

VARNISH MITIGATION

SOLAR TAURUS 60 GAS TURBINE COGENERATION FACILITY

By Larry B. Jordan, Sr. Technical Advisor, RIG

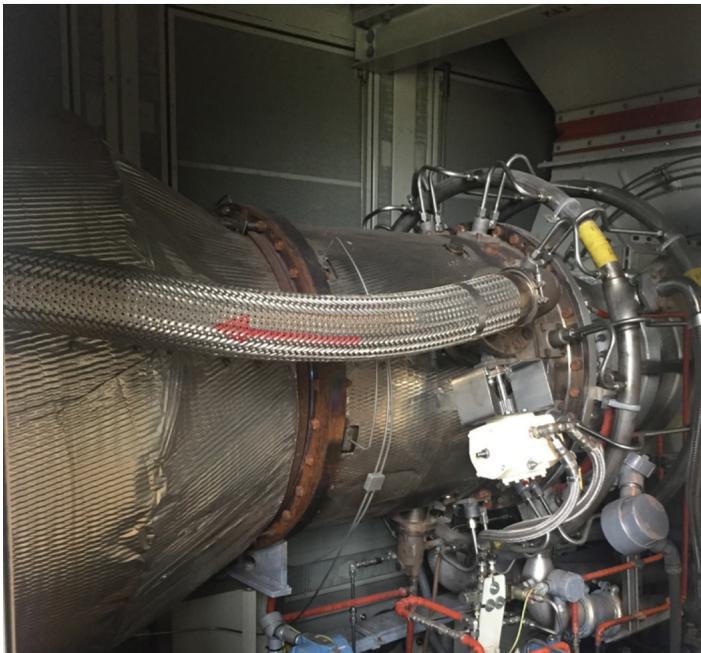
Case Study

SYNOPSIS

Solar Taurus 60 Gas Turbine was found to be in caution level for Varnish Potential.

RIG lowered the MPC rating from 27 to a 5.

GLOBAL LEADERS IN PRECOMMISSION & PLANT MAINTENANCE



Varnish Mitigation On A Gas Turbine

INTRODUCTION

Solar contracted RIG to facilitate Varnish Mitigation on a Taurus 60 Gas Turbine because Membrane Patch Colorimetry (MPC) analysis on the unit showed a level of 27. (Figure 1)

GT 201 utilized Chevron GST 32 in its lubrication system. The lubricant is estimated to have nine years of service on it. Operation of the unit is based on load needs and has several start ups and cool downs which can directly impact varnish formation.

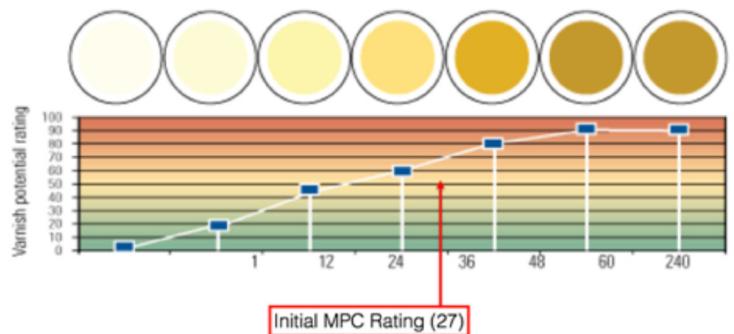
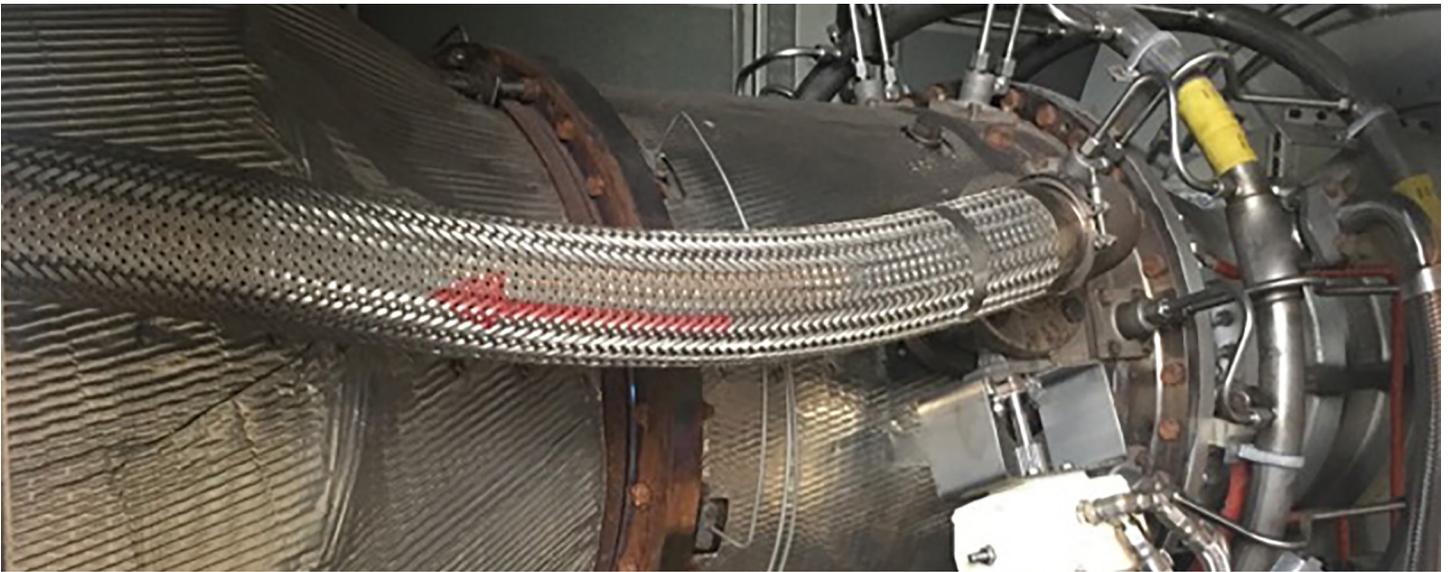


Figure 1. Initial MPC Rating (27)

METHOD

RIG installed the Varnish Adsorption System (VAS) to perform side stream filtration on Solar Taurus 60 Gas Turbine starting April 3, 2018. The unit was staged outside of the turbine room to allow walking paths for the evacuation routes. Hoses were wrapped with caution tape and laid out tight to the wall of the reservoir to keep tripping hazards to a minimum.

Side stream filtration was executed continuously throughout the month utilizing both particulate



filtration and resin filtration for soft varnish particles. RIG left pre-labeled sample bottles and shipping boxes to perform analysis at the following intervals:

- 2 weeks
- 3 weeks



Figure 2. RIG Varnish Adsorption System

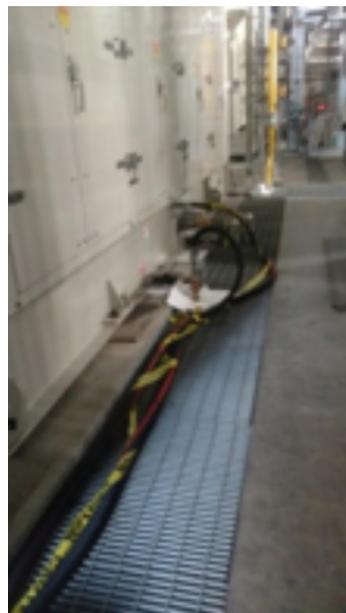


Figure 3. 1.5" Hose Connections Suction - Reservoir

Cogeneration facilities operating schedule has the Turbines lubricant heating and cooling daily. This has a direct impact on creation of varnish and oxidation deposits. To slow down the process, RIG recommends that the reservoir heaters and circulating pumps remain on when the system is brought down. Sustaining a more linear temperature of the lubricant will slow the oxidation process.

Note: The reservoir heater should not be on without circulation of the lubricant. RIG recommends that the Membrane Patch Colorimetry analysis be conducted at a semi annual basis and a full Varnish Potential Analysis is conducted annually.

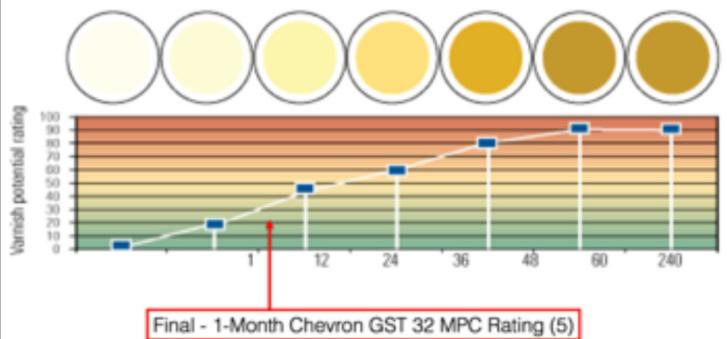


Figure 4. Final MPC Rating (5)

CONCLUSION

Solar Taurus 60 Gas Turbine's MPC was at a 27 to start, which put it in an abnormal/caution level. Within two weeks, RIG was able to bring the MPC to a 14 which is a Normal/Satisfactory rating. After the third week the MPC was lowered even further to an MPC of 5. (Figure 4)

Machine Condition

NORMAL

Lubricant Condition

NORMAL

Machine Name: Orange County Cogen - GT 201

Analysis Report

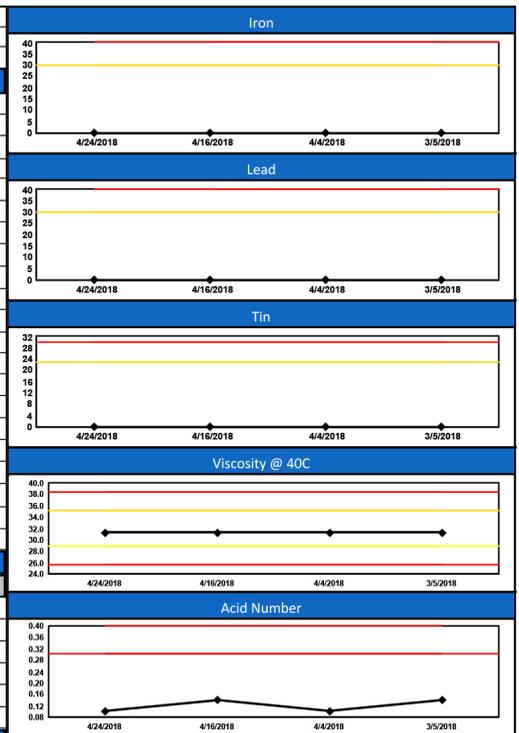
Component Information		Sample Information	Customer Information
Machine Type:	Industrial Turbine	Received:	PetrolinkUSA, LLC
Lubricant:	ChevronTexaco/GST 32	Report:	3021 E. Fourth Ave.
Machine MFG:	SOLAR	Sample No.:	Columbus, OH 43219
Machine MOD:		Analyst/Test:	Contact: Jason Bandy

PROBLEMS No problems found with current sample.

COMMENTS The results for this sample indicate normal conditions. Please continue scheduled sampling.

CUSTOMER NOTES Hour on machine: 3 Weeks.

Date Sampled	NEW OIL	4/24/2018	4/16/2018	4/4/2018	3/5/2018
Lab No	1842243	2216378	2210547	2199679	2174435
Machine / Lube Cond.		N / N	N / M	N / N	N / N
ELEMENTAL SPECTROSCOPY (ppm) ASTM D5185 Mod (-) indicates below detection limit					
Wear Metals	Iron	-	-	-	-
	Copper	-	-	-	-
	Lead	-	-	-	-
	Aluminum	-	-	-	-
	Tin	-	-	-	-
	Nickel	-	-	-	-
	Chromium	-	-	-	-
	Titanium	-	-	-	-
	Vanadium	-	-	-	-
	Silver	-	-	-	-
Additives	Calcium	-	-	-	-
	Magnesium	-	-	-	-
	Phosphorus	-	110	101	102
	Zinc	-	-	-	-
	Barium	-	-	-	-
Contaminants	Molybdenum	-	-	-	-
	Silicon	-	-	2	-
	Boron	-	-	-	-
	Lithium	-	-	-	-
	Sodium	-	-	-	-
Potassium	-	-	-	-	
PARTICLE COUNT (particles per ml) ISO 4406:99					
Pore Block Particle Count Alarm Limits Marginal (18/16/14)					
Pore Block ISO Code	17/16/12	17/15/12	18/17/13	15/14/10	17/16/12
>4 Micron	868	698	1823	278	962
>6 Micron	337	271	709	108	374
>14 Micron	25	20	54	8	28
>50 Micron	1	0	2	0	1
>100 Micron	0	0	0	0	0
VISCOSITY (centistokes) ASTM D445 MOD					
Viscosity@40°C	33.3	31.2	31.2	31.2	31.2
ACID NUMBER (mg KOH/g) ASTM D974 MOD					
Acid Number	0.09	0.10	0.14	0.10	0.14
WATER (PPM) a-ASTM D6304C b-IWI-134* c-Crackle d-IWI-135* e-IWI-370*					
Water		9 (a)	14 (a)	11 (a)	15 (a)



ISO Code

PARTICLE COUNT (particles per ml) ISO 4406:99					
Pore Block Particle Count Alarm Limits Marginal (18/16/14)					
Pore Block ISO Code	17/16/12	17/15/12	18/17/13	15/14/10	17/16/12
>4 Micron	868	698	1823	278	962
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>14 Micron	25	20	54	8	28
>50 Micron	1	0	2	0	1
>100 Micron	0	0	0	0	0

Normal

Lube Type: ChevronTexaco GST 32	Received: 04/25/2018	Orange County Cogen - GT 201 - MPC
Machine MFG: SOLAR	Report: 4/30/2018 3:55:00PM	Jason Bandy
Machine MOD:	Sample No: 3166-1-2332	PetrolinkUSA, LLC
Machine Type: Industrial Turbine		3021 E. Fourth Ave.
		Columbus, OH 43219

Observations/Recommendations

The current test results indicate a low level of degradation by-products associated with varnishing. Please continue routine sampling to monitor the trend in the level.

<p style="font-size: small;">Lab ID - Sample Date</p>				
<p style="font-size: small;">Lab ID - Sample Date</p>				
SAMPLE DATE	04/24/2018	04/16/2018	03/05/2018	
LABID	2216404	2210575	2174476	
ULTRA CENTRIFUGE TEST				
UC VALUE				
MEMBRANE PATCH COLORIMETRY				
COLOR VALUE	5	14	27	
PHYSICAL PROPERTIES				
ACID NUMBER mg KOH/g				
KARL FISCHER WATER ppm				
RULER TEST				
New Oil				
AMINE	Peak Area			
	Percent Remaining			
PHENOLIC	Peak Area			
	Percent Remaining			
ZDDP	Peak Area			
	Percent Remaining			

PetrolinkUSA, LLC assumes sole responsibility for the application of and reliance upon results and recommendations reported by TestOil, whose obligation is limited to good faith performance. Insight Services ®



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