CITY OF COLUMBIA CONTRACT #FED 548
FOR REPAIR OF DAMAGE TO COLUMBIA ENERGY CENTER UNITS

THIS CONTRACT (hereinafter “Contract”) by and between the City of Columbia, Missouri, a municipal corporation (hereinafter called “City”), and **General International, Inc.**, a **Corporation** organized in the State of **Connecticut** and with authority to transact business within the State of Missouri (hereinafter called “Contractor”), is made and entered into on the date of the last signatory noted below (hereinafter “Effective Date”). City and Contractor are each individually referred to herein as a “Party” and collectively as the “Parties”.

WHEREAS, City has a need for performance of the Project as defined herein and further described in the Bid Documents, Scope of Work, Plans and Project Specifications set forth herein and other Contract Documents; and

WHEREAS, in response to City’s competitive solicitation, Contractor has submitted a proposal dated **June 15, 2016** for the Project, which is attached as Exhibit L (the “Proposal”); and

WHEREAS, City has selected Contractor based upon Contractor’s representations that Contractor is qualified to complete the Project in accordance with the terms of this Contract.

NOW, THEREFORE, in consideration of the mutual covenants herein set forth, the Parties agree as follows:

1. **DEFINITIONS:**

   a. “As directed”, “as required”, “as permitted”, “acceptable to” and words of like import shall mean that the direction, requirement, or permission of the Engineer is intended.

   b. “City” shall mean the City of Columbia, Missouri, a municipal corporation acting through its authorized City officials, or appointed representatives.

   c. “Contract” or “Contract Documents” shall mean this document and all exhibits and attachments.

   d. “Contract Amount” or “Contract Price” shall mean the amount set forth in Section 3 of this Contract. The Contract Amount shall include all costs, permit fees, profit, overhead, expenses, and compensation of every kind for the Work and Products, except any Change Orders requested pursuant to Section 11.

   e. “Contractor” shall mean the Party having entered into the Contract to perform the work herein specified. Contractor is the Party identified as Contractor in the first paragraph of the Contract.

   f. “Effective Date” shall be the date of the last signatory to this Contract.

   g. “Engineer” shall mean the Director or the authorized representative or designated project manager of the City’s Department for whom the work is to be performed.

If applicable, the project manager for this Project shall be identified in subparagraph j of this Section.

h. "Final Acceptance" shall mean a written notice from the Engineer notifying the Contractor that construction has been satisfactorily completed and accepted. The written notice will follow the pre-final and final inspection reports and submission of all affidavits and paperwork required herein.

i. "Or Equal" is not intended to impose limitations preventing the free exercise of the Contractor's skill or to exclude products, which are satisfactory. Materials and workmanship shall be of the best of their respective kinds. Trade or manufacturer's names where used in these specifications are intended to establish standards of workmanship and materials. Any article or material equaling the standard may be used in place of that mentioned by the specifications, provided that the material or article proposed is submitted to and approved, in writing, by the Engineer. No substitution shall be made unless this definite approval has been obtained from the City.

j. "Products" shall mean the equipment, parts, materials, supplies, software, and other goods Contractor has agreed to supply to the City under the Contract.

k. "Project" shall mean the improvements for which Contractor is to provide Products and Work under this Contract. The Project for this Contract is described as **repair of damage to Columbia energy center units**.

l. "Project Manager" shall be the following project manager designated by the City of Columbia to manage the Project on behalf of the City (none if left blank): **Christian Johanningmeier**.

m. "RFP" shall mean the Request for Proposals issued by the City of Columbia in connection with the Work for the Project. The term RFP shall include and mean RFQ and Request for Quotes or Quotations when the bid documents utilize the term RFQ as opposed to RFP.

n. "Work" of Contractor or subcontractor includes all labor, services, and Products as set forth in the Proposals, subject to additions, deletions and other changes as provided for in the Contract.

2. **SCOPE OF WORK, PLANS AND PROJECT SPECIFICATIONS:** Subject to the terms and conditions set forth in this Contract, Contractor agrees to perform the Work in a good and workmanlike manner according to the specifications and plans set forth herein and in accordance with the Proposal and pricing which is attached as Exhibit L.

   Contractor shall be responsible for, and agrees to perform, all Work as provided in Exhibit L, or as otherwise defined in Section 1.

3. **CONTRACT AMOUNT:** Total payment by City to Contractor under this Contract shall not exceed **Two Million Seven Hundred Thousand Dollars and No Cents ($2,700,000.00) (hereinafter "Contract Amount")**, unless there is an amendment in writing as provided under the terms of this Contract.

Unless otherwise stated elsewhere in the Contract Documents, the quantities, models, makes and type and descriptions of all Work is set forth in Contractor's Proposal.

Payment of the Contract Amount shall be made as provided in Section 10. Except in case of additional work requested by the City under Change Order, all costs, permit fees, profit, overhead, expenses, and compensation of every kind for the Work are included in the Contract Amount. No labor, services, materials, supplies, tools, equipment, supervision, management, or anything else required by the Contract Documents for the proper and successful completion of the Work shall be paid for outside of or in addition to the Contract Amount. The Work set forth in the Contract Amount shall be itemized in Contractor's Proposal and Pricing. All Work not specifically set forth in Contractor's Proposal and Pricing as a separate pay item is a subsidiary obligation of Contractor, and all costs, permit fees, profit, overhead, expenses and compensation of every kind in connection therewith are included in the Contract Amount set forth in Contractor's Proposal and Pricing.

City is responsible for all taxes, duties, fees or other charges that Contractor is charged on all Products used in the performance of the Work (not including corporate taxes measured by net income due to performance or payment for work under this Contract). This responsibility is included within the Contract Amount. City also agrees to furnish, without charge, evidence of any tax or duty exemption acceptable to the taxing or customs authorities.

4. **COMPLETION TIME:** Contractor will start work promptly, after receipt of a Notice to Proceed and complete the Work within **one hundred twenty (120)** calendar days from the date of the Notice to Proceed. It is expressly understood and agreed, by and between the Contractor and the City, that the contract time to complete the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work. No extensions will be granted except in case of additional work requested by the City under Change Order.

Contractor shall not be liable and shall not be considered in breach of any obligations to perform, deliver or complete the Work or any parts thereof within specified durations or periods or by a specified time) if it is delayed or prevented, directly or indirectly, by any cause beyond its reasonable control, or by armed conflict, acts or threats of terrorism, epidemics, strikes or other labor disturbances, or acts or omissions of any governmental authority or of the City or City's contractors or suppliers. If any such cause or excusable event occurs, the schedule for Contractor's performance shall be adjusted accordingly and dates or times stated in the schedule for performance and/or completion of the Services shall be extended by the amount of time lost by reason of the event plus such additional time as may be needed to overcome the effect of the event. If acts or omissions of the City or its contractors or suppliers cause the delay, the parties may mutually agree on an equitable price adjustment.

5. **LIQUIDATED DAMAGES**: Time is of the essence in this Contract; provided that the City shall not terminate this Contract until the maximum amount of liquidated damages for delays have been reached. Subject to Section 4, a deduction of **Two Hundred and Fifty Dollars** / **per unit ($250.00)** per calendar day will be deducted by City from any

amount due, or that may become due, to Contractor as liquidated damages for each day that completion is delayed beyond the time requirement set forth herein; provided that such amount shall not exceed ten percent (10%) of the Contract Amount provided in Section 3 of this Contract. Contractor agrees such sum is a fair and reasonable approximation of the actual damages incurred by the City for the Contractor's failure to complete the Work within the time set forth herein and that such liquidated damages are not penal in nature but rather the parties attempt to fairly quantify the actual damages incurred by the City for such delays. Recovery of liquidated damages is City's exclusive remedy for Contractor's failure to complete the Work in accordance with this Contract; except the City's right to terminate this Contract for such delay as provided in this Section 5.

6. **BONDING:** When Contractor delivers this Contract, executed, to the City, each bound Contract shall be accompanied by an original executed Performance Bond and Labor and Material Payment Bond, on forms provided by City. Bonds shall be written by a company approved by City, each in an amount of one hundred percent (100%) of the Contract Price, guaranteeing complete and faithful performance of the Contract and payment of all bills of whatever nature which could become a lien against property. Contractor's Performance Bond is attached as Exhibit D. Contractor's Labor and Material Payment Bond is attached as Exhibit E.

7. **CONTRACTOR'S INSURANCE:** Contractor shall maintain, on a primary basis and at its sole expense, at all times during the life of this Contract the following insurance coverages, limits, including endorsements described herein. The requirements contained herein, as well as City's review or acceptance of insurance maintained by Contractor is not intended to, and shall not in any manner limit or qualify the liabilities or obligations assumed by Contractor under this Contract. Coverage to be provided as follows by a carrier with A.M. Best minimum rating of A- VIII.

    a. Workers' Compensation & Employers Liability. Contractor shall maintain Workers' Compensation insurance coverage in accordance with Missouri Revised Statutes or provide evidence of monopolistic state coverage with the following limits: $500,000 policy limit for each accident, $500,000 policy limit for each disease claim, and $500,000 for each employee with a disease claim.

    b. Commercial General Liability. Contractor shall maintain Commercial General Liability at a limit of not less than $2,000,000 Each Occurrence, $3,000,000 Annual Aggregate.

    c. Coverage shall not contain any endorsement(s) excluding Product/Completed Operations, Contractual Liability or Cross Liability.

    d. Business Auto Liability. Contractor shall maintain Business Automobile Liability at a limit not less than $2,000,000 Each Occurrence. Coverage shall include liability for Owned, Non-Owned & Hired automobiles. In the event Contractor does not own automobiles, Contractor agrees to maintain coverage for Hired & Non-Owned Auto Liability, which may be satisfied by way of endorsement to the Commercial General Liability policy or separate Business Auto Liability policy.

    e. Contractor may satisfy the minimum liability limits required for Commercial

General Liability or Business Auto Liability under an Umbrella or Excess Liability policy. There is no minimum per occurrence limit of liability under the Umbrella or Excess Liability; however, the Annual Aggregate limit shall not be less than the highest "Each Occurrence" limit for either Commercial General Liability or Business Auto Liability. Contractor agrees to endorse City as an Additional Insured on the Umbrella or Excess Liability, unless the Certificate of Insurance state the Umbrella or Excess Liability provides coverage on a "Follow-Form" basis.

f. The City of Columbia, its elected officials and employees are to be Additional Insureds with respect to the Project to which these insurance requirements pertain, but only to the extent of Contractor's indemnification obligations for third party damages as stated under this Contract. . Contractor is required to maintain coverages as stated and required to notify City of a Carrier change or cancellation within two (2) business days. Contractor's insurance certificate shall be attached as Exhibit F.

g. The Parties hereto understand and agree that City is relying on, and does not waive or intend to waive by any provision of this Contract, any monetary limitations or any other rights, immunities, and protections provided by the State of Missouri, as from time to time amended, or otherwise available to City, or its elected officials or employees.

h. Failure to maintain the required insurance in force may be cause for termination of this Contract. In the event Contractor fails to maintain and keep in force the required insurance or to obtain coverage from its subcontractors, City shall have the right to suspend this Contract without 24-hour notice during which time Contractor shall have 3 business days from time of suspension to provide sufficient evidence of compliance or otherwise City shall have the right to terminate in accordance with terms under this Contract.

i. The insurance required by the provisions of this article is required in the public interest and City does not assume any liability for acts of Contractor and/or their employees and/or their subcontractors in the performance of this Contract.

8. **HOLD HARMLESS AGREEMENT:** To the fullest extent not prohibited by law, Contractor shall indemnify and hold harmless the City of Columbia, its directors, officers, and employees from and against all claims brought by a third party on account of personal injury or damage to the third party's tangible property, to the extent caused by the negligence of Contractor, of anyone directly or indirectly employed by Contractor or by any subcontractor, in each case, in connection with providing these services under this Contract. This provision does not, however, require Contractor to indemnify, hold harmless, or defend the City of Columbia from its own negligence. In the event the injury or damage is caused by joint or concurrent negligence of City and Contractor, the loss or expense shall be borne by each party in proportion to its degree of negligence. For purposes of Contractor's indemnity obligation, no part of the Products or Site is considered third party property.

9. **PERMITS:** City shall timely obtain, effectuate and maintain in force any required permit, license, exemption, filing, registration and other authorization, including, but not limited

to, building and environmental permits, import licenses, environmental impact assessments and foreign exchange authorizations, required for the lawful performance of Services at the Site or fulfillment of City's obligations, except that Contractor shall obtain any license or registration necessary for Contractor to generally conduct business and visas or work permits, if any, necessary for Contractor's personnel. Contractor shall do all work in such manner as to comply with all ordinances and laws of the City, County, State, and Nation as apply to the work herein outlined.

10. **PAYMENTS:** The base scope for Services shall include Base Scope, Unit 4 S17/EGV Upgrade, and Inner Barrel Modification in Shop per Exhibit L. The total price for such Services is $1,305,000, ("Services Amount"). City shall pay twenty (20%) of this Services Amount, as part of its Notice to Proceed. For the remaining payments, Contractor shall submit invoices for 20% of Services upon completion of each of the four (4) units. For Products, Contractor shall submit invoices upon shipment of such Products. . City shall pay Contractor the full uncontested amount of the invoice within thirty (30) days from the invoice date.

For each calendar month, or fraction thereof, that payment is late, City shall pay a late payment charge computed at the rate of 1.5% per month on the overdue balance, or the maximum rate permitted by law if it is less. Contractor may suspend the Contract (or any affected portion thereof) immediately for cause if City (i) becomes Insolvent/Bankrupt, or (ii)fails to make any uncontested payment when due. The Contract (or any affected portion thereof shall immediately cease being suspended once the payment is paid in full.

Contractor will submit a completed Final Payment for Affidavit Release to City along with its invoice for final payment under this Agreement. The form for the Final Payment Affidavit is attached hereto as Exhibit G, and made a part of this Contract.

The Contractor shall indemnify and hold City harmless from all claims for payment for Work furnished by the Contractor or its subcontractors under the Contract, and shall promptly discharge the same, by payment or otherwise, and not suffer any mechanics or other liens to remain outstanding against any of City property, provided that the Contractor has been paid in full for such Work. When requested by City, the Supplier shall submit lien waivers (in form and substance mutually agreed upon by the Parties) from itself and any of its onsite suppliers furnishing Work under this Agreement, for which City may become liable for payment under the laws of the state.

11. **EXTRA WORK AND CHANGES**: If any extra work is to be done for which there is no quantity and price included in the Contract, or any change in the plans and specifications is deemed necessary by City, City may issue to Contractor a written change order or contract amendment directing that such extra work be done or that such change be made, and, to the extent such change order or contract amendment is accepted by the Contractor in writing, this Contract shall be modified accordingly. Extra work shall be done in accordance with the applicable specifications. Compensation to Contractor will be calculated as an addition to the Contract Amount, based upon such written terms as may be established between the Parties either:

a. By an acceptable lump sum proposal of Contractor; or

b. On a cost-plus limited basis not to exceed a specified limit; or

c. On a time and material basis per rates detailed in the Contractor proposal.

12. **PATENTS and CONFIDENTIALITY:** Contractor shall defend and indemnify City against any claim by a non-affiliated third party (a "Claim") alleging that Work furnished under this Contract infringe a patent in effect in the U.S., an EU member state or the country of the Site (provided there is a corresponding patent issued by the U.S. or an EU member state), or any copyright or trademark registered in the country of the Site, provided that City (a) promptly notifies Contractor in writing of the Claim, (b) makes no admission of liability and does not take any position adverse to Contractor, (c) gives Contractor sole authority to control defense and settlement of the Claim, and (d) provides Contractor with full disclosure and reasonable assistance as required to defend the Claim. This Section shall not apply and Contractor shall have no obligation or liability with respect to any Claim based upon (a) applicable Work that have been modified, or revised, (b) the combination of any Work with other Work when such combination is a basis of the alleged infringement, (c) failure to implement any update provided by Contractor that would have prevented the Claim, (d) unauthorized use of Work, or (e) applicable Work made or performed to City's specifications. Should any Work, or any portion thereof, become the subject of a Claim, Contractor may at its option (a) procure for City the right to continue using the Work, or application portion thereof, (b) modify or replace it in whole or in part to make it non-infringing, or (c) failing (a) or (b), take back and/or discontinue infringing Work (as applicable) and refund the price received by Contractor attributable to the infringing Work. This Section states Contractor's exclusive liability for intellectual property infringement by Work. Each party shall retain ownership of all Confidential Information and intellectual property it had prior to the Contract. Confidential Information, as used herein, shall mean information designated in writing as "confidential" or proprietary" by the disclosing party at the time of written disclosure. All rights in and to software not expressly granted to City are reserved by Contractor. All new intellectual property conceived or created by Contractor in the performance of this Contract, whether alone or with any contribution from City, shall be owned exclusively by Contractor. City agrees to deliver assignment documentation as necessary to achieve that result.

City is subject to Chapter 610 of the Revised Statutes of Missouri ("Missouri Sunshine Law"). The Parties agree that the Contract shall be interpreted in accordance with the provisions of the Missouri Sunshine Law, as amended and as applicable. Pursuant to this law, Contractor may provide City with information that it believes is a closed record under the Missouri Sunshine Law – this includes, but is not necessarily limited to, records relating to scientific and technological innovations in which the Contractor has a proprietary interest.

Contractor should designate any records it believes to be closed under Missouri Sunshine Law to be "confidential" or "proprietary." If the City receives an open records request for any such records regarding this Work, then the City shall timely notify Contractor to allow Contractor an opportunity to seek to protect such documents. This obligation does not apply to the Contract itself, which is a public record. The City agrees not to disclose any records the Contractor provides that are marked "confidential" or "proprietary" to any third party, except to the extent required by the Missouri Sunshine Law and in accordance with this paragraph.

13. **DISCHARGE OF EMPLOYEES:** Any employee of Contractor who is stationed at the site of the work and should prove to be quarrelsome, dishonest, incompetent or inexperienced, or should not work for the good of the job, shall, upon written notice from the City, be removed by Contractor and replaced by an employee with proper qualifications.

14. **ASSIGNMENT:** No assignment by Contractor of any principal construction contract or any part thereof will be recognized unless such assignment has had the approval of City and the Surety has been given due notice of such assignment in writing; provided that Contractor may assign or novate its rights and obligations under the Contract, in whole or in part, to any of its affiliates or may assign any of its accounts receivable under this Contract to any party without City's consent.

15. **SUBCONTRACTING:** No part of the onsite Work covered by this Contract shall be sublet by Contractor without the prior written approval of City. Contractor shall file with the Engineer a complete list of onsite subcontractors together with a list of the kinds of materials used. This list shall be submitted in writing to the Engineer as soon as subcontracts are made and approved by City.

16. **ACCIDENT PREVENTION:** Precaution shall be exercised at all times for the protection of persons (including employees) and property.

    a. The safety provisions of applicable laws shall be observed. Contractor shall not commit or permit a public or private nuisance during this Project.

    b. Contractor shall take all necessary steps to protect his own workers, the utility personnel, and the public from unnecessary danger or hazard during the prosecution of the Work. If in Contractor's reasonable opinion, the health, safety or security of personnel or the Site is, or is apt to be, imperiled by security risks, terrorists acts or threats, the presence of or threat of exposure to Hazardous Materials, or unsafe working conditions, Contractor may, in addition to other rights or remedies available to it, evacuate some or all of its personnel from Site, suspend performance of all or any part of the Contract, and/or remotely perform or supervise work. Any such occurrence shall be considered an excusable event. City shall reasonably assist in any such evacuation.

    c. Contractor has no responsibility or liability for the pre-existing condition of City's equipment or the Site. Prior to Contractor starting any work at Site, City will provide documentation that identifies the presence and condition of any known Hazardous Materials existing in or about City's equipment or the Site that Contractor may encounter while performing under this Contract. City shall disclose to Contractor industrial hygiene and environmental monitoring data regarding conditions that may affect Contractor's work or personnel at the Site. City shall keep Contractor informed of changes in any such conditions.

d. Contractor shall notify City if Contractor becomes aware of: (i) conditions at the Site differing materially from those disclosed by City, or (ii) previously unknown physical conditions at Site differing materially from those ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract. If any such conditions cause an increase in Contractor's cost of, or the time required for, performance of any part of the work under the Contract, an equitable adjustment in price and schedule shall be made in writing as a change order, in accordance with this Contract.

e. If Contractor encounters Hazardous Materials in City's equipment or at the Site that require special handling or disposal, Contractor is not obligated to continue work affected by the hazardous conditions. In such an event, City shall eliminate the hazardous conditions in accordance with applicable laws and regulations so that Contractor's work under the Contract may safely proceed, and Contractor and City shall mutually agree to an adjustment of the price to compensate for any increase in Contractor's cost of performance of any part of the work. . City shall properly store, transport and dispose of all Hazardous Materials introduced, produced or generated in the course of Contractor's work at the Site.

f. To the extent not prohibited by law, City shall indemnify Contractor for any and all claims, damages, losses, and expenses arising out of or relating to any Hazardous Materials which are or were (i) present in or about City's equipment or the Site prior to the commencement of Contractor's work, (ii) improperly handled or disposed of by City or City's employees, agents, contractors or subcontractors, or (iii) brought, generated, produced or released on Site by parties other than Contractor. In no event shall the language of this Agreement constitute or be construed as a waiver of limitation for either party's rights or defenses with regard to each party's applicable sovereign, governmental or official immunities and protections as provided by federal and state constitution or law.

g. As used in this section "Hazardous Materials" means any toxic or hazardous substance, hazardous material, dangerous or hazardous waste, dangerous good, radioactive material, petroleum or petroleum-derived products or by-products, or any other chemical, substance, material or emission, that is regulated, listed or controlled pursuant to any national, state, provincial, or local law, statute, ordinance, directive, regulation or other legal requirement of the United States ("U.S.") or the country of the Site.

17**.** **EQUAL OPPORTUNITY:** The City of Columbia is an equal opportunity, affirmative action employer pursuant to federal, state and local law. Contractor shall comply with federal, state and local laws related to Equal Opportunity. Contractor shall not discriminate based on race, color, religion, sex, national origin, ancestry, marital status, disability, sexual orientation or gender identity.

18. **DOMESTIC PURCHASING POLICY:** Contractors are encouraged to select and use materials manufactured, assembled, or produced in the United States in the performance of this Contract whenever the quality and price are comparable with other goods.

19. **AMERICANS WITH DISABILITIES ACT:** Contractor shall comply with all applicable provisions of the Americans with Disabilities Act and the regulations implementing the Act, including those regulations governing employment practices. If this Contract involves Contractor providing services directly to the public, Contractor shall make the services, programs, and activities governed by this Contract accessible to the disabled as required by the Americans with Disabilities Act and its implementing regulations. If this Contract involves construction work, the Project when completed shall comply with the requirements of the Americans with Disabilities Act and the regulations implementing the Act. Payment of funds under this Contract are conditional upon Contractor certifying to the City in writing that it and the completed Project complies with the Americans with Disabilities Act and 28 CFR Part 35.

20. **Reserved.**

21. **SPECIFICATIONS AND PLANS:** Contractor shall keep at the job site a copy of the plans and specifications and shall at all times give City and Engineer access thereto. Anything mentioned in the specifications and not shown on the plans, or shown on the plans and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In any case of discrepancy between the plans and the specifications, the matter shall be promptly submitted to Engineer, who shall promptly make a determination in writing. Any adjustment or interpretation by Contractor without this determination shall be at Contractor's own risk or expense. Engineer shall furnish from time to time such detail plans and other information as may be considered necessary, unless otherwise provided.

22. **REPAIRS AND/OR REPLACEMENT OF DEFECTIVE PORTIONS:** Contractor warrants that Work consisting of Products (i) shall be delivered free from defects in material and workmanship and title, (ii) will be free from defects in design, measured by the general state of knowledge at the time of the original design of the Products, which manifest themselves in a mechanical, structural or electrical failure and (iii) the usual purpose of which is to generate electric power, shall be fit for that purpose when operated according to Contractor's specific operating instructions or, in their absence, according to generally accepted operation practices of the electric power producing industry where applicable. Contractor also warrants that services provided for Work shall be performed in a competent, diligent manner in accordance with any mutually agreed specifications incorporated into the Contract.

    The warranty by Contractor for its materials, parts and components shall expire one (1) year from first use or eighteen (18) months from delivery, whichever occurs first, except that software is warranted for ninety (90) days from delivery. The warranty by Contractor for its services shall expire one (1) year after performance of the service, except that software-related services are warranted for ninety (90) days.

    If Work does not meet the warranties set forth in the paragraph above, City shall promptly notify Contractor in writing prior to expiration of the applicable Warranty Period. Within a reasonable period after receiving such notice, Contractor shall (i) at its option, repair or replace defective applicable part, and (ii) re-perform defective applicable services. If despite Contractor's reasonable efforts, a non-conforming part or service cannot be repaired, replaced, or re-performed, Contractor shall refund or credit monies paid by City for such non-conforming Work. Warranty repair replacement or reperformance by Contractor shall renew the applicable Warranty Period, but in no event to exceed 2 years from first use in the case of materials, parts, components, and services, and 180 days in the case of software and software-related services.

The warranties and remedies are conditioned upon (a) proper storage, installation, use, operation and maintenance of Products, (b) City keeping accurate and complete records of operation and maintenance during the warranty period and providing Contractor access to those records, and (c) modification or repair of Work only as authorized by Contractor in writing. Failure to meet any such conditions renders the warranty null and void. Contractor is not responsible for normal wear and tear.

This Section provides the exclusive remedies for all claims based upon the failure or defect in Work, whether the claim is based in contract, negligence, statute, or any tortious/extra-contractual liability theory, strict liability or otherwise. The foregoing warranties in this Section are exclusive and are in lieu of all other warranties, conditions and guarantees whether written, oral, implied or statutory. NO IMPLIED OR STATUTORY WARRANTY, OR WARRANTY OR CONDITION OF MERCHANTABILITY, QUALITY OR FITNESS FOR A PARTICULAR PURPOSE APPLIES

23. **INTERFERENCE:** All work scheduled by Contractor shall be planned with the consent of the Engineer and shall not in any way interfere with any utility, highway, railroad, or private property unless consent is given by authorized representatives of City.

24. **NO THIRD-PARTY BENEFICIARY**: No provision of this Contract is intended to nor shall it in any way inure to the benefit of any third party, so as to constitute any such person a third-party beneficiary under this Contract.

25. **TERMINATION FOR DEFAULT**: In addition to any failure of Contractor to perform any provisions herein, Contractor will be in default for the following: if Contractor commits a material breach of the Contract which does not otherwise have a specified contractual remedy, or becomes insolvent or is adjudicated a bankrupt, or commits any act of bankruptcy or insolvency. If Contractor is in default, then the Engineer may give notice in writing by registered mail to Contractor and the Surety of such delay, neglect, or default. If within thirty (30) days after such notice Contractor does not proceed to remedy to the satisfaction the Engineer the fault specified in said notice, or the Surety does not proceed to take over the work for completion under the direction of the Engineer, City shall have full power and authority to enter into agreements with others; or to use other such methods as in its opinion may be required for the completion of Contract in an acceptable manner.

    City may, by written notice, terminate this Contract in whole or in part for default of Contractor as described above after giving effect to the applicable notice and cure periods. Upon such termination (i) Contractor shall reimburse City the difference between that portion of the Contract Price allocable to the scope and the actual amounts reasonably incurred to complete that scope, and (ii) City shall pay to Contractor the amounts for Services performed before the effective date of termination.

26. **TERMINATION FOR CONVENIENCE**: The performance of work under this Contract may be terminated by the City of Columbia in whole or in part, whenever the City, through its Purchasing Agent, determines that such termination is in the best interest of the City of Columbia. Any such termination will be affected by delivery to Contractor of

a letter of termination specifying the extent to which performance of work under this Contract is terminated and the date upon which such termination is effective. After receipt of a termination letter, Contractor shall:

a. Stop work on this Contract on the date and to the extent specified in the letter.

b. Place no further orders for materials, services or facilities except as may be necessary to complete any portions of the work under this Contract not terminated.

c. Complete on schedule such part of the work as will not be terminated by termination letter.

If the Contract (or any portion thereof) is terminated for any reason other than Contractor's default under Section 25, City shall pay Contractor for all Work delivered, completed, or performed before the effective date of termination, plus expenses reasonably incurred by Contractor in connection with the termination. The amount due for Services shall be determined in accordance with the milestone schedule (for completed milestones) and rates set forth in the Contract (for work toward milestones not yet achieved and where there is no milestone schedule), as applicable or, where there are no milestones and/or rates in the Contract, at Contractor's then-current standard time and material rates. In addition, City shall pay Contractor a cancellation charge equal to 80% of the Contract Price applicable to uncompleted made-to-order parts Work.

27**.** **PREVAILING WAGES:** Contractor shall comply with all requirements of the prevailing wage law of Missouri Revised Statutes Sections 290.210 to 290.340, including the latest amendments thereto. This Contract shall be based upon payment by Contractor and his subcontractors of wage rates not less than the prevailing hourly wage rate for each craft or classification of workers engaged on the work as determined by the Missouri Division of Labor Standards. The Missouri Division of Labor Standard Annual Wage Order applicable to this Project is attached as Exhibit I.

Contractor and each subcontractor shall keep an accurate record showing the names, occupations, and crafts of all workers employed, together with the number of hours worked by each worker and the actual wages paid to each worker. Contractor shall maintain such records, and keep them open for inspection, in a manner consistent with RSMo § 290.290.

Pursuant to Section 290.250 RSMo, Contractor shall forfeit as a penalty to City one hundred dollars ($100.00) for each workman employed, for each calendar day, or portion thereof, such workman is paid less than the said stipulated rates for any work done under said contract, by him or by any subcontractor under him. After completion of the work and before final payment can be made under this Contract, Contractor and each subcontractor must file with City an affidavit stating that they have fully complied with the provisions and requirements of the prevailing wage law of Missouri. The form of the Affidavit of Compliance with the Prevailing Wage Law is attached hereto as Exhibit J.

28. **CONSTRUCTION SAFETY PROGRAM REQUIREMENTS:**

a. Contractor shall require all on-site employees to complete the ten-hour safety training program required pursuant to Section 292.675 RSMo, if they have not previously completed the program and have documentation of having done so. All employees working on the project are required to complete the program within sixty (60) days of beginning work on the Project.

b. Any employee found on the worksite subject to this section without documentation of the successful completion of the course required under subsection (a) shall be afforded twenty (20) days to produce such documentation before being subject to removal from the project.

c. Pursuant to Section 292.675 RSMo., Contractor shall forfeit as a penalty to City two thousand five hundred dollars ($2,500.00) plus one hundred dollars ($100.00) for each employee employed by Contractor or subcontractor, for each calendar day, or portion thereof, such employee is employed without the required training. The penalty shall not begin to accrue until the time periods in subsections (a.) and (b.) have elapsed. City shall withhold and retain from the amount due Contractor under this Contract, all sums and amounts due and owing City as a result of any violation of this section.

29. **EMPLOYMENT OF UNAUTHORIZED ALIENS PROHIBITED:** Contractor shall comply with Missouri Revised Statute Section 285.530 in that Contractor shall not knowingly employ, hire for employment, or continue to employ an unauthorized alien to perform work within the state of Missouri.

Contractor shall, by sworn affidavit and provision of documentation, affirm its enrollment and participation in a federal work authorization program with respect to the employees working in connection with the contracted services. Contractor shall also complete a Work Authorization Affidavit affirming that it does not knowingly employ any person who is an unauthorized alien in connection with the contracted services. The form of the Work Authorization Affidavit is set forth in Exhibit K. Contractor shall require all subcontractors to observe the requirements of this section and shall obtain a Work Authorization Affidavit from each subcontractor performing Work on the Project.

30. **NO WAIVER OF IMMUNITIES:** In no event shall the language of this Contract constitute or be construed as a waiver or limitation for either Party's rights or defenses with regard to each Party's applicable sovereign, governmental, or official immunities and protections as provided by federal and state constitutions or laws.

31. **AMENDMENT:** No amendment, addition to, or modification of any provision hereof shall be binding upon the Parties, and neither Party shall be deemed to have waived any provision or any remedy available to it unless such amendment, addition, modification or waiver is in writing and signed by a duly authorized officer or representative of the applicable Party or Parties.

32. **GOVERNING LAW AND VENUE:** This Contract shall be governed, interpreted, and enforced in accordance with the laws of the State of Missouri and/or the laws of the

United States, as applicable. The venue for all litigation arising out of, or relating to this Contract, shall be in Boone County, Missouri, or the United States Western District of Missouri. The Parties hereto irrevocably agree to submit to the exclusive jurisdiction of such courts in the State of Missouri. The Parties agree to waive any defense of forum non conveniens.

33. **GENERAL LAWS:** Contractor shall comply with all federal, state, and local laws, rules, regulations, and ordinances.

34. **NOTICES:**

a. The following persons are designated by the respective Parties to act on behalf of such Party and to receive all written notices and payment invoices:

IF TO CITY:

City of Columbia
Finance Department
P.O. Box 6015
Columbia, MO 65205-6015
ATTN: City Purchasing Agent

With a Copy to:

Water and Light Department
P.O. Box 6015
Columbia, Mo 65205
ATTN: Engineer or Project Manager

Christian Johanningmeier

IF TO CONTRACTOR:

General Electric International, Inc
2 Corporate Drive
Shelton, CT 06484
ATTN: **Blair Van Dyne**

b. Any notice required by this Contract to be given in writing or that either City or Contractor wishes to give to the other in writing shall be signed by or on behalf of the Party giving notice. The notice shall be deemed to have been completed when sent by certified or registered mail to the other Party at the address set forth herein, or delivered in person to said Party or their authorized representative.

c. Contractor's designated representative shall be available to meet with City at any time during the performance of the Work and shall have full authority to act on Contractor's behalf on any matter related to this Contract and/or the Work.

35. **CONTRACT DOCUMENTS:** The Contract Documents include this Contract and the following attachments or exhibits, which are incorporated herein by reference.

Exhibit	Description
A	RFP containing City's Scope of Work, Plans and Project Specifications
B	None – reserved for future use
C	None – reserved for future use
D	Contractor's Performance Bond

E	Contractor’s Labor & Material Payment Bond
F	Contractor’s Insurance Certificate
G	Contractor’s Affidavit for Final Payment
H	None – reserved for future use
I	Missouri Division of Labor Standards Annual Wage Order Applicable for the Project
J	Affidavit of Compliance with Prevailing Wage Law
K	Work Authorization Affidavit
L	Contractor’s Proposal and Pricing

In the event of a conflict between the terms of any Exhibit or Attachment and the terms of this Contract, the terms of this Contract control. In the event of a conflict between the terms of any Exhibit and any Attachment, the terms of the documents control in the order listed above.

36. LIMITATIONS OF LIABILITY

36.1 To the maximum extent permitted by applicable law, the total liability of either party for all claims arising from or related to the formation, performance or breach of this Contract, or provision of any Work, shall not exceed the Contract Amount provided in Section 3 of this Contract.

36.2 Neither party shall be liable for loss of profit or revenues, loss of use of equipment or systems, interruption of business, cost of replacement power, cost of capital, downtime costs, increased operating costs, any special, consequential, incidental, indirect, or punitive damages, or claims of customers for any of the foregoing types of damages. The provisions of this Section 36.2 shall not be interpreted so as to exclude the Owner’s liability for the payment when due of the Contract Price

36.3 All Contractor liability shall end upon expiration of the applicable warranty period, provided that City may continue to enforce a claim for which it has given notice prior to that date by commencing an action or arbitration, as applicable under this Contract, before expiration of any statute of limitations or other legal time limitation but in no event later than one year after expiration of such warranty period.

36.4 Contractor shall not be liable for advice or assistance that is not required for the work scope under this Contract.

36.5 If City is supplying Work to a third party, or using Work at a facility owned by a third party, City shall either (i) indemnify and defend Contractor from and against any and all claims by, and liability to, any such third party in excess of the limitations set forth in this Section 36, or (ii) require that the third party agree, for the benefit of and enforceable by Contractor, to be bound by all the limitations included in this Section 36. In no event shall the language of this Agreement constitute or be construed as a waiver of limitation for either party’s rights or defenses with regard to each party’s applicable sovereign, governmental, or official immunities and protections as provided by federal and state constitution or law.

36.6 For purposes of this Section 36, the term “Contractor” means Contractor, its affiliates, subcontractors and suppliers of any tier, and their respective employees. The limitations in this Section 36 shall apply regardless of whether a claim is based in contract, negligence, statute, indemnity, tortious/extra-contractual liability theory, strict liability or otherwise.

37. **ENTIRE CONTRACT:** This Contract represents the entire and integrated Contract between the Parties relative to the Project herein. All previous or contemporaneous contracts, representations, promises and conditions relating to Contractor’s services on this Project described herein are superseded.

[SIGNATURE PAGE FOLLOWS]

IN WITNESS WHEREOF, the PARTIES have hereunto set their hands and seals the day and year written below.

CITY OF COLUMBIA, MISSOURI

By: ______________________________

Name:______________________________

Title: ______________________________

Date: ______________________________

APPROVED AS TO FORM:

By: ______________________________
Nancy Thompson, City Counselor

CERTIFICATION: I hereby certify that this Contract is within the purpose of the appropriation to which it is to be charged account **551-7150-611-14-20 Project #FED548** and that there is an unencumbered balance to the credit of such account sufficient to pay therefore.

By: ______________________________
Michele Nix, Director of Finance

(Seal)

GENERAL ELECTRIC INTERNATIONAL, INC.

By: ______________________________

Name:______________________________

Title: ______________________________

Date: ______________________________

ATTEST:

By: ______________________________

Name:______________________________

Contract Exhibit

EXHIBIT A

Sole Source containing City's Scope of Work and Project Specifications

CITY OF COLUMBIA – PURCHASING
SOLE SOURCE JUSTIFICATION
(for Noncompetitive Purchases over $5,000)

Your approval is requested to initiate a sole source procurement action:

Requestor Name and Title: Steve Lewandowski, Assistant Power Production Superintendent

Note: Requestor must be an expert in the respective field who is able to defend this justification.

Department: **Water & Light – Electric Production** **Requisition #** 64006

Recommended Sole Source procurement action with:

Company Name: General Electric International, Inc.
Contact Name: Blair Van Dyne
Address: 7101 College Blvd., Ste 800
City, State, Zip Overlook, KS 66210-2082
Telephone: (913) 967-6215

Is the recommended company the manufacturer? ☒ Yes ☐ No

Does the manufacturer sell the item(s) through distributors? ☐ Yes ☒ No

Description of Product or Service: Repair of Columbia Energy Center Units 1, 2, 3, & 4 resulting from borescope inspection.

Describe the full scope of work contemplated including installation if required; items should include brand, model and part number if applicable

Schedule: 9 weeks required to complete work

Identify the date you need items delivered OR number of week/months work is to be performed or items delivered

Estimated Cost: $ 2,700,000.00

SOLE SOURCE RATIONALE

Explain why the recommended company is the only company who can perform the requirement. Address the following: Are there any other companies who can do this job? What condition (e.g. technological superiority, or performance risks, etc.) exists so that the recommended company has a significant advantage over any other company who can do this job?

It is important to sufficiently address the major reason for conducting a noncompetitive procurement, avoiding peripheral issues which detract from the main reason and reduce the credibility of the justification. The rational must be clear and convincing, avoiding generalities and unsupported conclusions. Use one or more of the following as applicable.

Use additional sheets if necessary.

A specific contractor is the only source of the required item because (check all that apply):

☒ The required items are **proprietary to the Contractor**

☒ A specific item is needed:

- ☐ to be compatible or interchangeable with existing hardware, software or system,
- ☒ as spare or replacement hardware,
- ☒ for the repair or modification of existing hardware, or
- ☐ for technical evaluation or test.

CITY OF COLUMBIA – PURCHASING
SOLE SOURCE JUSTIFICATION
(for Noncompetitive Purchases over $5,000)

☒ **It is not possible to obtain competition** (i.e., only one source is capable of supplying the items or meeting the requirements). *In a brief explanation, provide supporting evidence for the conclusion; other sources considered should be identified and why they are not able to meet the requirements.*

Borescope inspection of units revealed liberated vanes in units. GE is manufacturer of units and has developed a repair for units that fixes underlying issue, see attached TIL -1352-R2 dated March 14, 2016. GE is only supplier of required parts and of propriety plans for machining inner barrel of units.

☒ There is a **substantial technical risk** in contracting with any other contractor, thereby making that an unacceptable course of action (e.g., where only one contractor has been successful to date in implementing a difficult manufacturing process). *In a brief explanation, provide supporting evidence of other contractor's with relevant capabilities and emphasize their inability to overcome the substantial technical risk.*

Conversations with other vendors revealed that the required parts and plans are not available to other vendors without reverse engineering, see attached communication from Ethos.

☒ For support services effort, there is no reasonable expectation that a meaningful cost or other improvement could be made in the incumbent contractor's performance (e.g , the chances of another firm winning a competition are clearly remote. *Please provide a brief explanation.*

GE is the only supplier of parts and labor, see attached OEM letter GE has provided quote with significant discount from standard rates. Timeliness of repairs is essentials as CEC is over half of CWL generation capacity. Three of the four CEC units are out of service until repairs can be made. CWL has an operating guide in place for summer 2016 requiring shed of load on portions of the system if CEC is not available under certain overload conditions, see attached.

ACKNOWLEDGEMENT

This Section Must be Completed

☒ I am aware of the City of Columbia's requirements for competitive bidding for purchases over $5,000.00 and the criteria for justification for Single Source/Sole Brand Purchasing. I have gathered the required technical information and have made a concerted effort to review comparable/equal equipment (e.g., market research). I have attached the pertinent documentation showing what market research was conducted to preclude other items from consideration.

Stephen J Lewandowski
Signature

8-19-2016
Date

DEPARTMENTAL APPROVAL

Signature

8-19-2016
Date

PURCHASING APPROVAL

Signature

8-19-16
Date

Columbia Energy Center Due Diligence Review, Sega Engineering, December 10, 2009

City of Columbia, Missouri

Columbia Energy Center
Due Diligence Review

December 10, 2009

Sega Project No. 09-0188

ENGINEERING & TECHNICAL SERVICES

TABLE OF CONTENTS

SECTION 1

COLUMBIA ENERGY CENTER DUE DILIGENCE REVIEW

COLUMBIA ENERGY CENTER DUE DILIGENCE REVIEW

BACKGROUND

Sega was retained by the City of Columbia, Missouri to review the existing equipment and facilities at Ameren's Columbia Energy Center (CEC) for the purpose of potential purchase of a portion of the facility by the City.

The CEC was developed and constructed by Ameren, and was placed in commercial service in June-July of 2001 as a peaking facility. The plant is comprised of four identical 36 MW nominal General Electric Company (GE) gas-fired combustion turbines in simple-cycle configuration. The plant has been operated and maintained since commissioning by Siemens Operating Services Group through a long-term Operating and Maintenance (O&M) Agreement. The plant has been operated both locally and remotely by Ameren and Siemens from St. Louis, Missouri and Elgin, Illinois locations. Ameren dispatches the plant. The City of Columbia, Missouri presently has an active purchase power agreement (PPA) with Ameren to take part of the plant's output on a pre-scheduled basis. The CEC has primarily seen summer peaking operation since commissioning, with some limited operation during the winter months.

EXECUTIVE SUMMARY

Sega has performed a review of the CEC to gauge the basic design and configuration of the facility and to assess the overall condition of equipment and systems based on O&M documentation, interviews with Ameren and Siemens staff, and observations made during site walkdowns. Sega has performed a limited review and has not been involved in nor included any economic analyses or considerations.

Sega finds the CEC a typical representation of a combustion turbine power plant configured for simple-cycle peaking operation. The overall plant design is consistent with plants of this type, vintage, and intended service. The overall condition of the equipment and systems found in the facility appears to be appropriate for a plant of this age. Maintenance at the facility appears to be consistent with accepted utility industry practices. Operational history compares favorably with reported industry averages for similar units of size and type. Sega is not aware of any items or issues that would cause us to recommend against the purchase of part or all of the facility.

Specific recommendations are as follows:

1. Obtain the combustion turbine nameplate data and the original expected unit performance information.
2. Resolve the R1 compressor blade issue on all four units with the original equipment manufacturer's (OEM's) updated design. This should occur during the first scheduled major maintenance activities.
3. Continue to monitor the status of the two damaged first stage turbine blades on Unit 4. Replace at the first scheduled Hot Gas Path (HGP) Inspection as recommended by the OEM.
4. Consider adding appropriate combustion turbine spares to inventory such as combustion system components, turbine blades, etc., within the next several years. Discuss options with the OEM or other third-party parts suppliers. Otherwise, join parts pooling arrangement with other owners, if available.
5. Consider performing thermography in conjunction with other electrical testing activities.
6. Conduct routine (annual) electronic overspeed testing of the combustion turbines.
7. Conduct routine DC lube oil pump tests on the combustion turbines.
8. Consider performing the necessary testing to allow the use of a predictive emission monitoring system (PEMS) and eliminating the CEMS systems.
9. Revisit the 75 percent minimum load operational restriction presently in place and determine if further minimum load flexibility can be allowed without violating air permit requirements.
10. Consider repairing or replacing any equipment necessary to restore and maintain black-start capability for all four units.

11. Test the black-start capability on one unit at least once a year.

12. Join and participate in the Frame 6B Users Group.

REVIEW FINDINGS

The items below describe Sega's review of major equipment and systems. This evaluation is based on plant documentation provided, O&M history, interviews with Ameren and Siemens O&M personnel, observations made during the plant walkdowns, and Sega's experience with combustion turbine technology and similar facilities.

Combustion Turbines and Generators

History of Frame 6B

GE has been manufacturing the Model MS6001B designation combustion turbine generator set since 1978. Originally used for mechanical drives on large natural gas pipeline compressors and other petrochemical applications, this model was designated PG6531B for power generation in 1983. Known throughout the power and petrochemical industries as the "GE Frame 6B", GE reports more than 1,100 units have been installed with accumulated operation of over 60-million hours of service. Applications include natural gas pipeline compressor drives, petrochemical plant mechanical equipment drives, and combined-cycle generating plants, which are usually high capacity factor installations, as well as simple-cycle peaking applications that operate only a few hours each year.

The Frame 6B is one of a class of so-called "heavy duty frame" machines that GE developed from steam turbine technologies in the late 1940's and early 1950's. Frame machines use large journal bearings, have large rotating masses, and are designed to be stationary generating units as opposed to aeroderivative combustion turbines that were first designed for aircraft propulsion. GE used geometric scaling of compressors and turbines from its successful Frame 3 and Frame 7 machines to develop the 5, 6, and 9 series of gas turbines. This geometric similarity with components in the earlier machines allowed GE to maintain the temperatures, pressures, blade angles, and stresses that were the basis of design of successful earlier models. The Frame 6B operates at about 5,100 rpm (depending on the applications), and requires a gear box to drive a generator at synchronous speed. This feature also makes the Frame 6B adaptable for either 50 or 60 Hz power generating applications, as well as for a variety of mechanical drive applications.

GE originally manufactured these units in the United States. However, with GE's expansion to a global supply network, production has shifted to plants in France and Germany, although supported by GE's United States organization for parts and service.

Description of Frame 6B Technology

The Frame 6B was designed by scaling geometrically down from the Frame 7 base platform. The Frame 6B utilizes a multistage axial compressor which consists of blade discs bolted together into a dynamically stiff rotating compressor assembly. The compressor section and turbine are hard coupled to act as a single shaft. The turbine section is comprised of three stages, essentially two to drive the compressor and one that drives the generator through the load gearbox. The compressor and generator are arranged in a hot-end drive so that the exhaust from the power turbine exits to one side of the machine. The exhaust duct from a simple cycle Frame 6B extends perpendicular to the long axis of the unit, and between the generator and the turbine. GE uses two discrete sizes of combustors on its various models, and varies the number of combustors proportionally to the airflow of each model. The combustors are arranged in an annulus around the center axis of the unit.

GE developed its dry low NO_x (DLN) technology combustors and controls for gas turbines over several years and integrated DLN applications into the different model platforms. Since the mid 1990's the available DLN products for the Frame 6B gas turbine were designed to guarantee 15 ppmvd at 15 percent O_2 of NO_x. The latest designs have reduced this NO_x emission level to 9 ppmvd, and this feature may be available for retrofit on older Frame 6B installations, on a case-by-case basis.

GE has continued development of this frame series, upgrading to the PG6581B in 2000, which is now rated at 42.1 MW (ISO). GE has incrementally improved the performance of the Frame 6B gas turbine over the last 30 years of production, as listed in the following table.

TABLE 1
PERFORMANCE CHARACTERISTICS OF
FRAME 6B GAS TURBINES*

Turbine Model	Ship Dates	Firing Temperature (°F)	Output (kW at ISO)	Heat Rate (Btu/kWhr at ISO)	Exhaust Flow (10^3 lbs/hr)	Exhaust Temperature (°F)
MS6431A	1978	1850	31,050	11,220	1,077	891
MS6441A	1979	1850	31,800	11,250	1,112	901
MS6521B	1981	2020	36,730	11,120	1,117	1017
PG6531B	1983	2020	37,300	10,870	1,115	1005
PG6541B	1987	2020	38,140	10,900	1,117	999
PG6551B	1995	2020	39,120	10,740	1,137	1003
PG6561B**	1997	2020	39,620	10,740	1,145	989
PG6571B	1997	2077	40,590	10,600	1,160	1005
PG6581B	2000	2084	41,460	10,724	1,166	1016

*Source: GE Power Systems Performance and Reliability Improvements for Heavy Duty Gas Turbines, GER-4217A (12/03).

**Columbia Energy Center units.

Frame 6B Users Group

With such a large population of units, a user's group developed over the years for this specific gas turbine model called "The Frame 6 Users Group". It is a national organization of owners and operators of GE Frame 6B gas turbines that are currently operating, under construction, or under contract for future delivery of these units. Membership is limited to organizations that are directly involved in their management, operation, maintenance, or construction. The Frame 6B Users Group provides a forum for discussion and sharing of information for improvement of operational and maintenance practices, and to serve as a focal point for interface with the manufacturer. There is no annual membership fee, except for registration and the costs of attending their annual meeting which is usually held in May each year.

Observations Regarding Frame 6B Combustion Turbine Technology

Based on information about this specific installation provided by the seller, information available in the public domain from the manufacturer, and knowledge of other similar installations with which Sega is familiar, Sega has developed the following observations:

1. The GE Frame 6B gas turbine model is a mature technology application with over 1,100 installed units and more than 60-million hours of service reported.

2. Design of the Frame 6B gas turbine was based on geometric scaling from other proven successful GE gas turbine models.

3. GE has continued to develop uprating and improvement programs to the Frame 6B platform over its 30-year history and is continuing this effort. This provides Owners with options to upgrade the basic combustion turbine frame without installing new generation.

4. The gas turbine technology utilized is mature, with a large number of users and applications.

5. Many installations are supported by the OEM's ongoing programs and a national users group.

6. The large number of fleet units provides for a decent range of choices for after market components and repair options.

The CEC units are the PG6561 model variant with a nameplate of approximately 36 MW. Manufacturing was performed by GE in Essen, Germany. Unit serial numbers are shown in Table 2 (Page 7).

TABLE 2
COLUMBIA ENERGY CENTER
COMBUSTION TURBINES

Unit No.	Turbine OEM	Turbine Frame	Turbine Serial No.	GE USA No.	Gen. OEM	Gen. Frame	Gen. Serial	GE USA No.	Exciter Frame No.	Exciter Serial No.
1	GE	PG6581 (6B)	141-220	810350	Alstom	T214-234	500-591	0465	TJK71-13	500591
2	GE	PG6581 (6B)	141-210	810349	Alstom	T214-234	500-564	045	TJK71-13	500564
3	GE	PG6581 (6B)	140-870	810347	Alstom	T214-234	500-550	032	TJK71-13	500550
4	GE	PG6581 (6B)	140-880	810348	Alstom	T214-234	500-552	033	TJK71-13	500549

The DLN combustion system provided with CEC units typically produces NO_x emissions in the 15 ppm range. The actual unit nameplates or nameplate information was not provided for Sega's review. This documentation along with the original OEM expected unit performance should be made available for review by the potential owner.

Combustion Turbine Maintenance History

Per GE's publication Heavy-Duty Gas Turbine Operations and Maintenance Considerations (GER-3620K, 12/04), the CEC Frame 6B units have nominal inspection intervals as follows:

1. Combustor Inspection (CI): 450-factored starts or 12,000-factored hours
2. Hot Gas Path Inspection (HGP): 1,200-factored starts or 24,000-factored hours
3. Major Inspection: 2,400-factored starts or 48,000-factored hours

Items of Note:

1. Based on their operation, the CEC units are on track for "starts based" maintenance, with the first official CI to be performed at nominal 450-factored starts.
2. In addition to the CI, there is an issue within the Frame 6B fleet with some first stage compressor blades (R1). A series of Technical Information Letters (TILs) have been issued by the OEM to address issues with potential cracking of the blade root platforms. The CEC units need to be inspected every 25 starts until major maintenance is scheduled for the four machines at which time replacement blades of an improved design can be

installed. As a result of an updated issue of the TIL in March 2009, the R1 compressor blades were inspected twice in 2009 (spring and fall) and will be inspected at least annually until upgraded blades can be installed.

3. Unit 4 has at least two first-stage turbine blades with existing impact damage and leading edge tip loss. This situation appears to have been discovered during commissioning of the unit in 2001. In July 2002, the OEM issued a disposition indicating no immediate action was needed, no long-term degradation was expected and no effects on performance was expected if the blades were left in place. It is our understanding the present Owner plans to replace the blades during the first HGP inspection.

4. All four engines have experienced tip rubs in the compressor sections. This is not an uncommon occurrence with combustion turbines. A third party performed borescope inspections on all four units. As a follow up, the Owner had the OEM perform a borescope inspection on Unit 2 (unit with the most evidence of tip rub) in December 2008 to address the compressor tip rubs and tip curl. The OEM subsequently provided a disposition indicating there was no significant damage or risk to operation of the units.

5. Other outstanding TILs issued by the OEM were reviewed. The existing list of applicable TILs indicates 30 outstanding items, not including the R1 compresser blade item. Most of these TILs are minor or routine and require implementation during the next scheduled maintenance interval or require development of a preventive maintenance (PM) inspection procedure.

Plant Operating History

The four CEC units have operated in a peaking role since commissioning in mid 2001. The following cumulative start/run data is through July 2009:

TABLE 8
CEC COMBUSTION TURBINE STARTS AND TRIPS

Unit	Total Starts	Total Fired Hours	Emergency Trips
1	147	715.6	2
2	138	698.0	4
3	138	611.2	0
4	140	569.7	15

The units have been lightly used since commissioning, averaging less than 20 starts per year and less than 90 hours of annual operation, averaging 4.5 hours of operation per start generally in line with GEM recommendations. As demonstrated below, unit starting reliability and availability for the units has been good as compared with North American Electric Reliability Council (NERC) Generating Availability Data System (GADS) industry average data for the 2004-2008 time period. The plant exceeded the industry average in starting reliability and availability in all but two years (2001 - the commissioning year and 2009 - partial year of data).

TABLE 4
CEC PLANT RELIABILITY AND AVAILABILITY

Columbia Energy Center (Plant)		
Year	Starting Reliability	Availability
2001	89.5	91.1
2002	96.2	96.7
2003	97.5	98.7
2004	100	99.9
2005	100	95.7
2006	98.7	99.7
2007	100	99.0
2008	100	97.0
2009 (through June)	86.0	87.0
Industry Avg. 2004-2008*	**97.2**	**92.6**

*Source: NERC GADS Report 2004-2008 - Gas Turbines 20-49MW.

Generators

The generators are an air-cooled design, supplied by Alstom, and manufactured in France in 2000. Each generator is rated for continuous duty of 50.875 MVA at 35 degrees C with a power factor of 0.8.

The generator OEM performed warranty repairs/upgrades on the medium-voltage frame component on Unit 1 in December 2001. No other items of significance have been noted for this equipment.

Instrumentation and Control, and Communication Systems

The control systems utilized at the CEC are consistent with the technology and type in service at other facilities of this type and vintage.

Items of Note:

1. Each unit and its immediate auxiliaries are controlled by a triple redundant (TMR) GE Mark V system. This system is typical for this type of application.

2. Miscellaneous site balance-of-plant equipment is controlled by a non-redundant GE Fanuc programmable logic controller (PLC).

3. The units are not presently remotely monitored by the combustion turbine OEM.

4. Unit data is archived by an OSI PI system in St. Louis, Missouri. No local archiving is utilized except for the continuous emissions monitoring system (CEMS). CEMS reports are generated in St. Louis, Missouri.

5. There are T1 lines from the site to both St. Louis, Missouri and Elgin, Illinois. Units can be remotely started from either location.

6. Security camera video and maneuvering is also available at each location.

7. The City of Columbia, Missouri has a fiber connection into the site for monitoring only. The fiber line is maintained by Ameren.

8. Field control devices that are readily observable include Rosemount transmitters and Fisher valves. Both manufacturers are typical for utility power plant applications.

Generator Step-Up Transformers

There are two GE Prolec generator step-up (GSU) transformers serving the four units. They each are rated at 83 MVA at 55 degrees C rise with a a primary voltage 69,000 volts and a secondary voltage of 13,800 volts. Both transformers were manufactured in Mexico in 2001.

Items of Note:

1. Transformer 34 experienced some Buchholz relay issues shortly after commissioning in 2001. The OEM discovered a manufacturing deficiency, performed a modification and the issue has not recurred.

2. Dissolved gas analysis (DGA) of oil in both GSU transformers revealed high levels of H_2 in 2003 and 2004. Partial discharge was suspected, but not discovered through ultrasonic testing. No recent gassing has been noted. Annual DGA testing is still performed.

3. GE performed electrical and oil testing on GSU Transformer No. 34 in December 2006 with no abnormal findings and recommended performing DGA testing on an annual basis.

4. A third-party testing company, Electric Power Systems (EPS) performed electrical testing on GSU Transformer No. 12 in the fall of 2007 with no abnormal issues noted.

5. Minor oil leaks have been and continue to be a nuisance on both GSU transformers

Plant Auxiliary Electrical Systems

The plant is served by three 1,500-KVA station service transformers and four 500-KVA unit auxiliary transformers, all are 13,800 to 480 volts. Protective relaying for the generators and plant electrical systems utilizes Schweitzer microprocessor-based equipment. The electrical equipment and its configuration appears fairly typical for this peaking plant application. Plant batteries are the wet cell lead acid type.

Electrical equipment is tested every five years, with the most recent testing completed in 2007. A review of the test reports revealed no significant findings or concerns.

All four combustion turbine units were originally commissioned with black-start capability. However, since initial testing, black-start capability has not been tested. In 2008, the black-start inverter on Unit 1 failed. The inverter was bypassed and has not been repaired. Presently, two of the four units do not have working black-start capabilities. Siemens does not have a contractual obligation to maintain or test this capability.

Items of Note:

1. There have been a number of uninterruptable power supply (UPS) component failures throughout the life of the plant. Consideration should be given to upgrade or replace the remaining UPS systems in the future.

2. No thermography has been performed to date.

Environmental and Air Permit

A summary of the review of the plant's current Air Operating Permit (with expiration date of November 28, 2011) and environmental compliance follows.

Continuous Emission Monitoring System: A CEMS tracks nitrogen oxide (NO_x) emissions for each of the four CTGs. The plant has just one CEMS shelter (located between Units 2 and 3) which houses the analyzers and other equipment for all four units. The shelter is approximately 24 feet by 10 feet. The calibration gas bottles are stored in an enclosed area on one end of the shelter. Two separate HVAC systems are mounted on one end of the shelter. The presumption is one is a backup to the other. There are four separate analyzer and data logger racks within the shelter, one rack per unit. There is one work desk and computer. There is an ambient oxygen monitor installed in the interior of the shelter. The analyzer racks appear in "like new" condition and the tubing observed appeared in clean condition. The analyzers are the brand name "Ecotech". The racks appeared a bit tight on space for maintenance, but there is adequate space available both in front and behind the racks. Each rack includes an Environmental Services Corporation (ESC) 8832 data logger. The ESC loggers were updated when the system switched to ESC's StackVision™ data acquisition and handling system (DAHS) in 2004.

Siemens O&M staff perform all of the regularly scheduled maintenance of the CEMS equipment. The analyzers are continually operated year-round regardless of whether the units are operated. However, the analyzers are not calibrated unless the associated units are operating. This is acceptable and saves on calibration gases. Typically, a calibration event is triggered within the first hour of unit operation in order to obtain a valid calibration for data collection. Siemens O&M staff typically try to keep the calibration gas bottles turned off when the units are not operating in order to minimize the loss of calibration gas to the environment.

The CEMS DAHS logs, records, calculates, and develops reports needed for submittal to the state and federal agencies. Data within the DAHS are accessed via internet by Ameren (St. Louis, Missouri) in order to download the data and prepare reports for required submittals. The Siemens O&M staff is not involved with the air quality reporting process other than maintaining the CEMS.

It is our understanding Ameren has considered switching to a predictive emission monitoring system (PEMS) (Part 75, Appendix E) instead of the CEMS. However, they have put that decision on hold to avoid the costs associated with the stack testing that would be required to develop the PEMS.

The Missouri Department of Natural Resources (MDNR) conducts an annual visit of the facility to inspect compliance with the required monitoring, recordkeeping, and reporting requirements. The Ameren environmental staff have copies of these inspection reports. The Siemens O&M staff have indicated they are not aware of any notice of violations, deviations, or excess emissions being reported.

Siemens O&M staff have copies of the stack tests which have been performed on the units. There was an initial operation stack test as well as subsequent stack tests performed as part of the relative accuracy test audits (RATA) requirements for the CEMS.

In order to comply with permit conditions, Ameren has limited each unit to operation at 75 percent maximum load or greater. This is not a specific permit condition but determined by Ameren to be necessary to meet the new source performance standard limitation stated in the Permit as 0.0091 percent by volume (91 ppmdv) at 15 percent oxygen on a dry basis. An analysis of load and emissions had been performed to determine the minimum load required.

Summary of important air permit limits/conditions:

1. Total NO_x emitted from the facility is limited to no more than 100 tpy on a rolling 12 month basis. This includes emissions from the four CTGs, four diesel start-up engines, and two gas-fired fuel gas heaters.

2. CEMS are required to monitor and track NO_x emissions.

3. Only natural gas shall be burned by the CTGs.

4. NO_x shall not exceed 91 ppmdv (15 percent oxygen) to comply with NSPS Subpart GG.

5. The CTGs are affected units under the Acid Rain Program.

6. The units are exempted from 10 CSR 10-6.350 (Emission Limitation and Emissions Trading of Oxides of Nitrogen) if each unit is operated less than 400 hours from May through September averaged over the most recent three years.

7. The diesel starting engines have operational and emission limits. Each has a limit of 1.62 lb/hr of PM_{10}. Combined they have a limitation of 216 lbs of PM_{10} and 8.67 tons of NO_x in any consecutive 12-month period. Operationally, the combined operation of the four engines cannot exceed 250 minutes in any consecutive 24-hour period or else stack testing will be required.

8. Past Emissions:

   a. The NO_x emissions reported to the Acid Rain Program for the facility's four CTGs for the past five full years as follows:

TABLE 5
CEC PLANT TOTAL REPORTED NO_x EMISSIONS

Year	NO_x Emissions (tons)
2004	0.9
2005	1.9
2006	4.7
2007	2.9
2008	0.6

Items of Note:

1. During the Due Diligence site walkdown, the calibration gas bottle enclosure was opened for inspection. An odor of calibration gas was detected, indicating there was a leak in the calibration gas system. O&M staff indicated they are aware of the leak and would be repairing it.

2. There is an apparent operational limitation of 75 percent load has been set as the minimum allowable load. This item could be investigated by inspecting the emissions vs. load testing reports to determine if the minimum load could be lowered somewhat and still maintain compliance with the 91 ppmdv NO_x limitation, or to determine whether there is another underlying reason for the 75 percent load minimum limit. Typically the OEM emission guarantee basis is over the range of 60 percent or 65 percent through guaranteed capacity.

3. The Siemens O&M staff indicated they have experienced one spill of turbine lubricating (mineral) oil which required notification. The spill was remediated.

The air permit affords ample flexibility in emissions and operations for a peaking CTG facility. The CEMS appear to be in excellent working condition, although no functional checkout of the DAHS was performed during the site walkdown. Sega has not discovered any outstanding air permit compliance issues.

<u>General Operations and Maintenance</u>

The plant is operated and maintained through contracted services with an operating services group within Siemens Energy. The Owner does not have a full-time presence on site. Siemens provides O&M services for a number of clients and plants across the USA as well as internationally including both simple-cycle and combined-cycle configurations. Siemens typically provides O&M services for plants using Siemens combustion turbine technology. However, they do support plants that have other turbine manufacturers' equipment and systems. Siemens typically provides competent and well-trained staff at such sites. Siemens also provides engineering support from Orlando, Florida for their various O&M plants.

Record keeping at the plant appears to be adequate, with PM procedures and logs developed and maintained. Monthly operating reports are developed and submitted by the Siemens O&M staff.

The plant is typically manned Monday through Friday during normal daytime working hours, but operational coverage is extended as needed to support peak season operations.

The O&M staff start and run each combustion turbine diesel starting motor on a weekly basis, to help ensure starting reliability for the units.

Items of Note:

1. The combustion turbines are configured with electronic rather than mechanical overspeed devices, which is typical for turbines of recent manufacture. Many insurers recommend performing overspeed testing on an annual basis. Development and implementation of a routine overspeed testing regimen is recommended.

2. The plant parts inventory does not presently include any engine spares (combustion system components and turbine blades).

3. The GE combustion turbine auxiliary systems do not test the DC lube oil pumps during routine startups or shutdowns as several other turbine OEM's do. Many insurers recommend testing these pumps on a routine basis.

The following list of plant improvements have been incorporated since original construction and commissioning:

1. Constructed a storage building to house spare parts inventory.

2. Replaced all the combustion turbine lube oil pumps with an improved design.

3. Installed a K-Rail barrier to help segregate the high voltage portion of the plant site.

4. Fabricated structures for the site compressors.

5. Added priming pumps to the starting diesel fuel systems.

6. Added a package to the plant Ethernet system to allow remote start/stop/operation of the units through an emulation of the operating system.

7. New human machine interface (HMI) were configured and built to replace the original OEM furnished HMIs.

8. Updated the plant SCADA system to allow plant operation via the communication network.

9. Added an additional trip coil circuit to the generator circuit breakers to improve plant reliability.

10. Added a new voltage regulator power controller (VRPC) voltage regulation system to meet new Federal Energy Regulator Commission (FERC) requirements for voltage control and stability.

Potential Combined-Cycle Conversion

With an exhaust temperature of over 1,100 degrees F and exhaust flows in excess of 1-million pounds per hour, these Frame 6B gas turbines provide sufficient waste heat for use in heat recovery and combined-cycle applications. Simple-cycle applications such as the subject of this investigation are good candidates for combined-cycle conversion, yielding increases of approximately 50 percent in capacity with virtually no increase in fuel consumption. Without adding duct firing, the efficiency gain from a combined-cycle conversion would be on the order of 35 percent.

It is our understanding a combined-cycle conversion study was performed by Ameren in 2002. While Sega does not have access to that study, we have performed two basic modeling runs utilizing GT PRO software; one with the existing 6561B combustion turbine performance and the second with upgraded 6581B combustion turbine performance. Both models assume a single steam turbine (4x1 configuration). Thermal Performance Cycle Diagrams, System Summaries, and Water Accounting Sheets for the two scenarios have been included in Appendices A and B. Depending on combustion turbine upgrade selections, if any, approximately 81 to 88 additional MW of steam turbine generation could be added, for a total net nominal plant output of 218 to 231 MW. This assumes duct firing is not utilized for the heat recovery steam generators (HRSGs). Evaporative cooling has been added to both scenarios. Anticipated heat rate improvement would be from 11,000 BTU/kwh down to approximately 7,100 BTU/kwh (lower heating value (LVH) basis).

Considerations regarding a combined-cycle conversion center should include the following:

1. Water Supply: Approximately 1,400 gpm of makeup water would be required, primarily for cooling tower evaporation/blowdown

2. Site layout considerations would be somewhat limited. The hot-end drive configuration (generator is located at the exhaust end of the combustion turbine train) of the combustion turbines would require HRSGs to be offset from the machine centerline orientation. Available space for HRSGs and new stacks may be constrained by location of the existing GSU transformers. Veritical HRSG's could be considered if adequate real estate is not available. Frame 6B units have been fitted with vertical HRSG's in several overseas installations.

3. Steam turbine building, steam and feedwater pipe rack, and cooling tower layouts and locations would need to be carefully implemented. Additional area to the west and north of the existing site boundaries may need to be considered.

4. Air Permitting: Conversion to combine cycle typically includes a significant increase in the projected hours of operation and associated annual emission levels. As such, an air permit would be required for this conversion. We believe that the annual potential uncontrolled emissions of at least one pollutant, namely NO_x, would be in excess of 100-tons per year (tpy) and would trigger permitting of the conversion project under the Prevention of Significant Deterioration (PSD) program. Approval under the PSD program requires the application of Best Available Control Technology (BACT), the completion of a detailed ambient air quality impact analysis, and the public and USEPA review of the permitting action. The requirement with the most possible impact on the conversion project cost is the application of BACT. Application of BACT is likely to require the installation of a selective catalytic reduction (SCR) system to reduce NO_x, and an oxidation catalyst to reduce carbon monoxide (CO). Cost for this additional equipment should be included in the conversion project layout and costs. It may be possible that with the inclusion of the SCR and oxidation catalyst that the plant emissions potential could be kept less than 100 tpy and thus not trigger PSD review. Although the permitting process would be simplified as such, the cost for the equipment installation and operation would still be required since it would be required to avoid PSD review. Finally, the time required to obtain a permit which is reviewed under the PSD program is typically nine or 12 months or more, depending on the

amount of political and environmental opposition to the conversion project. If avoiding PSD review by keeping the potential emission less than 100 tpy, the permitting time could be reduced to six to eight months.

SUMMARY AND RECOMMENDATIONS

The CEC is a typical combustion turbine power plant presently configured for simple cycle peaking operation. The overall plant design is typical and adequate for a plant of this vintage and intended purpose. The overall condition of the facility and its equipment appears to be good, with the presence of a competent and professional contracted O&M staff on site. Maintenance activities appear to be consistent with accepted utility practices and operational performance of the plant compares favorably with industry averages for combustion turbine peaking plants of similar size.

Specific recommendations are as follows:

1. Obtain the combustion turbine nameplate data and the original expected unit performance information.

2. Resolve R1 compressor blade issue on all four units with the OEMs updated design. This should occur during the first scheduled major maintenance activities.

3. Continue to monitor the status of the two damaged first stage turbine blades on Unit 4. Replace at the first scheduled HGP Inspection as recommended by the OEM.

4. Consider adding appropriate combustion turbine spares to inventory such as combustion system components, turbine blades, etc., within the next several years. Discuss options with the OEM or other third-party parts suppliers. Otherwise join parts pooling arrangement with other owners, if available.

5. Consider performing thermography in conjunction with other electrical testing activities.

6. Conduct routine (annual) electronic overspeed testing of the combustion turbines.

7. Conduct routine DC lube oil pump tests on the combustion turbines.

8. Consider performing the necessary testing to allow the use of a PEMS and eliminating the CEMS systems.

9. Revisit the 75 percent minimum load operational restriction presently in place and determine if further minimum load flexibility can be allowed without violating air permit requirements.

10. Consider repairing or replacing any equipment necessary to provide black-start capability for all four units.

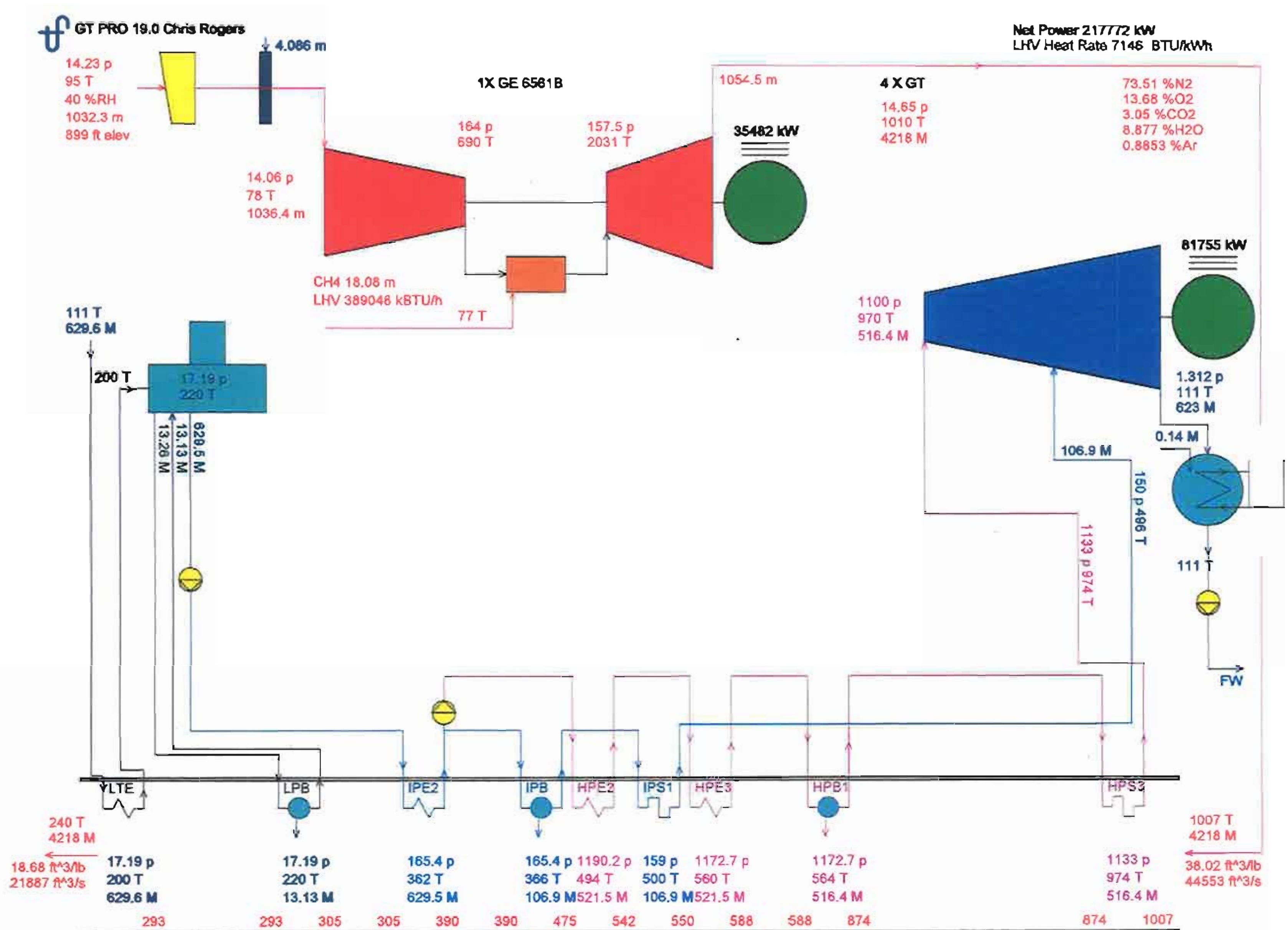
11. Test the black-start capability on one unit at least once a year.

12. Join and participate in the Frame 6B Users Group.

APPENDICES

APPENDIX A

COMBINED-CYCLE MODEL 6561 (EXISTING C/T'S) - 4X1 CONFIGURATION



p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK

Includes SCR

CEC Combined Cycle Conversion PG6561B Base Engine w/Evap Inlet & SCR

1262 12-08-2009 15:19:14 file=c:\program files\MYFILES\GTPRO.GTP

System Summary Report

GT PRO 19.0 Chris Rogers
1282 12-08-2009 15:19:14 file=c:\program files\MYFILES\GTPRO.GTP
CEC Combined Cycle Conversion
PG6561B Base Engine w/Evap Inlet & SCR
Plant Configuration: GT, HRSG, and condensing non-reheat ST
4 GE 6561B Engines, One Steam Turbine, GT PRO Type 6, Subtype 3
Steam Property Formulation: Thermoflow - STQUIK

SYSTEM SUMMARY

	Power Output kW		LHV Heat Rate BTU/kWh		Elect. Eff. LHV%	
	@ gen. term.	net	@ gen. term.	net	@ gen. term.	net
Gas Turbine(s)	141930		10965		31.12	
Steam Turbine(s)	81755					
Plant Total	223685	217772	6957	7146	49.05	47.76

PLANT EFFICIENCIES

PURPA efficiency %	CHP (Total) efficiency %	Power gen. eff. on chargeable energy, %	Canadian Class 43 Heat Rate, BTU/kWh
47.76	47.76	47.76	7720

GT fuel HHV/LHV ratio =	1.11			
DB fuel HHV/LHV ratio =	1.11			
Total plant fuel HHV heat input / LHV heat input =	1.11			
Fuel HHV chemical energy input (77F/25C) =	1726773	kBTU/hr	479659	BTU/s
Fuel LHV chemical energy input (77F/25C) =	1556193	kBTU/hr	432276	BTU/s
Total energy input (chemical LHV + ext. addn.) =	1556193	kBTU/hr	432276	BTU/s
Energy chargeable to power (93.0% LHV alt. boiler) =	1556193	kBTU/hr	432276	BTU/s

GAS TURBINE PERFORMANCE - GE 6561B

	Gross power output, kW	Gross LHV efficiency, %	Gross LHV Heat Rate BTU/kWh	Exh. flow kpph	Exh. temp. F
per unit	35482	31.12	10965	1055	1010
Total	141930			4218	

Number of gas turbine unit(s) =	4			
Gas turbine load [%] =	100	%		
Fuel chemical HHV (77F/25C) per gas turbine =	431693	kBTU/hr	119915	BTU/s
Fuel chemical LHV (77F/25C) per gas turbine =	389048	kBTU/hr	108069	BTU/s

STEAM CYCLE PERFORMANCE

HRSG eff. %	Gross power output kW	Internal gross elect. eff., %	Overall elect. eff., %	Net process heat output kBTU/hr
83.80	81755	32.68	27.39	0

Number of steam turbine unit(s) =	1			
Fuel chemical HHV (77F/25C) to duct burners =	0	kBTU/hr	0	BTU/s
Fuel chemical LHV (77F/25C) to duct burners =	0	kBTU/hr	0	BTU/s
DB fuel chemical LHV + HRSG inlet sens. heat =	1018689	kBTU/hr	282969	BTU/s
Net process heat output as % of total output =	0	%		

System Summary Report

ESTIMATED PLANT AUXILIARIES (kW)		
GT fuel compressor(s)*	0	kW
GT supercharging fan(s)*	0	kW
GT electric chiller(s)*	0	kW
GT chiller/heater water pump(s)	0	kW
HRSG feedpump(s)*	1190.2	kW
Condensate pump(s)*	46.32	kW
HRSG forced circulation pump(s)	0	kW
LTE recirculation pump(s)	0	kW
Cooling water pump(s)	873.7	kW
Air-cooled condenser fans	0	kW
Cooling tower fans	567.6	kW
HVAC	75	kW
Lights	140	kW
Aux. from PEACE running motor/load list	1292.8	kW
Miscellaneous gas turbine auxiliaries	322.7	kW
Miscellaneous steam cycle auxiliaries	174.7	kW
Miscellaneous plant auxiliaries	111.8	kW
Constant plant auxiliary load	0	kW
Gasification plant, ASU*	0	kW
Gasification plant, Coal mill	0	kW
Gasification plant, AGR*	0	kW
Gasification plant, Other/misc	0	kW
Desalination plant auxiliaries	0	kW
Program estimated overall plant auxiliaries	4795	kW
Actual (user input) overall plant auxiliaries	4795	kW
Transformer losses	1118.4	kW
Total auxiliaries & transformer losses	**5913**	**kW**
* Heat balance related auxiliaries		

System Summary Report

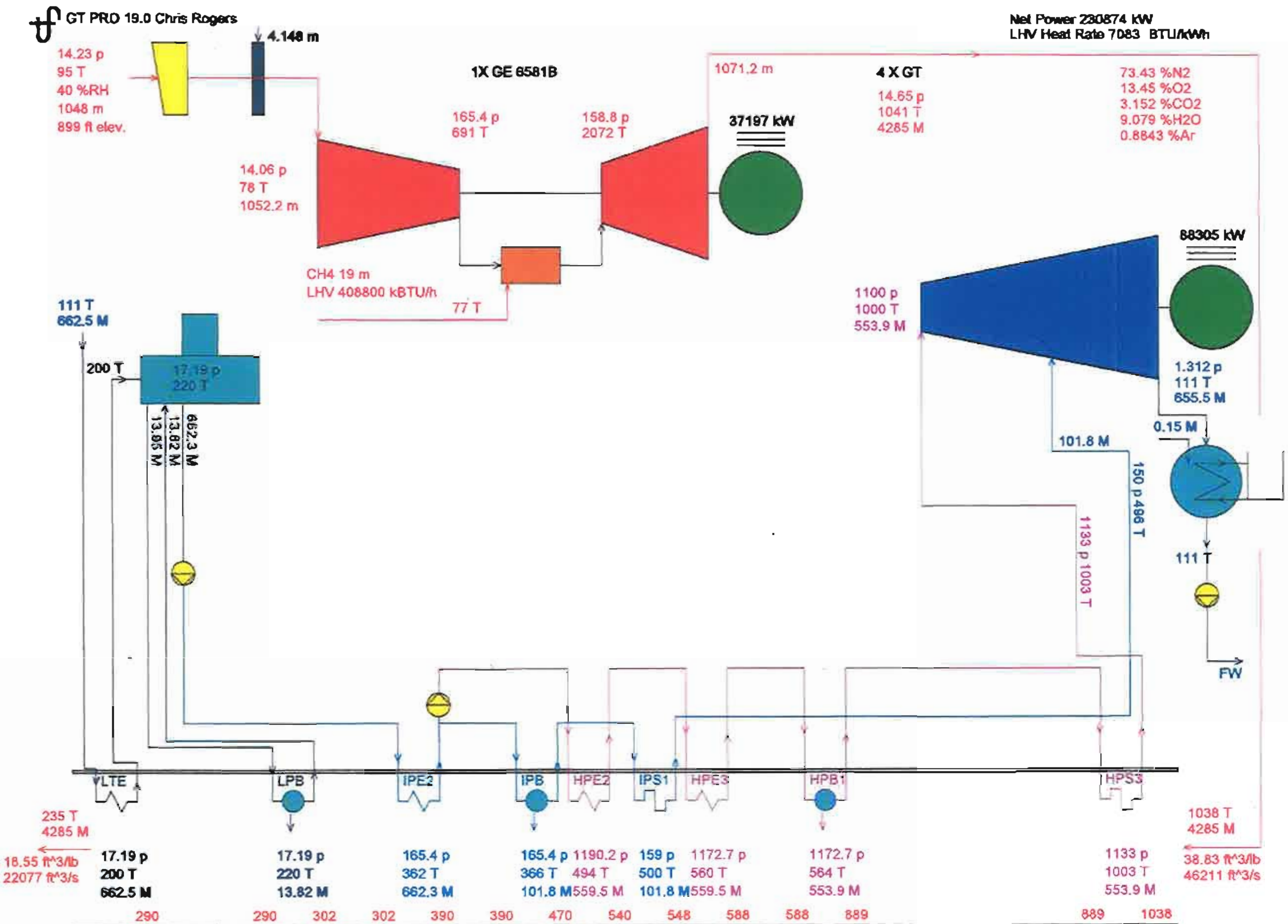
PLANT HEAT BALANCE				
Energy In	**517124**	**BTU/s**		
Ambient air sensible	17613	BTU/s		
Ambient air latent	17885	BTU/s		
Fuel enthalpy @ supply	481416	BTU/s		
External gas addition to combustor	0	BTU/s		
Steam and water	162.5	BTU/s		
Makeup and process return	48.77	BTU/s		
Energy Out	**516952**	**BTU/s**		
Net power output	206417	BTU/s		
Stack gas sensible	61718	BTU/s		
Stack gas latent	71297	BTU/s		
GT mechanical loss	1590.1	BTU/s		
GT gear box loss	2677.9	BTU/s		
GT generator loss	2831.8	BTU/s		
GT miscellaneous losses	2377.5	BTU/s		
GT ancillary heat rejected	0	BTU/s		
GT process air bleed	0	BTU/s		
Fuel compressor mech/elec loss	0	BTU/s		
Supercharging fan mech/elec loss	0	BTU/s		
Condenser	158010	BTU/s		
Process steam	0	BTU/s		
Process water	0	BTU/s		
Blowdown	959.7	BTU/s		
Heat radiated from steam cycle	3035	BTU/s		
ST/generator mech/elec/gear loss	1605.2	BTU/s		
Non-heat balance related auxiliaries	3373	BTU/s		
Transformer loss	1060.1	BTU/s		
Energy In - Energy Out	**172.3**	**BTU/s**	**0.0333**	**%**
Zero enthalpy: dry gases & liquid water @ 32 F (273.15 K)				
Gas Turbine and Steam Cycle: Energy In - Energy Out = 172.2 BTU/s				

Water Accounting

Plant Water Accounting	Current flow	% Included		
Total Water Consumption			670.5	kpph
Evaporative cooler	16.34	100	16.34	kpph
Fogger	0	100	0	kpph
External water to GT injection	0	100	0	kpph
Steam cycle makeup	6.453	100	6.453	kpph
Cooling tower makeup	647.7	100	647.7	kpph
Wet air-cooled condenser makeup	0	100	0	kpph
Total HRSG water addition	0	0	0	kpph
Condensate addition	0	0	0	kpph
Addition before LTE (FW Tank)	0	0	0	kpph
Addition at deaerator	0	0	0	kpph
Auxiliary cooling tower makeup	0	100	0	kpph
LMS100 cooling tower makeup	0	100	0	kpph
Total Water Discharge			135.9	kpph
HRSG blowdown	6.364	100	6.364	kpph
Cooling tower blowdown	129.5	100	129.5	kpph
Wet air-cooled condenser blowdown	0	100	0	kpph
Total HRSG water bleed	0	100	0	kpph
Deaerator bleed	0	100	0	kpph
IPE bleed	0	100	0	kpph
HPE bleed	0	100	0	kpph
Condensate bleed	0	100	0	kpph
Bleed before LTE (FW Tank)	0	100	0	kpph
Water condensed from GT inlet chilling	0	100	0	kpph
Auxiliary cooling tower blowdown	0	100	0	kpph
LMS100 cooling tower blowdown	0	100	0	kpph

APPENDIX B

COMBINED-CYCLE MODEL 6581B (UPGRADED C/T'S) - 4X1 CONFIGURATION



p[psia], T[F], M[kpph], Steam Properties: Thermoflow - STQUIK

Includes SCR

CEC Combined Cycle Conversion PG6581B Engine w/Evap Inlet & SCR

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System Summary Report

GT PRO 19.0 Chris Rogers
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CEC Combined Cycle Conversion
PG6581B Engine w/Evap Inlet & SCR
Plant Configuration: GT, HRSG, and condensing non-reheat ST
4 GE 6581B Engines, One Steam Turbine, GT PRO Type 6, Subtype 3
Steam Property Formulation: Thermoflow - STQUIK

SYSTEM SUMMARY

	Power Output kW		LHV Heat Rate BTU/kWh		Elect. Eff. LHV%	
	@ gen. term.	net	@ gen. term.	net	@ gen. term.	net
Gas Turbine(s)	148788		10990		31.05	
Steam Turbine(s)	88305					
Plant Total	237093	230874	6897	7083	49.48	48.18

PLANT EFFICIENCIES

PURPA efficiency %	CHP (Total) efficiency %	Power gen. eff. on chargeable energy, %	Canadian Class 43 Heat Rate, BTU/kWh
48.18	48.18	48.18	7653

GT fuel HHV/LHV ratio =	1.11			
DB fuel HHV/LHV ratio =	1.11			
Total plant fuel HHV heat input / LHV heat input =	1.11			
Fuel HHV chemical energy input (77F/25C) =	1814439	kBTU/hr	504011	BTU/s
Fuel LHV chemical energy input (77F/25C) =	1635199	kBTU/hr	454222	BTU/s
Total energy input (chemical LHV + ext. addn.) =	1635199	kBTU/hr	454222	BTU/s
Energy chargeable to power (93.0% LHV alt. boiler) =	1635199	kBTU/hr	454222	BTU/s

GAS TURBINE PERFORMANCE - GE 6581B

	Gross power output, kW	Gross LHV efficiency, %	Gross LHV Heat Rate BTU/kWh	Exh. flow kpph	Exh. temp. F
per unit	37197	31.05	10990	1071	1041
Total	148788			4285	

Number of gas turbine unit(s) =	4			
Gas turbine load [%] =	100	%		
Fuel chemical HHV (77F/25C) per gas turbine =	453610	kBTU/hr	126003	BTU/s
Fuel chemical LHV (77F/25C) per gas turbine =	408800	kBTU/hr	113556	BTU/s

STEAM CYCLE PERFORMANCE

HRSG eff. %	Gross power output kW	Internal gross elect. eff., %	Overall elect. eff., %	Net process heat output kBTU/hr
84.85	88305	33.12	28.10	0

Number of steam turbine unit(s) =	1			
Fuel chemical HHV (77F/25C) to duct burners =	0	kBTU/hr	0	BTU/s
Fuel chemical LHV (77F/25C) to duct burners =	0	kBTU/hr	0	BTU/s
DB fuel chemical LHV + HRSG inlet sens. heat =	1072380	kBTU/hr	297883	BTU/s
Net process heat output as % of total output =	0	%		

System Summary Report

ESTIMATED PLANT AUXILIARIES (kW)		
GT fuel compressor(s)*	0	kW
GT supercharging fan(s)*	0	kW
GT electric chiller(s)*	0	kW
GT chiller/heater water pump(s)	0	kW
HRSG feedpump(s)*	1271.1	kW
Condensate pump(s)*	48.7	kW
HRSG forced circulation pump(s)	0	kW
LTE recirculation pump(s)	0	kW
Cooling water pump(s)	932	kW
Air-cooled condenser fans	0	kW
Cooling tower fans	601	kW
HVAC	75	kW
Lights	150	kW
Aux. from PEACE running motor/load list	1312.2	kW
Miscellaneous gas turbine auxiliaries	336.8	kW
Miscellaneous steam cycle auxiliaries	188.7	kW
Miscellaneous plant auxiliaries	118.5	kW
Constant plant auxiliary load	0	kW
Gasification plant, ASU*	0	kW
Gasification plant, Coal mill	0	kW
Gasification plant, AGR*	0	kW
Gasification plant, Other/misc	0	kW
Desalination plant auxiliaries	0	kW
Program estimated overall plant auxiliaries	5034	kW
Actual (user input) overall plant auxiliaries	5034	kW
Transformer losses	1185.5	kW
Total auxiliaries & transformer losses	**6220**	**kW**
* Heat balance related auxiliaries		

System Summary Report

PLANT HEAT BALANCE			
Energy In	**542110**	**BTU/s**	
Ambient air sensible	17880	BTU/s	
Ambient air latent	18156	BTU/s	
Fuel enthalpy @ supply	505857	BTU/s	
External gas addition to combustor	0	BTU/s	
Steam and water	165	BTU/s	
Makeup and process return	51.29	BTU/s	
Energy Out	**541935**	**BTU/s**	
Net power output	218836	BTU/s	
Stack gas sensible	61181	BTU/s	
Stack gas latent	74107	BTU/s	
GT mechanical loss	1660.1	BTU/s	
GT gear box loss	2795.6	BTU/s	
GT generator loss	2964.7	BTU/s	
GT miscellaneous losses	2498.2	BTU/s	
GT ancillary heat rejected	0	BTU/s	
GT process air bleed	0	BTU/s	
Fuel compressor mech/elec loss	0	BTU/s	
Supercharging fan mech/elec loss	0	BTU/s	
Condenser	167335	BTU/s	
Process steam	0	BTU/s	
Process water	0	BTU/s	
Blowdown	1015.9	BTU/s	
Heat radiated from steam cycle	3187	BTU/s	
ST/generator mech/elec/gear loss	1709.7	BTU/s	
Non-heat balance related auxiliaries	3521	BTU/s	
Transformer loss	1123.7	BTU/s	
Energy In - Energy Out	**174.6**	**BTU/s**	**0.0322 %**
Zero enthalpy: dry gases & liquid water @ 32 F (273.15 K)			
Gas Turbine and Steam Cycle: Energy In - Energy Out = 174.5 BTU/s			

Water Accounting

Plant Water Accounting	Current flow	% Included		
Total Water Consumption			709.3	kpph
Evaporative cooler	16.59	100	16.59	kpph
Fogger	0	100	0	kpph
External water to GT injection	0	100	0	kpph
Steam cycle makeup	6.787	100	6.787	kpph
Cooling tower makeup	685.9	100	685.9	kpph
Wet air-cooled condenser makeup	0	100	0	kpph
Total HRSG water addition	0	0	0	kpph
Condensate addition	0	0	0	kpph
Addition before LTE (FW Tank)	0	0	0	kpph
Addition at deaerator	0	0	0	kpph
Auxiliary cooling tower makeup	0	100	0	kpph
LMS100 cooling tower makeup	0	100	0	kpph
Total Water Discharge			143.9	kpph
HRSG blowdown	6.696	100	6.696	kpph
Cooling tower blowdown	137.2	100	137.2	kpph
Wet air-cooled condenser blowdown	0	100	0	kpph
Total HRSG water bleed	0	100	0	kpph
Deaerator bleed	0	100	0	kpph
IPE bleed	0	100	0	kpph
HPE bleed	0	100	0	kpph
Condensate bleed	0	100	0	kpph
Bleed before LTE (FW Tank)	0	100	0	kpph
Water condensed from GT inlet chilling	0	100	0	kpph
Auxiliary cooling tower blowdown	0	100	0	kpph
LMS100 cooling tower blowdown	0	100	0	kpph

Columbia GT-1 Borescope Inspection Report, Advanced Turbine Support, LLC – March 28, 2016

ADVANCED TURBINE SUPPORT, LLC Professional Inspection Services

Borescope Inspection Report

Columbia Water and Light
Columbia GT-1
March 28, 2016

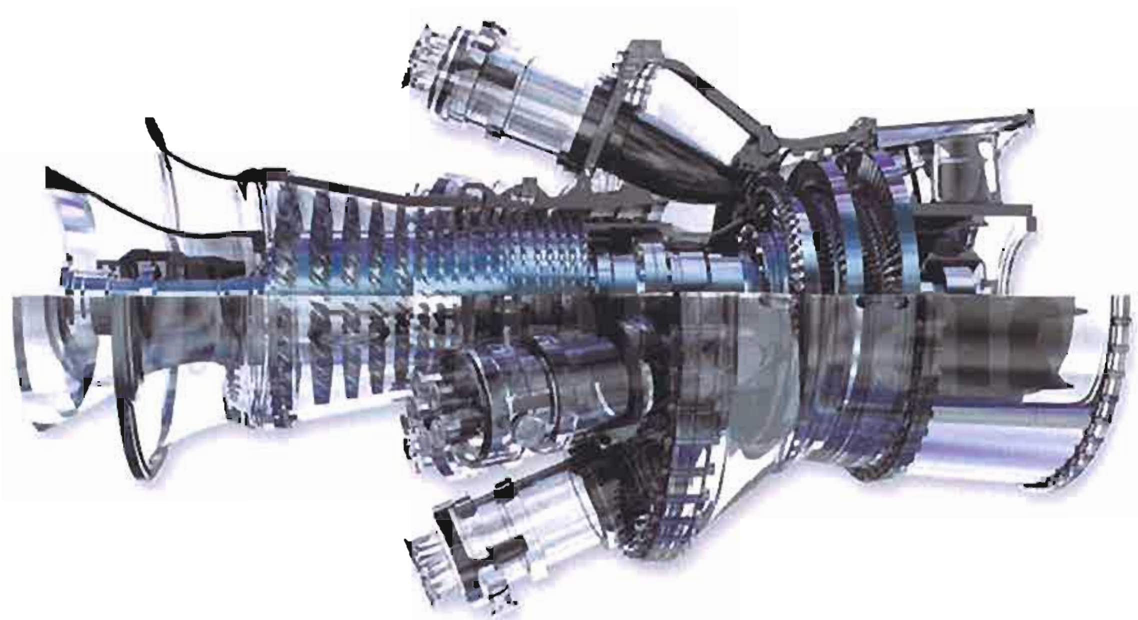

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Table of Contents

Documentation & Photographs

This report describes and documents the March 28th, 2016 borescope examination of the General Electric Frame MS6001B combustion turbine. The documentation is presented in text, table and photographic format. Due to the representative nature of borescope inspections, there may be a 10% plus or minus variable from what is listed in the "Percent of Component Inspected" section of the tables.

The photographs included in this report were selected from the inspection to best represent the condition of the unit. Selected photographs that show problem areas and typical views of the components observed are included as part of this report for documentation and comparison during future examinations.

Magnification of the distal tip lens may make objects appear larger. A surface that is actually straight or true may appear slightly wavy or curved in a photograph. Due to the possibility of optical distortion, someone familiar with borescope photography should be involved in the final engineering review of this report.

Purpose

The purpose of this borescope examination was to look for conditions considered to be abnormal to the unit and to gather trending data for future inspections.

Notes

The data plate has been removed from the unit.

Inspection Details

Utility	Inspector	Inspection Date		Serial Number
Columbia Water & Light	Mike Sladek	March 28, 2016		810350
Site / Unit No.	**Manufacturer**			**Model**
Columbia GT-1	General Electric			MS6001B
Type of Fuel	**Inspection Type**			**Site Contact**
Natural Gas	Borescope Inspection			John Gerke
Total Fired Hours	**Manual Starts**	**Total Starts**	**Fired Starts**	**Unit Trips**
1209.2	242	254	233	17

Inspection Areas

Inlet Area	Compressor Section
General	**Stages 1-17**
Inspected	1-14, 17
Combustion Section	**Turbine Section**
1-10	**Stages 1-3**
1-10	1-3

Applicable TILs

TIL	Description	Full/Limited/None
1067-R3	**2nd Stage Bucket Tip Deflection**	Limited

Unit rotated for this inspection	No

Urgent Findings

1. There is evidence of impact damage to the trailing edge of the stage R-17 rotor blades.
2. There is evidence of seventeen (17) liberated stage S-17 stator vanes from the 3 to 6 o' clock position.
3. There is evidence of seven (7) liberated EGV 1 from the 3 to 6 o' clock position.
4. There is evidence of four (4) liberated EGV 2 from the 3 to 6 o' clock position.
5. There are four (4) liberated vanes wedged between the stage S-17 stator vanes and EGV 2.

Observations

Inlet Section

General
No defects identified

Compressor Section

Stage	Condition	Access Point	Percent of Component Inspected
IGV	No defects identified	Inlet Bellmouth	100%
R1	No defects identified	Inlet Bellmouth	100%
S1	No defects identified	Inlet Bellmouth	100%
R2	No defects identified	Inlet Bellmouth	75%
S2	No defects identified	Inlet Bellmouth	70%
R3	Tip discoloration	Inlet Bellmouth	70%
S3	No defects identified	Inlet Bellmouth	50%
R4	No defects identified	Inlet Bellmouth	50%
S4	No defects identified	Inlet Bellmouth	35%
R5	Tip discoloration	Inlet Bellmouth	50%
S5	No defects identified	Inlet Bellmouth	35%
R6	No defects identified	Inlet Bellmouth	40%
R6	No defects identified	Inlet Bellmouth	40%
S6	No defects identified	Inlet Bellmouth	35%
R7	No defects identified	Inlet Bellmouth	35%
S7	No defects identified	Inlet Bellmouth	35%

Stage	Condition	Access Point	Percent of Component Inspected
R8	No defects identified	Inlet Bellmouth	35%
S8	No defects identified	Inlet Bellmouth	35%
R9	No defects identified	Inlet Bellmouth	35%
S9	No defects identified	Inlet Bellmouth	35%
R10	No defects identified	Inlet Bellmouth	35%
S10	No defects identified	Inlet Bellmouth	35%
R11	No defects identified	Inlet Bellmouth	50%
S11	No defects identified	Inlet Bellmouth	35%
R12	No defects identified	Inlet Bellmouth	35%
S12	No defects identified	Inlet Bellmouth	35%
R13	No defects identified	Inlet Bellmouth	35%
S13	No defects identified	Inlet Bellmouth	35%
R14	No defects identified	Inlet Bellmouth	35%
S14	No defects identified	Inlet Bellmouth	35%
R15	No available access	N/A	0%
S15	No available access	N/A	0%
R16	No available access	N/A	0%
S16	No available access	N/A	0%
R17	Trailing edge impact damage	Borescope Plug	90%
S17	Liberated vanes from the 3 to 6 o' clock position (17), Liberated vanes still in the unit between S17 and EGV 2(4)	Borescope Plug	75%
EGV1	Liberated vanes from the 3 to 6 o' clock position (7)	Borescope Plug	50%
EGV2	Liberated vanes from the 3 to 6 o' clock position (4)	Borescope Plug	50%

Combustion Section

Hot Side Hardware	
Can	**Condition**
1	No defects identified
2	No defects identified
3	No defects identified
4	No defects identified
5	No defects identified
6	No defects identified
7	No defects identified
8	No defects identified
9	No defects identified
10	No defects identified

Turbine Section

Stage 1 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
90%	75%
Condition	
No defects identified	

Stage 1 Buckets

Percent of Component Inspected			
LE Platform	**LE Tip**	**TE Platform**	**TE Tip**
75%	75%	75%	75%
Condition			
Tip discoloration			

Stage 1 Shroud Blocks

Percent of Component Inspected	75%
Condition	Rub marks at 6 o'clock

Turbine Section

Stage 2 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 2 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	75%
Condition	
No defects identified	

Stage 2 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 3 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 3 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	50%
Condition	
No defects identified	

Stage 3 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Exhaust Section

Exhaust Section	
Component	**Condition**
Strut Heat Shield	No Available Access
Inner Barrel	No Available Access
Outer Barrel	No Available Access
Diffuser	No defects identified

Recommendations

1. Do not operate the unit until engineering dispositions the Urgent Findings.
2. Borescope the unit on an annual interval to monitor the conditions identified during this inspection.

Limitation of Liability

A borescope inspection is intended to provide a representative sample of the unit condition. While every attempt will be made to identify all items considered to be abnormal, items may be missed that could cause future damage. The measurements included in this report are limited to visible surfaces only, these measurements could therefore differ from actual measurements taken after the unit is disassembled and additional surfaces are exposed. In no event shall Advanced Turbine Support, LLC be liable for compensatory, consequential, incidental, special, punitive or other damages whether the claim for damages is based on contract, tort, or otherwise. Advanced Turbine Support, LLC limits its liability to the value of this contract.

Photographs

Compressor Section

Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

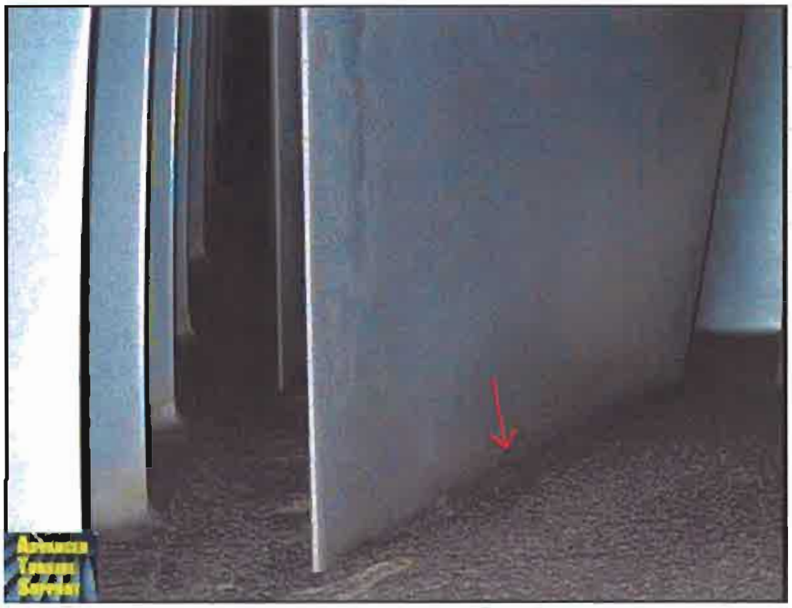
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

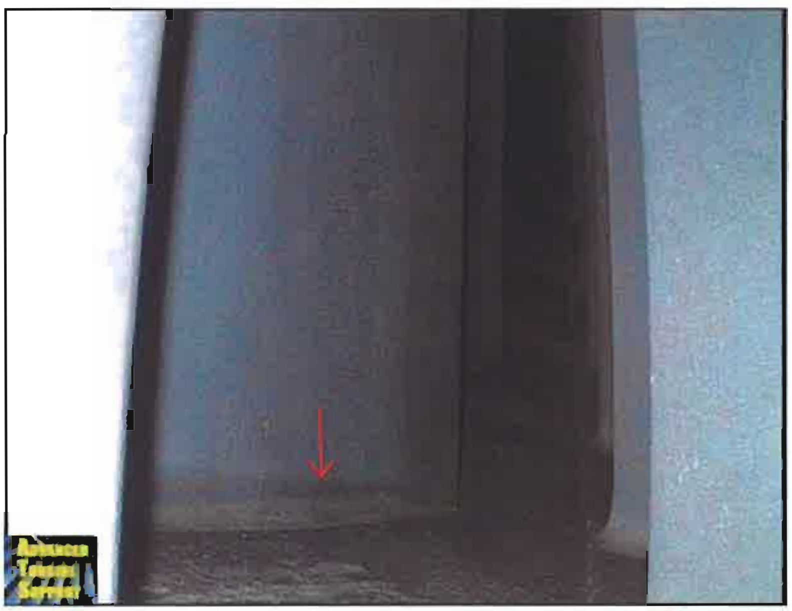
Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration



Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

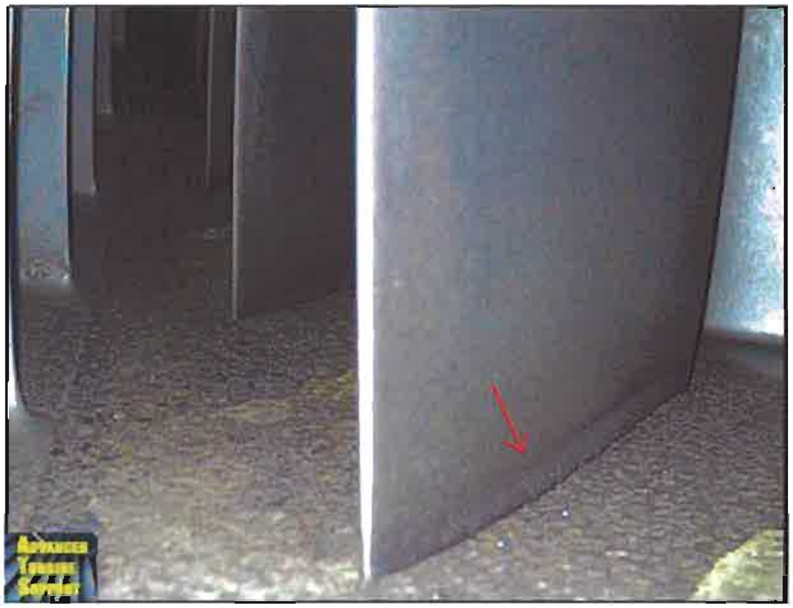
Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	3 o' clock position

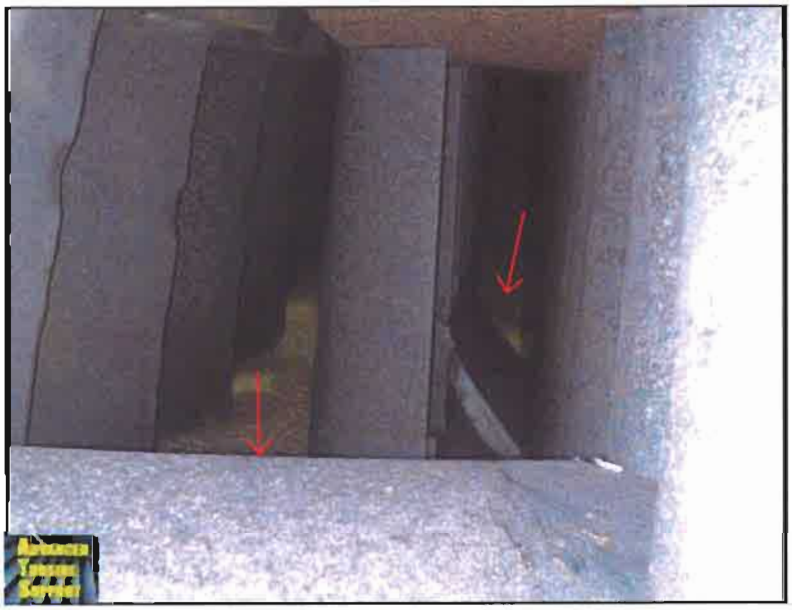
Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	3 o' clock position

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

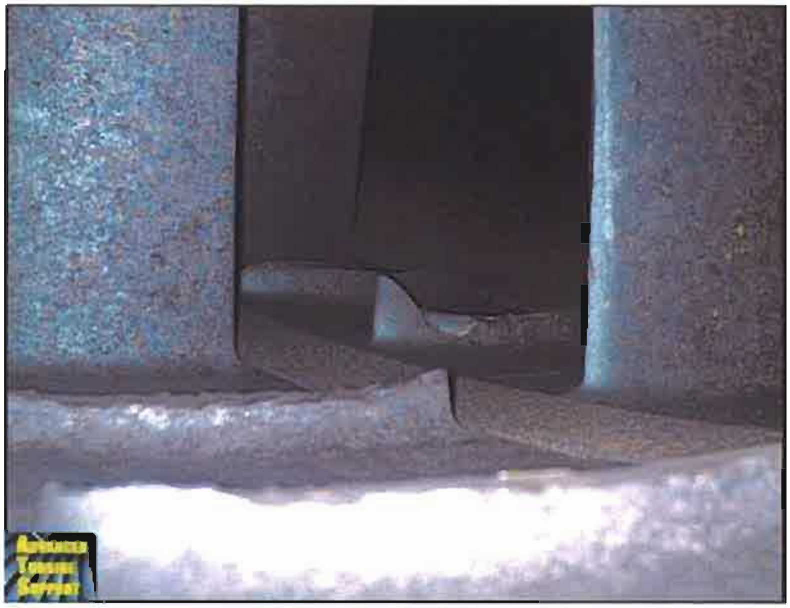
Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	



Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Trailing Edge
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge
Observation	Typical
Comments	12 o' clock position



Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Dovetail Right Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Dovetail Left Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Leading Edge Pressure Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Liberated Vane
Comments	

Combustion Section

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 7
Observation	Typical
Comments	

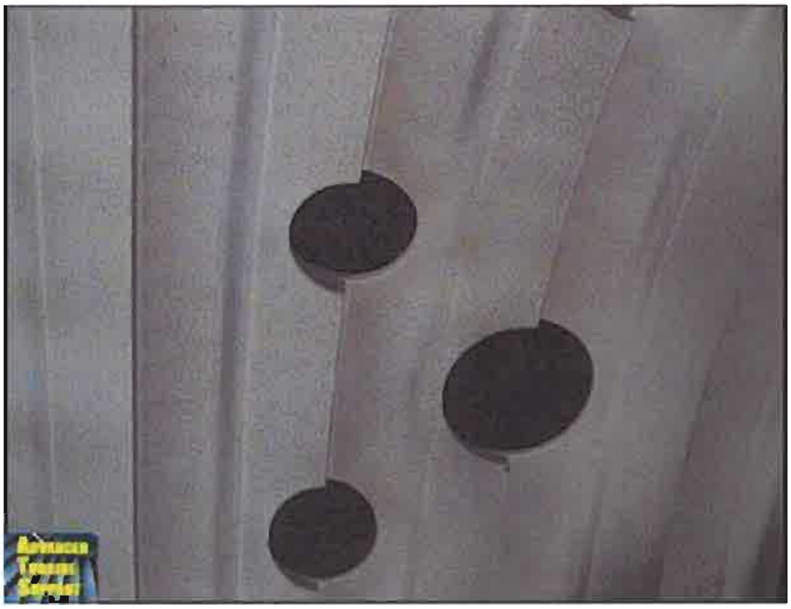
Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 7
Observation	Typical
Comments	



Section	Combustion Hot Side
Component	Liner
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Right Side Picture Frame
Location	TP 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Left Side Picture Frame
Location	TP 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 8
Observation	Typical
Comments	

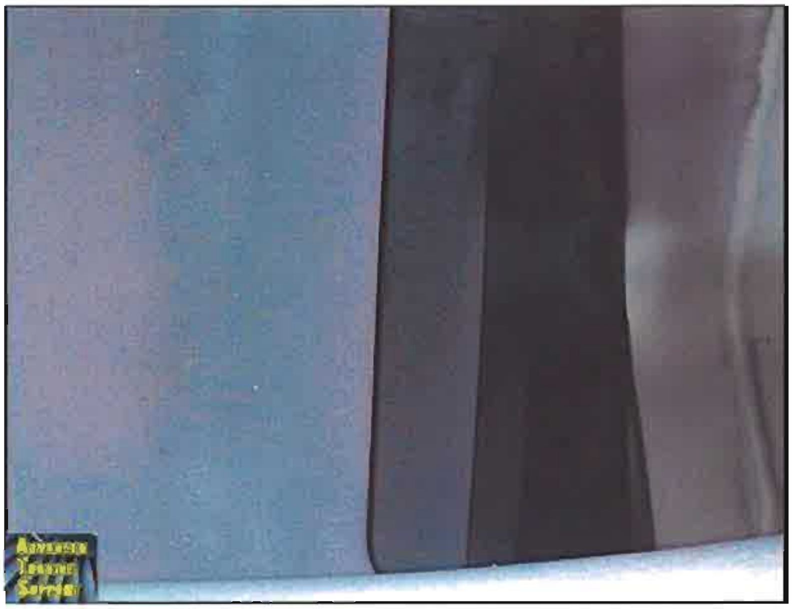
Section	Combustion Hot Side
Component	Floating Seal
Location	TP 6
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Floating Seal
Location	TP 7
Observation	Typical
Comments	

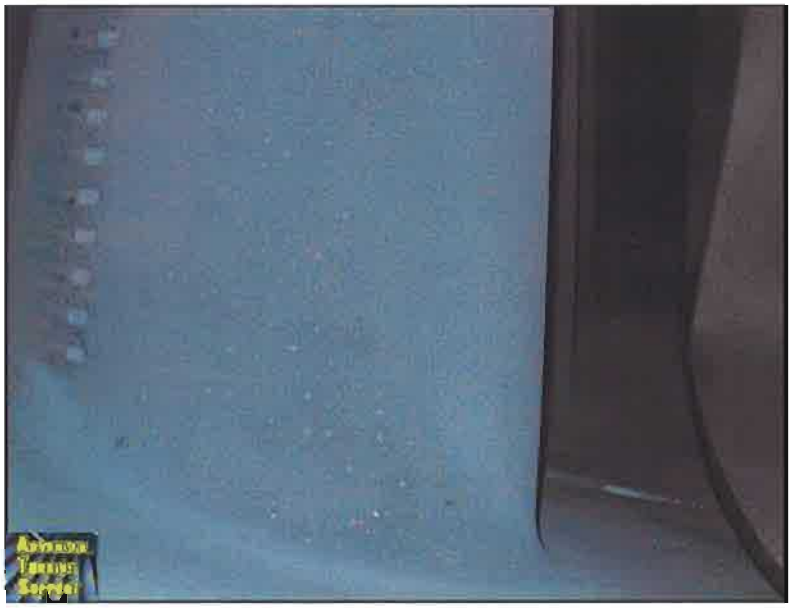
Turbine Section

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

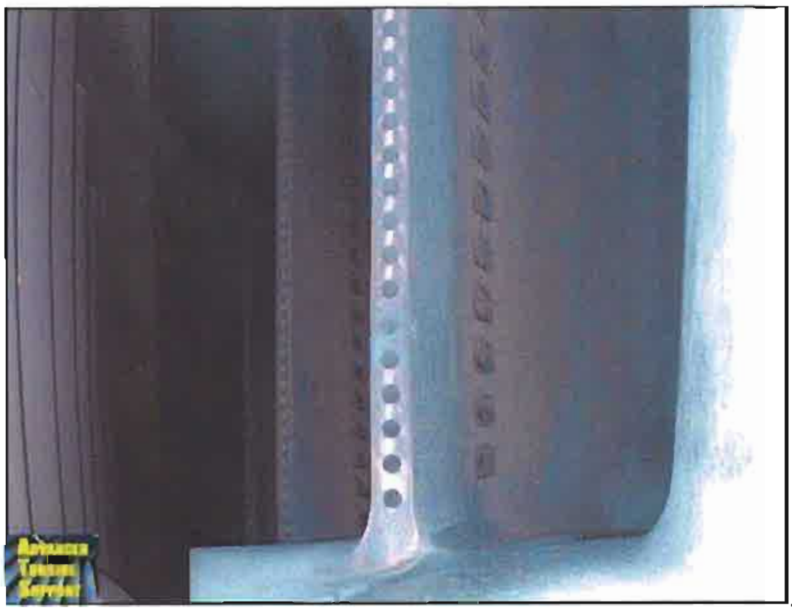


Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

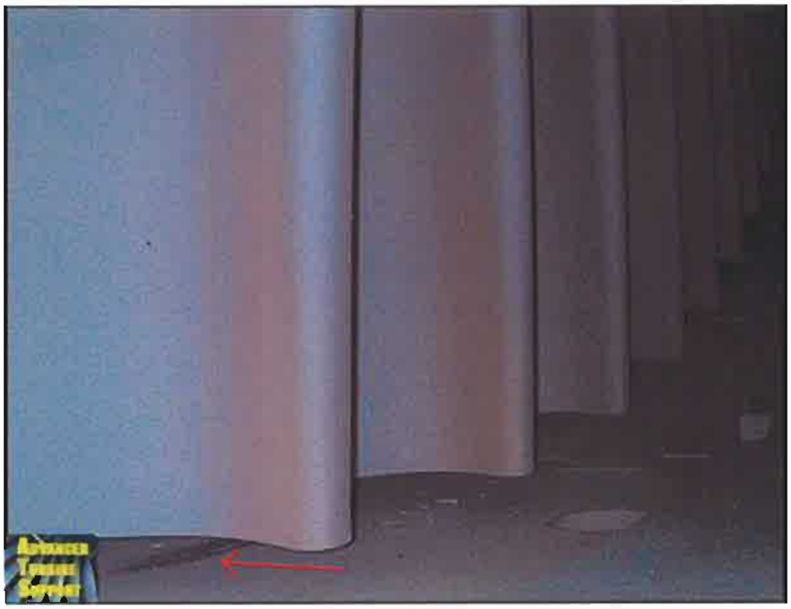
Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

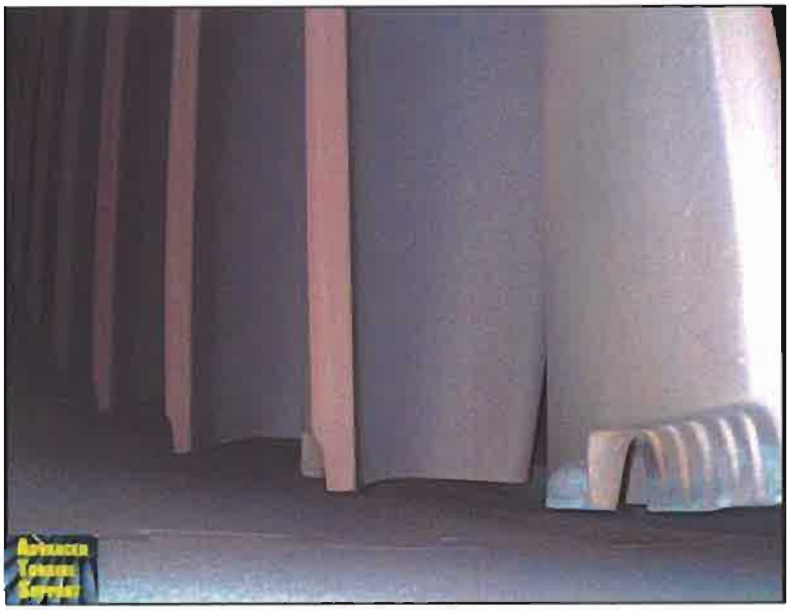


Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Rub Marks
Comments	6 o' clock position

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Suction Side
Observation	Tip Discoloration
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	

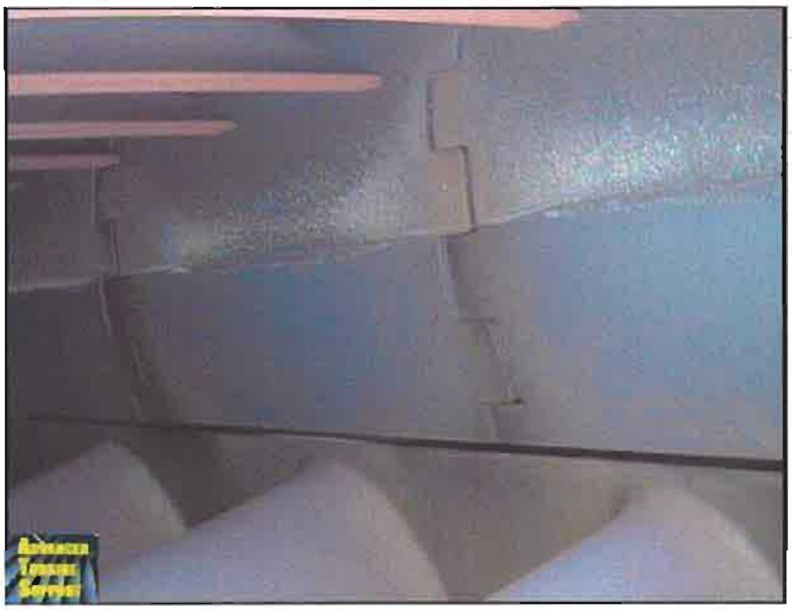
Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Suction Side
Observation	Rub Marks
Comments	6 o' clock position

Section	Turbine Stage 1
Component	Bucket
Location	Shroud Block
	Trailing Edge
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Shroud Block
	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Pressure Side
Observation	Deposits
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

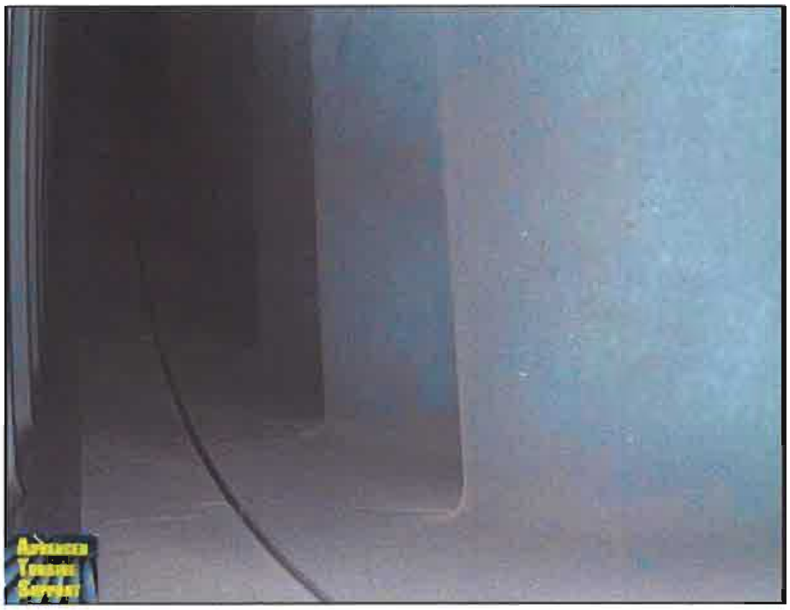
Section	Turbine Stage 2
Component	Bucket
Location	Honeycomb Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

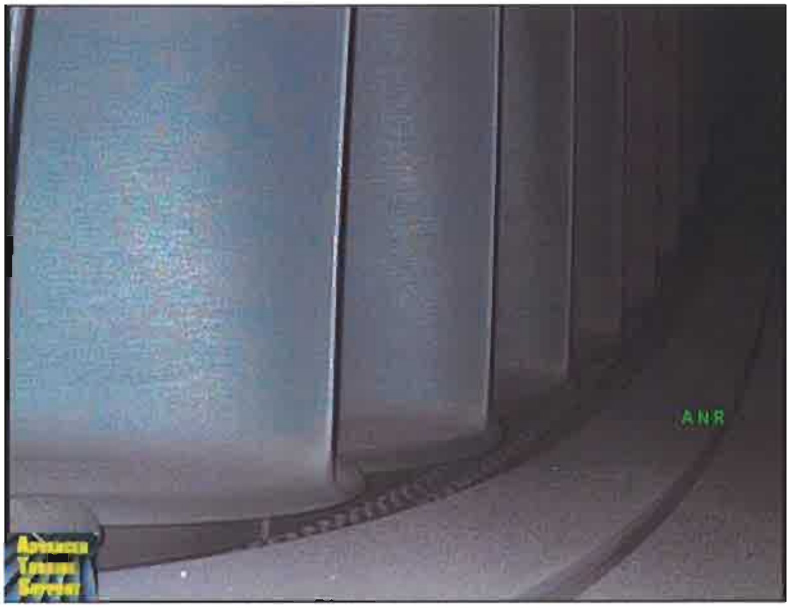
Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	



Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	



Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge Tip Shroud
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge Tip Shroud
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Exhaust Section

Section	Exhaust
Component	Diffuser
Observation	Typical
Comments	

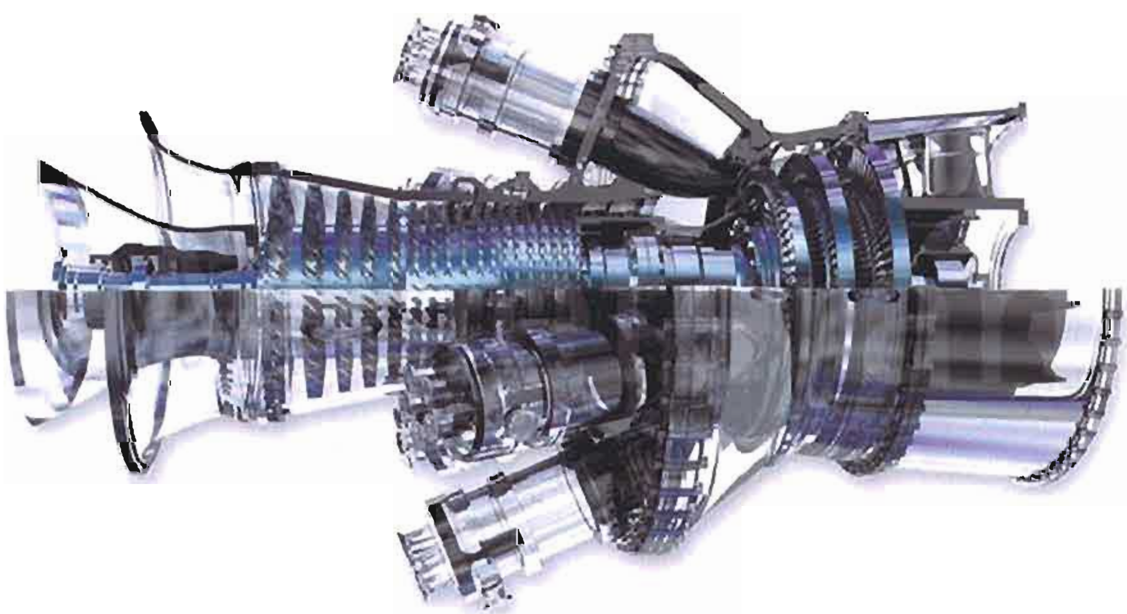
Section	Exhaust
Component	Diffuser
Observation	Typical
Comments	

Columbia GT-2 Borescope Inspection Report, Advanced Turbine Support, LLC – March 29, 2016

ADVANCED TURBINE SUPPORT, LLC Professional Inspection Services

Borescope Inspection Report

Columbia Water & Light
Columbia GT-2
March 29, 2016



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Gainesville, FL 32608
352-332-4061
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Table of Contents

Documentation & Photographs

This report describes and documents the March 29th, 2016 borescope examination of the General Electric Frame MS6001B combustion turbine. The documentation is presented in text, table and photographic format. Due to the representative nature of borescope inspections, there may be a 10% plus or minus variable from what is listed in the "Percent of Component Inspected" section of the tables.

The photographs included in this report were selected from the inspection to best represent the condition of the unit. Selected photographs that show problem areas and typical views of the components observed are included as part of this report for documentation and comparison during future examinations.

Magnification of the distal tip lens may make objects appear larger. A surface that is actually straight or true may appear slightly wavy or curved in a photograph. Due to the possibility of optical distortion, someone familiar with borescope photography should be involved in the final engineering review of this report.

Purpose

The purpose of this borescope examination was to look for conditions considered to be abnormal to the unit and to gather trending data for future inspections.

Notes

The data plate has been removed from the unit.

A 360 degree inspection was performed on the first stage bucket tips.

Inspection Details

Utility	Inspector		Inspection Date	Serial Number
Columbia Water & Light	Mike Sladek		March 29, 2016	810349
Site / Unit No.	**Manufacturer**			**Model**
Columbia GT-2	General Electric			MS6001B
Type of Fuel	**Inspection Type**			**Site Contact**
Natural Gas	Borescope Inspection			John Gerek
Total Fired Hours	**Manual Starts**	**Total Starts**	**Fired Starts**	**Unit Trips**
1077	241	251	235	17

Inspection Areas

Inlet Area	Compressor Section
General	**Stages 1-17**
Inspected	1-14, 17
Combustion Section	**Turbine Section**
1-10	**Stages 1-3**
1-10	1-3

Applicable TILs

TIL	Description	Full/Limited/None
1067-R3	**2nd Stage Bucket Tip Deflection**	Limited

Unit rotated for this inspection	Yes

Urgent Findings

1. There is evidence of clashing damage to the leading edge tips of (7) stage S-1 stator vanes from the 6 to 7 o' clock position.
2. There is evidence of trailing edge impact damage to the stage R-17 rotor blades.
3. There is evidence of fourteen (14) liberated S-17 stator vanes from the 3 to 9 o' clock position.
4. There is evidence of four (4) liberated EGV 1 vanes from the 3 to 6 o' clock position
5. There is evidence of two (2) liberated EGV 2 vanes near the 3 o' clock position.
6. There is evidence of impact damage and missing material from the leading edge tips of (12) first stage buckets.

Observations

Inlet Section

General
No defects identified

Compressor Section

Stage	Condition	Access Point	Percent of Component Inspected
IGV	No defects identified	Inlet Bellmouth	100%
R1	Tip discoloration, Rolled metal at the tips, Trailing edge platform clashing damage	Inlet Bellmouth	100%
S1	Clashing damage (7) from the 6 to 7 o' clock position, Photographs and measurements included below	Inlet Bellmouth	100%
R2	Tip discoloration, Rolled metal at the tips	Inlet Bellmouth	75%
S2	No defects identified	Inlet Bellmouth	70%
R3	Tip discoloration	Inlet Bellmouth	70%
S3	No defects identified	Inlet Bellmouth	50%
R4	Tip discoloration	Inlet Bellmouth	50%
S4	No defects identified	Inlet Bellmouth	35%
R5	No defects identified	Inlet Bellmouth	50%
S5	No defects identified	Inlet Bellmouth	35%
R6	No defects identified	Inlet Bellmouth	40%
R6	No defects identified	Inlet Bellmouth	40%
S6	No defects identified	Inlet Bellmouth	35%
R7	No defects identified	Inlet Bellmouth	35%
S7	No defects identified	Inlet Bellmouth	35%

Stage	Condition	Access Point	Percent of Component Inspected
R8	No defects identified	Inlet Bellmouth	35%
S8	No defects identified	Inlet Bellmouth	35%
R9	No defects identified	Inlet Bellmouth	35%
S9	No defects identified	Inlet Bellmouth	35%
R10	Minor leading edge impact damage	Inlet Bellmouth	35%
S10	No defects identified	Inlet Bellmouth	35%
R11	No defects identified	Inlet Bellmouth	50%
S11	No defects identified	Inlet Bellmouth	35%
R12	Minor leading edge impact damage	Inlet Bellmouth	35%
S12	No defects identified	Inlet Bellmouth	35%
R13	Minor leading edge impact damage	Inlet Bellmouth	35%
S13	No defects identified	Inlet Bellmouth	35%
R14	No defects identified	Inlet Bellmouth	35%
S14	No defects identified	Inlet Bellmouth	35%
R15	No available access	N/A	0%
S15	No available access	N/A	0%
R16	No available access	N/A	0%
S16	No available access	N/A	0%
R17	Trailing edge impact damage	Borescope Plug	90%
S17	Liberated vanes from the 3 to 9 o' clock position (14)	Borescope Plug	75%
EGV1	Liberated vanes from the 3 to 6 o' clock position (4)	Borescope Plug	50%
EGV2	Liberated vanes from the 3 o' clock position (2)	Borescope Plug	50%

Combustion Section

Hot Side Hardware	
Can	**Condition**
1	No defects identified
2	No defects identified
3	No defects identified
4	No defects identified
5	No defects identified
6	No defects identified
7	No defects identified
8	No defects identified
9	No defects identified
10	No defects identified

Turbine Section

Stage 1 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
90%	75%
Condition	
No defects identified	

Stage 1 Buckets

Percent of Component Inspected			
LE Platform	**LE Tip**	**TE Platform**	**TE Tip**
75%	100%	75%	75%
Condition			
Impact damage and missing material from (12) leading edge tips, Photographs and measurements included below			

Stage 1 Shroud Blocks

Percent of Component Inspected	75%
Condition	Rub marks at 6 o'clock

Turbine Section

Stage 2 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 2 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	75%
Condition	
No defects identified	

Stage 2 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 3 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 3 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	50%
Condition	
No defects identified	

Stage 3 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Exhaust Section

Exhaust Section	
Component	**Condition**
Strut Heat Shield	No available access
Inner Barrel	No available access
Outer Barrel	No available access
Diffuser	No available access

Recommendations

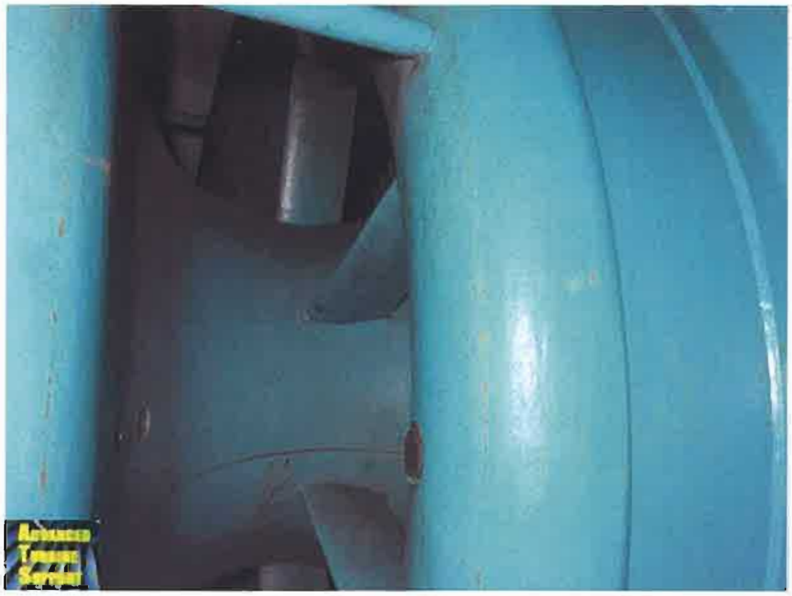
1. Do not operate the unit until engineering dispositions the Urgent Findings.
2. Borescope the unit on an annual interval to monitor the conditions identified during this inspection.

Limitation of Liability

A borescope inspection is intended to provide a representative sample of the unit condition. While every attempt will be made to identify all items considered to be abnormal, items may be missed that could cause future damage. The measurements included in this report are limited to visible surfaces only, these measurements could therefore differ from actual measurements taken after the unit is disassembled and additional surfaces are exposed. In no event shall Advanced Turbine Support, LLC be liable for compensatory, consequential, incidental, special, punitive or other damages whether the claim for damages is based on contract, tort, or otherwise. Advanced Turbine Support, LLC limits its liability to the value of this contract.

Photographs

Compressor Section



Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

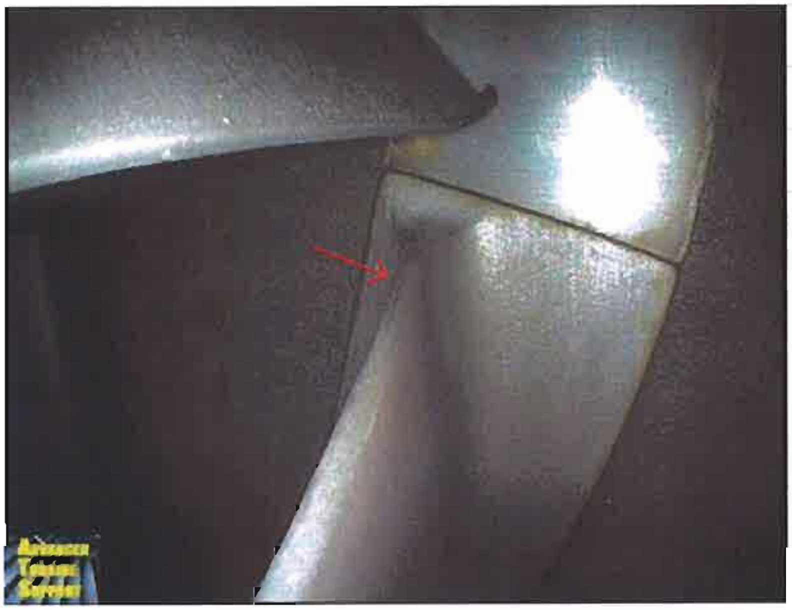
Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Tip
Observation	Rolled Metal
Comments	

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Tip
Observation	Rolled Metal
Comments	

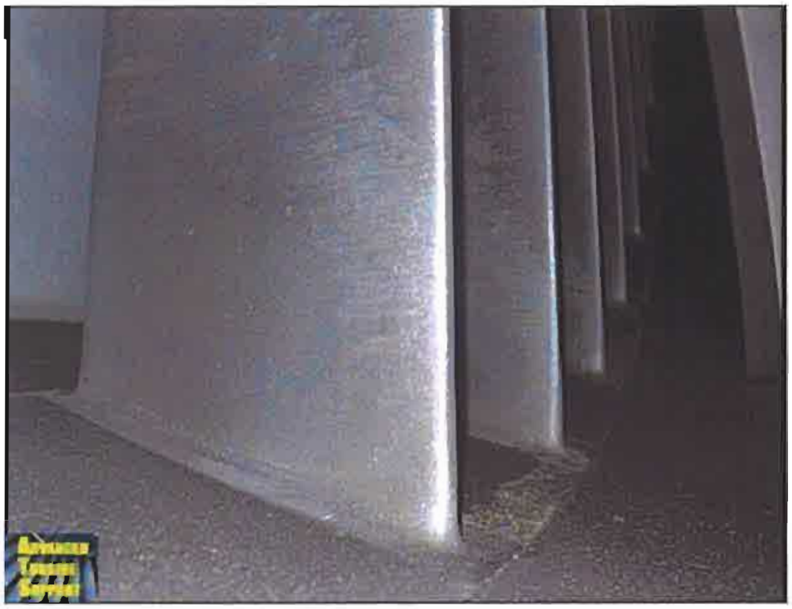


Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation Comments	Clashing Damage

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation Comments	Clashing Damage

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation	Clashing Damage
Comments	

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation	Clashing Damage
Comments	



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

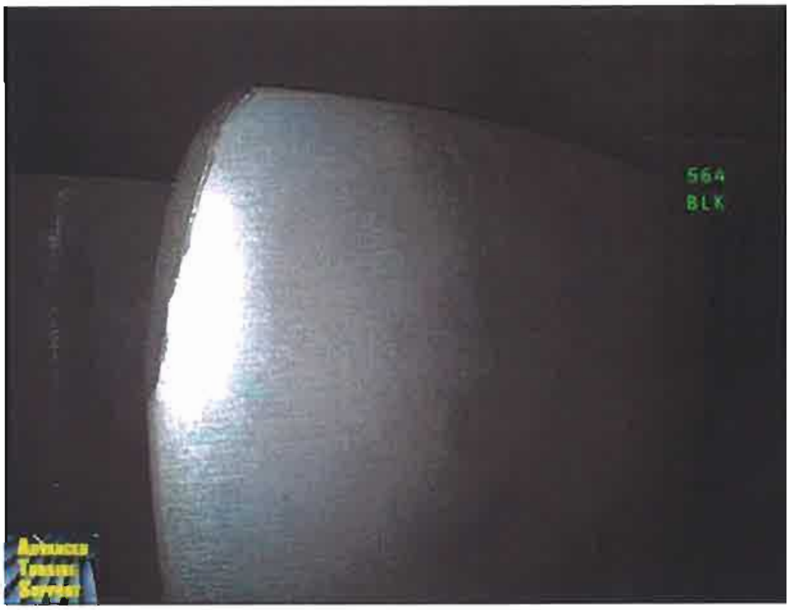
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation Comments	Clashing Damage

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

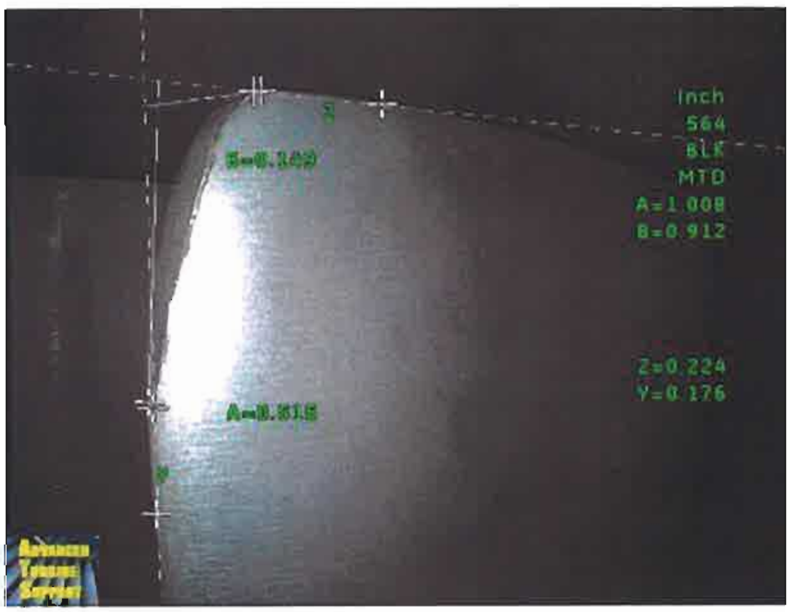
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

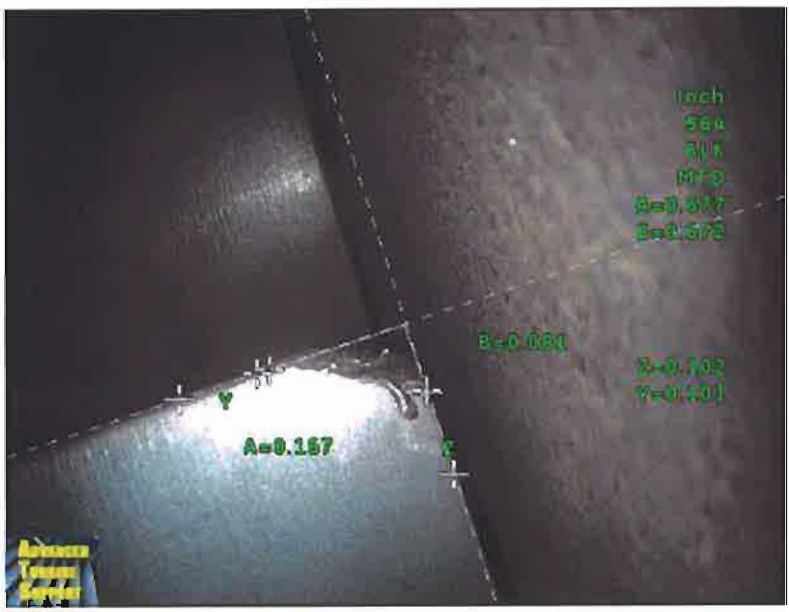


Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	6 o' clock position

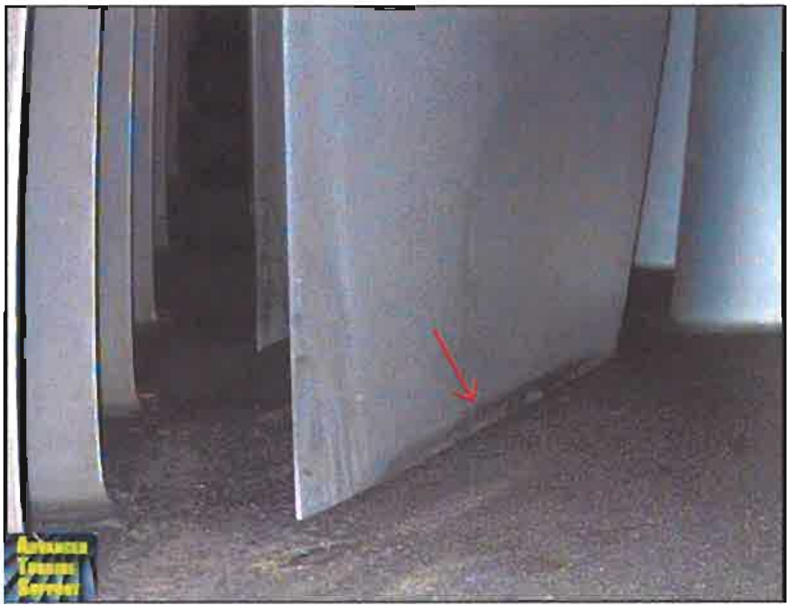


Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.515 B= 0.149
Observation	Clashing Damage
Comments	6 o' clock position

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	7 o' clock position



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.167 B= 0.081
Observation	Clashing Damage
Comments	7 o' clock position



Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Tip Discoloration
Comments	

Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Suction Side
Observation	Tip Discoloration/ Rolled Metal
Comments	

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Tip Discoloration
Comments	

Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Tip
Observation	Rub Marks
Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

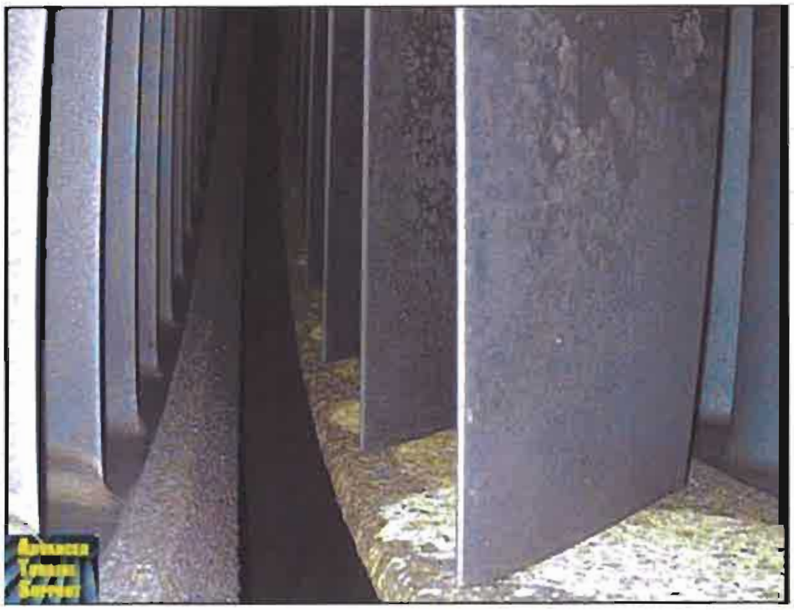
Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Impact Damage

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

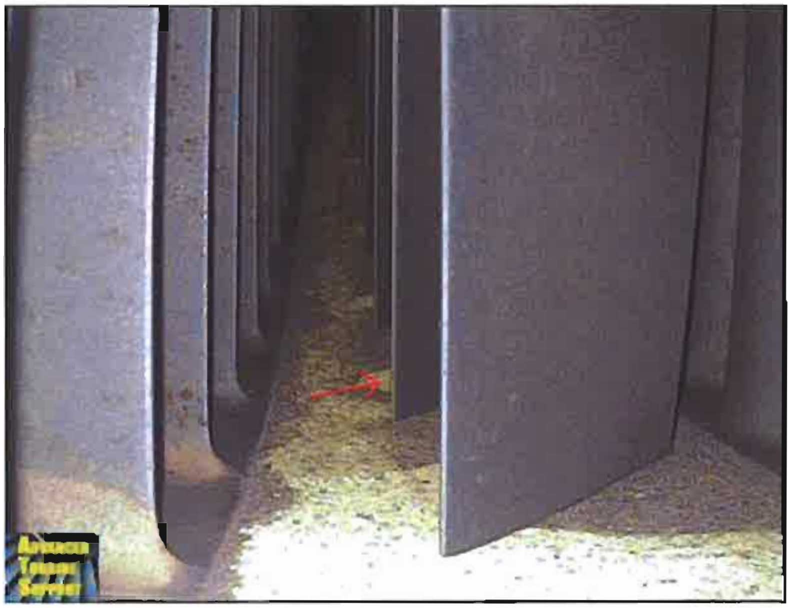
Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Impact Damage

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Impact Damage

Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

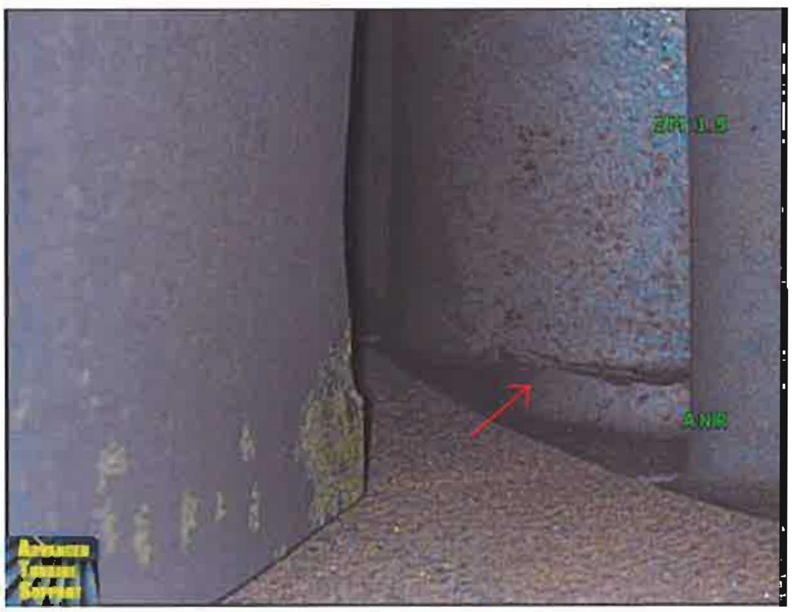
Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	6 o' clock position



Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	9 o' clock position

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

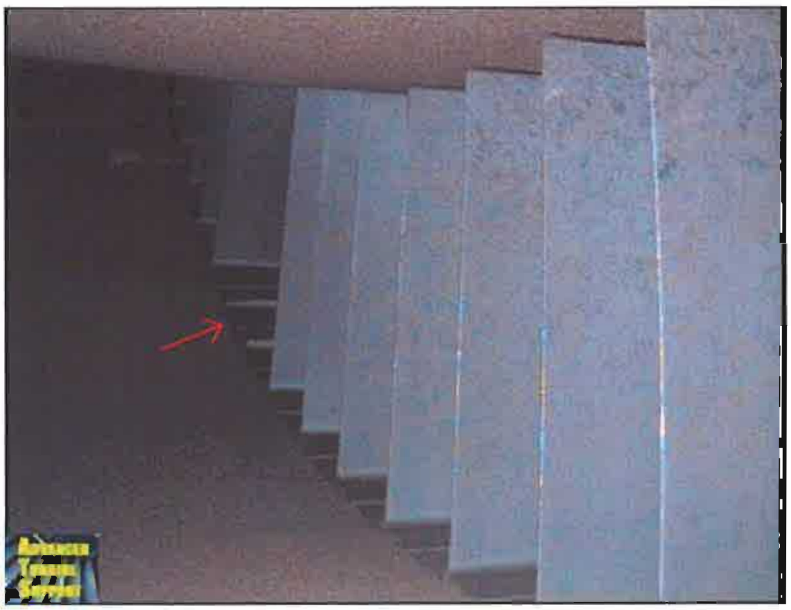
Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	6 o' clock position

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Dovetail Right Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Dovetail Right Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Typical
Comments	



Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Liberated Vane
Comments	3 o' clock position

Combustion Section

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 4
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 5
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 6
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Right Side Picture Frame
Location	TP 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Left Side Picture Frame
Location	TP 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 6
Observation	Typical
Comments	

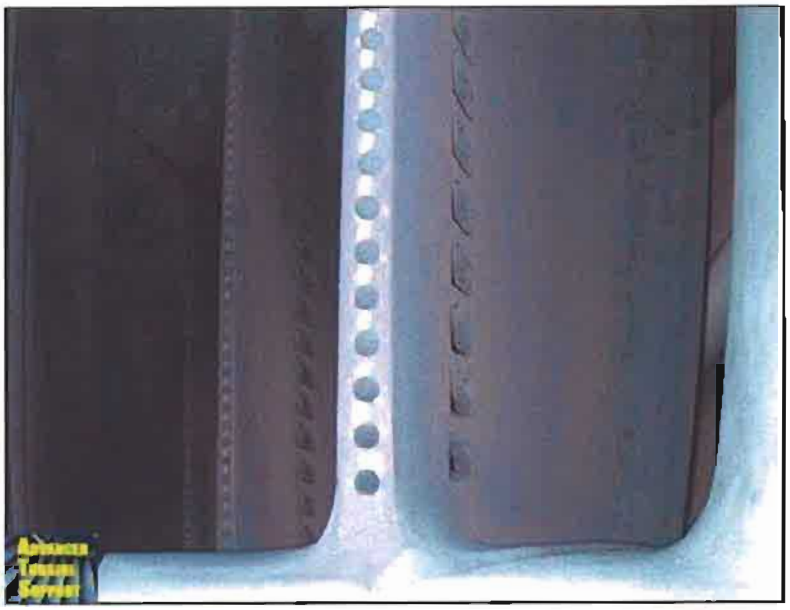
Section	Combustion Hot Side
Component	Floating Seal
Location	TP 4
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Floating Seal
Location	TP 7
Observation	Typical
Comments	

Turbine Section

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

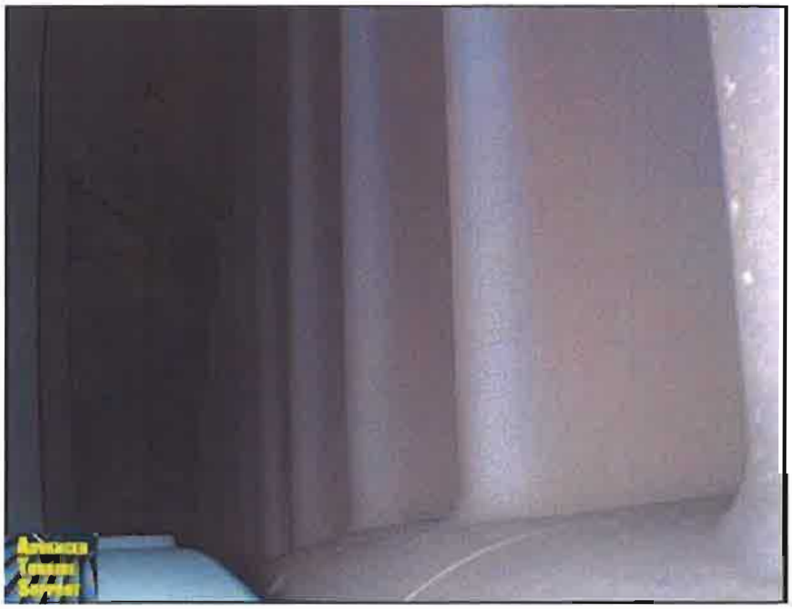


Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	



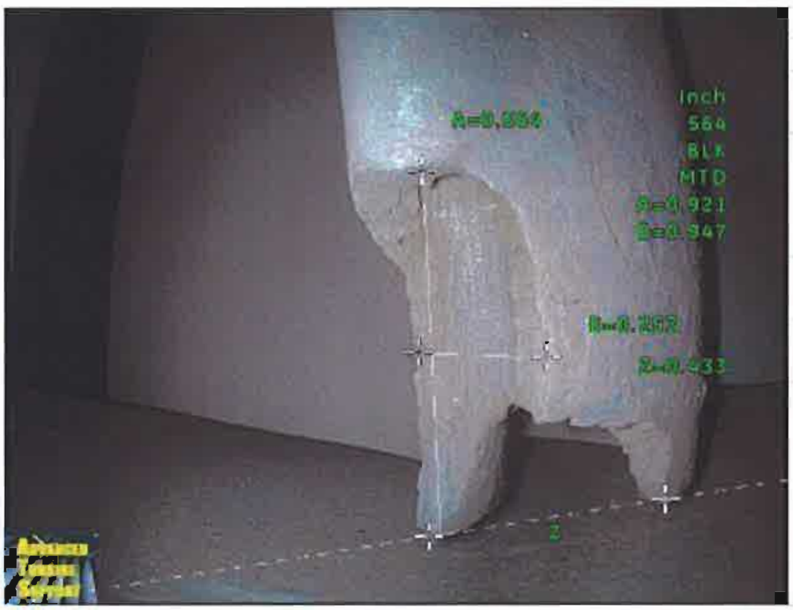
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge
	Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge
	Pressure Side
Observation	Rub Marks
Comments	6 o' clock position

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

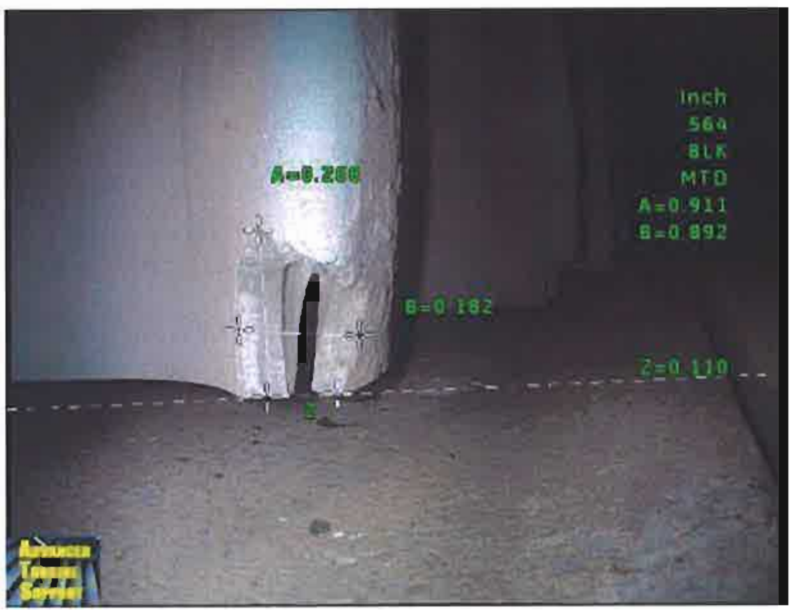
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	A= 0.260 B= 0.152
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	0.564 / 0.253
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

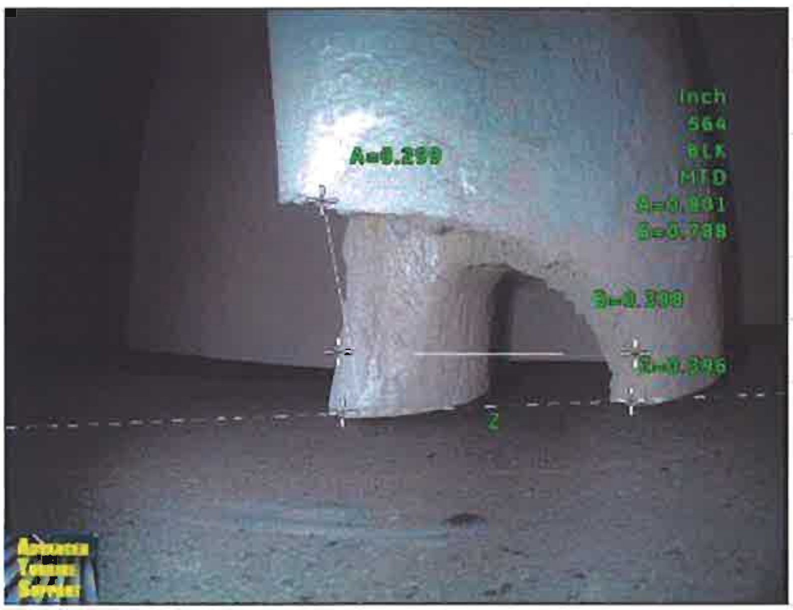


Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	0.268 / 0.182
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

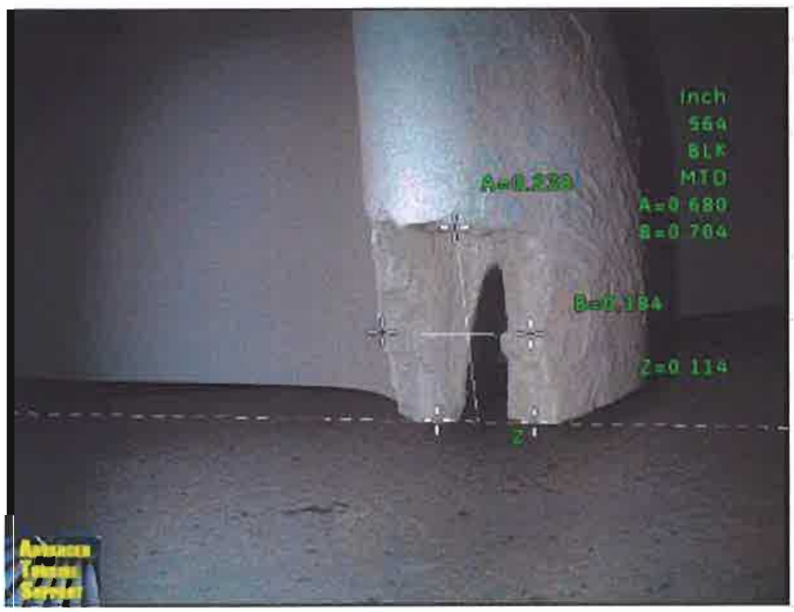
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	



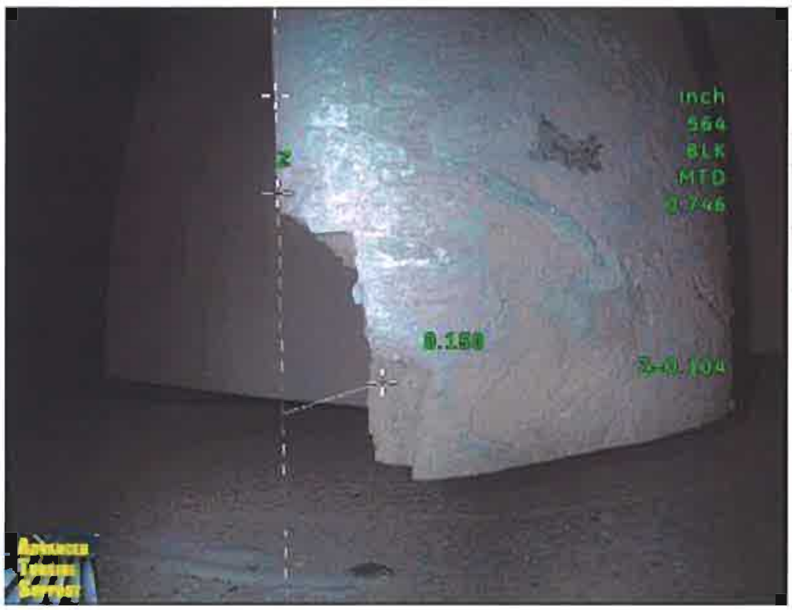
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	0.299 / 0.398
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	0.238 / 0.184
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	Point to Line
Measurement Values (Inches)	0.150
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	A= 0.292 B= 0.192
Observation	Impact Damage/ Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Material Loss/Material Loss
Comments	

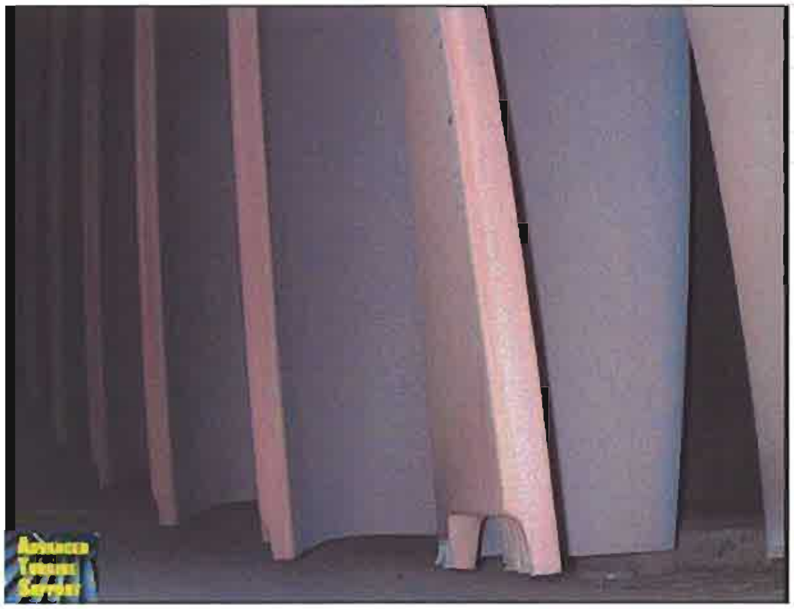
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Measurement Type	A= Distance from Tip B= Width of Damage
Measurement Values (Inches)	A= 0.363 B= 0.200
Observation	Impact Damage/Material Loss
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Suction Side
Observation	Typical
Comments	

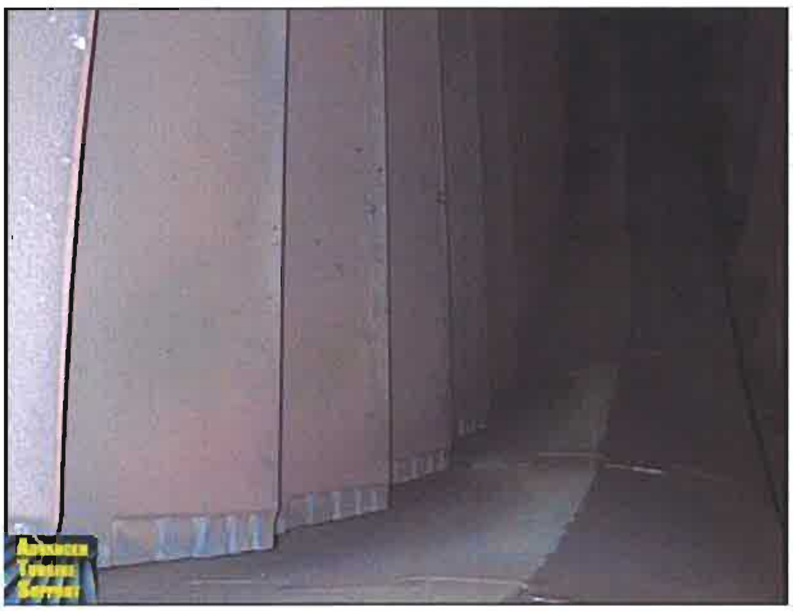
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Suction Side
Observation	Impact Damage
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge
	Platform
Observation	Typical
Comments	

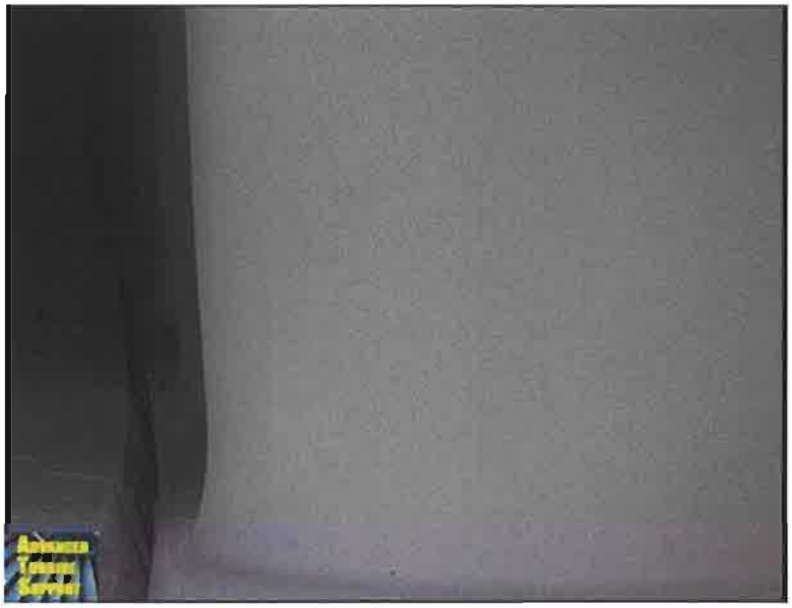
Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge
	Platform
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Suction Side
Observation	Typical
Comments	



Section	Turbine Stage 2
Component	Nozzle
Location	Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Pressure Side
Observation	Deposits
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

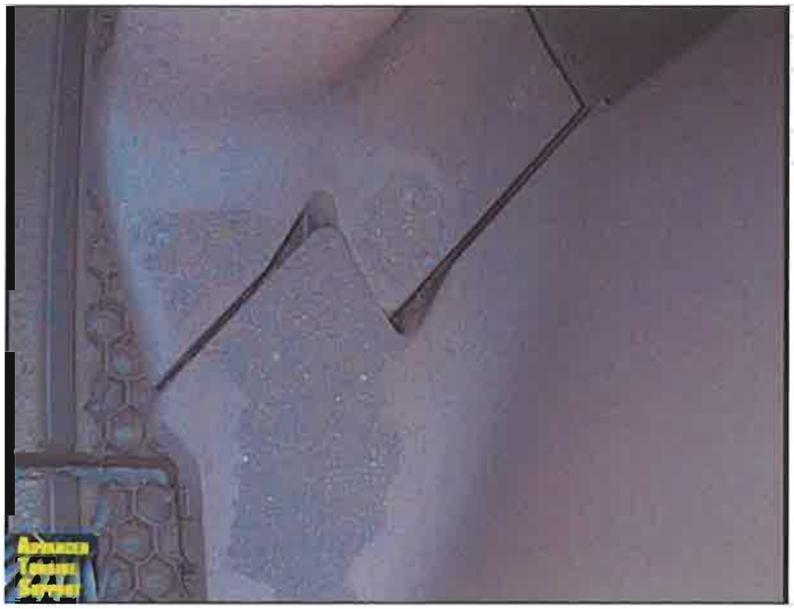
Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	



Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Honeycomb Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge Tip Shroud
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

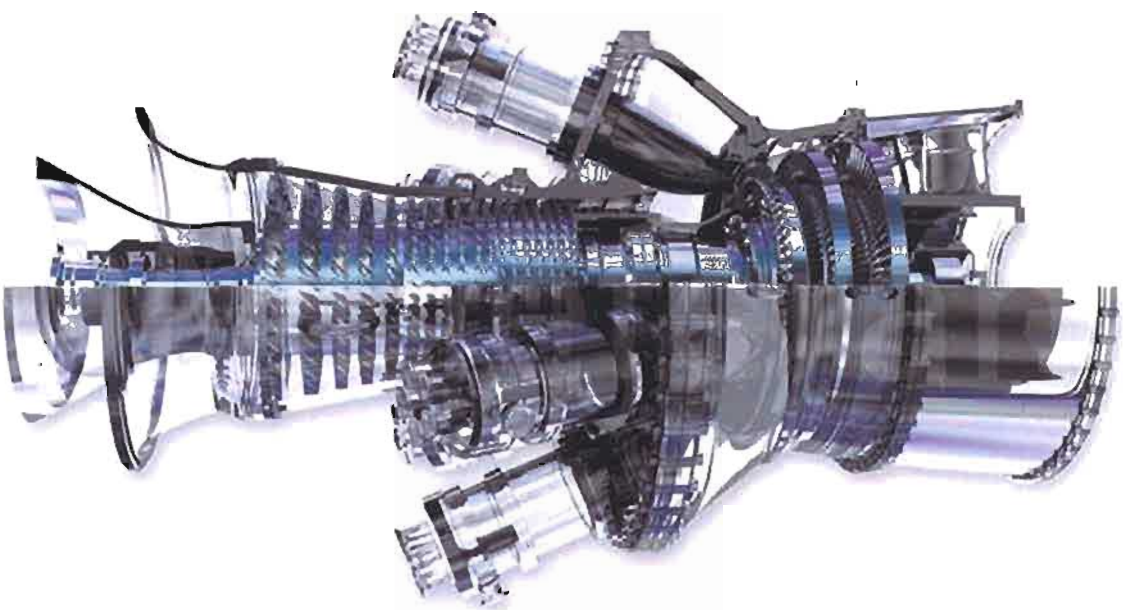
Section	Turbine Stage 3
Component	Bucket
Location	Honeycomb Seal
Observation	Typical
Comments	

Columbia GT-3 Borescope Inspection Report, Advanced Turbine Support, LLC – March 30, 2016

ADVANCED TURBINE SUPPORT, LLC — Professional Inspection Services

Borescope Inspection Report

Columbia Water & Light
Columbia GT-3
March 30, 2016



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Gainesville, FL 32608
352-332-4061
www.AdvancedTurbineSupport.com

Table of Contents

Documentation & Photographs

This report describes and documents the March 30th, 2016 borescope examination of the General Electric Frame MS6001B combustion turbine. The documentation is presented in text, table and photographic format. Due to the representative nature of borescope inspections, there may be a 10% plus or minus variable from what is listed in the "Percent of Component Inspected" section of the tables.

The photographs included in this report were selected from the inspection to best represent the condition of the unit. Selected photographs that show problem areas and typical views of the components observed are included as part of this report for documentation and comparison during future examinations.

Magnification of the distal tip lens may make objects appear larger. A surface that is actually straight or true may appear slightly wavy or curved in a photograph. Due to the possibility of optical distortion, someone familiar with borescope photography should be involved in the final engineering review of this report.

Purpose

The purpose of this borescope examination was to look for conditions considered to be abnormal to the unit and to gather trending data for future inspections.

Notes

The data plate has been removed from the unit.

Inspection Details

Utility	Inspector		Inspection Date	Serial Number
Columbia Water & Light	Mike Sladek		March 30, 2016	810347
Site / Unit No.	**Manufacturer**			**Model**
Columbia GT-3	General Electric			MS6001B
Type of Fuel	**Inspection Type**			**Site Contact**
Natural Gas	Borescope Inspection			John Gerek
Total Fired Hours	**Manual Starts**	**Total Starts**	**Fired Starts**	**Unit Trips**
1185.4	246	263	245	26

Inspection Areas

Inlet Area	Compressor Section
General	**Stages 1-17**
Inspected	1-14, 17
Combustion Section	**Turbine Section**
1-10	**Stages 1-3**
1-10	1-3

Applicable TILs

TIL	Description	Full/Limited/None
1067-R3	**2nd Stage Bucket Tip Deflection**	Limited

Unit rotated for this inspection	No

Urgent Findings

1. There is evidence of trailing edge impact damage to the stage R-17 rotor blades.
2. There is evidence of fifteen (15) liberated stage S-17 stator vanes from the 3 to 6 o' clock position.
3. There is evidence of three (3) liberated EGV 1 vanes from the 3 to 6 o' clock position.
4. There is evidence of metal gasket material in the secondary fuel nozzle burner tubes in combustion cans 3, 8, and 9.

Observations

Inlet Section

General
No defects identified

Compressor Section

Stage	Condition	Access Point	Percent of Component Inspected
IGV	No defects identified	Inlet Bellmouth	100%
R1	Tip discoloration, Rolled metal at the tips, Rub marks at 12 o' clock	Inlet Bellmouth	100%
S1	No defects identified	Inlet Bellmouth	100%
R2	No defects identified	Inlet Bellmouth	75%
S2	No defects identified	Inlet Bellmouth	70%
R3	No defects identified	Inlet Bellmouth	70%
S3	No defects identified	Inlet Bellmouth	50%
R4	No defects identified	Inlet Bellmouth	50%
S4	No defects identified	Inlet Bellmouth	35%
R5	No defects identified	Inlet Bellmouth	50%
S5	No defects identified	Inlet Bellmouth	35%
R6	No defects identified	Inlet Bellmouth	40%
R6	No defects identified	Inlet Bellmouth	40%
S6	No defects identified	Inlet Bellmouth	35%
R7	Rub marks at 6 o'clock	Inlet Bellmouth	35%
S7	No defects identified	Inlet Bellmouth	35%

Stage	Condition	Access Point	Percent of Component Inspected
R8	No defects identified	Inlet Bellmouth	35%
S8	No defects identified	Inlet Bellmouth	35%
R9	No defects identified	Inlet Bellmouth	35%
S9	No defects identified	Inlet Bellmouth	35%
R10	No defects identified	Inlet Bellmouth	35%
S10	No defects identified	Inlet Bellmouth	35%
R11	No defects identified	Inlet Bellmouth	50%
S11	Rolled metal along vane tips	Inlet Bellmouth	35%
R12	No defects identified	Inlet Bellmouth	35%
S12	No defects identified	Inlet Bellmouth	35%
R13	No defects identified	Inlet Bellmouth	35%
S13	No defects identified	Inlet Bellmouth	35%
R14	No defects identified	Inlet Bellmouth	35%
S14	No available access	N/A	0%
R15	No available access	N/A	0%
S15	No available access	N/A	0%
R16	No available access	N/A	0%
S16	No available access	N/A	0%
R17	Trailing edge impact damage	Borescope Plug	90%
S17	Liberated vanes from the 3 to 6 o' clock position (15), Liberated vanes still in the unit between S17 and EGV 2 (6)	Borescope Plug	75%
EGV1	Liberated vanes from the 3 to 6 o' clock position (3)	Borescope Plug	50%
EGV2	Impact damage	Borescope Plug	50%

Combustion Section

Hot Side Hardware	
Can	**Condition**
1	No defects identified
2	No defects identified
3	Metal gasket material in secondary fuel nozzle burner tube
4	No defects identified
5	No defects identified
6	No defects identified
7	No defects identified
8	Metal gasket material in secondary fuel nozzle burner tube
9	Metal gasket material in secondary fuel nozzle burner tube
10	No defects identified

Turbine Section

Stage 1 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
90%	75%
Condition	
No defects identified	

Stage 1 Buckets

Percent of Component Inspected			
LE Platform	**LE Tip**	**TE Platform**	**TE Tip**
75%	75%	75%	75%
Condition			
No defects identified			

Stage 1 Shroud Blocks

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 2 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 2 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	75%
Condition	
No defects identified	

Stage 2 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 3 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 3 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
50%	50%
Condition	
No defects identified	

Stage 3 Honeycomb Shroud

Percent of Component Inspected	50%
Condition	No defects identified

Exhaust Section

Exhaust Section	
Component	**Condition**
Strut Heat Shield	No available access
Inner Barrel	No available access
Outer Barrel	No available access
Diffuser	No defects identified

Recommendations

1. Do not operate the unit until engineering dispositions the Urgent Findings.
2. Borescope the unit on an annual interval to monitor the conditions identified during this inspection.

Limitation of Liability

A borescope inspection is intended to provide a representative sample of the unit condition. While every attempt will be made to identify all items considered to be abnormal, items may be missed that could cause future damage. The measurements included in this report are limited to visible surfaces only, these measurements could therefore differ from actual measurements taken after the unit is disassembled and additional surfaces are exposed. In no event shall Advanced Turbine Support, LLC be liable for compensatory, consequential, incidental, special, punitive or other damages whether the claim for damages is based on contract, tort, or otherwise. Advanced Turbine Support, LLC limits its liability to the value of this contract.

Photographs

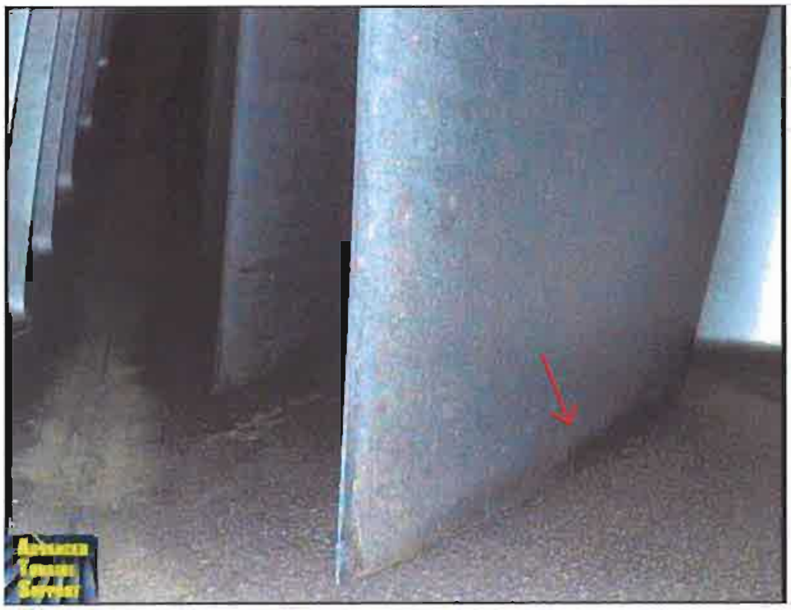
Compressor Section

Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

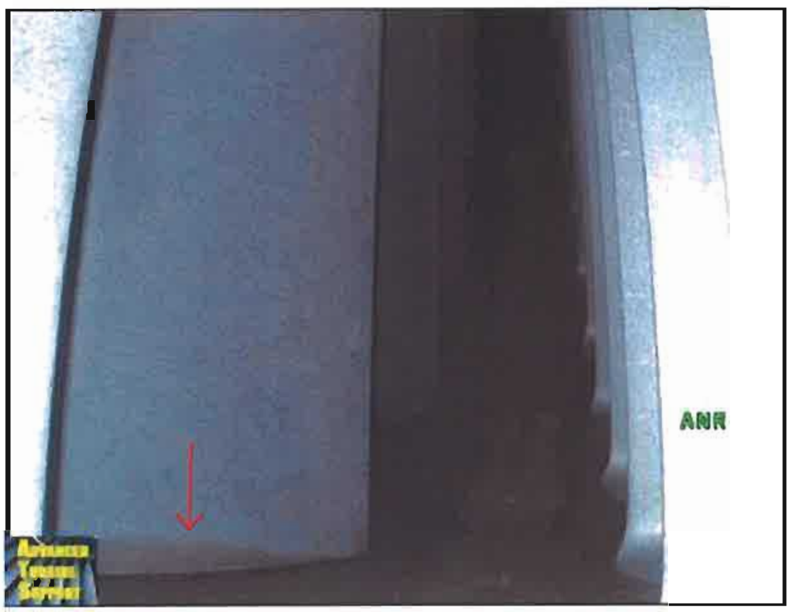
Section	Inlet Plenum
Component	Floor
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	Suction Side
Observation	Typical
Comments	



Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration



Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration

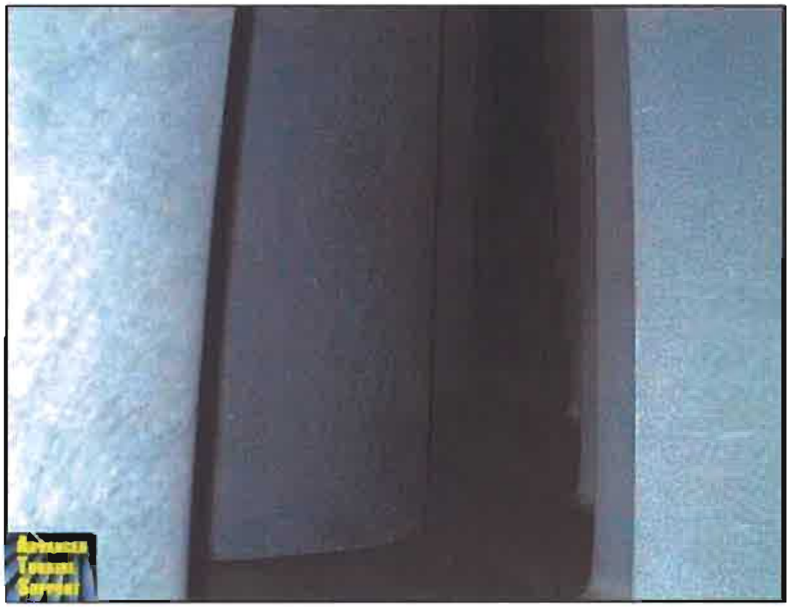
Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Tip
Observation	Rolled Metal
Comments	

Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Case
Observation	Rub Marks
Comments	12 o' clock position

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

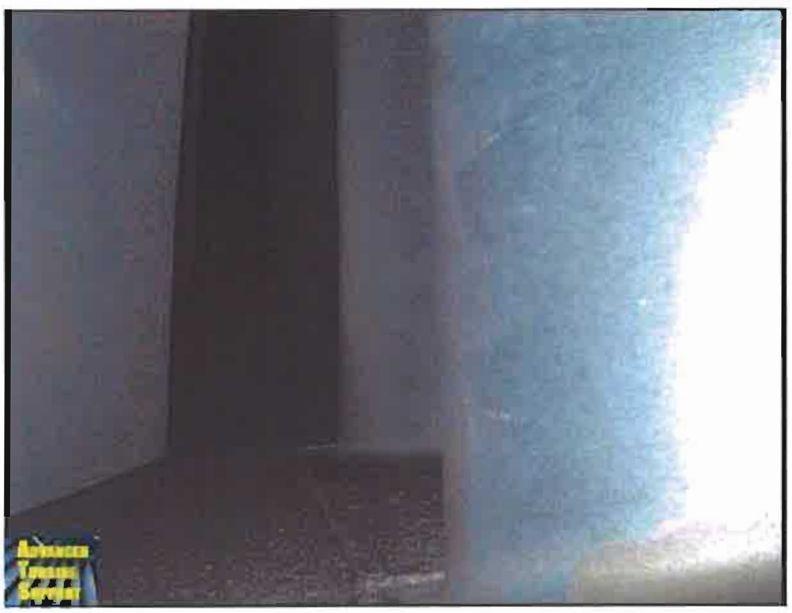
Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical



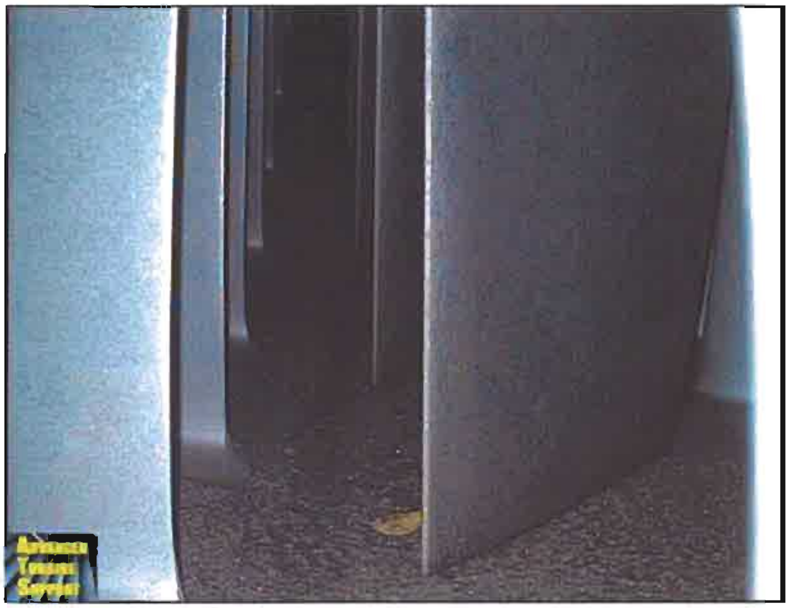
Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

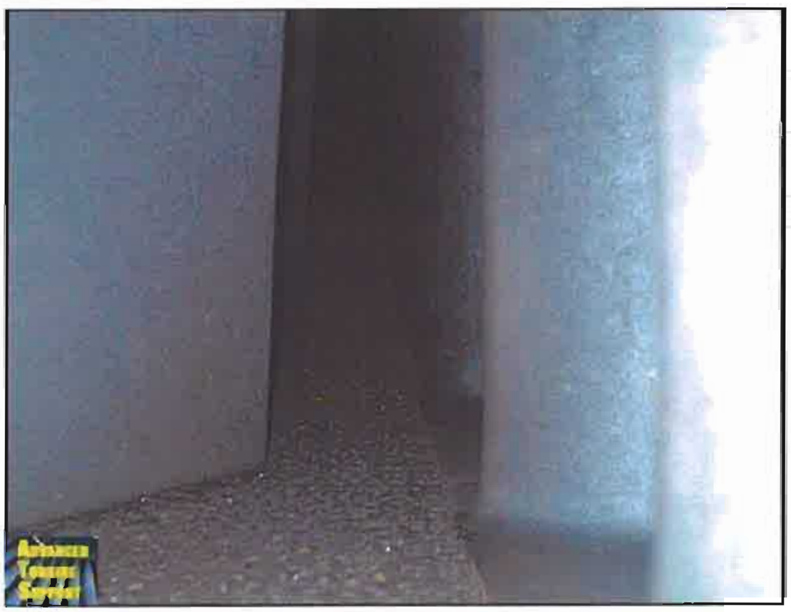
Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

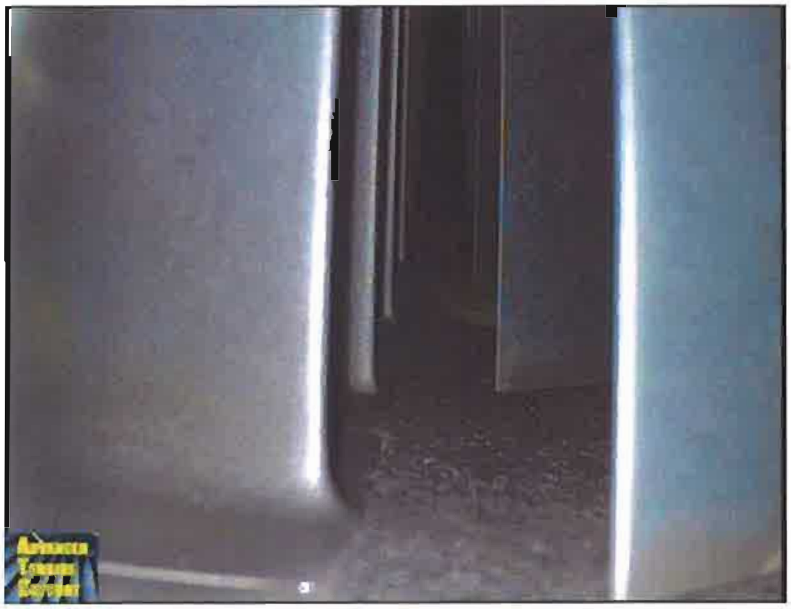
Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Tip Discoloration/Rub Marks
Comments	6 o' clock position

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Suction Side
Observation	Tip Discoloration
Comments	

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

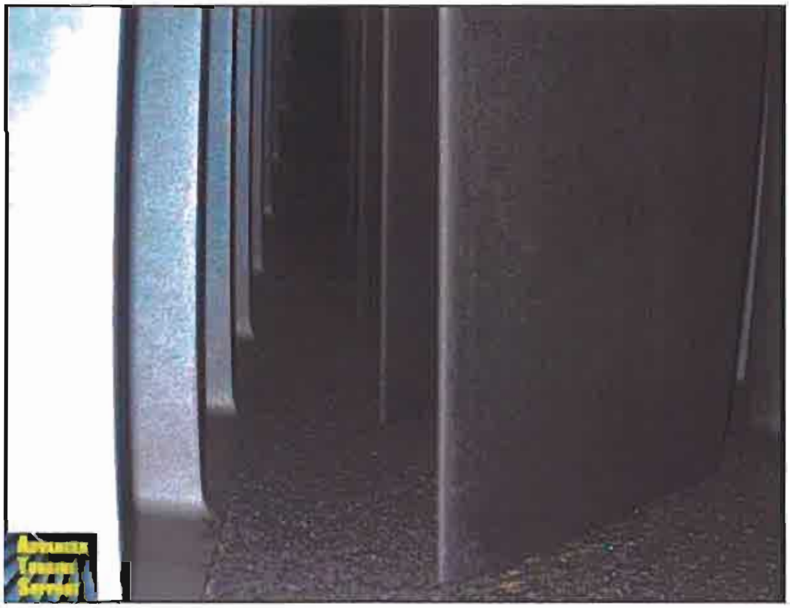
Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

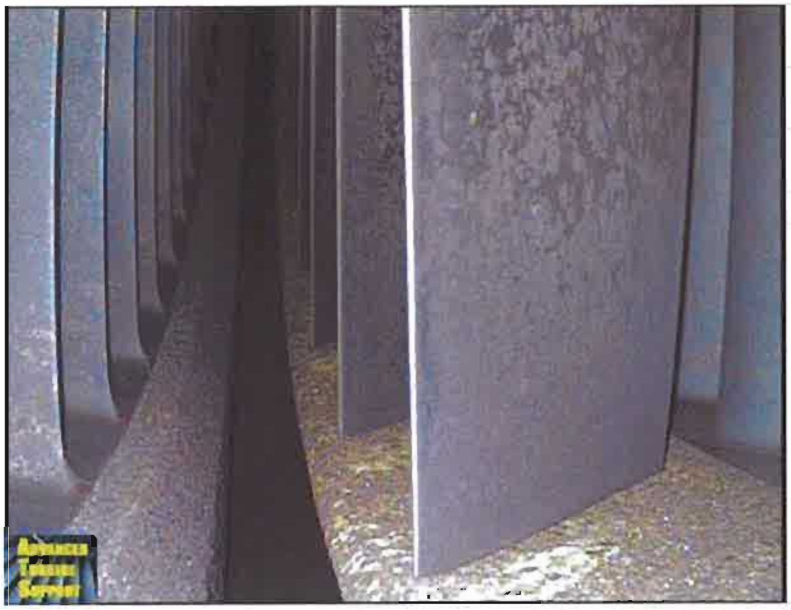
Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

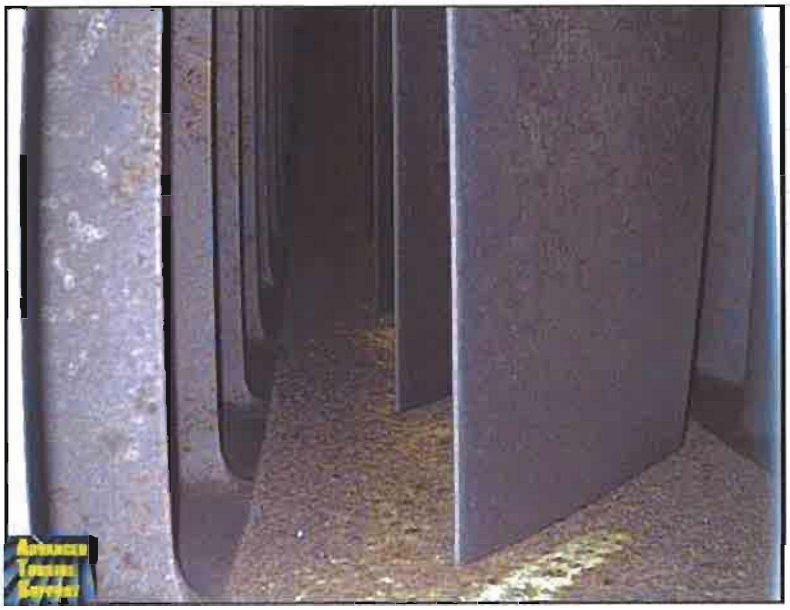


Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Tip
Observation Comments	Rolled Metal



Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

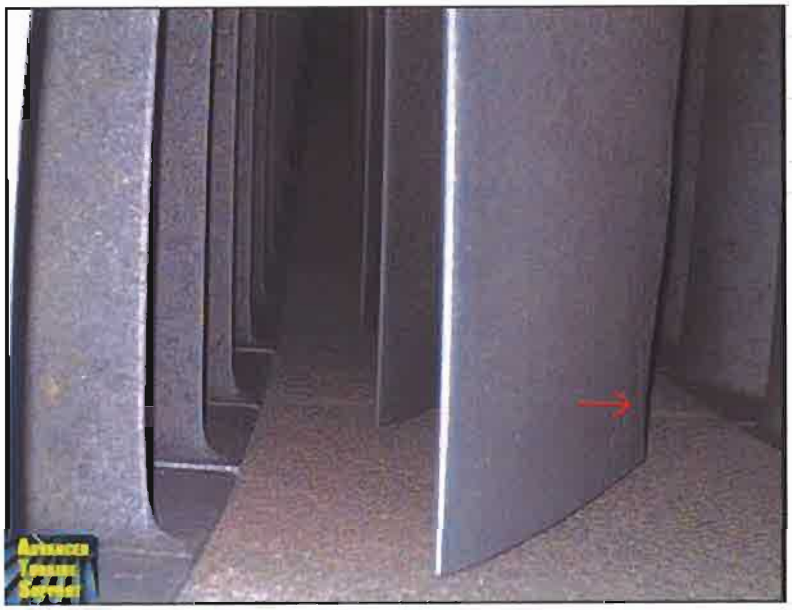
Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 14 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	Liberated Vane

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Impact Damage
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Suction Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Platform
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Trailing Edge
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	General
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Pressure Side
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Trailing Edge
Observation	Impact Damage/ Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	General
Observation	Liberated Vane
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Trailing Edge
Observation	Typical
Comments	

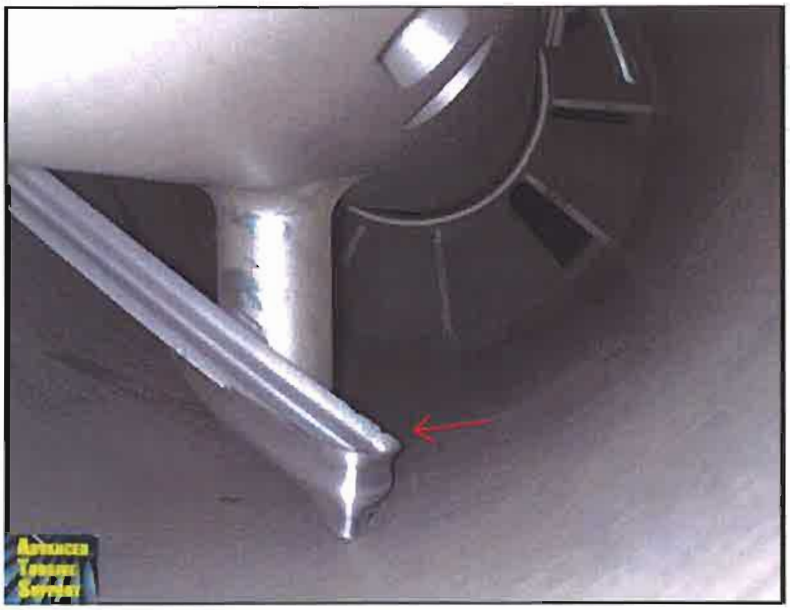
Combustion Section

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 10
Observation	Typical
Comments	



Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 3
Observation	Metal Gasket Material
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 3
Observation	Metal Gasket Material
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 8
Observation	Metal Gasket Material
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 8
Observation	Metal Gasket Material
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 9
Observation	Metal Gasket Material
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 4
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Right Side Picture Frame
Location	TP 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Left Side Picture Frame
Location	TP 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 3
Observation	Typical
Comments	

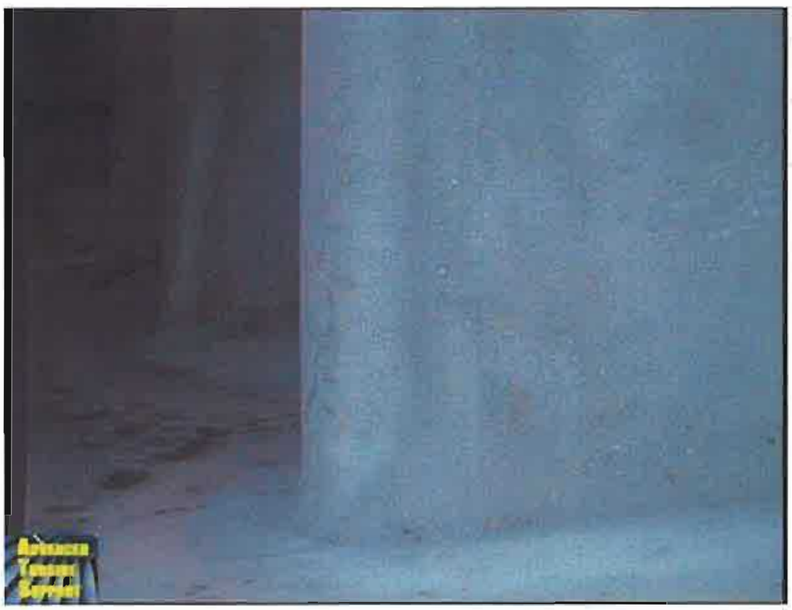
Section	Combustion Hot Side
Component	Side Seal
Location	TP 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Floating Seal
Location	TP 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Floating Seal
Location	TP 8
Observation	Typical
Comments	

Turbine Section

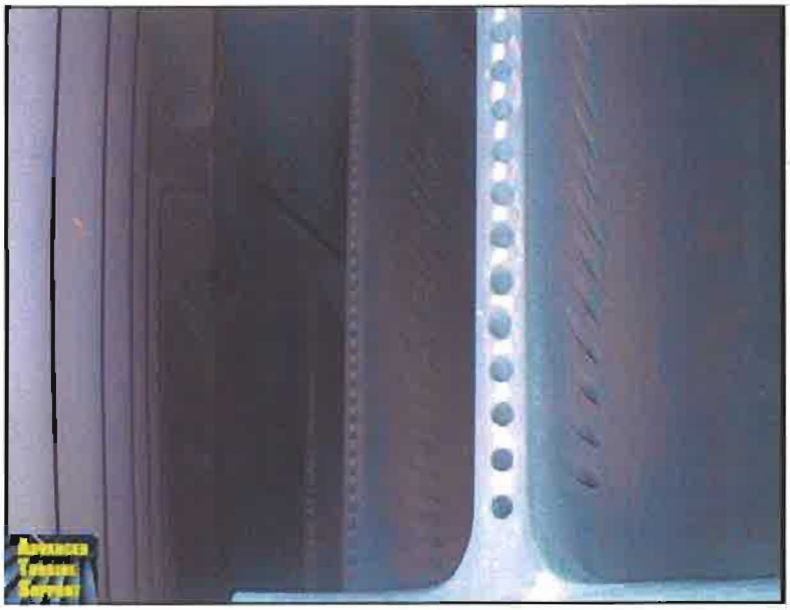
Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	



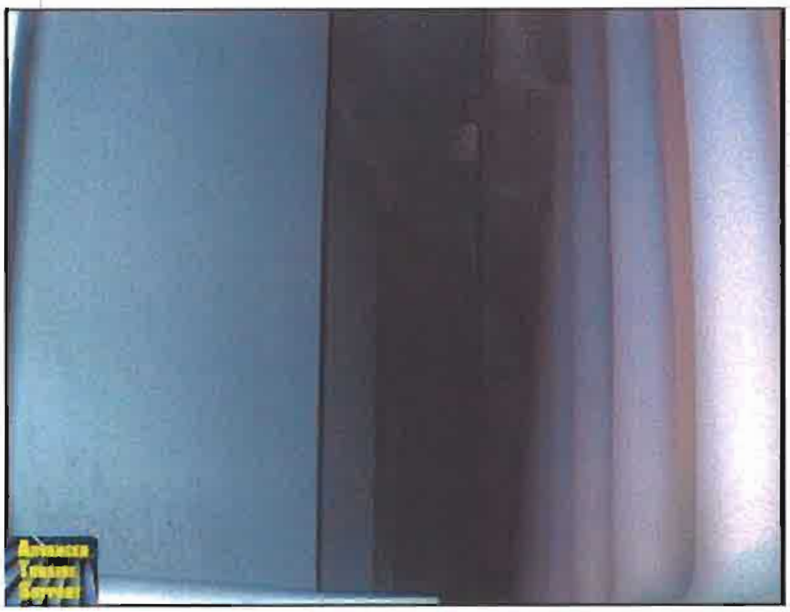
Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	TP 8
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	TP 8
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

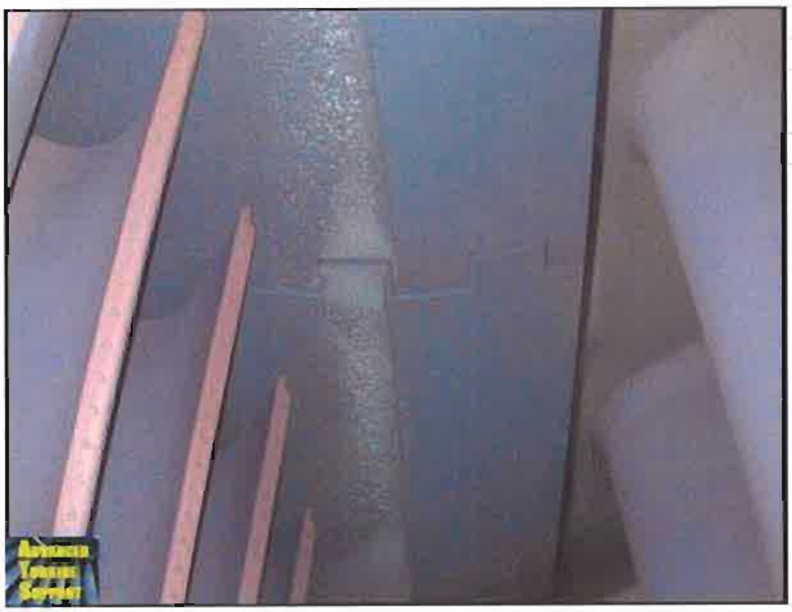
Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Suction Side
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Bucket
Location	Shroud Block Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge Tip Shroud
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Honeycomb Seal
Observation	Typical
Comments	

Exhaust Section

Section	Exhaust
Component	Diffuser
Observation	Typical
Comments	

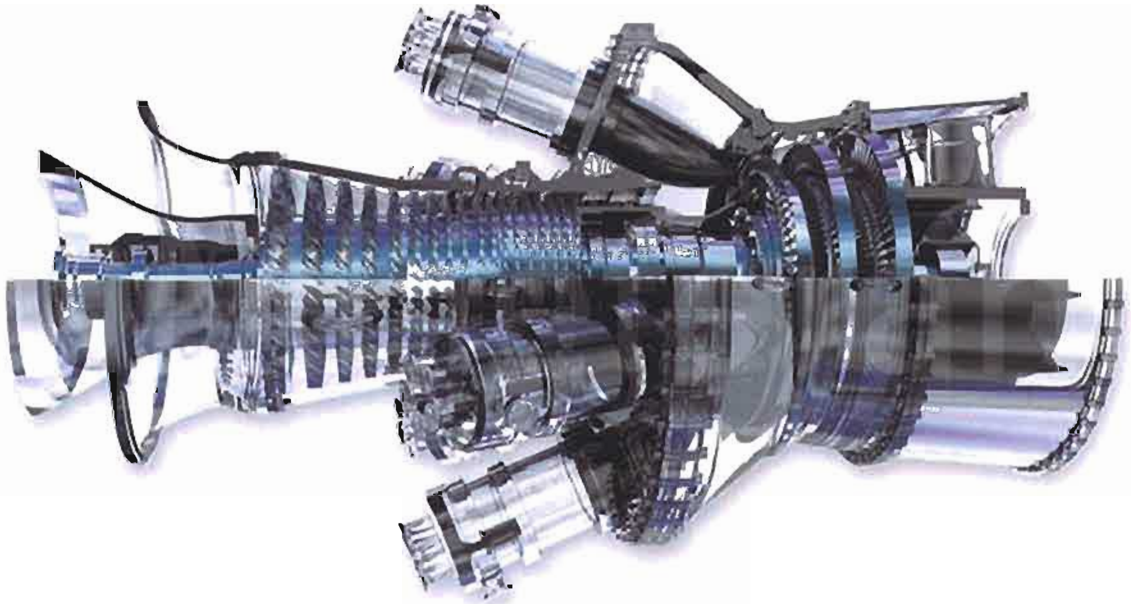
Section	Exhaust
Component	Diffuser
Observation	Typical
Comments	

Columbia GT-4 Borescope Inspection Report, Advanced Turbine Support, LLC – March 31, 2016

ADVANCED TURBINE SUPPORT, LLC
Professional Inspection Services

Borescope Inspection Report

Columbia Water & Light
Columbia GT-4
March 31, 2016



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Gainesville, FL 32608
352-332-4061
www.AdvancedTurbineSupport.com

Table of Contents

Documentation & Photographs

This report describes and documents the March 31st, 2016 borescope examination of the General Electric Frame MS6001B combustion turbine. The documentation is presented in text, table and photographic format. Due to the representative nature of borescope inspections, there may be a 10% plus or minus variable from what is listed in the "Percent of Component Inspected" section of the tables.

The photographs included in this report were selected from the inspection to best represent the condition of the unit. Selected photographs that show problem areas and typical views of the components observed are included as part of this report for documentation and comparison during future examinations.

Magnification of the distal tip lens may make objects appear larger. A surface that is actually straight or true may appear slightly wavy or curved in a photograph. Due to the possibility of optical distortion, someone familiar with borescope photography should be involved in the final engineering review of this report.

Purpose

The purpose of this borescope examination was to look for conditions considered to be abnormal to the unit and to gather trending data for future inspections.

Notes

The data plate has been removed from the unit.

Inspection Details

Utility	Inspector		Inspection Date	Serial Number
Columbia Water & Light	Mike Sladek		March 31, 2016	810348
Site / Unit No.	**Manufacturer**			**Model**
Columbia GT-4	General Electric			MS6001B
Type of Fuel	**Inspection Type**			**Site Contact**
Natural Gas	Borescope Inspection			John Gerke
Total Fired Hours	**Manual Starts**	**Total Starts**	**Fired Starts**	**Unit Trips**
1239.9	242	264	235	8

Inspection Areas

Inlet Area	Compressor Section
General	**Stages 1-17**
Inspected	1-13, 17
Combustion Section	**Turbine Section**
1-10	**Stages 1-3**
1-10	1-3

Applicable TILs

TIL	Description	Full/Limited/None
1067-R3	**2nd Stage Bucket Tip Deflection**	Limited

Unit rotated for this inspection	Yes

Urgent Findings

1. There is evidence of clashing damage to the leading edge tips of nine (9) stage S-1 stator vanes. These vanes are located at the 6 to 7 o' clock position.

Observations

Inlet Section

General
No defects identified

Compressor Section

Stage	Condition	Access Point	Percent of Component Inspected
IGV	No defects identified	Inlet Bellmouth	100%
R1	Trailing edge platform clashing damage	Inlet Bellmouth	100%
S1	Clashing damage (9) from the 6 to 7 o' clock position, Photographs and measurements included below	Inlet Bellmouth	100%
R2	No defects identified	Inlet Bellmouth	75%
S2	No defects identified	Inlet Bellmouth	70%
R3	No defects identified	Inlet Bellmouth	70%
S3	No defects identified	Inlet Bellmouth	50%
R4	Tip discoloration	Inlet Bellmouth	50%
S4	No defects identified	Inlet Bellmouth	35%
R5	Tip discoloration	Inlet Bellmouth	50%
S5	No defects identified	Inlet Bellmouth	35%
R6	Tip discoloration	Inlet Bellmouth	40%
S6	No defects identified	Inlet Bellmouth	35%
R7	Tip discoloration	Inlet Bellmouth	35%
S7	No defects identified	Inlet Bellmouth	35%

Stage	Condition	Access Point	Percent of Component Inspected
R8	Tip discoloration	Inlet Bellmouth	35%
S8	Rolled metal at the vane tips	Inlet Bellmouth	35%
R9	Tip discoloration	Inlet Bellmouth	35%
S9	No defects identified	Inlet Bellmouth	35%
R10	No defects identified	Inlet Bellmouth	35%
S10	No defects identified	Inlet Bellmouth	35%
R11	No defects identified	Inlet Bellmouth	50%
S11	No defects identified	Inlet Bellmouth	35%
R12	No defects identified	Inlet Bellmouth	35%
S12	No defects identified	Inlet Bellmouth	35%
R13	No defects identified	Inlet Bellmouth	35%
S13	No defects identified	Inlet Bellmouth	35%
R14	No available access	N/A	0%
S14	No available access	N/A	0%
R15	No available access	N/A	0%
S15	No available access	N/A	0%
R16	No available access	N/A	0%
S16	No available access	N/A	0%
R17	No defects identified	Borescope Plug	90%
S17	No defects identified	Borescope Plug	75%
EGV1	No defects identified	Borescope Plug	35%
EGV2	No defects identified	Borescope Plug	35%

Combustion Section

Hot Side Hardware	
Can	**Condition**
1	No defects identified
2	No defects identified
3	No defects identified
4	No defects identified
5	No defects identified
6	No defects identified
7	No defects identified
8	No defects identified
9	No defects identified
10	No defects identified

Turbine Section

Stage 1 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
90%	75%
Condition	
No defects identified	

Stage 1 Buckets

Percent of Component Inspected			
LE Platform	**LE Tip**	**TE Platform**	**TE Tip**
100%	75%	75%	75%
Condition			
No defects identified			

Stage 1 Shroud Blocks

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 2 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	75%
Condition	
No defects identified	

Stage 2 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
75%	75%
Condition	
No defects identified	

Stage 2 Honeycomb Shroud

Percent of Component Inspected	75%
Condition	No defects identified

Turbine Section

Stage 3 Nozzles

Percent of Leading Edge & Sidewalls Inspected	Percent of Trailing Edge & Sidewalls Inspected
75%	90%
Condition	
No defects identified	

Stage 3 Buckets

Percent of Component Inspected	
Leading Edge	**Trailing Edge**
100%	100%
Condition	
No defects identified	

Stage 3 Honeycomb Shroud

Percent of Component Inspected	100%
Condition	No defects identified

Exhaust Section

Exhaust Section	
Component	**Condition**
Strut Heat Shield	No available access
Inner Barrel	No available access
Outer Barrel	No available access
Diffuser	No defects identified

Recommendations

1. Have engineering disposition the Urgent Findings.
2. Perform an in-situ eddy current examination to the stage R-1 rotor blade trailing edge platform areas and the entire suction side of all the stage S-1 stator vanes. The purpose of this inspection is to detect cracking that may not be visible with in-situ dye penetrant inspections. We recommend this be repeated on a six-month or 25-start basis to monitor the clashing between the R-1 blades and the S-1 vanes if clashing exists. Cracks going undetected have led to vane liberations and catastrophic damage on other units.
3. Borescope the unit on an annual interval to monitor the conditions identified during this inspection.

Limitation of Liability

A borescope inspection is intended to provide a representative sample of the unit condition. While every attempt will be made to identify all items considered to be abnormal, items may be missed that could cause future damage. The measurements included in this report are limited to visible surfaces only, these measurements could therefore differ from actual measurements taken after the unit is disassembled and additional surfaces are exposed. In no event shall Advanced Turbine Support, LLC be liable for compensatory, consequential, incidental, special, punitive or other damages whether the claim for damages is based on contract, tort, or otherwise. Advanced Turbine Support, LLC limits its liability to the value of this contract.

Photographs

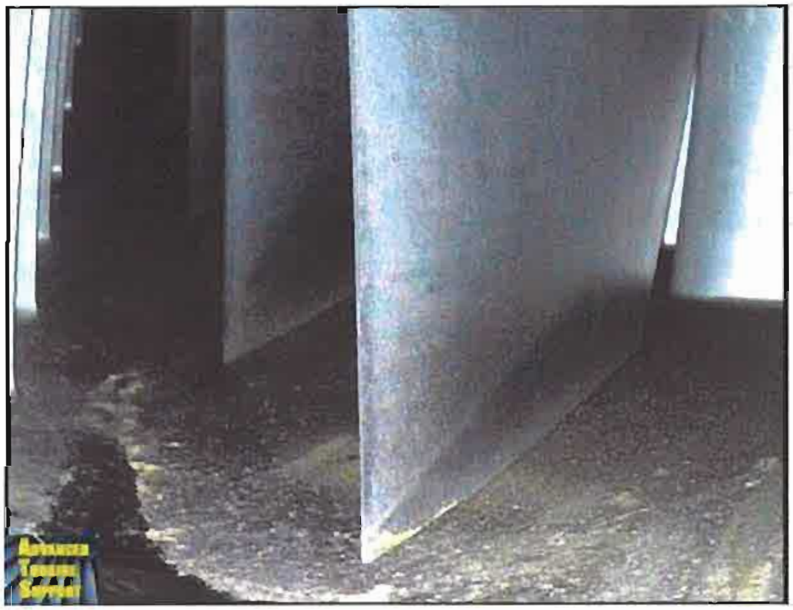
Compressor Section

Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

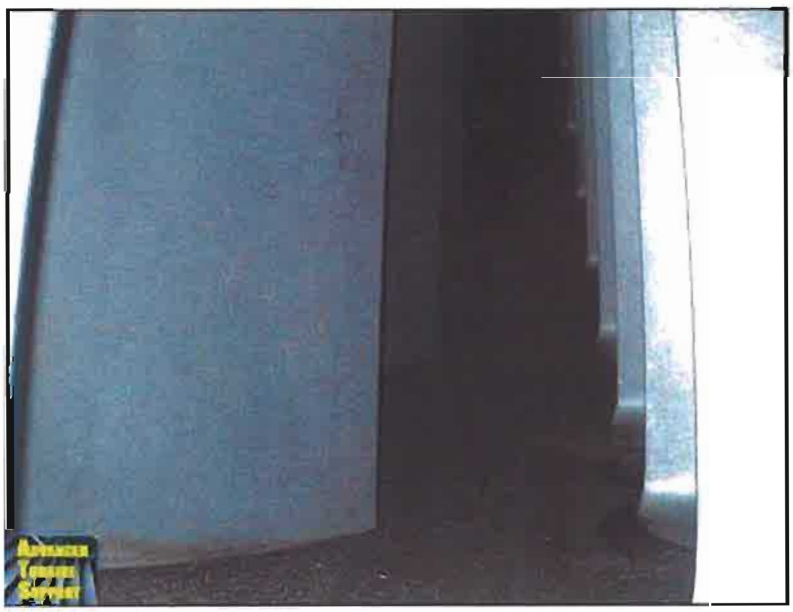
Section	Inlet Plenum
Component	Bellmouth
Observation	Typical
Comments	

Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	

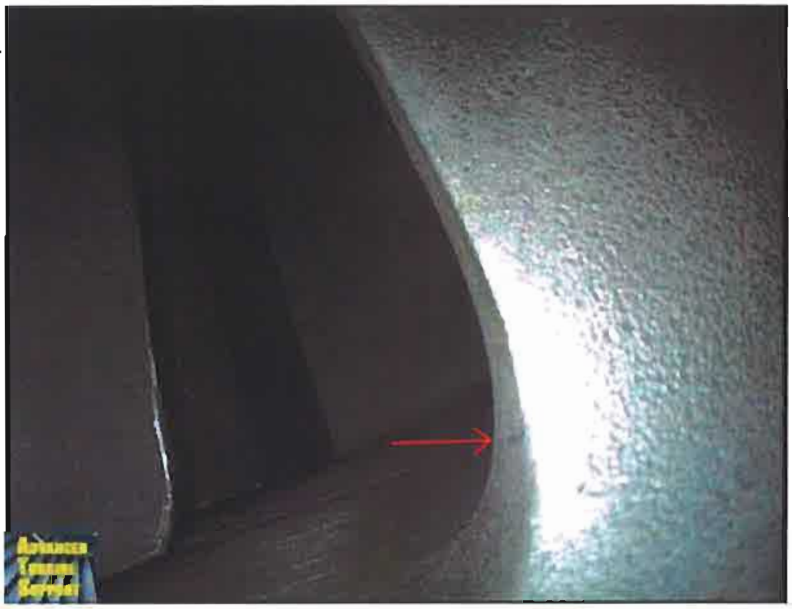
Section	Forward Compressor
Component	Variable Inlet Guide Vanes
Location	General
Observation	Typical
Comments	



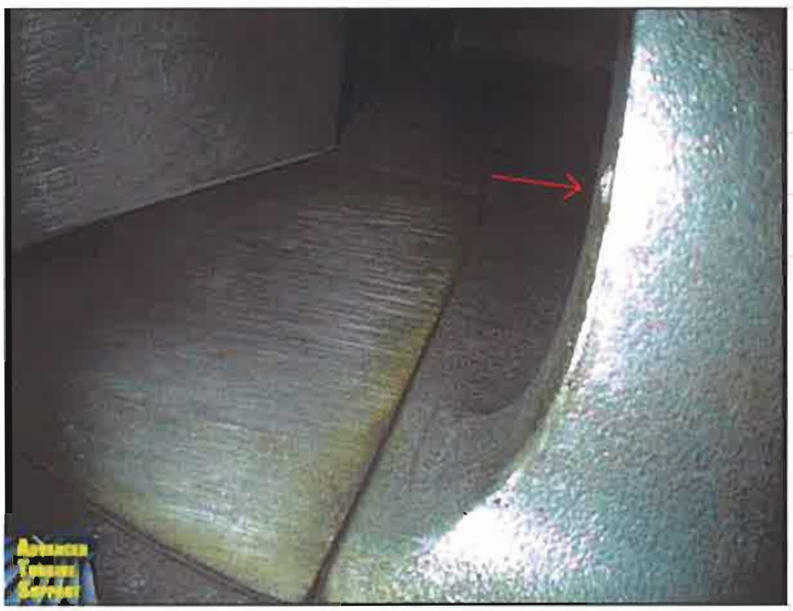
Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

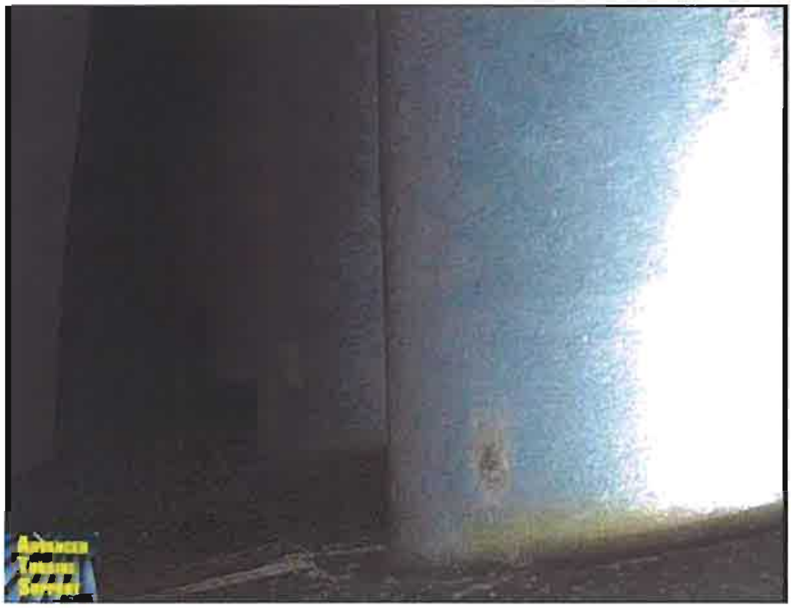


Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation	Minor Clashing Damage
Comments	

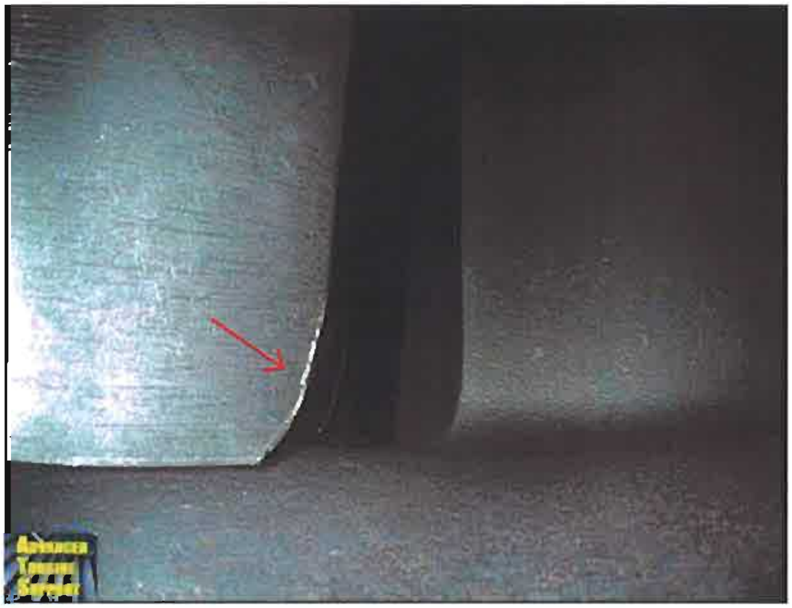


Section	Forward Compressor
Component	Stage 1 Rotor Blade
Location	Trailing Edge Platform
Observation	Minor Clashing Damage
Comments	

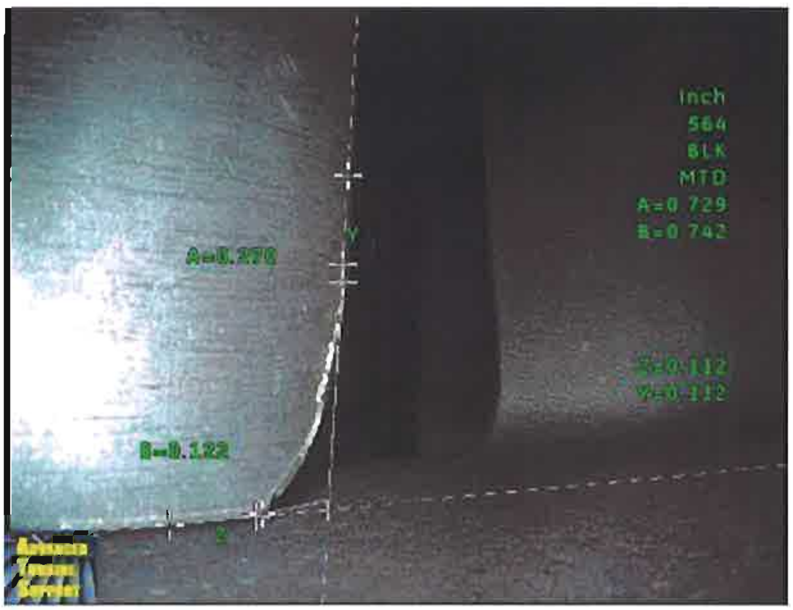
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

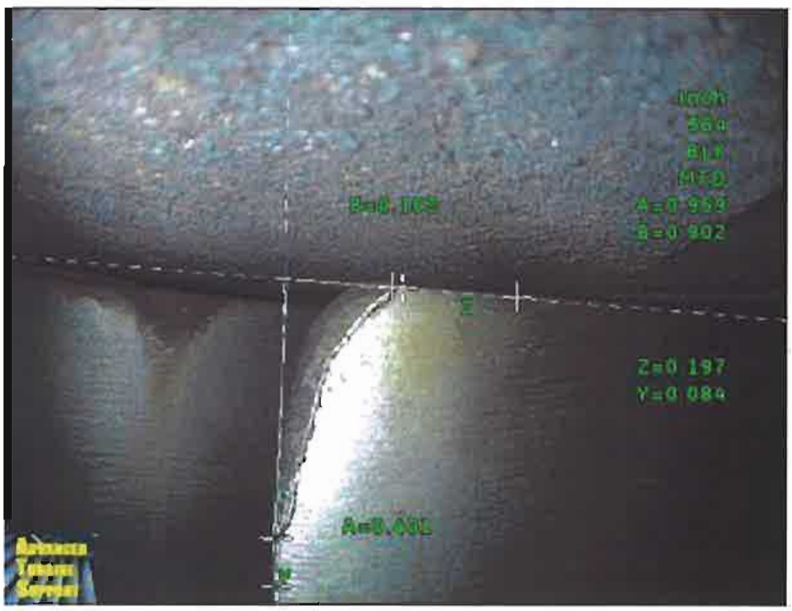


Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.270 B= 0.122
Observation	Clashing Damage
Comments	6 o' clock position

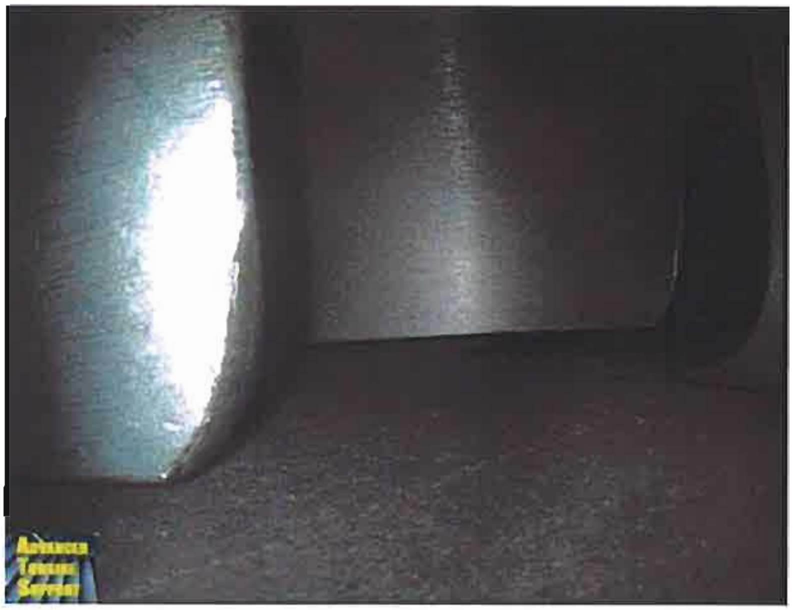
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	6 o' clock position

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.077 B= 0.107
Observation	Clashing Damage
Comments	6 o' clock position

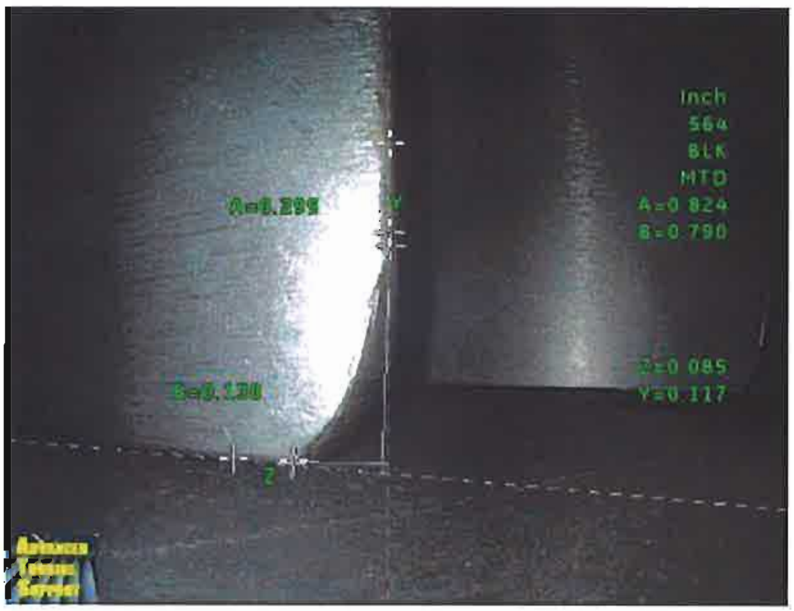
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	6 o' clock position



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.401 B= 0.152
Observation	Clashing Damage
Comments	6 o' clock position



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	7 o' clock position



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.299 B= 0.130
Observation	Clashing Damage
Comments	7 o' clock position

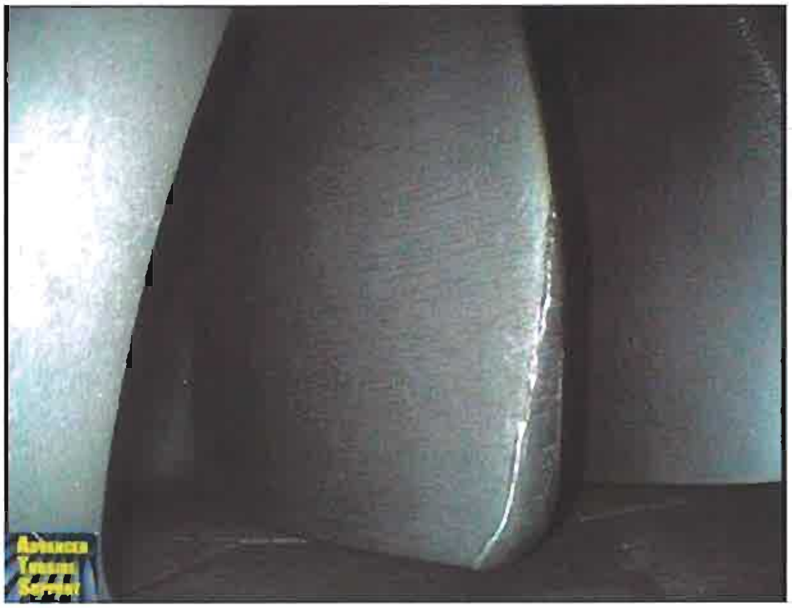
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	7 o' clock position

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Measurement Type	A= Distance from Tip B= Distance from Leading Edge
Measurement Values (Inches)	A= 0.126 B= 0.112
Observation	Clashing Damage
Comments	7 o' clock position

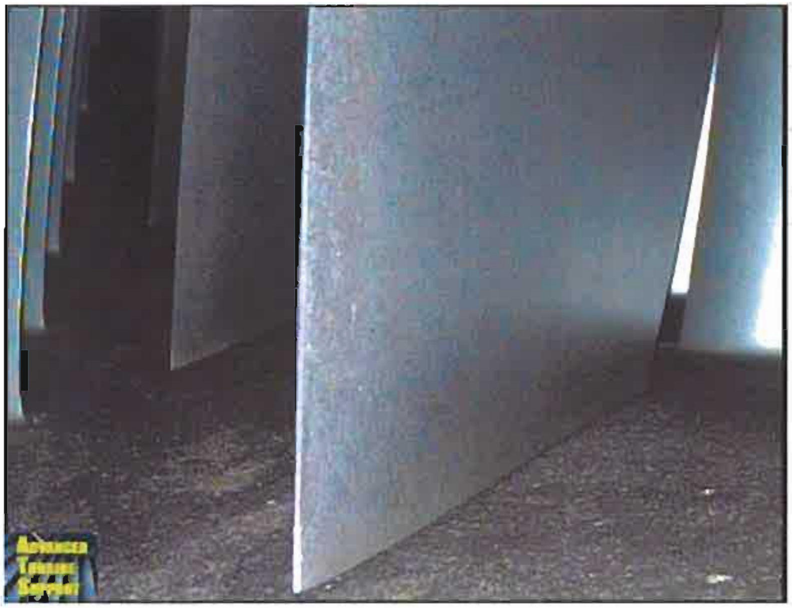
Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	

Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	



Section	Forward Compressor
Component	Stage 1 Stator Vane
Location	Tip
Observation	Clashing Damage
Comments	



Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 2 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

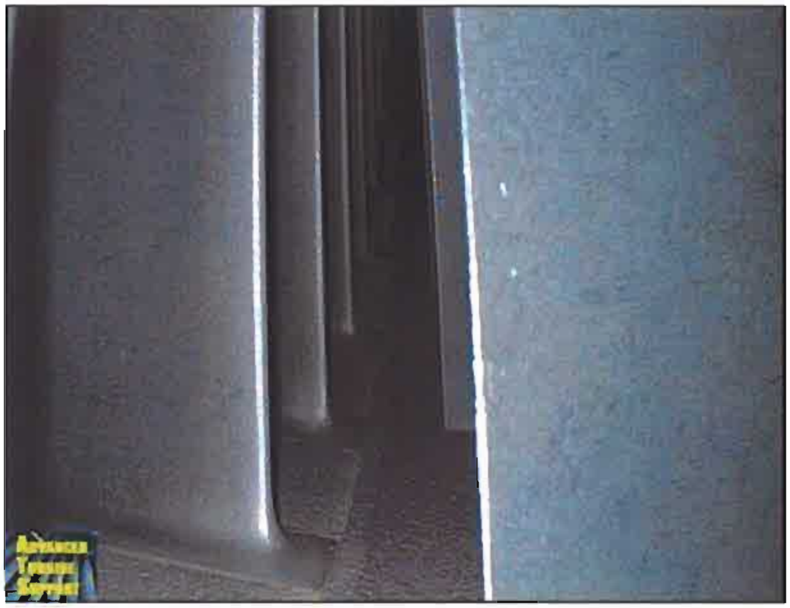
Section	Forward Compressor
Component	Stage 3 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

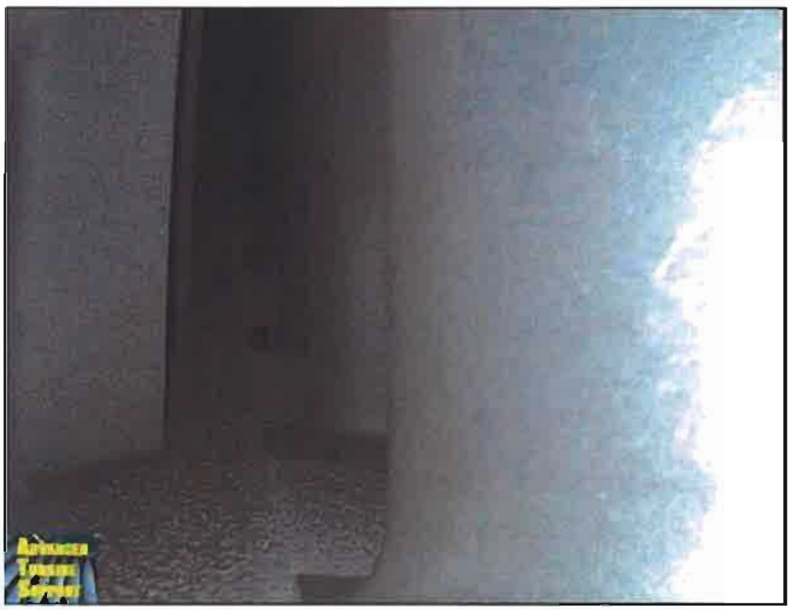
Section	Forward Compressor
Component	Stage 3 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

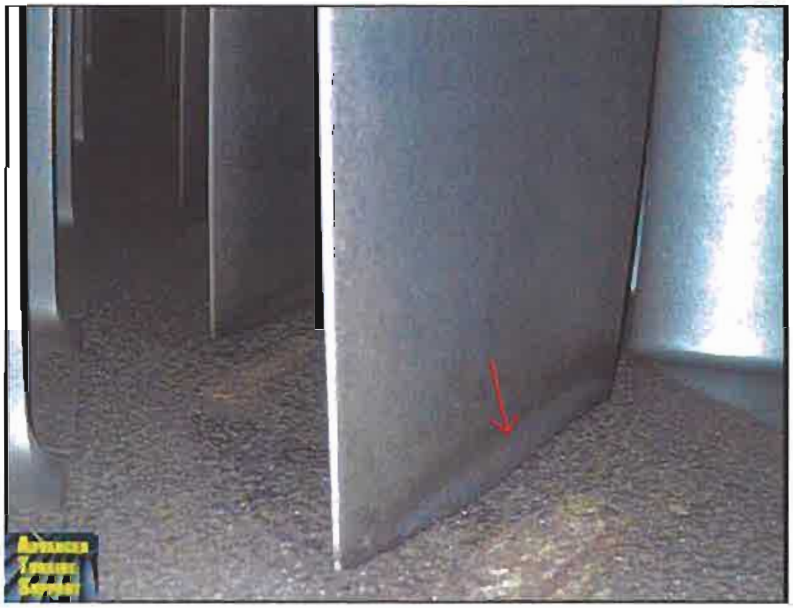
Section	Forward Compressor
Component	Stage 4 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration



Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 4 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

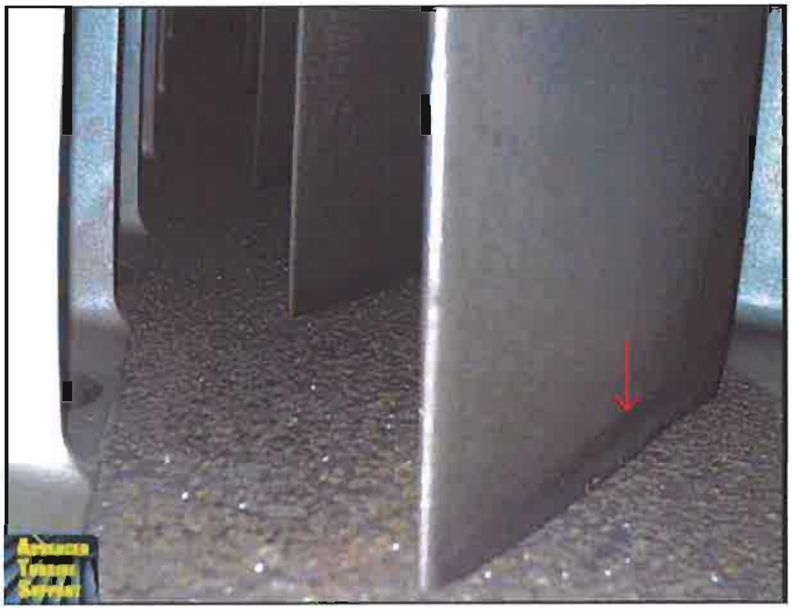


Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 5 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration

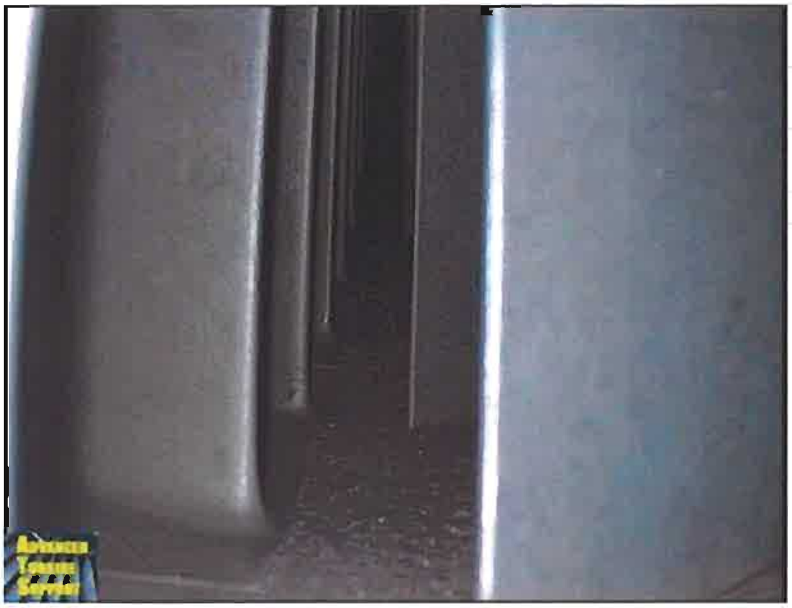
Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 5 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Tip Discoloration
Comments	

Section	Forward Compressor
Component	Stage 6 Rotor Blade
Location	Leading Edge Suction Side
Observation	Tip Discoloration
Comments	



Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

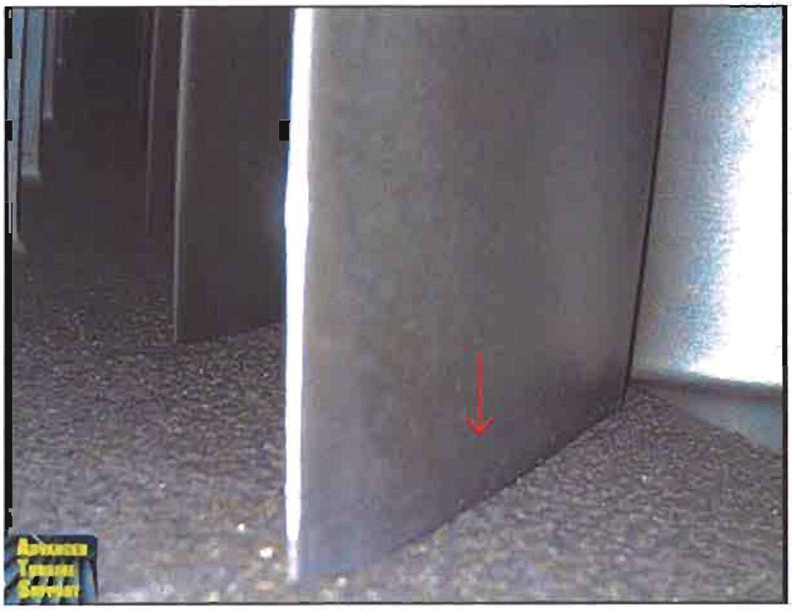
Section	Forward Compressor
Component	Stage 6 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 7 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

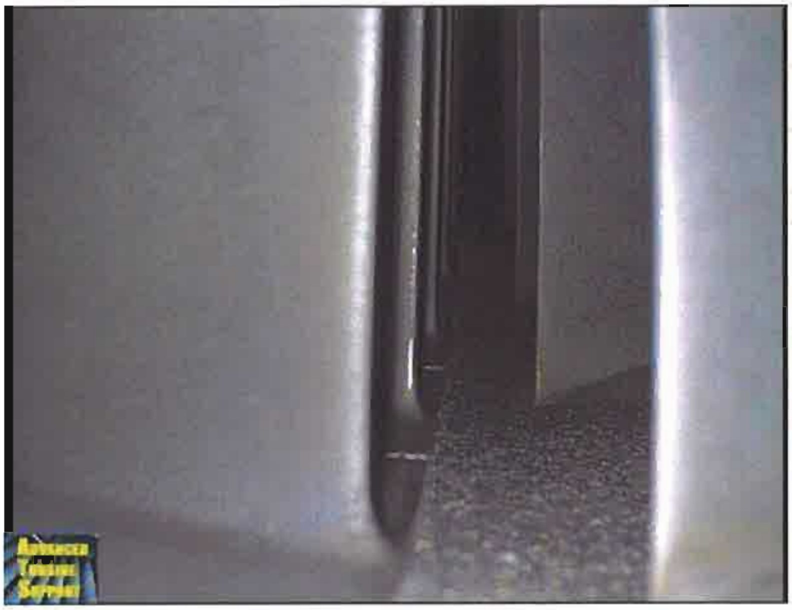
Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 7 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 8 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration



Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 8 Stator Vane
Location	Tip
Observation Comments	Rolled Metal

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 9 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Tip Discoloration

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 9 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 10 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

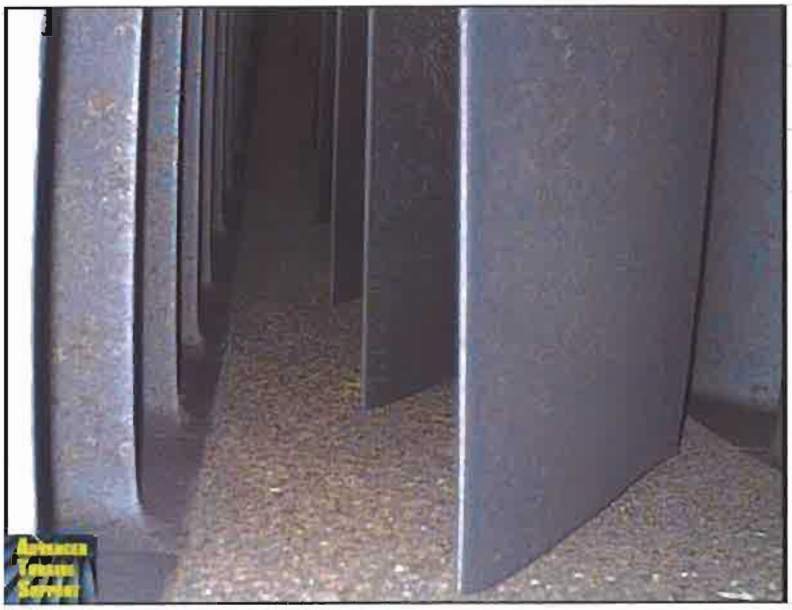
Section	Forward Compressor
Component	Stage 11 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Rotor Blade
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 12 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical



Section	Forward Compressor
Component	Stage 13 Rotor Blade
Location	Leading Edge Pressure Side
Observation Comments	Typical

Section	Forward Compressor
Component	Stage 13 Stator Vane
Location	Leading Edge Suction Side
Observation Comments	Typical

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Rotor Blade
Location	Trailing Edge
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Stage 17 Stator Vane
Location	Tip
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

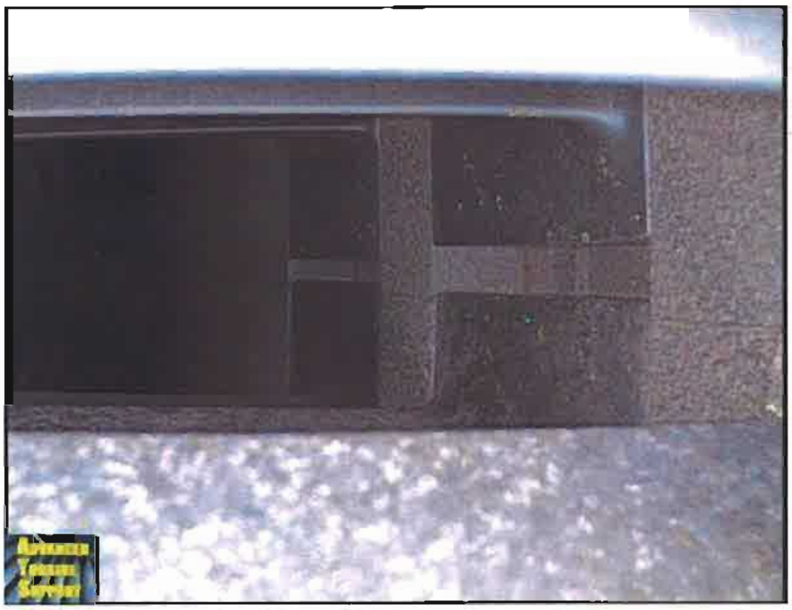
Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 1
Location	Tip
Observation	Typical
Comments	

Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Dovetail Right Side
Observation	Typical
Comments	



Section	Aft Compressor
Component	Exit Guide Vane 2
Location	Dovetail Left Side
Observation	Typical
Comments	

Combustion Section

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Combustion Cap
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Primary Fuel Nozzle
Location	Liner 9
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 7
Observation	Typical
Comments	

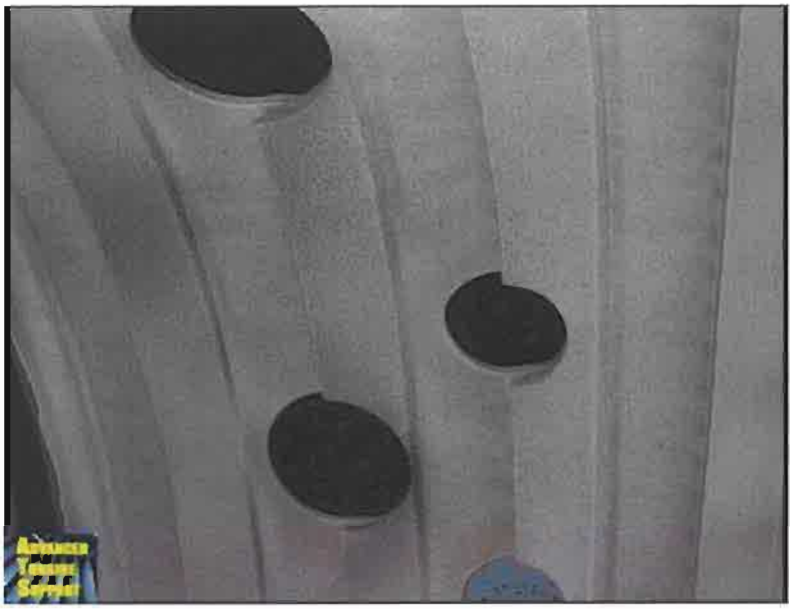
Section	Combustion Hot Side
Component	Secondary Fuel Nozzle
Location	Liner 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 3
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Crossfire Tube
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 3
Observation	Typical
Comments	



Section	Combustion Hot Side
Component	Liner
Location	Liner 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Liner
Location	Liner 10
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 1
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Venturi Ring
Location	Liner 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Right Side Picture Frame
Location	TP 8
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Left Side Picture Frame
Location	TP 7
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 2
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Side Seal
Location	TP 6
Observation	Typical
Comments	

Section	Combustion Hot Side
Component	Outer Floating Seal
Location	TP 6
Observation	Typical
Comments	

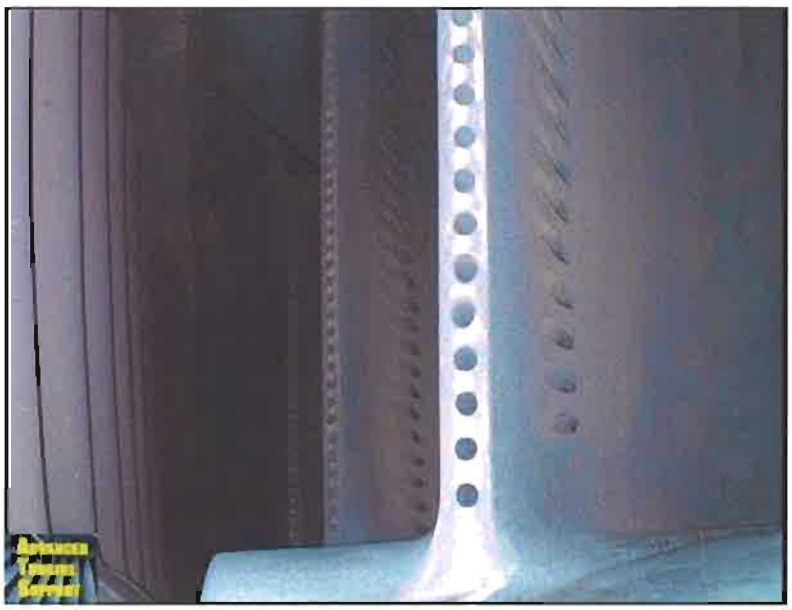
Section	Combustion Hot Side
Component	Inner Floating Seal
Location	TP 7
Observation	Typical
Comments	

Turbine Section

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Leading Edge
Location	General
Observation	Typical
Comments	



Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Nozzle Trailing Edge
Location	General
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Leading Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Platform
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Trailing Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Shroud Block
	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 1
Component	Bucket
Location	Shroud Block
	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Pressure Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Trailing Edge Suction Side
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Nozzle
Location	Discourager Seal
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 2
Component	Bucket
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Nozzle
Location	Trailing Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Leading Edge Tip Shroud
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Shroud Tip Interlocks
Observation	Typical
Comments	

Section	Turbine Stage 3
Component	Bucket
Location	Honeycomb Seal
Observation	Typical
Comments	

Exhaust Section

Section	Exhaust
Component	Diffuser
Observation	. Typical
Comments	

Section	Exhaust
Component	Diffuser
Observation	Typical
Comments	

GE Technical Information Letter TIL-1352-R3,
14 March, 2016

GE Power

POWER SERVICES ENGINEERING
PRODUCT SERVICE

TIL 1352-R3
14 MARCH 2016
Compliance Category - C
Timing Code - 4

TECHNICAL INFORMATION LETTER

MS6001B STATOR 17 AND EXIT GUIDE VANE DISTRESS

APPLICATION

All MS6001B gas turbines.

PURPOSE

Inform users that some 6B compressor stator 17 (S17) and exit guide vanes (EGVs) have experienced high cycle fatigue distress and in some cases cracking.

REASON FOR REVISION

To include all the 6B machines having cantilevered S17s and exit guide vanes. In addition, all the units affected by TIL-1170-2R1 are added to the current revision

Compliance Category

M - Maintenance	Identifies maintenance guidelines or best practices for reliable equipment operation.
C - Compliance Required	Identifies the need for action to correct a condition that, if left uncorrected, may result in reduced equipment reliability or efficiency. Compliance may be required within a specific operating time.
A - Alert	Failure to comply with the TIL could result in equipment damage or facility damage. Compliance is mandated within a specific operating time.
S – Safety	Failure to comply with this TIL could result in personal injury. Compliance is mandated within a specific operating time.

Timing Code

1	Prior to Unit Startup / Prior to Continued Operation (forced outage condition)
2	At First Opportunity (next shutdown)
3	Prior to Operation of Affected System
4	At First Exposure of Component
5	At Scheduled Component Part Repair or Replacement
6	Next Scheduled Outage

BACKGROUND DISCUSSION

The compressor section of 6B gas turbines has 17 stages of rotating components (rotor blades) and stationary components (stator vanes) and two stages of exit guide vanes.

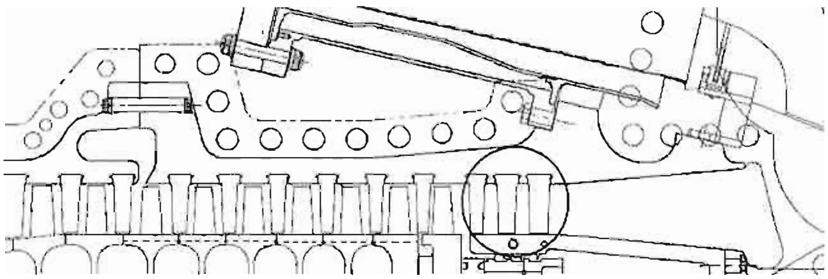


Figure 1: Cross section highlighting S17 to EGV2

Some users have experienced excessive stator groove wear at the stator 17 (S17) row or Exit Guide Vane (EGV) row and/or S17 distress with EGV cracking as shown in Figure 2. This has been detected during planned maintenance inspections and the liberated S17s were found in the combustion cans. In general, the S17s and EGVs at the half shell joint have been found to have liberated.

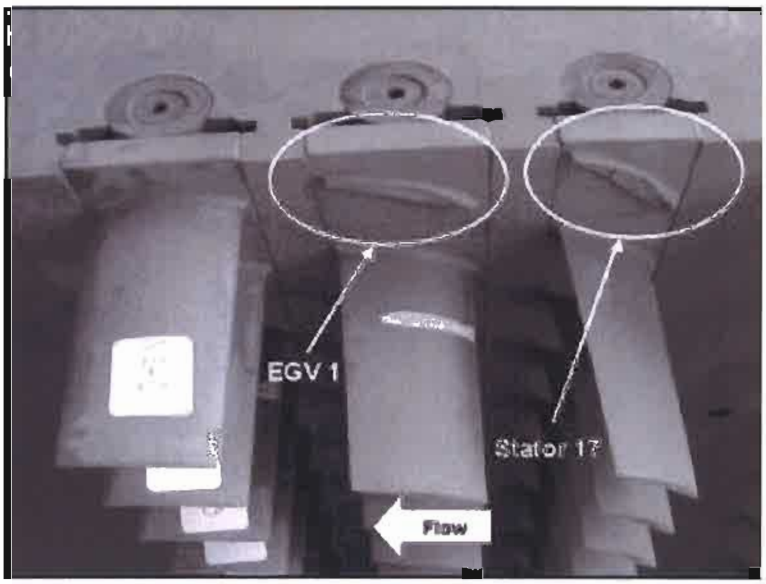


Figure 2: Liberated S17 and EGV1

The root cause of the S17 and EGV distress is an airflow emanating from the counter bore holes of the inner barrel. This phenomenon is known to have been aggravated by the unit operating at low ambient temperatures and at part load, especially with water/steam injection.

RECOMMENDATIONS

GE recommends performing the following steps:

1. Perform borescope inspection annually per GER 3620 to ensure the S17s and EGVs are not damaged or cracked.
2. If any indications are noted on the S17s or EGVs, the damaged vanes should be replaced at the earliest opportunity.

3. Customers are requested to contact their GE Service representatives to assist and evaluate the necessity of implementing the following recommendations. GE will evaluate the site condition and prior operation history and will recommend either implementing (i) or both (i & ii).

   (i) At the first planned inspection where the CDC casing is removed, not exceeding the Hot Gas Path inspection, install counter bore plugs in all MS 6001B units. Controls limits may need to be adjusted to reduce heat rate impact when bore plugs are installed.

   (ii) Implement new control protection software and compressor pressure ratio instrumentation for all MS6001B units at the earliest available opportunity. This will require additional instrumentation package to be installed in the inlet plenum and controls modification to be installed.

   As an alternative to (ii), customers can upgrade the S17s and EGVs to a shrouded configuration as shown in Figure 3, which would not require the above controls modification. Installing these shrouded S17s to EGVs would require inner barrel modification.

Figure 3: Representative picture of the shrouded hardware.

The TIL can be marked complete once all recommendations 1, 2 & 3 are completed.

PLANNING INFORMATION

Compliance

- Compliance Category: C
- Timing Code: 4

Manpower Skills

- Standard Manpower for Borescope Inspection
- Controls Field Engineer specially trained in S17 control installation

Parts

Contact your GE Service representative for assistance.

Special Tooling

Contact your GE Service representative for assistance.

Reference Documents

TIL-1352

Previous Modifications

TIL-1352-2R2

Scope of Work

- Inspection to be performed during annual borescope. If a defect is observed, the typical estimated time to replace the S17s will be approximately two millwrights for two 12-hour shifts.

- Installation of counter bore plugs may require approximately two millwrights for two 12-hour shifts.

- Control updates will take approximately four (4) to six (6) hours per unit to implement. Mark V and Mark VI controllers need to be rebooted for changes to take effect.

TIL DISPOSITION

Disposition of TILs should be entered in local records and also in GE Power ServiceNow. Follow the below instructions for entering the disposition record:

- Log into the Power ServiceNow at https://gepowerpac.service-now.com/til_new/ using your GE SSO number and password.
- Select "TIL Disposition".
- Click on the TIL for the serial number you want to update.
- Choose the most appropriate "Disposition Status" and enter "Disposition Notes".
- Click "Save".

Contact your local GE service representative for assistance or for additional information.

GE Technical Information Letter TIL-1382-R3,
14 January 2010

GE Energy

ENERGY SERVICES ENGINEERING
PRODUCT SERVICE

TIL 1382-R3
14 JANUARY 2010
Compliance Category - C
Timing Code - 2

TECHNICAL INFORMATION LETTER

COMPRESSOR ROTOR STAGE 1 BLADE (R1) INSPECTION

APPLICATION
Select Frame MS6001B Units.

PURPOSE
To inform affected users of the potential risk for cracking in the dovetail of specific compressor rotor stage 1 (R1) blades and of the recommendation to regularly inspect for this condition until the blade set is replaced with GE's improved blade.

REASON FOR REVISION
To further clarify recommendations and notify users of the availability of an improved blade.

Compliance Category

O - Optional	Identifies changes that may be beneficial to some, but not necessarily all, operators. Accomplishment is at customer's discretion.
M - Maintenance	Identifies maintenance guidelines or best practices for reliable equipment operation.
C - Compliance Required	Identifies the need for action to correct a condition that, if left uncorrected, may result in reduced equipment reliability or efficiency. Compliance may be required within a specific operating time.
A - Alert	Failure to comply with the TIL could result in equipment damage or facility damage. Compliance is mandated within a specific operating time.
S - Safety	Failure to comply with this TIL could result in personal injury. Compliance is mandated within a specific operating time.

Timing Code

1	Prior to Unit Startup / Prior to Continued Operation (forced outage condition)
2	At First Opportunity (next shutdown)
3	Prior to Operation of Affected System
4	At First Exposure of Component
5	At Scheduled Component Part Repair or Replacement
6	Next Scheduled Outage
7	Optional

BACKGROUND DISCUSSION

Certain compressor events on 6B gas turbine units have been attributable to a condition with the stage 1 compressor rotor (R1) blades (see Figure 1). These events have affected only a small percentage of the 6B fleet. At the R1 location, contact between the blade and wheel in a critical fillet of the blade dovetail may accompany micro-movement during cycling, potentially resulting in fretting-induced cracks that propagate through the blade platform. Such starts-based propagation may result in airfoil liberation and downstream compressor damage if left undetected.

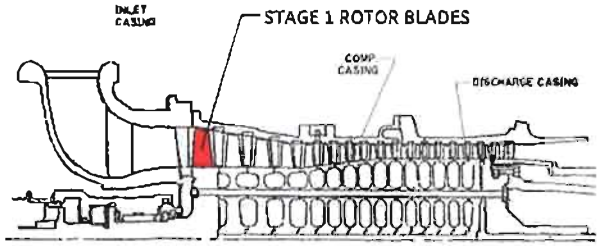


Figure 1: 6B Compressor Cross-Section

GE has developed an improved R1 blade (GE part number 119E8291P001 (kit # 301C5176G001)) containing a machined undercut feature in the dovetail. This undercut feature separates the critical fillet area from the contact face, eliminating the risk of fretting-induced cracking through the platform (see Figure 2). This design has been validated through successful operation and field experience and has been the production configuration in 6Bs shipped since February 2004.

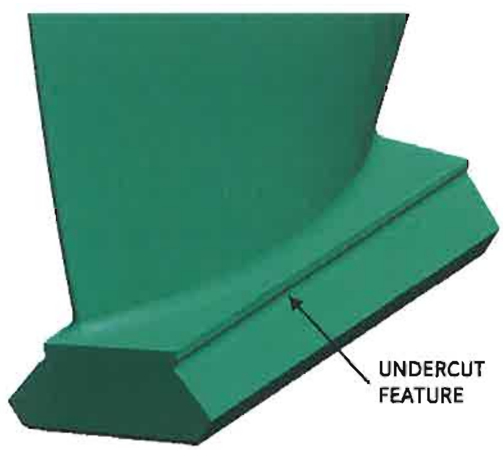


Figure 2: Improved R1 Blade Dovetail

RECOMMENDATIONS

NOTE: *During any visual inspection, if R1 cracks are found, unit should NOT be re-started. Contact GE engineering for recommendation.*

Units with R1 blade part number 101E2042P001 or 109E5170P001:

Units with less than 100 fired starts or 10,000 fired hours:

A visual inspection should be performed at the next shutdown. The inspection should be conducted as follows:

- From inside the inlet plenum and through the inlet guide vanes, visually inspect the first row of compressor blades, looking specifically for crack indications near the root area. Figure 3 illustrates an example of a propagated platform crack.
- Document any evidence of rubbing on the R1 blade tips.

This inspection should be repeated every 25 starts after the initial inspection or until undercut R1 blades are applied.

Please contact GE Product Service to report any indications found during the inspections. Confirmed cracks in R1 blades will warrant replacement of the entire blade row with GE's improved R1 blades.

Units that have reached 100 fired starts or 10,000 fired hours:

GE recommends that these blades be replaced with the improved R1 blade in order to take advantage of the undercut feature.

If blades are not replaced after 100 fired starts or 10,000 hours, it is recommended that they be visually inspected every 25 starts until replacement is possible, not to exceed the next annual borescope inspection.

Figure 2: R1 Platform Crack

<u>Units with R1 blade part number 103E3563P001, 103E3563P002, 103E3563P003, or 132D3731P002:</u>

A visual inspection should be performed annually. The inspection should be conducted as follows:

- From inside the inlet plenum and through the inlet guide vanes, visually inspect the first row of compressor blades, looking specifically for crack indications near the root area. Figure 3 illustrates an example of a propagated platform crack.
- Document any evidence of rubbing on the R1 blade tips.

GE recommends as an option to upgrade your blades to the improved R1 design to take advantage of the undercut feature.

This TIL and the inspection recommendations herein no longer apply once the improved R1 blades are installed.

Compliance
- Compliance Category: C
- Timing Code: 2

Manpower Skills
Visual inspection may be performed by site maintenance personnel.

Replacement of stage 1 blade row:

- o GE Technical Advisor
- o One or more GE Service Center blade technicians for blade removal and reinstallation
- o Craft labor for required disassembly and reassemble to allow access to the R-1 Blades

Parts
For units planning a scheduled gas turbine maintenance outage, please contact your GE representative for parts availability.

Replacement R1 blades: 119E8291P001 (kit # 301C5176G001). Allow 16 weeks for parts delivery.

Special Tooling
None

Reference Documents
None

Previous Modifications
None

Scope of Work
Inlet entry and visual inspection is performed during scheduled outages within recommended intervals. Estimated time for this inspection would be less than one hour, exclusive of inlet entry requirements.

Removal and reinstallation of the R1 blade set can typically be performed by one GE blade technician within a single 12-hour shift. This is exclusive of normal unit disassembly to expose the R1 blades.

Contact your local GE Service Manager or Contract Performance Manager for assistance or for additional information.

NOTE: *If you would like to receive future TILs by email, contact your local GE Service Manager or Contract Performance Manager for assistance.*

TIL COMPLIANCE RECORD

Compliance with this TIL must be entered in local records. GE requests that the customer notify GE upon compliance of this TIL.

Complete the following *TIL Compliance Record* and FAX it to:

TIL Compliance
FAX: (678) 844-3451
Toll free FAX: 1-888-896-TILS (1-888-896-8457)

TIL COMPLIANCE RECORD	For Internal Records Only #
Site Name:	Customer Name:
Customer Contact Information	**GE Contact Information**
Contact Name:	Contact Name:
Address:	Address:
Email:	Email:
Phone:	Phone:
FAX:	FAX:
Turbine Serial Number(s):	

INSTALLED EQUIPMENT		TIL Completed Date:	
		100% TIL Completed:	
Description:			
Unit Numbers:	Part Description:	Part Number	MLI Number
Comments:			

NOTE: *If there are any redlined drawings that pertain to this TIL implementation, please FAX the drawings along with this TIL Compliance Record.*

FAX this form to: **TIL Compliance**
FAX: (678) 844-3451
Toll free FAX: 1-888-896-TILS (1-888-896-8457)

Alstom Customer Information Bulletin No. 4
CHAAP150520GEN_U04A, dated 8 June 2015.

CUSTOMER INFORMATION BULLETIN

No. 4CHAAP150520GEN_U04A

Date: 8 June 2015

Editor: Thermal Service Generator Product Line - Janusz Bialik

Turbogenerator Rotor – brushless TKJ exciter

This CIB is to inform our customers concerning an issue with a connection on turbogenerator TKJ exciter.

Affected Fleet

The recommendation provided below is applicable only for the TKJ 71-13 exciter manufactured till 2012. This type of exciter is installed behind Topack family generator type: T 214-234, T 214-269, T 227-250, T 227-254.

Background

The affected connection is located on the rotating exciter part. It links the generator D- rotor connection leads to the collector ring and thus to the rectifier bridge (Figure 1 shows only the negative collector ring). The failing connection is made of two parts assembled together: part A is made of solid copper; part B is made of copper lamella. A dovetail soft soldered joint connects these two parts A and B together. The entire assembly is bolted to the collector rings on one side and to the D- leads on the other side.

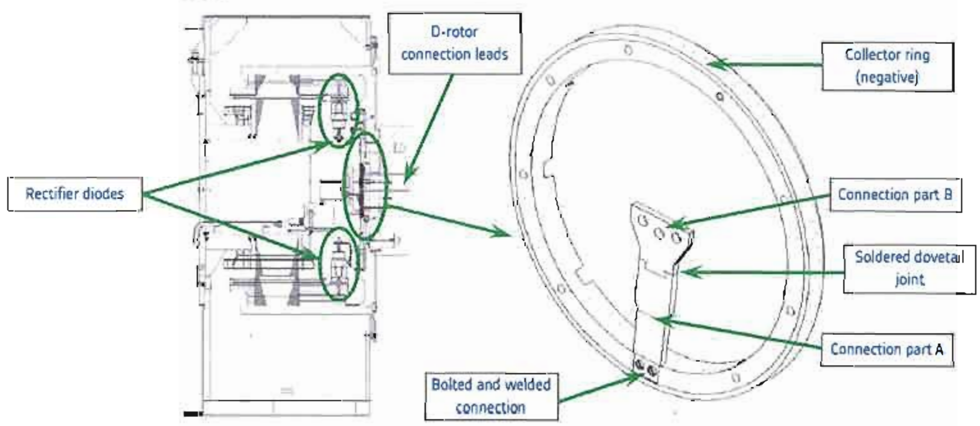


Figure 1: Area of findings on TKJ brushless exciters

ALSTOM (Switzerland) Ltd. · Brown Boveri Str. 7 · 5401 Baden · Switzerland
www.alstom.com/power

ALSTOM

The concerned exciter connection failed on thirteen (13) units during operation, resulting in forced outages.

Recommendation

Alstom has developed a modification package consisting of an improved exciter connection design with a superior mechanical performance. The upgrade solution eliminates the soft soldered joints, improves the connection flexibility and thus increases the generator reliability. Alstom recommends replacing both exciter connections (to positive and negative collector rings) with the new design during the next planned generator outage.
All required parts for this upgrade can be delivered as an upgrade kit and can be implemented within a regular outage.

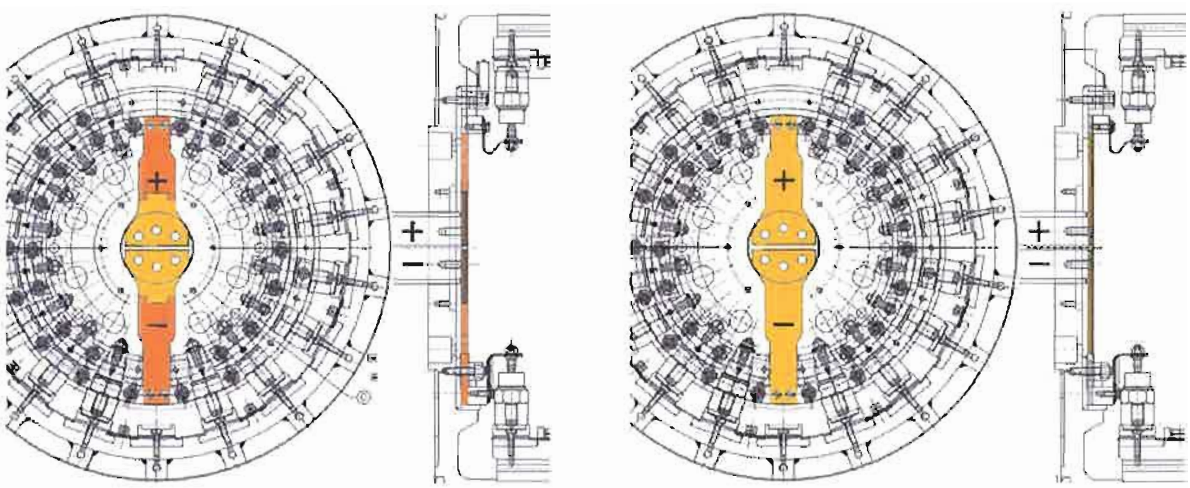


Figure 2: Old (left) and new (right) exciter connections design

Should you have any questions regarding this CIB, please contact your Customer Service Manager or Project Manager, referring to the number and subject of this CIB.

Contract Exhibit

EXHIBIT B

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Contract Exhibit

EXHIBIT C

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Contract Exhibit

EXHIBIT D

Contactors Performance Bond

Contract Exhibit

EXHIBIT E

Contractor's Labor and Material Payment Bond

Contract Exhibit

EXHIBIT F

Contractor's Insurance Certificate

Contract Exhibit

EXHIBIT G

Contractor's Affidavit for Final Payment

AFFIDAVIT FOR FINAL PAYMENT

TO ALL WHOM IT MAY CONCERN

KNOW ALL PERSONS BY THESE PRESENTS, THAT WHEREAS, the undersigned

____

Contractor Address City State

hereinafter referred to as Contractor, and the City of Columbia, Missouri, hereinafter referred to as Owner, have heretofore entered into a certain written Contract dated the__________day of _____________, 20________, covering work to be performed and material to be furnished for:

____

Name of Project

WHEREAS, Contractor has performed work, and furnished materials as provided under said Contract up to and including the date hereof, and upon supplying proper waiver of liens, is entitled to payment from the Owner for the sum of:

____DOLLARS,

Balance of said Contract

NOW, THEREFORE, in order to induce the Owner to make payment of said sum, and if said sum represents the balance due under said Contract, to induce the acceptance of said work and materials by the Owner, Contractor hereby represents that all work performed and materials furnished under said Contract up to and including the date hereof, including work and materials, if any, performed or furnished by subcontractors and material suppliers, have been paid in full, and Contractor hereby waives any and all liens, rights of liens, and claims on or against the premises at the address above given, or on any and all structures and buildings located thereon, arising under any law of the State wherein said premises are situated, and hereby releases and agrees to save harmless the Owner from and against any and all claims for and on account of work performed, or materials furnished by or for Contractor under said Contract or otherwise, Contractor represents that all Sales and Use taxes, if any, applicable to any material furnished by or for Contractor, have been paid in full.

____

Contractor

Personally appeared before me, a Notary Public, within and for the County of

__________________________,

State of Missouri, the person whose signature appears above, PERSONALLY AND KNOWN TO ME AND ACKNOWLEDGED, that signed the foregoing Affidavit for the purposes therein stated.

Subscribed and sworn to me this_________________day of____________________, 20______.
My Commission expires_________________________, 20___.

____

(Notary Public)

EXHIBIT H

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Contract Exhibit

EXHIBIT I

Missouri Division of Labor Standards Annual Wage Order 23

Missouri
Division of Labor Standards

WAGE AND HOUR SECTION

JEREMIAH W. (JAY) NIXON, Governor

Annual Wage Order No. 23

Section 010
BOONE COUNTY

In accordance with Section 290.262 RSMo 2000, within thirty (30) days after a certified copy of this Annual Wage Order has been filed with the Secretary of State as indicated below, any person who may be affected by this Annual Wage Order may object by filing an objection in triplicate with the Labor and Industrial Relations Commission, P.O. Box 599, Jefferson City, MO 65102-0599. Such objections must set forth in writing the specific grounds of objection. Each objection shall certify that a copy has been furnished to the Division of Labor Standards, P.O. Box 449, Jefferson City, MO 65102-0449 pursuant to 8 CSR 20-5.010(1). A certified copy of the Annual Wage Order has been filed with the Secretary of State of Missouri.

Original Signed by
John E. Lindsey, Director
Division of Labor Standards

This Is A True And Accurate Copy Which Was Filed With The Secretary of State: March 10, 2016

Last Date Objections May Be Filed: April 11, 2016

Prepared by Missouri Department of Labor and Industrial Relations

OCCUPATIONAL TITLE	** Date of Increase	*	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Asbestos Worker (H & F) Insulator			$32.36	55	60	$21.41
Boilermaker	7/16		$35.93	57	7	$28.33
Bricklayer and Stone Mason			$29.26	59	7	$16.91
Carpenter	6/16		$25.16	60	15	$16.10
Cement Mason			$27.55	9	3	$12.20
Communication Technician	6/16		$31.80	28	7	$12.90 + 13%
Electrician (Inside Wireman)	6/16		$31.80	28	7	$12.90 + 13%
Electrician (Outside-Line Construction\Lineman)			$42.27	43	45	$5.25 + 36%
Lineman Operator			$36.45	43	45	$5.25 + 36%
Groundman			$28.13	43	45	$5.25 + 36%
Elevator Constructor		a	$46.04	26	54	$31.645
Glazier	6/16		$26.87	122	76	$11.78
Ironworker			$28.41	11	8	$24.04
Laborer (Building):						
General			$22.36	42	44	$13.19
First Semi-Skilled			$24.36	42	44	$13.19
Second Semi-Skilled			$23.36	42	44	$13.19
Lather			USE CARPENTER RATE			
Linoleum Layer and Cutter	6/16		$25.04	60	15	$16.10
Marble Mason			$21.66	124	74	$12.68
Marble Finisher			$14.14	124	74	$9.08
Millwright	6/16		$26.16	60	15	$16.10
Operating Engineer						
Group I	6/16		$28.86	86	66	$24.98
Group II	6/16		$28.86	86	66	$24.98
Group III	6/16		$27.61	86	66	$24.98
Group III-A	6/16		$28.86	86	66	$24.98
Group IV	6/16		$26.63	86	66	$24.98
Group V	6/16		$29.56	86	66	$24.98
Painter	6/16		$23.24	18	7	$11.78
Pile Driver	6/16		$26.16	60	15	$16.10
Pipe Fitter	7/16	b	$38.00	91	69	$26.93
Plasterer			$26.09	94	5	$12.25
Plumber	7/16	b	$38.00	91	69	$26.93
Roofer \ Waterproofer			$29.30	12	4	$14.87
Sheet Metal Worker	7/16		$31.34	40	23	$17.04
Sprinkler Fitter - Fire Protection	7/16		$33.49	33	19	$19.45
Terrazzo Worker			$28.73	124	74	$14.38
Terrazzo Finisher			$18.68	124	74	$14.38
Tile Setter			$21.66	124	74	$12.68
Tile Finisher			$14.14	124	74	$9.08
Traffic Control Service Driver			$26.415	22	55	$9.045
Truck Driver-Teamster						
Group I			$25.30	101	5	$10.70
Group II			$25.95	101	5	$10.70
Group III			$25.45	101	5	$10.70
Group IV			$25.95	101	5	$10.70

Fringe Benefit Percentage is of the Basic Hourly Rate

**Annual Incremental Increase

OCCUPATIONAL TITLE	** Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits

* Welders receive rate prescribed for the occupational title performing operation to which welding is incidental.

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2)

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

a - Vacation: Employees over 5 years - 8%; Employees under 5 years - 6%
**b - All work over $7 Mil. Total Mech. Contract - $38.00, Fringes - $26.93
All work under $7 Mil. Total Mech. Contract - $36.66, Fringes - $21.49
c - Vacation: Employees after 1 year - 2%; Employees after 2 years - 4%; Employees after 10 years - 6%

REPLACEMENT PAGE
BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 9: Means the regular workday starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one hour to 9:00 a.m. All work performed in excess of the regular work day and on Saturday shall be compensated at one and one-half (1½) times the regular pay. In the event time is lost during the work week due to weather conditions, the Employer may schedule work on the following Saturday at straight time. All work accomplished on Sunday and holidays shall be compensated for at double the regular rate of wages. The work week shall be Monday through Friday, except for midweek holidays.

NO. 11: Means eight (8) hours shall constitute a day's work, with the starting time to be established between 6:00 a.m. and 8:00 a.m. from Monday to Friday. Time and one-half (1½) shall be paid for first two (2) hours of overtime Monday through Friday and the first eight (8) hours on Saturday. All other overtime hours Monday through Saturday shall be paid at double (2) time rate. Double (2) time shall be paid for all time on Sunday and recognized holidays or the days observed in lieu of these holidays.

NO. 12: Means the work week shall commence on Monday at 12:01 a.m. and shall continue through the following Friday, inclusive of each week. All work performed by employees anywhere in excess of forty (40) hours in one (1) work week, shall be paid for at the rate of one and one-half (1½) times the regular hourly wage scale. All work performed within the regular working hours which shall consist of a ten (10) hour work day except in emergency situations. Overtime work and Saturday work shall be paid at one and one-half (1½) times the regular hourly rate. Work on recognized holidays and Sundays shall be paid at two (2) times the regular hourly rate.

NO. 18: Means the regular work day shall be eight (8) hours. Working hours are from six (6) hours before Noon (12:00) to six (6) hours after Noon (12:00). The regular work week shall be forty (40) hours, beginning between 6:00 a.m. and 12:00 Noon on Monday and ending between 1:00 p.m. and 6:00 p.m. on Friday. Saturday will be paid at time and one-half (1½). Sunday and Holidays shall be paid at double (2) time. Saturday can be a make-up day if the weather has forced a day off, but only in the week of the day being lost. Any time before six (6) hours before Noon or six (6) hours after Noon will be paid at time and one-half (1½).

NO. 22: Means a regular work week of forty (40) hours will start on Monday and end on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A workday is to begin between 6:00 a.m. and 9:00 a.m. However, the project starting time may be advanced or delayed if mutually agreed to by the interest parties For all time worked on recognized holidays, or days observed as such, double (2) time shall be paid

NO. 26: Means that the regular working day shall consist of eight (8) hours worked between 6:00 a.m., and 5:00 p.m., five (5) days per week, Monday to Friday, inclusive. Hours of work at each jobsite shall be those established by the general contractor and worked by the majority of trades. (The above working hours may be changed by mutual agreement). Work performed on Construction Work on Saturdays, Sundays and before and after the regular working day on Monday to Friday, inclusive, shall be classified as overtime, and paid for at double (2) the rate of single time The employer may establish hours worked on a jobsite for a four (4) ten (10) hour day work week at straight time pay for construction work; the regular working day shall consist of ten (10) hours worked consecutively, between 6:00 a.m. and 6:00 p.m., four (4) days per week, Monday to Thursday, inclusive. Any work performed on Friday, Saturday, Sunday and holidays, and before and after the regular working day on Monday to Thursday where a four (4) ten (10) hour day workweek has been established, will be paid at two times (2) the single time rate of pay. The rate of pay for all work performed on holidays shall be at two times (2) the single time rate of pay.

REPLACEMENT PAGE
BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 28: Means a regular workday shall consist of eight (8) hours between 7:00 a.m. and 5:30 p.m., with at least a thirty (30) minute period to be taken for lunch. Five (5) days a week, Monday through Friday inclusive, shall constitute a work week. The Employer has the option for a workday/workweek of four (4) ten (10) hour days (4-10's) provided:

-The project must be for a minimum of four (4) consecutive days.
-Starting time may be within one (1) hour either side of 8:00 a.m.
-Work week must begin on either a Monday or Tuesday; If a holiday falls within that week it shall be a consecutive work day. (Alternate: If a holiday falls in the middle of a week, then the regular eight (8) hour schedule may be implemented).
-Any time worked in excess of any ten (10) hour work day (in a 4-10 hour work week) shall be at the appropriate overtime rate.

All work outside of the regular working hours as provided, Monday through Saturday, shall be paid at one & one-half (1½) times the employee's regular rate of pay. All work performed from 12:00 a.m. Sunday through 8:00 a.m. Monday and recognized holidays shall be paid at double (2) the straight time hourly rate of pay. Should employees work in excess of twelve (12) consecutive hours they shall be paid double time (2X) for all time after twelve (12) hours. Shift work performed between the hours of 4:30 p.m. and 12:30 a.m. (second shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus ten (10%) percent for seven and one-half (7½) hours work. Shift work performed between the hours of 12:30 a.m. and 8:00 a.m. (third shift) shall receive eight (8) hours pay at the regular hourly rate of pay plus fifteen (15%) percent for seven (7) hours work. A lunch period of thirty (30) minutes shall be allowed on each shift. All overtime work required after the completion of a regular shift shall be paid at one and one-half (1½) times the shift hourly rate.

NO. 33: Means the standard work day and week shall be eight (8) consecutive hours of work between the hours of 6:00 a.m. and 6:00 p.m., excluding the lunch period Monday through Friday, or shall conform to the practice on the job site Four (4) days at ten (10) hours a day may be worked at straight time, Monday through Friday and need not be consecutive. All overtime, except for Sundays and holidays shall be at the rate of time and one-half (1½). Overtime worked on Sundays and holidays shall be at double (2) time.

NO. 40: Means the regular working week shall consist of five (5) consecutive (8) hour days' labor on the job beginning with Monday and ending with Friday of each week. Four (4) 10-hour days may constitute the regular work week. The regular working day shall consist of eight (8) hours labor on the job beginning as early as 6:00 a.m. and ending as late as 5:30 p.m. All full or part time labor performed during such hours shall be recognized as regular working hours and paid for at the regular hourly rate. All hours worked on Saturday and all hours worked in excess of eight (8) hours but not more than twelve (12) hours during the regular working week shall be paid for at time and one-half (1½) the regular hourly rate. All hours worked on Sundays and holidays and all hours worked in excess of twelve (12) hours during the regular working day shall be paid at two (2) times the regular hourly rate. In the event of rain, snow, cold or excessively windy weather on a regular working day, Saturday may be designated as a "make-up" day. Saturday may also be designated as a "make-up" day, for an employee who has missed a day of work for personal or other reasons Pay for "make-up" days shall be at regular rates.

BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 42: Means eight (8) hours between the hours of 8:00 a m. and 4:30 p.m. shall constitute a work day. The starting time may be advanced one (1) or two (2) hours. Employees shall have a lunch period of thirty (30) minutes. The Employer may provide a lunch period of one (1) hour, and in that event, the workday shall commence at 8:00 a.m. and end at 5:00 p.m. The workweek shall commence at 8:00 a.m. on Monday and shall end at 4:30 p m. on Friday (or 5:00 p.m. on Friday if the Employer grants a lunch period of one (1) hour), or as adjusted by starting time change as stated above. All work performed before 8:00 a.m. and after 4:30 p.m. (or 5:00 p.m. where one (1) hour lunch is granted for lunch) or as adjusted by starting time change as stated above or on Saturday, except as herein provided, shall be compensated at one and one-half (1½) times the regular hourly rate of pay for the work performed. All work performed on Sunday and on recognized holidays shall be compensated at double (2) the regular hourly rate of pay for the work performed. When working a five 8-hour day schedule and an Employer is prevented from working forty (40) hours, Monday through Friday, or any part thereof by reason of inclement weather (rain or mud), Saturday or any part thereof may be worked as a make-up day at the straight time rate. The Employer shall have the option of working five eight (8) hour days or four ten (10) hour days Monday through Friday. If an Employer elects to work five (5) eight (8) hour days during any work week, hours worked more than eight (8) per day or forty (40) hours per week shall be paid at time and one-half (1½) the hourly rate Monday through Friday. If an Employer elects to work four (4) ten (10) hour days in any week, work performed more than ten (10) hours per day or forty (40) hours per week shall be paid at time and one-half (1½) the hourly rate Monday through Friday. If an Employer is working ten (10) hour days and loses a day due to inclement weather, they may work ten (10) hours Friday at straight time. All hours worked over the forty (40) hours Monday through Friday will be paid at time and one-half (1½) overtime rate. Overtime shall be computed at half-hour intervals. Shift Work: Two (2) or three (3) shifts shall be permitted, provided such shifts are scheduled for a minimum of three (3) consecutive days. The second shift shall begin at 4:30 p.m. and end at 12:30 a.m. with one-half (1/2) hour for lunch between 7:30 p.m. and 9:00 p.m. and shall received eighty (8) hours' pay. The third shift shall begin at 12:30 a.m. and end at 8:00 a.m. with one-half (1/2) hour for lunch between 3:30 a.m. and 5:00 a.m. and shall received (8) hour's; pay. There shall be at least one (1) foreman on each shift on jobs where more than one shift is employed, provided that there are two (2) or more employees on second and on the third shifts. All shifts shall arrange to interchange working hours at the end of each week. When three shifts are used, the applicable rate must be paid from Saturday at 8:00 a.m. until the following Monday at 8:00 a.m. When three shifts are employed, the second and third shifts shall contain at least one-half (1/2) as many employees as the first shift.

NO. 43: Eight (8) hours shall constitute a work day between the hours of 7:00 a.m. and 4:30 p.m. Forty (40) hours within five (5) days, Monday through Friday inclusive, shall constitute the work week. Work performed in the 9th and 10th hour, Monday through Friday, shall be paid at time and one-half (1½) the regular straight time rate of pay. Contractor has the option to pay two (2) hours per day at the time and one-half (1½) the regular straight time rate of pay between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. Work performed outside the regularly scheduled working hours and on Saturdays, Sundays and recognized legal holidays, or days celebrated as such, shall be paid for at the rate of double (2) time.

NO. 56: Means the regular work day shall be eight (8) hours between 6:00 a.m. and 4:30 p.m. The first two (2) hours of work performed in excess of the eight (8) hour work day, Monday through Friday, and the first ten (10) hours of work on Saturday, shall be paid at one & one-half (1½) times the straight time rate. All work performed on Sunday, observed holidays and in excess of ten (10) hours a day, Monday through Saturday, shall be paid at double (2) the straight time rate.

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BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 57: Means eight (8) hours per day shall constitute a day's work and forty (40) hours per week, Monday through Friday, shall constitute a week's work. The regular starting time shall be 8:00 a.m. If a second or third shift is used, the regular starting time of the second shift shall be 4:30 p.m. and the regular starting period for the third shift shall be 12:30 a.m. These times may be adjusted by the employer. The day shift shall work a regular eight (8) hours shift as outlined above. Employees working a second shift shall receive an additional $0.25 above the regular hourly rate and perform seven and one-half (7½) hours work for eight (8) hours pay. Third shift employees shall be paid an additional $0.50 above the regular hourly rate and work seven (7) hours for eight (8) hours pay. When circumstances warrant, the Employer may change the regular workweek to four (4) ten-hour days at the regular time rate of pay. All time worked before and after the established workday of eight (8) hours, Monday through Friday, and all time worked on Saturday shall be paid at the rate of time and one-half (1½) except in cases where work is part of an employee's regular Friday shift. All time worked on Sunday and recognized holidays shall be paid at the double (2) time rate of pay except in cases where work is part of an employee's previous day's shift. For all overtime hours worked $27.04 of the fringe benefits portion of the prevailing wage shall be paid at the same overtime rate at which the cash portion of the prevailing wage is to be paid. The remaining $1.29 of the fringe benefit portion of the prevailing wage may be paid at straight time.

NO. 59: Means that except as herein provided, eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work. All time worked outside of the standard eight (8) hour work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½). All time worked on Sunday and holidays shall be classified as overtime and paid at the rate of double (2) time. The Employer has the option of working either five (5) eight hour days or four (4) ten hour days to constitute a normal forty (40) hour work week. When the four (4) ten-hour work week is in effect, the standard work day shall be consecutive ten (10) hour periods between the hours of 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a week's work, Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed ten (10) hours or forty (40) hours per week. When the five day eight (8) hour work week is in effect, forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours or forty (40) hours per week. The regular starting time (and resulting quitting time) may be moved to 6:00 a.m. or delayed to 9:00 a.m. Make-up days shall not be utilized for days lost due to holidays.

NO. 60: Means the Employer shall have the option of working five 8-hour days or four 10-hour days Monday through Friday. If an Employer elects to work five 8-hour days during any work week, hours worked more than eight (8) per day or forty (40) per week shall be paid at time and one-half (1½) the hourly wage rate plus fringe benefits Monday through Friday. SATURDAY MAKE-UP DAY: If an Employer is prevented from working forty (40) hours, Monday through Friday, or any part thereof by reason of inclement weather (rain or mud), Saturday or any part thereof may be worked as a make-up day at the straight time rate. It is agreed by the parties that the make-up day is not to be used to make up time lost due to recognized holidays. If an Employer elects to work four 10-hour days, between the hours of 6:30 a.m. and 6:30 p.m. In any week, work performed more than ten (10) hours per day or forty (40) hours per week shall be paid at time and one half (1½) the hourly wage rate plus fringe benefits Monday through Friday. If an Employer is working 10-hour days and loses a day due to inclement weather, the Employer may work ten (10) hours on Friday at straight time. All hours worked over the forty (40) hours Monday through Friday will be paid at time and one-half (1½) the hourly wage rate plus fringe benefits All Millwright work performed in excess of the regular work day and on Saturday shall be compensated for at time and one-half (1½) the regular Millwright hourly wage rate plus fringe benefits. The regular work day starting at 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. All work accomplished on Sundays and recognized holidays, or days observed as recognized holidays, shall be compensated for at double (2) the regular hourly rate of wages plus fringe benefits NOTE: All overtime is computed on the hourly wage rate plus an amount equal to the fringe benefits.

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BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 86: The regular workday shall consist of eight (8) consecutive hours, exclusive of a thirty (30) minute lunch period, with pay at the straight time rate with all hours in excess of eight (8) hours in any one day to be paid at the applicable overtime rate at time and one-half (1½). The regular workday shall begin between the hours of 6:00 a.m. and 8:00 a.m. The Employer may have the option to schedule the work week from Monday through Thursday at ten (10) hours per day at the straight time rate of pay with all hours in excess of ten (10) hours in any one day to be paid at the applicable overtime rate at time and one-half (1½). If the Employer elects to work from Monday through Thursday and is stopped due to inclement weather, holiday or other conditions beyond the control of the Employer, they shall have the option to work Friday at the straight time rate of pay to complete the forty (40) hours for the workweek. All overtime work performed on Monday through Saturday shall be paid at time and one-half (1½) the hourly rate. Fringe benefits shall be paid at the one and one half the hourly rate. All work performed on Sundays and recognized holidays shall be paid at double (2) the hourly rate. Fringe benefits shall be paid at double the hourly rate. Shifts may be established when considered necessary by the Employer. Shift hours and rates will be as follows. If shifts are established, work on the First Shift will begin between 6:00 a.m. and 9:00 a.m. and consist of eight (8) hours of work plus one-half hour unpaid lunch. Hours worked during the first shift will be paid at the straight time rate of pay. The second shift shall start eight hours after the start of the first shift and consist of eight (8) hours of work plus one-half hour unpaid lunch. Work on the second shift will begin between 2:00 p.m. and 5:00 p.m. and be paid the straight time rate plus $2.50 per hour. The third shift shall start eight hours after the start of the second shift and consist of eight (8) hours plus one-half hour unpaid lunch. Work on the third shift will begin between 10:00 p.m. and 1:00 a.m. and be paid the straight time rate plus $3.50 per hour. The additional amounts that are to be paid are only applicable when working shifts. Shifts that begin on Saturday morning through those shifts which end on Sunday morning will be paid at time and one-half these rates. Shifts that begin on Sunday morning through those shifts which end on Monday morning will be paid at double time these rates.

NO. 91: Means eight (8) hours shall constitute a day's work commencing at 7:00 a.m. and ending at 3:30 p.m., allowing one-half (½) hour for lunch. The option exists for the Employer to use a flexible starting time between the hours of 6:00 a.m. and 9:00 a.m. The regular workweek shall consist of forty (40) hours of five (5) workdays, Monday through Friday. The workweek may consist of four (4) ten (10) hour days from Monday through Thursday, with Friday as a make-up day. If the make-up day is a holiday, the employee shall be paid at the double (2) time rate. The employees shall be paid time and one-half (1½) for work performed on Saturdays, before the regular starting time or after the regular quitting time or over eight (8) hours per work day (unless working a 10-hour work day, then time and one-half (1½) is paid for work performed over ten (10) hours a day) or over forty (40) hours per work week. Work performed on Sundays and recognized holidays shall be paid at the double (2) time rate of pay. SHIFT WORK: When it is necessary for the project to operate in shifts, there will be three (3) eight (8) hour shifts commencing at 8:00 a.m. Shift work must continue for a period of not less than three (3) consecutive work days, two (2) days which must be regular work days (Monday through Friday). In the event the second or third shift of any regular work day shall fall into a Saturday or a holiday, such extension into a Saturday or holiday shall be considered as part of the previous workday and employees shall be paid at the regular shift rate. The first day shift shall work a regular eight (8) hour day at regular rates. The second shift shall be eight (8) hours regular time pay plus $2.50 per hour premium for eight (8) hours work. Third shift will be for eight (8) hours regular time pay plus $3 00 per hour premium for eight (8) hours work.

NO. 94: Means eight (8) hours shall constitute a day's work between the hours of 8:00 a.m. and 5:00 p.m. The regular workday starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. All work performed in excess of the regular work day and on Saturday shall be compensated at one and one-half (1½) times the regular pay. In the event time is lost during the work week due to weather conditions, the Employer may schedule work on the following Saturday at straight time. All work accomplished on Sunday and holidays shall be compensated at double the regular rate of wages.

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BOONE COUNTY
BUILDING CONSTRUCTION - OVERTIME SCHEDULE

NO. 101: Means that except as provided below, eight (8) hours a day shall constitute a standard work day, and forty (40) hours per week shall constitute a week's work, which shall begin on Monday and end on Friday. All time worked outside of the standard work day and on Saturday shall be classified as overtime and paid the rate of time and one-half (1½) (except as herein provided). All time worked on Sunday and recognized holidays shall be classified as overtime and paid at the rate of double (2) time. The regular starting time of 8:00 a.m. (and resulting quitting time of 4:30 p.m.) may be moved forward to 6:00 a.m. or delayed one (1) hour to 9:00 a.m. The Employer has the option of working either five (5) eight-hour days or four (4) ten-hour days to constitute a normal forty (40) hour work week. When a four (4) ten-hour day work week is in effect, the standard work day shall be consecutive ten (10) hour periods between the hours of 6:30 a.m. and 6:30 p.m. Forty (40) hours per week shall constitute a week's work Monday through Thursday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Friday and/or Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed ten (10) hours per day or forty (40) hours per week. Starting time will be designated by the employer. When the five (5) day eight (8) hour work week is in effect, forty (40) hours per week shall constitute a week's work, Monday through Friday, inclusive. In the event the job is down for any reason beyond the Employer's control, then Saturday may, at the option of the Employer, be worked as a make-up day; straight time not to exceed eight (8) hours per day or forty (40) hours per week. Make-up days shall not be utilized for days lost due to holidays.

NO. 122: Means the regular workday shall be (8) hours. The regular work week shall be forty (40) hours, beginning 6:00 a.m. on Monday and ending 6:00 p.m. on Friday. Saturday will be time and one-half (1½). Sunday and Holidays shall be double (2) time. Saturday can be a make-up day if weather has forced a day off.

NO. 124: Means eight (8) hours shall constitute a day's work on all classes of work between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. The pay for time worked during these hours shall be at the regular wage rate. The regular workweek shall be Monday through Friday. Employment from 4:30 p.m. to 12:00 midnight, Monday through Friday, shall be paid for at one and one-half (1½) times the regular hourly rate. From 12:00 midnight until 8:00 a.m. on any day shall be paid for at twice the regular hourly rate. All time worked on Sundays and the recognized holidays shall be paid at the rate of double (2) time. It is understood that forty (40) hours shall constitute a regular workweek, (5-8's) Sunday Midnight through Friday Midnight, understanding anything over eight (8) hours is one and one-half (1½) times the hourly wage rate.

BOONE COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 3: All work done on New Year's Day, Decoration Day, July 4th, Labor Day, Veteran's Day, Thanksgiving and Christmas shall be compensated at the double (2) time rate of pay. When any of these holidays fall on a Sunday, the following Monday shall be observed.

NO. 4: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving and Christmas Day shall be paid at the double time rate of pay. If any of the above holidays fall on Sunday, Monday will be observed as the recognized holiday. If any of the above holidays fall on Saturday, Friday will be observed as the recognized holiday and holidays falling on Sunday will be observed on the following Monday.

NO. 5: All work that shall be done on New Year's Day, Memorial Day, Independence Day. Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day shall be paid twice the amount of his or her regular hourly wage rate for each hour of fraction thereof worked on any such day .

NO. 7: The following days are assigned days and are recognized as holidays. New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This is applied to protect Labor Day When a holiday falls during the normal workweek, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week. However, no reimbursement for these eight (8) hours is to be paid to the workman unless worked. If workman are required to work the above enumerated holidays or days observed as such, or on Sunday, they shall receive double (2) the regular rate of pay for such work.

NO. 8: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day, or the days observed in lieu of these holidays, shall be paid at the double time rate of pay.

NO. 15: All work accomplished on the recognized holidays of New Year's Day, Decoration Day (Memorial Day), Independence Day (Fourth of July), Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, or days observed as these named holidays, shall be compensated for at double (2) the regular hourly rate of wages plus fringe benefits. If a holiday falls on Saturday, it shall be observed on the preceding Friday. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day, Christmas Day, Decoration Day or Independence Day except to preserve life or property.

NO. 19: All work done on New Year's Day, Memorial Day, July 4th, Labor Day, Thanksgiving Day, and Christmas Day shall be paid at the double time rate of pay. The employee may take off Friday following Thanksgiving Day. However, the employee shall notify his or her Foreman, General Foreman or Superintendent on the Wednesday preceding Thanksgiving Day. When one of the above holidays falls on Sunday, the following Monday shall be considered a holiday and all work performed on either day shall be at the double (2) time rate. When one of the holidays falls on Saturday, the preceding Friday shall be considered a holiday and all work performed on either day shall be at the double (2) time rate.

NO. 23: All work done on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day and Sundays shall be recognized holidays and shall be paid at the double time rate of pay. When a holiday falls on Sunday, the following Monday shall be considered a holiday. When a holiday falls on Saturday, Friday is recognized as a holiday.

NO. 44: All work done on New Year's Day, Decoration Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, and Christmas Day shall be paid at the double time rate of pay. If a holiday falls on a Sunday, it shall be observed on the Monday following. If a holiday falls on a Saturday, it shall be observed on the proceeding Friday. No work shall be performed on these days except in emergency to protect life or property. All work performed on these holidays shall be compensated at double the regular hourly rate for the work performed. Overtime shall be computed at half-hour intervals.

NO. 45: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the day after Thanksgiving, the day before Christmas, and Christmas Day, shall be paid at the double time rate of pay.

BOONE COUNTY
HOLIDAY SCHEDULE – BUILDING CONSTRUCTION

NO. 54: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, the Friday after Thanksgiving Day, and Christmas Day shall be paid at the double (2) time rate of pay. When a holiday falls on Saturday, it shall be observed on Friday. When a holiday falls on Sunday, it shall be observed on Monday.

NO. 55: The following days are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workmen unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make up day when an observed holiday occurs during the work week. Employees have the option to work that make up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 60: All work performed on New Year's Day, Armistice Day (Veteran's Day), Decoration Day (Memorial Day), Independence Day (Fourth of July), Thanksgiving Day and Christmas Day shall be paid at the double time rate of pay. No work shall be performed on Labor Day except when triple (3) time is paid When a holiday falls on Saturday, Friday will be observed as the holiday. When a holiday falls on Sunday, the following Monday shall be observed as the holiday.

NO. 66: All work performed on Sundays and the following recognized holidays, or the days observed as such, of New Year's Day, Decoration Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, shall be paid at double (2) the hourly rate plus an amount equal to the hourly Total Indicated Fringe Benefits. Whenever any such holidays fall on a Sunday, the following Monday shall be observed as a holiday.

NO. 69: All work performed on New Year's Day, Memorial Day, July Fourth, Labor Day, Veteran's Day, Thanksgiving Day or Christmas Day shall be compensated at double (2) their straight-time hourly rate of pay. Friday after Thanksgiving and the day before Christmas are also holidays, however, if the employer chooses to work the normal work hours on these days, the employee will be paid at straight -time rate of pay. If a holiday falls on a Saturday, the holiday will be observed on Saturday; if a holiday falls on a Sunday, the holiday will be observed on the following Monday.

NO. 74: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day, shall be paid at double (2) time of the hourly rate of pay. In the event one of the above holiday's falls on Saturday, the holiday shall be celebrated on Saturday. If the holiday falls on Sunday, the holiday will be celebrated on Monday.

NO. 76: The following days are recognized as holidays: New Years Day, Memorial Day, Independence Day, Labor Day, Veterans Day, Thanksgiving Day, and Christmas. No work of any pretense shall be performed on Charismas Day or Independence Day. Any work performed on the other holidays shall be paid for at least two (2) times the regular rate of pay. If a holiday falls on a Sunday, the following Monday will be observed. If a holiday falls on a Saturday, the preceding Friday will be observed.

OCCUPATIONAL TITLE	* Date of Increase	Basic Hourly Rates	Over-Time Schedule	Holiday Schedule	Total Fringe Benefits
Carpenter	6/16	$30.83	23	16	$16.10
Electrician (Outside-Line Construction\Lineman)		$42.27	9	12	$5.25 + 36%
Lineman Operator		$36.45	9	12	$5.25 + 36%
Lineman - Tree Trimmer		$24.15	32	31	$9.98 + 3%
Groundman		$28.13	9	12	$5.25 + 36%
Groundman - Tree Trimmer		$17.84	32	31	$7.50 + 3%
Laborer					
General Laborer	6/16	$27.96	2	4	$13.17
Skilled Laborer	6/16	$27.96	2	4	$13.17
Millwright	6/16	$30.83	23	16	$16.10
Operating Engineer					
Group I	6/16	$27.94	21	5	$24.87
Group II	6/16	$27.59	21	5	$24.87
Group III	6/16	$27.39	21	5	$24.87
Group IV	6/16	$23.74	21	5	$24.87
Oiler-Driver	6/16	$23.74	21	5	$24.87
Pile Driver	6/16	$30.83	23	16	$16.10
Traffic Control Service Driver		$26.415	28	27	$9.045
Truck Driver-Teamster					
Group I	6/16	$29.27	25	21	$12.45
Group II	6/16	$29.43	25	21	$12.45
Group III	6/16	$29.42	25	21	$12.45
Group IV	6/16	$29.54	25	21	$12.45

Use Heavy Construction Rates on Highway and Heavy construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(3).

Use Building Construction Rates on Building construction in accordance with the classifications of construction work established in 8 CSR 30-3.040(2).

If a worker is performing work on a heavy construction project within an occupational title that is not listed on the Heavy Construction Rate Sheet, use the rate for that occupational title as shown on the Building Construction Rate sheet.

*Annual Incremental Increase

REPLACEMENT PAGE
BOONE COUNTY
OVERTIME SCHEDULE - HEAVY CONSTRUCTION

FED: Minimum requirement per Fair Labor Standards Act means time and one-half (1 ½) shall be paid for all work in excess of forty (40) hours per work week.

NO. 2: Means a regular workweek shall be forty (40) hours and will start on Monday and end on Friday. The Employer shall have the option of working five 8-hour days or four 10-hour days Monday through Friday. If an Employer elects to work five 8-hour days during any workweek, hours worked more than eight (8) per day or 40 per week shall be paid at time and one-half the hourly rate Monday through Friday. If an Employer elects to work four 10-hour days in a week, work performed more than ten (10) hours per day or 40 hours per week shall be paid at time and one-half the hourly rate Monday through Friday. When working a five 8-hour day schedule and an Employer is prevented from working forty (40) hours Monday through Friday, or any part thereof, by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. If an Employer is working a four 10-hour day schedule and loses a day due to inclement weather, he may work 10 hours Friday at straight time. All hours worked over the 40 hours Monday through Friday will be paid at 1 ½ overtime rate. A workday shift is to begin at the option of the Employer, between 6:00 a.m. and not later than 9:00 a.m. However, the project starting time may be advanced or delayed if required. If workmen are required to work the enumerated holidays or days observed as such or Sundays, they shall receive double (2) the regular rate of pay for such work. Overtime shall be computed at one-half (1/2) hour intervals. Shift: The Contractor may elect to work one, two or three shifts on any work. When operating on more than one shift, the shifts shall be known as the day shift, swing shift, and graveyard shift as such terms are recognized in the industry. When two shifts are worked on any operation, the shifts will consist of eight (8) or ten (10) hours exclusive of lunchtime. When three shifts are worked the first day or day shift will consist of eight (8) hours exclusive of lunchtime. The second or swing shift shall consist of seven and one-half (7 1/2) hours work for eight hours pay, exclusive of lunchtime, and the third or the graveyard shift shall consist of seven (7) hours work for eight (8) hours pay, exclusive of the lunchtime. All time in excess of normal shifts shall be considered overtime. Multiple shift (the two or three shift) operation will not be construed on the entire project if at anytime it is deemed advisable and necessary for the Employer to multiple shift a specific operation. However, no shift shall be started between midnight and six a.m. except the graveyard shift on a three-shift operation, or except in an unusual or emergency situation. If an Employer starts a shift between midnight and 6 a.m. except the graveyard shift on a three-shift operation, he shall reimburse all employees for the entire shift at the double time rate. Completion of the second shift on a two-shift operation or completion of the graveyard shift on a three-shift operation that carries over into Saturday morning, shall be at the straight time rate. Overtime shall be computed at ½ hour intervals.

NO. 9: Eight (8) hours shall constitute a work day between the hours of 7:00 a.m. and 4:30 p.m. Forty (40) hours within five (5) days, Monday through Friday inclusive, shall constitute the work week. Work performed in the 9th and 10th hour, Monday through Friday, shall be paid at time and one-half (1½) the regular straight time rate of pay. Contractor has the option to pay two (2) hours per day at the time and one-half (1½) the regular straight time rate of pay between the hours of 6:00 a.m. and 5:30 p.m., Monday through Friday. Worked performed in the first eight (8) hours on Saturday shall be paid at the rate of one and eight tenths (1.8) the regular straight time rate. Work performed outside these hours and on Sundays and recognized legal holidays, or days celebrated as such, shall be paid for at the rate of double (2) time.

NO. 21: Means the regular workday for which employees shall be compensated at straight time hourly rate of pay shall, unless otherwise provided for, begin at 8:00 a.m. and end at 4:30 p.m. However, the project starting time may be advanced or delayed at the discretion of the Employer. At the discretion of the Employer, when working a five (5) day eight (8) hour schedule, Saturday may be used for a make-up day. If an Employer is prohibited from working on a holiday, that employer may work the following Saturday at the straight time rate. However, the Employer may have the option to schedule his work from Monday through Thursday at ten (10) hours per day at the straight time rate of pay with all hours in excess of ten (10) hours in any one day to be paid at the applicable overtime rate. If the Employer elects to work from Monday through Thursday and is stopped due to circumstances beyond his control, he shall have the option to work Friday or Saturday at the straight time rate of pay to complete his forty (40) hours. If an Employer is prohibited from working on a holiday, that Employer may work the following Friday or Saturday at the straight time rate. Overtime will be at one and one-half (1½) times the regular rate. If workmen are required to work the enumerated holidays or days observed as such, or Sundays, they shall receive double (2) the regular rate of pay for such work.

REPLACEMENT PAGE
BOONE COUNTY
OVERTIME SCHEDULE - HEAVY CONSTRUCTION

NO. 23: Means the regular workweek shall start on Monday and end on Friday, except where the Employer elects to work Monday through Thursday, (10) hours per day. All work over ten (10) hours in a day or forty (40) hours in a week shall be at the overtime rate of one and one-half (1½) times the regular hourly rate. The regular workday shall be either eight (8) or ten (10) hours. If a job can't work forty (40) hours Monday through Friday because of inclement weather or other conditions beyond the control of the Employer, Friday or Saturday may be worked as a make-up day at straight time (if working 4-10's). Saturday may be worked as a make-up day at straight time (if working 5-8's). An Employer, who is working a four (4) ten (10) hour day work schedule may use Friday as a make-up day when a workday is lost due to a holiday. A workday is to begin at the option of the Employer but not later than 11:00 a.m. except when inclement weather, requirements of the owner or other conditions beyond the reasonable control of the Employer prevent work. Except as worked as a make-up day, time on Saturday shall be worked at one and one-half (1½) times the regular rate Work performed on Sunday shall be paid at two (2) times the regular rate. Work performed on recognized holidays or days observed as such, shall also be paid at the double (2) time rate of pay For all overtime hours worked during the week or on Saturday $15.55 of the fringe benefits portion of the prevailing wage shall be paid at time and one-half (1½). For all overtime hours worked on Sundays or recognized holidays $15.55 of the fringe benefits portion of the prevailing wage shall be paid double time. The remaining $.55 of the fringe benefit portion of the prevailing wage shall be paid at straight time

NO. 25: Means a regular work week of forty (40) hours, starting on Monday and ending on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof by reason of inclement weather, Saturday or any part thereof maybe worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A work day is to begin between 6:00 a.m. and 9:00 a.m. However, the project starting time maybe advanced or delayed if mutually agreed to by the interest parties. All hours worked on recognized holidays, or days observed as such, double (2) time shall be paid.

NO. 28: Means a regular work week of forty (40) hours will start on Monday and end on Friday. The regular work day shall be either eight (8) or ten (10) hours. If a crew is prevented from working forty (40) hours Monday through Friday, or any part thereof by reason of inclement weather, Saturday or any part thereof may be worked as a make-up day at the straight time rate. Employees who are part of a regular crew on a make-up day, notwithstanding the fact that they may not have been employed the entire week, shall work Saturday at the straight time rate. A workday is to begin between 6:00 a.m. and 9:00 a.m. However, the project starting time may be advanced or delayed if mutually agreed to by the interest parties. For all time worked on recognized holidays, or days observed as such, double (2) time shall be paid.

NO. 32: Means the overtime rate shall be time and one-half the regular rate for work over forty (40) hours per week. Sundays and Holidays shall be paid at double the straight time rate.

BOONE COUNTY
HOLIDAY SCHEDULE – HEAVY CONSTRUCTION

NO. 4: All work performed on New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Day, or observed as such, shall be paid at the double time rate of pay. When a Holiday falls on a Sunday, Monday shall be observed. No work shall be performed on Labor Day, except in case of jeopardy to life or property. This is applied to protect Labor Day.

NO. 5: The following days are recognized as holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. If a holiday falls on a Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward a forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workman unless worked. If workmen are required to work the above recognized holidays or days observed as such, or Sundays, they shall receive double (2) the regular rate of pay for such work. The above shall apply to the four 10's Monday through Friday work week. The ten (10) hours shall be applied to the forty (40) hour work week.

NO. 12: All work performed on New Year's Day, Memorial Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day, Christmas Day, or days celebrated as such, shall be paid at the double time rate of pay. When one of the foregoing holidays falls on Sunday, it shall be celebrated on the following Monday. When one of the foregoing holidays falls on Saturday, it shall be celebrated on the Friday before the holiday.

NO. 16: The following days are recognized as holidays: New Year's Day, Memorial Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on Sunday, it shall be observed on the following Monday. If a holiday falls on Saturday, it shall be observed on the preceding Friday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week, however, no reimbursement for this eight (8) hours is to be paid to the worker unless worked. If workers are required to work the above recognized holidays or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 21: The following days are recognized as holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workman unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make-up day when an observed holiday occurs during the work week. Employees have the option to work that make-up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 27: The following days are recognized as holidays. New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. If a holiday falls on a Sunday, it shall be observed on the following Monday. No work shall be performed on Labor Day except in case of jeopardy to work under construction. This rule is applied to protect Labor Day. When a holiday falls during the normal work week, Monday through Friday, it shall be counted as eight (8) hours toward the forty (40) hour week; however, no reimbursement for this eight (8) hours is to be paid the workmen unless worked. An Employer working a four (4) day, ten (10) hour schedule may use Friday as a make up day when an observed holiday occurs during the work week. Employees have the option to work that make up day. If workmen are required to work the above enumerated holidays, or days observed as such, they shall receive double (2) the regular rate of pay for such work.

NO. 31: All work performed on New Year's Day, Presidents' Day, Veterans' Day, Good Friday, Decoration Day, Fourth of July, Labor Day, Christmas Eve Day, Christmas Day, Thanksgiving Day and Day after Thanksgiving or days celebrated for the same.

Contract Exhibit

EXHIBIT J

Affidavit of Compliance with Prevailing Wage Law

AFFIDAVIT OF COMPLIANCE WITH THE PREVAILING WAGE LAW

Before me, the undersigned Notary Public, in and for the County of____________,

State of________________, personally came and appeared___________________,
(Name)

______________________________, of the_________________________________,
(Position) (Company Name)

a (Corporation), (Partnership), (Proprietorship), and after being duly sworn, did depose and say that all provisions and requirements set out in Chapter 290, Sections 290.210 through and including 290.340, Missouri Revised Statues, pertaining to the payment of wages to workmen employed on public works projects have been fully satisfied and there has been no exception to the full and complete compliance with said provisions and requirements and with Annual Wage Order No.__________issued by the Missouri Division of Labor Standards on the__________day of__________________, 20______, in carrying out the Contract and work in connection with:

____
(Name of Project)

located at ____in

_________________County, Missouri, and completed on the ______day of

________________________, 20________.

____
(Signature)

Personally appeared before me, a Notary Public, within and for the County of

______________________,

State of Missouri, the person whose signature appears above, PERSONALLY AND KNOWN TO ME AND ACKNOWLEDGED, that signed the foregoing Affidavit for the purposes therein stated.

Subscribed and sworn to me this____________day of__________________, 20_____.

My Commission expires____________________, 20___.

____
(Notary Public)

Contract Exhibit

EXHIBIT K

Work Authorization Affidavit

EXHIBIT L

Contractor's Proposal and Pricing

COLUMBIA ENERGY CENTER

6B – Major Inspections

TURBINE SN: 810347, 810349, 810350
PROPOSAL: 1086707
DATE: 6/15/2016

GE INTERNATIONAL, INC.

QUOTATION NO.: 1086707

TO: Columbia Energy Center
701 E Broadway
Columbia, MO

SN: 810347, 810349, 810350

DATE: 6/15/16

NOTICE: This quotation is void unless accepted within 30 days date hereof and is subject to change upon notice. However, if GE elects to perform the services covered by the quotation is in response to an order placed 30 or more days after the date of the quotation, the terms of the quotation will apply.

ATTN: Steve Lewandowski

Email: steve.lewandowski@como.gov

573-874-6262

Type of Service:

0 Field Service engineering

0 Craft Labor

General Electric International, Inc. (GEII) is pleased to offer this firm price proposal for Major Inspections on City of Columbia General Electric 6B Serial Numbers 810347, 810349, 810350. An option is included to perform the S17/EGV shrouded configuration modification to Serial Number 810348.

GEII price assume working 10 hour shifts, 7 days per week, for a projected 9 weeks, with work projected to begin during the third week of June 2016.

It is our pleasure to provide you our services, and we are looking forward to hear a favorable answer from you. If you have any questions, please don't hesitate to call at any time.

Thank you for the opportunity to serve you.

GENERAL ELECTRICINTERNATIONAL INC.(GEII)

By: Blair Van Dyne

Address: General Electric International, Inc.
7101 College Blvd., Suite 800
Overlook, KS 66210-2082
Tel: 913-967-6215

Email: blair.vandyne@ge.com

Section I – Scope of Supply

BASE SCOPE of SUPPLY

- Demobilize / Move Off Site Mobilization / Site Setup
- Materials On Site
- Tools On Site
- Mobilize / Move On Site

Disassembly

-
- Breaker Open
- Turbine On Turning Gear / Cooldown
- Water Wash Offline
- Sign on LOTO
- Disassemble Load Gear Coupling & Alignment Check
- Disconnect wiring and conduit in turbine compartment
- Remove Roof & Enclosure Panels
- Remove Instrumentation
- Remove Turbine Compartment Piping
- Perform Rotor Position Checks
- Remove Fuel Nozzles and End Covers (U/H)
- Remove Crossfire Tubes, Liners, Flow Sleeves & Cans (U/H)
- Disassemble Accessory Coupling & Alignment Check
- Remove Inlet Plenum, Elbow & Duct Components
- Remove Exhaust Duct and Elbow Components (if applicable)
- Install Casing Support Jacks
- Remove Exhaust Frame Casing
- Remove Turbine Casing
- Remove Transition Pieces (U/H
- Measure 1st Stage Nozzle Concentricity
- Remove 1st Stage Nozzle (U/H)
- Remove Support Ring (U/H)
- Remove CDC & Compressor Casings
- Remove Inlet Bellmouth Casing
- Perform Thrust Check & Calculate Set "A" Position
- Verify Opening Clearances
- Remove Bearings
- Remove Rotor
- Replace 1st stage buckets on Unit 1.
- Remove damaged S17s and EGVs

Clean & Inspect

- Clean & Visually Inspect Load Coupling
- Clean & Visually Inspect Roof & Enclosures Panels
- Clean & Visually Inspect Instrumentation (Customer)
- Clean & Visually Inspect Turbine Compartment Piping
- Clean & Visually Inspect Fuel Nozzles & End Covers
- Clean & Visually Inspect Accessory Coupling
- Clean & Visually Inspect Crossfire Tubes, Liners, Flow Sleeves & TP's
- Clean & Visually Inspect Inlet Plenum, Elbow & Duct Components
- Clean & Visually Inspect Exhaust Duct & Elbow Components
- Clean & Visually Inspect Inlet Guide Vanes Per Applicable TIL's
- Clean & Visually Inspect Compressor Components
- Clean & Visually Inspect Compressor Vanes (Steam cleaning if required can be performed as extra work)
- Clean & Visually Inspect Last Stage and EGV per applicable TIL's
- Clean & Visually Inspect Rotor & Bearings
- Perform Minor Blending of Compressor Blades. 10 man hours per unit is included.
- Clean & Visually Inspect Exhaust Frame, Turbine, Compressor & Bellmouth Casings
- Visually Inspect Turbine Components
- NDE/NDT S1-S4 stator vanes, S17 – EV2 stator vanes
- Visually inspect shrouds, buckets, 2nd and 3rd stage nozzles in-place

Reassembly

- Install Rotors
- Install Bearings
- Assemble Turbine Side of Load Coupling
- Install Support Ring (U/H)
- Install 1st Stage Nozzle (U/H)
- Perform 1st Stage Nozzle Concentricity Checks
- Verify Closing Clearances and Thrust Check
- Install Inlet Bellmouth Casing
- Install Transition Pieces
- Install Exhaust Frame Casing
- Install Inlet Plenum, Elbow & Duct Components
- Install CDC & Compressor Casings
- Install shrouded S17s/EGVs in Inner barrell
- Install Exhaust Duct and Elbow Components
- Install Turbine Casing
- Install Liner, Flow Sleeves and Crossfire Tubes
- Assemble Accessory Coupling & Alignment Checks
- Install Fuel Nozzle and End Covers
- Perform Closing Rotor Position Checks
- Install Turbine Compartment Piping
- Install Instrumentation
- Assemble Load Coupling Load Gear Side and Alignment Checks
- Connect wiring and conduit in turbine compartment for Roof Installation
- Install Roof & Enclosure Panels
- Auxiliary Systems Inspection
- Visually Inspect Starting Motor
- Visually Inspect Torque Converter
- Visually Inspect Exhaust Frame Blower

- Visually Inspect Ratchet
- Visually Inspect Load Gear
- Visually Inspect Inlet Fogger / Sprits / Evap Cooler
- Remove Lube Oil (Customer)
- Visually Inspect Lube Oil System
- Visually Inspect Hydraulic Oil System (Customer)
- Refill Lube Oil System (Customer)
- Visually Inspect Cooling Water System
- Visually Inspect Water Wash System
- Visually Inspect Water Injection System
- Visually Inspect Steam Injection System
- Visually Inspect Fuel Stop / Speed Ratio Valve
- Visually Inspect Atomizing Air System
- Visually Inspect Liquid Fuel System
- Visually Inspect Fuel Purge System
- Visually Inspect Accessory Gear Box
- Check Out / Start Up
- Sign off LOTO
- Pre-Start Up Checks
- Start Up Checks
- Demobilize / Move Off Site

TIL Num	TIL Title	Notes
1067-R3	E-CLASS SECOND-STAGE BUCKET TIP SHROUD DEFLECTION	Inspect in place
1585-R1	PROPER USE AND CARE OF FLEXIBLE METAL HOSES	Visual Inspeciton
1562-R1	HEAVY DUTY GAS TURBINE SHIM MIGRATION AND LOSS	Visually Inspect
1132-2R1	VARIABLE INLET GUIDE VANES - SPRING & THRUST WASHERS	Visually Inspect
1213-R2	SPIRAL WOUND METAL GASKET RECOMMENDATIONS	Customer provided parts
1872	MS6001B AXIAL FLOAT	
1454-2R3	STATOR BLADE DOVETAIL BASE CRACKING	Rock check
1352-R3	MS6001B STATOR 17 AND EXIT GUIDE VANE DISTRESS	
1382-R3	COMPRESSOR ROTOR STAGE 1 BLADE INSPECTION	Potentially
1628	E AND B CLASS GAS TURBINE SHELL INSPECTION	

All other offerings that are not in the workscope are considered extra work, and not included in the T&M estimates provided in Section III.

Section II - Responsibilities

RESPONSIBILITIES	N/A	GE	CUST
SAFETY			
1. Personal safety equipment (Hard Hats, Eye Protection with sideshields, ear protection, NOMEX). Other safety requirement specific to site, if mandatory, is not part of this scope of supply	☐	☒	☐
2. Safety orientation (Basic) for labor force	☐	☒	☐
3. Site-specific safety orientation for labor force. Time and cost incurred to undergo Site-specific safety and other customer requirements such as drug programs shall be billed as an out-of-scope item	☐	☐	☒
4. First aid facility, assistance in obtaining medical care, access to Customer medical sites, emergency care or ambulance	☐	☐	☒
5. Isolate and tag out (LOCKOUT-TAGOUT) all systems (chemical, electrical, mechanical, environmental, steam, etc) associated with workscope	☐	☒	☒
6. Testing to make work free from hazardous material (lead, asbestos) and disposal and abatement of such. It is assumed that NO HAZARDOUS material will be encountered in performing the workscope	☐	☐	☒
7. Confined Space Work monitoring equipment, and calibration thereof	☐	☐	☒
8. Hole watch personnel for confined space work (maximum 1 person)	☐	☐	☒
9. Fire watch personnel & overall plant fire protection, if required	☐	☐	☒
10. Fire watch personnel for limited hot work	☐	☒	☐
11. Fire watch extinguishers, if necessary, for turbine work area	☐	☒	☒
12. Electricians/Technicians to lock-out/tag-out, disconnect and reconnect wiring & conduit necessary for disassembly/reassembly	☐	☐	☒
MANPOWER, LICENSES & INSURANCE			
13. Permits, licenses, governmental or public utility charges and inspection fees necessary to conduct work	☐	☐	☒

RESPONSIBILITIES

	N/A	GE	CUST
14. Representative scheduled concurrent with GE crews to facilitate location of parts and other outage activities	☐	☐	☒
15. Tracking of component repairs performed in the GE Service Center, if applicable	☐	☒	☐
16. Electrical tests and necessary maintenance and/or repairs on all electrical motors or power circuits, if required	☐	☐	☒
17. Electricians to assist GE generator specialist, if applicable	☒	☐	☐
18. Technicians to work in coordination with GE Controls Representative for Controls Retrofit. Includes calibration of Servo Valves with New Controls System and I/O checks with new devices	☒	☐	☐
19. Technicians with equipment to calibrate existing turbine instrumentation and to assist GE Controls in I/O checks for the old instrumentation	☒	☐	☐
20. Shipping and insurance as needed for all items to be repaired, if applicable	☐	☐	☒
21. Periodic electrical megger testing to monitor generator field condition during outage.	☒	☐	☐
22. Operating Personnel to perform operation of turbine-generator equipment, drain and fill fluid systems, shutdown, start-up, lube oil flushes, other flushes, etc.	☐	☐	☒
23. Receiving, off-loading and proper storage of all new and refurbished parts	☐	☐	☒
24. Engineering support for balance of plant or balance refinement	☒	☐	☐
25. Start-up support (performed as Extra Work as requested by customer).	☐	☒	☐
26. Reserved	☒	☐	☐
27. Responsibility for any delays not caused by GE or beyond GE's control	☐	☐	☒
28. Responsibility for GE's complete access to the unit in order to perform workscope as described herein	☐	☐	☒

TOOLS, EQUIPMENT & SUPPLIES

	N/A	GE	CUST
29. Operator for Overhead Crane or Forklift, with required safety training	☐	☐	☒
30. Overhead Crane or Forklift, necessary maintenance, as required	☐	☐	☒

RESPONSIBILITIES	N/A	GE	CUST
31. Trash containers & disposal of all materials used	☐	☐	☒
32. Wash facilities	☐	☒	☐
33. Sanitary facilities (Porta-cans)	☐	☒	☐
34. Change facilities for crew	☐	☒	☐
35. Parking space for GE's work force	☐	☐	☒
36. Office trailer/area for Field Engineers	☐	☒	☐
37 Office trailer/area for crew foremen (Change Shack, Telephone service by GE)	☐	☒	☐
38. Normal plant service required for maintenance such as light, heat, water, compressed air and electric power (110/220/480V)	☐	☐	☒
39. Supplementary lighting	☐	☐	☒
40. Turbine maintenance tools needed to perform workscope described herein	☐	☒	☐
41. Special tooling originally supplied with the unit (skid pan, shoe shaft jacks, field rigging and protective covers, turbine shell and hood rigging, turbine rotor stands, electric bolt heaters, etc.)	☐	☐	☒
42. Expendable, consumable or miscellaneous materials (rags, hones, joint compounds, solvents, greases, etc.)	☐	☒	☐
43. Miscellaneous spare parts (gaskets, bolts, turbine oil, etc.)	☐	☐	☒
44. Shop Repair for any component that necessitates repair to complete the workscope described herein (in addition to repairs quote provided herein	☐	☐	☒
45. Parts, spares or replenishment, needed to support the workscope described herein Sufficient spare and renewal parts should be on hand at the beginning of the outage to as to prevent delays resulting from repair or procurement time.	☐	☐	☒
46. Material and/or parts that which become a permanent part of the unit after installation unless specifically specified as being furnished by GE in the quotation	☐	☐	☒
47. Crew Vehicle	☒	☐	☐
48. Engine driven welding machine, leads (fuel by Customer)	☐	☐	☒

RESPONSIBILITIES	N/A	GE	CUST
49. Engine driven air compressor, leads (fuel by Customer)........	☐	☒	☐
50. Acetylene and oxygen........	☐	☐	☒
51. Scaffolding, if required........	☐	☐	☒
52. Material and labor for removal and installation of insulation........	☐	☐	☒
53. Protective coatings and heaters to maintain generator while disassembled........	☒	☐	☐
54. Designated work and laydown areas accessible to crane and turbine........	☐	☐	☒
55. Material for protection of laydown surfaces........	☐	☐	☒
56. Rotor supports and cribbing material for equipment requiring laydown........	☐	☐	☒
57. Machine shop facilities for small projects on site, if required........	☐	☐	☒
58. Lapping blocks for all valve work, if applicable........	☒	☐	☐
59. Stator and exciter alignment shim packs, if applicable........	☒	☐	☐
60. Exciter and Generator protection plan........	☒	☐	☐
61. All coupling alignment pins, if applicable........	☒	☐	☐
62. Drilling and tapping of broken bolts 1/2 inch diameter or more, if required........	☐	☐	☒
63. All required bearing mandrills, if applicable........	☒	☐	☐
64. Cleaning and hydrotesting of lube oil coolers........	☒	☐	☐
65. Blast cleaning and non-destructive test services........	☐	☒	☐
66. Painting, if required........	☐	☐	☒
67. Blue contact checks of any horizontal joints, if required........	☐	☐	☒

Assumptions and Clarifications

1. Sufficient spare and renewal parts will be provided by Columbia Energy Center and will be on hand at the beginning of the outage as to prevent any delays resulting from repair or procurement time.

2. Unless specicially stated otherwise within this proposal, all component repairs to be provided by Columbia Energy Center.

3. All material and/or replacement parts, which become a permanent part of the unit after installation will be furnished by Columbia Energy Center unless specifically specified as being furnished/supplied by GEII within this proposal.

4. Any realignment of Turbine Generator components is considered extra work.

5. It is assumed that no hazardous material will be encountered in performing the workscope. Disposal of any hazardous or regulated material will be the responsibility of Columbia Energy Center.

6. GEII shall furnish Columbia Energy Center with a complete list of inspection results, including details of conditions found, corrective actions taken and unusual conditions observed, along with a list of parts expended during the inspection to include those recommended for the next inspection.

7. Safety: GEII will utilize an "on-site" safety checklist as a minimum for conformance to safety while on Columbia Energy Center's property. Additionally, GEII will conform to Columbia Energy Center's safety requirements for personal protective clothing and devices, such as safety glasses (side shields if required), hard hats and hand protection (gloves if required).

8. Columbia Energy Center will provide shipping and insurance as needed for all items to be shipped offsite for repair.

9. Columbia Energy Center will provide overhead crane maintenance as required.

10. GE Requires Lift forms to be completed on lifts greater than 80% of crane capacity

11. Columbia Energy Center will provide special tooling as originally supplied with the turbine-generator set, including but not limited to generator skid pan, shoe, rotor jacking devices, eyebolts, field rigging and protective covers, turbine shell and hood rigging, turbine rotor stands, electric bolt heaters, guide pins.

12. Any drug testing and/or background checks of GEII personnel or its subcontractors required by Columbia Energy Center will be performed at the expense of Columbia Energy Center.

13. All permits, licenses, governmental or public utility charges and inspection fees are the responsibility of Columbia Energy Center.

14. Workscope and Pricing assume that the customer equipment maintains original GE design and manufacturing specifications. Any previous modifications that deviate from the original GE

specifications will result in a review and/or modification of the workscope and additional costs to be billed to the Columbia Energy Center.

15. In the case where it is found that welding, cutting, or grinding of material containing ***Hexavalent Chromium*** to be either directly or indirectly involved in the work as reflected in this proposal and which warrants procedures necessary to adhere to occupational and safety guidelines as outlined by local, state, and/or federal guidelines, the customer retains responsibility to reimburse GE Energy Services for such work at cost plus 25% or subcontract the work to a third party at their discretion. Any additional exposure to direct or indirect costs to GEII scope attributable to addressing ***Hexavalent Chromium*** issues will be billed to the customer at time and material rates as reflected in this contract.

16. As part of outage field services, GE and Columbia Energy Center will develop and implement a turbine component and equipment lay-down plan. Because the lay-down plan requires adequate load support from Columbia Energy Center facility structures such as turbine deck floors, ground pads and slabs, etc., Columbia Energy Center is responsible for evaluating the lay-down plan to make sure Columbia Energy Center facilities will support all loads associated with the plan.

17. The above price estimate is based on the Workscope and the Distribution of Responsibilities shown in Section II. Pricing is in 2016 Dollars, and does not include applicable sales or use tax.

18. GE is offering a 30% discount off list pricing for emergent parts needed in support of the outage.

19. GE is offering a 30% discount off the GE Power Services Commercial Rates effective May 6, 2016 for emergent work.

Payment Terms

Payment shall be made Net 30 days after submittal of invoice, without deduction or set-off.

Payment Limitations

This quotation is void unless accepted within 30 days from date hereof and is subject to change upon notice. However, if GE elects to perform the services covered by the quotation in response to an order placed 30 or more days after the date of the quotation, the terms of the quotation shall apply.

Terms and Conditions

General Electric International, Inc. Products and/or Services Terms and Conditions shall apply.

Section III

Pricing and Commercial Rates Schedule

Description	Price
Base Scope	$941,000
Unit 4 S17/EGV Upgrade	$320,000*
Replace R1 Blades (per unit)	$20,500
Moment Weight/Tip Grind new R1s in shop (per unit)	$5,700
Inner Barrel Modification in shop (per unit)	$11,000
Refurbished 1st Stage Bucket Kit (314B7162G015)	$76,637
R1 Blade Kit (Qty 32, 119E8291P001) per unit	$70,891.74
R17 Blades (103E3574P001) each	$214.77
Compressor Stator Vanes Shrouded design (Stage 17, EGV 1 & EGV 2) per unit	$139,302
Counter bore plug (Qty 2) per unit	$827

*Pricing assumes Unit 4 is made available to GE immediately following reassembly of first unit. Stand-alone pricing for Unit 4 major is $410,000.

Section IV: Appendix

TIL-1352 S17 and EGV's DISTRESS

Discussion:

The compressor section of 6B gas turbines has 17 stages of rotating components (rotor blades), 17 stages of stationary components (stator vanes), and two stages of exit guide vanes.

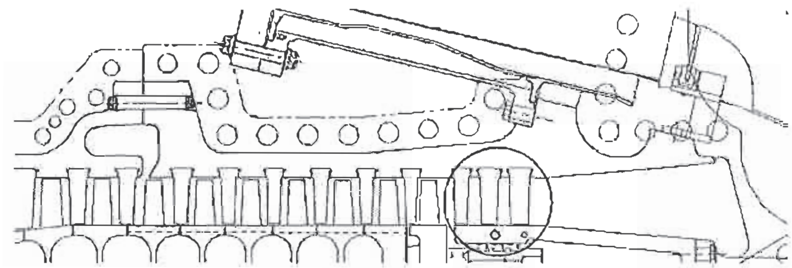

Figure 1: Cross section highlighting S17 to EGV2

Some users have experienced excessive stator groove wear at the stator 17 (S17) row or Exit Guide Vane (EGV) row and/or S17 distress with EGV cracking as shown in Figure 2. This has been detected during planned maintenance inspections and the liberated S17s were found in the combustion cans. In general, the S17s and EGVs at the half shell joint have been found to have liberated.

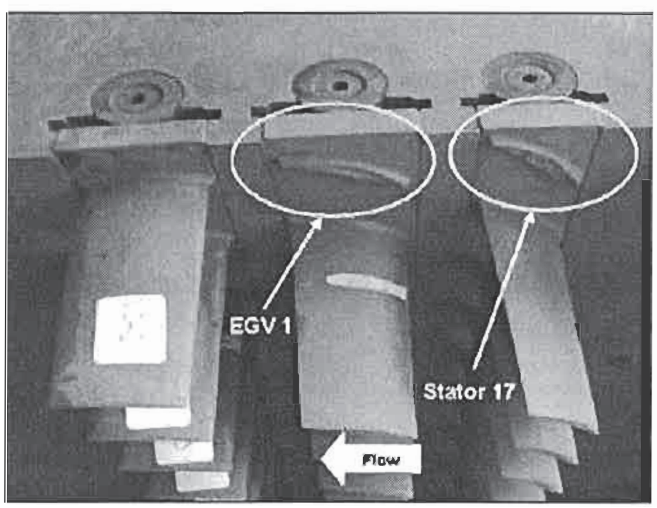

Figure 2: Liberated S17 and EGV1

The root cause of the S17 and EGV distress is an airflow emanating from the counter bore holes of the inner barrel. This phenomenon is known to have been aggravated by the unit operating at low ambient temperatures and at part load, especially with water/steam injection.

TIL-1352 S17 and EGV's DISTRESS

Recommendations

GE recommends performing the following:

1. Perform borescope inspection annually per GER 3620 to ensure the S17s and EGVs are not damaged or cracked.
2. If any indications are noted on the S17s or EGVs, the damaged vanes should be replaced at the earliest opportunity.
3. Implement new control protection software and compressor pressure ratio instrumentation for all MS6001B units at the earliest available opportunity. This will require additional instrumentation package to be installed in the inlet plenum and controls modification to be installed.
4. The customers can upgrade the S17s and EGVs to a shrouded configuration as shown in Figure 3, which would not require the above controls modification. Installing these shrouded S17s to EGVs would require inner barrel modifications or a new pre-modified inner barrel.

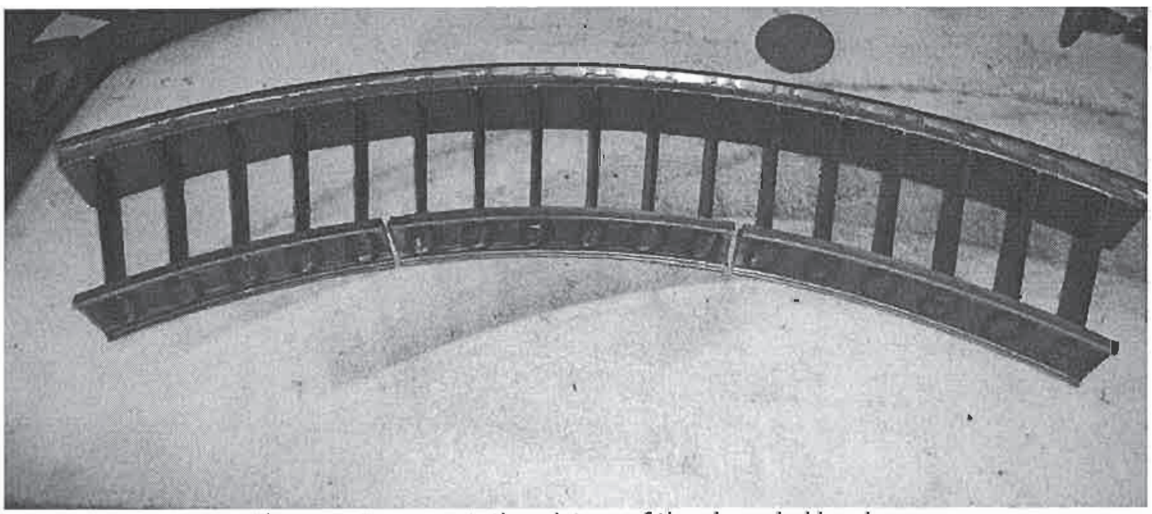

Figure 3: Representative picture of the shrouded hardware.

5. At the first planned inspection where the CDC casing is removed, not exceeding the Hot Gas Path inspection, install counter bore plugs in all MS 6001B units. Controls limits may need to be adjusted to reduce heat rate impact when bore plugs are installed.
6. Implementation of recommendations 3 & 4 is dependent on the site condition and prior operation history. Customers are requested to contact the GE Service representatives to assist and evaluate the necessity of implementing the above recommendations.

The TIL can be marked complete once the counter bore plugs and controls modification or shrouded S17s to EGVs are installed.

GE Power Services

United States

Effective:

Time and Material Rates - as discounted for Columbia

April 2016

Hourly Rates U.S. Dollar

Craft Classification	ST	OT	DT	Per Diem
Supervisor	$ 127.08	$ 182.33	$221.00	$154.70
Keyman	$ 79.87	$ 108.56	$137.24	$ 82.88
Journeyman	$ 59.68	$ 78.84	$ 98.00	$ 82.88
Safety Coordinator	$111.61	$ 111.61	$ 111.61	$ 215.48
I&E	$ 60.78	$ 92.82	$ 92.82	$149.18

Definitions:

1. "Straight-Time" rates shall apply to the first eight consecutive hours worked each day, beginning with the established shift starting time, Monday through Friday, excluding Saturdays, Sundays or GE holidays. Shift time must be established before the job starts.

2. "Overtime" rates shall apply to all hours worked before or after the established work shift of eight hours, Monday through Friday, and to all hours worked on Saturday and Sunday. All hours worked on Legal Holidays would also be on an overtime rate. When required, Double Time will be billed at two times the Straight Time rate

3. Scheduled holidays are as follows: New Year's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas Eve and Christmas Day

4. The time of craft labor personnel to attend customer-required safety training or to submit to customer-required drug/alcohol testing, as well as any incremento cost associated with such programs or tests, will be billed per above rates plus the associated costs.

Minimum Billing

5. If personnel report to work, a minimum of 8 hours and per diem will be billed. If on stand-by, a minimum of 4 hours per day and per diem will be billed

6. Travel expense (Mob Fee) reimbursement as listed above is billed for all jobs in lieu of expenses.

7. Per Diem (above) shall be paid on a seven days per week basis for all job sites, (regardless of work scheduled, i.e., 4/10, 5/10 or 6/12). During the final week of the work at a job site, per diem applies to days worked only.

Toolsets and Rentals:

8 The above rates include small hand tools having an initial value of $200 or less, required for the disassembly and reassembly of power generation or mechanical drive equipment.

9. All materials, consumables, equipment rental (including DLN tuning kit, Hytorc, etc.) furnished by GE to support the job, plus transportation charges to the job site, will be billed at cost plus a fee of 20% for procurement and administration.

10. Turbine Toolset rental will be invoiced per the following rate sheet, reflecting a 10% discount Rental of other tools will be billed at invoice at 20% for procurement and administration. Delivery and pick-up of Tools will be billed at cost plus 20%.

GE Power Services

Commercial Rates

United States
Effective:
May 6, 2016

Hourly Rates U.S. Dollar

Service Description	Standard
Engineers	
Mechanical Technical Field Advisor	$330
Specialty Technical Field Advisor	$460
Startup Specialist	$495
Onsite Project Manager	$505
Offsite Project Scheduler	$290
Service Center Technicians	
Generator Winder	$320
Work Leader	$325
Automated Machining	$295
Steam Shop Repair Specialist	$260
Steam Onsite Repair Specialist	$310
Gas Shop Repair Specialist	$335
Gas Onsite Repair Specialist	$385

Technical Field Advisor Service

Technical Advisory Service is defined as technical advice and counsel from field personnel based on engineering and operational practices as applicable to the equipment. TFA Services do not include supervision or management of purchaser's employees, agents or other contractors

Onsite Project Manager

This service includes all outage manager responsibilities including planning, organizing, integrating and monitoring of resources such as labor, supervisors, tools and technical assistants.

Offsite Project Scheduler

Personnel utilized to support schedule-related activities.

Service Center Technician

Generator Winder: Specialists experienced in the inspection, test and repair of rotating electrical equipment including synchronous power generators, exciters & excitation equipment and related auxiliaries.

Work Leader: Specialists experienced in directing the work activities of Generator Winders, Steam Technicians or Machining Technicians, excluding technical advice and counsel.

Automated Machining: Specialists utilizing computer-aided repairs including robotic welding, CNC, machining and other similar services.

Shop Repair Specialist - Specialists utilizing GE facilities to perform work on gas and steam turbines.

Onsite Repair Specialist - Onsite Specialist maintaining and repairing gas and steam turbines.

Power Engineering Requests (ER)

The Power Engineering Request ("ER") will provide technical support for customer questions. The customer will be charged for ER responses to one question on one topic (such as, historical records, fleet data, and unit specific data). For each follow-up question, responses and/or telephone call, GE will charge the customer at the hourly rate listed above. GE will determine at its discretion whether any question warrants a funded engineering study. Any such engineering study will be quoted based on the customer's specifications.

ER pricing	$4000/case

Rate Terms

1. The normal workday and normal workweek are defined as eight (8) consecutive hours and five (5) consecutive normal workdays, respectively, excluding any holidays or weekends.

Normal	1.00 x Standard rate
Overtime 1	1.50 x Standard rate
Overtime 2	2.00 x Standard rate
Peak	1.20 x Applicable rate
<48 hour notice	1.30 x Applicable rate

2. The Overtime 1 rate above applies to billable hours on Saturday and normal workday hours greater than 8 but less than 12 consecutive hours.
3. The Overtime 2 rate above applies to billable hours on Sundays, holidays and normal workday hours greater than 12 consecutive hours.
4. Peak multiplier applies to billable hours at the applicable rate from March 7thnd to May 15thth and October 3rdth to November 13th^{h}. When committed 60 days or earlier before start of peak period (date), the peak adder can be waived.
5. Travel time will be charged at the applicable hourly rate (i.e., standard rate times applicable multiplier(s) as set forth in 1 above) on a round trip basis with point of departure.
6. Travel & Living (T&L) for the continental U.S.A. will be billed for all days during the assignment including weekends and travel days by the GE representative responsible for providing the service, as follows:

T&L	$400 per day per employee

Or consult with your local GE Power Services representative for a local per diem rate.

Air, train, rental car, or public transportation	Cost plus 20% administrative fee

7. Purchased labor and materials will be billed at cost plus 30% Markup.
8. Consult with your local GE Power Services representative to determine any applicable charges for special tooling and/or test equipment or any taxes, fees or VAT that may be in addition to the above rates.
9. Minimum billing of 8 hours for all services provided, including standby time. Minimum standby time is 8 hours at the standard rate (weekdays and weekends).
10. All rates are based on GE's standard terms and conditions of sale (PSTC) or (Form ES 104).

Startup Specialist

Directs the start-up and troubleshooting of turbine control and excitation systems and interfacing circuits, breakers, and power systems beyond the control system. Performs vibration measurement, balancing of units and is versed in all GE controls systems (analog through digital) models.

Specialty Technical Field Advisor Service

Generator	Technical advice and counsel for the inspection, test and repair of generator equipment
Controls TFA	Start-up support and troubleshooting of turbine controls systems Performs device calibrations and DLN tuning (gas units)
Excitation TFA	Start-up and troubleshooting of excitation systems, including static start, load commutating inverter (LCI) equipment
Gas/Steam Path Audit	Inspecting and determining the thermodynamic losses of the turbine steam/gas path
Gas Turbine DLN	Tuning Dry Low NOx (DLN) systems to optimize reductions in gas turbine emissions and extend expected life of combustion system components
Vibration	Vibration data acquisition and analysis, perform a diagnostic balance program, make recommendations and install balance weights
Laser Alignment	Use GE proprietary digital laser alignment equipment, technology and fleet data to optimize internal component alignment
Consulting Analyst	Technical assistance of personnel not normally classified as field personnel for the solutions requiring highly specialized knowledge
Diagnostics	Performance of diagnostics tests and diagnostic data analysis, such as plant evaluations & general consulting
Professional Witness	Technical direction and coordination of performance tests not conducted by GE