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January 31, 2022

NUCOR Melt Shop

Subject: January 2022 vibration survey

Below is a summary report for the Melt Shop monthly vibration survey that was performed on 01/21/22. 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

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Defects

West Caster Mold Water Pump

High 2 x rpm vibration continues to be 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 again 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 showing 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. Motor may need attention soon and pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

Cooling Tower #3 Supply Pump

Pump was down again 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 vibration remains high and overall vibration has increased significantly over the past two months.. Pump has a high amplitude 1 x rpm vibration with a 2 x rpm vibration present as well. This could be coupling related or issue with impeller causing an imbalance. For now, it is recommended to inspect the pump coupling. If all looks good, then the issue may be with the impeller or pump shaft could be bent. Rated as a **CLASS III** 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.

Furnace Reverse Air Fan

The thrusting and impacting that was seen back in November 2021 was noticed again this month, but at slightly lower amplitude. For now, it is recommended to perform a thorough inspection of the inside of the fan housing, ensuring that the fan is in good shape and is not making contact anywhere on the fan wheel and/or inner cone. Rated as a **CLASS I** defect for now.

Spray Chamber Exhaust Fan

Motor and fan still have high fan speed vibration. Both fan bearings are showing signs of defects/wear with the ODE bearing showing the higher vibrations. 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 likely has some imbalance 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.

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Abbreviated Last Measurement Summary
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           Database:  nucorja9.rbm
           Station:   Melt Shop

    MEASUREMENT POINT             OVERALL LEVEL       HFD / VHFD
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    WCMWP      - WEST CASTER MOLD WATER PUMP   (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .230 In/Sec       .474 G-s
           MIH                     .201 In/Sec      1.223 G-s
           MIA                     .182 In/Sec       .882 G-s
           PIA                     .110 In/Sec      1.472 G-s
           PIH                     .120 In/Sec      1.280 G-s
           POH                     .140 In/Sec      1.248 G-s

    MCMWP      - MID CASTER MOLD WATER PUMP    (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .084 In/Sec       .441 G-s
           MIH                     .089 In/Sec       .282 G-s
           MIA                     .145 In/Sec       .437 G-s
           PIA                     .125 In/Sec      1.024 G-s
           PIH                     .164 In/Sec      1.314 G-s
           POH                     .139 In/Sec       .833 G-s

    WBOSTRP    - WEST Booster PUMP             (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .066 In/Sec       .493 G-s
           MIH                     .046 In/Sec       .216 G-s
           MIA                     .024 In/Sec       .178 G-s
           PIA                     .067 In/Sec       .509 G-s
           PIH                     .114 In/Sec       .377 G-s
           POH                     .163 In/Sec       .418 G-s

    ECSWP 1LFT - EAST CASTER SPRAY WP 1 LEFT   (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .083 In/Sec       .210 G-s
           MIH                     .067 In/Sec       .254 G-s
           MIA                     .058 In/Sec       .107 G-s

    MCSWP 2LFT - MID CASTER SPRAY WP 2 LEFT    (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .102 In/Sec       .298 G-s
           MIH                     .065 In/Sec       .324 G-s
           MIA                     .070 In/Sec       .143 G-s

    WCSWP 4RT  - WEST CASTER SPRAY WP 4 RIGH   (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .075 In/Sec       .293 G-s
           MIH                     .085 In/Sec       .445 G-s
           MIA                     .106 In/Sec       .330 G-s

    MSERVOHYDP - MIDDLE SERVO Hyd PUMP         (21-Jan-22)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .179 In/Sec       .154 G-s
           MIH                     .084 In/Sec       .099 G-s
           PIV                     .200 In/Sec       .644 G-s
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WSERVOHYDP - WEST SERVO Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.069 In/Sec	.157 G-s
MIH	.054 In/Sec	.206 G-s
PIV	.096 In/Sec	.610 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.078 In/Sec	.189 G-s
MIH	.102 In/Sec	.418 G-s
PIV	.143 In/Sec	.881 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.062 In/Sec	.436 G-s
MIH	.092 In/Sec	.517 G-s
PIV	.275 In/Sec	1.706 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.105 In/Sec	.431 G-s
MIH	.113 In/Sec	.656 G-s
PIV	.296 In/Sec	2.512 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.119 In/Sec	.587 G-s
MIH	.090 In/Sec	.560 G-s
PIV	.204 In/Sec	1.266 G-s

1SUPLYP - #1 Supply Pump (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.055 In/Sec	.139 G-s
MIH	.056 In/Sec	.222 G-s
MIA	.073 In/Sec	.124 G-s
PIA	.207 In/Sec	.284 G-s
PIH	.151 In/Sec	.571 G-s
POH	.167 In/Sec	.773 G-s

2SUPLYP - #2 Supply Pump (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.065 In/Sec	1.020 G-s
MIH	.066 In/Sec	.994 G-s
MIA	.059 In/Sec	.587 G-s
PIA	.203 In/Sec	.373 G-s
PIH	.173 In/Sec	.522 G-s
POH	.239 In/Sec	1.515 G-s

5SUPLYP - #5 Supply Pump (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.073 In/Sec	.595 G-s
MIH	.115 In/Sec	.668 G-s
MIA	.166 In/Sec	.187 G-s
PIA	.602 In/Sec	.720 G-s
PIH	.555 In/Sec	.545 G-s
POH	.385 In/Sec	.977 G-s

6SUPLYP - #6 Supply Pump (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.044 In/Sec	.279 G-s
MIH	.066 In/Sec	.224 G-s
MIA	.073 In/Sec	.179 G-s
PIA	.155 In/Sec	.549 G-s
PIH	.163 In/Sec	.685 G-s
POH	.197 In/Sec	1.378 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.036 In/Sec	.332 G-s

MIH	.030 In/Sec	.650 G-s
MIA	.014 In/Sec	.877 G-s
FIH	.024 In/Sec	.138 G-s
FOH	.044 In/Sec	.062 G-s

CBID - CASTER BAGHOUSE ID FAN (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.057 In/Sec	.067 G-s
MOV	.032 In/Sec	.099 G-s
MIH	.072 In/Sec	.138 G-s
MIV	.045 In/Sec	.152 G-s
MIA	.031 In/Sec	.172 G-s
FIA	.115 In/Sec	.932 G-s
FIH	.106 In/Sec	1.629 G-s
FIV	.061 In/Sec	.881 G-s
FOH	.091 In/Sec	.573 G-s
FOV	.030 In/Sec	.625 G-s
FOA	.055 In/Sec	.667 G-s

FRAF - Furnace REVERSE AIR Fan (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.082 In/Sec	.321 G-s
MIH	.066 In/Sec	.342 G-s
MIA	.057 In/Sec	.216 G-s
FIA	.074 In/Sec	.497 G-s
FIH	.065 In/Sec	.578 G-s
FOH	.065 In/Sec	.336 G-s

EFBHF - East Furnace Bag House Fan (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.037 In/Sec	.213 G-s
MIH	.054 In/Sec	.598 G-s
MIA	.026 In/Sec	.262 G-s
FIA	.052 In/Sec	.841 G-s
FIH	.062 In/Sec	1.026 G-s
FOH	.070 In/Sec	.902 G-s

WFBHF - WEST Furnace Bag House Fan (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.058 In/Sec	.406 G-s
MIH	.077 In/Sec	.467 G-s
MIA	.076 In/Sec	.317 G-s
FIA	.072 In/Sec	.903 G-s
FIH	.089 In/Sec	1.303 G-s
FOH	.092 In/Sec	.713 G-s

MIDCHYDP - MIDDLE CASTER Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.153 In/Sec	.247 G-s
MIH	.067 In/Sec	.469 G-s
PIH	.386 In/Sec	2.024 G-s

SCHYDP - SOUTH CASTER Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.119 In/Sec	.692 G-s
MIH	.072 In/Sec	.494 G-s
PIH	.368 In/Sec	1.153 G-s

SCEXFAN - SPRAY CHAMBER EXHAUST Fan (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	1.424 In/Sec	.321 G-s
MIH	1.361 In/Sec	.171 G-s
MIA	1.058 In/Sec	.196 G-s
FIH	.727 In/Sec	.529 G-s
FOH	.601 In/Sec	.786 G-s

ENARCOHYDP - EAST NARCO Hyd PUMP (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.039 In/Sec	.102 G-s
MIH	.038 In/Sec	.167 G-s

	PIV	.116 In/Sec	.324 G-s

NC OCILLA - North Caster Oscillator (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.126 In/Sec	.073 G-s
MIH	.083 In/Sec	.233 G-s
MIA	.088 In/Sec	.230 G-s
GIA	.091 In/Sec	.148 G-s
GIH	.085 In/Sec	.288 G-s
GOH	.097 In/Sec	.447 G-s

MC OCILLA - Middle Caster Oscillator (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.123 In/Sec	.106 G-s
MIH	.114 In/Sec	.222 G-s
MIA	.104 In/Sec	.127 G-s
GIA	.155 In/Sec	.129 G-s
GIH	.114 In/Sec	.128 G-s
GOH	.135 In/Sec	.199 G-s

SC OCILLA - South Caster Oscillator (21-Jan-22)

	OVERALL LEVEL	1K-20KHz
MOH	.121 In/Sec	.101 G-s
MIH	.131 In/Sec	.129 G-s
MIA	.093 In/Sec	.060 G-s
GIA	.110 In/Sec	.321 G-s
GIH	.100 In/Sec	.412 G-s
GOH	.113 In/Sec	.482 G-s

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK