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

July 26th, 2023

NUCOR Melt Shop

Subject: July 2023 vibration survey

Below is a summary report for the Melt Shop monthly vibration survey that was performed on 07/20-21/23. 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.

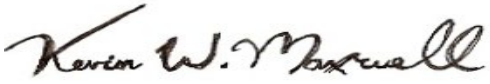
Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

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

East Caster Mold Water Pump

Pump was down this survey; however, the following still applies: Pump is still showing some signs of internal wear. Couplings may also have 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.

Middle Caster Mold Water Pump

Vibration data shows issues in the pump. Data suggests looseness/wear of the pump bearings/fits. Impeller and other pump internals may also have wear. The pump will likely need attention soon. Rated as a **CLASS II** defect.

Cooling Tower Pump #5

Pump was down this survey; however, the following still applies: Data still shows high 1 x rpm axial vibration in the pump. Pump impeller/shaft could be out of balance or bent. Pump could also have 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 still indicates 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.

Servo Hyd. Recirc. Pump

The pump still has higher than average vibration. Spectral data shows harmonics of hydraulic vane frequency. This may be due to internal pump wear and or flow issue. Rated as a **CLASS II** defect.

Caster ID Baghouse Fan

Motor DE and fan DE waveform data still shows an impacting or knock type vibration. DE motor vibration is slightly lower while the fan DE remains higher in amplitude. Waveform data shows the fan DE having the more pronounced impacting. 1-20 Khz high frequency magnitude trend shows DE fan horizontal to have the highest amplitude on record at 3.7 g's. Spectral data shows increased rpm harmonics and bearing frequencies. The DE fan bearing needs a visual inspection soon. The bearing may have defects/wear. 1 x rpm fan vibration is also higher especially at the ODE bearing. A trim balance or fan cleaning is recommended during next extended outage. Because of the high acceleration in the DE fan bearing, this is rated as a **CLASS III** defect.

Furnace Reverse Air Fan

The impacting seen in fan bearings was present gain this survey. Impact is also audible when standing near DE of fan. At the very least, the fan wheel and internal fan housing should be checked. Motor appears to have some early signs of bearing defects. According to trend data, the motor bearing issue is minor at this time. We will monitor this issue closely. Rated as a **CLASS II** defect.

Spray Chamber Exhaust Fan

Motor vibration has increased this survey. Motor and fan have high fan speed vibration with motor having a much higher amplitude of vibration. 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 (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.108 In/Sec	.171 G-s
MIH	.113 In/Sec	.284 G-s
MIA	.187 In/Sec	.225 G-s
PIA	.252 In/Sec	.372 G-s
PIH	.154 In/Sec	.620 G-s
POH	.181 In/Sec	.649 G-s
MCMWP - MID CASTER MOLD WATER PUMP (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.085 In/Sec	1.464 G-s
MIH	.206 In/Sec	1.080 G-s
MIA	.247 In/Sec	1.197 G-s
PIA	.297 In/Sec	2.008 G-s
PIH	.250 In/Sec	3.486 G-s
POH	.228 In/Sec	3.650 G-s
WBOSTRP - WEST Booster PUMP (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.060 In/Sec	.704 G-s
MIH	.044 In/Sec	.348 G-s
MIA	.033 In/Sec	.279 G-s
PIA	.091 In/Sec	1.094 G-s
PIH	.106 In/Sec	.690 G-s
POH	.211 In/Sec	2.376 G-s
ECSWP 1LFT - EAST CASTER SPRAY WP 1 LEFT (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.187 In/Sec	.292 G-s
MIH	.072 In/Sec	.606 G-s
MIA	.090 In/Sec	.243 G-s
MCSWP 3RT - MID CASTER SPRAY WP 3 RIGHT (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.177 In/Sec	.826 G-s
MIH	.178 In/Sec	1.674 G-s
MIA	.090 In/Sec	.460 G-s
WCSWP 4RT - WEST CASTER SPRAY WP 4 RIGH (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.158 In/Sec	.682 G-s
MIH	.097 In/Sec	1.049 G-s
ESERVOHYDP - EAST SERVO Hyd PUMP (20-Jul-23)		
	OVERALL LEVEL	1K-20KHz
MOH	.024 In/Sec	.142 G-s
MIH	.042 In/Sec	.254 G-s
PIV	.117 In/Sec	.969 G-s

MSERVOHYDP - MIDDLE SERVO Hyd PUMP (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.172 In/Sec	.603 G-s
MIH	.052 In/Sec	.393 G-s
PIV	.136 In/Sec	.832 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.120 In/Sec	.602 G-s
MIH	.113 In/Sec	.958 G-s
PIV	.209 In/Sec	2.686 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.069 In/Sec	.197 G-s
MIH	.119 In/Sec	.102 G-s
PIV	.289 In/Sec	.043 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.262 In/Sec	.600 G-s
MIH	.181 In/Sec	1.185 G-s
PIV	.326 In/Sec	3.965 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.262 In/Sec	.703 G-s
MIH	.201 In/Sec	1.505 G-s
PIV	.177 In/Sec	3.920 G-s

1SUPLYP - #1 Supply Pump (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.077 In/Sec	.190 G-s
MIH	.086 In/Sec	.160 G-s
MIA	.081 In/Sec	.112 G-s
PIA	.327 In/Sec	.517 G-s
PIH	.258 In/Sec	.529 G-s
POH	.197 In/Sec	.569 G-s

2SUPLYP - #2 Supply Pump (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.074 In/Sec	.605 G-s
MIH	.096 In/Sec	.771 G-s
MIA	.129 In/Sec	.436 G-s
PIA	.282 In/Sec	.609 G-s
PIH	.246 In/Sec	.888 G-s
POH	.327 In/Sec	1.621 G-s

3SUPLYP - #3 Supply Pump (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.075 In/Sec	1.057 G-s
MIH	.077 In/Sec	.943 G-s
MIA	.069 In/Sec	.551 G-s
PIA	.291 In/Sec	.302 G-s
PIH	.161 In/Sec	.594 G-s
POH	.232 In/Sec	1.393 G-s

6SUPLYP - #6 Supply Pump (20-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.058 In/Sec	.230 G-s
MIH	.072 In/Sec	.172 G-s
MIA	.083 In/Sec	.125 G-s
PIA	.268 In/Sec	.627 G-s
PIH	.195 In/Sec	.700 G-s
POH	.233 In/Sec	1.388 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (21-Jul-23)

		OVERALL LEVEL	1K-20KHz
MOH		.031 In/Sec	.150 G-s
MIH		.041 In/Sec	.184 G-s
MIA		.027 In/Sec	.098 G-s
FIH		.044 In/Sec	1.014 G-s
FOH		.068 In/Sec	.113 G-s

CBID - CASTER BAGHOUSE ID FAN (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.089 In/Sec	.164 G-s
MOV	.068 In/Sec	.252 G-s
MIH	.098 In/Sec	.282 G-s
MIV	.128 In/Sec	.725 G-s
MIA	.070 In/Sec	.522 G-s
FIA	.184 In/Sec	1.282 G-s
FIH	.355 In/Sec	3.706 G-s
FIV	.242 In/Sec	2.812 G-s
FOH	.303 In/Sec	1.254 G-s
FOV	.127 In/Sec	.882 G-s
FOA	.107 In/Sec	.841 G-s

FRAF - Furnace REVERSE AIR Fan (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.090 In/Sec	.173 G-s
MIH	.050 In/Sec	.548 G-s
MIA	.040 In/Sec	.225 G-s
FIH	.129 In/Sec	.674 G-s

EFBHF - East Furnace Bag House Fan (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.057 In/Sec	.466 G-s
MIH	.091 In/Sec	1.205 G-s
MIA	.057 In/Sec	.944 G-s

WFBHF - WEST Furnace Bag House Fan (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.074 In/Sec	.838 G-s
MIH	.088 In/Sec	.773 G-s
MIA	.041 In/Sec	.525 G-s
FIA	.094 In/Sec	1.232 G-s
FIH	.114 In/Sec	1.493 G-s

NCHYDP - North CASTER Hyd PUMP (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.052 In/Sec	.555 G-s
MIH	.059 In/Sec	.986 G-s
PIH	.103 In/Sec	.953 G-s

SCHYDP - SOUTH CASTER Hyd PUMP (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.102 In/Sec	.371 G-s
MIH	.076 In/Sec	.644 G-s
PIH	.160 In/Sec	1.094 G-s

SCEXFAN - SPRAY CHAMBER EXHAUST Fan (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	1.451 In/Sec	.569 G-s
MIH	1.485 In/Sec	.329 G-s
MIA	.726 In/Sec	.172 G-s
FIH	1.043 In/Sec	.291 G-s
FOH	.669 In/Sec	1.072 G-s

ENARCOHYDP - EAST NARCO Hyd PUMP (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.064 In/Sec	.118 G-s
MIH	.061 In/Sec	.102 G-s
PIV	.161 In/Sec	.337 G-s

WNARCOHYDP - WEST NARCO Hyd PUMP (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.036 In/Sec	.103 G-s
MIH	.043 In/Sec	.196 G-s
PIV	.128 In/Sec	.672 G-s

MC OCILLA - Middle Caster Oscillator (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.223 In/Sec	.225 G-s
MIH	.153 In/Sec	.113 G-s
MIA	.079 In/Sec	.122 G-s
GIA	.075 In/Sec	.029 G-s
GIH	.096 In/Sec	.830 G-s
GOH	.089 In/Sec	.798 G-s

SC OCILLA - South Caster Oscillator (21-Jul-23)

	OVERALL LEVEL	1K-20KHz
MOH	.145 In/Sec	1.376 G-s
MIH	.114 In/Sec	.500 G-s
MIA	.122 In/Sec	.332 G-s
GIA	.181 In/Sec	1.344 G-s
GIH	.153 In/Sec	1.825 G-s
GOH	.150 In/Sec	1.044 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK