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FACIL:50-261 H. B. Robinson Plant, Unit 2, Carolina Power and Ligh 05000261

AUTH.NAME	AUTHOR AFFILIATION
UTLEY,E.E.	Carolina Power & Light Co.

RECIP.NAME	RECIPIENT AFFILIATION
EISENHUT,D.G.	Division of Operating Reactors

SUBJECT: Forwards reaponses to NRC 800225 request for info re turbine disc integrity in operating Westinghouse nuclear low pressure turbines.Proprietary version of site-specific responses withheld (ref 10CFR2.790).

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	OELD	1	0	STS GROUP LEADR	1	0
EXTERNAL:	19 ACRS	16	16	LPDR	1	~~1~~ NP
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

MEMORANDUM FOR: TERA Corp.

FROM: US NRC/TIDC/Distribution Services Branch

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TIDC/DSB Authorized Signature

cc: DSB Files

CP&L
Carolina Power & Light Company

March 18, 1980

File: NG-3514(R) Serial: NO-80-453

Mr. D. G. Eisenhut, Acting Director
Division of Operating Reactors
United States Nuclear Regulatory Commission
Washington, D. C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
TURBINE DISC CRACKING

Dear Mr. Eisenhut:

Enclosed are:

1. One (1) copy - Application for Withholding (Attachment No. 1).
2. One (1) copy - Affidavit AW-80-15 (Attachment No. 2).
3. One (1) copy - Response to Site-Specific Questions (Attachment No. 3).
4. One (1) copy - Appendix A (proprietary) - Responses to Question 1-d.
5. One (1) copy - Appendix B (non-proprietary) - Responses to Question 1-d.

The purpose of this letter is to respond to your request for information of February 25, 1980, relative to turbine disc integrity in operating Westinghouse nuclear low pressure turbines. Per your request in the subject letter, responses to the generic questions have been coordinated through a task force whose representation includes all owners of Westinghouse nuclear low pressure turbines and is chaired by Mr. Wayne Stiede of Commonwealth Edison. The consensus responses to the generic questions have been submitted to you by Westinghouse at the request of the task force and is identified as Westinghouse Steam Turbine Division letter, dated March 14, 1980 from J. Schmerling, Westinghouse, to D. Eisenhut, NRC (copy attached).

The site-specific responses contain proprietary information of the Westinghouse Electric Corporation. In conformance with the requirements of 10CFR Section 2.790, as amended, of the Commission's regulations, we are enclosing with the submittal an application for withholding from public disclosure and an affidavit. The affidavit sets forth the basis on which the information may be withheld from public disclosure by the Commission.

PROP FILES
CHANGE: LF W ROSS
NRC PDR : NP ENG BR
LPDR : NP BC (2)
NSIC : NP

8003250451

Correspondence with respect to the affidavit or application for withholding should reference AW-80-15 and should be addressed to Mr. R. Williamson, Manager, Customer Order Engineering, Westinghouse Electric Corporation, Steam Turbine Divisions Lester Branch, Box 9175, Philadelphia, PA 19113.

Your letter also requested justification of continued operation until a full ultrasonic inspection was made on all discs. Our letter of December 28, 1979 to Mr. Albert Schwencer of your staff delineated our present plans for inspection of the turbines and our reasons for continuing operation until that inspection. The information contained in that letter is reiterated below:

1. The LP turbines will be disassembled for inspection during the refueling outage which is currently scheduled for May, 1980. During the refueling outage, the No. 1 and No. 2 discs on both rotors will be ultrasonically inspected (total of 8 discs).

2. Turbine disc No. 3 is a new disc that was installed on the LP rotors during the last refueling outage April-July, 1979 (total of 4 new discs). Because the discs in the No. 3 position are new, we presently have no plans to inspect those discs.

3. Turbine discs 4, 5, and 6 were removed during the replacement of the No. 3 discs and each was NDE inspected and all surfaces restored to fresh material by Westinghouse (total of 12 discs). In view of the fact that no disc indications were found by the definitive inspection methods used (as compared to the existing UT method), we do not presently plan to reinspect these discs this refueling outage. Westinghouse concurs in this decision.

4. A turbine missile analysis was performed for H. B. Robinson when the plant was licensed and is summarized in the Final Safety Analysis Report. That analysis concluded that no disc fragments would completely penetrate the turbine casing.

In addition to the above, we believe that the calculated maximum crack size to critical crack size ratio (A/Acr) specified in Section I of Appendix B for the Robinson turbine discs further supports our plans (a maximum of .5 for disc No. 2, considerably less for the other discs). These values indicate a large margin of safety for the Robinson turbine even though the crack growth rate data on which the A/Acr ratio is based is 50% higher than that used by the NRC. A value for A/Acr of 1.0 is considered by Westinghouse and the Disc Integrity Task Force members to warrant immediate inspection of the turbine; we fully support these conclusions.

Another consideration is that the turbine missile analysis contained in the FSAR appears to contain considerable margin and conservatism. A substantial increase in disc fragment energy would be required to produce a missile that even penetrated the outer turbine casing.

Carolina Power & Light Company has great interest in the resolution of any problems defined by inspections of Westinghouse LP turbines. We plan to follow any future disc inspection recommendations made by Westinghouse and will keep you and your staff advised as required in each case. CP&L does not believe that the continued operation of the H. B. Robinson plant until the refueling outage represents any increased risk to the public health and safety. Nor do we believe that the public interest would be served by forcing an inspection during any unexpected short-term outages before the refueling outage.

We trust this information is suitable for your use. In order to facilitate our finalization of outage schedules and plans, it is requested that you forward any comments on our planned actions by April 15, 1980. If you have any questions, please contact our staff.

Yours very truly,

E. E. Utley
Executive Vice President
Power Supply and Customer Services

JJS/jc (881-069)
Attachments

cc: Mr. J. D. Neighbors (NRC) -w/o att.

Sworn to and subscribed before me this 18th day of March 1980

Franklin Murray
Notary Public

My commission expires: October 4, 1981

FRANKLIN M... NOTARY PUBLIC WAKE COUNTY, N. C.

DOCKET NO. 50-261

DATE: 80/03/26

NOTE TO NRC AND/OR LOCAL PUBLIC DOCUMENT ROOMS

The following item submitted with letter dated 80/03/18 from Carolina Power & Light Co is being withheld from public disclosure in accordance with Section 2.790.

PROPRIETARY INFORMATION

Request for info re turbine disc integrity

Sharon Hunt
4/5-0816

Distribution Service's Branch

AW-80-15

March 14, 1980

Darrell G. Eisenhut
Division of Operating Reactors
Office of Nuclear Reactor Regulation
US Nuclear Regulatory Commission
Washington DC 20555

APPLICATION FOR WITHHOLDING PROPRIETARY INFORMATION FROM PUBLIC DISCLOSURE

Subject: H. B. Robinson Docket #50-261
Information in Response to NRC Request for Information of February 25, 1980, Relative to Low Pressure Turbine Disc Integrity.

Reference: Appendix A letter from E. E. Utley to Eisenhut, dated 3/18/80

Dear Mr. Eisenhut:

This application for withholding is submitted by Westinghouse Electric Corporation ("Westinghouse") pursuant to the provisions of paragraph (b)(1) of Section 2.790 of the Commission's regulations. Withholding from public disclosure is requested with respect to the subject information which is further identified in the affidavit accompanying this application.

The undersigned has reviewed the information sought to be withheld and is authorized to apply for its withholding on behalf of Westinghouse, STG-TOD.

The affidavit accompanying this application sets forth the basis on which the information may be withheld from public disclosure by the Commission and addresses with specificity the considerations listed in paragraph (b)(4) of Section 2.790 of the Commission's regulations.

Accordingly, it is respectfully requested that the subject information which is proprietary to Westinghouse and which is further identified in the affidavit be withheld from public disclosure in accordance with 10CFR Section 2.790 of the Commission's regulations.

Correspondence with respect to this application for withholding or the accompanying affidavit should be addressed to the undersigned.

Very truly yours,

Robert B Williamson

R. Williamson, Manager
Customer Order Engineering
Westinghouse Electric Corporation

Attachment No. 1

R. AW-80-15

AFFIDAVIT

COMMONWEALTH OF PENNSYLVANIA
COUNTY OF DELAWARE:

Before me, the undersigned authority, personally appeared Robert Williamson, who, being by me duly sworn according to law, deposes and says that he is authorized to execute this Affidavit on behalf of Westinghouse Electric Corporation ("Westinghouse") and that the averments of fact set forth in this Affidavit are true and correct to the best of his knowledge, information, and belief:

Robert Williamson, Manager
Customer Order Engineering

Sworn to and subscribed before me
this 5.......day of March 1980....

HENRY E. SQUILLACE
Notary Public, Marple Twp., Delaware Co.
My Commission Expires Oct. 18, 1980

Attachment No. 2

(1) I am Manager, Customer Order Engineering in the Steam Turbine Generator Technical Operations Division of Westinghouse Electric Corporation and as such, I have been specifically delegated the function of reviewing the proprietary information sought to be withheld from public disclosure in connection with nuclear power plant licensing, and am authorized to apply for its withholding on behalf of the Westinghouse Power Generation Divisions.

(2) I am making this Affidavit in conformance with the provisions of 10 CFR Section 2.790 of the Commission's regulations and in conjunction with the Westinghouse application for withholding accompanying this Affidavit.

(3) I have personal knowledge of the criteria and procedures utilized by Westinghouse Power Generation Divisions in designating information as a trade secret, privileged or as confidential commercial or financial information.

(4) Pursuant to the provisions of paragraph (b)(4) of Section 2.790 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure should be withheld.

(i) The information sought to be withheld from public disclosure is owned and has been held in confidence by Westinghouse.

(ii) The information is of a type customarily held in confidence by Westinghouse and not customarily disclosed to the public. Westinghouse has a rational basis for determining the types of information customarily held in confidence by it and, in that connection, utilizes a system to determine when and whether to hold certain types of information in confidence. The application of that system and the substance of that system constitutes Westinghouse policy and provides the rational basis required.

Under that system, information is held in confidence if it falls in one or more of several types, the release of which might result in the loss of an existing or potential competitive advantage, as follows:

(a) The information reveals the distinguishing aspects of a process (or component, structure, tool, method, etc.) where prevention of its use by any of Westinghouse's competitors without license from Westinghouse constitutes a competitive economic advantage over other companies.

(b) It consists of supporting data, including test data, relative to a process (or component, structure, tool, method, etc.), the application of which data secures a competitive economic advantage, e.g., by optimization or improved marketability.

(c) Its use by a competitor would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing a similar product.

(d) It reveals cost or price information, production capacities, budget levels, or commercial strategies of Westinghouse, its customers or suppliers.

(e) It reveals aspects of past, present, or future Westinghouse or customer funded development plans and programs of potential commercial value to Westinghouse.

(f) It contains patentable ideas, for which patent protection may be desirable.

(g) It is not the property of Westinghouse, but must be treated as proprietary by Westinghouse according to agreements with the owner.

(h) Public disclosure of this information would allow unfair and untruthful judgments on the performance and reliability of Westinghouse equipment components and improper comparison with similar components made by competitors.

There are sound policy reasons behind the Westinghouse system which include the following:

(a) The use of such information by Westinghouse gives Westinghouse a competitive advantage over its competitors. It is, therefore, withheld from disclosure to protect the Westinghouse competitive position.

(b) It is information which is marketable in many ways. The extent to which such information is available to competitors diminishes the Westinghouse ability to sell products and services involving the use of the information.

(c) Use by our competitor would put Westinghouse at a competitive disadvantage by reducing his expenditure of resources at our expense.

(d) Each component of proprietary information pertinent to a particular competitive advantage is potentially as valuable as the total competitive advantage. If competitors acquire components of proprietary information, any one component may be the key to the entire puzzle, thereby depriving Westinghouse of a competitive advantage.

(e) Unrestricted disclosure would jeopardize the position of prominence of Westinghouse in the world market, and thereby give a market advantage to the competition in those countries.

(f) The Westinghouse capacity to invest corporate assets in research and development depends upon the success in obtaining and maintaining a competitive advantage.

(iii) The information is being transmitted to the Commission in confidence and, under the provisions of 10 CFR Section 2.790, it is to be received in confidence by the Commission.

(iv) The information is not available in public sources to the best of our knowledge and belief.

(v) The proprietary information sought to be withheld in this submittal is that which is appropriately marked in Appendix A to letter from E. E. Utley to Eisenhut, dated March 18, 1980 concerning information in response to NRC request for information of February 25, 1980, relative to low pressure turbine disc integrity.

The information enables Westinghouse to:

(a) Develop test inputs and procedures to satisfactorily verify the design of Westinghouse supplied equipment.

(b) Assist its customers to obtain licenses.

Further, the information has substantial commercial value as follows.

(a) Westinghouse can sell the use of this information to customers.

(b) Westinghouse uses the information to verify the design of equipment which is sold to customers.

(c) Westinghouse can sell services based upon the experience gained and the test equipment and methods developed.

Public disclosure of this information is likely to cause substantial harm to the competitive position of Westinghouse because it would enhance the ability of competitors to design, manufacture, verify, and sell electrical equipment for commercial turbine-generators without commensurate expenses. Also, public disclosure of the information would enable others having the same or similar equipment to use the information to meet NRC requirements for licensing documentation without purchasing the right to use the information.

The development of the equipment described in part by the information is the result of many years of development by Westinghouse and the expenditure of a considerable sum of money.

This could only be duplicated by a competitor if he were to invest similar sums of money and provided he had the appropriate talent available and could somehow obtain the requisite experience.

Further the deponent sayeth not.

ATTACHMENT NO. 3

SITE SPECIFIC GENERAL QUESTIONS AND ANSWERS

I. Provide the following information for each LP turbine

IA. QUESTION: Turbine Type?

ANSWER

The Robinson No. 2 Unit is a 739MW, AEH-controlled, tandem compound four-flow, three-casing, condensing, 1800 RPM turbine utilizing 44-inch last-stage blades in each low-pressure element. The low-pressure elements are designated as Building Block 81.

IB. QUESTION: Numbers of hours of operation for each LP turbine at time of last inspection?

ANSWER

The total number of operating hours for both LP-1 and LP-2 as of the last inspection in April, 1979, is 34,201 hours. Expected total to May, 1980, is 41,000 hours. Disc operating hours are as follows: (1) Discs 1 & 2 - 41,000 hours, (2) Discs 3, 4, 5, 6 - 6,852 hours.

IC. QUESTION: Number of turbine trips and overspeeds?

ANSWER

The total number of unit trips and overspeeds are listed below up to January, 1980.

TRIPS	OVERSPEED TRIPS
51	5

ID. QUESTION: For each disc?

1. Type of material, including material specifications

2. Tensile properties date

3. Toughness properties data, including FATT and upper energy and temperature

4. Keyway temperatures

5. Calculated keyway crack size for the turbine time specified in "B" above

6. Critical crack size

7. Ratio of calculated crack to critical crack size

8. Crack growth rate

9. Calculated bore and keyway stresses at operating design overspeed

10. Calculated KIC data

11. Minimum yield strength specified for each disc.

<u>ANSWER</u>

The above information is shown by Appendix A of this questionnaire.

II. <u>QUESTION</u>: Provide details of the result of any completed in-service inspection of LP turbine rotors, including areas examined, since issuance of an operating license. For each indication detected, provide details of the location of the crack, its orientation, and size.

<u>ANSWER</u>

During a scheduled inspection of the LP turbines in January, 1979, steeple cracks were found on the L-3 and L-4 rows of the No. 3 disc on both ends of each turbine. While the unit was operating with spare rotors, the rotors having steeple cracks were returned to the Westinghouse facility in Charlotte, North Carolina. The No. 3 disc was replaced on both rotors; the numbers 4, 5, and 6 discs were NDE inspected and prepared for reinstallation. No indications were found on any of the Numbers 4, 5, and 6 discs.

III. <u>QUESTION</u>: Provide the normal water chemistry conditions for each LP turbine and describe any condenser inleakages or other significant changes in secondary water chemistry to this point in its operating life. Discuss the occurrence of cracks in any given trubine as related to history of secondary water chemistry in the unit.

<u>ANSWER</u>

Normal chemistry seen by both LP rotors:

a. PH 8.8-92
b. conductivity - <5.0 umhos total, <2 umhos cation
c. ammonia - 0.2-0.5 ppm
d. chorides - <0.01 ppm
e. chemistry treatment type - coordinated phosphate

Marcey - Halstead Ratio 2.3-2.6

2. Steam generator carryover - <0.35%
3. Steam generator blowdown - 79.5 GPM total

f. Condenser air inleakage[1] - 20-45 DFM
g. Condenser circ water inleakage[2] - 5-10 gpm

1. Search for air inleakage is normally initiated when:

   A. Significant increase occurs in the inleakage rate

   B. Increased use of hydrogen is needed to control the oxygen in the condensate.

   C. Both vacuum pumps are needed to keep back pressure from increasing and affecting the unit's load.

2. At inleakages of 10 gpm and increasing, the condenser tubes are inspected for leaks. For the past two years, condenser tube plugging has been performed on an average of every 2-3 months.

2. Abnormal occurrences - high air inleakage

   A. During 1976 the hydrazine injection rate began to increase from a nominal rate of approximately 150,000 MR/month. The rate continued to increase following the 1976 outage as follows:

DATE	HYDRAZINE RATE(ml)	COMMENTS
1/77	810,000	
2/77	593,000	
3/77	991,750	
4/77	1,349,500	
5/77	2,222,973	
6/77	1,873,575	
7/77	2,990,150	
8/77	1,261,050	Problem corrected
9/77	0	Unit off line majority of the time.

10/77	24,000
11/77	0
12/77	133,600

The above was caused by a leak in the condensate pump expansion joint.

The present rate as of February, 1980, is 141,000 ml/month.

At this point in time, we see no correlation between disc cracking and historical secondary chemistry problems with the unit.

IV. QUESTION: If your plant has not been inspected, describe your proposed schedule and approach to ensure that turbine cracking does not exist in your turbine.

ANSWER

As described in II above, the No. 3 disc on each LP turbine was replaced and the numbers 4, 5, and 6 discs were inspected by Westinghouse after the unshrinking process. Our plans are to ultrasonically inspect the remaining Nos. 1 and 2 discs on both LP turbines during the scheduled outage in May, 1980. Future inspections of all discs will be performed as recommended by Westinghouse or as required by other circumstances. Please be informed that we cannot assure that cracking will not occur. However, Westinghouse's analysis shows that even if cracking does occur, the maximum expected size will be less than 1.0 at the proposed time of inspection. (See site specific question 1.D.7). We consider that this demonstrates the safety of the unit is adequate.

V. QUESTION: NOT APPLICABLE TO ROBINSON NO. 2

VI. QUESTION: Indicate whether an analysis and evaluation regarding turbine missiles has been perfomed for your plant and provided to the staff. If such analysis and evaluation has been performed and reported, please provide appropriate reference to the available documentation. In the event that such studies have not been made, consideration should be given to scheduling such an action.

ANSWER

A turbine missile analysis was perfomed for the H. B. Robinson No. 2 turbine when the plant was licensed and is summarized in the Final Safety Analysis Report. As you are aware, Westinghouse has not completed the revised missile analysis study for this unit at this time. (Expected completion is June, 1980). Upon completion of this revised study, we plan to submit this information to you. In addition, we will recalculate probabilities P_2 P_3, and P_4; this information shall also be passed on to you.

APPENDIX B

Notes on Answers to Site Specific Question 1D

1. Type of material is Ni-Cr-Mo-V alloy steel similar to ASTM A-471. The minimum yield strength specified for each disc is given in Section B.

2. Tensile properties data of tests taken from the disc hub are given in Section B. Data obtained from rim material are presented in Section C.

3. Toughness properties are also presented in Sections B and C. As described above, Section B contains hub properties and Section C contains rim properties. Upper shelf energy is not presented when it is the same as the room temperature energy.

4. The keyway temperature is presented in Section G. This is the calculated temperature two inches from the exhaust face of the disc at the bore during full load operation with all moisture separator reheaters functioning (where applicable).

5. The maximum expected keyway crack size has been calculated for each disc in each unit and is given in Section H. This is done by multiplying the crack growth rate by the time the unit was in operation prior to the disc/keyway inspection. For units not yet inspected, the time used should be the expected operating time when the unit will be inspected. The crack growth rate is given in Section G in response to Question I.D.8.

6. The critical crack size at 1800 rpm and at design overspeed is presented in Section F. It is calculated using the relationship:

$$A_{CR}\ (eff) = \left[\qquad\qquad\right]^{b,c,e}$$

Where $\left[\qquad\qquad\qquad\qquad\right]^{b,c,e}$

7. This is the ratio of Item 5 to Item 6 and is shown in Section I.

8. The crack growth rate is given in Section G. These crack growth rates are the minimum expected rates based upon known cracks to date. Westinghouse has changed the basis for determining these rates to utilize the NRC gray book operating hours. It is believed this agrees with the way the NRC staff determines crack growth rates. Except for four units, the crack growth rate of the number one disc and number 6 disc of BB 80 and BB 81 turbines should be assumed to be zero since this disc operates dry under normal conditions. The four exceptions are Haddam Neck, Indian Point 2, Indian Point 3, and Cooper 1.

9. The bore tangential stress at 1800 rpm and at design overspeed are presented in Section E. The values presented include the stresses due to shrink fit and centrifugal force loads only. Additional analyses to include thermal stresses and pressure stresses are being made but are not presently available.

10. The fracture toughness, K_{IC}, of each disc is calculated from the Charpy v-notch and tensile data. The values, presented in Sections B and C are calculated at the upper shelf temperature or room temperature, whichever gives the lower result.

11. The minimum yield strength specified for each disc is presented in Section B.

Note: There are five discs on three units where complete data is not available to answer all of the questions. We believe the NRC staff considers the ratio A/A_{CR} as the critical paramater. Westinghouse is calculating "worst case" ratios for these discs. If there is a problem, please contact the Westinghouse Projects Manager or Engineer.

APPENDIX B

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 6
7. TEST NO. TD55528

B. MATERIAL PROPERTIES (HUB)
1. TYPE (MIN. Y.S. [ ] b,c,e (KSI)) TD
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e MN [ ] b,c,e SI [ ] b,c,e P [ ] b,c,e CR [ ] b,c,e MO [ ] b,c,e V [ ] b,c,e

NI [ ] b,c,e AS [ ] b,c,e SB [ ] b,c,e SN [ ] b,c,e AL [ ] b,c,e CU [ ] b,c,e S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 b,c,e
A (IN.) [ ]

I CRACK SIZE TO CRITICAL CRACK SIZE RATIO b,c,e
A/ACR (OVERSPEED) [ ]

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 5
7. TEST NO. TD44488

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL b,c,e
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e MN [ ] b,c,e SI [ ] b,c,e P [ ] b,c,e CR [ ] b,c,e [ ] b,c,e V [ ] b,c,e

NI [ ] b,c,e AS [ ] b,c,e SB [ ] b,c,e SN [ ] b,c,e AL [ ] b,c,e CU [ ] b,c,e S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/ACR (OVERSPEED) [ ] b,c,e

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 4
7. TEST NO. TD55592

B. MATERIAL PROPERTIES (HUB)
1. TYPE TD
(MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 3
7. TEST NO. TE26453

B. MATERIAL PROPERTIES (HUB)

1. TYPE TE
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.)

[ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACKED SIZE RATIO

[ ] b,c,e

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 2
7. TEST NO. TD55576

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] b,c,e TD
(MIN. Y.S. (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,E

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102304

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GEN
6. DISC# 1
7. TEST NO. TD44541

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] b,c,e (KSI)) TD
2. SUPPLIER: MIDVALE HEPPENSTALL b,c,e
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102303

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 6
7. TEST NO. TD55527

B. MATERIAL PROPERTIES (HUB)
1. TYPE TD
(MIN. Y.S. [ ]b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ]b,c,e.

D. CHEMISTRY

[C]b,c,e [MN]b,c,e [SI]b,c,e [P]b,c,e [CR]b,c,e [MO]b,c,e [V]b,c,e

[NI]b,c,e [AS]b,c,e [SB]b,c,e [SN]b,c,e [AL]b,c,e [CU]b,e,e [S]b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ]b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ]b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ]b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ]b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ]b,c,e

ID # : D081102303

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 5
7. TEST NO. TD55519

B. MATERIAL PROPERTIES (HUB)
1. TYPE TD
(MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A. (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D0811023o3

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 4
7. TEST NO. TD55591

B. MATERIAL PROPERTIES (HUB)
1. TYPE TD
(MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,e,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102303

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 3
7. TEST NO. TE26452

B. MATERIAL PROPERTIES (HUB)
1. TYPE [ ] b,c,e ~~TE~~ TE
(MIN. Y.S. (KSI))
2. SUPPLIER: [ ] b,c,e
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

C. MATERIAL PROPERTIES (RIM) [ ] b,c,e
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

D. CHEMISTRY

C [ ] b,c,e	MN [ ] b,c,e	SI [ ] b,c,e	P [ ] b,c,e	CR [ ] b,c,e	MO [ ] b,c,e	V [ ] b,c,e
NI [ ] b,c,e	AS [ ] b,c,e	SB [ ] b,c,e	SN [ ] b,c,e	AL [ ] b,c,e	CU [ ] b,c,e	S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA [ ] b,c,e
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

G. SERVICE DATA [ ] b,c,e
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

H. CALCULATED CRACK SIZE AS OF MAY 1980 A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102303

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 2
7. TEST NO. TD44516

B. MATERIAL PROPERTIES (HUB)

1. TYPE [ ] b,c,e TD
   (MIN. Y.S. (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL b,c,e
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e	MN [ ] b,c,e	SI [ ] b,c,e	P [ ] b,c,e	CR [ ] b,c,e	MO [ ] b,c,e	V [ ] b,c,e
NI [ ] b,c,e	AS [ ] b,c,e	SB [ ] b,c,e	SN [ ] b,c,e	AL [ ] b,e,e	CU [ ] b,c,e	S [ ] b,c,e

E. BORE STRESS

SPEED (RPM) STRESS

1. 1800 (KSI)
2. 2160 (120%) (KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,e,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 b,c,e
A (IN.) [ ]

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO b,c,e
A/Acr (OVERSPEED) [ ]

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 5
7. TEST NO. TD55518

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e MN [ ] b,c,e SI [ ] b,c,e P [ ] b,c,e CR [ ] b,c,e MO [ ] b,c,e V [ ] b,c,e

NI [ ] b,c,e AS [ ] b,c,e SB [ ] b,c,e SN [ ] b,c,e AL [ ] b,c,e CU [ ] b,c,e S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,e,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : DO81102303

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 2
5. LOCATION GOV
6. DISC# 1
7. TEST NO. TD55537

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e	MN [ ] b,c,e	SI [ ] b,c,e	P [ ] b,c,e	CR [ ] b,c,e	MO [ ] b,c,e	V [ ] b,c,e
NI [ ] b,c,e	AS [ ] b,c,e	SB [ ] b,c,e	SN [ ] b,c,e	AL [ ] b,c,e	CU [ ] b,c,e	S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 6
7. TEST NO. TD55526

B. MATERIAL PROPERTIES (HUB)
1. TYPE TD
(MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))
[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))
[ ] b,c,e

D. CHEMISTRY

C	MN	SI	P	CR	MO	V
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,e,e

NI	AS	SB	SN	AL	CU	S
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)
[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)
[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 4
7. TEST NO. TD55589

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e MN [ ] b,c,e SI [ ] b,c,e P [ ] b,c,e CR [ ] b,c,e MO [ ] b,c,e V [ ] b,c,e

NI [ ] b,c,e AS [ ] b,c,e SB [ ] b,c,e SN [ ] b,c,e AL [ ] b,c,e CU [ ] b,c,e S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION
1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 3
7. TEST NO. TE26449

B. MATERIAL PROPERTIES (HUB)
1. TYPE TC
(MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)
1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.) -
7. U.S. IMPACT TEMP. (DEG.F) -
8. U.S. IMPACT ENG. (FT.LB.) -
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA
1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA
1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 2
7. TEST NO. TD55575

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL [ ] b,c,e
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ]

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102302

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GEN
6. DISC# 1
7. TEST NO. TD55540

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] (KSI)) b,c,e TD
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO .50] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATE CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102301

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 6
7. TEST NO. TD55525

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C	MN	SI	P	CR	MO	V
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e

NI	AS	SB	SN	AL	CU	S
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSIZE) [ ] b,c,e

ID # : 0081102301

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 5
7. TEST NO. TD44487

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C	MN	SI	P	CR	MO	V
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e

NI	AS	SB	SN	AL	CU	S
[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e	[ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATE CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102301

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 4
7. TEST NO. TD55587

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

C [ ] b,c,e MN [ ] b,c,e SI [ ] b,c,e P [ ] b,c,e CR [ ] b,c,e MO [ ] b,c,e V [ ] b,c,e

NI [ ] b,c,e AS [ ] b,c,e SB [ ] b,c,e SN [ ] b,c,e AL [ ] b,c,e CU [ ] b,c,e S [ ] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A(Acr) (OVER SPEED) [ ] b,c,e

ID # : D0811023Q1

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 1
7. TEST NO. TD55539

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] b,c,e (KSI)) TD
2. SUPPLIER: BETHLEHEM STEEL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS
1. 1800	(KSI)
2. 2160 (120%)	(KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102301

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 3
7. TEST NO. TE26447

B. MATERIAL PROPERTIES (HUB)

1. TYPE (MIN. Y.S. [ ] b,c,e (KSI)) TE
2. SUPPLIER:
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.) -
7. U.S. IMPACT TEMP. (DEG.F) -
8. U.S. IMPACT ENG. (FT.LB.) -
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e,

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM) STRESS

1. 1800 (KSI)
2. 2160 (120%) (KSI)

[ ] b,c,e

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980
A (IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO
A/Acr (OVERSPEED) [ ] b,c,e

ID # : D081102301

LP TURBINE DISC INFORMATION

A. UNIT IDENTIFICATION

1. BUILDING BLOCK 81
2. UNIT ROBINSON #2 (REP)
3. CUSTOMER: CAROLINA P&L
4. LP# 1
5. LOCATION GOV
6. DISC# 2
7. TEST NO. TD55574

B. MATERIAL PROPERTIES (HUB)

1. TYPE TD
   (MIN. Y.S. [ ] b,c,e (KSI))
2. SUPPLIER: MIDVALE HEPPENSTALL
3. Y.S. (KSI)
4. U.T.S. (KSI)
5. ELONGATION
6. R.A.
7. FATT (DEG.F)
8. R.T. IMPACT(FT.LB.)
9. U.S. IMPACT TEMP. (DEG.F)
10. U.S. IMPACT ENG. (FT.LB.)
11. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

C. MATERIAL PROPERTIES (RIM)

1. Y.S. (KSI)
2. U.T.S. (KSI)
3. ELONGATION
4. R.A.
5. FATT (DEG.F)
6. R.T. IMPACT(FT.LB.)
7. U.S. IMPACT TEMP. (DEG.F)
8. U.S. IMPACT ENG. (FT.LB.)
9. U.S. KIC (KSI*SQRT(IN.))

[ ] b,c,e

D. CHEMISTRY

[C] b,c,e [MN] b,c,e [SI] b,c,e [P] b,c,e [CR] b,c,e [MO] b,c,e [V] b,c,e

[NI] b,c,e [AS] b,c,e [SB] b,c,e [SN] b,c,e [AL] b,c,e [CU] b,c,e [S] b,c,e

E. BORE STRESS

SPEED (RPM)	STRESS	
1. 1800	(KSI)	[ ] b,c,e
2. 2160 (120%)	(KSI)	

F. CRACK DATA

1. A-CR-OP (1800 RPM) (IN.)
2. A-CR-OS (OVERSPEED) (IN.)

[ ] b,c,e

G. SERVICE DATA

1. OPER. TEMP. METAL TEMP. HUB (DEG.F)
2. ESTIMATED MAX DA/DT (IN/HR)

[ ] b,c,e

H. CALCULATED CRACK SIZE AS OF MAY 1980 A(IN.) [ ] b,c,e

I. CRACK SIZE TO CRITICAL CRACK SIZE RATIO. A/Acr (OVERSPEED) [ ] b,c,e