HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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September 26, 2019

NUCOR Melt Shop

Subject: September vibration survey

Most of the machines surveyed were found to be in good condition with the exception of the following:

QualiTest® uses a four step rating system for defects.

Class I: Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

Class III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

Class IV; Defect (s) present that makes continued reliability unpredictable, and possibility of secondary damage is high. Repairs should be made ASAP. An unscheduled shutdown should be considered for repairs

Defects

West Caster Mold Water Pump
High 1 x rpm vibration is present in the motor axial. This indicates angular misalignment. Perform a precision alignment with less than .003" offset and angularity. Ensure there is no soft foot present. Rated as a **CLASS II** defect.

East Caster Mold Water Pump
Pump is showing some signs of internal wear. Coupling may also be wearing due to misalignment. Perform a precision alignment with less than .003" offset and angularity. Ensure there is no soft foot present. Rated as a **CLASS II** defect.

Cooling Tower #6 Supply Pump
The pump bearing vibration data still indicates there is bearing wear, and possibly cavitation in the pump. Inspect ODE pump bearing SOON. Ensure the pump has no inlet restrictions and is operating in the correct part of the curve. Rated as a **CLASS II** defect.

Cooling Tower #3 Supply Pump
The pump appears to have cavitation which is causing a high noise floor in the spectrum. This is also making the ODE pump bearing have high acceleration. This could also be a bearing issues but the noise floor is masking the data somewhat. Pump impeller or other pump internals may be worn which could be causing this vibration. Pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

Cooling Tower #2 Supply Pump
The pump appears to have cavitation which is causing a high noise floor in the spectrum. This is also making the ODE pump bearing have high acceleration. This could also be a bearing issues but the noise floor is masking the data somewhat. Pump impeller or other pump internals may be worn which could be causing this vibration. Pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

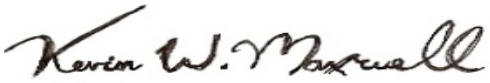
Spray Chamber Exhaust Fan
Vibration has increased again this survey. Fan bearing data is showing signs of mechanical looseness/wear in the bearings and/or fits. **Fan bearings need to be checked for looseness wear SOON**. Motor axial vibration remains higher than normal and may be due to sheave or belt issue. Ensure belts are in good shape and sheaves are aligned and not worn. Rated as a **CLASS III** defect.

Caster Baghouse Reverse Fan
This motor has a NU bearing in the drive end instead of a deep groove ball bearing. The NU bearing is designed for a radial type of load such as belt drive application. This unit is a direct drive application and does not need this type of motor bearing at the drive end. The bearing may not be able to load properly at times and can cause the type of vibration previously seen a few months ago. Motor may need to be swapped out in the future with a motor that has the proper bearing. We will continue to monitor this closely. Rated as a **CLASS I** defect for now.

West Furnace Bag house Fan
Fan outboard bearing data shows a dominant bearing frequency peak with sidebands of rpm. This is a split race bearing so vibrations like this are somewhat common. The concern here is the amplitude of the sidebands. Bearing may need to be inspected as scheduling allows. Rated as a **CLASS II** defect for now.

As always, it has been a pleasure to serve NUCOR Steel Flowood-Jackson, MS. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

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Abbreviated Last Measurement Summary

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Database: nucorja9.rbm
Station: Melt Shop

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
WCMWP	- WEST CASTER MOLD WATER PUMP	(19-Sep-19)	
		OVERALL LEVEL	1K-20KHz
MOH		.199 In/Sec	.517 G-s
MIH		.148 In/Sec	.860 G-s
MIA		.372 In/Sec	.628 G-s
PIA		.507 In/Sec	.834 G-s
PIH		.287 In/Sec	1.118 G-s
POH		.174 In/Sec	1.137 G-s
MCMWP	- MID CASTER MOLD WATER PUMP	(19-Sep-19)	
		OVERALL LEVEL	1K-20KHz
MOH		.043 In/Sec	.462 G-s
MIH		.080 In/Sec	.571 G-s
MIA		.113 In/Sec	.739 G-s
PIA		.131 In/Sec	.325 G-s
PIH		.145 In/Sec	.863 G-s
POH		.099 In/Sec	.980 G-s
WBOSTRP	- WEST Booster PUMP	(19-Sep-19)	
		OVERALL LEVEL	1K-20KHz
MOH		.048 In/Sec	.464 G-s
MIH		.046 In/Sec	.263 G-s
MIA		.031 In/Sec	.197 G-s
PIA		.092 In/Sec	.569 G-s
PIH		.128 In/Sec	.483 G-s
POH		.151 In/Sec	1.418 G-s
ECSWP 1LFT	- EAST CASTER SPRAY WP 1 LEFT	(19-Sep-19)	
		OVERALL LEVEL	1K-20KHz
MOH		.343 In/Sec	.929 G-s
MIH		.149 In/Sec	1.070 G-s
MIA		.255 In/Sec	.527 G-s

MCSWP 2LFT - MID CASTER SPRAY WP 2 LEFT (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.546 In/Sec	.683 G-s
MIH	.245 In/Sec	.872 G-s
MIA	.176 In/Sec	.942 G-s

MCSWP 3RT - MID CASTER SPRAY WP 3 RIGHT (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.669 In/Sec	.601 G-s
MIH	.300 In/Sec	1.617 G-s
MIA	.096 In/Sec	1.036 G-s

ESERVOHYDP - EAST SERVO Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.019 In/Sec	.228 G-s
MIH	.061 In/Sec	.150 G-s
PIV	.126 In/Sec	.724 G-s

MSERVOHYDP - MIDDLE SERVO Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.112 In/Sec	.314 G-s
MIH	.079 In/Sec	.346 G-s
PIV	.131 In/Sec	.669 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.057 In/Sec	.127 G-s
MIH	.052 In/Sec	.471 G-s
PIV	.066 In/Sec	.797 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.125 In/Sec	1.007 G-s
MIH	.064 In/Sec	.174 G-s
PIV	.357 In/Sec	.724 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.168 G-s
MIH	.104 In/Sec	.234 G-s
PIV	.355 In/Sec	.615 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.398 In/Sec	.246 G-s
MIH	.488 In/Sec	.289 G-s
PIV	.218 In/Sec	.574 G-s

1SUPLYP - #1 Supply Pump (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.081 In/Sec	.153 G-s
MIH	.084 In/Sec	.297 G-s
MIA	.099 In/Sec	.264 G-s
PIA	.187 In/Sec	.321 G-s
PIH	.192 In/Sec	1.259 G-s
POH	.199 In/Sec	1.466 G-s

3SUPLYP - #3 Supply Pump (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.049 In/Sec	.177 G-s
MIH	.065 In/Sec	.884 G-s
MIA	.078 In/Sec	.844 G-s
PIA	.245 In/Sec	.134 G-s
PIH	.163 In/Sec	.875 G-s
POH	.275 In/Sec	2.012 G-s

5SUPLYP - #5 Supply Pump (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.368 G-s
MIH	.040 In/Sec	.499 G-s

MIA	.045 In/Sec	.409 G-s
PIA	.218 In/Sec	1.029 G-s
PIH	.200 In/Sec	1.067 G-s
POH	.231 In/Sec	1.534 G-s

6SUPLYP - #6 Supply Pump (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.300 G-s
MIH	.070 In/Sec	.245 G-s
MIA	.085 In/Sec	.185 G-s
PIA	.179 In/Sec	.965 G-s
PIH	.207 In/Sec	.994 G-s
POH	.265 In/Sec	1.956 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.065 In/Sec	.509 G-s
MIH	.063 In/Sec	.280 G-s
MIA	.062 In/Sec	.223 G-s
FIH	.058 In/Sec	.441 G-s
FOH	.120 In/Sec	.157 G-s

CBID - CASTER BAGHOUSE ID FAN (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.031 In/Sec	.085 G-s
MOV	.029 In/Sec	.168 G-s
MIH	.056 In/Sec	.164 G-s
MIV	.047 In/Sec	.171 G-s
MIA	.033 In/Sec	.195 G-s
FIA	.138 In/Sec	.773 G-s
FIH	.086 In/Sec	1.139 G-s
FIV	.058 In/Sec	.592 G-s
FOH	.037 In/Sec	.222 G-s
FOV	.020 In/Sec	.257 G-s
FOA	.039 In/Sec	.270 G-s

FRAF - Furnace REVERSE AIR Fan (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.057 In/Sec	.283 G-s
MIH	.050 In/Sec	.232 G-s
MIA	.040 In/Sec	.340 G-s
FIA	.065 In/Sec	.350 G-s
FIH	.103 In/Sec	.419 G-s
FOH	.082 In/Sec	.215 G-s

EFBHF - East Furnace Bag House Fan (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.421 G-s
MIH	.049 In/Sec	.391 G-s
MIA	.055 In/Sec	.291 G-s
FIA	.072 In/Sec	.647 G-s
FIH	.092 In/Sec	.472 G-s
FOH	.090 In/Sec	.693 G-s

WFBHF - WEST Furnace Bag House Fan (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.068 In/Sec	.205 G-s
MIH	.082 In/Sec	.451 G-s
MIA	.052 In/Sec	.627 G-s
FIA	.103 In/Sec	.516 G-s
FIH	.122 In/Sec	.836 G-s
FOH	.126 In/Sec	.706 G-s

NCHYDP - North CASTER Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.089 In/Sec	.252 G-s
MIH	.055 In/Sec	.373 G-s
PIH	.091 In/Sec	.439 G-s

MIDCHYDP - MIDDLE CASTER Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.116 In/Sec	.313 G-s
MIH	.090 In/Sec	.397 G-s
PIH	.141 In/Sec	.609 G-s

SCHYDP - SOUTH CASTER Hyd PUMP (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.056 In/Sec	.199 G-s
MIH	.036 In/Sec	.580 G-s
PIH	.124 In/Sec	1.892 G-s

SCEXFAN - SPRAY CHAMBER EXHAUST Fan (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.517 In/Sec	.321 G-s
MIH	.659 In/Sec	.353 G-s
MIA	.822 In/Sec	.205 G-s
FIH	.392 In/Sec	.846 G-s
FOH	.415 In/Sec	.261 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK