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

BORESCOPE INSPECTION REPORT

REDUCTION GEARBOX
TAURUS 60
COLD END DRIVE

Reduction Gearbox Serial Number
GBE17-79058

Reduction Gearbox Ratio
8.3:1

Reduction Gearbox Serviceable
Yes

Inspection Performed By
Cameron Marr

Inspection Date
Thursday, August 29, 2019

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BORESCOPE INSPECTION INFORMATION

Country	**United States**	Inspection Date	**8/29/2019**
Customer Name	**SoEnergy**	Inspection Performed By	**Cameron Marr**
Site Name	**Electro-Quip**	Reason For Inspection	**Routine Maintenance**
District	**DWOD**	Borescope Equipment Used (Brand/Model)	**Olympus Ultralight/Samsung Galaxy S8**
Work Order #		Borescope Inspection Procedure (WFM Task #)	**128**

PACKAGE INFORMATION

PD #	**59731**	Package S/N	**TG001137**
Unit Customer Tag	**TG01137**	Package Hours	**0**
		Package Starts	**0**

ENGINE INFORMATION

Engine GP[1] P/N	**TDSDAA-1500-007**	Fuel Type	**Dual**
Engine GP S/N	**1080T**	Gas Fuel Hours	**0**
Engine Rating	**7301S**	Liquid Fuel Hours	**0**
Combustion Type	**SoLoNOx**	Total Hours	**24976**
		Total Starts	**1312**

REDUCTION GEARBOX INFORMATION

Reduction Gearbox P/N	**E196800-206-960**	Total Service hours	**0**
Reduction Gearbox S/N	**GBE17-79058**	Total Starts	**0**
Reduction Gearbox Output Speed/Freq.	**60Hz - 1800rpm**	Hours since last inspection	**0**
Reduction Gearbox Ratio	**8.3:1**	Starts since last inspection	**0**
		Next Planned Overhaul Service Hours	**0**

NOTES

[1] GP stands for “Gas Producer”.

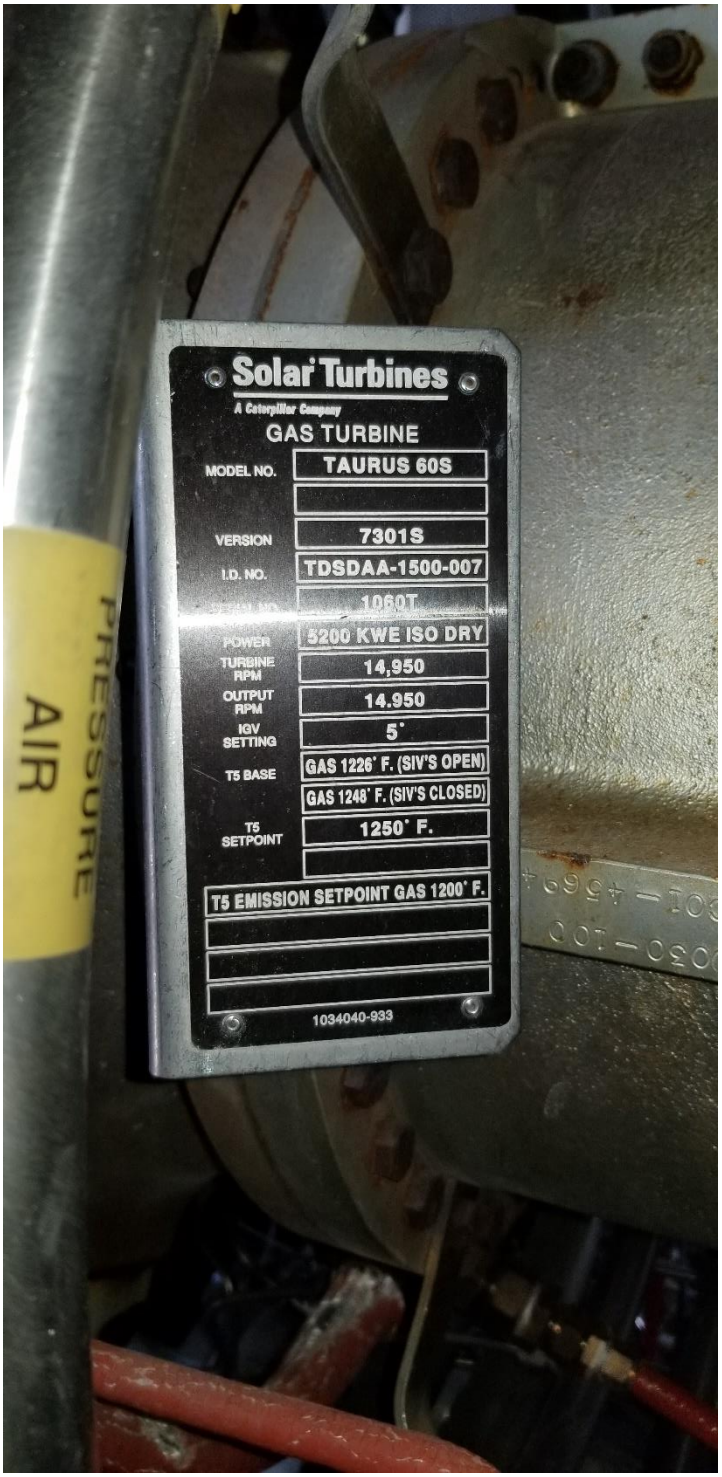
BORESCOPE INSPECTION CHECK LIST

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

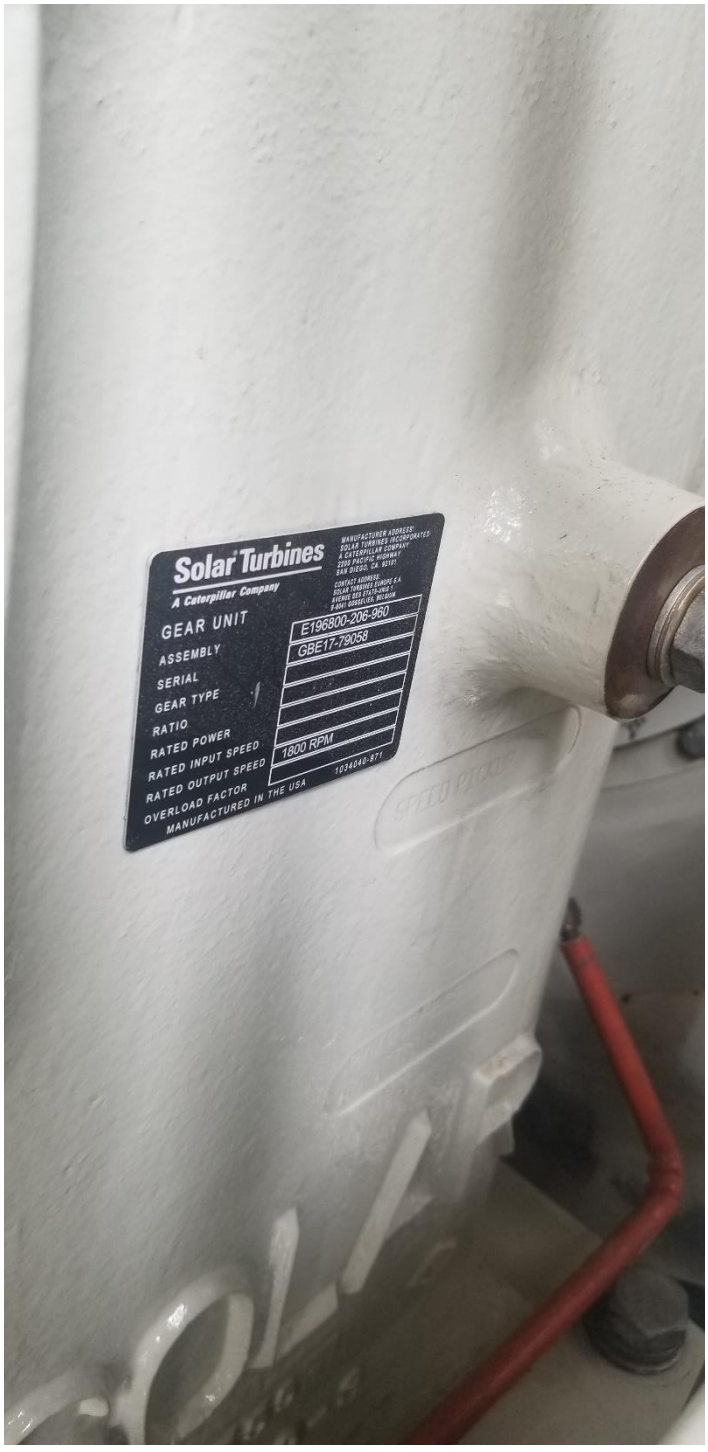
[2] For detailed step instructions, please refer to the Borescope Inspection Procedure (Work Force Management Task) mentioned in the Borescope Inspection Information section.

EQUIPMENT DATA PLATE

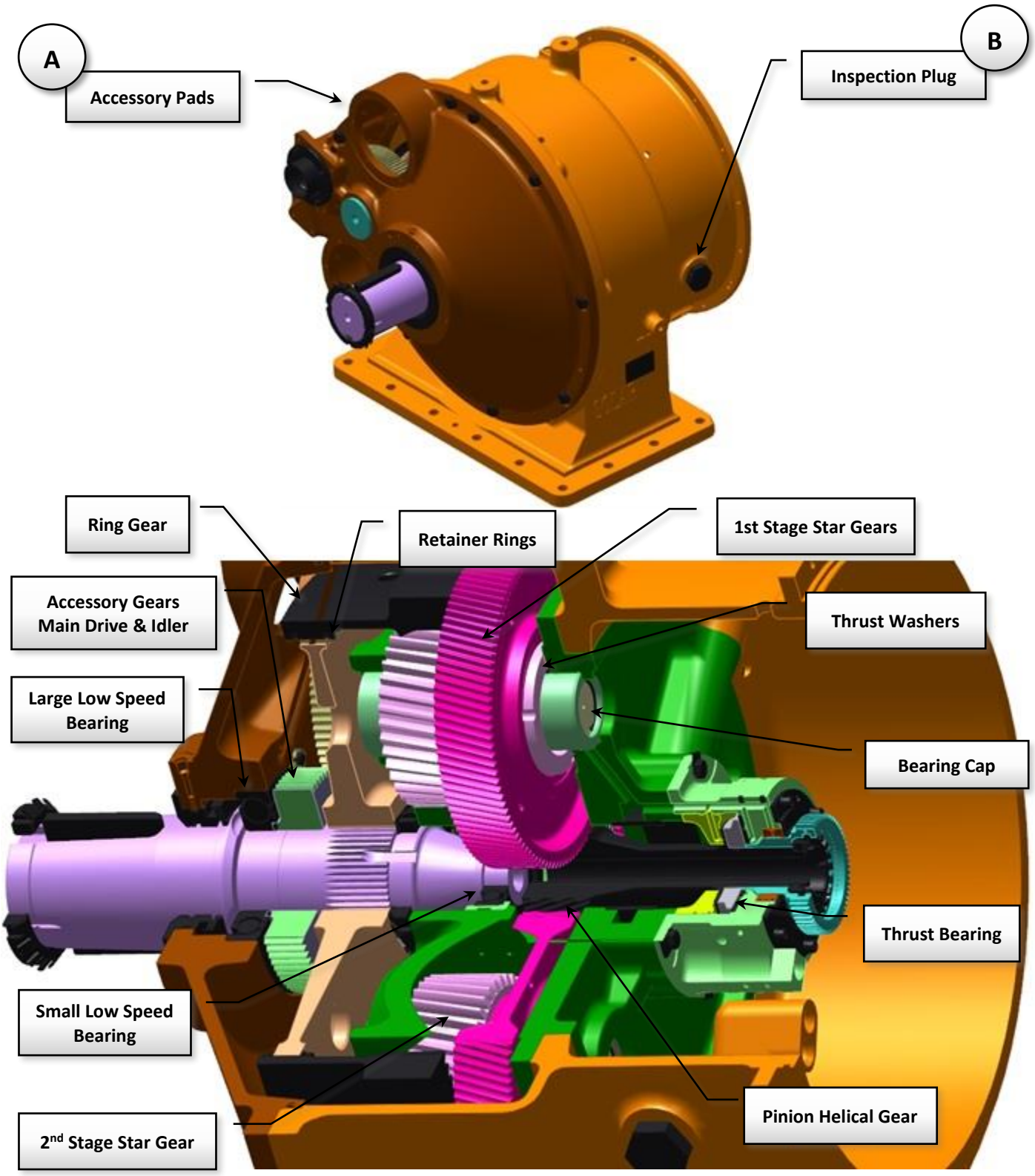
Gas Turbine



Reduction GearBox



BORESCOPE INSPECTION LOCATIONS

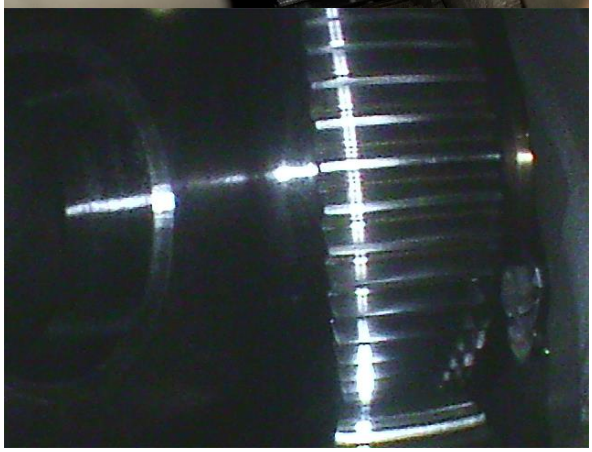


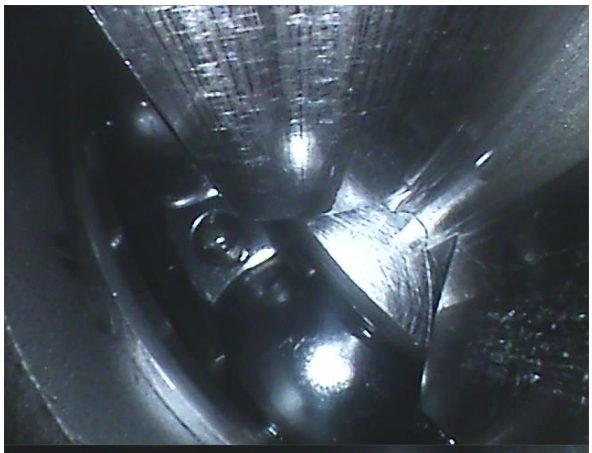
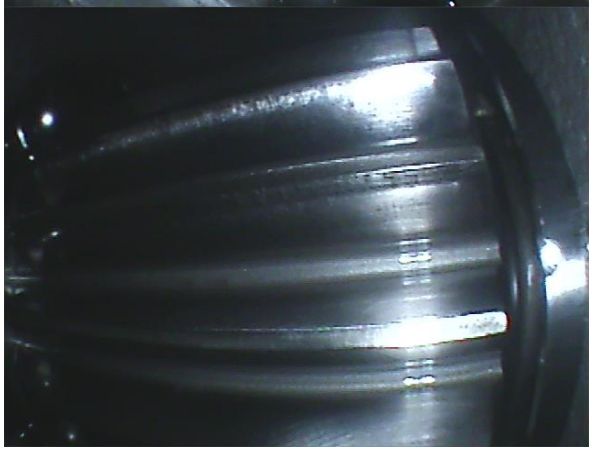
BORESCOPE INSPECTION SUMMARY

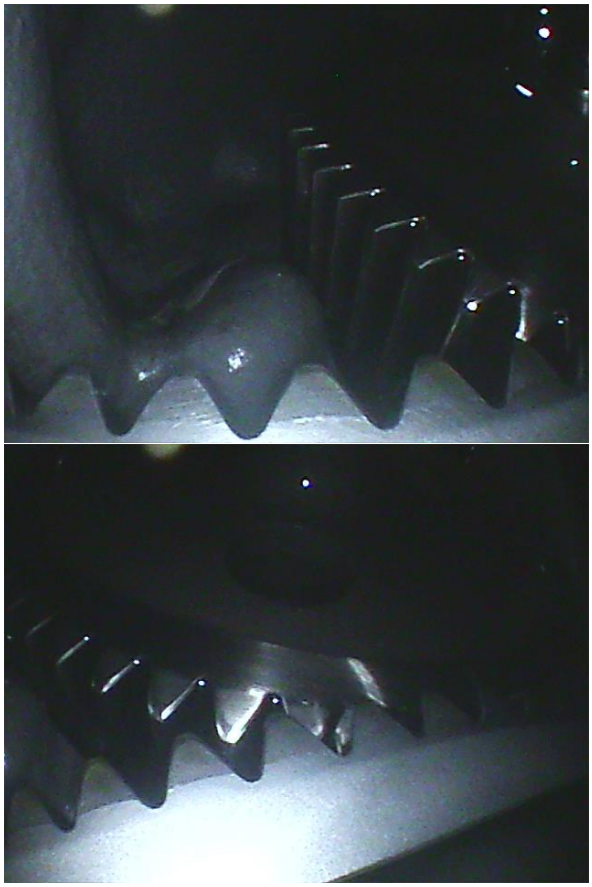
Access Port	Location	Inspection for	Normal Condition	Damaged Condition	Comments
A	Main Drive Accessory	a)Gear wear b)Teeth damages	✓		
A	Idler Gear	a)Gear wear b)Teeth damages	✓		
A	Other Accessory Gear	a)Gear wear b)Teeth damages	✓		
A	Large Low Speed Brg	a)Gear wear b)Teeth damages	✓		
A	Pinion Helical Gear	a)Gear wear b)Teeth damages	✓		
A	1st Stage Star Gear	a)Gear wear b)Teeth damages	✓		
A	2nd Stage Star Gear	a)Gear wear b)Teeth damages	✓		
A	Ring Gear	a)Gear wear b)Teeth damages	✓		
A	Small Low Speed Brg	a)Rollers pitting b)Inner/Outer race pitting c)Rollers cage damages	✓		

Access Port	Location	Inspection for	Normal Condition	Damaged Condition	Comments
B	Bearing Cap	a)Color change	✓		
A	Retainer Rings	a)Wear b)Cracks c)Wire dislodgement from groove	✓		
A	Thrust Washers	a)Wear b)Scoring c)Cracks	✓		
B	Thrust Bearing	a)Wear b)Scoring c)Cracks d)Babbitt melting	✓		
X	Other1	TBD			
X	Other2				
X	Other3	TBD			

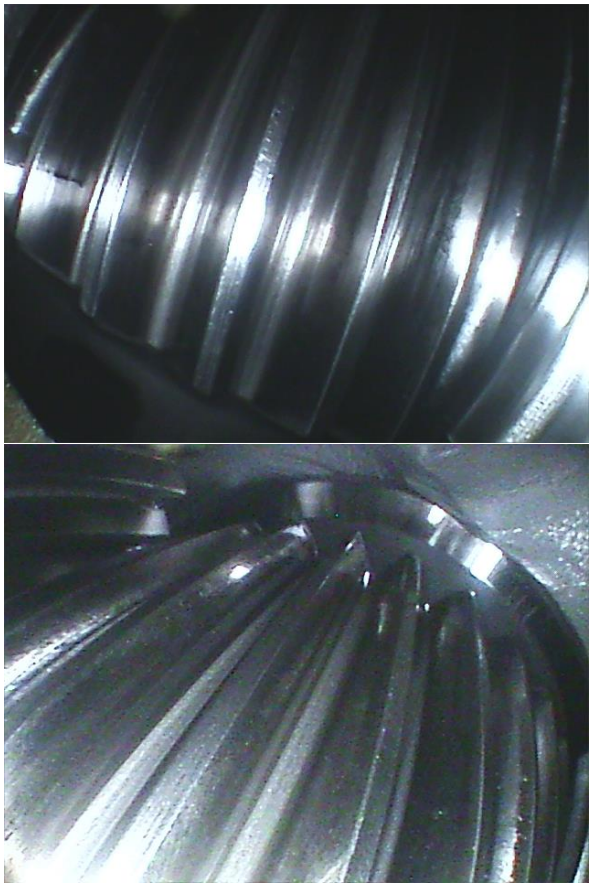
BORESCOPE INSPECTION PICTURES

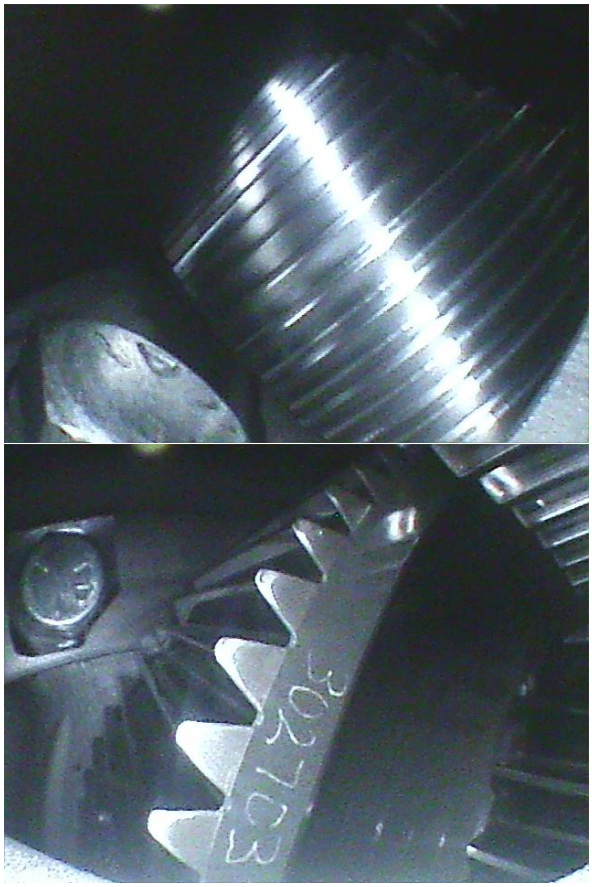
Access location Description	Picture	Inspection for	Severity / Comments
A Main Drive Accessory	 	a)Gear wear b)Teeth damages	Normal Condition
A Idler Gear	 	a)Gear wear b)Teeth damages	Normal Condition

A Other Accessory Gear	 	a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
			

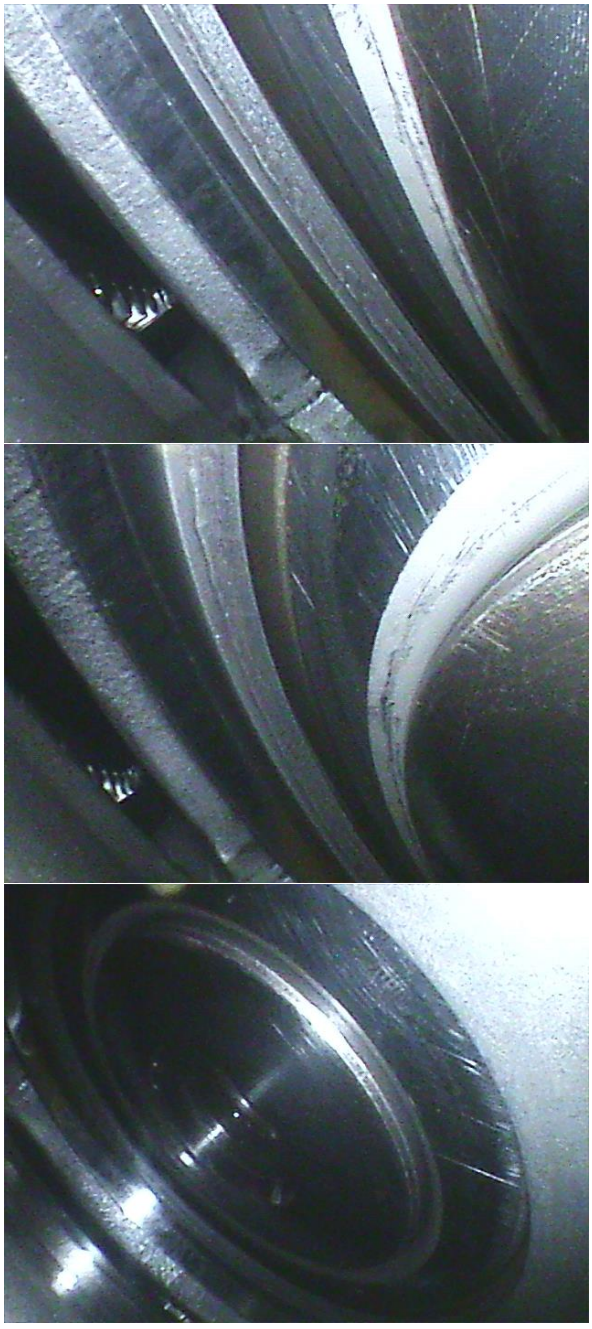
Access location Description	Picture	Inspection for	Severity / Comments
A Large Low Speed Brg		a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A Pinion Helical Gear		a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A 1st Stage Star Gear		a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A 2nd Stage Star Gear		a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A Ring Gear		a)Gear wear b)Teeth damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A Small Low Speed Brg		a)Rollers pitting b)Inner/Outer race pitting c)Rollers cage damages	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
B Bearing Cap	 	a)Color change	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
A Retainer Rings	 	a)Wear b)Cracks c)Wire dislodgement from groove	Normal Condition
A Thrust Washers		a)Wear b)Scoring c)Cracks	Normal Condition

Access location Description	Picture	Inspection for	Severity / Comments
B Thrust Bearing		a)Wear b)Scoring c)Cracks d)Babbitt melting	Normal Condition
X Other1	No Picture Available	TBD	

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

CONCLUSION

Gearbox was found to be in normal condition

RECOMMENDATION

Continue with regular maintenance and inspections.

BORESCOPE INSPECTION OF REDUCTION GEARBOX GENERAL OBJECTIVES

The reduction gearbox borescope inspection is an internal inspection performed by a trained specialist who assesses the condition of the gearbox components. This inspection is performed using an instrument specifically designed to examine the reduction gearbox components, via the different access ports.

These inspections are one of the primary diagnostic methods for maintaining the equipment. Both rigid and flexible fiberscopes can be used 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.

While every effort is made to examine all accessible parts of the reduction gearbox, 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 reduction gearbox'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: **Cameron Marr**
Inspector Email Address: marr_cameron_h@solarturbines.com
Inspector Phone Number: 361-318-

Monday, September 23, 2019