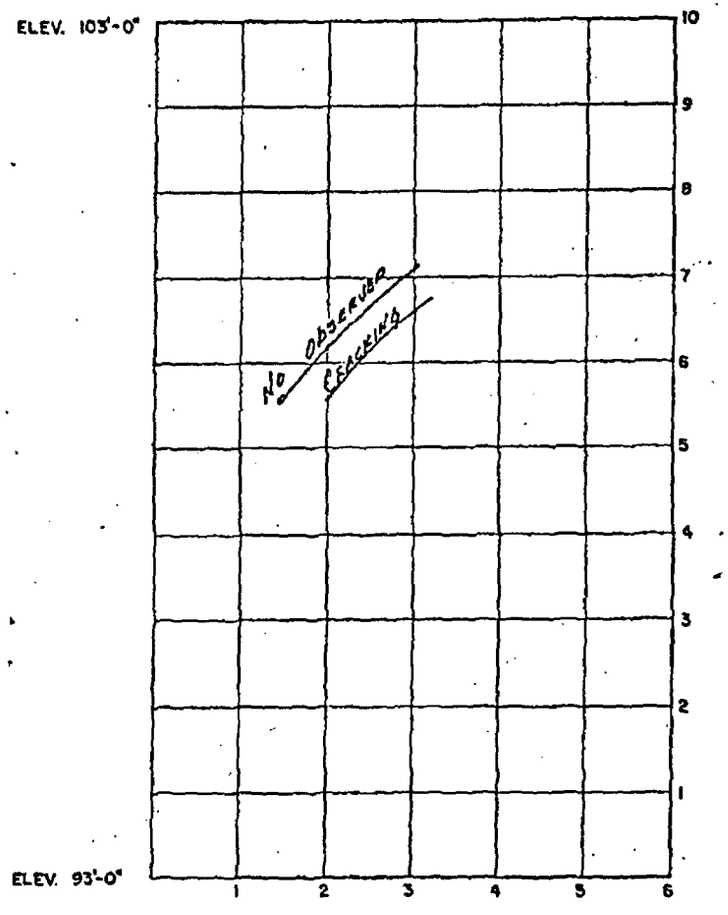


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 10/21/76
PRESSURE 0
W J E No. 71465

TIME 0112
SURVEYED BY TJR

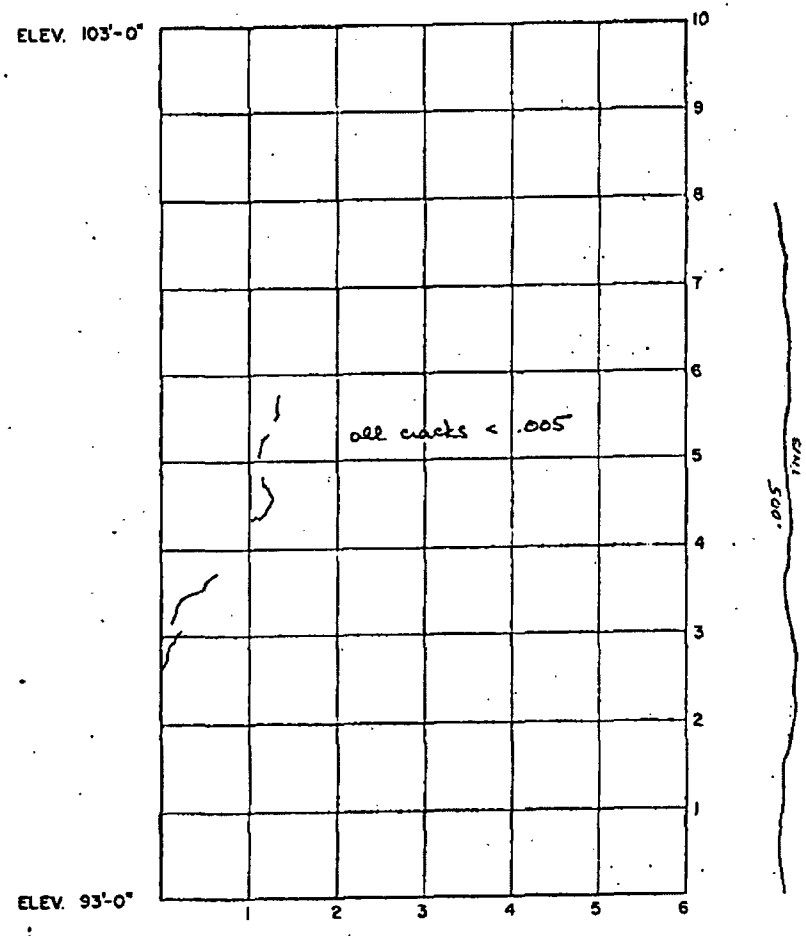


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270

DATE 11/1/76
PRESSURE 30 psi
W J E No. 71465

TIME 0430
SURVEYED BY TJR

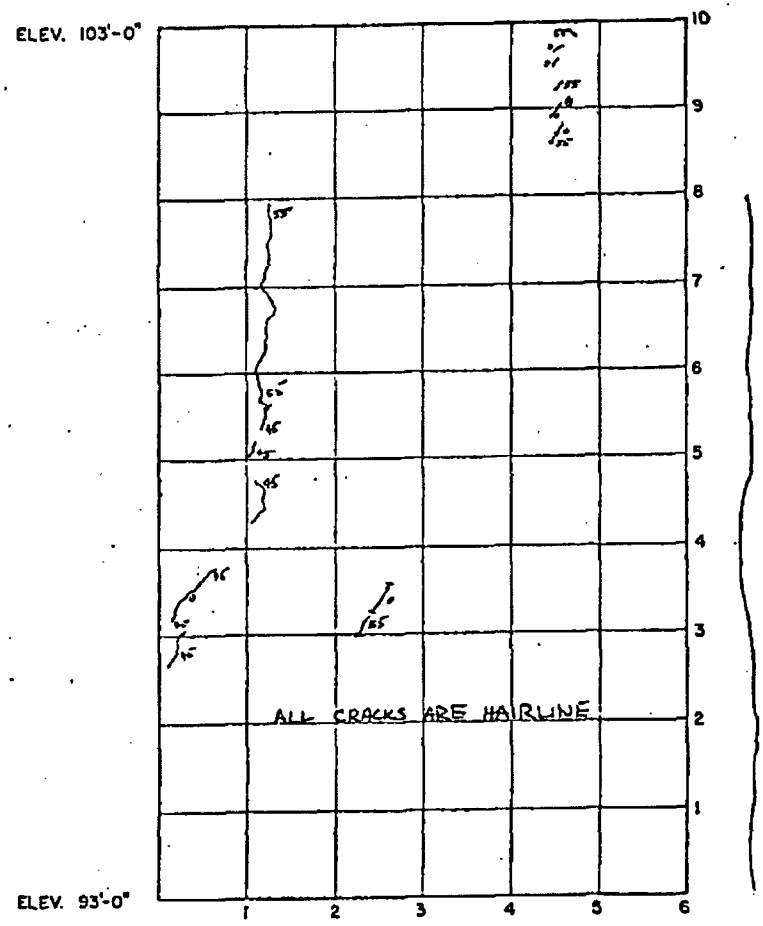


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-1
PRESSURE 45 psig
W J E No. 71465

TIME 12:35
SURVEYED BY DWB

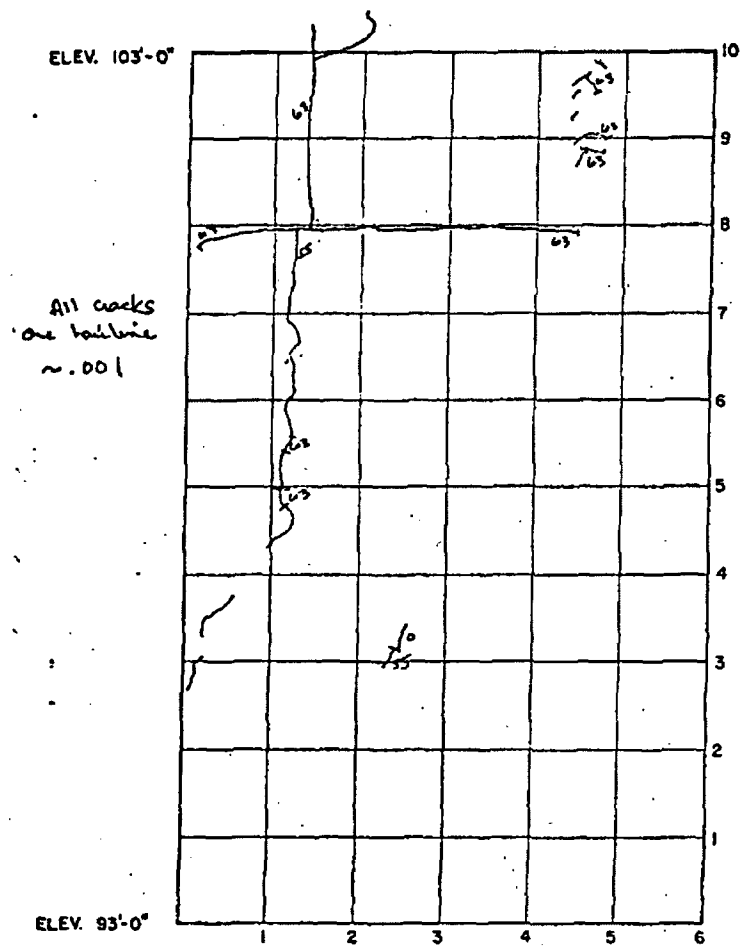


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-1
PRESSURE 55 psig
W J E No. 71465

TIME 8:25 pm
SURVEYED BY DWB

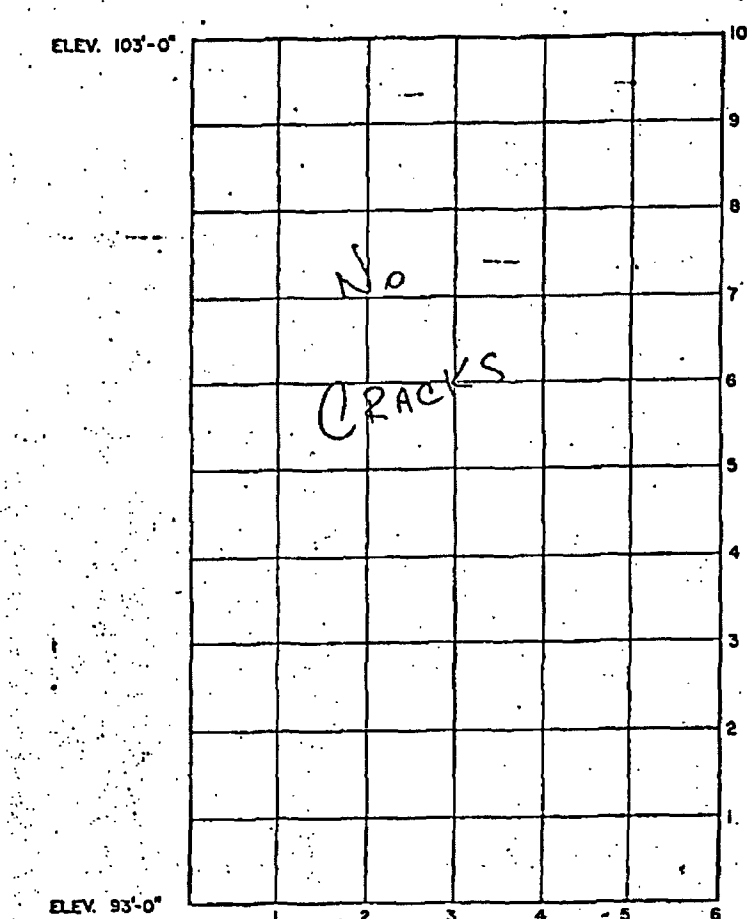


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-2-76
PRESSURE 633
W J E No. 71465

TIME 0420
SURVEYED BY DWB



CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

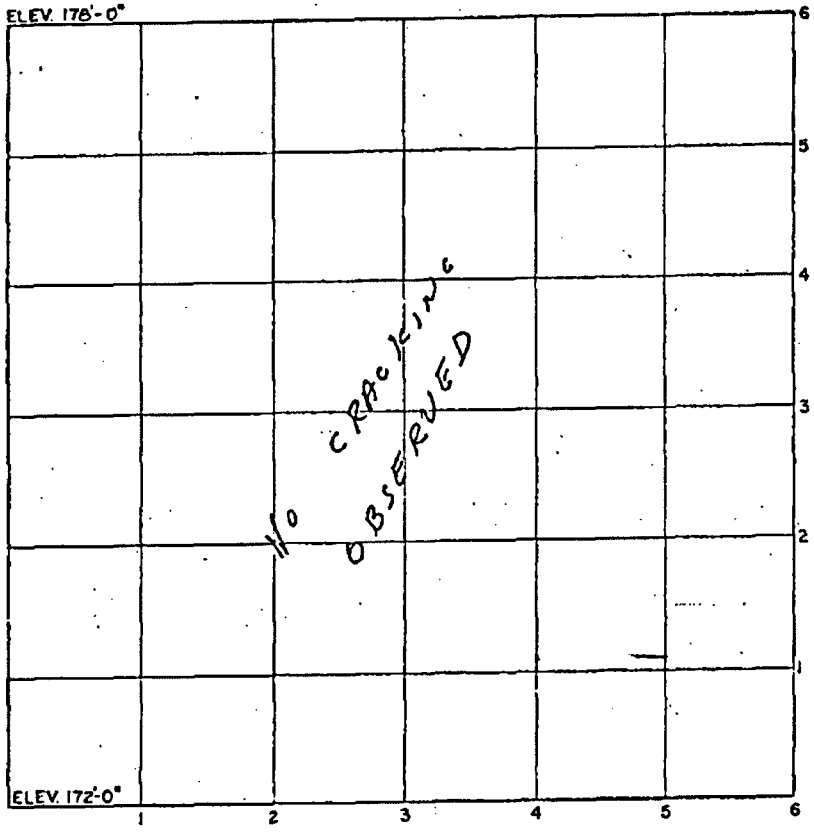
CRACK SURVEY — AZIMUTH 270°

DATE 11-3-76
PRESSURE 0
W J E No. 71465

TIME 1230
SURVEYED BY Tom Gunderson

AREA NO. 119

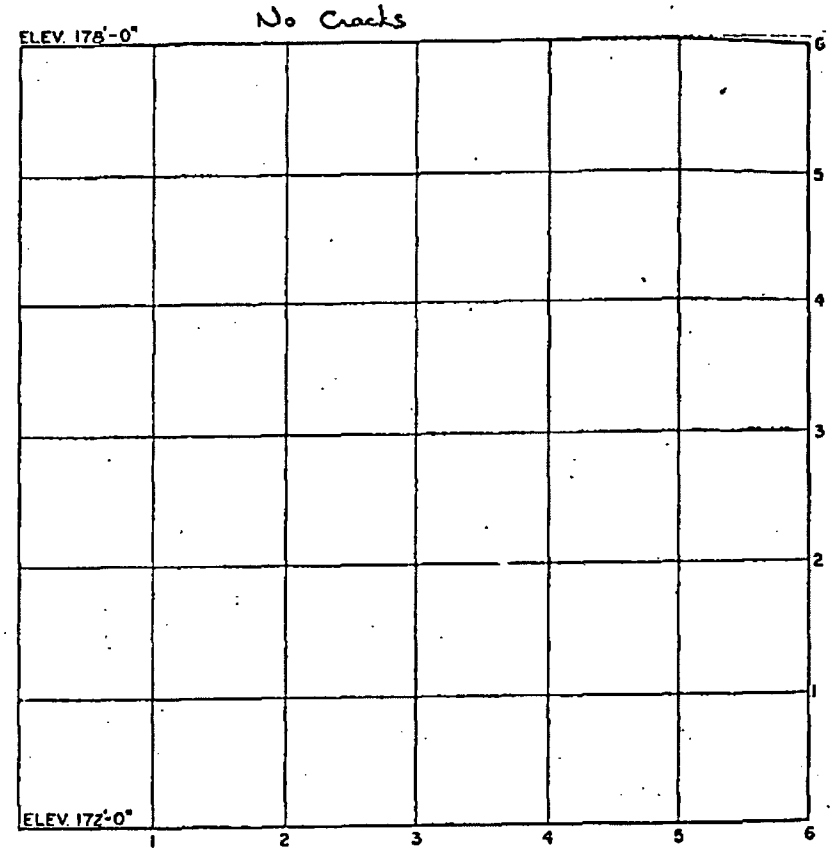
CYLINDER MIDHEIGHT



CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 10/30/76 TIME 2330
PRESSURE 10" Before test SURVEYED BY R. Kane
WJE No. 71465

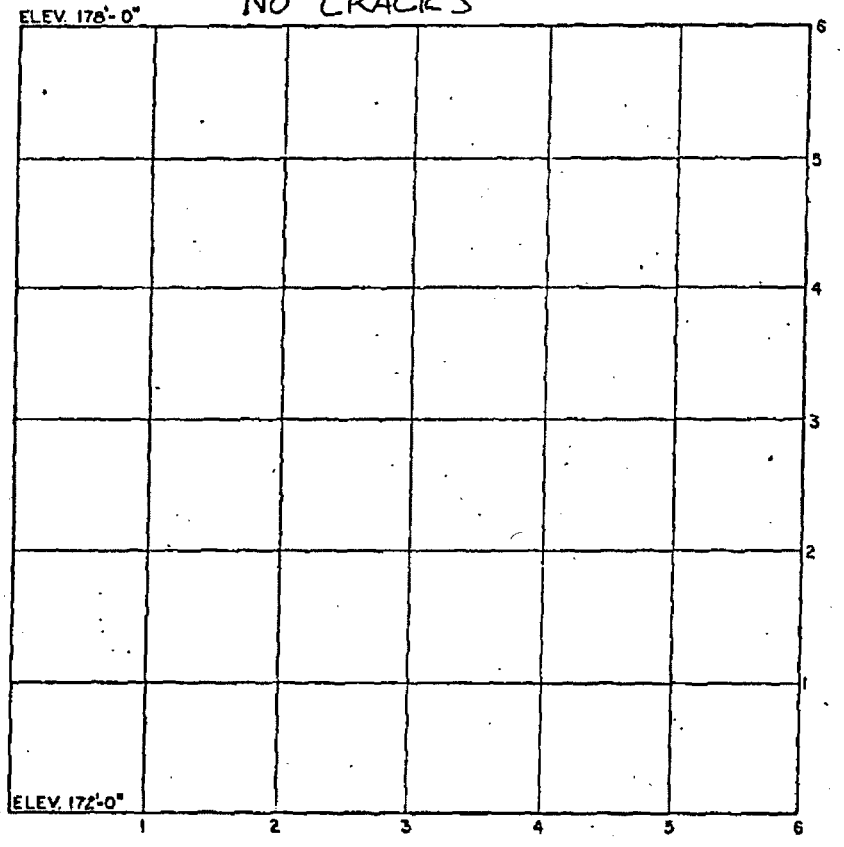


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-1 TIME 4:24 AM
PRESSURE 35.0 psig SURVEYED BY DWB
WJE No. 71465

NO CRACKS



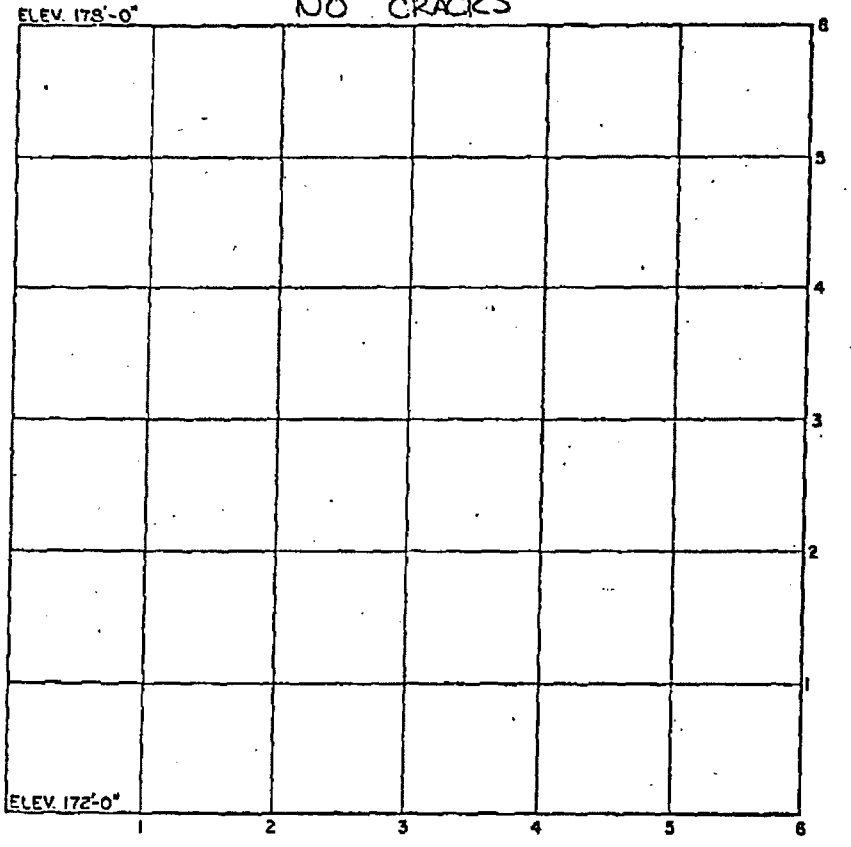
CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-1-76
PRESSURE 45 psig
WJE No. 71465

TIME 12:05 pm
SURVEYED BY DWB

NO CRACKS

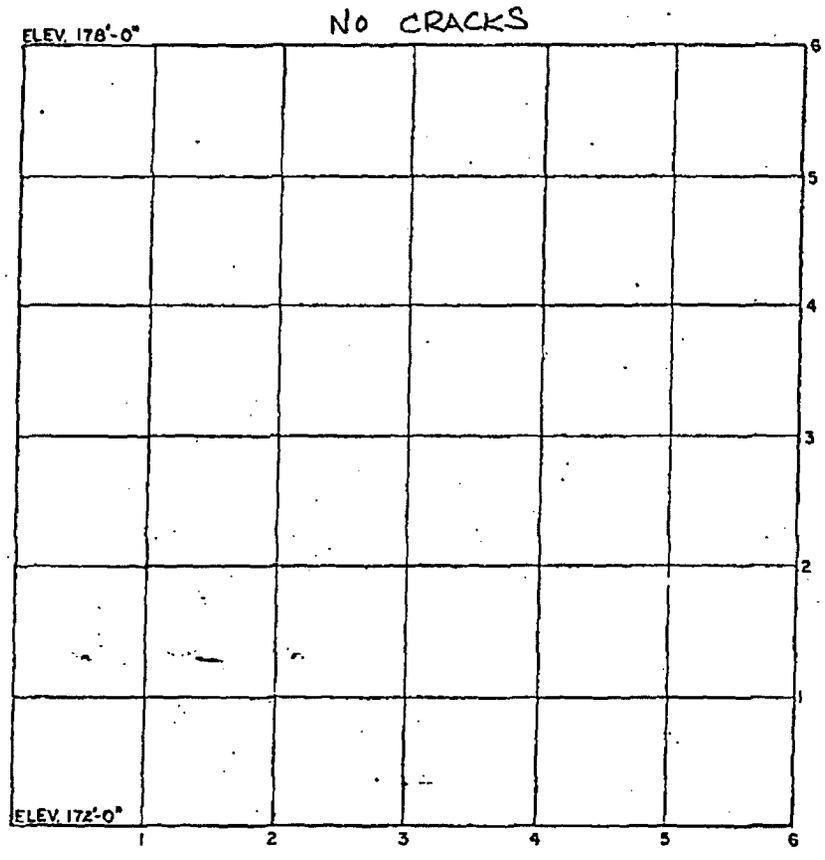


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-1-76
PRESSURE 55 psig
WJE No. 71465

TIME 7:40
SURVEYED BY DWB

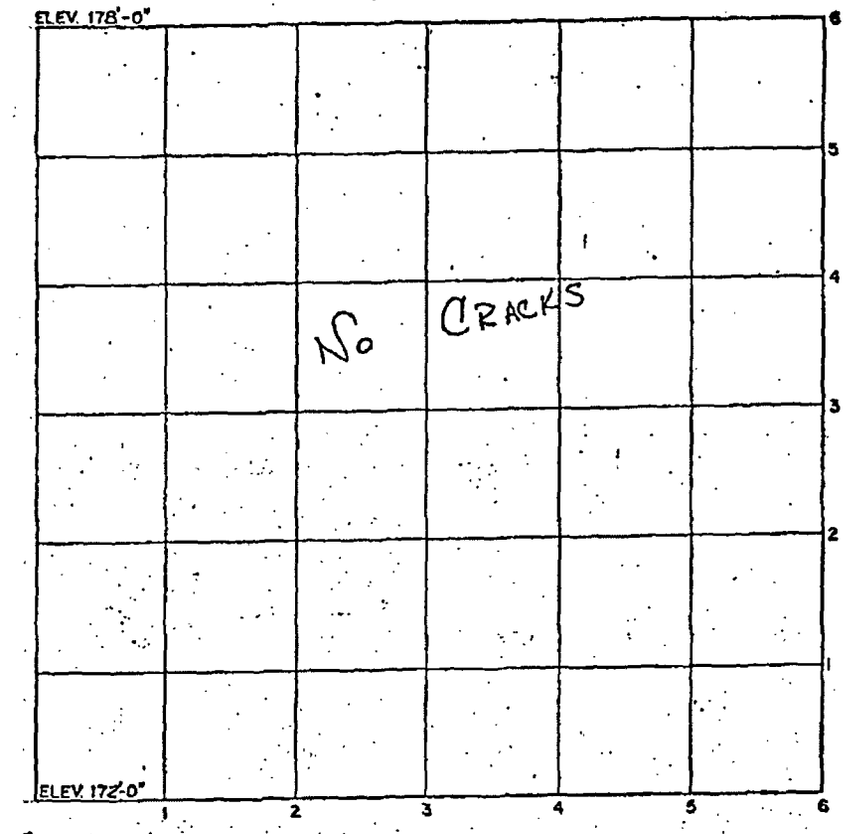


CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY — AZIMUTH 270°

DATE 11-2-76
PRESSURE 633 psig
WJE No. 71465

TIME 3:15 AM
SURVEYED BY DWB



CRYSTAL RIVER — UNIT No. 3
FLORIDA POWER CORPORATION

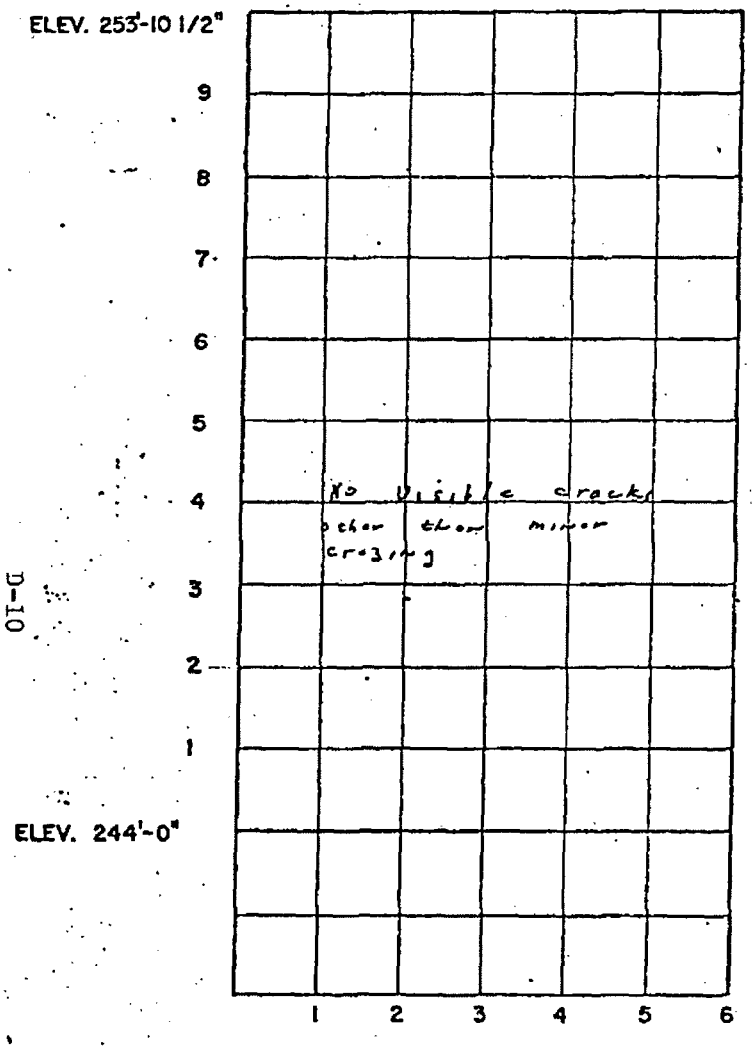
CRACK SURVEY — AZIMUTH 270°

DATE 10-3-76
PRESSURE 0
WJE No. 71465

TIME 1430
SURVEYED BY Tom Buchman

AREA NO. 120

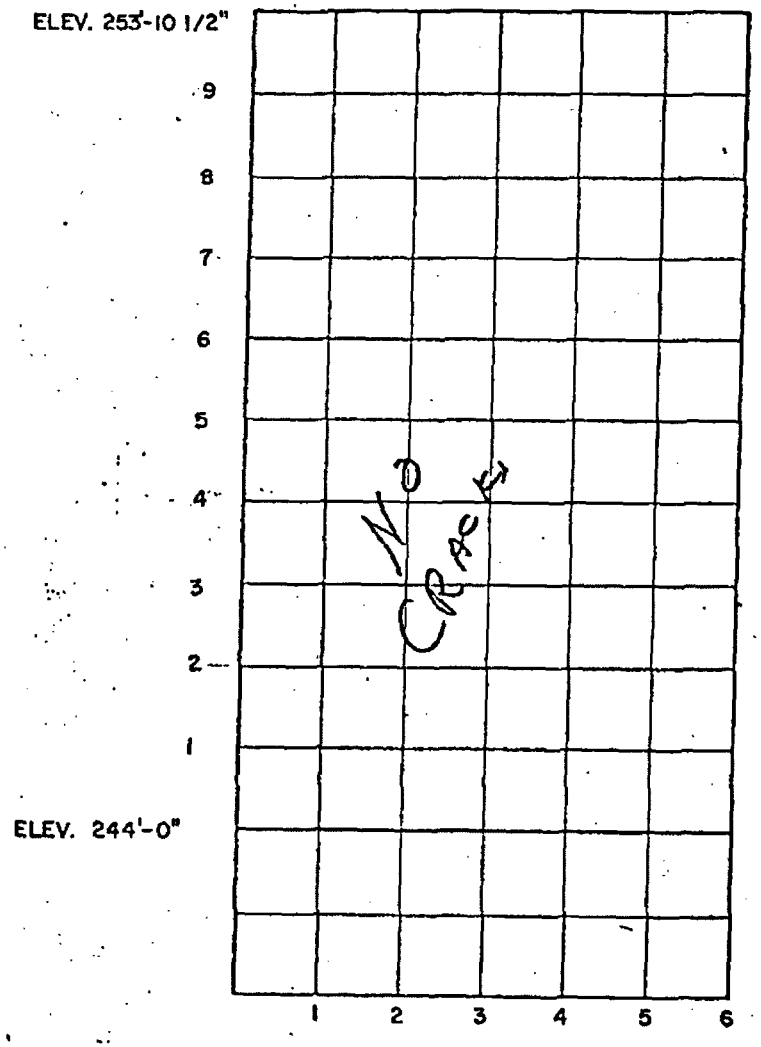
RING BEAM AND DOME



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

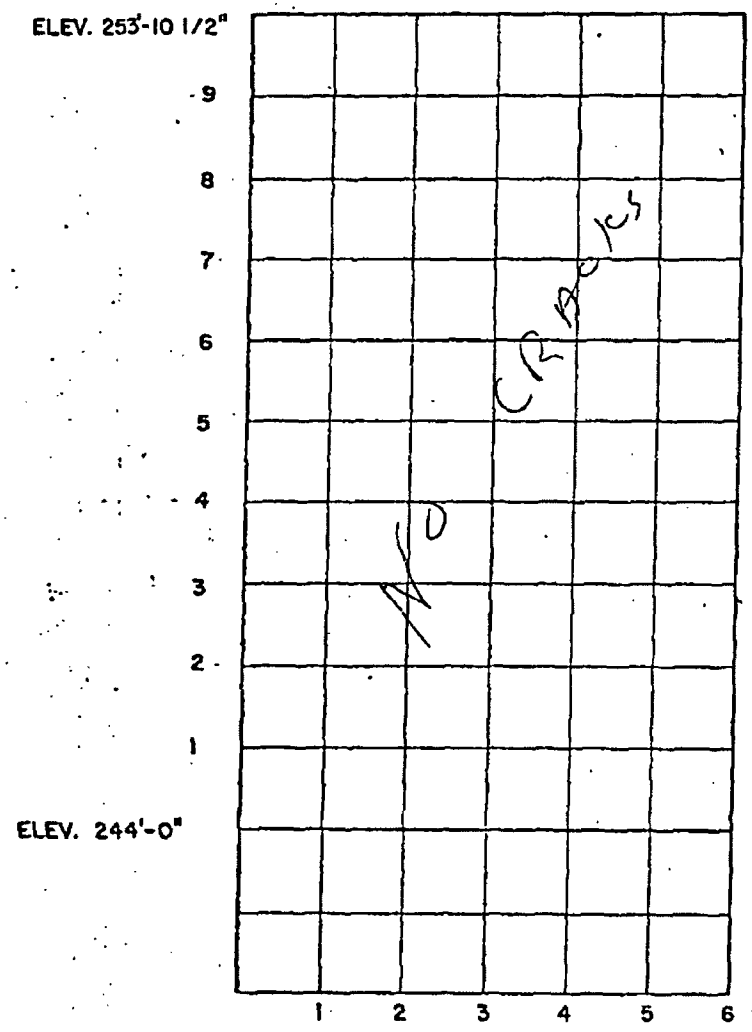
DATE 10-29-76 TIME 1020
PRESSURE 0 SURVEYED BY RK + WP
WJE No. 71465



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76 TIME 0530
PRESSURE 35 SURVEYED BY R. Krause
WJE No. 71465

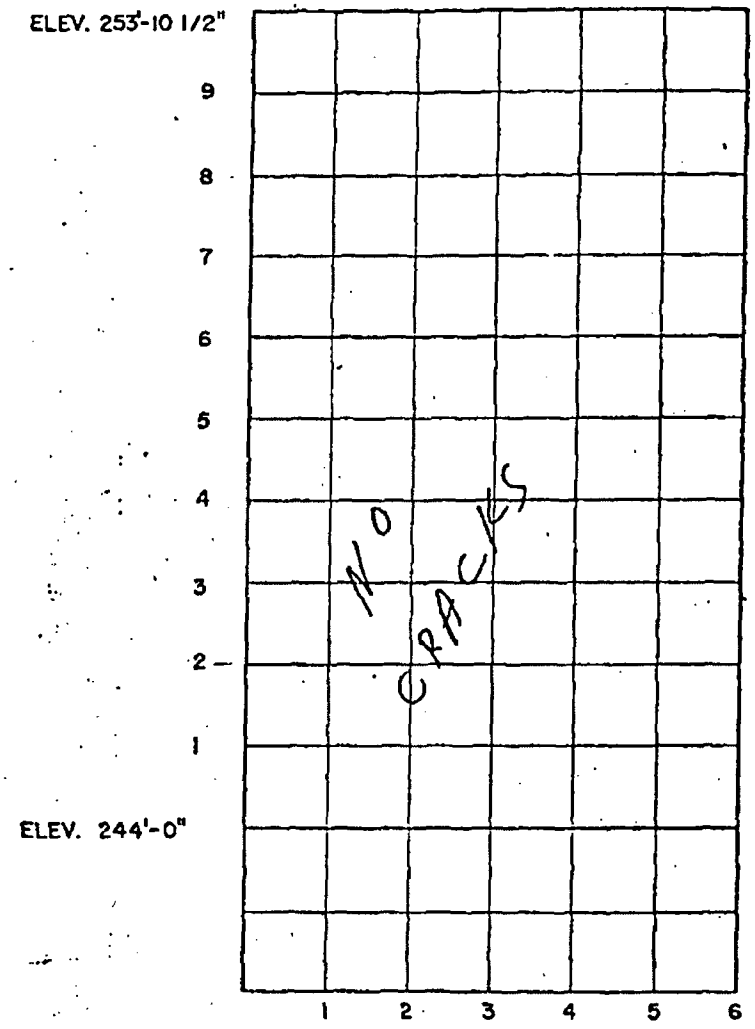


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 45
WJE No. 71465

TIME 1235
SURVEYED BY R. Franco

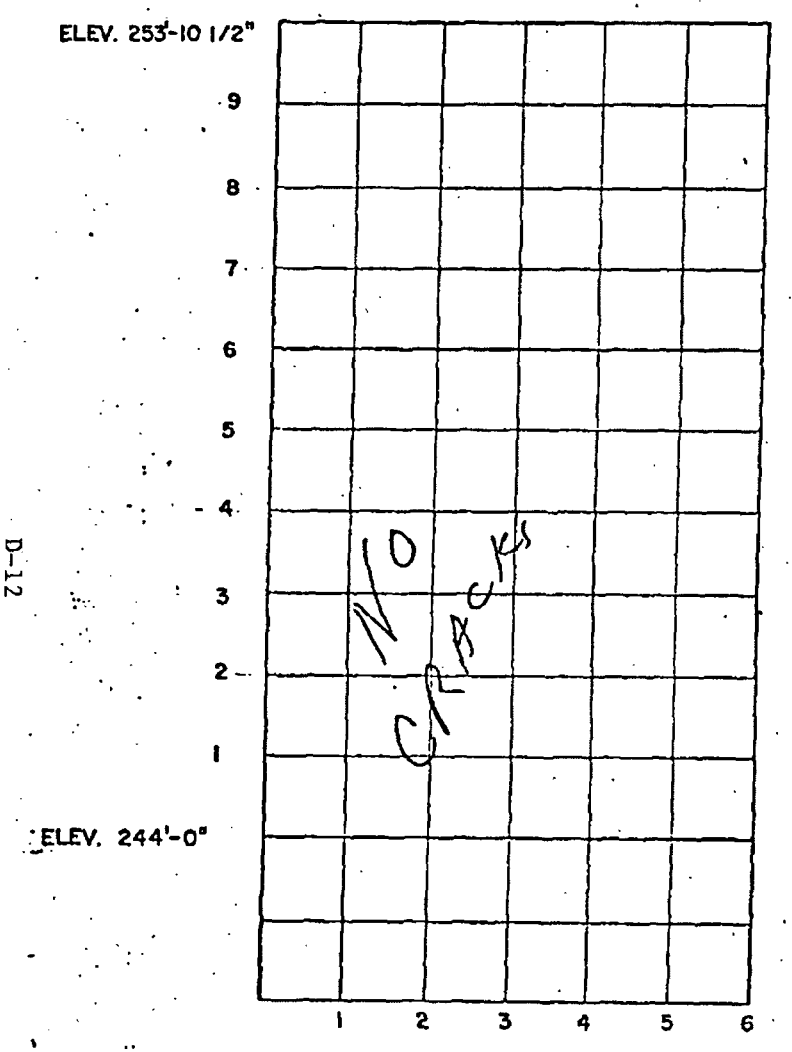


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 55
WJE No. 71465

TIME 2005
SURVEYED BY R. Franco

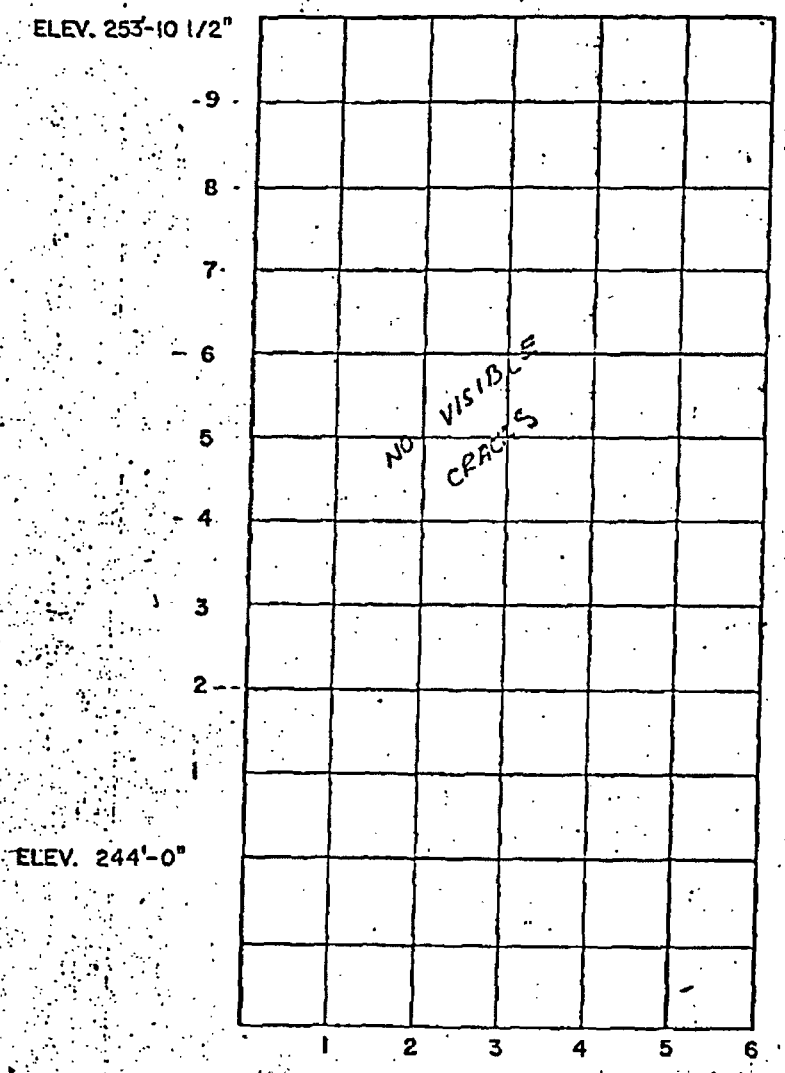


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-2-76
PRESSURE 63.3
WJE No. 71465

TIME 0325
SURVEYED BY R. Krance

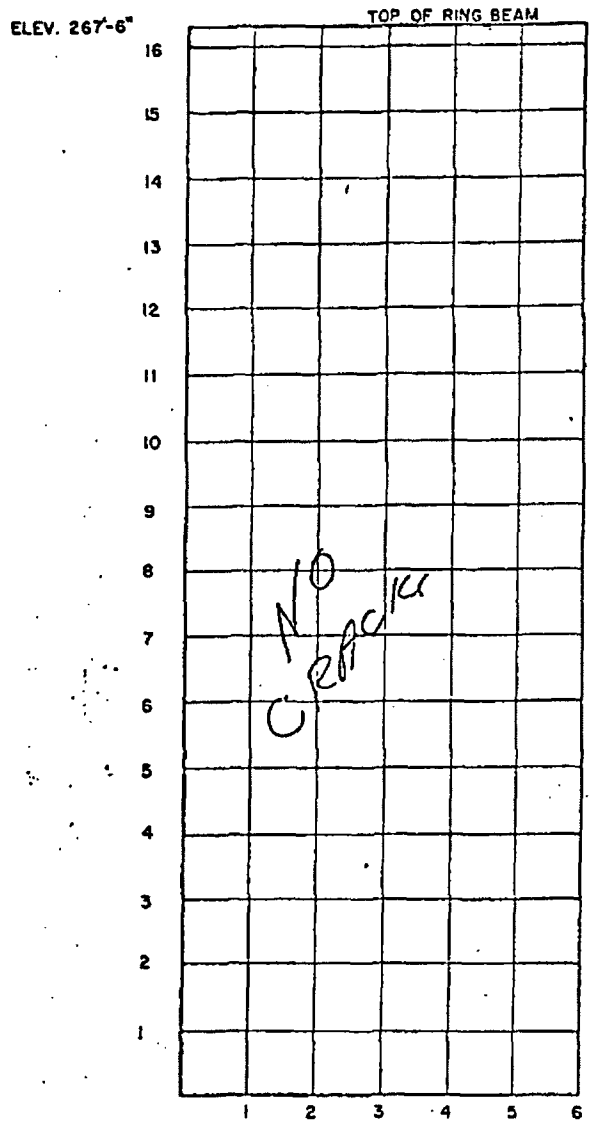


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/3/76
PRESSURE 0.0 psig

TIME 1315
SURVEYED BY B.N.

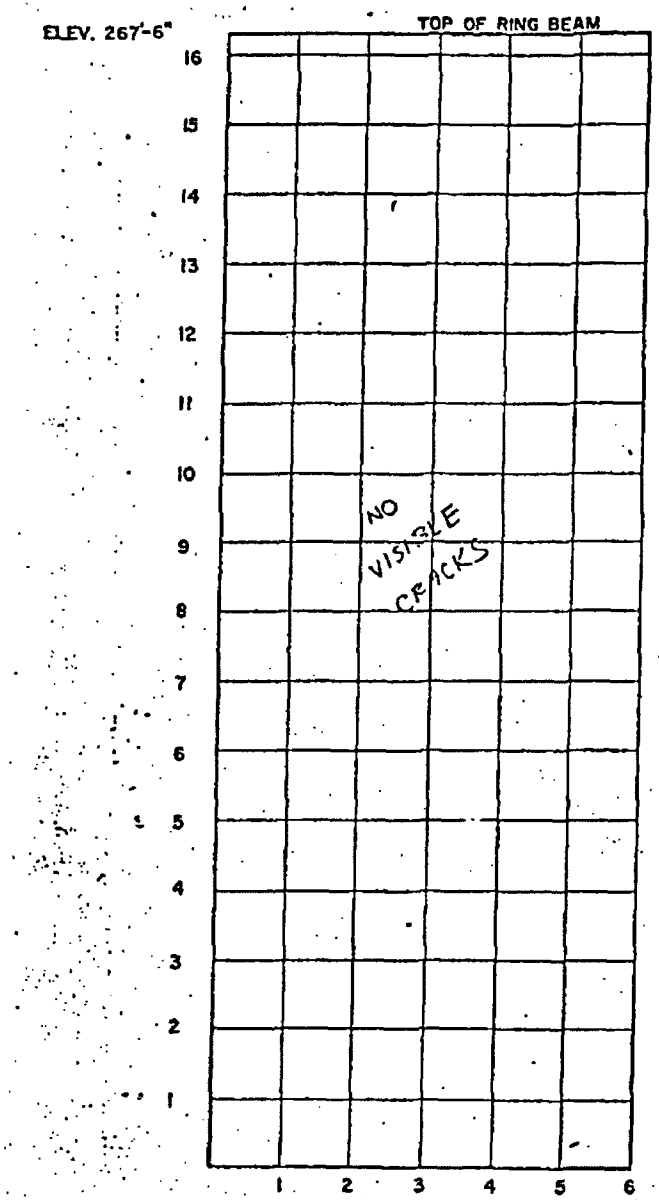


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-2-76
PRESSURE 63.3
WJE No. 71465

TIME 0330
SURVEYED BY R. Kraner

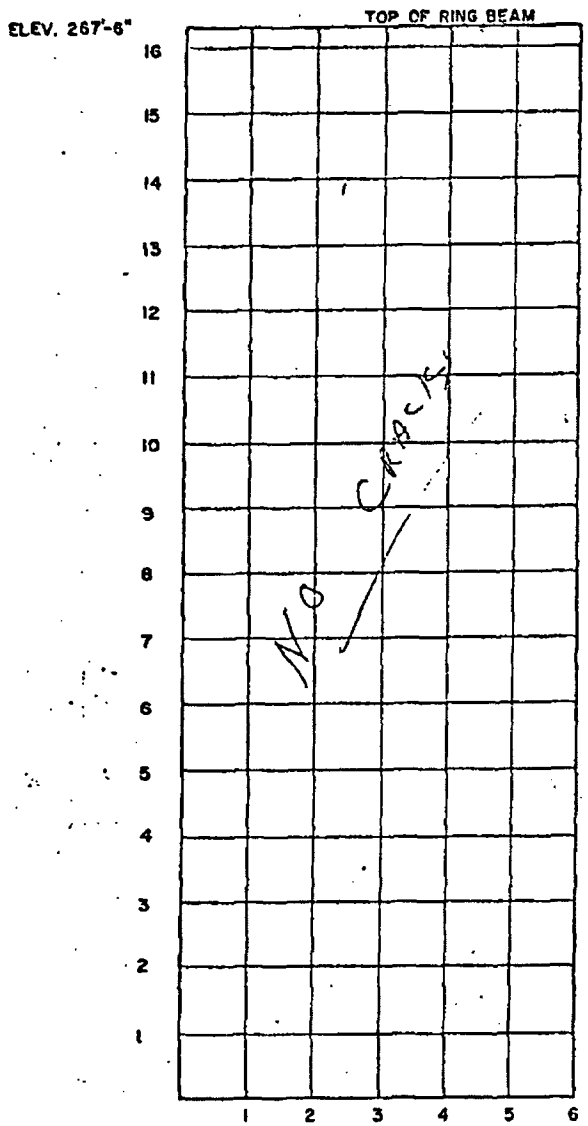


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11/3/76
PRESSURE 0.0 min
WJE No. 71465

TIME 1315
SURVEYED BY B.N

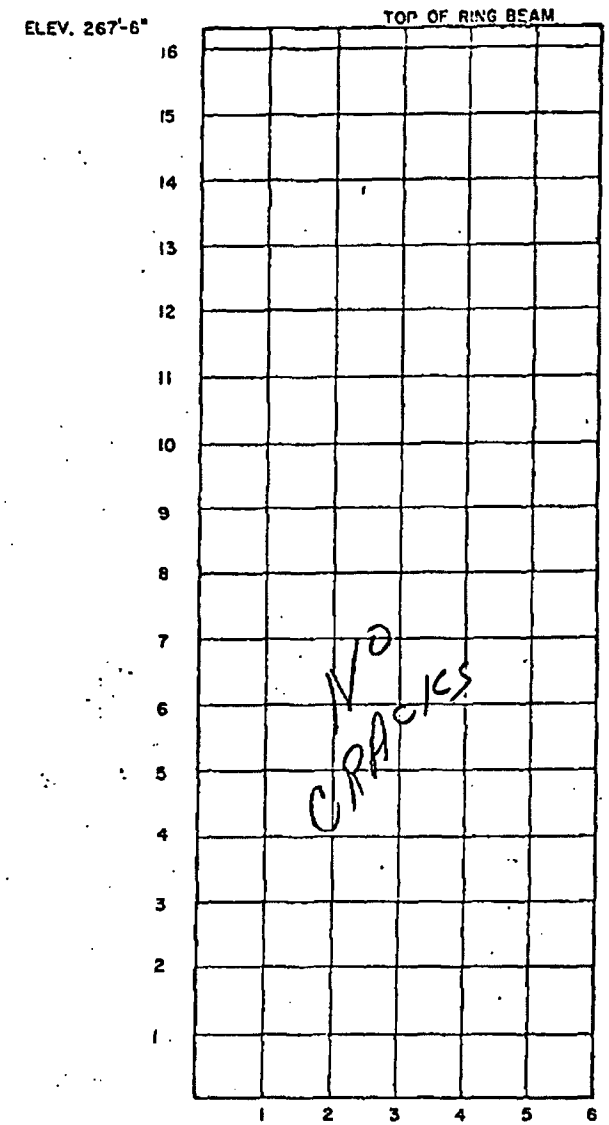


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-1-96
PRESSURE 45
WJE No. 71465

TIME 1330
SURVEYED BY R. Kane

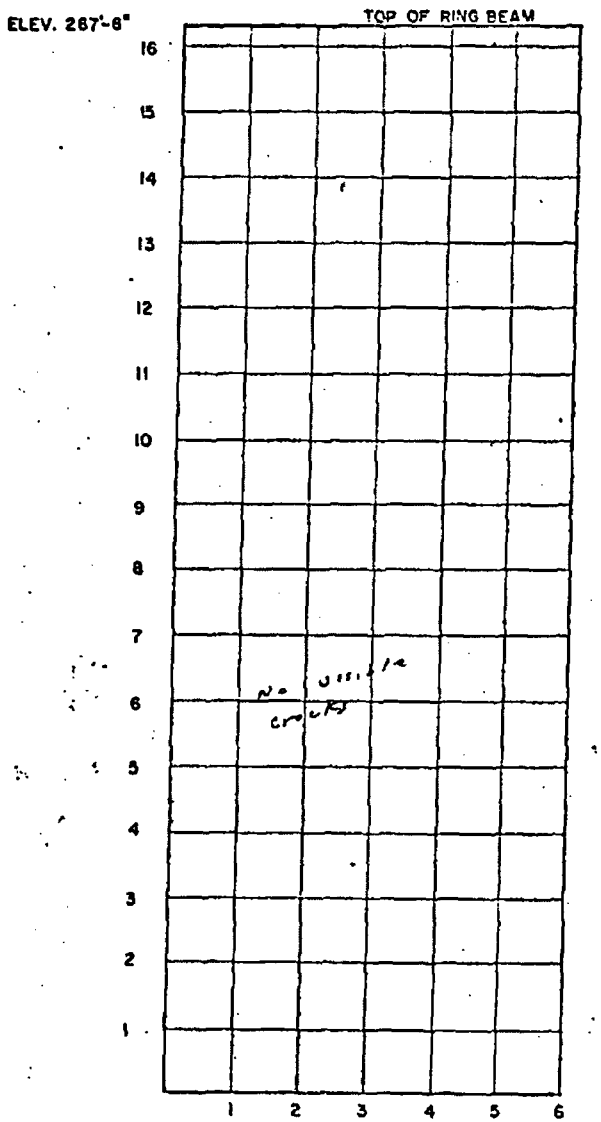


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-1-96
PRESSURE 55
WJE No. 71465

TIME 2005
SURVEYED BY R. Kane

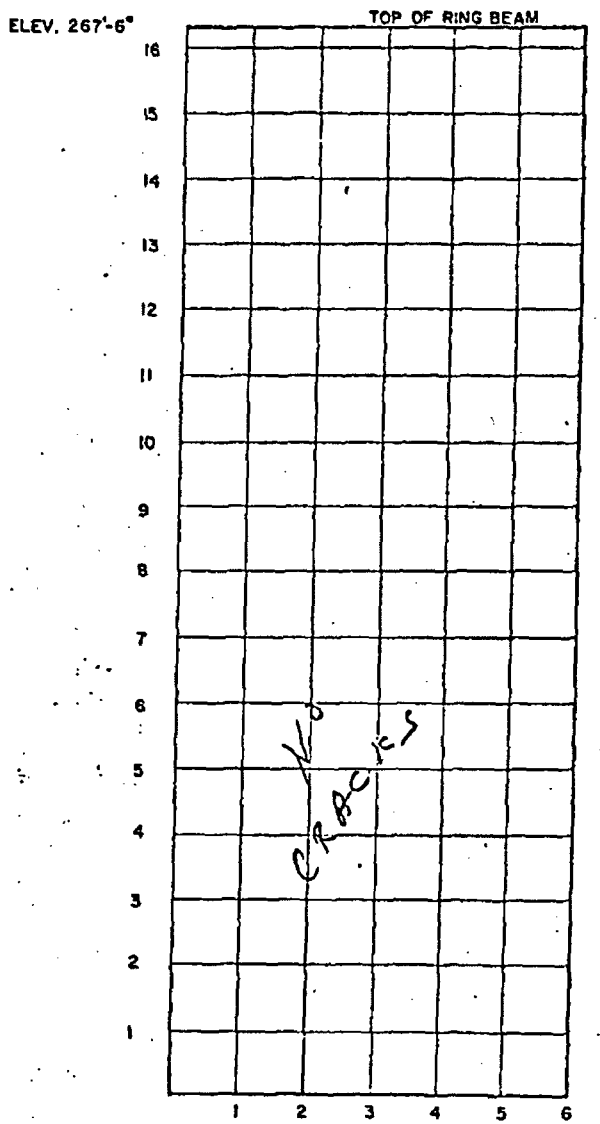


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME 1010
SURVEYED : PK + WP



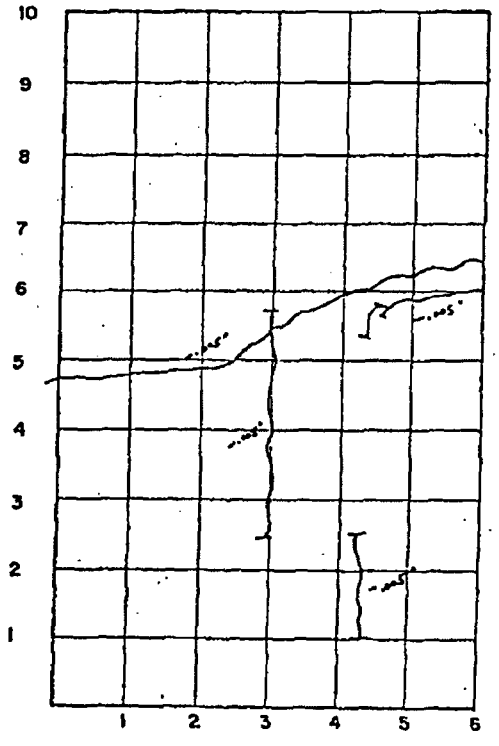
CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71466

TIME 0530
SURVEYED R. Krause

TOP SURFACE OF RING BEAM



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

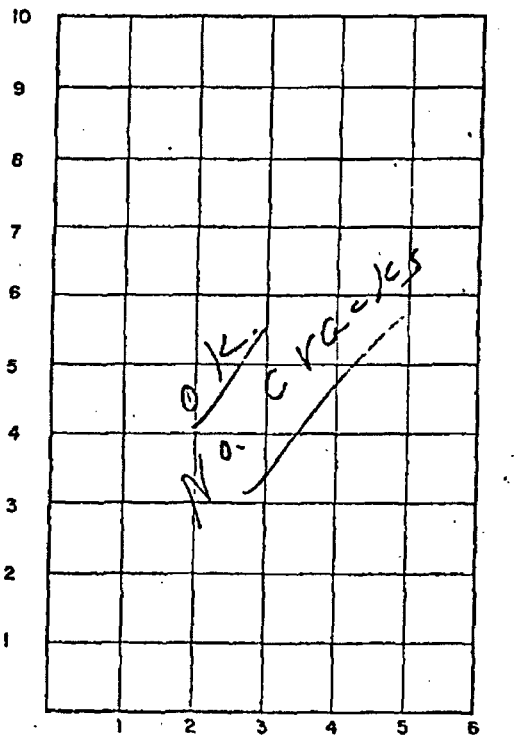
CRACK SURVEY – AZIMUTH 200

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME 940
SURVEYED BY RK + WP

SHEET

TOP SURFACE OF RING BEAM



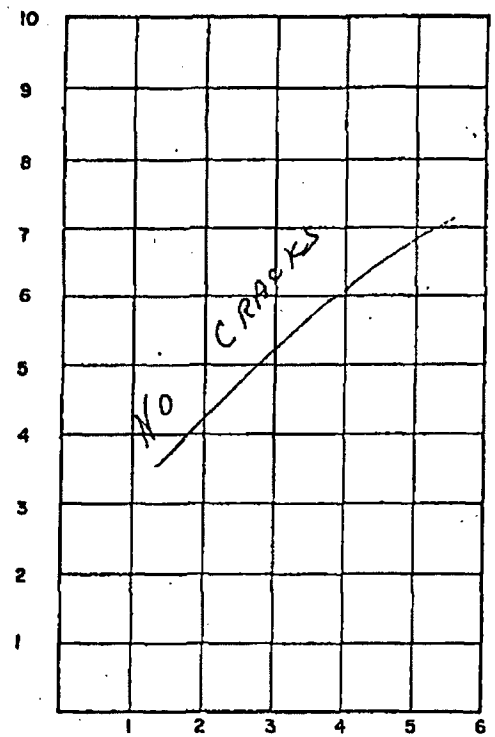
CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME 0510
SURVEYED BY R. Kremus

TOP SURFACE OF RING BEAM



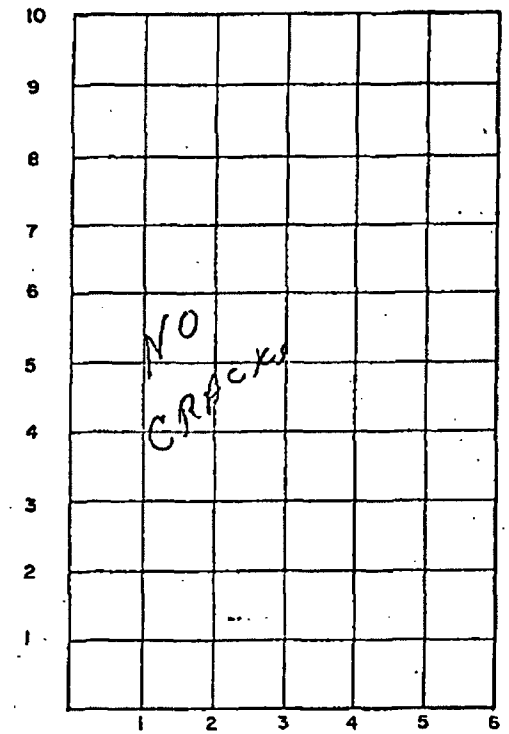
CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE ~~[illegible]~~ 45
WJE No. 71465

TIME 1225
SURVEYED BY R. Krause

TOP SURFACE OF RING BEAM



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

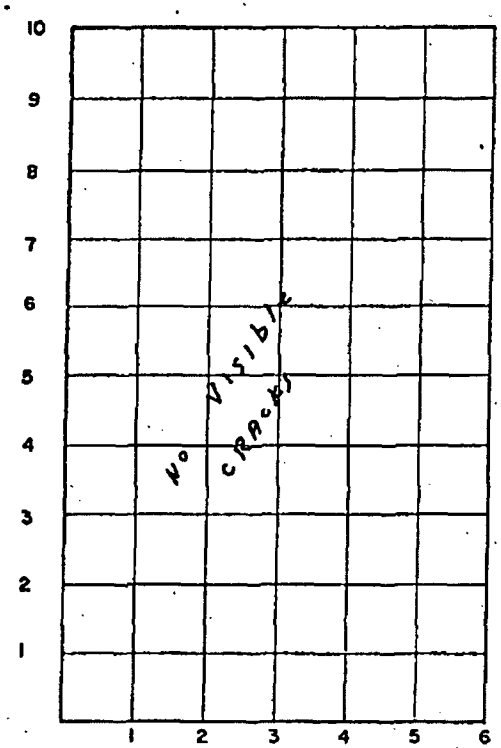
CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 55
WJE No. 71465

TIME 20 hrs
SURVEYED BY R. Krause

Sheet

TOP SURFACE OF RING BEAM

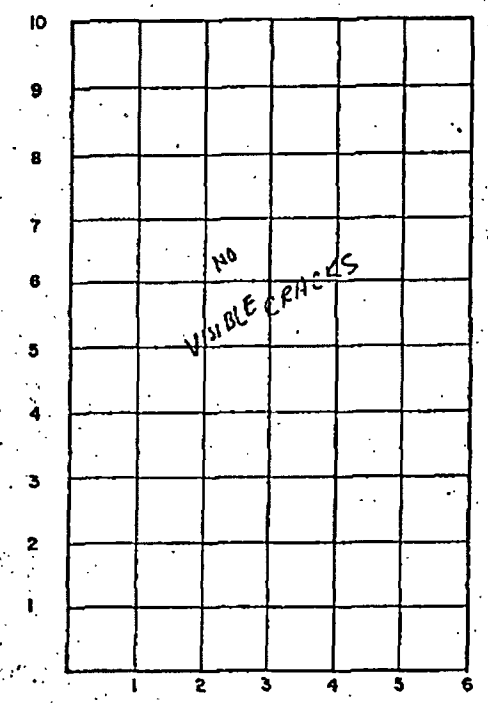


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-2-76 TIME 0330
PRESSURE 63.3 SURVEYED BY R. Krause
WJE No. 71465

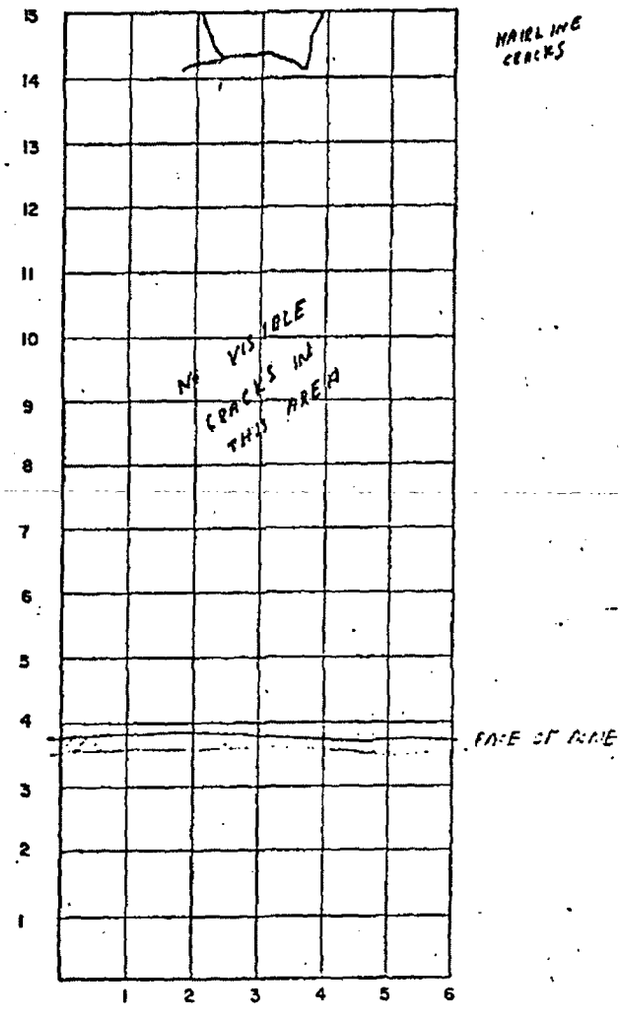
TOP SURFACE OF RING BEAM



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/3/76 TIME 1710
PRESSURE 0.0 psig SURVEYED BY B.N.

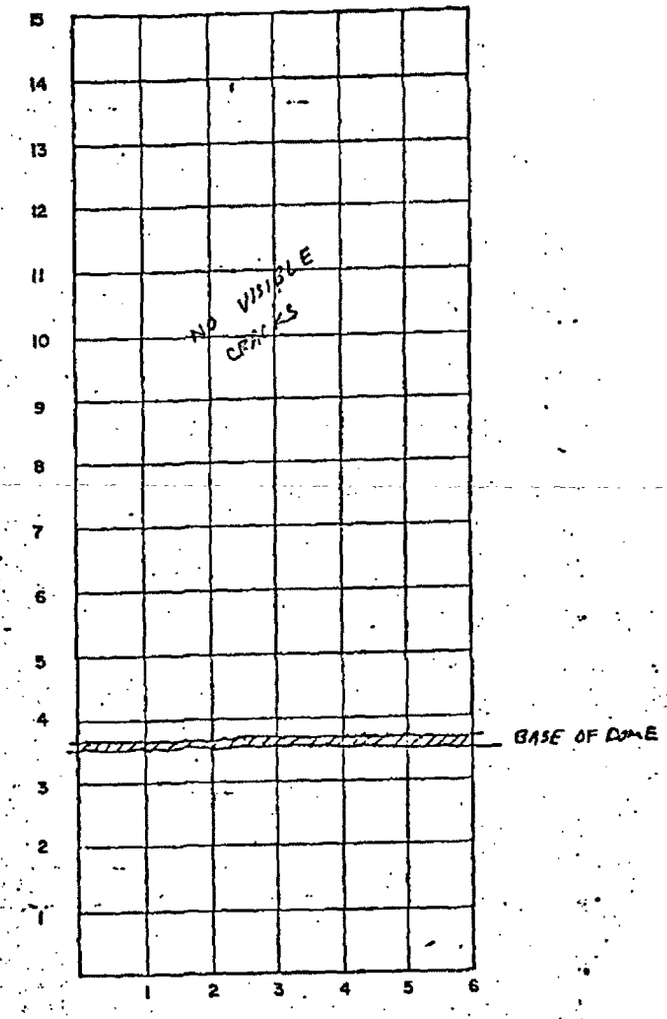


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11/2/76
PRESSURE 63.3
WJE No. 71165

TIME 0245 - 0345
SURVEYED BY B.N.

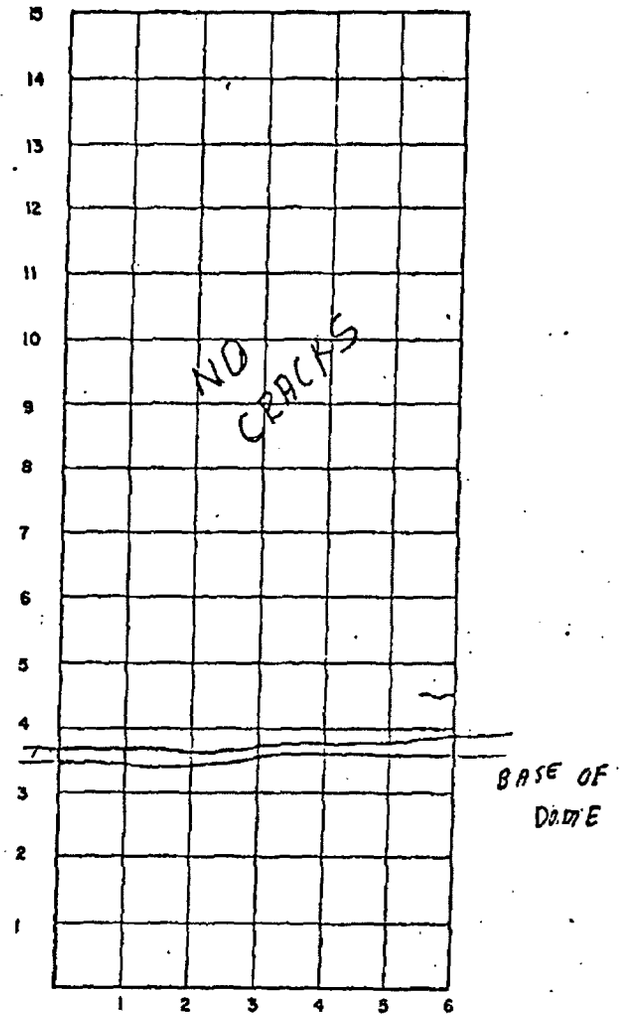


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11/3/76
PRESSURE 5.0 psig
WJE No. 71165

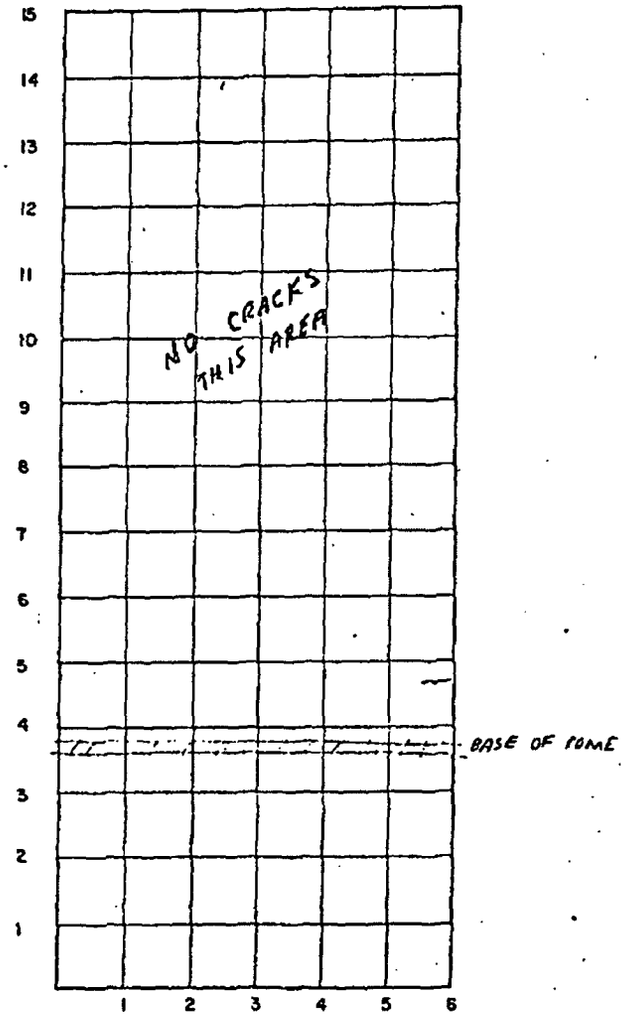
TIME 1215-1245
SURVEYED BY B.N.



CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

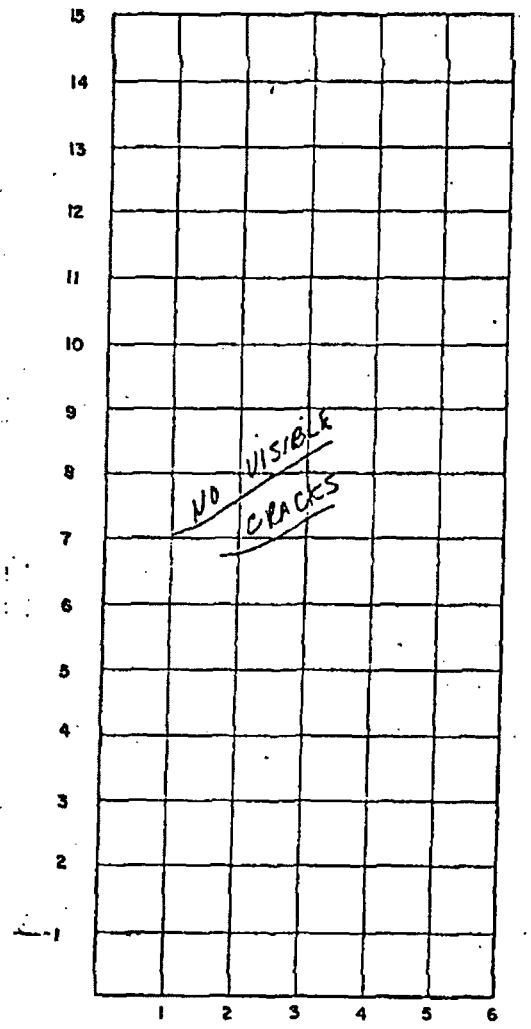
DATE _____ TIME 1150-1245
PRESSURE 45 SURVEYED BY BN
WJE No. 71465



CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11/1/76 TIME [illegible]
PRESSURE 55 SURVEYED BY B.N.
WJE No. 71465

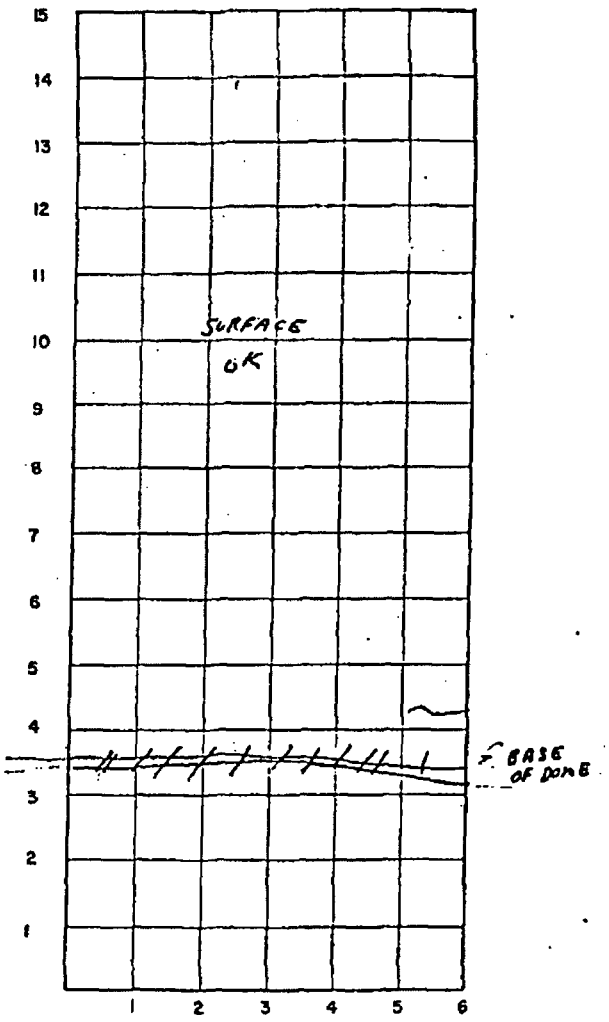


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME 2 pm
SURVEYED BY RK + WP

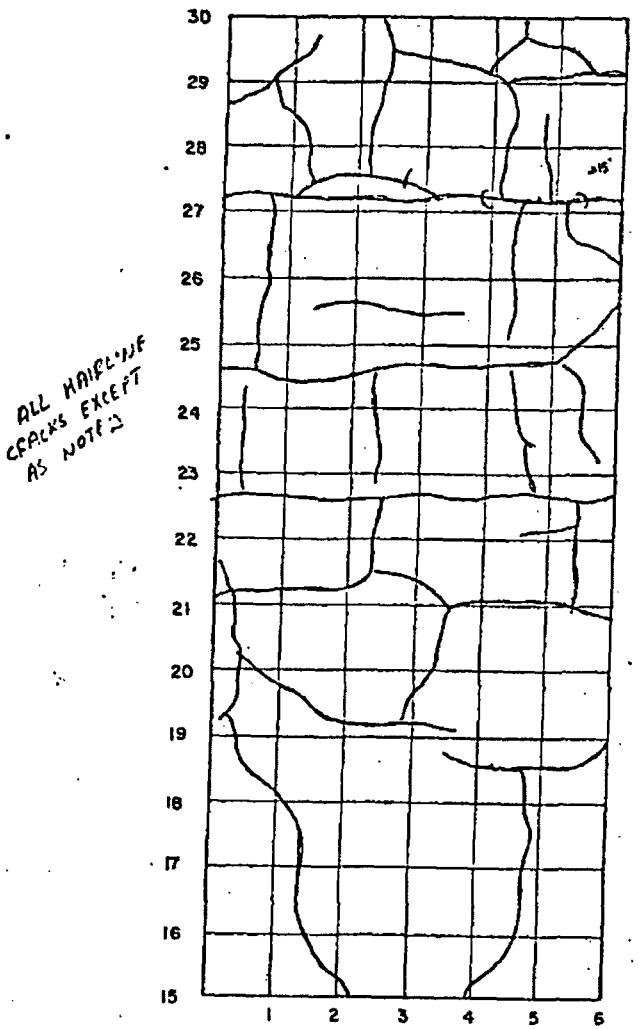


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME 4:30-5:30
SURVEYED BY BN

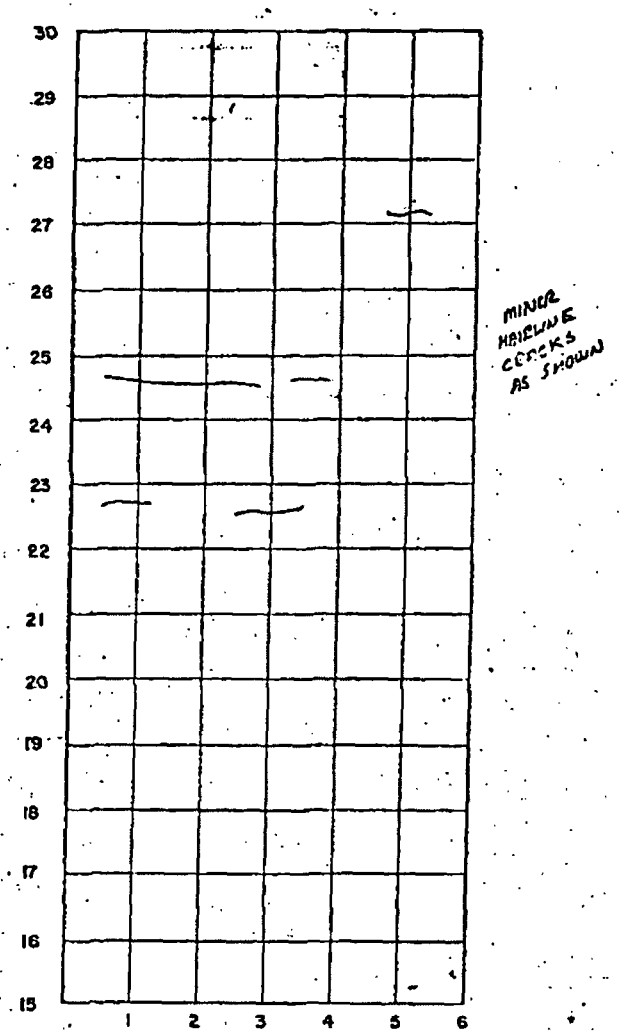


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/2/76
PRESSURE 6.3
WJE No. 71465

TIME 1245-1245
SURVEYED BY B.N.



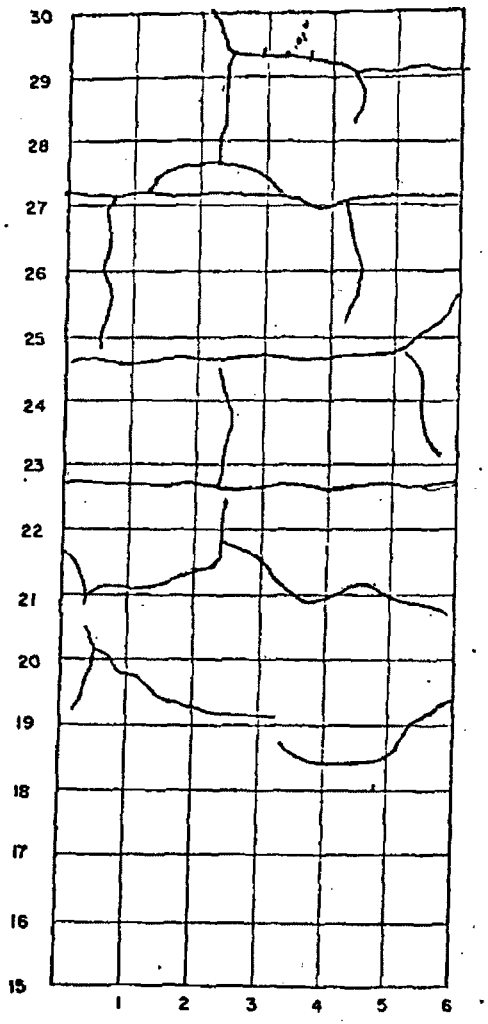
CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/3/76
PRESSURE 0.0 psig
WJE No. 71465

TIME 1215-1245
SURVEYED BY B.N.

HAIRLINE CRACKS EXCEPT AS NOTED



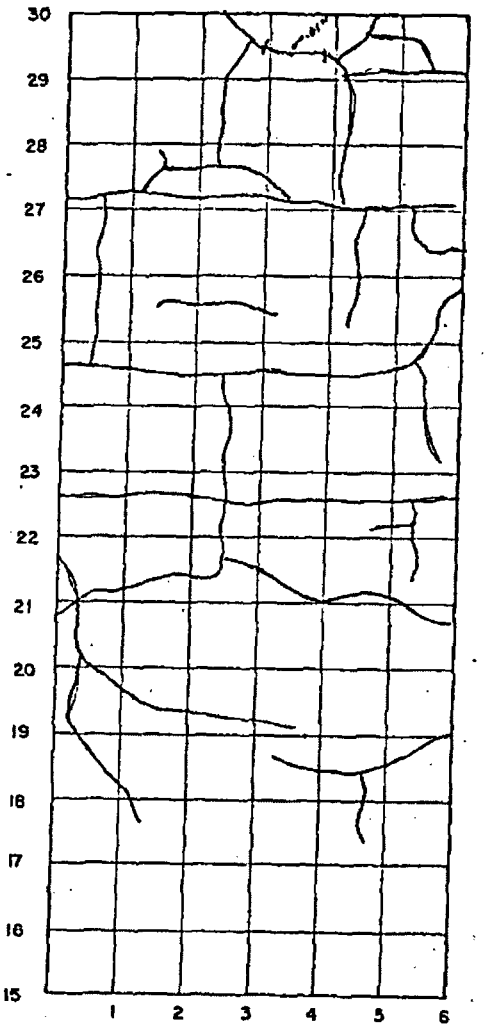
CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 95
WJE No. 71465

TIME [illegible]
SURVEYED BY BN

ALL HAIRLINE CRACKS EXCEPT AS NOTED

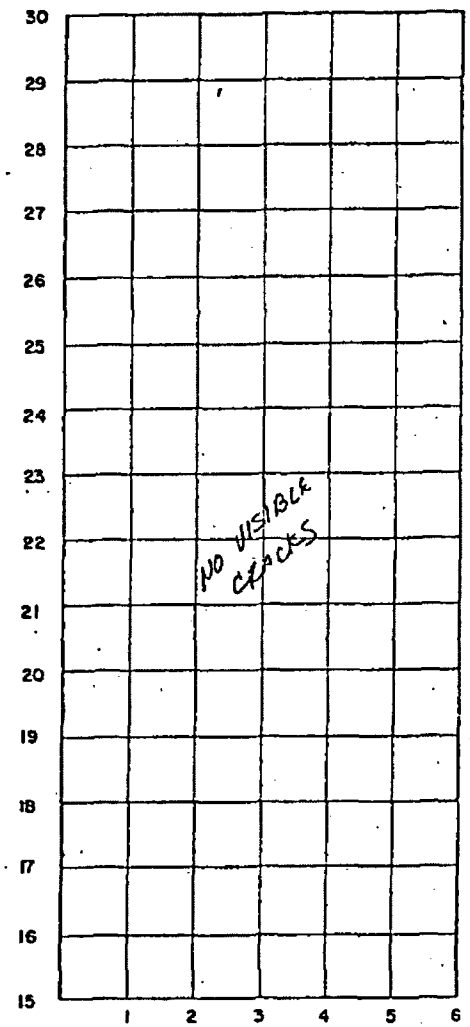


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/1/76
PRESSURE 55
WJE No. 71465

TIME 1920-2015
SURVEYED BY BN

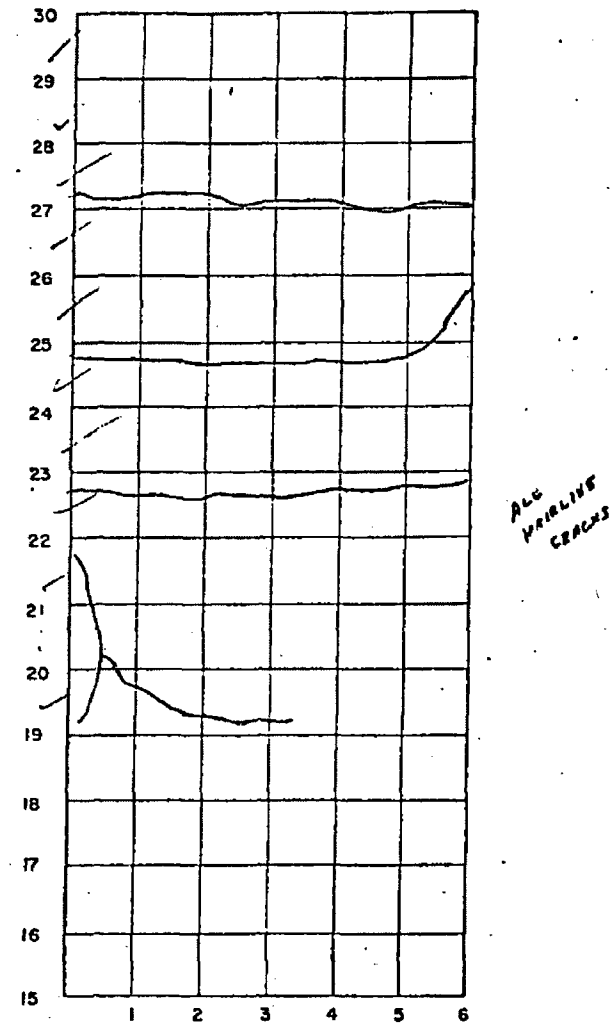


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME 0910
SURVEYED BY RKL WP

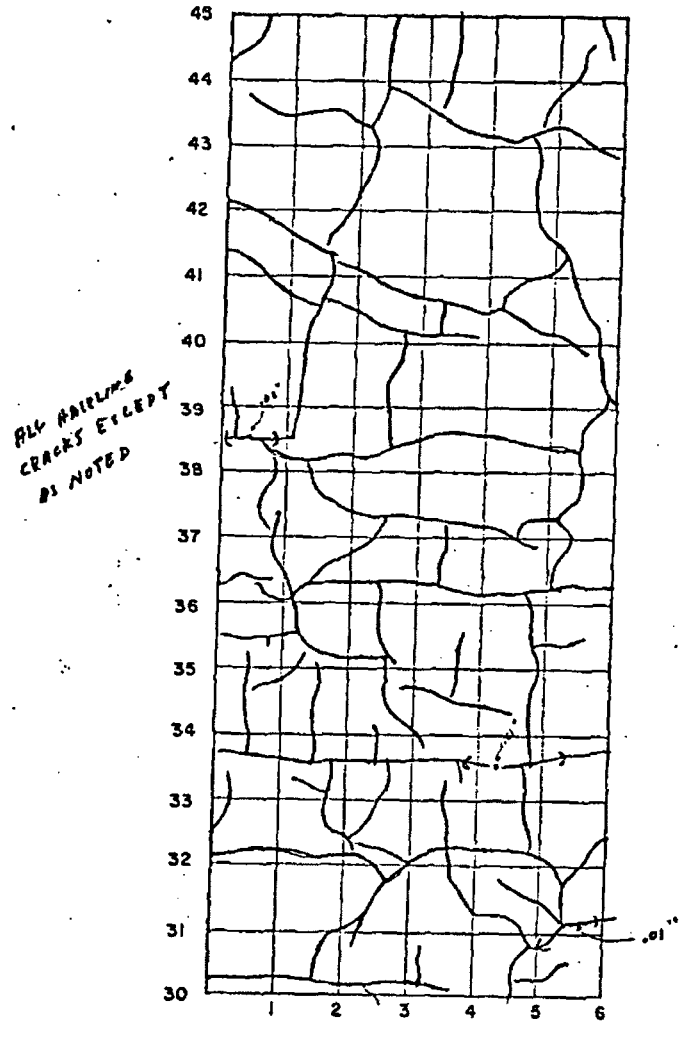


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME [illegible]
SURVEYED BY B.N.

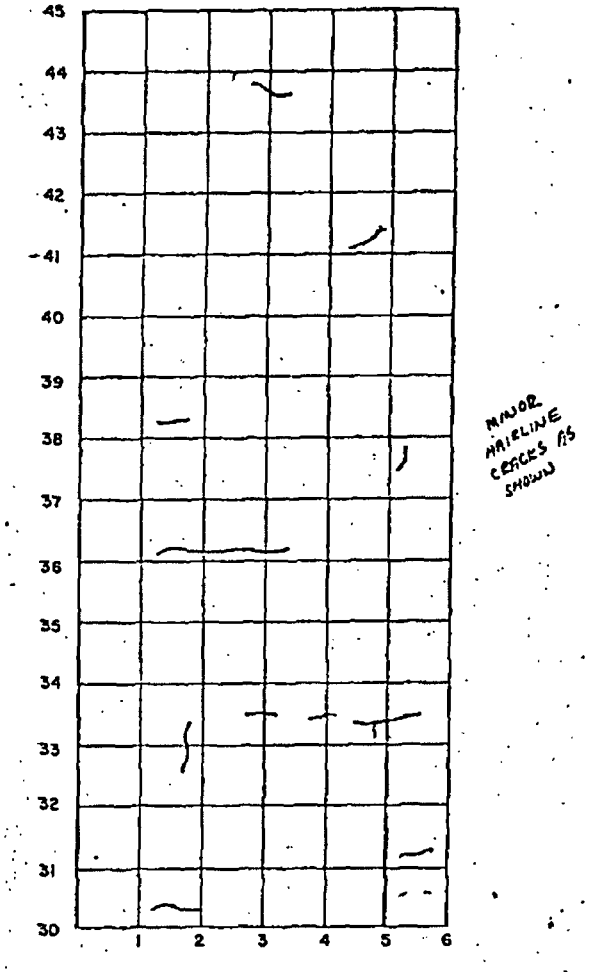


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/3/76
PRESSURE 63.3
WJE No. 71465

TIME 0245-0345
SURVEYED BY F.N.



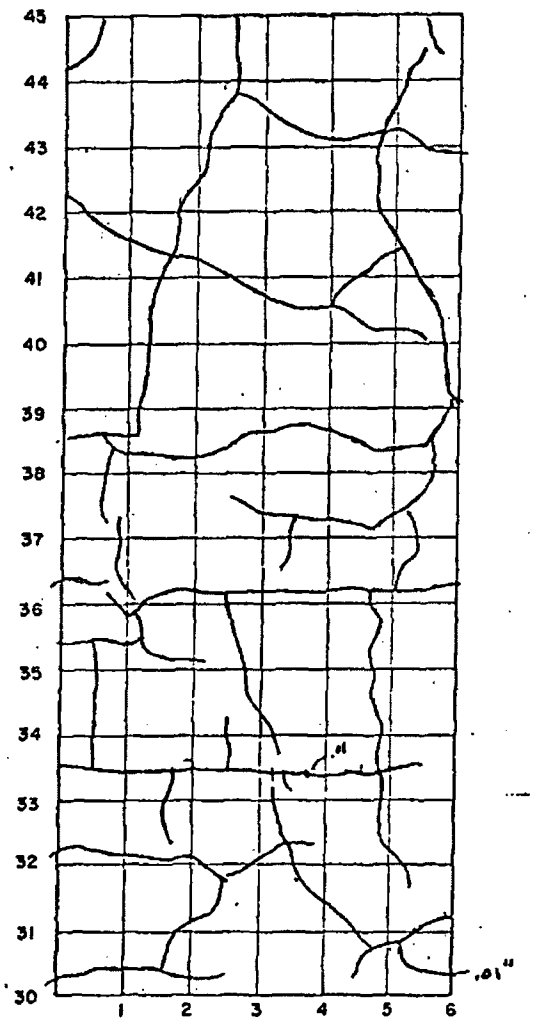
CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/3/76
PRESSURE 0.0 psig

TIME 1215-1245
SURVEYED BY B.N.

HAIRLINE CRACKS EXCEPT AS NOTED

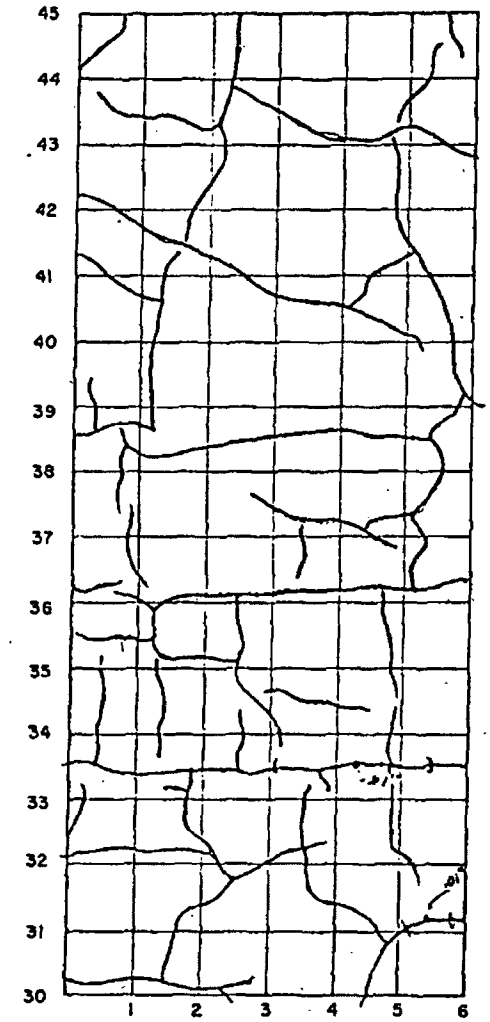


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE _____ TIME 1[illegible] – 1745
PRESSURE [illegible] SURVEYED BY F.N.
WJE No. 71465

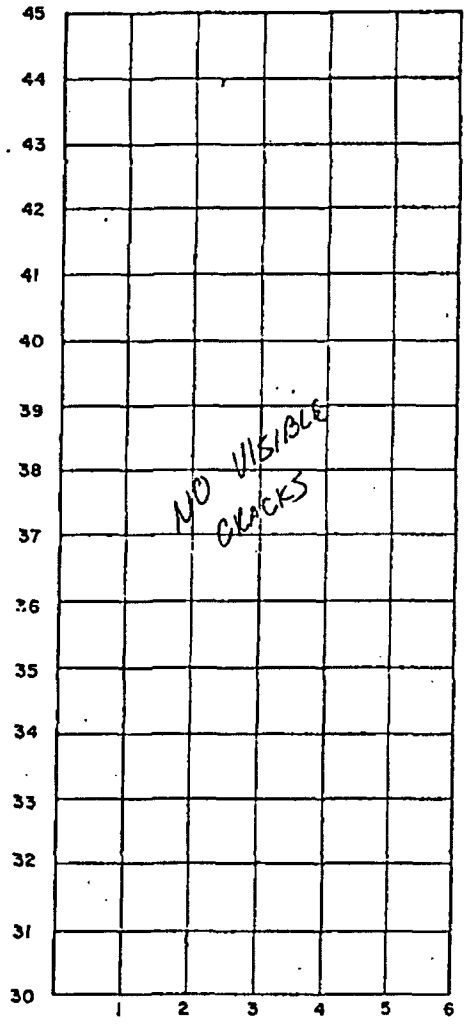
ALL HAIRLINE EXCEPT AS NOTED



CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/1/76 TIME 1[illegible]
PRESSURE 55 SURVEYED BY R.N.
WJE No. 71465

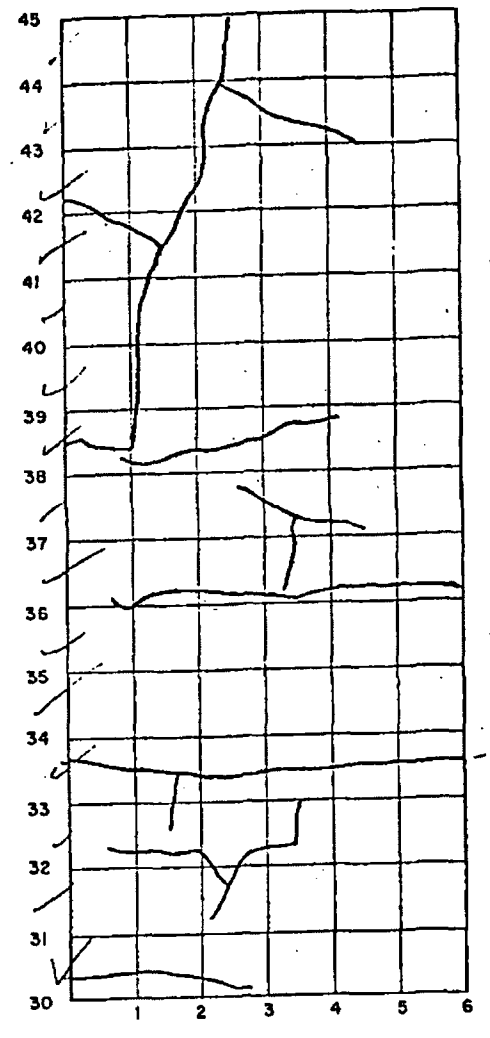


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 10-27-76
PRESSURE 0
WJE No. 71465

TIME 2215
SURVEYED BY [illegible]

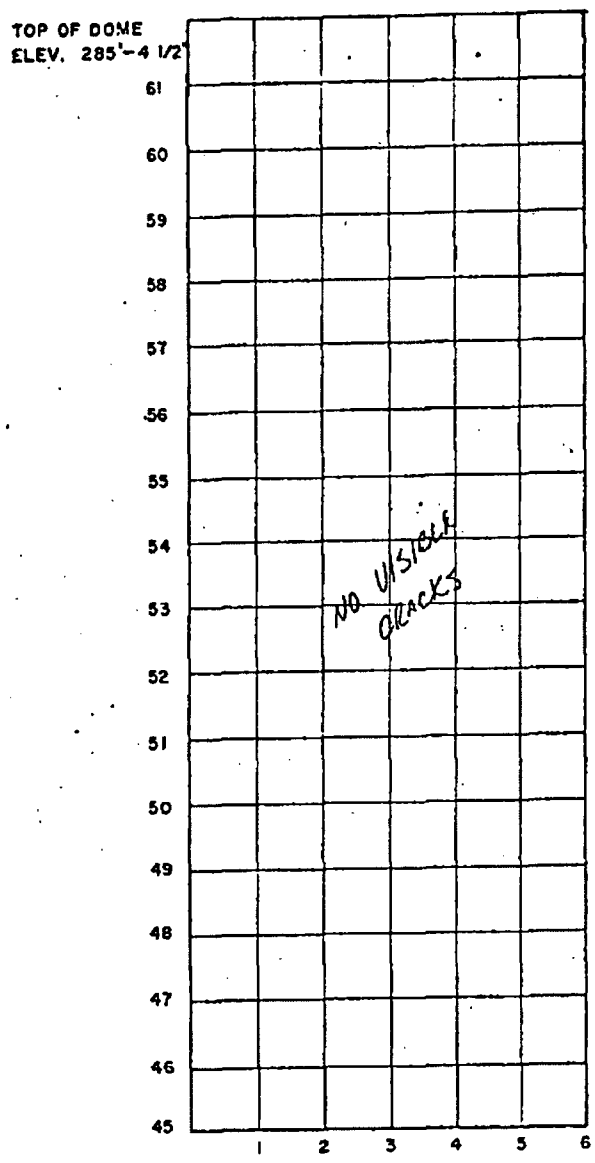


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME [illegible]
SURVEYED BY B.N.

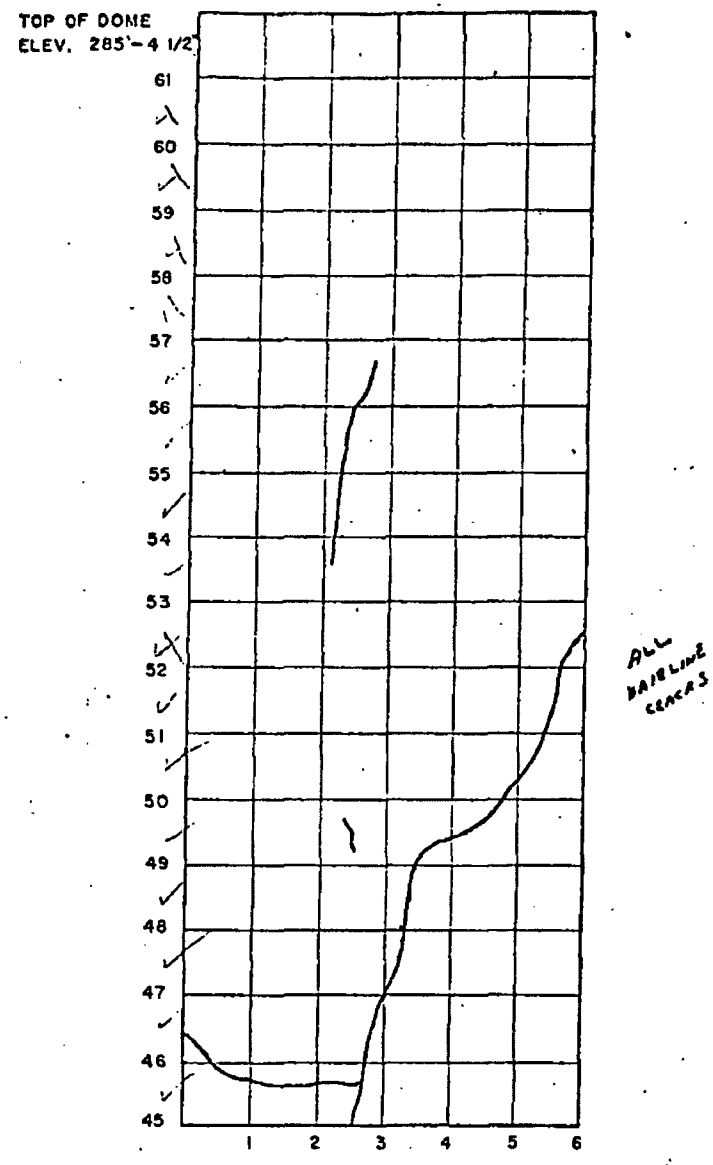


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME 0920
SURVEYED BY FK + WP

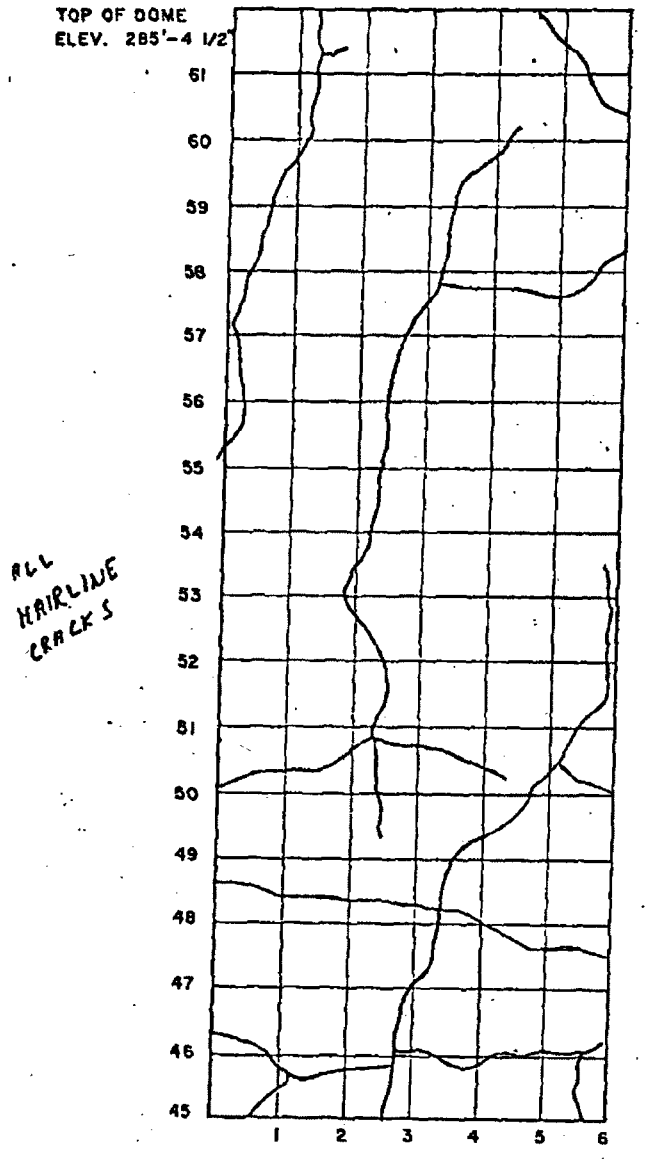


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME [illegible]
SURVEYED BY B.N.

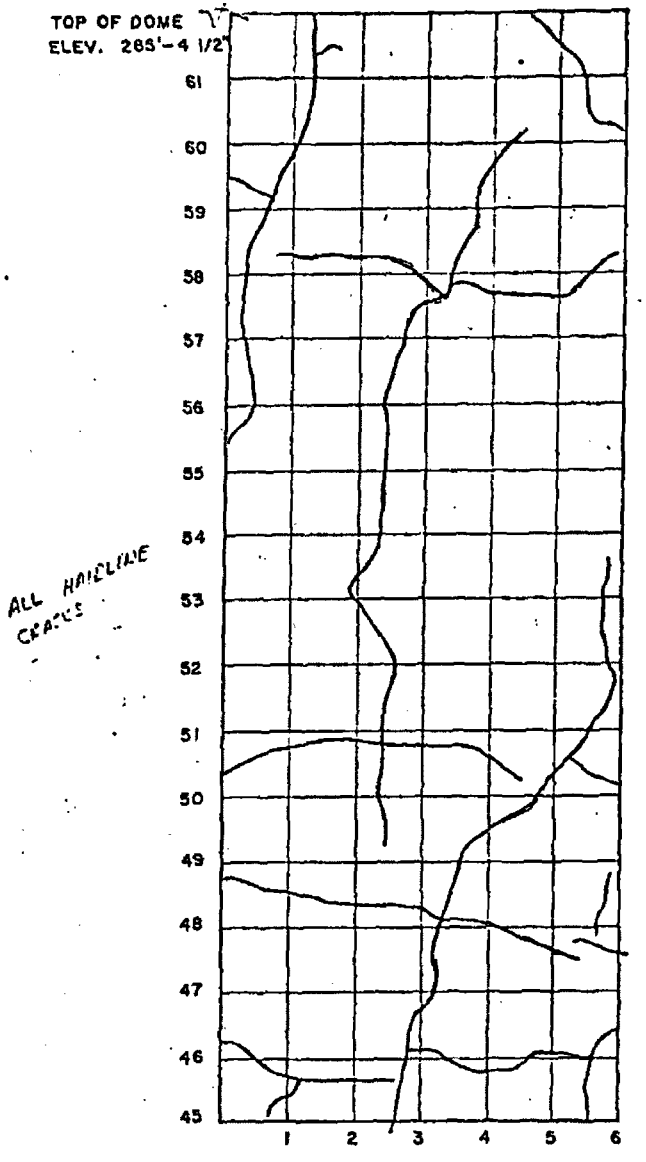


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/1/76
PRESSURE 95
WJE No. 71465

TIME 1150-1245
SURVEYED BY B.N.

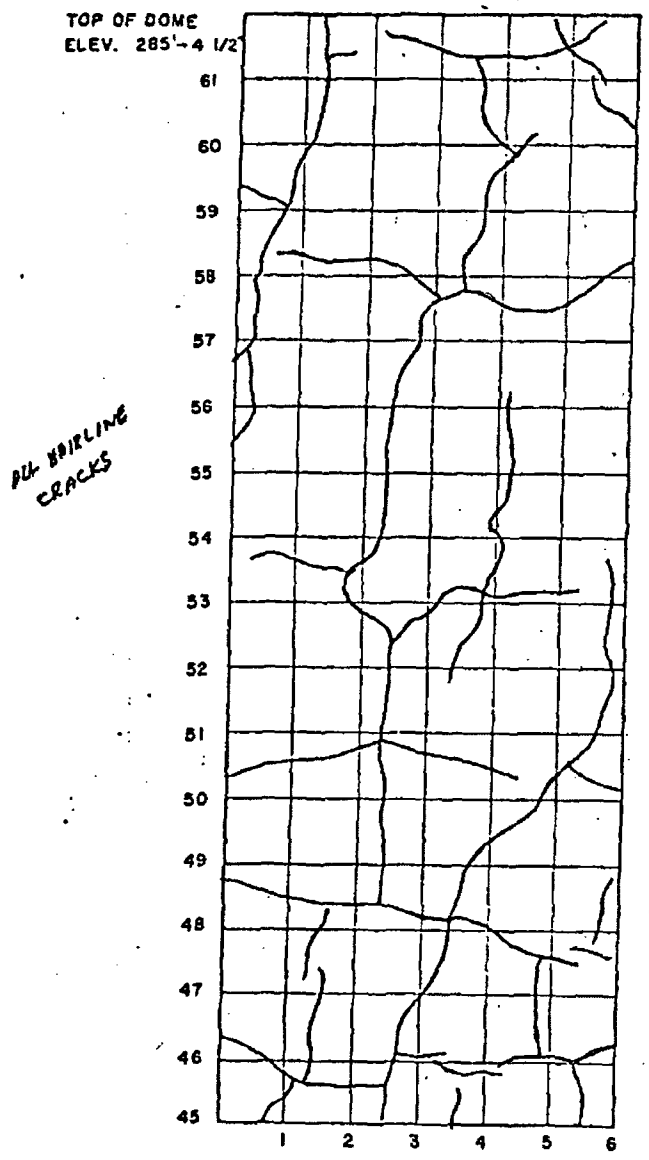


CRYSTAL RIVER – UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY – AZIMUTH 200

DATE 11/1/76
PRESSURE 55
WJE No. 71465

TIME [illegible]
SURVEYED BY B.N.

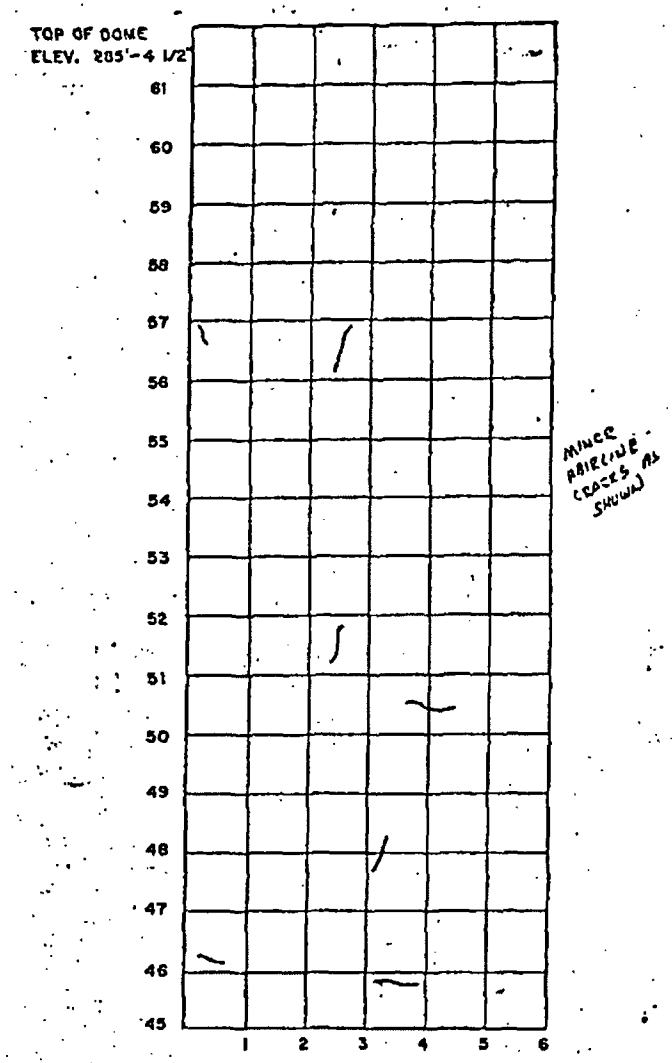


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 200

DATE 11/2/76
PRESSURE 63.3
WJE No. 71465

TIME [illegible]
SURVEYED BY B.N.



CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

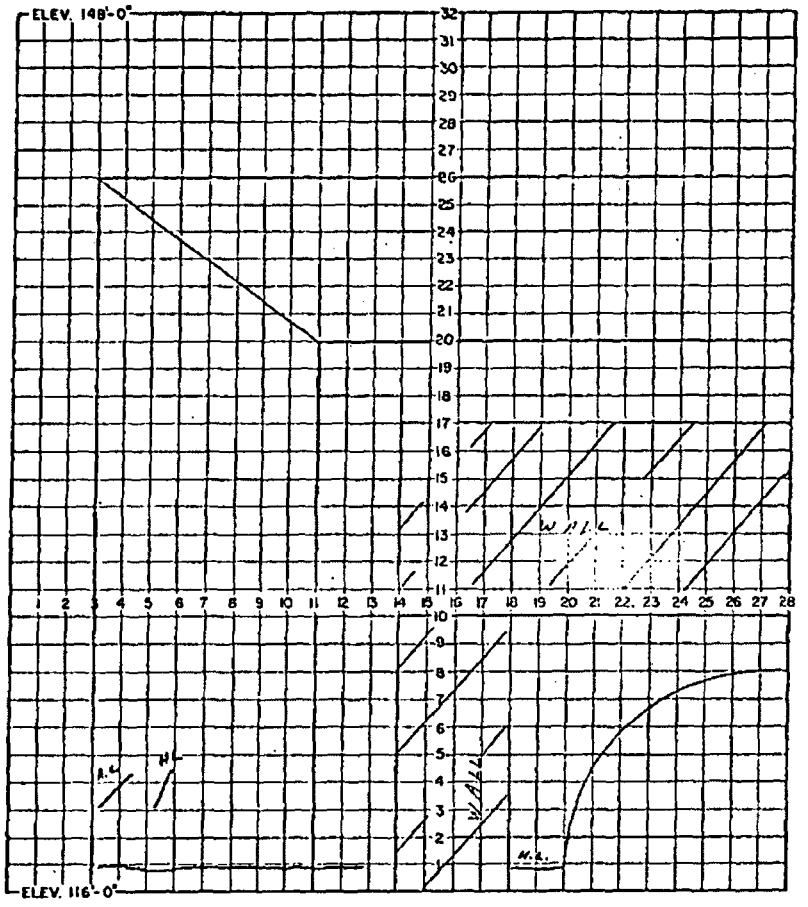
CRACK SURVEY - AZIMUTH 200

DATE 11/2/76
PRESSURE 0.0 psig
WJE No. 71465

TIME 1215-1245
SURVEYED BY B.N.

AREA NO. 121

EQUIPMENT HATCH

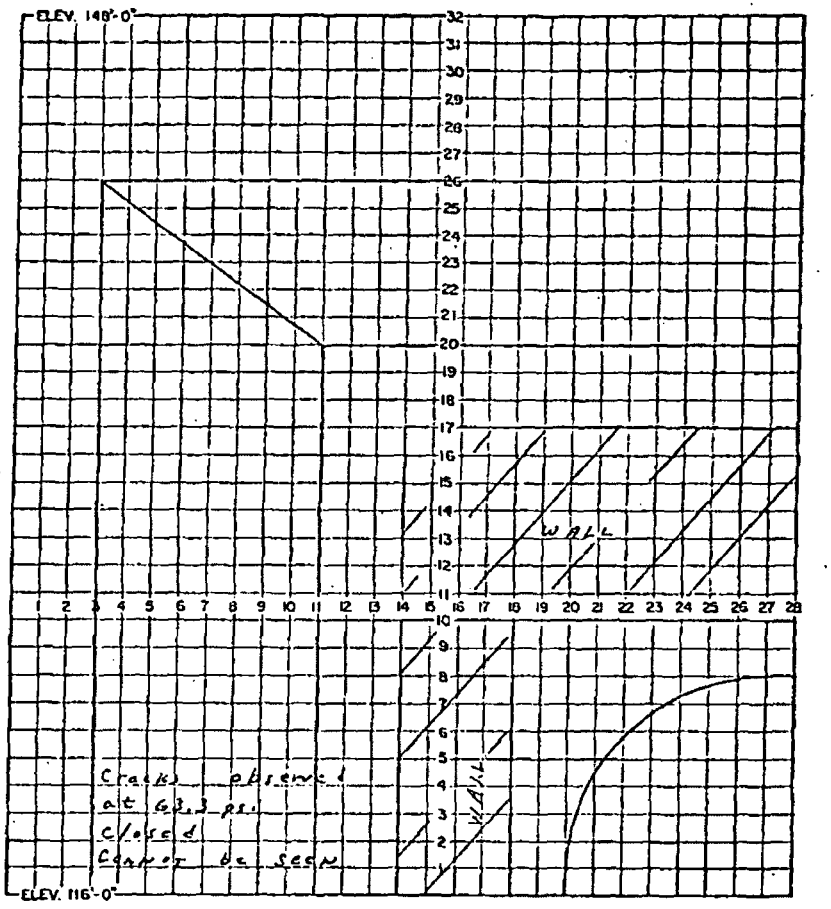


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 11-2-76
PRESSURE 63.3
W J E No. 71465

TIME 0320
SURVEYED BY R. Krause

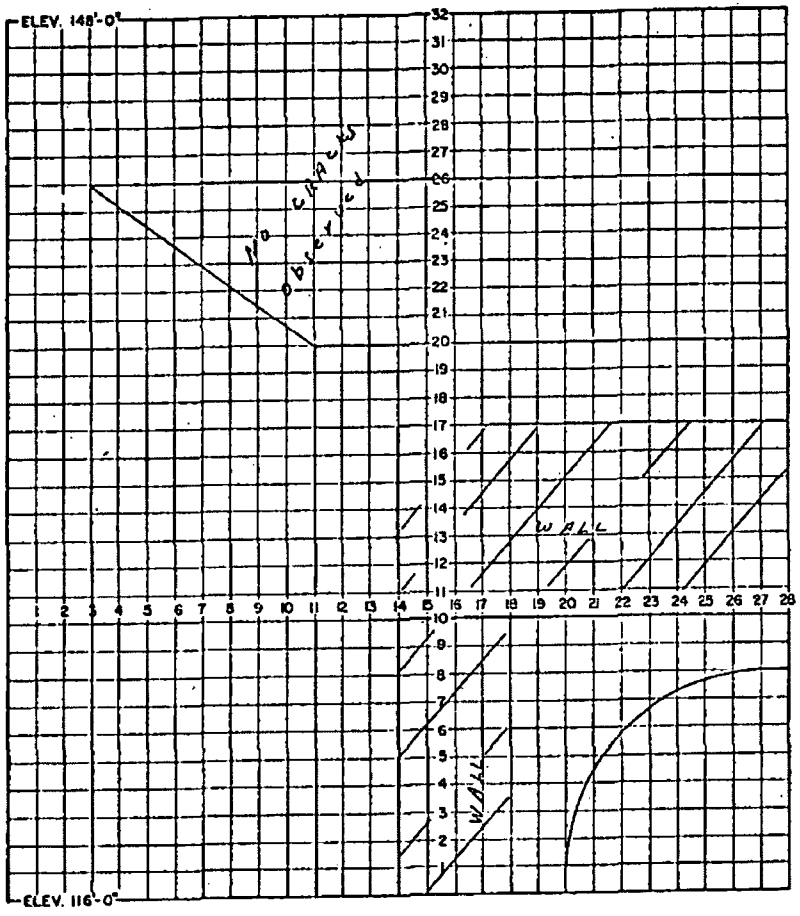


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 11-3-76
PRESSURE 0
W J E No. 71465

TIME 1245
SURVEYED BY R. Krause

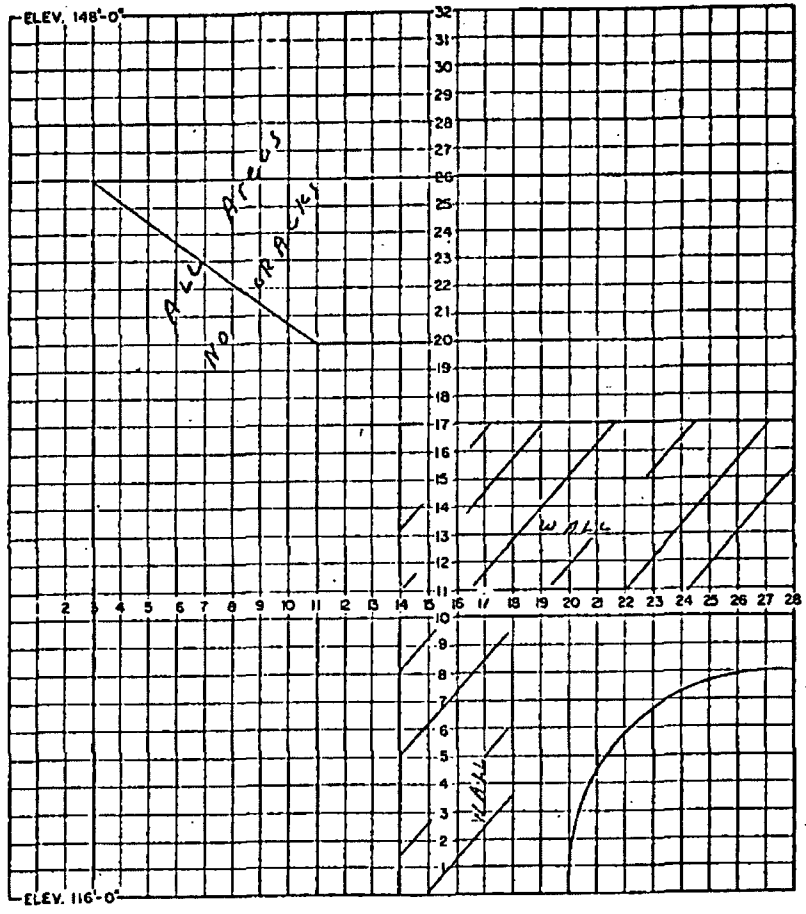


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 11-1-76
PRESSURE 45
WJE No. 71465

TIME 1230
SURVEYED BY R. Krause

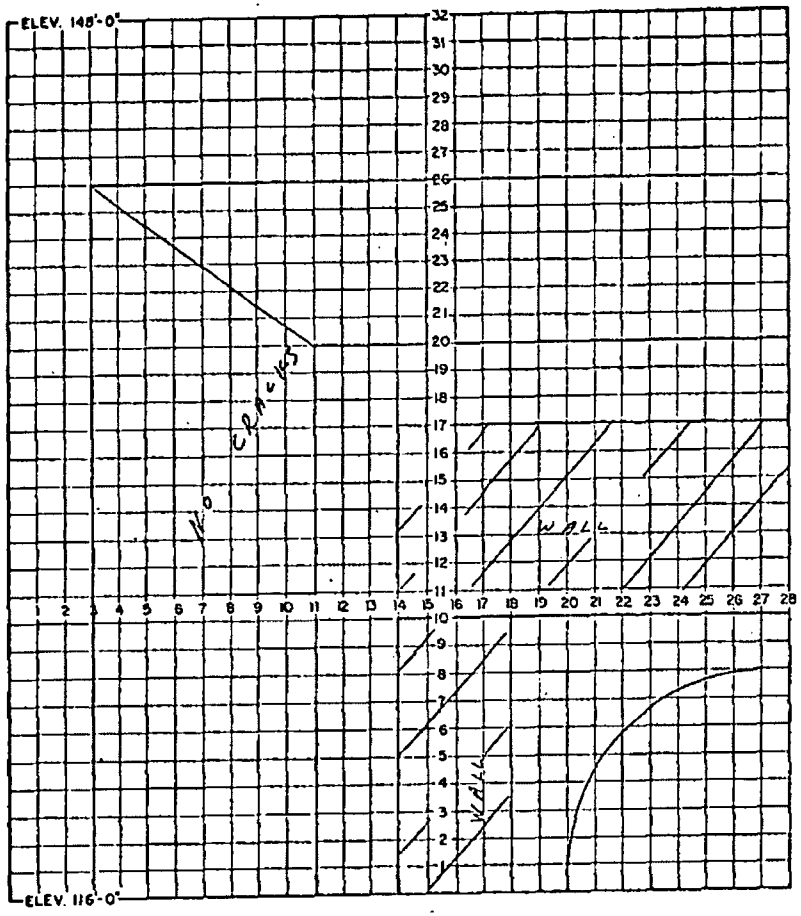


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 11-1-76
PRESSURE 55
WJE No. 71465

TIME 1945
SURVEYED BY R. Krause

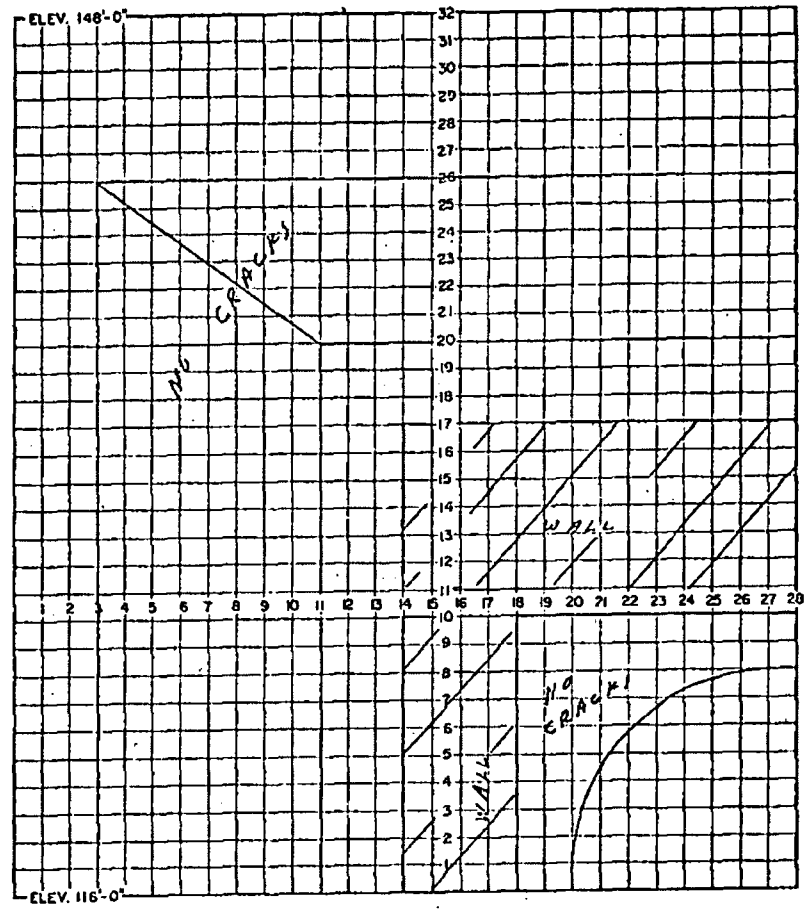


CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 10-29-76
PRESSURE 0
WJE No. 71465

TIME
SURVEYED BY R. Krause



CRYSTAL RIVER - UNIT No. 3
FLORIDA POWER CORPORATION

CRACK SURVEY - AZIMUTH 150

DATE 11-1-76
PRESSURE 35
WJE No. 71465

TIME 0415
SURVEYED BY R. Krause

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 0
DATE 8/31/76

TENDON NUMBER	END	TIME	NOTES	
D 121	S	0[illegible]	OK	THB
	F	0733	OK	TR
D 140	S	[illegible]	OK	THB
	F	0762	OK	TR
D 203	S	0727	OK	TR
	F	0700	OK CJ open more than .01"	THB
D 215	S	0753	OK	TR
	F	0730	Circles marked	THB
D 326	S	0757	OK	TR
	F	0[illegible]	OK	THB
D 339	S	0760	OK	TR
	F	0765	OK	TR
12 V 20	S	0700	OK	TR
	F	0736	OK	TR
23 V 15	S	0729	OK	
	F	[illegible]	OK PERIMETER CRACK FREE	TR
34 V 6	S	0728	OK	
	F	0737	OK	TR
45 V 3	S	0720	OK	
	F	0737	OK	TR
56 V 1	S	0731	OK	
	F	0730	OK	TR
13 H 10	S	0130	OK	RR + TRL
	F	0142	OK	TR
13 H 19	S	0025	OK	TJG & WP
	F	0120	OK	TJG
13 H 37	S	0040	OK	TJG & WP
	F	0020	OK	THB
51 H 30	S	0058	OK	TJG & W.P.
	F	0110	OK	TJG & W.
51 H 41	S	0115	Circles Built due to impact of [illegible]	TJG & W.
	F	0120	OK	TJG & W.
53 H 17	S	0140	H.L. cr. Top left Corner	RR + TR
	F	0110	OK .005 Circles Marked	THB
53 H 32	S	0115	OK	TJG
	F	0010	OK Circles Marked	THB
53 H 47	S	0610	OK	TJG
	F	0014	OK	THB
62 H 11	S	0140	H.L. cr. Top left Corner	RR + TR
	F			TR
64 H 21	S	0610	OK	TJG
	F	0010	OK .005 Circles Marked	THB

BY: TR
THB
RR

T.S. SIGNOFF [signature]

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 35 psi
DATE 11-1-76

TENDON NUMBER	END	TIME	NOTES	
D 121	S	0520	OK	TMB
	F	0530	OK	TR
D 140	S	0440	OK	TMB
	F	0540	OK	BN
D 203	S	0550	OK	TR
	F	0520	OK CT same as initial (.012)	TMB
D 215	S	0605	OK	BN
	F	0420	CT opened to .012-.015"	TMB
D 326	S	0540	OK	BN
	F	0520	OK	TR
D 339	S	0530	~~OK~~ H.L. CRACK BTM RT.	BN
	F	0515	No Change	TMB
12 V 20	S	0507	OK	TR
	F	0427	OK	TR
23 V 15	S	0502	OK	TR
	F	0425	OK	TR
34 V 5	S	0515	OK	TR
	F	0420	OK	TR
45 V 5	S	0510	OK	TR
	F	0420	OK	TR
56 V 1	S	0508	OK	TR
	F	0420	OK	TR
13 H 10	S	[illegible]	HL @ upper & lower right	DWB
	F	0430	OK	RK
13 H 19	S	0445	OK	TG&WP
	F	0430	OK	RK
13 H 37	S	0450	OK	TG&WP
	F	0430	OK.	
51 H 30	S	0420	OK	TG&WP
	F	0500	OK	TG&WP
51 H 41	S	0430	OK	TG&WP
	F	0510	OK	TG&WP
53 H 17	S	0510	No Change	DWB
	F	0450	OK	TMB
53 H 32	S	0510	OK	TG&WP
	F	0445	OK New crack appeared	TMB
53 H 47	S	0520	OK	TG&WP
	F	0440	OK	TMB
62 H 11	S	0410	No Change	DWB
	F	0417	OK	TR
64 H 21	S	0435	OK	TG&WP
	F	0420	OK	TMB

BY: TJG WJT DR
RK TN

T.S. SIGNOFF

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 45 psi
DATE 11-1-76

TENDON NUMBER	END	TIME	NOTES	
D 121	S	1245	OK	TMB
	F	1220	NO CHANGE - OK	TR
D 140	S	1120	OK	TMB
	F	1214	OK	TR
D 203	S	110	OK - TJG	
	F	1227	OK CT Some ≈ .005	TMB
D 215	S	1107	OK	TR
	F	1230	OK CT Some ≈ .010	TMB
D 324	S	1204	H.L. CRACK AT EDGE, TOP LFT CORNER	TR
	F	1245	OK	TMB
D 339	S	1106	NO CHANGE	TR
	F	1255	OK	TR
12 V 20	S	1150	OK	TR
	F	1230	HL ~~outside~~ clockwise ~~footing~~ corner to wall	DwB
23 V 15	S	1122	OK	TR
	F	1252	OK	DwB
34 V 6	S	1122	OK	TR
	F	1230	HL inside clockwise corner ~16"	DwB
45 V 3	S	1100	HL H.L. CRACK L. LEFT CORNER	TR
	F	12:30	HL inside col corner ~2" from, ~3" long	DwB
56 V 1	S	1158	OK	TR
	F	12:30	OK	DwB
13 H 10	S	12:30	No change	DwB
	F	1200	O K.	RK
13 H 19	S	12:05	OK	TG-WP
	F	1200	O K	RK
13 H 37	S	12:10	OK	TG-WP
	F	1205	OK	TMB
51 H 30	S	11:15	OK	TG-WP
	F	12:30	OK	TG-WP
51 H 41	S	11:55	OK	TG-WP
	F	12:35	OK	TG-WP
53 H 17	S	12:30	No change	DwB
	F	1210	Pretch T shrinkage crack - Not previously noted	TMB
53 H 32	S	12:15	OK	TG-WP
	F	1206	OK	TMB
53 H 47	S	12:20	OK	TG-WP
	F	11:57	OK	TMB
62 H 11	S	12:30	Separation between Pl. & concrete (new)	DwB
	F	12:30	HL upper L & mid R	DwB
64 H 21	S	12:16	OK	TG-WP
	F	1226	OK	TMB

BY: R. K, T.G. WP
DwB, TMB

T.S. SIGNOFF _____

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 55 psi
DATE 11-1-76

TENDON NUMBER	END	TIME	NOTES	
D 121	S	1912	OK	TMB
	F	1950	OK	TR
D 140	S	1944	OK	TMB
	F	1965	OK	TR
D 203	S	2000	OK	TR
	F	1940	No Change	TMB
D 215	S	2030	OK	TR
	F	2004	OK No Change	TMB
D 324	S	1910	CRACK <.005 ON LOWER BEVEL	TR
	F	2020	OK	TMB
D 339	S	1947	No CHANGE	TR
	F	2020	OK	TR
12 V 20	S	1950	OK	TR
	F	2035	No Change	DWB
23 V 15	S	1934	OK	TR
	F	2030	No Change	DWB
34 V 6	S	1934	OK	TR
	F	2030	No Change	DWB
45 V 5	S	1949	H.C. CRACK LEFT CORNER	TR
	F	2035	OK	DWB
56 V 1	S	1940	H.C. CRACK LEFT CORNER	TR
	F	2035	OK	DWB
13 H 10	S	2040	No Change	DWB
	F	1930	OK	RK
15 H 13	S	1940	OK	WP TG
	F	1935	OK	RK
13 H 37	S	—	TR WINDY FAIL TO INSPECT	WP TG
	F	1943	OK	TMB
51 H 30	S	1935	.005" CRACK ON LEFT TOP CORNER	WP TG
	F	2010	OK	WP TG
51 H 41	S	1930	OK	WP TG
	F	2015	OK	WP TG
53 H 17	S F	1950	OK New Crack (Abt. .01")	TMB
	S S	1945	No Change	DWB
53 H 32	S	1950	OK	WP TG
	F	1952	OK No Change (CJ > .01")	TMB
53 H 47	S	2000	OK	WP TG
	F	1945	OK	TMB
62 H 11	S	2045	BL crack ~ .003 extends to Below	DWB
	F	2045	No Change	DWB
64 H 21	S	1945	OK	WP TG
	F	1939	OK	TMB

BY: R.K., WPTG
TR TMB
DWB

T.S. SIGNOFF

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 633 psig
DATE 11-2-76

TENDON NUMBER	END	TIME	NOTES	
D 121	S	0335	OK	TMB
	F	0315	OK	TR
D 140	S	0310	OK	TMB
	F	0307	OK	TR
D 203	S	0352	OK	TR
	F	0330	New crack system abt. .005" developed	TMB
D 215	S	0318	OK	TR
	F	0305	No Change (C Tabt .003)	TMB
D 324	S	0306	H.L. X ON LOWER BEVEL (.005)	TR
	F	0402	OK	TR
D 339	S	0311	Add H.L. X ON INSIDE CORNER	TR
	F	0346	OK	TR
12 V 20	S	0259	OK	TR
	F	0430	HL inside col	DWB
23 V 15	S	0253	OK	TR
	F	0425	NC	DWB
34 V 8	S	0253	OK	TR
	F	0425	HL now about 8" long	DWB
45 V 5	S	0307	H.L. CRACK L. LEFT CORNER	TR
	F	0430	OK	DWB
56 V 1	S	0310	H.L. X LEFT CORNER	TR
	F	0420	OK	DWB
15 H 10	S	0422	NC.	DWB
	F	0375	O.K	CJK
13 H 19	S	0305	OK	WP, TG
	F	0375	OK	RK.
13 H 37	S		To windy To INSPECT	WP TG
	F	0317	OK	TMB
51 H 30	S	0250	.003 (NO INCREASE IN CRACK SIZE)	WP TG
	F	0325	OK	WP TG
51 H 41	S	0300	OK	WP TG
	F	0330	OK	WP TG
53 H 17	S	0320	N.C.	DWB
	F	0317	OK No Change	TMB
53 H 32	S	0315	OK	WP TG
	F	0310	OK No Change	TMB
53 H 47	S	0320	OK	WP TG
	F	0320	OK	TMB
62 H 11	S	0435	NC	DWB
	F	0325	NC	DWB
64 H 21	S	0310	OK	WP, TG
	F	0300	OK	TMB

+ Two intersecting cracks

BY: WP, TG, PK
TR, TMB, DWB

T.S. SIGNOFF

TENDON ANCHORAGE OBSERVATION

DATA SHEET 6

TEST PRESSURE 0
DATE 11-3-76

TENDON NUMBER	END	TIME	NOTES
D 121	S	1415	OK TMB
	F	1255	OK EN
D 140	S	1437	OK TMB
	F	1255	OK EN
D 203	S	1400	OK RK
	F	1420	OK CJ still open .006" TMB
D 215	S	1305	OK TG
	F	1430	Crack sys - @ 1300 some deformeters TMB
D 324	S	1250	OK RK
	F	1255	OK RK
D 333	S	1300	HAIRLINE CRACK BOTTOM RIGHT SIDE EN
	F	1310	OK TG
12 V 20	S	1250	OK RK
	F	1238	OK TG.
23 V 15	S	1250	OK RK
	F	1230	OK TG.
34 V 6	S	1250	OK RK
	F	1232	OK TG
45 V 5	S	1250	OK RK
	F	1234	OK TG.
56 V 1	S	1250	OK RK
	F	1236	OK TG.
13 H 10	S	1244	OK TG.
	F	1230	OK RK
13 H 19	S	1310	OK WP+TG
	F	1230	OK R.K.
13 H 37	S	1315	OK WP+TG
	F	1432	OK TMB
51 H 30	S	1300	OK WP+TG
	F	1335	OK WP+TG.
51 H 41	S	1305	OK WP+TG.
	F	1340	OK WP+TG
53 H 17	S	1445	OK TG
	F	1427	OK TMB
53 H 32	S	1275	OK WP+TG
	F	1425	OK TMB
53 H 47	S	1330	OK WP+TG
	F	1422	OK TMB
62 H 11	S	1247	OK TG
	F	1241	OK TG
64 H 21	S	1320	OK WP+TG
	F	1540	OK TMB

BY: R.K. WP, TG, TMB

T.S. SIGNOFF _____

APPENDIX E

COMPUTER OUTPUT - SAMPLE

DATA SHEET 3 PG. 1 OF 5 DATE : 10 / 31 / 76

EQUIPMENT HATCH MERIDIONAL STRAINS

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	STRAIN
480	35M	5.3844E+01
481	35M*	1.7948E+01
482	36M	5.1280E+00
483	36M*	-5.1280E+00
484	42M	1.2807E+04
485	42M*	1.2820E+01
486	43M	5.1280E+00
487	43M*	1.5384E+01
486	43M	5.1280E+00
487	43M*	1.5384E+01
488	44M	-1.0256E+01
489	44M*	-1.5384E+01
490	45M	2.5050E+04
491	45M*	-7.6920E+00
492	46M	1.2820E+01
493	46M*	-7.6920E+00
494	47	1.7051E+03
495	47M*	7.6920E+00
496	48M	2.5640E+01
497	48M*	-1.7948E+01
484	42M	1.2807E+04
485	42M*	1.2820E+01
498	41M	2.3076E+01
499	41M*	7.3774E+05
500	40M	-8.9740E+01
501	40M*	-3.8460E+01
502	39M	-7.9484E+01
503	39M*	3.5896E+01
504	38M	-9.2304E+01
505	38M*	-3.5896E+01
506	37M	-3.8460E+01
507	37M*	-4.6152E+01

SIGNED _____

DATA SHEET 3 PG. 2 OF 5 DATE : 10 / 31 / 76

EQUIPMENT HATCH HOOP STRAINS

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	STRAIN
508	35H	-7.9484E+03
509	35H*	-1.5384E+01
510	36H	7.4356E+03
511	36H*	5.1280E+01
512	42H	1.2820E+01
513	42H*	2.5640E+01
514	43H	7.9484E+01
515	43H*	2.0512E+01
514	43H	7.9484E+01
515	43H*	2.0512E+01
516	44H	-4.3588E+01
517	44H*	-2.5640E+00
518	45H	-6.7177E+02
519	45H*	-2.8204E+01
520	46H	-1.2820E+01
521	46H*	-3.0768E+01
522	47H	5.1280E+00
523	47H*	2.5640E+00
524	48H	-2.3076E+01
525	48H*	4.1024E+01
512	42H	1.2820E+01
513	42H*	2.5640E+01
526	41H	1.3076E+02
527	41H*	-5.1280E+00
528	40H	-2.0512E+01
529	40H*	-2.3076E+01
530	39H	2.5640E+01
531	39H*	-5.8972E+01
532	38H	1.4461E+04
533	38H*	8.9740E+01
534	37H	-1.6922E+02
535	37H*	2.8460E+02

SIGNED _____

DATA SHEET 3 PG. 3 OF 5 DATE : 10 / 31 / 76

PENETRATION STRAINS · MAIN STEAM LINE

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	STRAIN
560	76H	-1.0332E+02
561	76D	-1.2665E+02
562	76M	-7.9992E+01
563	77H	5.6661E+01
564	77D	4.3329E+01
565	77M	-5.9994E+01
566	78H	-2.3331E+01
567	78D	-9.9990E+00
568	78M	-6.6660E+00
569	79H	7.3326E+01
570	79D	9.9990E+02
571	79M	4.6662E+01
572	80H	-4.6662E+01
573	80D	-1.3332E+01
574	80M	2.3331E+01
575	81H	-2.6664E+01
576	81D	-3.3330E+00
577	81M	1.9998E+01
578	82H	1.9998E+01
579	82D	2.3331E+01
580	82M	0.0000E+00
581	83H	-3.3330E+02
582	83D	-3.3330E+02
583	83M	-6.6660E+02
584	84H	-6.6660E+02
585	84D	-6.6660E+02
586	84M	3.3330E+02
587	85H	-3.3330E+02
588	85D	-3.3330E+02
589	85M	0.0000E+00
590	86H	-6.6660E+02
591	86D	-3.3330E+02
592	86M	-3.3330E+02
593	87H	0.0000E+00
594	87D	0.0000E+00
595	87M	-6.6660E+02
596	88H	-3.3330E+02
597	88D	0.0000E+00
598	88M	0.0000E+00
599	89H	-3.3330E+02
600	89D	-6.6660E+02
601	89M	0.0000E+00

SIGNED _____

DATA SHEET 3 PG. 4 OF 5 DATE : 10 / 31 / 76

PENETRATION STRAINS FEEDWATER LINE

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	STRAIN
602	90H	-6.6660E+02
603	90D	-6.6660E+02
604	90M	3.3330E+02
605	91H	0.0000E+00
606	91D	0.0000E+00
607	91M	-9.9990E+02
608	92H	-3.3330E+02
609	92D	-6.6660E+02
610	92M	-6.6660E+02
611	93H	0.0000E+00
612	93D	9.3324E+03
613	93M	0.0000E+00
614	94H	-3.3330E+02
615	94D	-1.3332E+01
616	94M	6.6660E+00
617	95H	0.0000E+00
618	95D	-1.9998E+01
619	95M	0.0000E+00
620	96H	-3.3330E+02
621	96D	-6.6660E+02
622	96M	-3.3330E+02
623	97H	-3.3330E+02
624	97D	-3.3330E+02
625	97M	-3.3330E+02
626	98H	0.0000E+00
627	98D	-3.3330E+02
628	98M	-6.6660E+02
629	99H	3.3330E+02
630	99D	-6.6660E+02
631	99M	-3.3330E+02
632	100H	0.0000E+00
633	100D	0.0000E+00
634	100M	-3.3330E+02
635	101H	-3.3330E+02
636	101D	-6.6660E+02
637	101M	-3.3330E+02
638	102H	3.3330E+02
639	102D	-6.6660E+02
640	102M	-3.3330E+01
641	103H	-3.3330E+02
642	103D	0.0000E+00
643	103M	0.0000E+00

SIGNED _____

DATA SHEET 4 PG. 2 OF 4 DATE : 10 / 31 / 76

RADIAL DISPLACEMENTS

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	DISPLACEMENT
417	1	1.1426E-02
418	4	3.5696E-02
419	7	6.3327E-02
420	10	2.3800E-02
421	13	4.3027E-03
422	16	-1.6176E-02
423	19	-3.8006E-02
424	22	-3.2196E-02
425	25	-4.6264E-02
426	128	-5.2914E-02
427	2	6.1910E-03
428	5	3.6842E-02
429	8	7.0028E-02
430	11	5.5005E-02
431	14	2.4269E-02
432	17	1.9287E-02
433	20	-2.9685E-02
434	23	-4.4497E-02
435	26	-4.9303E-02
436	129	3.2825E-02
437	3	7.7418E-03
438	6	2.9133E-02
439	9	6.3910E-03
440	12	5.6250E-02
441	15	2.0355E-02
442	18	1.9055E-02
443	21	-3.5883E-03
444	24	-2.0221E-02
445	27	-4.9703E-02
446	130	2.3196E-03

SIGNED _____

DATA SHEET 4 PG. 3 OF 4

DATE : 10 / 31 / 76

EQUIPMENT HATCH VERTICAL DISPLACEMENTS

PRESSURE 20.00 PSIG

TIME : 22.12

CHANNEL	GAGE	DISPLACEMENT
447	48V	3.2208E-02
448	47V	-1.5066E-02
449	46V	4.2533E-02
450	45V	2.7995E-02
451	44V	3.7141E-02
452	43V	-2.5694E-02
453	35V	1.9253E-02
454	36V	1.8987E-02
455	42V	1.6047E-02
456	41V	1.8088E-02
457	40V	1.8861E-02
458	39V	1.7470E-02
459	38V	1.6675E-02
460	37V	0.0000E+00

SIGNED

DATA SHEET 4 PG. 4 OF 4 DATE : 10 / 31 / 76

EQUIPMENT HATCH RADIAL DISPLACEMENTS

PRESSURE 20.00 PSIG TIME : 22.12

CHANNEL	GAGE	DISPLACEMENT
461	35	2.9663E-02
462	36	2.3788E-02
463	42	2.6757E-02
464	43	1.5588E-02
463	42	2.6757E-02
465	41	2.9949E-02
466	40	3.9824E-02
467	39	4.7841E-02
468	38	5.8478E-02
464	43	1.5588E-02
470	44	1.6135E-02
471	45	2.1666E-02
472	46	3.0442E-02
473	47	2.6030E-02
474	48	3.3047E-02

SIGNED