

General Electric LM2500 Gas Turbine

## **LM2500 SAC Borescope Inspection UNIT TM41**

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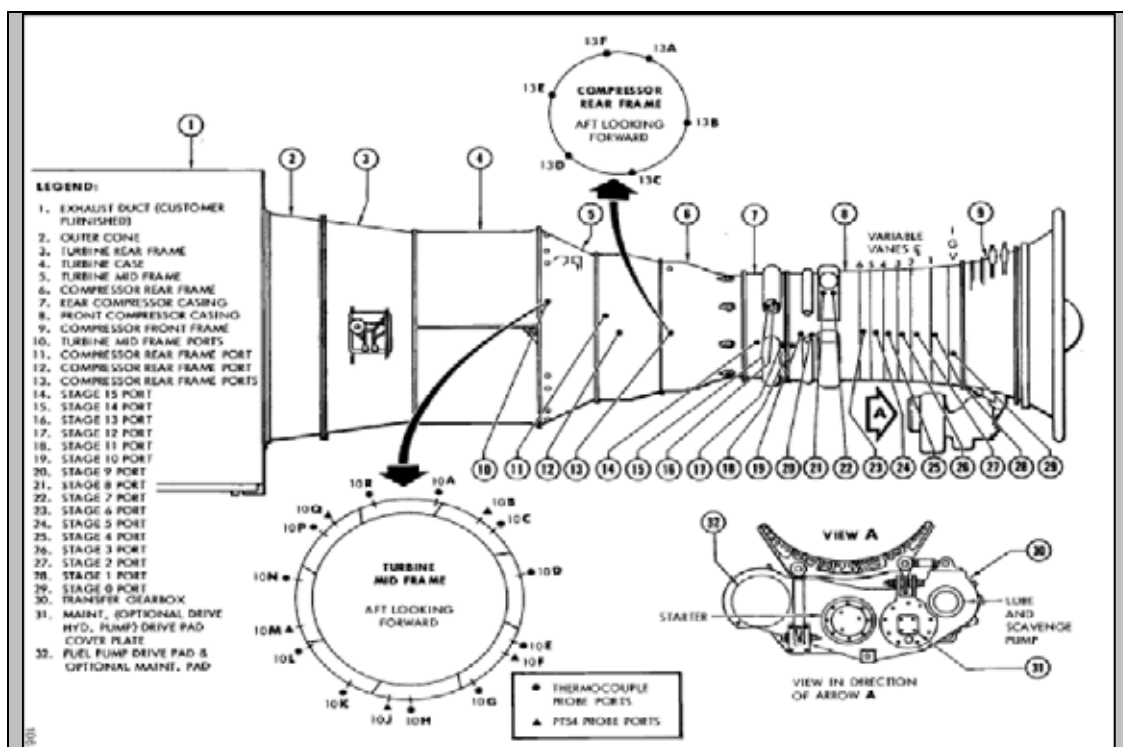
CUST –

ENGINE SERIAL NUMBER:  
481-694

TCT SALES ORDER NUMBER:  
UK9000087

### LM2500 SAC BORESCOPE REPORT

Location:	Dar ES Salaam, Tanzania
Purchase order:	TBC, W/O UK80000157
Date of visit:	13-18 May 2008
Purpose:	Borescope inspection in accordance with GEK 97310, Vol. 1, Table 5-4 to Table 5-11
Purpose:	Lube and Scavenge Pump Inlet Screens Inspection and Cleaning in accordance with GEK 97310, Vol. 1, Table 5-3.18
Written by:	Mark Devine
Engine hours:	1174.45
Starts:	N/K
Fuel type:	Dual
Overview:	Engine visually acceptable for further operation but has reported high heat rate.



BORESCOPE ACCESS PORT LOCATIONS.

Volume 1, Tbl 5-4 – Tbl 5-11

LM2500 SAC Borescope inspection

### COMPRESSOR:

Component	Condition
Stages 1 through 9 Blades	<ul style="list-style-type: none"> <li>Stage 3 blades, no damage found.</li> <li>Stage 4 blades, no damage found.</li> <li>Stage 9 blades, no damage found.</li> <li>Acceptable in accordance with GEK 97310 Vol. 1 table 5-4.</li> </ul>

<b>Stages 10 through 16 Blades</b>	<ul style="list-style-type: none"> <li>• Stage 10 blades, no damage found.</li> <li>• Stage 15 blades, no damage found.</li> <li>• Stage 16 blades, no defects found.</li> <li>• Acceptable in accordance with GEK 97310 Vol. 1 table 5-4.</li> </ul>
<b>Tip clanging contact stages 3-6</b>	<ul style="list-style-type: none"> <li>• No defects found.</li> <li>• Acceptable.</li> </ul>
<b>Stator Vanes (all)</b>	<ul style="list-style-type: none"> <li>• No defects found.</li> <li>• Acceptable.</li> </ul>
<b>All VSV Vanes</b>	<ul style="list-style-type: none"> <li>• No defects found.</li> <li>• Acceptable.</li> </ul>
<b>HPC Rotor and Stator Airflow Path Surfaces</b>	<ul style="list-style-type: none"> <li>• Normal levels of dirt/corrosion present.</li> <li>• Acceptable.</li> </ul>

#### Reference Photographs - HPC Blades and Vanes

 <p>Stg 16 blade condition</p>	
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**Inspection References:** GEK 97310 Vol. 1, Table 5-4 Compressor Blades and Vanes, paragraph 5-3.6 and figures 5-8, 5-9 and 5-10.

#### COMBUSTOR and FUEL NOZZLES:

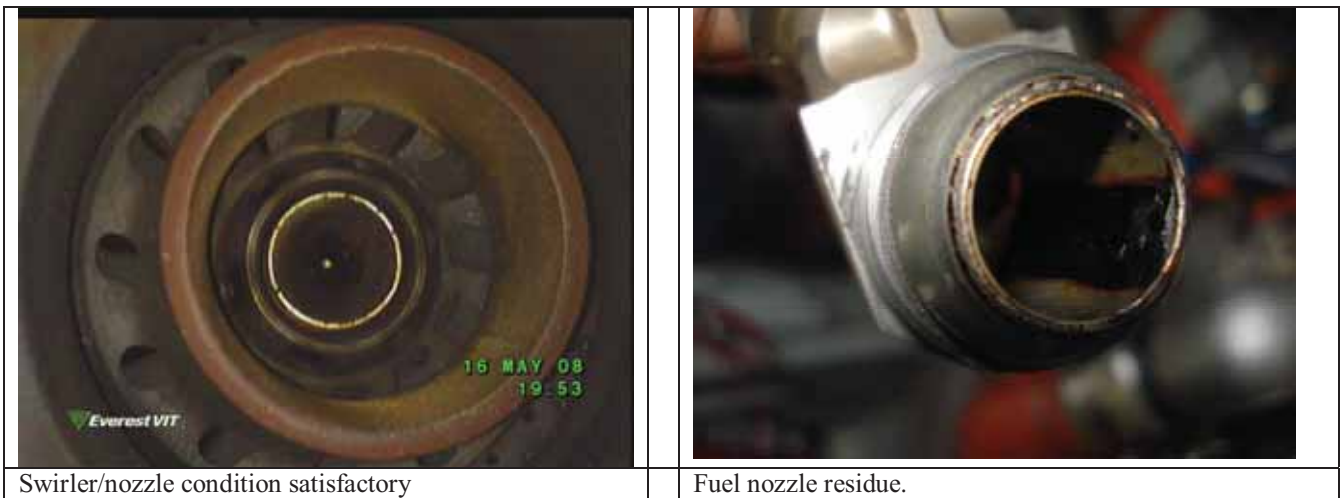
Component	Condition
<b>All Combustor Surfaces</b>	<ul style="list-style-type: none"> <li>• General condition acceptable.</li> </ul>
<b>Dome Band/Dome Plate</b>	<ul style="list-style-type: none"> <li>• Minor thermal barrier coating loss/degradation-acceptable</li> </ul>
<b>Riveted Joints</b>	<ul style="list-style-type: none"> <li>• No defects found</li> </ul>
<b>Trumpet and swirler cups</b>	<ul style="list-style-type: none"> <li>• Minor thermal barrier coating loss/degradation-acceptable.</li> </ul>
<b>Dome Assembly</b>	<ul style="list-style-type: none"> <li>• No defects found</li> </ul>
<b>Igniter Ferrule</b>	<ul style="list-style-type: none"> <li>• No defects found</li> </ul>
<b>Combustor Cowl</b>	<ul style="list-style-type: none"> <li>• No defects found</li> </ul>

<b>Inner and Outer Liner</b>	<ul style="list-style-type: none"> <li>No defects found</li> </ul>
<b>Fuel nozzle</b>	<ul style="list-style-type: none"> <li>3 fuel nozzles were removed from engine for inspection. #11 pos S/N PHCHN387, #17 pos S/N PHCHN388, #26 pos S/N PHCHN320.</li> <li>One fuel nozzle found with contamination/residue, suspect remnants of liquid fuel running</li> <li>Fuel nozzle #11 position S/N PHCHN387 replaced in accordance with GEK97310 SWP 104 04. Fuel Nozzle installed P/N L31809P10, S/N PHCC2735, customers own stock</li> </ul>

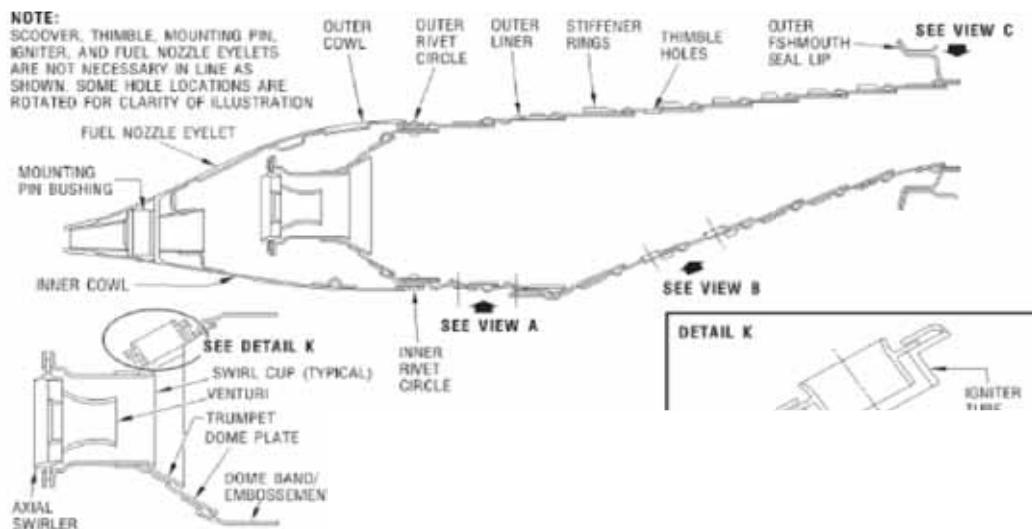
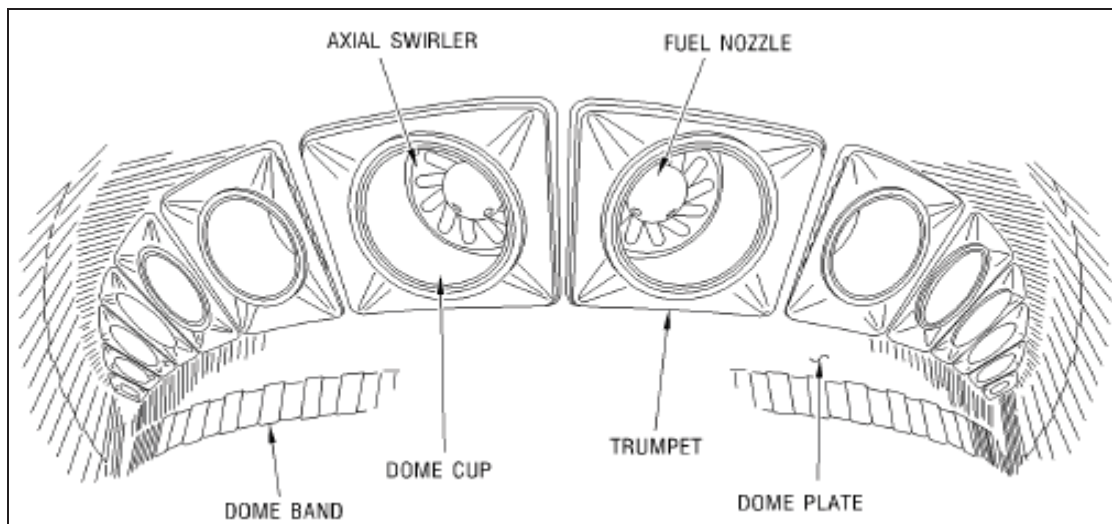
**Reference Photographs – Combustor, Pre-mixers**

	
Combustor TBC condition satisfactory	Combustor TBC condition satisfactory
	
Combustor TBC condition satisfactory	Swirler/Nozzle condition satisfactory







**GEK 937310 Inspection References:**



**HPT ASSEMBLY:**

Component	Condition		
<b>HPT Stage 1 Nozzle Assembly</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	<b>Nozzle airfoil</b>		
	N/A	N/A	No defects found in areas inspected
	<b>Inner and Outer Platform</b>		
	N/A	N/A	No defects found in areas inspected
	General remarks	Condition satisfactory for continued use.	
<b>HPT Rotor Blade-Stage 1</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	<b>HPT Rotor Blades-Leading Edge Area A</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blades-Leading Edge Area B</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade Tips</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Trailing Edge Area A</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Trailing Edge Area B</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Concave Surface Area A</b>		
	N/A	N/A	No defects found
	General remarks	Condition satisfactory for continued use	
<b>HPT Stages 1 and 2 Nozzle Shroud</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	N/A	N/A	No defects found in areas inspected
	General remarks	Condition satisfactory for continued use	
<b>HPT Stage 2 Nozzle Assembly</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	N/A	N/A	No defects found in areas inspected
	General remarks	Condition satisfactory for continued use	
<b>HPT Rotor Blade-Stage 2</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	<b>HPT Rotor Blades-Leading Edge Area A</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blades-Leading Edge Area B</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade Tips</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Trailing Edge Area A</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Trailing Edge Area B</b>		
	N/A	N/A	No defects found
	<b>HPT Rotor Blade-Concave Surface Area A</b>		
	N/A	N/A	No defects found
	General remarks	Condition satisfactory for continued use.	
<b>HPT Stage 2 Nozzle Shroud</b>	<b>Defect</b>	<b>Location</b>	<b>Findings/GEK limits</b>
	N/A	N/A	No defects found in areas inspected
	General remarks	Condition satisfactory for continued use	

**Reference Photographs – HPT assembly**

 <p>14 MAY 08 22:37 Everest VIT</p>	 <p>14 MAY 08 23:11 Everest VIT</p>
Stg 1 Blade condition satisfactory.	Stg 2 Blade condition satisfactory.

**PACKAGE INSPECTION RECORD:**

Component	Condition
<b>Lube and Scavenge Pump Inlet Screens Inspection.</b>	<ul style="list-style-type: none"> <li>All screens and magnetic plugs found to be clean.</li> </ul>
<b>Gas Turbine External Inspection.</b>	<ul style="list-style-type: none"> <li>Stud loose on power turbine stator case. Unable to tighten without risk of damage/shearing stud. Monitor for continued security, acceptable for continued use.</li> </ul>

	
Loose stator lock stud x 1.	

## Recommendations

## Borescope inspection

- Engine condition satisfactory for continued use
- Lubricate the loose LPTS lock in hopes to tighten in situ, if not find suitable application to retain loose assembly to avoid case damage.
- Customer has reported a higher heat rate compared to the other units. The following steps are recommended
  - Inlet inspection
  - Inspection of filtration system (to include differential pressure reading and ensure instrumentation is calibrated) – this is higher than TM43, refer to package limits.
    - Inspect air inlet for dirty filters- replace as required
  - Inspect for on engine pipe leaks
  - Device inspection and calibration
  - Perform VSV system inspection checks in accordance GEK 97310 Vol. 2 WP118 00 and WP 206 00 – recommend full system (VIGV – HP6)

Questions to be answered by customer

- Last inlet filter change?
  - Are there available filters at site?
- When was the last time the all sensors have been inspected and calibrated?
  - Fuel manifold pressure low
  - PS3A/B difference
- Has there been a gradual increase to heat rate?
- How is the VSV system angle measured (LVDT/on engine protractor)
- Is there spare VG controllers on site?
  - If yes, what is the part number

### Parts used during outage:

Parts used			
Part #	Component Description	Source	Issued
C10-218	SAFETY-CABLE W/FERRULE	NEW	25
4058T39P01	GASKET	NEW	3
M83248/1-121	PREFORMED PACKING	NEW	1
J221P910	PREFORMED PACKING	NEW	2
J221P912	PREFORMED PACKING	NEW	3
J221P905	PREFORMED PACKING	NEW	5
L31809P10	FUEL NOZZLE, S/N PHCC2735	DOWANS	1



## Site supplied information