HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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

August 14, 2020

Nucor Roll Mill
Jackson-Flowood, MS

Subject: August 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

Roll Stand 1A Planetary Gearbox
Overall vibration amplitudes are varying with survey while gearbox data show signs of distress. We will continue to monitor this unit closely. Still rated as a **CLASS I** defect for now.

Roll Stand 1 Motor
There has been a significant amount of 360 Hz. vibration especially at the drive end axial of the motor. There are also several rpm sidebands around the 360 Hz. peak. This indicates a drive problem such as SCR card fault. There could also be an issue with the armature. It is recommended to inspect the drive as soon as practical. This issue will be monitored closely. Because of the electrical vibration, this is rated as a **CLASS II** defect.

Roll Stand 2 int. Gearbox
Input rpm sidebands around the gear mesh frequencies indicate possible oscillation of the input gear set. This could be from an issue with the speed synch on the drives, drive line slop, or some other process issue. Gearbox may need an internal inspection in the future. Rated as a **CLASS I** defect.

Roll Stand 5
Vibration decreased in the gearbox outboard side this survey. A dominant gear mesh vibration is present towards the output of the gearbox. The up and down amplitude of this peak from month to month is likely due to change in tooth load and machine speed. We will continue to monitor this very closely. Rated as a **CLASS I** defect for now.

Roll Stand 5 Cooling Fan Motor
There still appears to be a vibration in this unit that may be due to imbalance of the fan wheel. Inspect, clean fan wheel as time allows. Ensure all bolts are tight. We will monitor this closely. Rated as a **CLASS II** defect.

Roll Stand 6
Overall vibration decreased from last month. A dominant gear mesh vibration is present towards the output of the gearbox. The up and down amplitude of this peak is likely due to change in tooth load and speed. This issue seems to have begun after gearbox was repaired. We will continue to monitor this very closely. Rated as a **CLASS I** defect.

Roll Stand 7
Output side of the gearbox vibration decreased this survey. We still suspect this to be possibly due to a resonant gear mesh frequency vibration. The up and down amplitude of this peak from month to month is likely due to change in tooth load and machine speed. We will continue to monitor this very closely. Rated as a **CLASS I** defect.

Roll Stand 9
Vibration has increased this survey in the input side of the gearbox. Overall amplitude much higher than normal. Data shows several harmonics at what appears to be gear mesh frequency of the input gear. It is unclear if process/load is affecting this sudden increase in amplitudes. An inspection of the gearbox may be needed in the near future. Rated as a **CLASS II** defect.

Roll Stand 13 Cooling Fan Motor
Fan appears to have vibration associated with fan imbalance. Resonance may also be a factor as this vibration does seem to vary slightly depending on the speed of the DC motor. We will monitor this closely. Rated as a **CLASS I** defect.

Roll Stand 15
The motor appears to have vibrations that likely indicate fluting of the motor bearings. It is recommended to inspect the motor bearings and ensure that the grounding mechanism is installed and working properly. Rated as a **CLASS II** defect.

Ejector Fan

Overall vibrations are lower in the motor and fan since replacing the motor. There still seems to be higher than normal high frequency acceleration amplitude in the outboard fan bearing. We will monitor this issue closely. Rated as a **CLASS I** defect for now.

Furnace Cooling Tower Drive South

Motor has an increase in axial vibration. This appears to be occurring at 1 x motor rpm and may indicate an issue with the drive coupling or some other structural issue such as loose fasteners. Inspect unit for these types of issues as downtime allows. Rated as a **CLASS II** defect.

Abbreviated Last Measurement Summary
****

Database: nucorja9.rbm
Station: Roll Mill Rolls

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
STD1A	- Stand 1A	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.094 In/Sec	.030 G-s
MIH		.062 In/Sec	.021 G-s
MIA		.066 In/Sec	.093 G-s
COH		.239 In/Sec	.183 G-s
GIA		.037 In/Sec	.040 G-s
GIH		.066 In/Sec	.065 G-s
GI2		.052 In/Sec	.030 G-s
GI3		.044 In/Sec	.134 G-s
GI4		.030 In/Sec	.056 G-s
GI5		.021 In/Sec	.045 G-s
GI6		.018 In/Sec	.079 G-s
GOH		.018 In/Sec	.0098 G-s
STD2A	- Stand 2A	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.115 In/Sec	.056 G-s
MIH		.063 In/Sec	.021 G-s
MIA		.100 In/Sec	.020 G-s
COH		.266 In/Sec	.049 G-s
STD1	- Stand 1	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.097 In/Sec	.215 G-s
MIH		.089 In/Sec	.029 G-s
MIA		.274 In/Sec	.070 G-s
GIA		.079 In/Sec	.032 G-s
GIH		.033 In/Sec	.027 G-s
COH		.120 In/Sec	.086 G-s
STD2	- Stand 2	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.050 In/Sec	.027 G-s
MIH		.070 In/Sec	.044 G-s
MIA		.083 In/Sec	.065 G-s
GIA		.032 In/Sec	.044 G-s
GIH		.047 In/Sec	.045 G-s
COH		.165 In/Sec	.030 G-s
STD3	- Stand 3	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.063 In/Sec	.084 G-s
MIH		.098 In/Sec	.045 G-s
MIA		.098 In/Sec	.112 G-s

	GIA	.032 In/Sec	.067 G-s
	GIH	.038 In/Sec	.047 G-s
	COH	.242 In/Sec	.026 G-s

STD4 - Stand 4 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.041 In/Sec	.074 G-s
MIH	.059 In/Sec	.031 G-s
MIA	.092 In/Sec	.471 G-s
GIA	.036 In/Sec	.014 G-s
GIH	.106 In/Sec	.014 G-s
COH	.159 In/Sec	.061 G-s

STD5 - Stand 5 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.058 In/Sec	.043 G-s
MIH	.075 In/Sec	.056 G-s
MIA	.100 In/Sec	.049 G-s
GIA	.039 In/Sec	.0016 G-s
GIH	.028 In/Sec	.010 G-s
GOH	.107 In/Sec	.071 G-s
COH	.701 In/Sec	.034 G-s

STD6 - Stand 6 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.049 In/Sec	.069 G-s
MIH	.036 In/Sec	.059 G-s
MIA	.083 In/Sec	.036 G-s
GIA	.067 In/Sec	.019 G-s
GIH	.052 In/Sec	.031 G-s
GOH	.206 In/Sec	.046 G-s
COH	.255 In/Sec	.083 G-s

STD7 - Stand 7 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.042 In/Sec	.050 G-s
MIH	.049 In/Sec	.114 G-s
MIA	.049 In/Sec	.051 G-s
GIA	.056 In/Sec	.0051 G-s
GIH	.030 In/Sec	.011 G-s
GOH	.140 In/Sec	.061 G-s
COH	.314 In/Sec	.116 G-s

STD8 - Stand 8 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.037 G-s
MIH	.058 In/Sec	.024 G-s
MIA	.053 In/Sec	.025 G-s
GIA	.097 In/Sec	.130 G-s
GIH	.040 In/Sec	.017 G-s
COH	.138 In/Sec	.041 G-s

STD9 - Stand 9 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.065 G-s
MIH	.193 In/Sec	.164 G-s
MIA	.068 In/Sec	.079 G-s
GIA	.087 In/Sec	.074 G-s
GIH	.076 In/Sec	.681 G-s
COH	.181 In/Sec	.066 G-s

STD10 - Stand 10 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.031 In/Sec	.056 G-s
MIH	.035 In/Sec	.070 G-s
MIA	.046 In/Sec	.030 G-s
GIA	.047 In/Sec	.123 G-s
GIH	.036 In/Sec	.078 G-s
COH	.095 In/Sec	.034 G-s

STD11 - Stand 11 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.023 In/Sec	.027 G-s
MIH	.022 In/Sec	.057 G-s
MIA	.057 In/Sec	.064 G-s
GIA	.044 In/Sec	.019 G-s
GIH	.046 In/Sec	.082 G-s
GOH	.110 In/Sec	.029 G-s

STD14 - Stand 14 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.110 In/Sec	.090 G-s
MIH	.081 In/Sec	.033 G-s
MIA	.073 In/Sec	.085 G-s
GIA	.024 In/Sec	.0097 G-s
GIH	.017 In/Sec	.011 G-s
GOH	.017 In/Sec	.0051 G-s
COH	.392 In/Sec	.034 G-s

STD15 - Stand 15 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.073 In/Sec	.374 G-s
MIH	.079 In/Sec	.326 G-s
MIA	.129 In/Sec	.426 G-s
GIA	.034 In/Sec	.082 G-s
GIH	.039 In/Sec	.085 G-s
COH	.535 In/Sec	.081 G-s

STD16 - Stand 16 (12-Aug-20)

	OVERALL LEVEL	1K-20KHz
MOH	.063 In/Sec	.099 G-s
MIH	.073 In/Sec	.286 G-s
MIA	.083 In/Sec	.171 G-s
GIA	.132 In/Sec	.222 G-s
GIH	.065 In/Sec	.070 G-s
GOH	.046 In/Sec	.142 G-s
COH	.166 In/Sec	.063 G-s

NORTH AC - NORTH AIR COMPRESSOR QUINCY (12-Aug-20)

	OVERALL LEVEL	1 - 20 KHz
MOH	.150 In/Sec	.179 G-s
MIH	.135 In/Sec	.294 G-s
MIA	.208 In/Sec	.121 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.195 In/Sec	.400 G-s
CIH	.203 In/Sec	.538 G-s
COH	.183 In/Sec	.529 G-s

SOUTH AC - SOUTH AIR COMPRESSOR QUINCY (12-Aug-20)

	OVERALL LEVEL	1 - 20 KHz
MOH	.070 In/Sec	.844 G-s
MIH	.138 In/Sec	.473 G-s
MIA	.095 In/Sec	.429 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.202 In/Sec	.555 G-s
CIH	.144 In/Sec	.453 G-s
COH	.204 In/Sec	.582 G-s

WEST AC - WEST AIR COMPRESSOR QUINCY (12-Aug-20)

	OVERALL LEVEL	1 - 20 KHz
MOH	.233 In/Sec	.236 G-s
MIH	.205 In/Sec	.259 G-s
MIA	.297 In/Sec	.097 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.158 In/Sec	.557 G-s
CIH	.179 In/Sec	.626 G-s
COH	.173 In/Sec	.530 G-s

Station: Roll Mill Utilities

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
HYDPMP1	- Hydraulic Pump East	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.169 In/Sec	.145 G-s
MIH		.393 In/Sec	.126 G-s
PIV		.259 In/Sec	.765 G-s
HYDPMP2	- Hydraulic Pump Center	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.110 In/Sec	.650 G-s
MIH		.378 In/Sec	.633 G-s
PIV		.268 In/Sec	.689 G-s
DESFAN	- Desolution Fan	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.043 In/Sec	.035 G-s
MIH		.030 In/Sec	.048 G-s
COMFAN	- Combustion Air Fan	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.145 In/Sec	.141 G-s
MIH		.113 In/Sec	.286 G-s
MIA		.088 In/Sec	.120 G-s
FIH		.071 In/Sec	.210 G-s
FOH		.092 In/Sec	.856 G-s
EJCFAN	- Ejector Air Fan	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.052 In/Sec	.210 G-s
MIH		.034 In/Sec	.860 G-s
MIA		.070 In/Sec	.704 G-s
FIH		.032 In/Sec	.733 G-s
FOH		.040 In/Sec	1.496 G-s
COLPMP2	- Furnace Cooling Pump center	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.209 In/Sec	.352 G-s
MIH		.116 In/Sec	.157 G-s
MIA		.080 In/Sec	.124 G-s
FCTSOUTH	- Furnace CT Drive South	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.310 In/Sec	.018 G-s
MIH		.139 In/Sec	.048 G-s
MIA		.521 In/Sec	.012 G-s
FCTNORTH	- Furnace CT Drive North	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.387 In/Sec	.047 G-s
MIH		.195 In/Sec	.131 G-s
MIA		.159 In/Sec	.036 G-s
SCLPMP2	- Scale Pit Pump North	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.234 In/Sec	.215 G-s
MIH		.132 In/Sec	.253 G-s
MIA		.115 In/Sec	.178 G-s
PIH		.133 In/Sec	.054 G-s
CTWTR2	- CT Pump West	(12-Aug-20)	
		OVERALL LEVEL	1K-20KHz
MOH		.137 In/Sec	.407 G-s
MIH		.104 In/Sec	.632 G-s
MIA		.122 In/Sec	.390 G-s

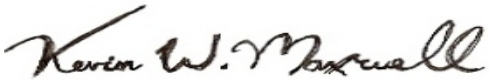
```
      MILWTR3    - Mill Water Pump West          (12-Aug-20)
                                  OVERALL LEVEL     1K-20KHz
             MOH                   .075 In/Sec       .396 G-s
             MIH                   .048 In/Sec       .491 G-s
             MIA                   .031 In/Sec       .326 G-s

      MILWTR1    - Mill Water Pump East          (12-Aug-20)
                                  OVERALL LEVEL     1K-20KHz
             MOH                   .059 In/Sec       .244 G-s
             MIH                   .058 In/Sec       .334 G-s
             MIA                   .043 In/Sec       .090 G-s

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

As always, it has been a pleasure to NUCOR Steel Flowood, MS. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

Cell: 901-486-4565
Email: kwilliam@gohispeed.com