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September 28, 2023

Nucor Roll Mill
Jackson-Flowood, MS

Subject: September vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on September , 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.

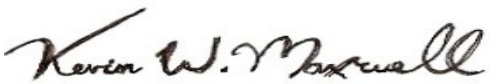
Class III; Defect (s) present that may cause failure in short term (less than 2 months). This should be addressed as soon as practical, with a high maintenance priority. Increase monitoring frequency.

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,



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Defects

Roll Stand 1A
Planetary gearbox also has some increased 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, they may also indicate internal wear or defects in internal components. We are monitoring this closely. Rated as a **CLASS I** defect.

Roll Stand 2
Inboard gearbox (Int.) is showing some elevated 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. 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 decreased quite a bit 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 slightly higher 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. This is rated as a **CLASS I** defect.

Roll Stand 7
Gearbox vibration was significantly higher in amplitude this survey. Vibration data shows high amplitude gear mesh harmonics on outboard end of the gear casing. We 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 outboard end of gearbox, this is rated as a **CLASS II** defect.

Roll Stand 8 and 9 COOLING FANS
It appears that the newly installed cooling fan structure for 8 and 9 stands is resonant at three different frequencies. A bump test was performed on the structure to determine the natural frequencies of the structure. 13, 15.5, and 19 Hz. are natural frequencies of the structure. The first peak at 13 Hz. is close to the rpm of the motor under load. This is causing excessive vibration of the cooling fan frame. For now, it is recommended to install a flexible expansion joint between the motor and cooling fan ducting/housing. This should help isolate the motor from the cooling fan structure. Rated as a **CLASS II** defect.

Roll Stand 14
Stand was not in operation; however, the following still applies: 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
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.

Furnace Cooling Tower Drive South
Motor 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.

South Air Compressor
Motor has an increase in 1 x rpm vibration especially in the axial direction. For now, check coupling and ensure alignment is good. Rated as a **CLASS II** defect.

West Air Compressor
Motor and compressor has an increase in 1 x rpm vibration with vibration being the highest in the axial direction. For now, check couplings, check all base fasteners, and ensure alignment is good. Rated as a **CLASS III** 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 bearing data is still showing some ½ harmonics of rpm in the spectral data. 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
Route No. 1: RM ROLL DRIVES

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
STD1A	- Stand 1A	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.131 In/Sec	.031 G-s
	MIH	.084 In/Sec	.019 G-s
	MIA	.105 In/Sec	.040 G-s
	COH	.207 In/Sec	.067 G-s
	GIA	.156 In/Sec	.155 G-s
	GIH	.238 In/Sec	1.129 G-s
	GI2	.220 In/Sec	.556 G-s
	GI3	.208 In/Sec	.417 G-s
	GI4	.172 In/Sec	.670 G-s
	GI5	.120 In/Sec	.577 G-s
	GI6	.087 In/Sec	.130 G-s
	GOH	.086 In/Sec	.039 G-s
STD2A	- Stand 2A	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.055 In/Sec	.027 G-s
	MIH	.049 In/Sec	.131 G-s
	MIA	.098 In/Sec	.078 G-s
	COH	.097 In/Sec	.107 G-s
STD1	- Stand 1	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.098 In/Sec	.253 G-s
	MIH	.038 In/Sec	.061 G-s
	MIA	.587 In/Sec	.188 G-s
	GIA	.058 In/Sec	.044 G-s

	GIH	.034 In/Sec	.043 G-s
	COH	.066 In/Sec	.043 G-s

STD2 - Stand 2 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.151 In/Sec	.071 G-s
MIH	.129 In/Sec	.145 G-s
MIA	.439 In/Sec	.246 G-s
GIA	.109 In/Sec	.045 G-s
GIH	.086 In/Sec	.093 G-s
COH	.326 In/Sec	.075 G-s

STD3 - Stand 3 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.060 In/Sec	.039 G-s
MIH	.082 In/Sec	.074 G-s
MIA	.102 In/Sec	.093 G-s
GIA	.023 In/Sec	.025 G-s
GIH	.037 In/Sec	.034 G-s
COH	.170 In/Sec	.070 G-s

STD4 - Stand 4 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.042 In/Sec	.086 G-s
MIH	.059 In/Sec	.024 G-s
MIA	.070 In/Sec	.161 G-s
GIA	.066 In/Sec	.425 G-s
GIH	.053 In/Sec	.488 G-s
COH	.181 In/Sec	.060 G-s

STD5 - Stand 5 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.033 In/Sec	.066 G-s
MIH	.050 In/Sec	.131 G-s
MIA	.111 In/Sec	.055 G-s
GIA	.087 In/Sec	.0051 G-s
GIH	.066 In/Sec	.057 G-s
GOH	.183 In/Sec	.177 G-s
COH	.391 In/Sec	.126 G-s

STD6 - Stand 6 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.072 In/Sec	.037 G-s
MIH	.068 In/Sec	.032 G-s
MIA	.085 In/Sec	.056 G-s
GIA	.096 In/Sec	.043 G-s
GIH	.043 In/Sec	.172 G-s
GOH	.254 In/Sec	.290 G-s
COH	.194 In/Sec	.092 G-s

STD7 - Stand 7 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.046 In/Sec	.068 G-s
MIH	.031 In/Sec	.213 G-s
MIA	.059 In/Sec	.192 G-s
GIA	.096 In/Sec	.170 G-s
GIH	.045 In/Sec	.058 G-s
GOH	.240 In/Sec	.094 G-s
COH	.433 In/Sec	.168 G-s

STD8 - Stand 8 (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.064 In/Sec	.012 G-s
MIH	.070 In/Sec	.044 G-s
MIA	.060 In/Sec	.121 G-s
GIA	.037 In/Sec	.090 G-s
GIH	.032 In/Sec	.171 G-s
COH	.172 In/Sec	.102 G-s

STD9	- Stand 9	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.055 In/Sec	.066 G-s
	MIH	.066 In/Sec	.122 G-s
	MIA	.072 In/Sec	.134 G-s
	GIA	.071 In/Sec	.133 G-s
	GIH	.070 In/Sec	.321 G-s
	COH	.260 In/Sec	.138 G-s
STD10	- Stand 10	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.041 In/Sec	.021 G-s
	MIH	.048 In/Sec	.039 G-s
	MIA	.144 In/Sec	.022 G-s
	GIA	.095 In/Sec	.369 G-s
	GIH	.078 In/Sec	.355 G-s
	COH	.188 In/Sec	.356 G-s
STD11	- Stand 11	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.023 In/Sec	.043 G-s
	MIH	.028 In/Sec	.115 G-s
	MIA	.032 In/Sec	.075 G-s
	GIA	.052 In/Sec	.117 G-s
	GIH	.066 In/Sec	.327 G-s
	GOH	.057 In/Sec	.048 G-s
	COH	.125 In/Sec	.079 G-s
STD12	- Stand 12	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.025 In/Sec	.025 G-s
	MIH	.028 In/Sec	.062 G-s
	MIA	.065 In/Sec	.126 G-s
	COH	.089 In/Sec	.031 G-s
STD13	- Stand 13	(25-Sep-23)	
		OVERALL LEVEL	1K-20KHz
	MOH	.041 In/Sec	.164 G-s
	MIH	.057 In/Sec	.646 G-s
	MIA	.087 In/Sec	.430 G-s
	GIA	.037 In/Sec	.070 G-s
	GIH	.042 In/Sec	.033 G-s
	GOH	.026 In/Sec	.102 G-s
	COH	.280 In/Sec	.590 G-s
NORTH AC	- NORTH AIR COMPRESSOR QUINCY	(25-Sep-23)	
		OVERALL LEVEL	1 - 20 KHz
	MOH	.110 In/Sec	1.228 G-s
	MIH	.073 In/Sec	.256 G-s
	MIA	.063 In/Sec	.516 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.310 In/Sec	.626 G-s
	CIH	.144 In/Sec	.408 G-s
	COH	.185 In/Sec	.450 G-s
SOUTH AC	- SOUTH AIR COMPRESSOR QUINCY	(25-Sep-23)	
		OVERALL LEVEL	1 - 20 KHz
	MOH	.152 In/Sec	.293 G-s
	MIH	.134 In/Sec	.504 G-s
	MIA	.430 In/Sec	.067 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.377 In/Sec	.506 G-s
	CIH	.103 In/Sec	.304 G-s
	COH	.241 In/Sec	.426 G-s
WEST AC	- WEST AIR COMPRESSOR QUINCY	(25-Sep-23)	
		OVERALL LEVEL	1 - 20 KHz
	MOH	.728 In/Sec	.365 G-s
	MIH	.416 In/Sec	.261 G-s
	MIA	1.383 In/Sec	.225 G-s

	OVERALL LEVEL	1K-20KHz
CIA	1.137 In/Sec	.564 G-s
CIH	.481 In/Sec	.643 G-s
COH	.467 In/Sec	.367 G-s

Database: nucorja9.rbm
Station: Roll Mill Utilities
Route No. 1: UTILITIES

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD

HYDPMP2 - Hydraulic Pump Center (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.056 In/Sec	.301 G-s
MIH	.167 In/Sec	.252 G-s
PIV	.295 In/Sec	.907 G-s

HYDPMP3 - Hydraulic Pump West (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.066 In/Sec	.489 G-s
MIH	.302 In/Sec	.406 G-s
PIV	.261 In/Sec	1.570 G-s

DESFAN - Desolution Fan (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.037 In/Sec	.059 G-s
MIH	.047 In/Sec	.031 G-s

COMFAN - Combustion Air Fan (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.124 In/Sec	.144 G-s
MIH	.096 In/Sec	.169 G-s
MIA	.075 In/Sec	.111 G-s
FIH	.061 In/Sec	.346 G-s
FOH	.080 In/Sec	.413 G-s

EJCFAN - Ejector Air Fan (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.206 In/Sec	.268 G-s
MIH	.185 In/Sec	.309 G-s
MIA	.079 In/Sec	.149 G-s
FIA	.075 In/Sec	.301 G-s
FIH	.101 In/Sec	.345 G-s
FOH	.202 In/Sec	.439 G-s

COLPMP2 - Furnace Cooling Pump center (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.232 In/Sec	.138 G-s
MIH	.280 In/Sec	.247 G-s
MIA	.056 In/Sec	.153 G-s

FCTSOUTH - Furnace CT Drive South (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.417 In/Sec	.110 G-s
MIH	.112 In/Sec	.079 G-s
MIA	.449 In/Sec	.055 G-s

FCTNORTH - Furnace CT Drive North (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.594 In/Sec	.110 G-s
MIH	.409 In/Sec	.083 G-s
MIA	.148 In/Sec	.042 G-s

SCLPMP2 - Scale Pit Pump North (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.478 In/Sec	.139 G-s
MIH	.187 In/Sec	.294 G-s

	MIA	.197 In/Sec	.177 G-s

EASTBOOST - East Booster Pump Small (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.681 In/Sec	.110 G-s
MIH	.415 In/Sec	.106 G-s
MIA	.292 In/Sec	.045 G-s

CTWTR2 - CT Pump West (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.098 In/Sec	.238 G-s
MIH	.183 In/Sec	.192 G-s
MIA	.089 In/Sec	.191 G-s

MILWTR2 - Mill Water Pump Center (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.084 In/Sec	.355 G-s
MIH	.055 In/Sec	.924 G-s
MIA	.045 In/Sec	.498 G-s

MILWTR1 - Mill Water Pump East (25-Sep-23)

	OVERALL LEVEL	1K-20KHz
MOH	.116 In/Sec	.300 G-s
MIH	.087 In/Sec	.311 G-s
MIA	.058 In/Sec	.139 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK