

LM6000 PC BORESCOPE REPORT for OMPA

Unit Name: Gas Turbine LM6000PC

Title: Borescope Inspection

ESN: 191-472 Unit # 3

Job Number: AA23-1500

Date: 10/05/2023

BACKGROUND

Information	
Site Location:	1420 N. Union Ponca City, Oklahoma 74601
Job Dates:	10/05/2023
Performed by:	Michael OBrien
Package-Type:	GE Sprint
Engine Hours:	17732.8
Fired Starts:	1913
Fuel Type:	Natural Gas
Generator Type:	GE
Generator S/N:	336X615
Customer Contact:	Dave Huff
PE FS Manager:	Alice Marconi
PE CS Manager:	David Evinrude

Job Description

Perform the following Inspections following applicable work packages & Procedures:

1. Borescope Inspection
2. IGB Inspection
3. CRF Oil-In manifold Clamp Inspection
4. T48 probe Inspection
5. P48 probe inspection
6. Fuel Nozzle Inspection

Job Conclusion:

- Borescope and all applicable inspections were performed as required.

Recommendations:

- Recommend water wash more frequently and add an extra rinse cycle to help with deposits.
- Recommend replacing the VBV door hinge bushings.
- PES engineering has advised the engine is released for continued operation but recommends the affected areas of the S1 Shrouds, S1 and S2 Blades be reinspected every 200 operational hours.

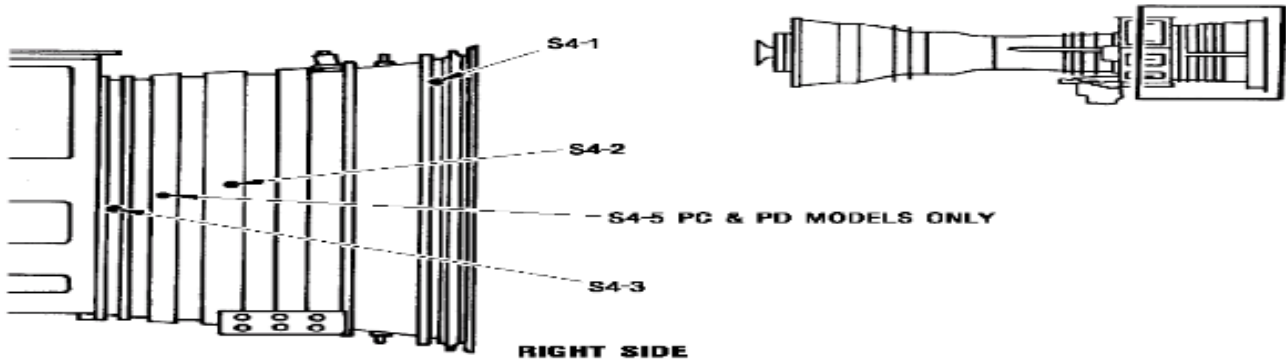
Open Action Items

- N/A

Extra Work

- Replaced the lower igniter with customer supplied part. The lower igniter had .012-inch wear on collar.

Low-Pressure Compressor



LPC Inspection Ports:	S4-2 to S4-5
LPC (Rotor Blades – Stages 0-4)	Minor deposits, Serviceable
LPC (Vaness – Stages 0-4)	Minor deposits, Serviceable
LPC Inner Shrouds & Bushings	Serviceable, no bushing protrusion noted.
Additional Comments	VBV system inspection performed. Door hinge nylon bushings missing and broken.



External Photo of ID Plate



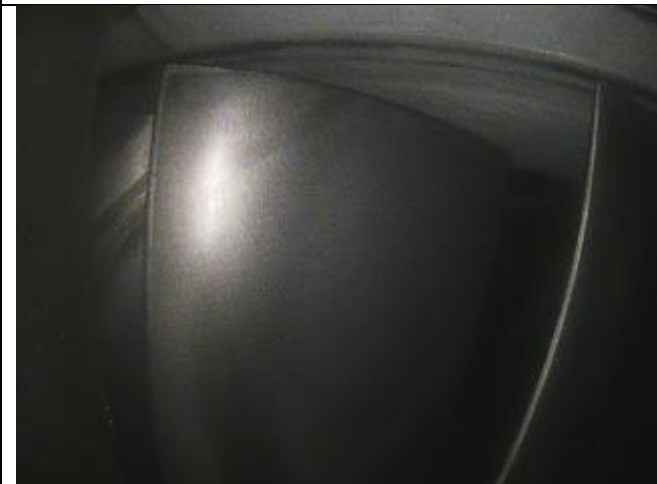
External Photo of LPC Right Side



LPC Stage 1 T/E Tip



LPC Stage 1 T/E Root



LPC Stage 2 L/E Tip



LPC Stage 2 L/E Root



LPC Stage 2 T/E Tip



LPC Stage 2 T/E Root



LPC Stage 3 L/E Tip



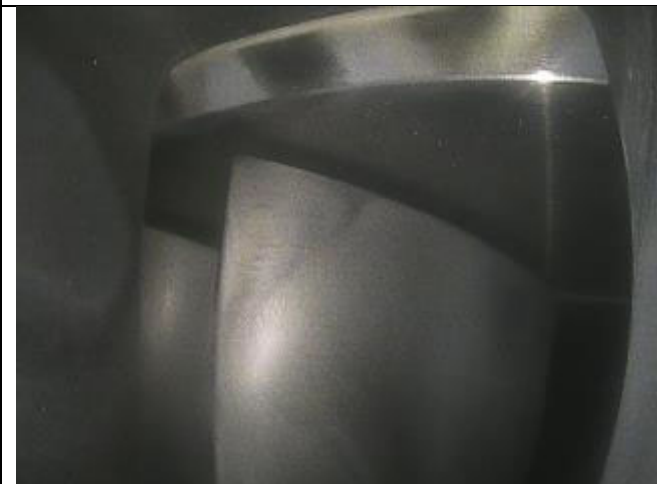
LPC Stage 3 L/E Root



LPC Stage 3 T/E Tip



LPC Stage 3 T/E Root



LPC Stage 4 L/E Tip



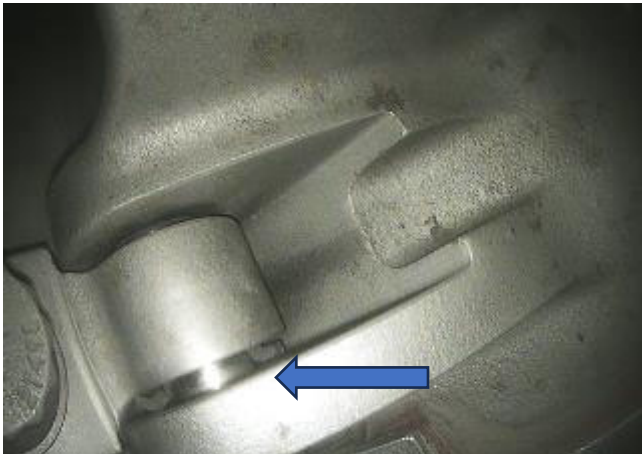
LPC Stage 4 L/E Root



VBV Inspection



VBV Inspection / Door Hinge Bushings Broken/Missing

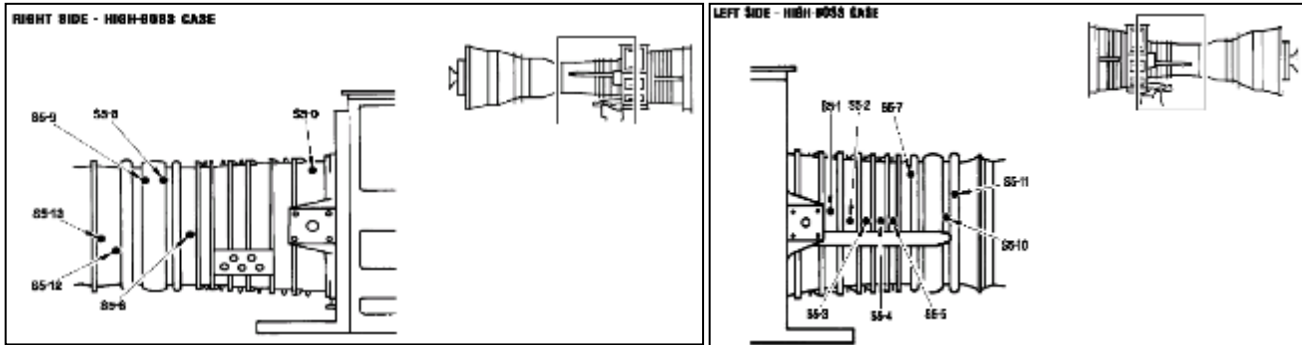


VBV Inspection / Nylon Bushings Broken/Missing



VBV Inspection / Hinge Contact Evident

High Pressure Compressor



HPC Inspection Ports	S5-0 through S5-13
Rotor Blades	Minor deposits, Serviceable
Stage 1 Blade Mid-Spans	Minor deposits, Serviceable
Rotor Weep Holes	No wetness noted, Serviceable
Stator Vanes	Minor deposits, Serviceable
Stage 1&2 Blade Retainers	Blade retainers secure and in Serviceable condition
Spool Rub Coat	Minor TBC loss on rotor, Serviceable
IGB Splines	No sludge noted, Serviceable
Additional Comments	



External View HPC VSV Right Side

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HPC Stage 1 L/E Tip



HPC Stage 1 L/E Root



HPC Stage 1 Carboloy Pad



HPC Stage 1 Carboloy Pad



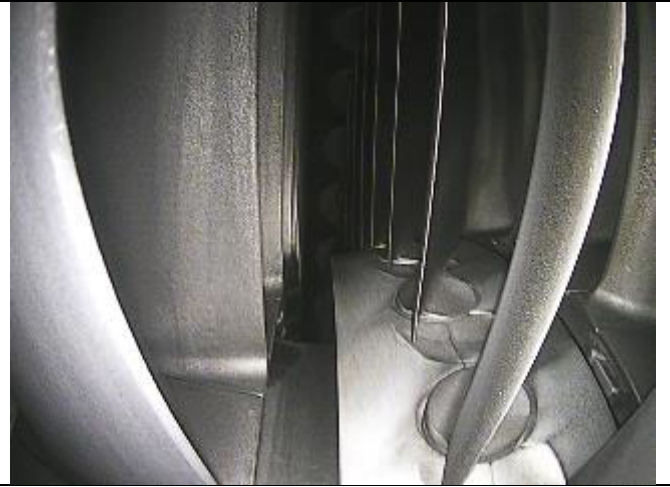
HPC Stage 1 Blade retainers



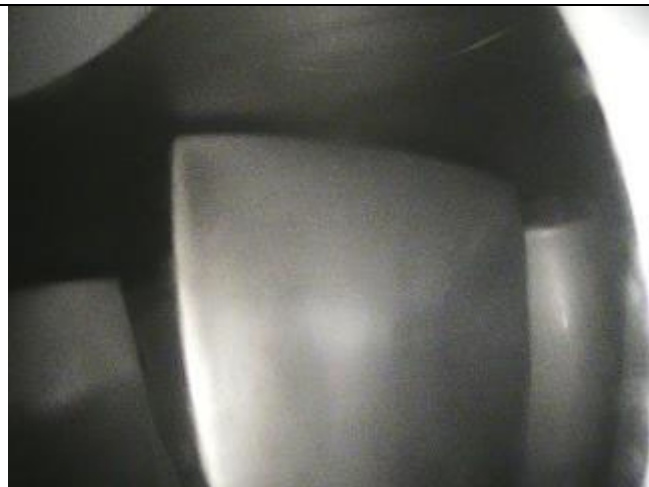
HPC Rotor Disk Weep Hole



HPC Stage 1 T/E Tip



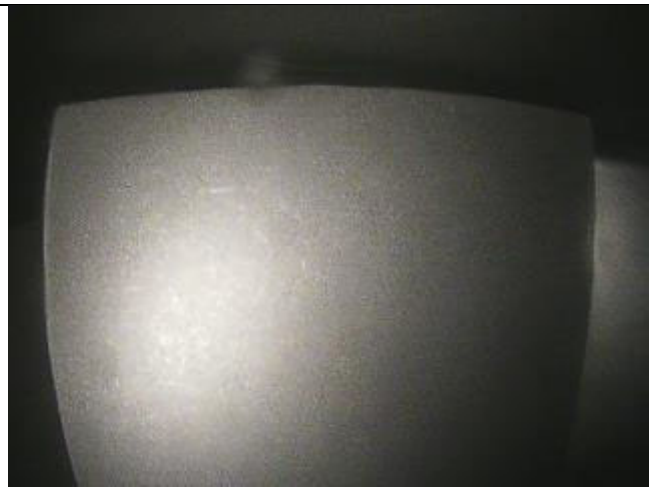
HPC Stage 1 T/E Root



HPC Stage 2 L/E Tip



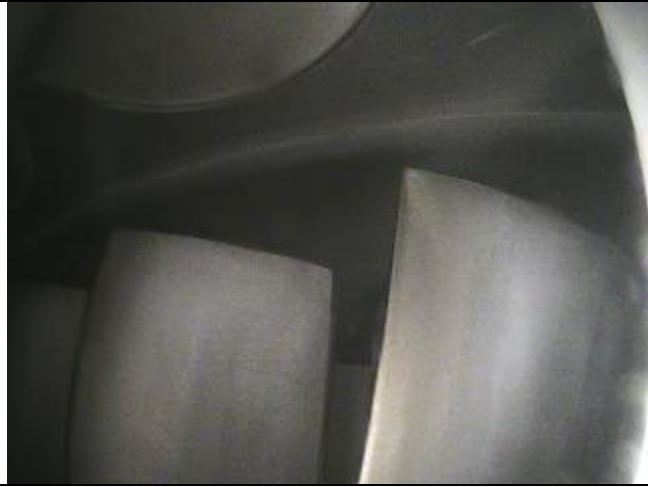
HPC Stage 2 L/E Root



HPC Stage 2 T/E Tip



HPC Stage 2 T/E Root



HPC Stage 3 L/E Tip



HPC Stage 3 L/E Root



HPC Stage 3 T/E Tip



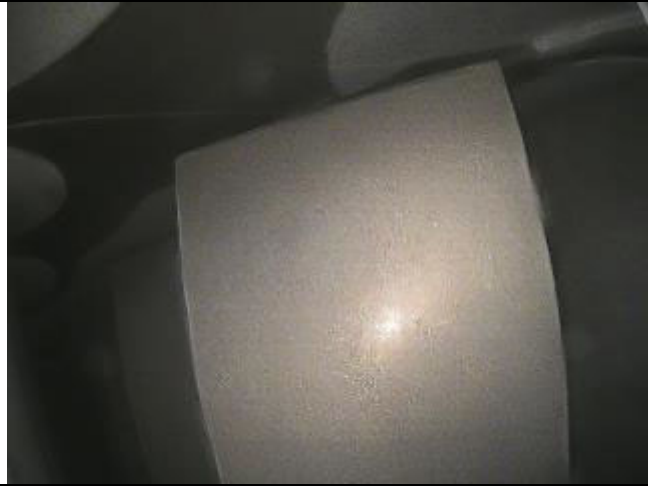
HPC Stage 3 T/E Root



HPC Stage 4 L/E Tip



HPC Stage 4 L/E Root



HPC Stage 4 T/E Tip



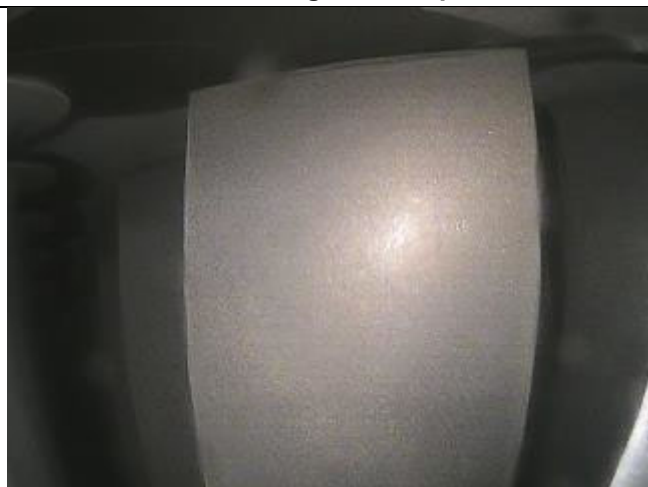
HPC Stage 4 T/E Root



HPC Stage 5 L/E Tip









HPC Stage 5 L/E Root



HPC Stage 5 T/E Tip



HPC Stage 5 T/E Root

		
<p>HPC Stage 6 L/E Tip</p>		<p>HPC Stage 6 L/E Root</p>
		
<p>HPC Stage 6 T/E Tip</p>		<p>HPC Stage 6 T/E Root</p>
		
<p>HPC Stage 7 L/E Tip</p>		<p>HPC Stage 7 L/E Root</p>



HPC Stage 10 T/E Tip



HPC Stage 10 T/E Root



HPC Stage 11 L/E Tip



HPC Stage 11 L/E Root



HPC Stage 12 T/E Tip



HPC Stage 12 T/E Root



HPC Stage 13 L/E Tip



HPC Stage 13 L/E Root



HPC Stage 13 T/E Tip



HPC Stage 13 T/E

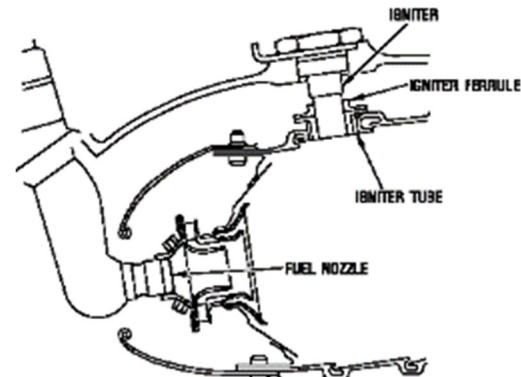
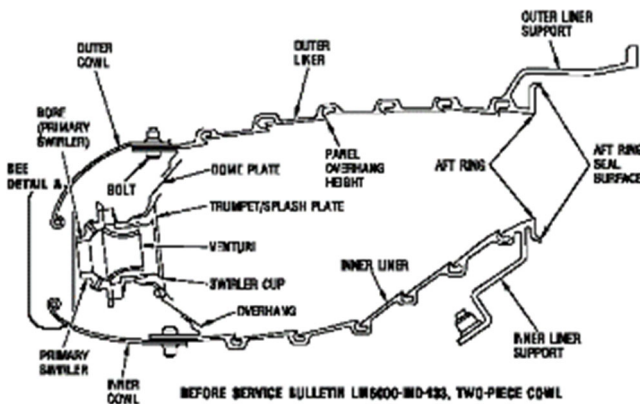
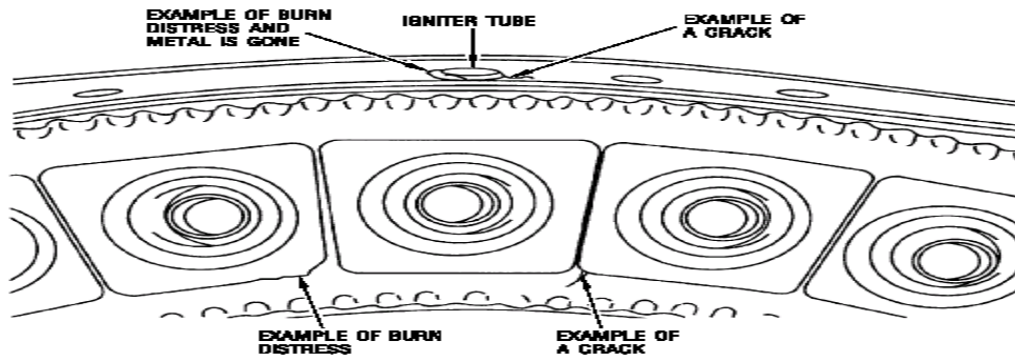


HPC Stage 14 L/E Tip

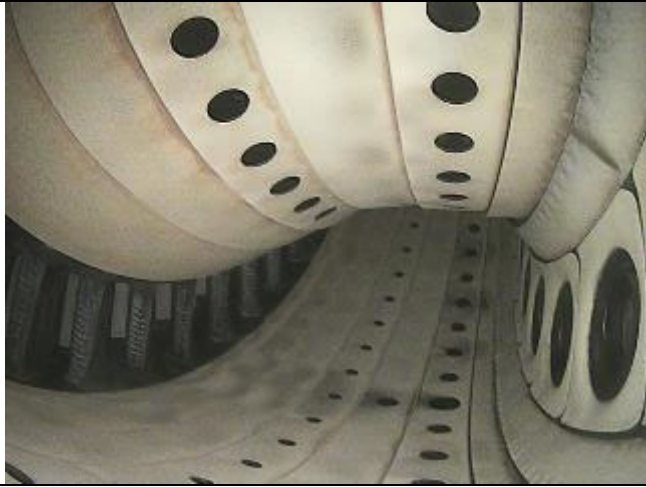


HPC Stage 14 L/E Root

Combustor



Combustor Ports	S6-1 through S6-6
All Surfaces	Normal discoloration, Serviceable
Cowl	Normal discoloration, Serviceable
Primary Swirlers	Normal wear and discoloration, Serviceable
Dome Assembly (Dome Plate, Trumpet/ Splash Plate)	Normal wear and discoloration noted, Serviceable
Inner & Outer Liner	Normal discoloration, Serviceable
Secondary Swirlers	Normal wear and deposits noted, Serviceable
Igniters	Lower Igniter found with wear of .012 inch. Replaced the igniter with customer supplied part.
Fuel Nozzles	Normal wear noted, Serviceable
Additional Comments	



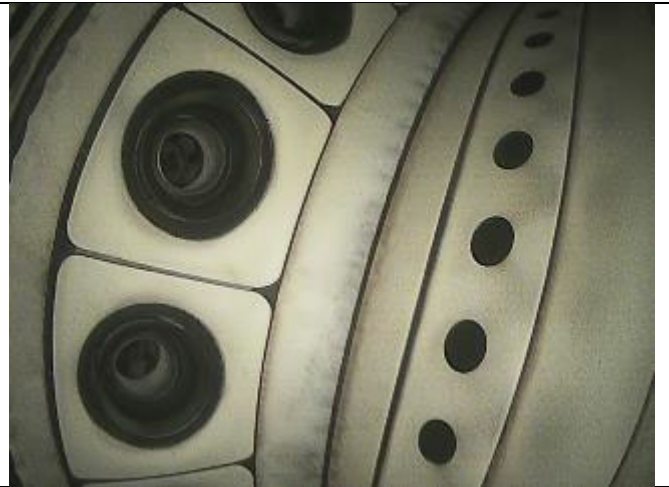
Combustor Overview



Combustor Overview



Combustor Splash Plates and outer liner



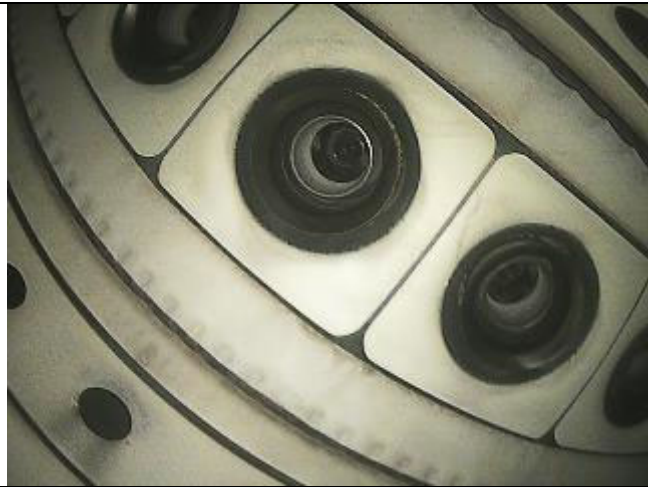
Combustor Splash Plates and inner liner



Combustor Outer Liner



Combustor Inner Liner



Combustor Splash Plates



Combustor Splash Plates



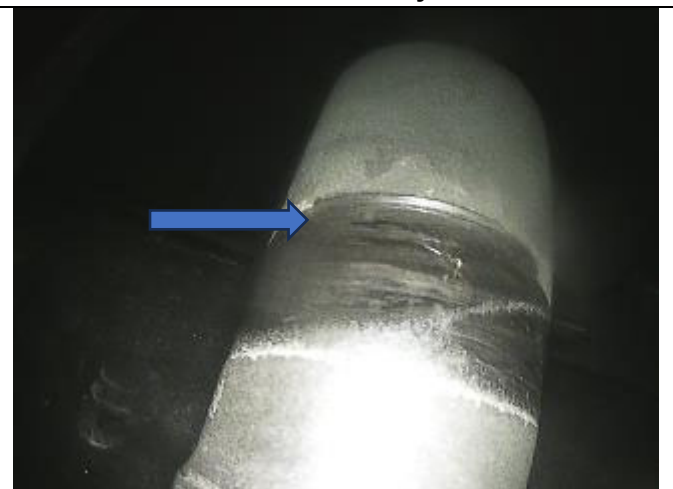
Combustor Secondary Swirler



Combustor Secondary Swirler

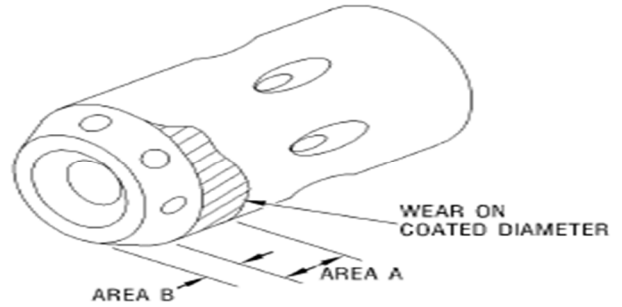
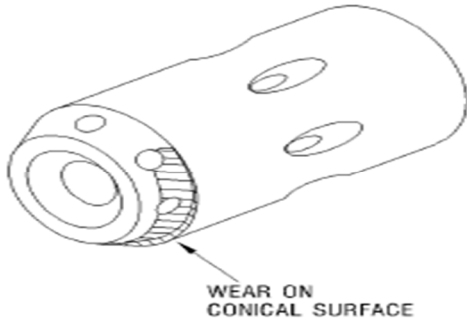


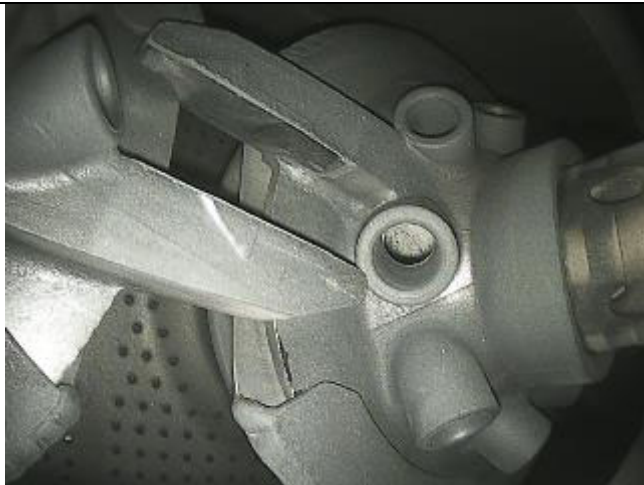
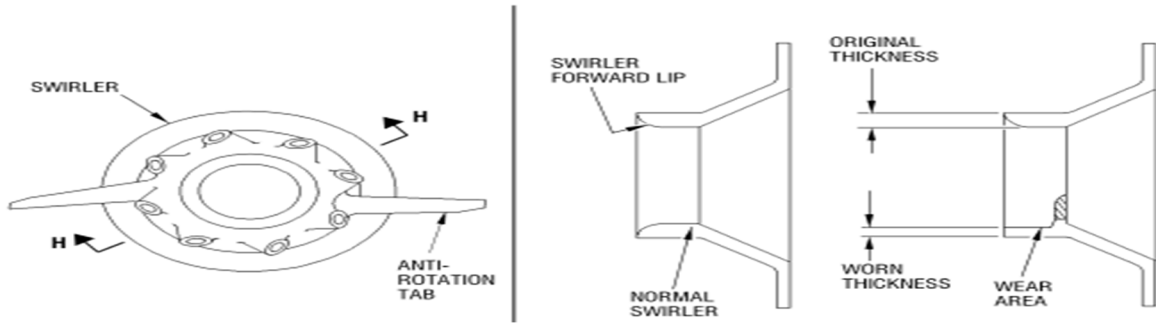
Igniter Upper



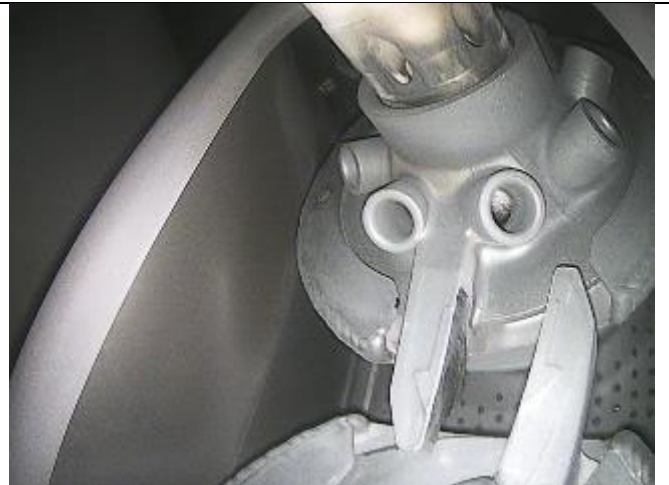
Igniter Lower found with wear / Replaced

Fuel Nozzle & Combustor Bore Inspection





Combustor Bore anti-rotation tabs



Combustor Bore anti-rotation tabs

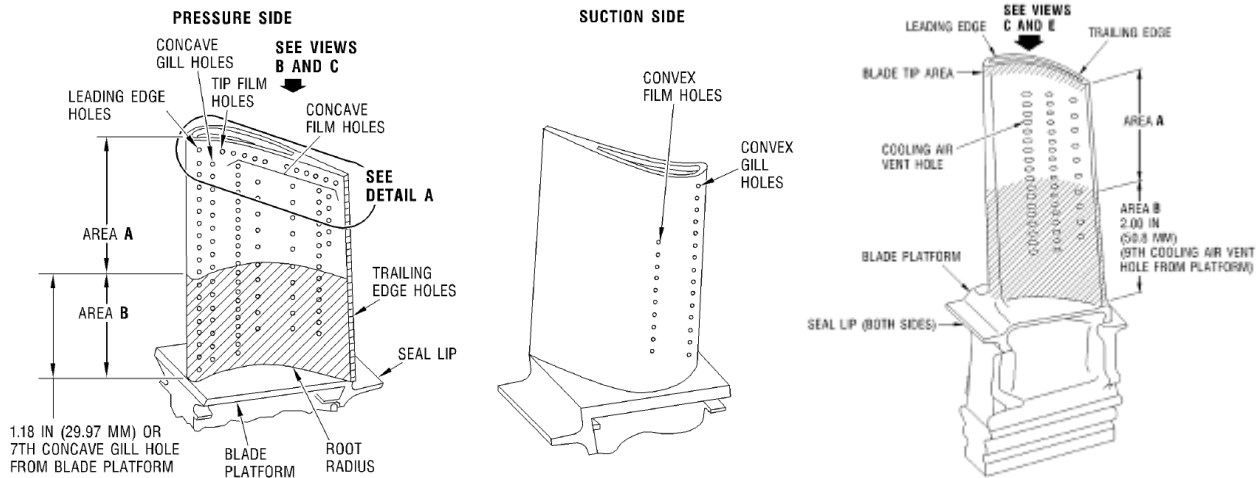


Combustor Secondary Swirler and splash plates



Combustor Secondary Swirler and splash plates

High-Pressure Turbine Rotor & Nozzle



HPT Inspection Ports	S7-1,S7-2,S8-1
HPT Stage 1 Nozzles	Excessive erosion on leading edges noted. Serviceable?
HPT Stage 1 Shrouds	Stage 1 Shrouds blistering, buckling and missing material. PES Engineering to give final disposition on serviceability and repairs.
HPT Stage 1 Rotor Blades	Minor deposits and moderate TBC loss on L/E. Missing material L/E tips. PES Engineering to determine serviceability.
HPT Stage 2 Nozzles	Minor craze cracks on T/E, some TBC loss.
HPT Stage 2 Shrouds	Normal wear, Serviceable
HPT Stage 2 Rotor Blades	Serviceable? PES Engineering to determine serviceability. L/E tips missing material.
Stage 11 Check Valves	Serviceable
Borescope Plugs (S7-1,7-2)	Serviceable



HPTN1 L/E.



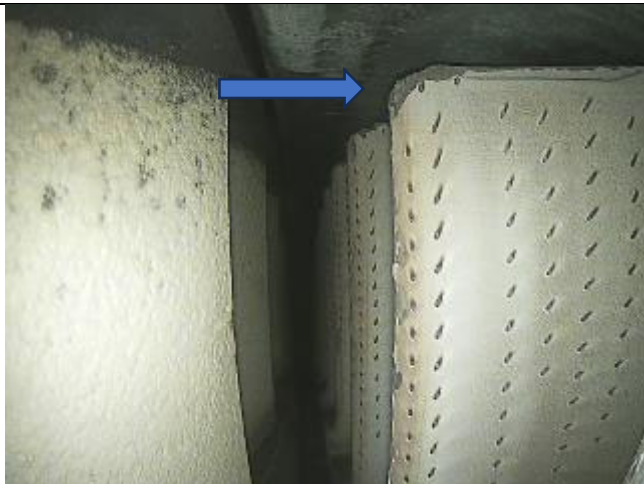
HPTN1 L/E.



HPTN1 T/E Outer Platform. Note tip damage.



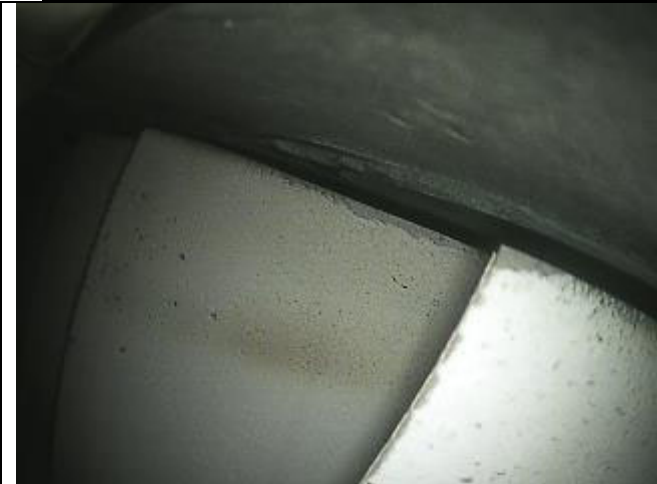
HPTN1 T/E Inner Platform.



HPTR1 L/E Tip. Note Tip damage.



HPTR1 L/E Root. Note TBC loss.



HPTR1 T/E Tip.



HPTR1 T/E Root.



HPTN2 L/E. Outer Platform.



HPTN2 L/E. Inner Platform



HPTN2 T/E and Outer Platform. Note erosion/deposits?



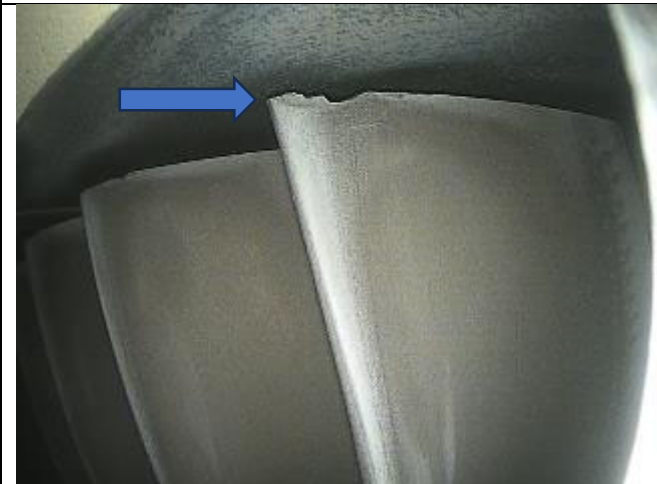
HPTN2 T/E and Outer Platform.



HPTN2 T/E and Inner Platform



HPTN2 T/E and Inner Platform.



HPTR2 L/E Tip. Note tip damage.



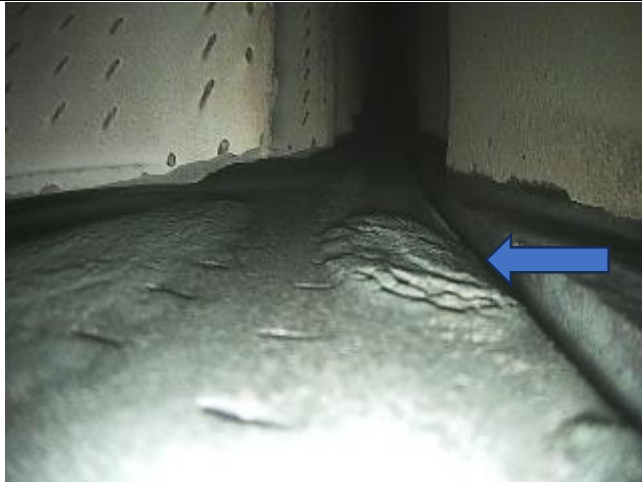
HPT2 L/E Root



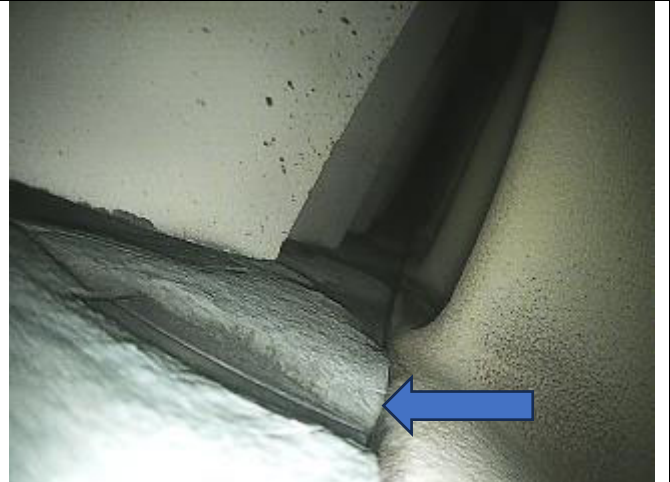
HPTR2 T/E Tip



HPTR2 T/E Root



HPT Stage 1 Shroud excessive blistering noted.



HPT stage 1 Shroud excessive material missing noted.



HPT Stage 2 Shroud.



HPN2 Cooling air tube.

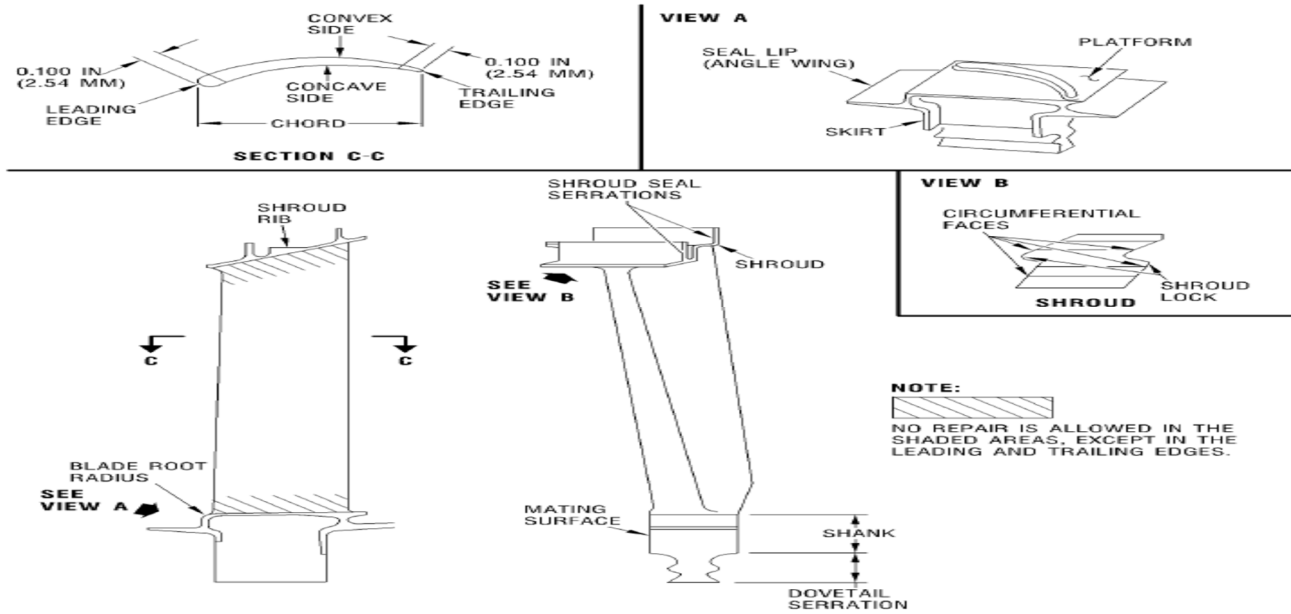


Stage 11 check valve



Stage 11 check valve

LPT



LPT Inspection Ports	S8-1 through S8-4
Nozzle Vanes	Serviceable
Rotor Blades	Serviceable
T4.8 Probes	Slight heat erosion evident, Serviceable
P4.8 Probe	Slight erosion evident, Serviceable
Additional Comments	IGB Splines clear, Serviceable. CRF clamps okay.



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View of LPT R/S



T48 Probe & LPT Stage 1 Nozzle L/E



P48 Probe



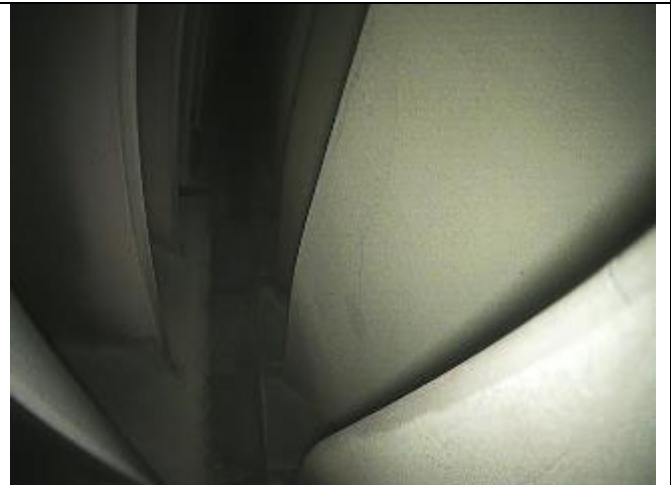
LPT Stage 1 Nozzle Outer Platform



LPT Stage 1 Nozzle Inner Platform



LPT Stage 1 T/E Outer Platform



LPT Stage 1 T/E Inner Platform



LPT Stage 2 L/E Outer Platform



LPT Stage 2 L/E Inner Platform



LPT Stage 3 T/E Outer Platform



LPT Stage 3 T/E Inner Platform



LPT Stage 4 L/E Outer Platform



LPT Stage 4 L/E Inner Platform

IGB & CRF Oil-Manifold Insp



IGB Splines



IGB Spline Bearing



CRF Inspection



CRF-Inspection

Post Borescope Inspection

LPC Ports S-4 to S-5 Installed Torqued and safety Cabled	Tech: MOB
HPC Ports S5-0 to S5-13 Installed, Torqued, and safety cable	Tech: MOB
Combustor Ports S6-1 to S6-6 Installed, Torqued, and safety cable	Tech: MOB
Fuel Nozzles installed, Torqued, and safety cable	Tech: MOB
HPT Ports S7-1 to S7-2 Installed, Torqued, and safety cable	Tech: MOB
LPT Ports S8-1 to S8-4 Installed, Torqued, and safety cable	Tech: MOB
TLO Pump Finger Screens Installed	Tech: MOB
Drive Pad Cover Plate Installed:	Tech MOB

Calibrated Tools

Tool Description	PE Gauge ID	S/N	Torque Range	Task
Torque Wrench		0821902230	40-200 inch lbs.	Port Plugs
Torque Wrench		0921111046	200-1000 inch lbs.	Port Plugs

Parts

Description:	Part number	Qty.	Supplied by:
Borescope kit	NA	1	PES