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August 14, 2020

NUCOR Melt Shop

Subject: August 2020 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. Pump may also have some internal wear. Perform a precision alignment with less than .003" offset and angularity. Ensure there is no soft foot present in the motor. Rated as a **CLASS II** defect.

East Caster Mold Water Pump
Pump is still 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.

West Booster Pump
Pump data shows another increase in non-synchronous vibration at the outboard end of the pump. This is good indication of bearing defects taking place in the pump bearings. Pump will need attention SOON. Rated as a **CLASS III** defect.

Caster Spray Water Pump (2nd pump from road -Middle-East Pump)
Motor has extreme amount of vibration this survey. 1 x rpm vibration indicates issue likely in the pump or drive shaft. Motor bearings may also have damage especially the drive end motor bearing. Inspect unit ASAP. 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.

Cooling Tower #3 Supply Pump
Pump was not in service during this survey; however, the following most likely 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 #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 also be worn which could be causing this vibration. Pump needs to be inspected as time allows. Rated as a **CLASS II** defect.

Furnace Reverse Air Fan
Outboard (Back End) fan bearing data still shows some impacting occurring within the bearing. This could be signs of axial thrusting or some other type of aerodynamic forces being generated by the fan. For now, it is recommended to inspect the fan bearings as time allows. Ensure drive end bearing is fixed and outboard end bearing is set to float. Rated as a **CLASS II** defect.

Caster Baghouse ID Fan
High frequency acceleration is trending upward in the outboard fan bearing. This is likely an early indication of bearing defects/wear of the outboard bearing. This will be monitored closely. Rated as a **CLASS I** defect.

Spray Chamber Exhaust Fan

Fan vibration is higher than when we balanced fan last week. This is likely due to the fan operating near a critical speed which is causing the motor and fan to have amplified fan speed vibration. Outboard fan bearing also is showing signs of defects/wear. Inspect fan bearings especially the ODE fan bearing for defects and proper lubrication. This unit is operating near a critical speed and is resonant which is likely influencing the high vibration in the motor and fan. It is recommended to replace the fan and fan shaft assembly as downtime allows. Fan has excessive build up and fan shaft is possibly bent and or worn. We will continue to monitor this closely. 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	(11-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.092 In/Sec	.695 G-s
MIH		.115 In/Sec	.822 G-s
MIA		.215 In/Sec	.754 G-s
PIA		.241 In/Sec	.901 G-s
PIH		.170 In/Sec	.793 G-s
POH		.118 In/Sec	.905 G-s
* PIV		.500 In/Sec	.905 G-s
* MIV		.198 In/Sec	.904 G-s
* MOV		.154 In/Sec	.397 G-s
MCMWP	- MID CASTER MOLD WATER PUMP	(11-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.065 In/Sec	.822 G-s
MIH		.076 In/Sec	.640 G-s
MIA		.097 In/Sec	.511 G-s
PIA		.138 In/Sec	1.123 G-s
PIH		.115 In/Sec	1.002 G-s
POH		.089 In/Sec	.917 G-s
ECMWP	- EAST CASTER MOLD WATER PUMP	(09-Jul-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.070 In/Sec	.247 G-s
MIH		.057 In/Sec	.206 G-s
MIA		.303 In/Sec	.162 G-s
PIA		.394 In/Sec	.828 G-s
PIH		.142 In/Sec	.863 G-s
POH		.140 In/Sec	.889 G-s
* MIV		.324 In/Sec	.208 G-s
* MOV		.059 In/Sec	.151 G-s
WBOSTRP	- WEST Booster PUMP	(09-Jul-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.075 In/Sec	.671 G-s
MIH		.033 In/Sec	.668 G-s
MIA		.026 In/Sec	.223 G-s
PIA		.115 In/Sec	1.549 G-s
PIH		.114 In/Sec	.760 G-s
POH		.146 In/Sec	1.545 G-s
EBOSTRP	- EAST Booster PUMP	(11-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.048 In/Sec	.273 G-s
MIH		.061 In/Sec	.275 G-s
MIA		.032 In/Sec	.265 G-s
PIA		.060 In/Sec	.091 G-s
PIH		.075 In/Sec	.072 G-s

	POH	.080 In/Sec	.107 G-s

ECSWP 1LFT - EAST CASTER SPRAY WP 1 LEFT (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.646 In/Sec	.426 G-s
MIH	.200 In/Sec	.697 G-s
MIA	.296 In/Sec	.343 G-s
* PIH	.150 In/Sec	.343 G-s

MCSWP 2LFT - MID CASTER SPRAY WP 2 LEFT (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	2.490 In/Sec	1.519 G-s
MIH	.782 In/Sec	1.089 G-s
MIA	.488 In/Sec	.887 G-s
* PIA	.141 In/Sec	.887 G-s

MCSWP 3RT - MID CASTER SPRAY WP 3 RIGHT (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.471 In/Sec	.432 G-s
MIH	.149 In/Sec	.264 G-s
MIA	.422 In/Sec	.250 G-s

WCSWP 4RT - WEST CASTER SPRAY WP 4 RIGH (17-Jun-20)

	OVERALL LEVEL	1K-20KHz
MOH	.153 In/Sec	.435 G-s
MIH	.095 In/Sec	.385 G-s
MIA	.106 In/Sec	.417 G-s

ESERVOHYDP - EAST SERVO Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.015 In/Sec	.184 G-s
MIH	.052 In/Sec	.189 G-s
PIV	.105 In/Sec	.432 G-s

MSERVOHYDP - MIDDLE SERVO Hyd PUMP (17-Jun-20)

	OVERALL LEVEL	1K-20KHz
MOH	.119 In/Sec	.188 G-s
MIH	.094 In/Sec	.250 G-s
PIV	.104 In/Sec	1.039 G-s

WSERVOHYDP - WEST SERVO Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.115 In/Sec	.187 G-s
MIH	.081 In/Sec	.337 G-s
PIV	.092 In/Sec	.690 G-s

SERVOHRECP - SERVO Hyd RECIRC PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.064 In/Sec	.125 G-s
MIH	.043 In/Sec	.261 G-s
PIV	.049 In/Sec	.974 G-s

N2DECKHYDP - North 2ND DECK Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.154 In/Sec	1.183 G-s
MIH	.096 In/Sec	.550 G-s
PIV	.234 In/Sec	1.174 G-s

2DEKRECIP - 2ND DECK L&S Hyd RECIRC PUM (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.136 In/Sec	.352 G-s
MIH	.088 In/Sec	.508 G-s
PIV	.236 In/Sec	2.019 G-s

M2DECKHYDP - MIDDLE 2ND DECK Hyd PUMP (09-Dec-19)

	OVERALL LEVEL	1K-20KHz
MOH	.242 In/Sec	.208 G-s
MIH	.157 In/Sec	.193 G-s
PIV	1.045 In/Sec	1.005 G-s

S2DECKHYDP - SOUTH 2ND DECK Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.423 In/Sec	.902 G-s
MIH	.579 In/Sec	.343 G-s
PIV	.492 In/Sec	2.683 G-s

1SUPLYP - #1 Supply Pump (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.052 In/Sec	.205 G-s
MIH	.063 In/Sec	.262 G-s
MIA	.071 In/Sec	.112 G-s
PIA	.179 In/Sec	.724 G-s
PIH	.134 In/Sec	.639 G-s
POH	.155 In/Sec	.526 G-s

2SUPLYP - #2 Supply Pump (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.050 In/Sec	.815 G-s
MIH	.054 In/Sec	.949 G-s
MIA	.055 In/Sec	.712 G-s
PIA	.218 In/Sec	.787 G-s
PIH	.175 In/Sec	.496 G-s
POH	.274 In/Sec	1.931 G-s
* POV	.230 In/Sec	1.931 G-s

3SUPLYP - #3 Supply Pump (09-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.048 In/Sec	.799 G-s
MIH	.061 In/Sec	.904 G-s
MIA	.063 In/Sec	.615 G-s
PIA	.180 In/Sec	.721 G-s
PIH	.155 In/Sec	.759 G-s
POH	.241 In/Sec	1.761 G-s

4SUPLYP - #4 Supply Pump (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.052 In/Sec	.567 G-s
MIH	.045 In/Sec	.611 G-s
MIA	.065 In/Sec	.542 G-s
PIA	.172 In/Sec	.862 G-s
PIH	.174 In/Sec	.580 G-s
POH	.181 In/Sec	.684 G-s

5SUPLYP - #5 Supply Pump (09-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.617 G-s
MIH	.036 In/Sec	.437 G-s
MIA	.075 In/Sec	.445 G-s
PIA	.167 In/Sec	1.495 G-s
PIH	.170 In/Sec	.906 G-s
POH	.191 In/Sec	.989 G-s

6SUPLYP - #6 Supply Pump (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.040 In/Sec	.297 G-s
MIH	.058 In/Sec	.256 G-s
MIA	.068 In/Sec	.112 G-s
PIA	.190 In/Sec	1.164 G-s
PIH	.176 In/Sec	.818 G-s
POH	.211 In/Sec	1.156 G-s
* POV	.132 In/Sec	1.295 G-s

CBRA - CASTER BAGHOUSE REVERSE AIR (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.350 G-s
MIH	.033 In/Sec	.202 G-s
MIA	.029 In/Sec	.282 G-s
FIH	.028 In/Sec	.381 G-s
FOH	.049 In/Sec	.224 G-s
* FOV	.039 In/Sec	.072 G-s

* FIV	.048 In/Sec	.076 G-s	

CBID - CASTER BAGHOUSE ID FAN (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.047 In/Sec	.067 G-s
MOV	.034 In/Sec	.078 G-s
MIH	.049 In/Sec	.190 G-s
MIV	.035 In/Sec	.190 G-s
MIA	.026 In/Sec	.209 G-s
FIA	.057 In/Sec	.489 G-s
FIH	.078 In/Sec	2.872 G-s
FIV	.046 In/Sec	2.268 G-s
FOH	.075 In/Sec	1.205 G-s
FOV	.019 In/Sec	1.583 G-s
FOA	.047 In/Sec	1.405 G-s

FRAF - Furnace REVERSE AIR Fan (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.040 In/Sec	.536 G-s
MIH	.037 In/Sec	.261 G-s
MIA	.036 In/Sec	.070 G-s
FIA	.052 In/Sec	.138 G-s
FIH	.083 In/Sec	.358 G-s
FOH	.042 In/Sec	.232 G-s

EFBHF - East Furnace Bag House Fan (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.514 G-s
MIH	.050 In/Sec	.528 G-s
MIA	.041 In/Sec	.155 G-s
FIA	.071 In/Sec	.292 G-s
FIH	.055 In/Sec	.778 G-s
FOH	.083 In/Sec	1.335 G-s

WFBHF - WEST Furnace Bag House Fan (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.046 In/Sec	.532 G-s
MIH	.071 In/Sec	.468 G-s
MIA	.182 In/Sec	.397 G-s
FIA	.083 In/Sec	.467 G-s
FIH	.078 In/Sec	1.219 G-s
FOH	.078 In/Sec	1.272 G-s
* FOV	.068 In/Sec	.654 G-s
* FIV	.144 In/Sec	.368 G-s

NCHYDP - North CASTER Hyd PUMP (17-Jun-20)

	OVERALL LEVEL	1K-20KHz
MOH	.046 In/Sec	.303 G-s
MIH	.029 In/Sec	.235 G-s
* MIA	.034 In/Sec	.252 G-s
* PIA	.055 In/Sec	.229 G-s
PIH	.049 In/Sec	.510 G-s
* POH	.079 In/Sec	.417 G-s

MIDCHYDP - MIDDLE CASTER Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.085 In/Sec	.325 G-s
MIH	.083 In/Sec	1.385 G-s
* MIA	.074 In/Sec	.172 G-s
* PIA	.141 In/Sec	.325 G-s
PIH	.137 In/Sec	.504 G-s
* POH	.143 In/Sec	.436 G-s

SCHYDP - SOUTH CASTER Hyd PUMP (11-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.071 In/Sec	.636 G-s
MIH	.038 In/Sec	.607 G-s
* MIA	.055 In/Sec	.157 G-s
* PIA	.092 In/Sec	.573 G-s
PIH	.160 In/Sec	2.047 G-s

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          * POH                       .124 In/Sec       .859 G-s

      SCEXFAN    - SPRAY CHAMBER EXHAUST Fan     (11-Aug-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .997 In/Sec       .033 G-s
             MIH                    .944 In/Sec       .057 G-s
             MIA                    .329 In/Sec       .072 G-s
             FIH                    .469 In/Sec       .297 G-s
             FOH                    .460 In/Sec      1.912 G-s

      ENARCOHYDP - EAST NARCO Hyd PUMP           (11-Aug-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .054 In/Sec       .050 G-s
             MIH                    .058 In/Sec       .103 G-s
             PIV                    .227 In/Sec       .626 G-s

      WNARCOHYDP - WEST NARCO Hyd PUMP           (09-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .322 In/Sec      .0020 G-s
             MIH                    .259 In/Sec      .0083 G-s
             PIV                    .482 In/Sec      .0067 G-s

      NC OCILLA  - North Caster Oscillator       (11-Aug-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .193 In/Sec       .047 G-s
             MIH                    .162 In/Sec       .172 G-s
             MIA                    .153 In/Sec       .504 G-s
             GIA                    .102 In/Sec       .147 G-s
             GIH                    .141 In/Sec       .492 G-s
             GOH                    .151 In/Sec       .571 G-s

      MC OCILLA  - Middle Caster Oscillator      (11-Aug-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .173 In/Sec       .096 G-s
             MIH                    .151 In/Sec       .114 G-s
             MIA                    .121 In/Sec       .225 G-s
             GIA                    .090 In/Sec       .100 G-s
             GIH                    .124 In/Sec       .132 G-s
             GOH                    .114 In/Sec       .119 G-s

      SC OCILLA  - South Caster Oscillator       (11-Aug-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .120 In/Sec       .155 G-s
             MIH                    .120 In/Sec       .059 G-s
             MIA                    .099 In/Sec       .166 G-s
             GIA                    .102 In/Sec       .159 G-s
             GIH                    .095 In/Sec       .356 G-s
             GOH                    .105 In/Sec       .204 G-s

      Extra 1    - Extra 1                       (17-Oct-19)
                                   OVERALL LEVEL     1 - 20 KHz
             MIH                    .278 In/Sec       .421 G-s
             MIA                    .163 In/Sec       .369 G-s

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   Clarification Of Vibration Units:
      Acc      -->  G-s      RMS
      Vel      -->  In/Sec   PK

     * - Indicates Data Has Date/Time Different From Machine Date/Time
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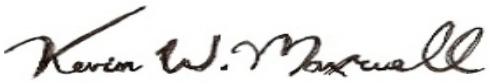
As always, it has been a pleasure to serve NUCOR Steel Flowood-Jackson, MS. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



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