7030 Ryburn Dr. Millington, TN Phone: (901) 873-5300 Fax: (901) 873-5301 www.gohispeed.com

November 23, 2021

NUCOR Melt Shop

Subject: November 2021 vibration survey

Below is a summary report for the Melt Shop monthly vibration survey that was performed on 11/18/21. Most of the machines surveyed were found to be in good condition except for 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.

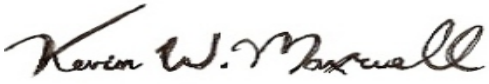
Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

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

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

Cell: 901-486-4565

Email: kwilliam@gohispeed.com

Defects

West Caster Mold Water Pump

High 2 x rpm vibration is present in in motor and pump. This indicates angular misalignment. Motor and pump may also have some internal wear. Perform a precision alignment with less than .003" offset and angularity (rim and face). Ensure there is no soft foot present in the motor. Rated as a **CLASS II** defect.

East Caster Mold Water Pump

Pump was down this survey; however, the following still applies: Pump is still showing some signs of internal wear. Coupling is also showing signs of wear likely due to misalignment. Perform a precision alignment with less than .002" offset and angularity. Ensure there is no soft foot present. Rated as a **CLASS II** defect.

Cooling Tower #2 Supply Pump

Motor data is starting to show some definite signs of motor bearing issues. 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 also be worn which could be causing this vibration. Pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

Cooling Tower #3 Supply Pump

Pump was down this survey; however, the following still applies: 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 could also be worn which could be causing this vibration. Pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

Cooling Tower #6 Supply Pump

The pump vibration data is still indicating that 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.

Caster ID Baghouse Fan

Fan inboard axial spectrum has several sidebands peaks around 2 x outer race defect frequency. With this bearing being a split race bearing, this may indicate an internal issue of the bearing. We are monitoring this closely. Rated as a **CLASS I** defect for now.

Furnace Reverse Air Fan

Fan was thrusting axially during data collection which is causing axial impacting. It is unclear what could be causing the thrusting. Ensure air flow isn't causing this vibration. Rated as a **CLASS II** defect.

Spray Chamber Exhaust Fan

Motor and fan have high fan speed vibration. Outboard fan bearing is showing signs of defects/wear. Inspect fan bearings especially the ODE fan bearing for defects and proper lubrication as soon as practical. This unit is very likely operating near a critical speed and is resonant which is likely influencing the high vibration in the motor and fan. Fan also has some imbalance likely caused by build-up. Because of the high vibration amplitudes, this is rated as a **CLASS III** defect.

South Caster Oscillator

This unit has visible axial movement of the input of the gear drive. You can see the movement at the coupling gap. Data of the gear drive does show some gear noise and this unit seems to be knocking worse than the other two drives. Inspect unit as scheduling allows. Rated as a **CLASS II** defect.

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	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.250 In/Sec	.351 G-s
MIH		.187 In/Sec	1.301 G-s
MIA		.149 In/Sec	1.154 G-s
PIA		.274 In/Sec	.937 G-s
PIH		.156 In/Sec	1.234 G-s
POH		.178 In/Sec	1.311 G-s
MCMWP	- MID CASTER MOLD WATER PUMP	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.091 In/Sec	.611 G-s
MIH		.119 In/Sec	.454 G-s
MIA		.195 In/Sec	.767 G-s
PIA		.169 In/Sec	1.325 G-s
PIH		.175 In/Sec	.897 G-s
POH		.145 In/Sec	1.048 G-s
WBOSTRP	- WEST Booster PUMP	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.060 In/Sec	.198 G-s
MIH		.055 In/Sec	.233 G-s
MIA		.054 In/Sec	.227 G-s
PIA		.091 In/Sec	.458 G-s
PIH		.116 In/Sec	.727 G-s
POH		.165 In/Sec	1.223 G-s
EBOSTRP	- EAST Booster PUMP	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.051 In/Sec	.172 G-s
MIH		.061 In/Sec	.257 G-s
MIA		.051 In/Sec	.205 G-s
PIA		.095 In/Sec	.127 G-s
PIH		.095 In/Sec	.144 G-s
POH		.076 In/Sec	.220 G-s
ECSWP 1LFT	- EAST CASTER SPRAY WP 1 LEFT	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.139 In/Sec	.433 G-s
MIH		.117 In/Sec	1.004 G-s
MIA		.118 In/Sec	.605 G-s
MCSWP 2LFT	- MID CASTER SPRAY WP 2 LEFT	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.115 In/Sec	.222 G-s
MIH		.084 In/Sec	.550 G-s
MIA		.098 In/Sec	.329 G-s
MCSWP 3RT	- MID CASTER SPRAY WP 3 RIGHT	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.216 In/Sec	.587 G-s
MIH		.155 In/Sec	1.014 G-s
MIA		.151 In/Sec	.282 G-s
ESERVOHYDP	- EAST SERVO Hyd PUMP	(18-Nov-21)	
		OVERALL LEVEL	1K-20KHz
MOH		.033 In/Sec	.252 G-s
MIH		.067 In/Sec	.123 G-s
PIV		.147 In/Sec	.581 G-s

WSERVOHYDP - WEST SERVO Hyd PUMP (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.101 In/Sec	.159 G-s
MIH	.074 In/Sec	.241 G-s
PIV	.095 In/Sec	1.124 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.058 In/Sec	.120 G-s
MIH	.073 In/Sec	.462 G-s
PIV	.093 In/Sec	.477 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.404 G-s
MIH	.062 In/Sec	.417 G-s
PIV	.234 In/Sec	1.372 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.115 In/Sec	.504 G-s
MIH	.157 In/Sec	.517 G-s
PIV	.330 In/Sec	2.440 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.064 In/Sec	.284 G-s
MIH	.129 In/Sec	.429 G-s
PIV	.151 In/Sec	1.217 G-s

1SUPLYP - #1 Supply Pump (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.192 G-s
MIH	.071 In/Sec	.195 G-s
MIA	.071 In/Sec	.160 G-s
PIA	.247 In/Sec	1.342 G-s
PIH	.211 In/Sec	1.039 G-s
POH	.224 In/Sec	1.096 G-s

2SUPLYP - #2 Supply Pump (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.043 In/Sec	.191 G-s
MIH	.077 In/Sec	1.194 G-s
MIA	.084 In/Sec	.789 G-s
PIA	.226 In/Sec	.720 G-s
PIH	.190 In/Sec	.735 G-s
POH	.224 In/Sec	1.384 G-s

5SUPLYP - #5 Supply Pump (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.044 In/Sec	.381 G-s
MIH	.071 In/Sec	.724 G-s
MIA	.082 In/Sec	.216 G-s
PIA	.283 In/Sec	1.777 G-s
PIH	.290 In/Sec	.855 G-s
POH	.251 In/Sec	1.689 G-s

6SUPLYP - #6 Supply Pump (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.214 G-s
MIH	.082 In/Sec	.182 G-s
MIA	.099 In/Sec	.145 G-s
PIA	.154 In/Sec	.772 G-s
PIH	.178 In/Sec	.529 G-s
POH	.202 In/Sec	1.400 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.046 In/Sec	.491 G-s
MIH	.040 In/Sec	.582 G-s

	MIA	.036 In/Sec	.801 G-s
	FIH	.057 In/Sec	.445 G-s
	FOH	.087 In/Sec	.146 G-s

CBID - CASTER BAGHOUSE ID FAN (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.075 In/Sec	.075 G-s
MOV	.038 In/Sec	.144 G-s
MIH	.071 In/Sec	.132 G-s
MIV	.051 In/Sec	.163 G-s
MIA	.036 In/Sec	.324 G-s
FIA	.178 In/Sec	.997 G-s
FIH	.103 In/Sec	1.238 G-s
FIV	.087 In/Sec	.718 G-s
FOH	.108 In/Sec	1.153 G-s
FOV	.030 In/Sec	.668 G-s
FOA	.072 In/Sec	.589 G-s

FRAF - Furnace REVERSE AIR Fan (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.128 In/Sec	.439 G-s
MIH	.103 In/Sec	.227 G-s
MIA	.104 In/Sec	.196 G-s
FIA	.135 In/Sec	.854 G-s
FIH	.127 In/Sec	.926 G-s
FOH	.122 In/Sec	.376 G-s

EFBHF - East Furnace Bag House Fan (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.039 In/Sec	.316 G-s
MIH	.065 In/Sec	.792 G-s
MIA	.032 In/Sec	.363 G-s
FIA	.062 In/Sec	.790 G-s
FIH	.075 In/Sec	1.265 G-s
FOH	.072 In/Sec	.987 G-s

WFBHF - WEST Furnace Bag House Fan (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.057 In/Sec	.343 G-s
MIH	.078 In/Sec	.662 G-s
MIA	.088 In/Sec	.655 G-s
FIA	.095 In/Sec	1.391 G-s
FIH	.109 In/Sec	1.681 G-s
FOH	.102 In/Sec	1.043 G-s

SCEXFAN - SPRAY CHAMBER EXHAUST Fan (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	1.923 In/Sec	.771 G-s
MIH	1.880 In/Sec	.172 G-s
MIA	1.021 In/Sec	.148 G-s
FIH	1.170 In/Sec	.499 G-s
FOH	1.359 In/Sec	1.410 G-s

ENARCOHYDP - EAST NARCO Hyd PUMP (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.092 In/Sec	.466 G-s
MIH	.072 In/Sec	.126 G-s
PIV	.405 In/Sec	.599 G-s

MC OCILLA - Middle Caster Oscillator (18-Nov-21)

	OVERALL LEVEL	1K-20KHz
MOH	.251 In/Sec	.154 G-s
MIH	.218 In/Sec	.245 G-s
MIA	.141 In/Sec	.141 G-s
GIA	.144 In/Sec	.073 G-s
GIH	.171 In/Sec	.808 G-s
GOH	.176 In/Sec	.904 G-s

SC OCILLA - South Caster Oscillator (18-Nov-21)

	OVERALL LEVEL	1K-20KHz

MOH	.224	In/Sec	.473 G-s
MIH	.232	In/Sec	.154 G-s
MIA	.173	In/Sec	.188 G-s
GIA	.139	In/Sec	.687 G-s
GIH	.197	In/Sec	.415 G-s
GOH	.175	In/Sec	1.184 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK