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

June 26th, 2023

Nucor Roll Mill
Jackson-Flowood, MS

Subject: June vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on June 20-21, 2023. 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.

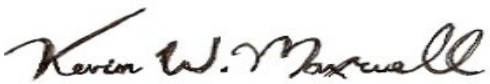
Class III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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

Hi-Speed **Industrial Service** tests and inspects industrial machinery and equipment and makes recommendations concerning maintenance and repairs based on its experience in the field of industrial repair and maintenance. The information contained herein is provided as an opinion only, not as a guaranty or warranty of the matters discussed herein.

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

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

Defects

Roll Stand 1A

Drive motor data is now showing some signs of bearing issues in the motor. Planetary gearbox also has some vibration and noise floor in spectral data at the input end of the gearbox. The increased amplitudes and gear mesh frequencies in spectral data may be influenced some due to load and speed; however the noise floor and high g's are concerning and may indicate internal wear or defects in internal components. We are monitoring this closely. **Motor is rated as a CLASS II defect.** Gearbox is a **CLASS I** defect.

Roll Stand 2

Inboard gearbox (Int.) is showing some gear mesh vibration with sidebands of input rpm. This issue appears to come and go based on load and speed. This type of vibration is an indication of heavy tooth load or possible gear wear. Rated as a **CLASS I** defect for now.

Roll Stand 5

Cooling fan motor still has elevated 1 x rpm vibration with some DC drive motor rpm vibration as well (this may be a resonance). Check all fasteners and motor frame for looseness. The cooling fan may have build up causing imbalance. As far as gearbox goes, gear mesh vibration increased some this month. Previous gear inspections of the gearbox show some tooth wear in this 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. This is rated as a **CLASS II** defect.

Roll Stand 6

Gear mesh vibration was lower in amplitude this month. A dominant gear mesh vibration is sometimes 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. We will continue to monitor this very closely. Because of the high amplitude this month, this issue is rated as a **CLASS II** defect.

Roll Stand 7

Gearbox vibration was quite a bit lower this survey. High gear mesh harmonics on outboard end gear casing. 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. Because of the high amplitudes in the gearbox, this is rated as a **CLASS II** defect.

Roll Stand 14

Drive motor spectral data shows some non-synchronous peaks that are evident of bearing defects. This may be a fluting issue of the bearing races. Motor will likely need attention in the next few months. Rated as a **CLASS II** defect for now.

Roll Stand 15

Motor was not in service this survey; however, the following likely still applies Drive motor inboard data is showing some newly presence of non-synchronous peaks in spectral data. This indicates some minor bearings defects are likely present in DE motor bearing. This is minor as of now and this will be watched closely. Rated as a **CLASS I** defect.

North and South Quincy Air Compressor

Compressors have elevated drive end axial vibration. Data shows vibration to be at 1 x input rpm. For now check compressor shaft for run-out and ensure coupling is in good condition and properly aligned. Soft/flexible base may also be causing some of this vibration. Rated as a **CLASS II** defect.

Furnace Cooling Tower Drives North and South

Motors data shows axial and radial vibration that appears to be occurring at or near 1 x motor rpm and may indicate a structural issue such as loose fasteners, weak flexible motor base. This could also be caused by a resonance or air flow turbulence in this unit. We will continue to monitor this issue closely. Rated as a **CLASS II** defect.

Mill Water West Pump

Motor was not in operation this survey; however, the following still applies: Top thrust bearing spectral data shows signs of bearing defects according to the spectral data of the Outboard end of the motor. This appears to be light defects at this time and will be monitored closely. Rated as a **CLASS I** defect.

Ejector Fan

Fan outboard bearing is showing some ½ harmonics of rpm in the spectral data. The fan seemed to have a strange type of noise which appeared to come and go as the load changed. For now, inspect fan bearing clearances and inspect fan wheel ensuring the fan wheel is not rubbing into inner cone. Inspect fan wheel for cracks also. Rated as a **CLASS II** defect.

Abbreviated Last Measurement Summary
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Database: nucorja9.rbm
Station: Roll Mill Rolls

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
STD1A - Stand 1A	(22-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.081 In/Sec	.261 G-s
MIH	.071 In/Sec	.600 G-s
MIA	.126 In/Sec	1.035 G-s
* COH	.173 In/Sec	.049 G-s
* GIA	.104 In/Sec	.282 G-s
* GIH	.213 In/Sec	.538 G-s
* GI2	.192 In/Sec	.484 G-s
* GI3	.155 In/Sec	.397 G-s
* GI4	.126 In/Sec	.814 G-s
* GI5	.084 In/Sec	.361 G-s
* GI6	.069 In/Sec	.0067 G-s
* GOH	.066 In/Sec	.036 G-s
STD2A - Stand 2A	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.051 In/Sec	.020 G-s
MIH	.027 In/Sec	.033 G-s
MIA	.047 In/Sec	.023 G-s
COH	.136 In/Sec	.036 G-s
STD1 - Stand 1	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.105 In/Sec	.041 G-s
MIH	.054 In/Sec	.0097 G-s
MIA	.074 In/Sec	.013 G-s
GIA	.034 In/Sec	.019 G-s
GIH	.081 In/Sec	.042 G-s
COH	.083 In/Sec	.016 G-s
STD2 - Stand 2	(22-Jun-23)	
	OVERALL LEVEL	1K-20KHz

	MOH	.101 In/Sec	.079 G-s
	MIH	.111 In/Sec	.087 G-s
	MIA	.214 In/Sec	.097 G-s
	GIA	.099 In/Sec	.108 G-s
	GIH	.102 In/Sec	.058 G-s
	COH	.378 In/Sec	.045 G-s

STD3 - Stand 3 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.045 In/Sec	.045 G-s
	MIH	.061 In/Sec	.043 G-s
	MIA	.128 In/Sec	.036 G-s
	GIA	.046 In/Sec	.014 G-s
	GIH	.056 In/Sec	.018 G-s
	COH	.155 In/Sec	.102 G-s

STD4 - Stand 4 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.059 In/Sec	.028 G-s
	MIH	.159 In/Sec	.019 G-s
	MIA	.085 In/Sec	.030 G-s
	GIA	.047 In/Sec	.063 G-s
	GIH	.046 In/Sec	.026 G-s
	COH	.204 In/Sec	.048 G-s

STD5 - Stand 5 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.039 In/Sec	.033 G-s
*	MIH	.060 In/Sec	.181 G-s
*	MIA	.099 In/Sec	.020 G-s
*	GIA	.112 In/Sec	.010 G-s
*	GIH	.134 In/Sec	.061 G-s
	GOH	.730 In/Sec	.376 G-s
*	COH	.420 In/Sec	.028 G-s

STD6 - Stand 6 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.093 In/Sec	.021 G-s
	MIH	.067 In/Sec	.034 G-s
	MIA	.102 In/Sec	.014 G-s
	GIA	.140 In/Sec	.0061 G-s
	GIH	.039 In/Sec	.0092 G-s
	GOH	.133 In/Sec	.136 G-s
	COH	.320 In/Sec	.039 G-s

STD7 - Stand 7 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.041 In/Sec	.048 G-s
	MIH	.041 In/Sec	.085 G-s
	MIA	.064 In/Sec	.195 G-s
	GIA	.184 In/Sec	.087 G-s
	GIH	.066 In/Sec	.034 G-s
	GOH	.550 In/Sec	.946 G-s
	COH	.318 In/Sec	.057 G-s

STD8 - Stand 8 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.084 In/Sec	.032 G-s
	MIH	.109 In/Sec	.021 G-s
	MIA	.088 In/Sec	.273 G-s
	GIA	.084 In/Sec	.0069 G-s
	GIH	.083 In/Sec	.046 G-s
	COH	.234 In/Sec	.146 G-s

STD9 - Stand 9 (22-Jun-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.054 In/Sec	.040 G-s
	MIH	.054 In/Sec	.084 G-s
	MIA	.067 In/Sec	.122 G-s
	GIA	.042 In/Sec	.0088 G-s

	GIH	.118 In/Sec	1.057 G-s
	COH	.147 In/Sec	.048 G-s

STD10 - Stand 10 (22-Jun-23)

	OVERALL LEVEL	1K-20KHz
MOH	.067 In/Sec	.054 G-s
MIH	.068 In/Sec	.051 G-s
MIA	.045 In/Sec	.051 G-s
GIA	.128 In/Sec	.188 G-s
GIH	.073 In/Sec	.130 G-s
COH	.287 In/Sec	.126 G-s

STD11 - Stand 11 (22-Jun-23)

	OVERALL LEVEL	1K-20KHz
MOH	.032 In/Sec	.035 G-s
MIH	.028 In/Sec	.140 G-s
MIA	.031 In/Sec	.099 G-s
GIA	.053 In/Sec	.058 G-s
GIH	.067 In/Sec	.169 G-s
GOH	.063 In/Sec	.045 G-s
COH	.192 In/Sec	.029 G-s

STD13 - Stand 13 (22-Jun-23)

	OVERALL LEVEL	1K-20KHz
MOH	.054 In/Sec	.301 G-s
MIH	.101 In/Sec	.544 G-s
MIA	.165 In/Sec	.387 G-s
GIA	.050 In/Sec	.017 G-s
GIH	.034 In/Sec	.025 G-s
GOH	.037 In/Sec	.0045 G-s
COH	.275 In/Sec	.124 G-s

STD14 - Stand 14 (22-Jun-23)

	OVERALL LEVEL	1K-20KHz
MOH	.264 In/Sec	.351 G-s
MIH	.211 In/Sec	.187 G-s
MIA	.131 In/Sec	.178 G-s
GIA	.067 In/Sec	.055 G-s
GIH	.035 In/Sec	.059 G-s
GOH	.041 In/Sec	.018 G-s
COH	.163 In/Sec	.163 G-s

NORTH AC - NORTH AIR COMPRESSOR QUINCY (22-Jun-23)

	OVERALL LEVEL	1 - 20 KHz
MOH	.112 In/Sec	.770 G-s
MIH	.064 In/Sec	.400 G-s
MIA	.096 In/Sec	.819 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.364 In/Sec	.438 G-s
CIH	.255 In/Sec	.545 G-s
COH	.204 In/Sec	.355 G-s

SOUTH AC - SOUTH AIR COMPRESSOR QUINCY (22-Jun-23)

	OVERALL LEVEL	1 - 20 KHz
MOH	.111 In/Sec	.217 G-s
MIH	.103 In/Sec	.118 G-s
MIA	.398 In/Sec	.194 G-s
	OVERALL LEVEL	1K-20KHz
CIA	.466 In/Sec	.583 G-s
CIH	.265 In/Sec	.467 G-s
COH	.241 In/Sec	.338 G-s

Station: Roll Mill Utilities

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
HYDPMP2 - Hydraulic Pump Center	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.060 In/Sec	.230 G-s
MIH	.158 In/Sec	.236 G-s
PIV	.272 In/Sec	.556 G-s
HYDPMP3 - Hydraulic Pump West	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.118 In/Sec	.220 G-s
MIH	.278 In/Sec	.525 G-s
PIV	.277 In/Sec	1.206 G-s
DESFAN - Desolution Fan	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.045 In/Sec	.054 G-s
MIH	.058 In/Sec	.026 G-s
COMFAN - Combustion Air Fan	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.110 In/Sec	.155 G-s
MIH	.105 In/Sec	.178 G-s
MIA	.130 In/Sec	.142 G-s
FIH	.071 In/Sec	.175 G-s
FOH	.153 In/Sec	.426 G-s
EJCFAN - Ejector Air Fan	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.196 In/Sec	.236 G-s
MIH	.198 In/Sec	.267 G-s
MIA	.097 In/Sec	.132 G-s
FIA	.104 In/Sec	.246 G-s
FIH	.101 In/Sec	.450 G-s
FOH	.246 In/Sec	.769 G-s
COLPMP2 - Furnace Cooling Pump center	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.414 In/Sec	.186 G-s
MIH	.234 In/Sec	.123 G-s
MIA	.166 In/Sec	.107 G-s
FCTSOUTH - Furnace CT Drive South	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.128 In/Sec	.110 G-s
MIH	.176 In/Sec	.071 G-s
MIA	.346 In/Sec	.022 G-s
FCTNORTH - Furnace CT Drive North	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.390 In/Sec	.058 G-s
MIH	.354 In/Sec	.112 G-s
MIA	.129 In/Sec	.074 G-s
SCLPMP2 - Scale Pit Pump North	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.317 In/Sec	.161 G-s
MIH	.113 In/Sec	.371 G-s
MIA	.157 In/Sec	.222 G-s
CTWTR2 - CT Pump West	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz
MOH	.185 In/Sec	.364 G-s
MIH	.147 In/Sec	.295 G-s
MIA	.123 In/Sec	.212 G-s
MILWTR2 - Mill Water Pump Center	(21-Jun-23)	
	OVERALL LEVEL	1K-20KHz

MOH	.074 In/Sec	.129 G-s
MIH	.072 In/Sec	.659 G-s
MIA	.043 In/Sec	.606 G-s

MILWTR1 - Mill Water Pump East (21-Jun-23)

	OVERALL LEVEL	1K-20KHz
MOH	.052 In/Sec	.284 G-s
MIH	.049 In/Sec	.436 G-s
MIA	.033 In/Sec	.285 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK