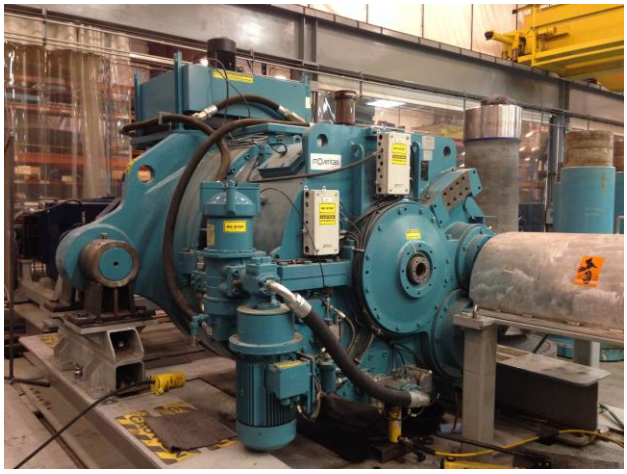
Field Service Report

OG&E Centennial Wind Farm – Moventas Gearbox Conversion

OBJECTIVE:

OG&E Manager Renewable Energy made the decision to convert the first of two wind turbine gearboxes from Castrol A320 PAO-based gear oil to EcoGear 320XP. They chose a Moventas PLH-1100.1 Series gearbox that is part of a GE 1.5MW Wind Turbine. The gearbox had been removed due to a broken tooth on the intermediate pinion back in late 2011, and shipped to ReNew Energy Maintenance in Sioux Falls, SD to be rebuilt/repaired.



The repairs were complete in February of 2012, and the gearbox has remained at the ReNew site in storage since. The rotational equipment was rotated every 2 weeks, and the oil pump energized every 6 months to apply a fluid film on the mating surfaces.

System Information:

Input Horsepower – 300 @ 22 RPM
Seal Type – buna N & Labyrinth
Output – 1.8 MW
Speed – 1440 RPM
System Volume – 85 gallons
Operating temperature – 50-70°C (high level limit at 75C)
Ratio: 78 : 1

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While on site at ReNew, many other gearboxes were open to observation. From the comments of Dave Ward and Gary Cavigielli in the shop, the below pictures represent the normal condition of the inside of these gearboxes. Notice the varnish build-up on the walls of the inside of the boxes below.

The failed gear in the picture below left riddled the box with the wear metals observed in the picture on the right.

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The conversion was conducted at the ReNew Energy site on April 7, 2015.

Conversion Procedure

ACT worked closely with management and personnel from ReNew who have conducted many of these flushes both in the field, and at the location. The conversion included a 4-step process as follows:

1. Drain Current Fluid & Clean System
    a. Pulled a sample of the oxidized Castrol PAO for analysis

2. FLUSH
    a. Added 60 gallons of EcoSafe 320 to conduct as Flushing fluid and circulated thru the system at full speed (1450 RPM) and normal operating temp (50°C) for approximately 3.5 hours
    b. Sample pulled and submitted for analysis
    c. Drain Flush Fluid

3. RINSE
    a. Added 60 gallons of EcoSafe 320 to conduct Rinse – circulated thru the system at full speed and normal operating temp for 1.5 hours
    b. Sample pulled and submitted for analysis
    c. Drain Rinse Fluid

4. FINAL CHARGE
    a. Added approximately 65 gallons of EcoSafe 320XP – circulated thru the system for 20 minutes at full speed
        i. NOTE: because the system/fluid was not brought up to operating temperature, the sample appears cloudy on the top half. This was entrained air that was dissipating after the sample was pulled, and would have eventually released.
            1. The ReNew staff commented that EcoGear foam characterstics were superior to the Castrol A320 in that while they would purge the line to fill a sample with the PAO, the bucket would fill with foam. Entrained air yes – but no foam head at all with the EcoGear 320XP.
    b. Sample pulled and was overnight-mailed to ACT lab for analysis

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WTG-63 Select a system name for trending report

Fluid:		Castrol A320	Castrol A320	EcoGear® 320	EcoGear® 320	EcoGear® 320 XP	EcoGear® 320 XP
Pulled:			4/7/15	4/7/15	4/7/15	3/31/15	4/7/15
Received:			4/9/15	4/9/15	4/9/15	No Date	4/9/15
Completed:			4/10/15	4/10/15	4/10/15	4/10/15	4/10/15
Visual:			Clear-DkRed	Hazy-Orange	Hazy-Yellow	Clear-Lt Yellow	Clear-Yellow
	Range	**Results**	**Results**	**Results**	**Results**	**Results**	**Results**
Viscosity (cSt)†	**288 - 352**		337.86	276.63	314.61	298.81	306.78
Total Acid Number (mgKOH/g)	**0.2 - 2.0 - 5.0**	~	4.74	0.63	0.59	0.59	0.57
Water (ppm)	**<7500**	~	440	426	560	308	569
Tramp Oil % (T)	**≤2%**	No	No	Yes	No	No	No
ISO Particle Count Typical Maximum:	**17 / 15 / 12**	/ /	25 / 25 / 25	26 / 25 / 23	23 / 20 / 15	/ /	20 / 18 / 14
Other							

Oil Change*			CHECK FILTRATION	CHECK FILTRATION	CHECK FILTRATION		CHECK FILTRATION
Reason for Sample			Prospect	1st Flush	2nd Flush	CofA	Initial
P.O. #							

ReNew/OG&E set 18/16/13 as the target ISO Particle Count cleanliness. ReNew intends to continue spin test and filtration for another 4 to 6 hours to reduce the ISO PC.

Gearbox will be shipped back to OG&E Centennial Wind Farm in LaVerne, OK and installed up-tower on or about June 8, 2015.