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

November 23, 2022

NUCOR Melt Shop

Subject: November 2022 vibration survey

Below is a summary report for the Melt Shop monthly vibration survey that was performed on 11/14/22. 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.

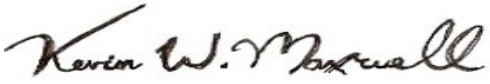
Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

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

1 x motor rpm vibration has increased(almost doubled in amplitude in one month) to near .8 ips-pk. Data suggests a coupling/alignment issue. Motor and pump may also have some internal wear. Inspect couplings and 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 III** defect.

East Caster Mold Water Pump

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 Pump

Outboard end of pump has increased vibration at 2 x rpm. This may be due to loose bolts, bent shaft, or coupling issue. Inspect pump/bolts/coupling as scheduling 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 Pump #5

Pump was recently replaced; however, data still shows high 1 x rpm axial vibration in the pump. Pump impeller/shaft could be out of balance or pump has cocked bearing or some other internal misalignment. Inspect 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. Impeller may have excessive wear. Rated as a **CLASS II** defect.

2nd Deck Hyd. Pumps

North and south pumps have some high vibrations. Pumps have significant hydraulic passing frequencies with some high 1 x rpm vibration in pump verticals. Maybe a loading issue or flow issue. But may also be some internal wear of pumps. Ensure filters aren't clogged and pumps are operating at normal flow. Rated as **CLASS II** defects.

Caster ID Baghouse Fan

Motor DE and fan DE waveform data still shows an impacting or knock type vibration. Waveform data shows the fan DE having the more pronounced impacting. It is possible that the knocking type vibration/sound is coming form the DE fan bearing according to data. Acceleration has also increased at the DE fan bearing over the past couple of months. It is recommended to change DE fan bearing and pull back coupling flange on fan shaft inspecting coupling gear hubs as scheduling allows. Rated as a **CLASS II** defect.

Furnace Reverse Air Fan

Motor appears to have some early signs of bearing defects. According to trend data, this does not appear to be severe at this time. For now ensure motor bearings have adequate amounts of grease. We will monitor this issue closely. Rated as a **CLASS II** defect.

Spray Chamber Exhaust Fan

Motor and fan have high fan speed vibration with motor having a much higher amplitude of 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

Database: nucorja9.rbm
Station: Melt Shop

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
WCMWP - WEST CASTER MOLD WATER PUMP (14-Nov-22)		
	OVERALL LEVEL	1K-20KHz
MOH	.725 In/Sec	.405 G-s
MIH	.565 In/Sec	.683 G-s
MIA	.417 In/Sec	.486 G-s
PIA	.533 In/Sec	1.978 G-s
PIH	.180 In/Sec	1.123 G-s
POH	.201 In/Sec	1.451 G-s
ECMWP - EAST CASTER MOLD WATER PUMP (14-Nov-22)		
	OVERALL LEVEL	1K-20KHz
MOH	.088 In/Sec	.251 G-s
MIH	.114 In/Sec	.192 G-s
MIA	.327 In/Sec	.138 G-s
PIA	.287 In/Sec	1.056 G-s
PIH	.214 In/Sec	.887 G-s
POH	.234 In/Sec	1.034 G-s
WBOSTRP - WEST Booster PUMP (14-Nov-22)		
	OVERALL LEVEL	1K-20KHz
MOH	.056 In/Sec	.656 G-s
MIH	.041 In/Sec	.529 G-s
MIA	.028 In/Sec	.186 G-s
PIA	.069 In/Sec	.305 G-s
PIH	.112 In/Sec	.493 G-s
POH	.133 In/Sec	1.318 G-s
EBOSTRP - EAST Booster PUMP (14-Nov-22)		
	OVERALL LEVEL	1K-20KHz
MOH	.067 In/Sec	.127 G-s
MIH	.047 In/Sec	.223 G-s
MIA	.037 In/Sec	.385 G-s
PIA	.068 In/Sec	.080 G-s

PIH		.076 In/Sec	.252 G-s
POH		.058 In/Sec	.272 G-s

ECSWP 1LFT - EAST CASTER SPRAY WP 1 LEFT (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.125 In/Sec	.233 G-s
MIH	.076 In/Sec	.332 G-s
MIA	.058 In/Sec	.168 G-s

MCSWP 2LFT - MID CASTER SPRAY WP 2 LEFT (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.101 In/Sec	.158 G-s
MIH	.071 In/Sec	.283 G-s
MIA	.096 In/Sec	.029 G-s

MCSWP 3RT - MID CASTER SPRAY WP 3 RIGHT (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.124 In/Sec	.346 G-s
MIH	.098 In/Sec	.365 G-s
MIA	.106 In/Sec	.392 G-s

ESERVOHYDP - EAST SERVO Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.023 In/Sec	.190 G-s
MIH	.068 In/Sec	.104 G-s
PIV	.137 In/Sec	.682 G-s

WSERVOHYDP - WEST SERVO Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.096 In/Sec	.170 G-s
MIH	.071 In/Sec	.269 G-s
PIV	.078 In/Sec	1.008 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.066 In/Sec	.092 G-s
MIH	.118 In/Sec	.319 G-s
PIV	.195 In/Sec	1.374 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.075 In/Sec	.900 G-s
MIH	.121 In/Sec	1.259 G-s
PIV	.433 In/Sec	7.762 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.120 In/Sec	.790 G-s
MIH	.140 In/Sec	1.197 G-s
PIV	.392 In/Sec	3.724 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.134 In/Sec	.518 G-s
MIH	.146 In/Sec	.875 G-s
PIV	.586 In/Sec	2.624 G-s

1SUPLYP - #1 Supply Pump (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.055 In/Sec	.166 G-s
MIH	.065 In/Sec	.164 G-s
MIA	.075 In/Sec	.112 G-s
PIA	.243 In/Sec	.560 G-s
PIH	.205 In/Sec	.627 G-s
POH	.182 In/Sec	.727 G-s

2SUPLYP - #2 Supply Pump (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.070 In/Sec	.680 G-s
MIH	.087 In/Sec	.426 G-s

MIA	.102 In/Sec	.227 G-s
PIA	.395 In/Sec	.398 G-s
PIH	.258 In/Sec	.462 G-s
POH	.418 In/Sec	1.698 G-s

5SUPLYP - #5 Supply Pump (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.039 In/Sec	.419 G-s
MIH	.069 In/Sec	.706 G-s
MIA	.093 In/Sec	.368 G-s
PIA	.675 In/Sec	.186 G-s
PIH	.222 In/Sec	.760 G-s
POH	.326 In/Sec	.959 G-s

6SUPLYP - #6 Supply Pump (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.042 In/Sec	.219 G-s
MIH	.067 In/Sec	.219 G-s
MIA	.069 In/Sec	.154 G-s
PIA	.184 In/Sec	.467 G-s
PIH	.177 In/Sec	.577 G-s
POH	.228 In/Sec	1.757 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.051 In/Sec	.301 G-s
MIH	.046 In/Sec	.147 G-s
MIA	.023 In/Sec	.109 G-s
FIH	.021 In/Sec	.165 G-s
FOH	.039 In/Sec	.094 G-s

CBID - CASTER BAGHOUSE ID FAN (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.090 In/Sec	.113 G-s
MOV	.046 In/Sec	.100 G-s
MIH	.112 In/Sec	.349 G-s
MIV	.098 In/Sec	.495 G-s
MIA	.047 In/Sec	.262 G-s
FIA	.210 In/Sec	.959 G-s
FIH	.203 In/Sec	1.672 G-s
FIV	.184 In/Sec	1.675 G-s
FOH	.181 In/Sec	1.284 G-s
FOV	.044 In/Sec	1.333 G-s
FOA	.091 In/Sec	.875 G-s

FRAF - Furnace REVERSE AIR Fan (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.031 In/Sec	.238 G-s
MIH	.028 In/Sec	.167 G-s
MIA	.021 In/Sec	.059 G-s
FIA	.042 In/Sec	.396 G-s
FIH	.038 In/Sec	.648 G-s
FOH	.027 In/Sec	.216 G-s

EFBHF - East Furnace Bag House Fan (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.287 G-s
MIH	.053 In/Sec	.513 G-s
MIA	.034 In/Sec	.572 G-s
FIA	.066 In/Sec	.830 G-s
FIH	.067 In/Sec	1.260 G-s
FOH	.098 In/Sec	.976 G-s

WFBHF - WEST Furnace Bag House Fan (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.060 In/Sec	.372 G-s
MIH	.082 In/Sec	.466 G-s
MIA	.074 In/Sec	.348 G-s
FIA	.090 In/Sec	.796 G-s
FIH	.096 In/Sec	1.348 G-s

	FOH	.058 In/Sec	.873 G-s

NCHYDP - North CASTER Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.072 In/Sec	.834 G-s
MIH	.145 In/Sec	.821 G-s
PIH	.155 In/Sec	.622 G-s

SCHYDP - SOUTH CASTER Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.384 G-s
MIH	.030 In/Sec	.530 G-s
PIH	.137 In/Sec	.610 G-s

SCEXFAN - SPRAY CHAMBER EXHAUST Fan (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.658 In/Sec	.203 G-s
MIH	.831 In/Sec	.302 G-s
MIA	.391 In/Sec	.201 G-s
FIH	.402 In/Sec	.447 G-s
FOH	.484 In/Sec	.849 G-s

ENARCOHYDP - EAST NARCO Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.043 In/Sec	.038 G-s
MIH	.048 In/Sec	.200 G-s
PIV	.178 In/Sec	.827 G-s

WNARCOHYDP - WEST NARCO Hyd PUMP (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.046 In/Sec	.089 G-s
MIH	.043 In/Sec	.149 G-s
PIV	.113 In/Sec	.591 G-s

NC OCILLA - North Caster Oscillator (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.102 In/Sec	.058 G-s
MIH	.099 In/Sec	.128 G-s
MIA	.075 In/Sec	.126 G-s
GIA	.078 In/Sec	.347 G-s
GIH	.075 In/Sec	.103 G-s
GOH	.089 In/Sec	.283 G-s

MC OCILLA - Middle Caster Oscillator (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.092 In/Sec	.042 G-s
MIH	.086 In/Sec	.079 G-s
MIA	.064 In/Sec	.094 G-s
GIA	.064 In/Sec	.039 G-s
GIH	.071 In/Sec	.090 G-s
GOH	.067 In/Sec	.223 G-s

SC OCILLA - South Caster Oscillator (14-Nov-22)

	OVERALL LEVEL	1K-20KHz
MOH	.094 In/Sec	.108 G-s
MIH	.075 In/Sec	.102 G-s
MIA	.054 In/Sec	.404 G-s
GIA	.053 In/Sec	.077 G-s
GIH	.062 In/Sec	.226 G-s
GOH	.059 In/Sec	.343 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK