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July 27, 2021

Nucor Roll Mill
Jackson-Flowood, MS

Subject: July vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on July 23, 2021. 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,

Kevin W. Maxwell

ISO Certified Vibration Analyst, Category III

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Defects

Roll Stand 1A Planetary Gearbox
Gearbox data shows some signs of minor internal defects/wear of gearbox. We will continue to monitor this unit closely. Still rated as a **CLASS I** defect for now.

Roll Stand 2
The drive end of the intermediate gearbox showed an increase in gear mesh frequencies with 2 and 4 x GMF being high in amplitude. Input rpm sidebands were also present around the GMF harmonics. These peaks vary in amplitude according to speed and gear load. We will monitor this stand very closely in the future. For now, this is rated as a **CLASS I** defect.

Roll Stand 2 Cooling Fan Motor
Cooling fan motor vibration has increased again this month. Data suggests base looseness. Inspect all hold down bolts and frame for looseness. Rated as a **CLASS II** defect.

Roll Stand 5
Gear mesh vibration is about the same this month. Inspection of the gearbox does 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. Because of the motor bearing issue starting to appear in the spectral data and the visible gear tooth defects this is rated as a **CLASS II** defect for now.

Roll Stand 6
Gear mesh vibration is about the same this 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. We will continue to monitor this very closely. Rated as a **CLASS I** defect.

Roll Stand 7
Gearbox vibration was back up again this month. Mill was running at high load 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. Because of the increase in amplitude this is rated as a **CLASS II** defect.

Roll Stand 8 Cooling Fan Motor
Motor vibration has increased .5 ips-pk this month. On average, this motor runs around .1-.15 ips-pk. Highest vibration is at a frequency that appears to not be synchronous with motor rpm. This could be resonance or structural issue. For now, ensure motor frame is mounted correctly to the drive motor and not loose or have soft foot. Rated as a **CLASS II** defect.

Furnace Cooling Tower Drive South
Motor still has high axial vibration. This appears to be occurring at 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 in this unit since the blade pitch has been altered. We will continue to monitor this issue closely. Rated as a **CLASS II** defect.

Combustion Air Fan
Motor/fan vibration was down some this survey. Historically this unit operates at a speed that appears to be structurally resonant to rpm. Rpm harmonics are present when this occurs which is somewhat odd. These types of harmonics typically are caused by mechanical looseness, but this vibration only occurs when unit is operating as certain rpms. We will monitor this closely. Rated as a **CLASS I** 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	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.148 In/Sec	.038 G-s
	MIH	.041 In/Sec	.092 G-s
	MIA	.176 In/Sec	.462 G-s
	COH	.233 In/Sec	.165 G-s
	GIA	.076 In/Sec	.209 G-s
	GIH	.181 In/Sec	.940 G-s
	GI2	.171 In/Sec	.133 G-s
	GI3	.120 In/Sec	.251 G-s
	GI4	.104 In/Sec	.201 G-s
	GI5	.091 In/Sec	.841 G-s
	GI6	.065 In/Sec	.281 G-s
	GOH	.053 In/Sec	.055 G-s
STD2A	- Stand 2A	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.057 In/Sec	.034 G-s
	MIH	.053 In/Sec	.074 G-s
	MIA	.083 In/Sec	.103 G-s
	COH	.105 In/Sec	.044 G-s
STD1	- Stand 1	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.076 In/Sec	.076 G-s
	MIH	.124 In/Sec	.051 G-s
	MIA	.352 In/Sec	.272 G-s
	GIA	.030 In/Sec	.040 G-s
	GIH	.086 In/Sec	.022 G-s
	COH	.166 In/Sec	.171 G-s
STD2	- Stand 2	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.117 In/Sec	.088 G-s
	MIH	.203 In/Sec	.090 G-s
	MIA	.229 In/Sec	.214 G-s
	GIA	.085 In/Sec	.100 G-s
	GIH	.061 In/Sec	.225 G-s
	COH	.583 In/Sec	.047 G-s
STD3	- Stand 3	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.081 In/Sec	.818 G-s
	MIH	.103 In/Sec	.041 G-s
	MIA	.209 In/Sec	.204 G-s
	GIA	.046 In/Sec	.062 G-s
	GIH	.049 In/Sec	.100 G-s
	COH	.257 In/Sec	.026 G-s
STD4	- Stand 4	(23-Jul-21)	
		OVERALL LEVEL	1K-20KHz
	MOH	.087 In/Sec	.086 G-s
	MIH	.096 In/Sec	.046 G-s
	MIA	.115 In/Sec	.205 G-s
	GIA	.105 In/Sec	.030 G-s
	GIH	.123 In/Sec	.040 G-s

	COH	.220 In/Sec	.064 G-s

STD5 - Stand 5 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.081 In/Sec	.076 G-s
MIH	.079 In/Sec	.062 G-s
MIA	.079 In/Sec	.312 G-s
GIA	.104 In/Sec	.028 G-s
GIH	.074 In/Sec	.088 G-s
GOH	.213 In/Sec	.471 G-s
COH	.459 In/Sec	.050 G-s

STD6 - Stand 6 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.094 In/Sec	.078 G-s
MIH	.056 In/Sec	.079 G-s
MIA	.121 In/Sec	.069 G-s
GIA	.084 In/Sec	.023 G-s
GIH	.066 In/Sec	.060 G-s
GOH	.247 In/Sec	.451 G-s
COH	.228 In/Sec	.044 G-s

STD7 - Stand 7 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.055 In/Sec	.215 G-s
MIH	.065 In/Sec	.172 G-s
MIA	.111 In/Sec	.338 G-s
GIA	.087 In/Sec	.080 G-s
GIH	.087 In/Sec	.075 G-s
GOH	.916 In/Sec	1.629 G-s
COH	.362 In/Sec	.113 G-s

STD9 - Stand 9 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.056 In/Sec	.205 G-s
MIH	.116 In/Sec	.054 G-s
MIA	.104 In/Sec	.098 G-s
GIA	.116 In/Sec	.109 G-s
GIH	.062 In/Sec	.091 G-s
COH	.156 In/Sec	.077 G-s

STD10 - Stand 10 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.038 In/Sec	.035 G-s
MIH	.078 In/Sec	.136 G-s
MIA	.062 In/Sec	.141 G-s
GIA	.108 In/Sec	.530 G-s
GIH	.061 In/Sec	.226 G-s
COH	.125 In/Sec	.091 G-s

STD13 - Stand 13 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.105 In/Sec	.066 G-s
MIH	.123 In/Sec	.116 G-s
MIA	.189 In/Sec	.161 G-s
GIA	.028 In/Sec	.048 G-s
GIH	.034 In/Sec	.068 G-s
GOH	.031 In/Sec	.055 G-s
COH	.249 In/Sec	.323 G-s

STD14 - Stand 14 (23-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.128 In/Sec	.053 G-s
MIH	.108 In/Sec	.041 G-s
MIA	.079 In/Sec	.112 G-s
COH	.335 In/Sec	.030 G-s
GIA	.048 In/Sec	.021 G-s
GIH	.034 In/Sec	.028 G-s
GOH	.029 In/Sec	.012 G-s

NORTH AC - NORTH AIR COMPRESSOR QUINCY (23-Jul-21)			
		OVERALL LEVEL	1 - 20 KHz
	MOH	.245 In/Sec	.320 G-s
	MIH	.204 In/Sec	.459 G-s
	MIA	.336 In/Sec	.250 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.262 In/Sec	.557 G-s
	CIH	.143 In/Sec	.536 G-s
	COH	.277 In/Sec	.460 G-s
SOUTH AC - SOUTH AIR COMPRESSOR QUINCY (23-Jul-21)			
		OVERALL LEVEL	1 - 20 KHz
	MOH	.123 In/Sec	1.035 G-s
	MIH	.177 In/Sec	.475 G-s
	MIA	.092 In/Sec	.432 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.274 In/Sec	.693 G-s
	CIH	.133 In/Sec	.412 G-s
	COH	.226 In/Sec	.494 G-s

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

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
HYDPMP2 - Hydraulic Pump Center (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.043 In/Sec	.308 G-s
MIH	.115 In/Sec	.198 G-s
PIV	.274 In/Sec	.710 G-s
HYDPMP3 - Hydraulic Pump West (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.085 In/Sec	.178 G-s
MIH	.256 In/Sec	.105 G-s
PIV	.271 In/Sec	.533 G-s
DESFAN - Desolution Fan (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.041 In/Sec	.122 G-s
MIH	.040 In/Sec	.023 G-s
COMFAN - Combustion Air Fan (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.133 In/Sec	.153 G-s
MIH	.126 In/Sec	.221 G-s
MIA	.082 In/Sec	.121 G-s
FIH	.078 In/Sec	.266 G-s
FOH	.127 In/Sec	.397 G-s
EJCFAN - Ejector Air Fan (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.136 In/Sec	.319 G-s
MIH	.094 In/Sec	.409 G-s
MIA	.093 In/Sec	.214 G-s
FIH	.050 In/Sec	.552 G-s
FOH	.105 In/Sec	1.062 G-s
COLPMP2 - Furnace Cooling Pump center (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.264 In/Sec	.121 G-s
MIH	.108 In/Sec	.136 G-s
MIA	.113 In/Sec	.178 G-s
FCTSOUTH - Furnace CT Drive South (22-Jul-21)		
	OVERALL LEVEL	1K-20KHz
MOH	.488 In/Sec	.055 G-s

	MIH	.360 In/Sec	.074 G-s
	MIA	.598 In/Sec	.068 G-s

FCTNORTH - Furnace CT Drive North (22-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.475 In/Sec	.073 G-s
MIH	.318 In/Sec	.085 G-s
MIA	.134 In/Sec	.040 G-s

SCLPMP1 - Scale Pit Pump South (22-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.156 In/Sec	.400 G-s
MOV	.114 In/Sec	.400 G-s
MIV	.096 In/Sec	.155 G-s
MIH	.133 In/Sec	.117 G-s
MIA	.085 In/Sec	.097 G-s

CTWTR1 - CT Pump East/Middle Pump (22-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.125 In/Sec	.254 G-s
MIH	.076 In/Sec	.175 G-s
MIA	.076 In/Sec	.182 G-s

MILWTR3 - Mill Water Pump West (22-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.098 In/Sec	.313 G-s
MIH	.051 In/Sec	.390 G-s
MIA	.038 In/Sec	.239 G-s

MILWTR1 - Mill Water Pump East (22-Jul-21)

	OVERALL LEVEL	1K-20KHz
MOH	.054 In/Sec	.231 G-s
MIH	.043 In/Sec	.419 G-s
MIA	.039 In/Sec	.307 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK