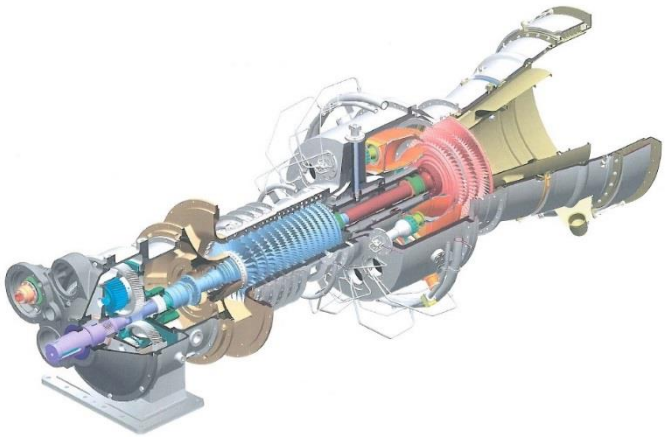
Solar® Turbines
A Caterpillar Company

Solar Turbines Incorporated - Customer Service Center
9330 Sky Park Court
SAN DIEGO, CA, 92123-4304
U.S.A.

BORESCOPE INSPECTION REPORT



GAS TURBINE ENGINE
TAURUS 65
COLD END DRIVE

Engine Serial Number
OHI21-D0140

Engine Rating
6300 / NA KWe

Engine Serviceable
Yes

Inspection Performed By
Mazza Diego

Inspection Date
Tuesday, January 16, 2024

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BORESCOPE INSPECTION INFORMATION

Country	**Spain**	Inspection Date	**1/16/2024**
Customer Name	**J VILASECA PAPELERA**	Inspection Performed By	**Mazza Diego**
Site Name	**VILASECA**	Reason For Inspection	**Unplanned Inspection**
District	**PGEW**	Borescope Equipment Used (Brand/Model)	**Olympus Iplex**
Work Order #	**M1061779600**	Borescope Inspection Procedure (WFM Task #)	**133**

PACKAGE INFORMATION

PD #	**3H861**	Package S/N	**1B028T1**
Unit Customer Tag	**TG1**	Package Hours	**79802**
		Package Starts	**399**

ENGINE INFORMATION

Engine GP[1] P/N	**ED841S-A0G00P00**	Gas Fuel Hours	**2423**
Engine GP S/N	**OHI21-D0140**	Liquid Fuel Hours	**0**
Engine Rating	**6300 / NA KWe**	Total Hours	**2423**
Combustion Type	**SoLoNOx**	Total Starts	**14**
Fuel Type	**Gas**	Next Planned Overhaul Running Hours	**N/A**
Inspection Last Date	**N/A**	Gas Fuel Hours since last inspection	
		Liquid Fuel Hours since last inspection	
		Starts since last inspection	

NOTES

Borescope completed before Offline Compressor Wash.

[1] GP stands for “Gas Producer”.

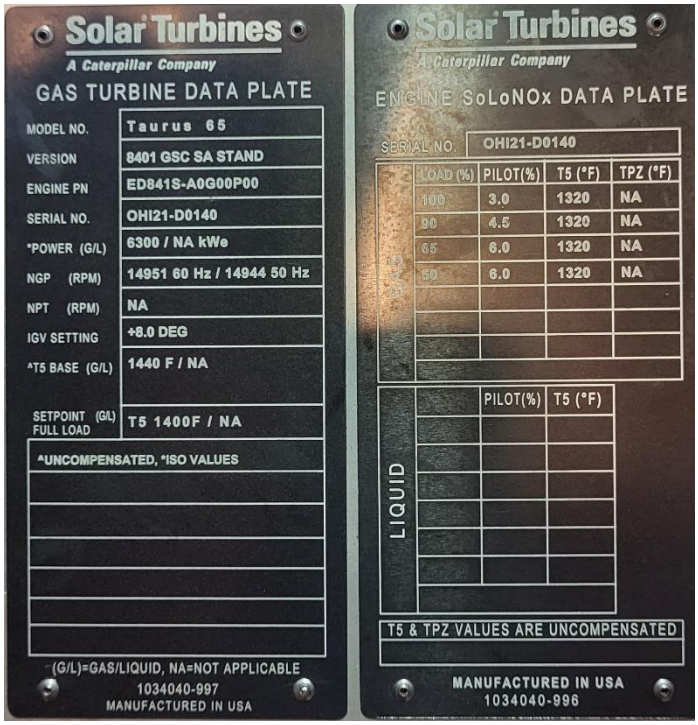
BORESCOPE INSPECTION CHECK LIST

Step	Description[2]	Performed			Initials & Date
		Yes	No	N/A	
1	Complete Task Risk Assessment.	✓			MD January 16, 2024
2	Complete Job Safety Analysis.	✓			MD January 16, 2024
3	Ensure the shutdown Gas Turbine engine is cool.	✓			MD January 16, 2024
4	Prepare the package for a Borescope Inspection.	✓			MD January 16, 2024
5	Perform Borescope Inspection (Record images, measurements and comments on the Borescope Inspection Report).	✓			MD January 16, 2024
6	Return Gas Turbine engine to service.	✓			MD January 16, 2024
7	Complete the Borescope Inspection Report (Borescope report sections populated correctly, FSR signature, Customer signature).	✓			MD January 19, 2024
8	Print/Scan the document as a PDF. Archive the document under the WFM associated Major Assembly / Field Attachments section.	✓			MD January 19, 2024

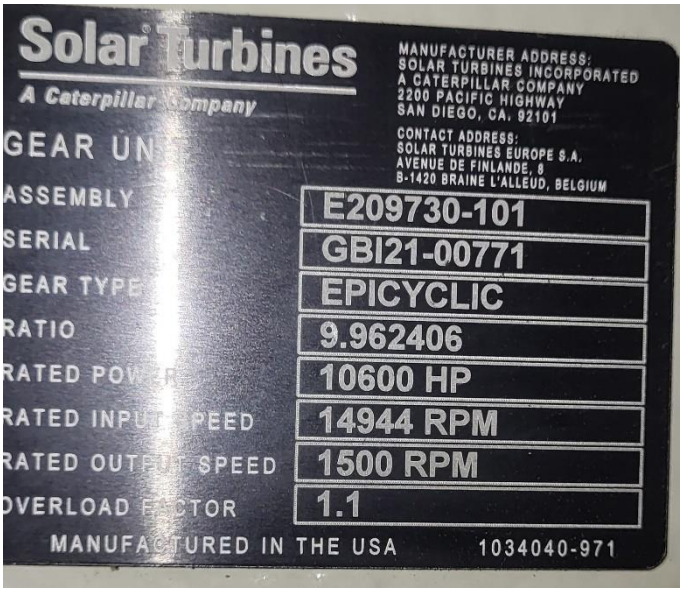
[2] For detailed step instructions, please refer to the Solar Turbines WFM (Work Force Management) internal procedure mentioned in the Equipment Information section.

EQUIPMENT DATA PLATE

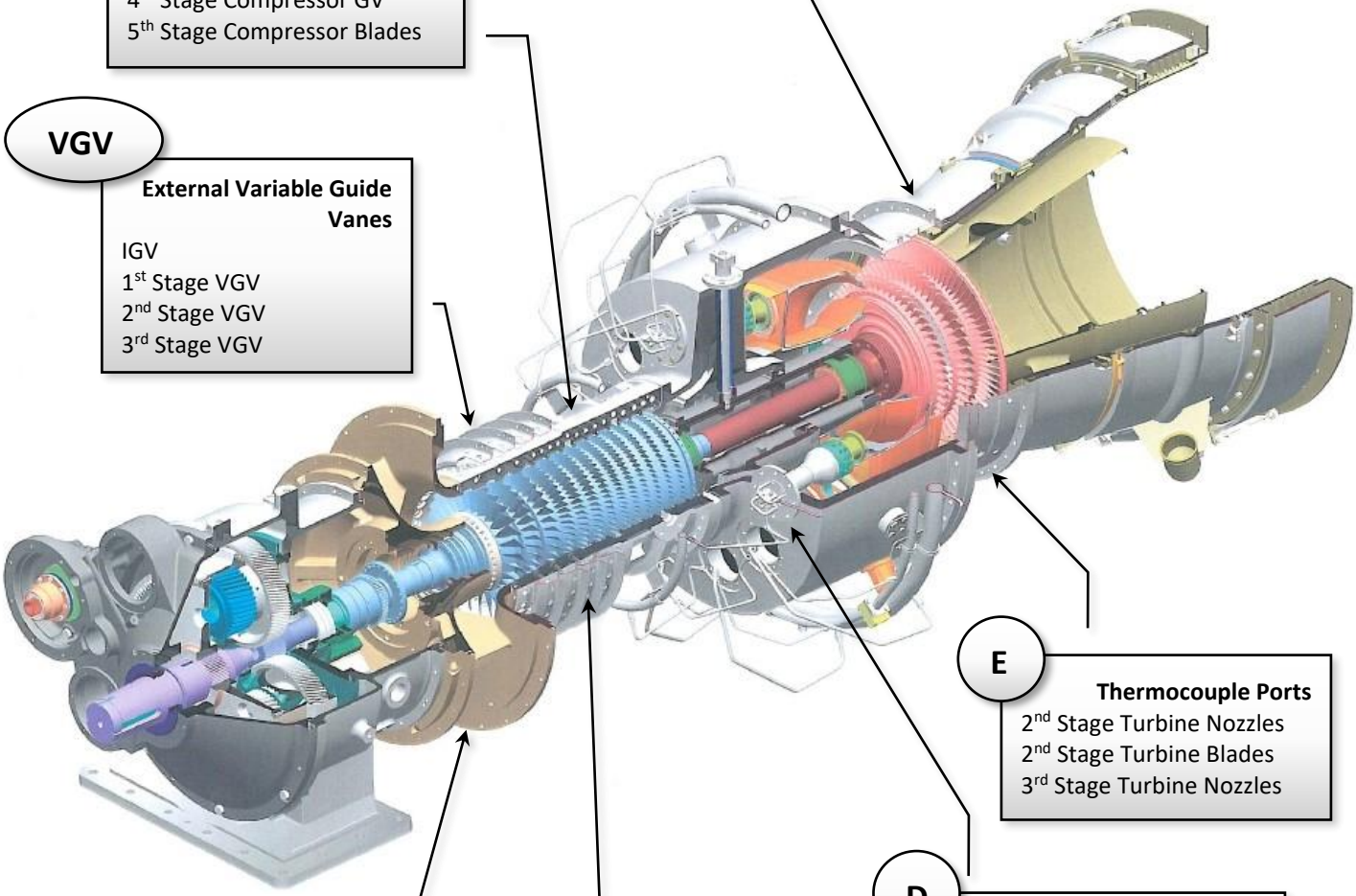
Gas Turbine



Reduction GearBox



BORESCOPE INSPECTION LOCATIONS



F

Exhaust Port
3rd Stage Turbine Nozzles
3rd Stage Turbine Blades

C

Borescope Ports
4th Stage Compressor Blades
4th Stage Compressor GV
5th Stage Compressor Blades

VGV

External Variable Guide Vanes
IGV
1st Stage VGV
2nd Stage VGV
3rd Stage VGV

E

Thermocouple Ports
2nd Stage Turbine Nozzles
2nd Stage Turbine Blades
3rd Stage Turbine Nozzles

D

Fuel Injector
Compressor Exit GV
Injectors
Combustor Interior
Torch Tube
1st Stage Turbine Nozzles
1st Stage Turbine Blades

A

Air inlet
Air Inlet Duct
Air Inlet Screen
IGV
1st Stage Compressor Blades
1st Stage Compressor VGV

B

Borescope Ports
2nd Stage Compressor Blades
3nd Stage Compressor VGV
3rd Stage Compressor Blades

BORESCOPE INSPECTION SUMMARY

Access Port	Location	Inspection for	Normal Condition	Minor	Moderate	Severe	Comments
A	Air Inlet Duct	a)Potential FOD b)Corrosive Pitting c)Cracks d)Excessive fouling	✓				
A	Air Inlet Screen	a)Potential FOD b)Cracks, damaged mesh	✓				
A	IGV	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	✓				
A	1st Stg Compressor Blades	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	✓				
A	1st Stg Compressor VGV	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area		✓			
B	2nd Stg Compressor Blades	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	✓				

Access Port	Location	Inspection for	Normal Condition	Minor	Moderate	Severe	Comments
B	2nd Stg Compressor VGV	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	✓				
B	3rd Stg Compressor Blades	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	✓				
C	4th Stg Compressor Blades	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	✓				
C	4th Stg Compressor GV	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area					Not Checked
C	5th Stg Compressor Blades	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	✓				
D	Compressor Exit GV	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	✓				

Access Port	Location	Inspection for	Normal Condition	Minor	Moderate	Severe	Comments
D	Injectors	a)Pilot center erosion b)Fuel hole contaminated, blocked c)Liquid: broken fuel spoke	✓				
D	Combustor Interior	a)Cracks, Qty, length, orientation b)Thermal erosion c)Hot spots d)Buckling or warpage	✓				
D	Torch Tube	a)Thermal erosion	✓				
D	1st Stg Turbine Nozzles	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	✓				
D	1st Stg Turbine Blades	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	✓				
E	2nd Stg Turbine Nozzles	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	✓				

Access Port	Location	Inspection for	Normal Condition	Minor	Moderate	Severe	Comments
E	2nd Stg Turbine Blades	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	✓				
E	3rd Stg Turbine Nozzles	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	✓				
F	3rd Stg Turbine Nozzles	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	✓				
F	3rd Stg Turbine Blades	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	✓				
VGV	IGV	a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	✓				

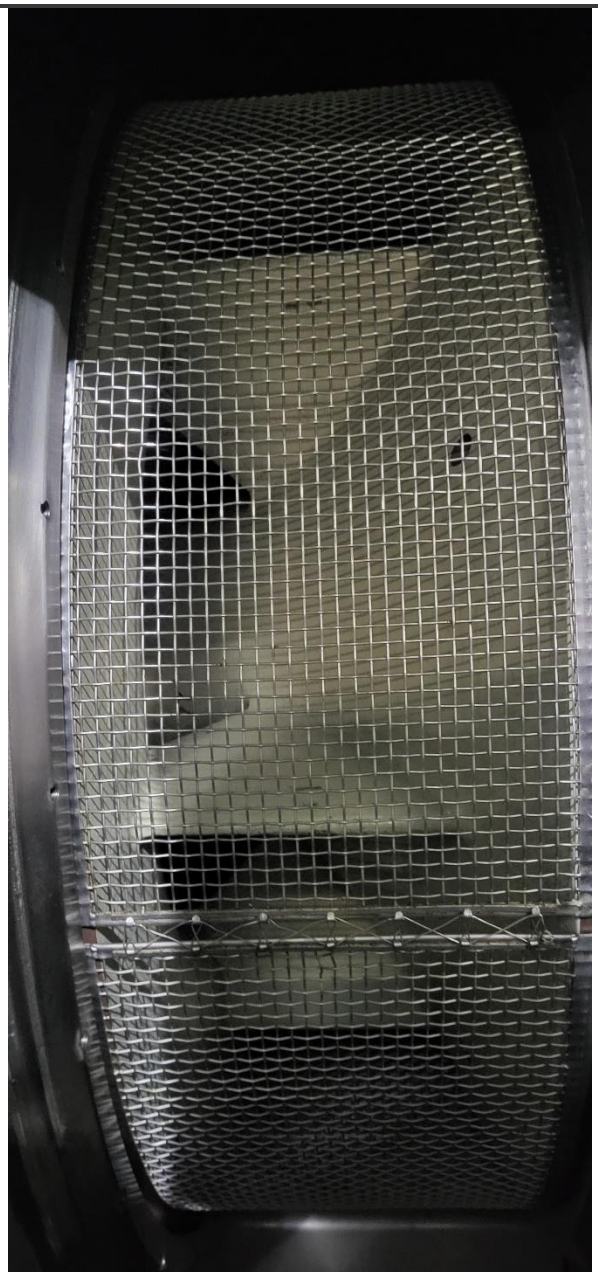
Access Port	Location	Inspection for	Normal Condition	Minor	Moderate	Severe	Comments
VGV	1st Stg VGV	a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	✓				
VGV	2nd Stg VGV	a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	✓				
VGV	3rd Stg VGV	a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	✓				
X	Other1	TBD					
X	Other2	TBD					
X	Other3	TBD					

BORESCOPE INSPECTION PICTURES

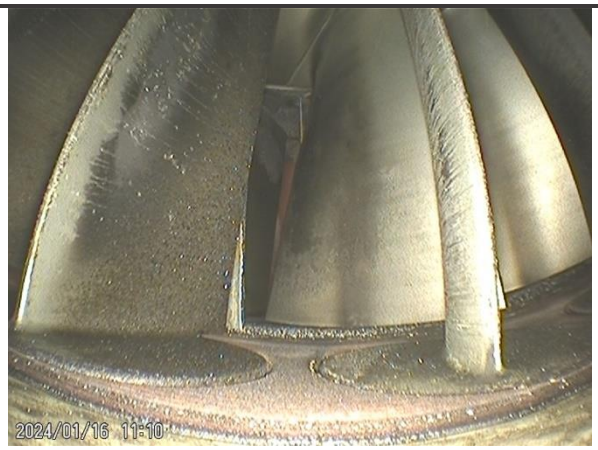
Access location Description	Picture	Inspection for	Severity / Comments

A Air Inlet Duct		a)Potential FOD b)Corrosive Pitting c)Cracks d)Excessive fouling	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
			

A Air Inlet Screen		a)Potential FOD b)Cracks, damaged mesh	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
			

A IGV	  	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	Normal Condition Not applicable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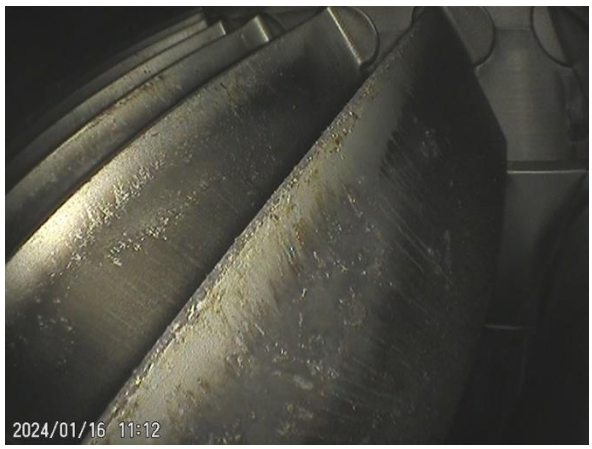
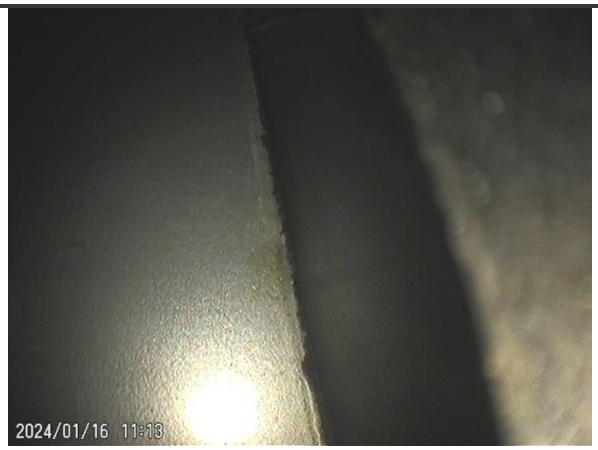
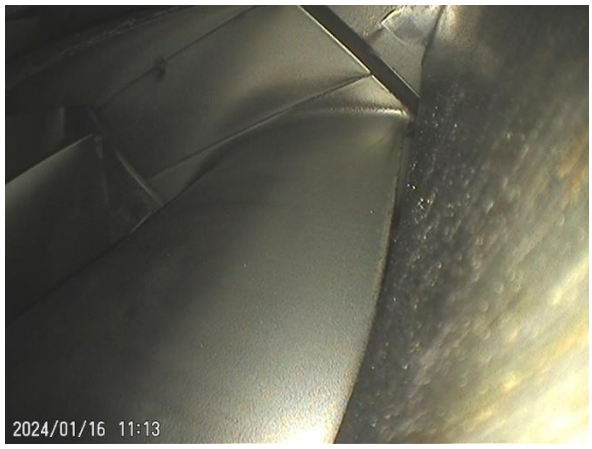
Access location Description	Picture	Inspection for	Severity / Comments
	  		

A 1st Stg Compressor Blades	  	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	Normal Condition Not applicable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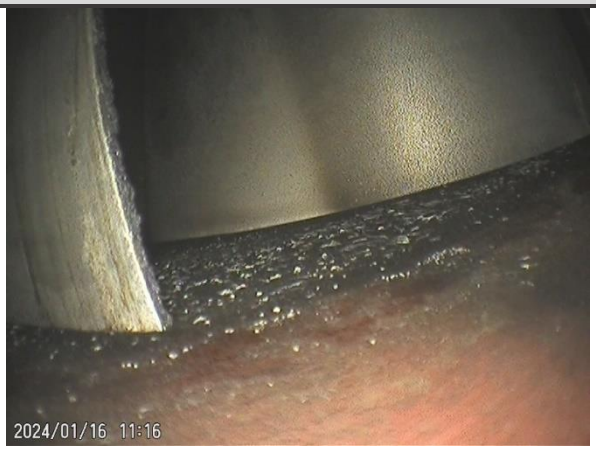
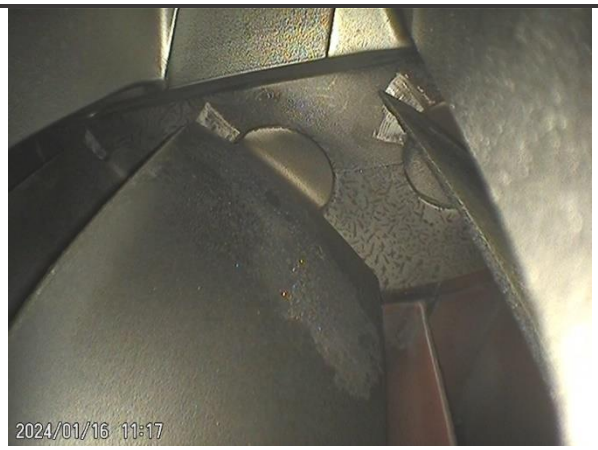
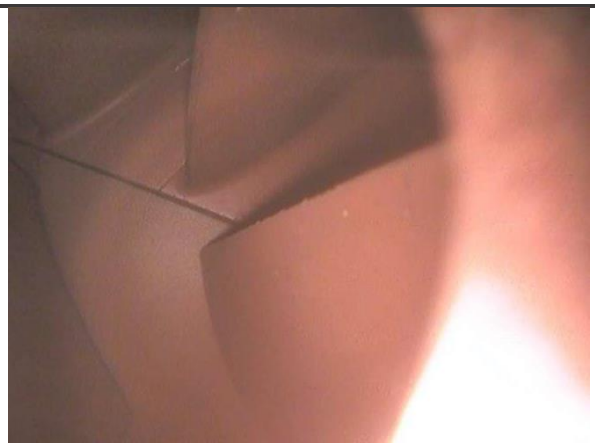
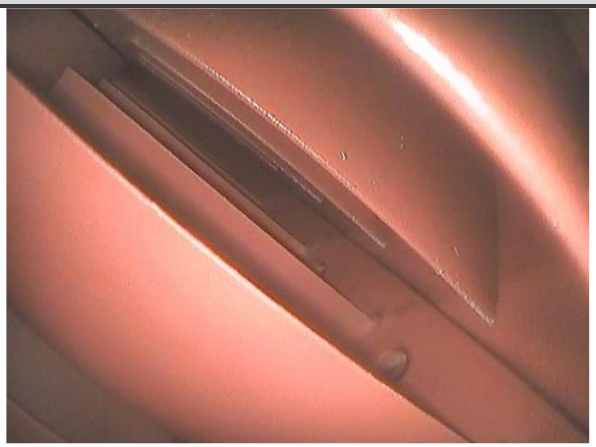
Access location Description	Picture	Inspection for	Severity / Comments
	 		

A 1st Stg Compressor VGV	 	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	Minor Blade tip rub, gap width

Access location Description	Picture	Inspection for	Severity / Comments
	 		

B 2nd Stg Compressor Blades	 	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	Normal Condition Not applicable

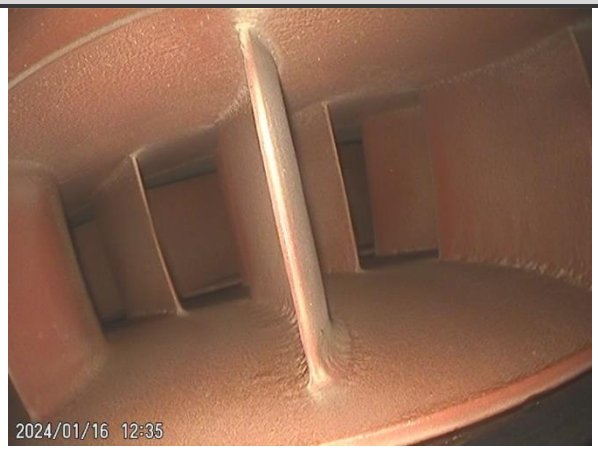
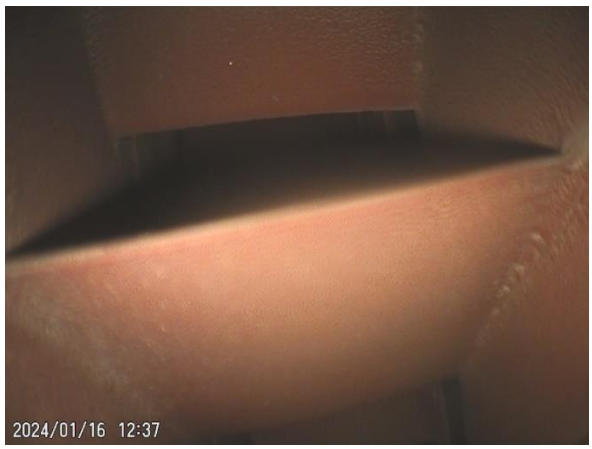
Access location Description	Picture	Inspection for	Severity / Comments
	 		
B 2nd Stg Compressor VGV		a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	Normal Condition Not applicable

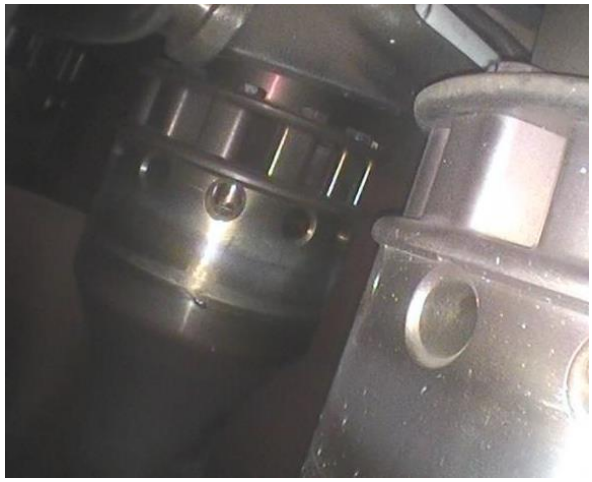
Access location Description	Picture	Inspection for	Severity / Comments
B 3rd Stg Compressor Blades		a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	Normal Condition Not applicable
C 4th Stg Compressor Blades	 	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
C 4th Stg Compressor GV	Not Checked	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	Not Checked

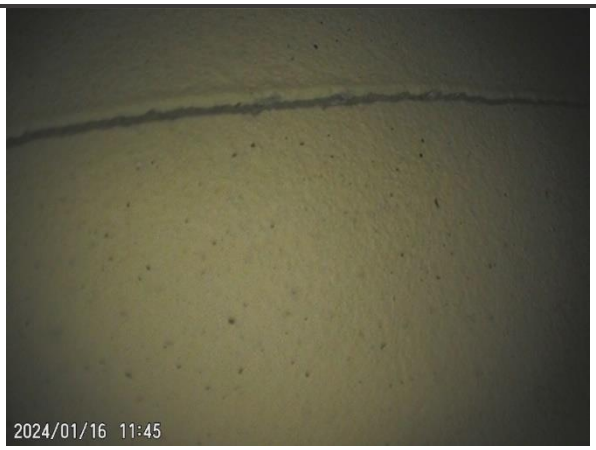
C 5th Stg Compressor Blades	 	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area d)Tip rub, Gap & curling	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
	 		

Access location Description	Picture	Inspection for	Severity / Comments
D Compressor Exit GV	  	a)Nicks and dents, Qty and size b)Excessive fouling c)Corrosive pitting. Affected Area	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
D Injectors	 	a)Pilot center erosion b)Fuel hole contaminated, blocked c)Liquid: broken fuel spoke	Normal Condition Not applicable

D Combustor Interior	  	a)Cracks, Qty, length, orientation b)Thermal erosion c)Hot spots d)Buckling or warpage	Normal Condition Not applicable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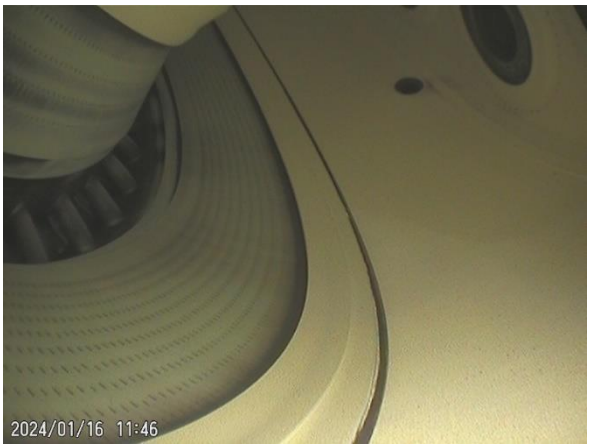
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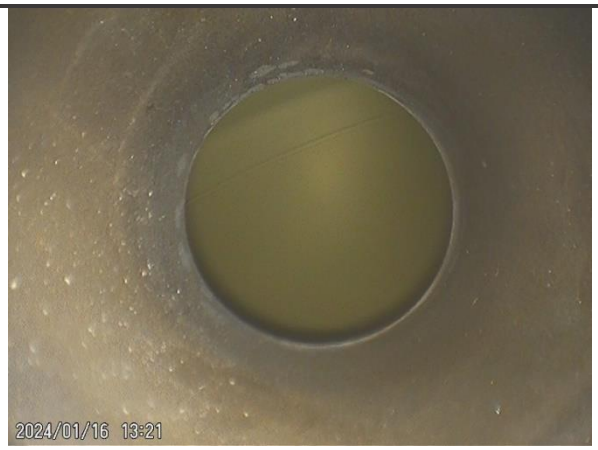
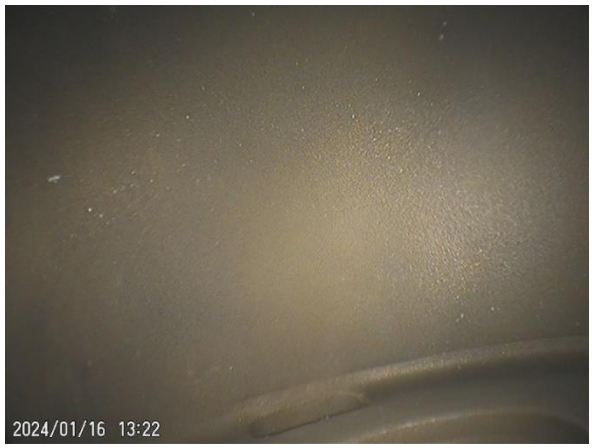
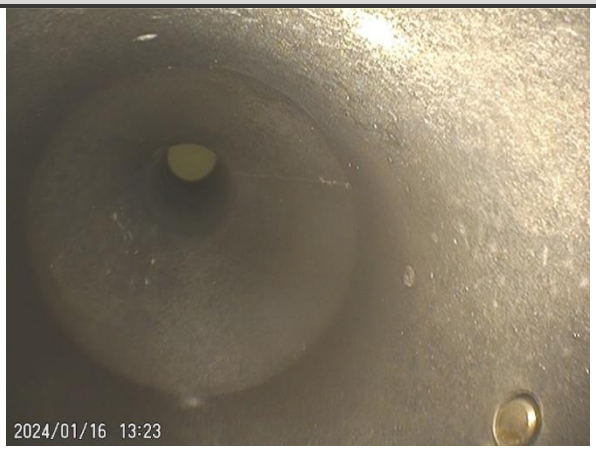
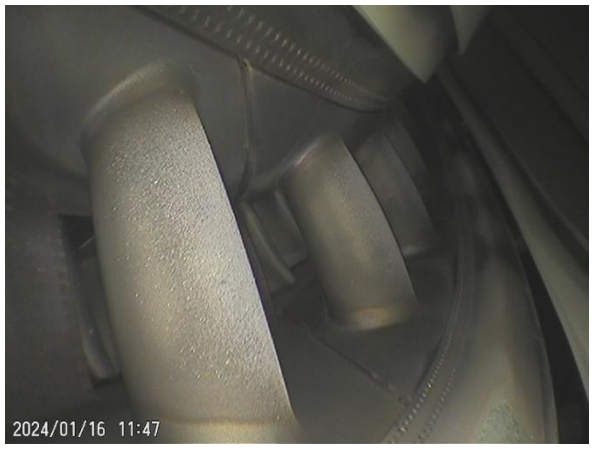
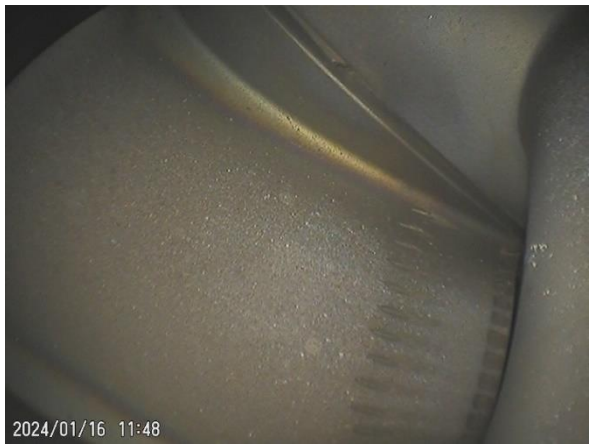
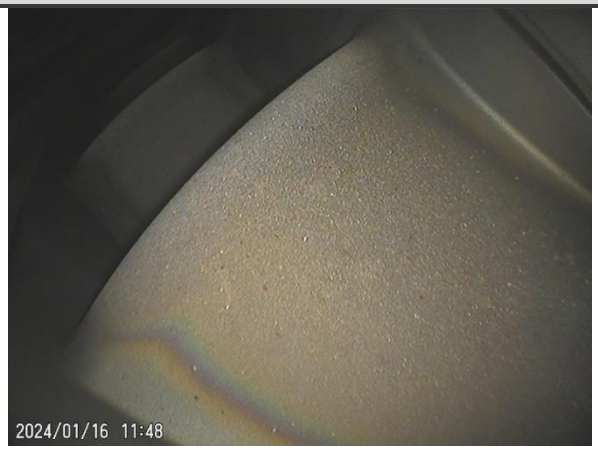
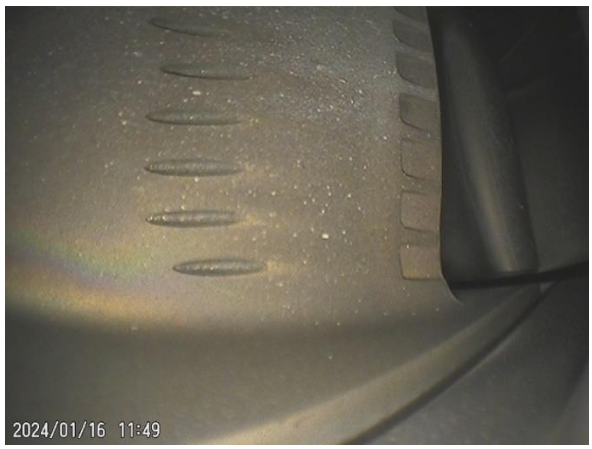
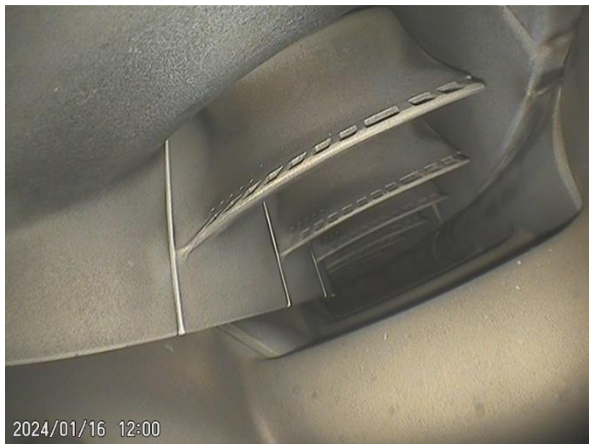
Access location Description	Picture	Inspection for	Severity / Comments
	 		

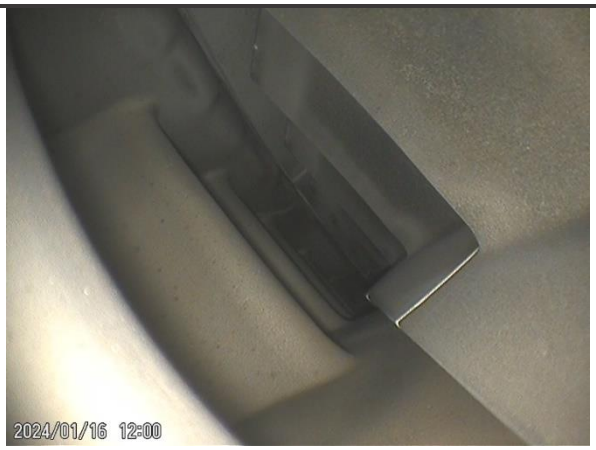
D Torch Tube	  	a)Thermal erosion	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
	 		

D 1st Stg Turbine Nozzles	  	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
	  		

D 1st Stg Turbine Blades	  	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	Normal Condition Not applicable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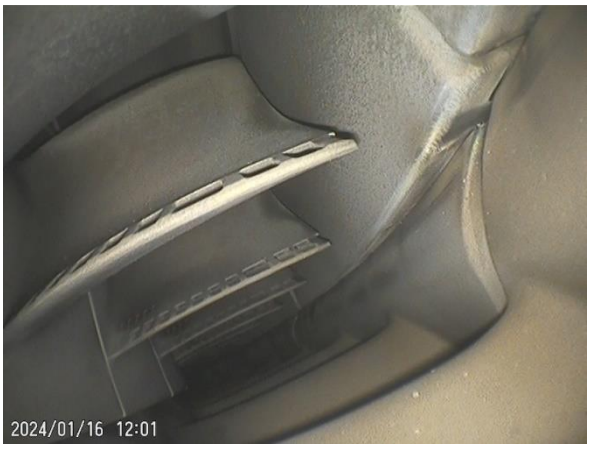
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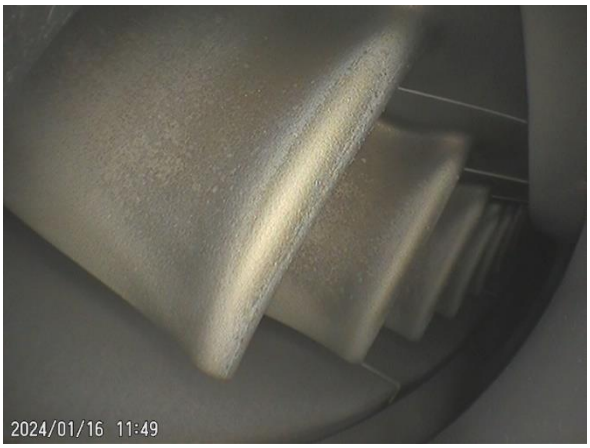
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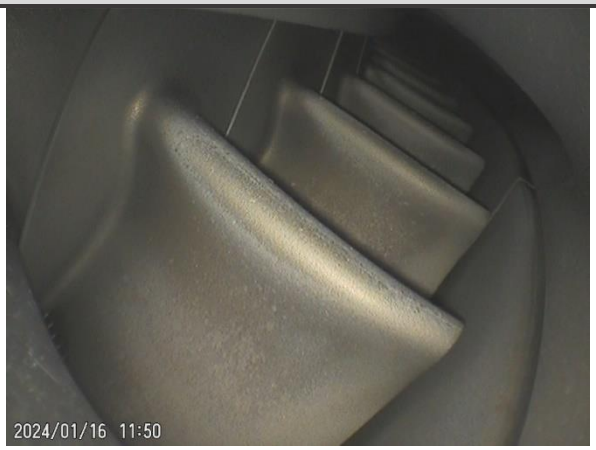
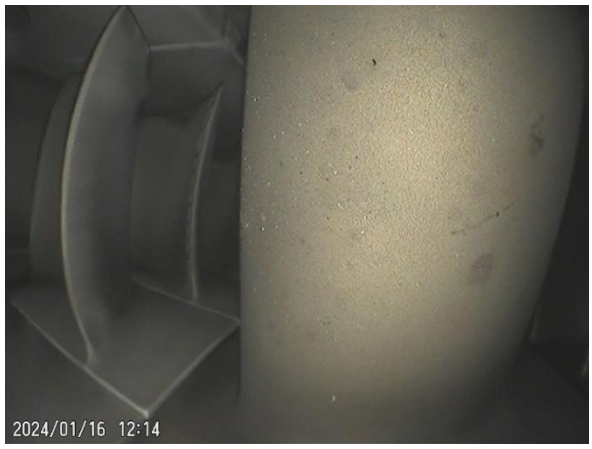
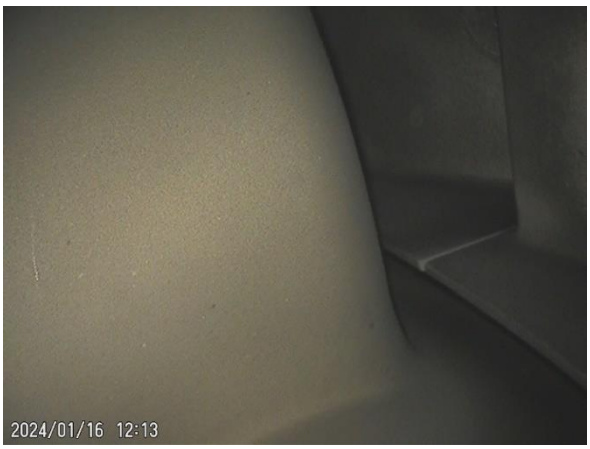
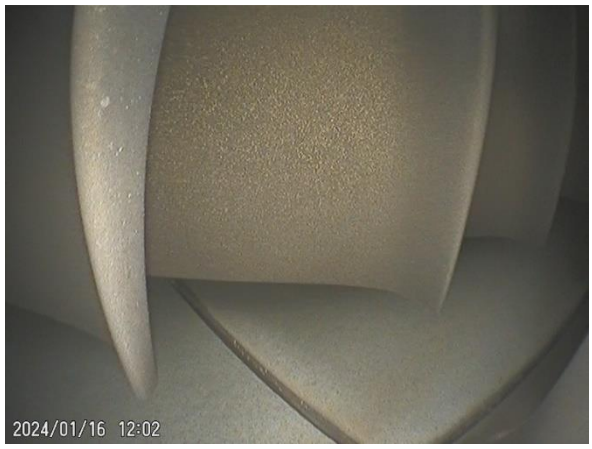
Access location Description	Picture	Inspection for	Severity / Comments
	 		

E 2nd Stg Turbine Nozzles	 	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
	 		

E 2nd Stg Turbine Blades	  	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	Normal Condition Not applicable

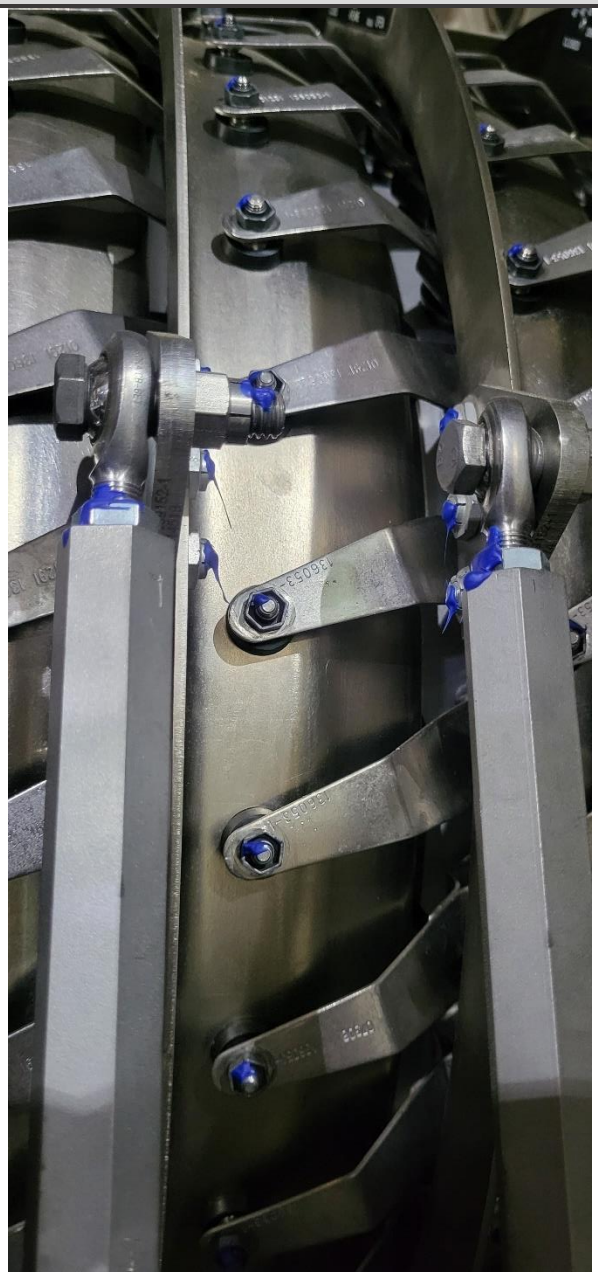
Access location Description	Picture	Inspection for	Severity / Comments
	  		

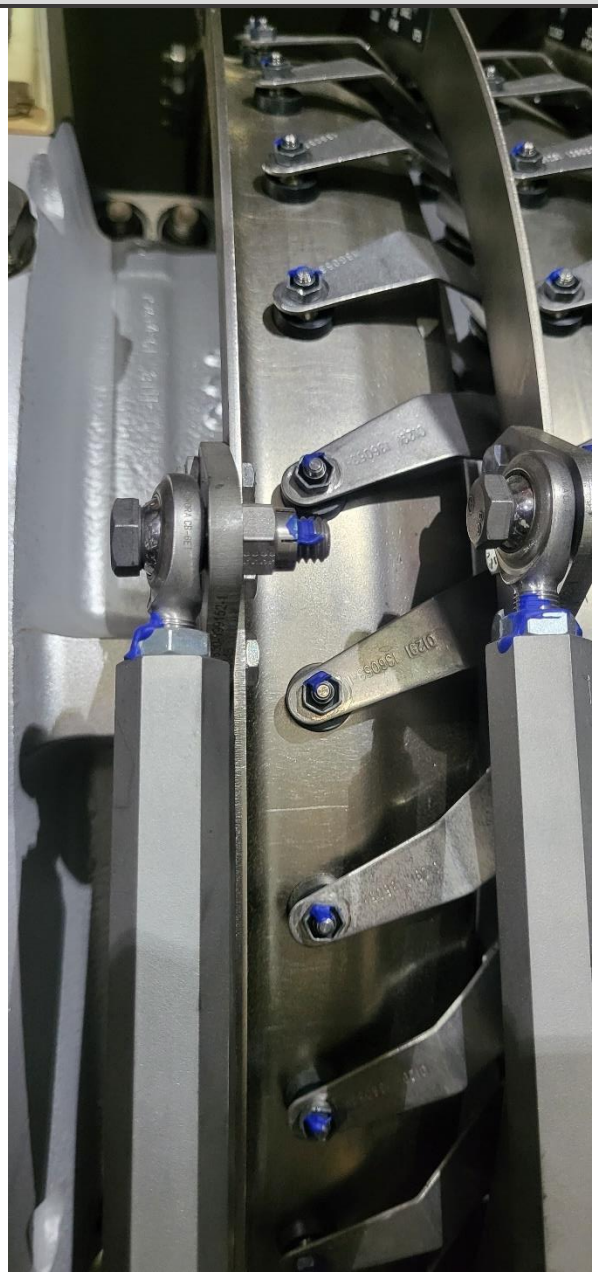
Access location Description	Picture	Inspection for	Severity / Comments
E 3rd Stg Turbine Nozzles	 	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	Normal Condition Not applicable
F 3rd Stg Turbine Nozzles		a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
F 3rd Stg Turbine Blades	  	a)Cracks, Qty, length, orientation b)Thermal erosion, Depth and area c)FOD Affected area d)Tip rub, gap width	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
VGV IGV		a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
VGV 1st Stg VGV		a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
VGV 2nd Stg VGV		a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
VGV 3rd Stg VGV		a)Cracks b)Lever arms bent c)Grommet out of position on unison ring d)Corrosion	Normal Condition Not applicable

Access location Description	Picture	Inspection for	Severity / Comments
X Other1	No Picture Available	TBD	
X Other2	No Picture Available	TBD	
X Other3	No Picture Available	TBD	

CONCLUSION

BORESCOPE INSPECTION OF GAS TURBINE ENGINE GENERAL OBJECTIVES

The gas turbine borescope inspection is an internal inspection performed by a trained specialist who assesses the condition of the gas turbine components. This inspection is performed using an instrument specifically designed to examine the gas path, via the access ports positioned along the engine, from the air inlet to the exhaust.

These inspections are one of the primary diagnostic methods for maintaining turbo-machinery. Both rigid and flexible fiberscopes are used in conjunction with especially formed guide tubes to inspect the internal stationary and rotating components. Primary goals are to detect early signs of wear or impending failure. The major benefits of the inspection include equipment condition awareness and effective scheduling of any necessary maintenance interventions. In addition, greater reliability / longevity can be achieved through internal inspections, as well as reducing the potential of severe equipment damage.

The operating gas turbine engine components, by design, are exposed to high thermal and mechanical constraints. Internal inspections are thus necessary to determine if wear or thermal erosion has occurred. In addition, these inspections will quantify if any foreign object damage (FOD) or corrosion has occurred, as well as assessing internal components for thermal deterioration, cracking or distortion.

While every effort is made to examine all accessible parts of the engine, some areas are not accessible through a borescope inspection. Therefore, a borescope inspection should not be considered to be the ultimate method to assess an engine's health.

This borescope inspection has been performed following a Hierarchical Task Analysis procedure exposed in TL 21.7/100.

SOLAR TURBINES INSPECTOR SIGNATURE / DATE

Inspector Name: **Mazza Diego**
Inspector Email Address:
Inspector Phone Number:

CUSTOMER SIGNATURE / DATE

Customer Name:
Customer Email Address:
Customer Phone Number: