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July 29, 2022

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 27, 2022. 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.

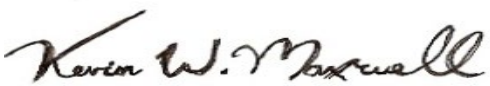
Class II: Defect (s) present that may cause problem in long term (2-6 months). Repair during normal maintenance scheduling. Continue to monitor.

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

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
Gearbox data shows vibration levels to be low again this survey. Input side still has some vibration around 1300 Hz. This is high frequency acceleration and may be gear or bearing related. Seems to be higher in vibration under heavy load. Roll stands were running slower and less loaded during this survey. We will monitor this closely. Rated as a **CLASS I** defect.

Roll Stand 2
Motor had much higher amplitude this survey in the axial direction. Data shows vibration to be related to SCR firing rate. It is recommended to inspect all SCR's in the VFD as soon as practical. Rated as a **CLASS II** defect.

Roll Stand 3
Outboard motor bearing is starting to show some signs of bearing issue. Data is showing outer race defects harmonics on the ODE bearing. This will be monitored very closely in the coming surveys. Rated as a **CLASS II** defect for now.

Roll Stand 5
Gear mesh vibration decreased slightly this month. Last gear 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. This is rated as a **CLASS II** defect.

Roll Stand 6
Gear mesh vibration decreased 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 decreased some 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 high amplitudes in the gearbox and bearing defect related vibrations in the motor, this is rated as a **CLASS II** defect.

Roll Stand 14
The vibration that was seen in the input axial of the gearbox a couple of surveys ago was present again this survey. The change in vibration may be due to process load and speed. We will continue to monitor this closely and report any changes. Rated as a **CLASS I** defect.

Roll Stand 16
Drive motor has bearing issues. Vibration data indicates race defects in the motor bearings which likely caused by electrical fluting. Motor should be scheduled for replacement as scheduling allows. Ensure new motor has proper grounding/fluting protection. Rated as a **CLASS III** defect.

South Quincy Compressor
Inboard motor bearing vibration data shows some signs of defects in the motor bearings. Motor will likely need attention in the near future. Rated as a **CLASS II** defect.

Ejector Fan

Vibration is up some on the fan bearings. Data also shows some recent ½ harmonics of fan rpm. This typically is due to fit looseness or rub. It is recommended to inspect fan wheel/ fan hub for looseness and ensure no rubbing is occurring and perform lift check on fan shaft as time allows. Ensure there isn't any axial play of the fan shaft. Rated as a **CLASS II** defect.

Furnace Cooling Tower Drives North and South

Motors had higher vibrations this survey; however, the normally high vibration in the motor 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 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

Top thrust bearing is showing 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.

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

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
STD1A - Stand 1A	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.058 In/Sec	.044 G-s
MIH - Motor IB Horizontal	.080 In/Sec	.058 G-s
MIA - Motor IB Axial	.098 In/Sec	.061 G-s
COH - COOLING FAN HORZ	.208 In/Sec	.037 G-s
GIA - Gearbox IB Axial	.062 In/Sec	.150 G-s
GIH - Gearbox IB Horizontal	.112 In/Sec	.714 G-s
GI2 - Gearbox 2 BEARING Horizontal	.086 In/Sec	.145 G-s
GI3 - Gearbox 3 BEARING Horizontal	.079 In/Sec	.208 G-s
GI4 - Gearbox 4 BEARING Horizontal	.064 In/Sec	.142 G-s
GI5 - Gearbox 5 BEARING Horizontal	.047 In/Sec	.310 G-s
GI6 - Gearbox 6 BEARING Horizontal	.036 In/Sec	.143 G-s
GOH - Gearbox OB Horizontal	.026 In/Sec	.061 G-s
STD2A - Stand 2A	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.066 In/Sec	.0099 G-s
MIH - Motor IB Horizontal	.034 In/Sec	.082 G-s
MIA - Motor IB Axial	.079 In/Sec	.022 G-s
COH - COOLING FAN HORIZONTAL OUTBOARD	.192 In/Sec	.039 G-s
STD1 - Stand 1	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.107 In/Sec	.131 G-s
MIH - Motor IB Horizontal	.117 In/Sec	.083 G-s

MIA - Motor IB Axial	.599 In/Sec	.445 G-s
GIA - Gearbox IB Axial	.039 In/Sec	.035 G-s
GIH - Gearbox IB Horizontal	.128 In/Sec	.023 G-s
COH - COOLING FAN HORZ	.073 In/Sec	.027 G-s

STD2 - Stand 2 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.177 In/Sec	.122 G-s
MIH - Motor IB Horizontal	.127 In/Sec	.083 G-s
MIA - Motor IB Axial	.607 In/Sec	.728 G-s
GIA - Gearbox IB Axial	.091 In/Sec	.056 G-s
GIH - Gearbox IB Horizontal	.076 In/Sec	.048 G-s
COH - Motor OB Horizontal	.224 In/Sec	.048 G-s

STD3 - Stand 3 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.077 In/Sec	.039 G-s
MIH - Motor IB Horizontal	.115 In/Sec	.071 G-s
MIA - Motor IB Axial	.276 In/Sec	.152 G-s
GIA - Gearbox IB Axial	.037 In/Sec	.110 G-s
GIH - Gearbox IB Horizontal	.048 In/Sec	.114 G-s
COH - COOLING FAN MOH	.186 In/Sec	.066 G-s

STD4 - Stand 4 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.042 In/Sec	.012 G-s
MIH - Motor IB Horizontal	.065 In/Sec	.087 G-s
MIA - Motor IB Axial	.119 In/Sec	.306 G-s
GIA - Gearbox IB Axial	.100 In/Sec	.368 G-s
GIH - Gearbox IB Horizontal	.077 In/Sec	.100 G-s
COH - COOLING FAN MOH	.224 In/Sec	.017 G-s

STD5 - Stand 5 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.041 In/Sec	.029 G-s
MIH - Motor IB Horizontal	.065 In/Sec	.125 G-s
MIA - Motor IB Axial	.083 In/Sec	.068 G-s
GIA - Gearbox IB Axial	.135 In/Sec	.021 G-s
GIH - Gearbox IB Horizontal	.133 In/Sec	.049 G-s
GOH - Gearbox OB Horizontal	.206 In/Sec	.135 G-s
COH - COOLING FAN MOH	.404 In/Sec	.039 G-s

STD6 - Stand 6 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.066 In/Sec	.013 G-s
MIH - Motor IB Horizontal	.071 In/Sec	.044 G-s
MIA - Motor IB Axial	.167 In/Sec	.031 G-s
GIA - Gearbox IB Axial	.038 In/Sec	.0059 G-s
GIH - Gearbox IB Horizontal	.039 In/Sec	.040 G-s
GOH - Gearbox OB Horizontal	.167 In/Sec	.061 G-s
COH - COOLING FAN MOH	.354 In/Sec	.033 G-s

STD7 - Stand 7 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.046 In/Sec	.069 G-s
MIH - Motor IB Horizontal	.037 In/Sec	.076 G-s
MIA - Motor IB Axial	.121 In/Sec	.178 G-s
GIA - Gearbox IB Axial	.052 In/Sec	.0088 G-s
GIH - Gearbox IB Horizontal	.025 In/Sec	.023 G-s
GOH - Gearbox OB Horizontal	.176 In/Sec	.054 G-s
COH - COOLING FAN MOH	.376 In/Sec	.066 G-s

STD8 - Stand 8 (28-Jul-22)

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.044 In/Sec	.022 G-s
MIH - Motor IB Horizontal	.088 In/Sec	.016 G-s
MIA - Motor IB Axial	.063 In/Sec	.160 G-s
GIA - Gearbox IB Axial	.042 In/Sec	.012 G-s
GIH - Gearbox IB Horizontal	.044 In/Sec	.010 G-s
COH - COOLING FAN MOH	.203 In/Sec	.041 G-s

STD9	- Stand 9	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.034 In/Sec	.024 G-s
MIH	- Motor IB Horizontal	.060 In/Sec	.090 G-s
MIA	- Motor IB Axial	.149 In/Sec	.089 G-s
GIA	- Gearbox IB Axial	.133 In/Sec	.027 G-s
GIH	- Gearbox IB Horizontal	.082 In/Sec	.092 G-s
COH	- COOLING FAN MOH	.148 In/Sec	.058 G-s
STD10	- Stand 10	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.037 In/Sec	.018 G-s
MIH	- Motor IB Horizontal	.048 In/Sec	.0084 G-s
MIA	- Motor IB Axial	.095 In/Sec	.037 G-s
GIA	- Gearbox IB Axial	.041 In/Sec	.127 G-s
GIH	- Gearbox IB Horizontal	.047 In/Sec	.155 G-s
COH	- COOLING FAN MOH	.139 In/Sec	.055 G-s
STD11	- Stand 11	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.018 In/Sec	.021 G-s
MIH	- Motor IB Horizontal	.028 In/Sec	.024 G-s
MIA	- Motor IB Axial	.025 In/Sec	.085 G-s
GIA	- Gearbox IB Axial	.031 In/Sec	.024 G-s
GIH	- Gearbox IB Horizontal	.041 In/Sec	.025 G-s
GOH	- Gearbox OB Horizontal	.031 In/Sec	.056 G-s
COH	- COOLING FAN MOH	.183 In/Sec	.029 G-s
STD12	- Stand 12	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.018 In/Sec	.029 G-s
MIH	- Motor IB Horizontal	.023 In/Sec	.087 G-s
MIA	- Motor IB Axial	.042 In/Sec	.062 G-s
COH	- COOLING FAN MOH	.090 In/Sec	.047 G-s
STD13	- Stand 13	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.061 In/Sec	.059 G-s
MIH	- Motor IB Horizontal	.085 In/Sec	.105 G-s
MIA	- Motor IB Axial	.114 In/Sec	.129 G-s
GIA	- Gearbox IB Axial	.049 In/Sec	.121 G-s
GIH	- Gearbox IB Horizontal	.045 In/Sec	.095 G-s
GOH	- Gearbox OB Horizontal	.048 In/Sec	.239 G-s
COH	- COOLING FAN MOH	.398 In/Sec	.231 G-s
STD14	- Stand 14	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.110 In/Sec	.521 G-s
MIH	- Motor IB Horizontal	.090 In/Sec	.093 G-s
MIA	- Motor IB Axial	.077 In/Sec	.494 G-s
GIA	- Gearbox IB Axial	.142 In/Sec	.219 G-s
GIH	- Gearbox IB Horizontal	.081 In/Sec	.118 G-s
GOH	- Gearbox OB Horizontal	.069 In/Sec	.039 G-s
COH	- COOLING FAN MOH	.247 In/Sec	.202 G-s
STD15	- Stand 15	(28-Jul-22)	
		OVERALL LEVEL	1K-20KHz
MOH	- Motor OB Horizontal	.061 In/Sec	.202 G-s
MIH	- Motor IB Horizontal	.052 In/Sec	.074 G-s
MIA	- Motor IB Axial	.049 In/Sec	.383 G-s
GIA	- Gearbox IB Axial	.042 In/Sec	.227 G-s
GIH	- Gearbox IB Horizontal	.061 In/Sec	.278 G-s
COH	- COOLING FAN MOH	.122 In/Sec	.095 G-s
NORTH AC	- NORTH AIR COMPRESSOR QUINCY	(28-Jul-22)	
		OVERALL LEVEL	1 - 20 KHz
MOH	- MOTOR OUTBOARD HORIZONTAL	.140 In/Sec	.748 G-s
MIH	- MOTOR INBOARD HORIZONTAL	.117 In/Sec	.878 G-s
MIA	- MOTOR INBOARD AXIAL	.165 In/Sec	.419 G-s

	OVERALL LEVEL	1K-20KHz
CIA - COMPRESSOR INBOARD AXIAL	.428 In/Sec	.704 G-s
CIH - COMPRESSOR INBOARD HORIZONTAL	.221 In/Sec	.468 G-s
COH - COMPRESSOR OUTBOARD HORIZONTAL	.229 In/Sec	.374 G-s

SOUTH AC - SOUTH AIR COMPRESSOR QUINCY (28-Jul-22)

	OVERALL LEVEL	1 - 20 KHz
MOH - MOTOR OUTBOARD HORIZONTAL	.126 In/Sec	2.147 G-s
MIH - MOTOR INBOARD HORIZONTAL	.221 In/Sec	3.144 G-s
MIA - MOTOR INBOARD AXIAL	.106 In/Sec	1.940 G-s
	OVERALL LEVEL	1K-20KHz
CIA - COMPRESSOR INBOARD AXIAL	.299 In/Sec	.685 G-s
CIH - COMPRESSOR INBOARD HORIZONTAL	.127 In/Sec	.426 G-s
COH - COMPRESSOR OUTBOARD HORIZONTAL	.340 In/Sec	.347 G-s

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK

Database: nucorja9.rbm
Station: Roll Mill Utilities

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
HYDPMP1 - Hydraulic Pump East	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.078 In/Sec	.192 G-s
MIH - Motor IB Horizontal	.156 In/Sec	.253 G-s
PIV - Pump IB Vertical	.357 In/Sec	2.765 G-s
HYDPMP2 - Hydraulic Pump Center	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.097 In/Sec	.365 G-s
MIH - Motor IB Horizontal	.310 In/Sec	.425 G-s
PIV - Pump IB Vertical	.307 In/Sec	2.252 G-s
DESFAN - Desolution Fan	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.031 In/Sec	.053 G-s
MIH - Motor IB Horizontal	.037 In/Sec	.038 G-s
COMFAN - Combustion Air Fan	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.105 In/Sec	.122 G-s
MIH - Motor IB Horizontal	.096 In/Sec	.245 G-s
MIA - MOTOR IB Axial	.065 In/Sec	.148 G-s
FIH - Fan IB Horizontal	.061 In/Sec	.091 G-s
FOH - Fan OB Horizontal	.082 In/Sec	.629 G-s
EJCFAN - Ejector Air Fan	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.139 In/Sec	.285 G-s
MIH - Motor IB Horizontal	.125 In/Sec	.221 G-s
MIA - Motor IB AXIAL	.070 In/Sec	.139 G-s
FIA - Fan IB Axial	.073 In/Sec	.532 G-s
FIH - Fan IB Horizontal	.086 In/Sec	1.218 G-s
FOH - Fan OB Horizontal	.217 In/Sec	.640 G-s
COLPMP2 - Furnace Cooling Pump center	(28-Jul-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.181 In/Sec	.121 G-s
MIH - Motor IB Horizontal	.075 In/Sec	.191 G-s
MIA - Motor IB Axial	.122 In/Sec	.211 G-s

FCTSOUTH - Furnace CT Drive South	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.421 In/Sec	.091 G-s	
MIH - Motor IB Horizontal	.147 In/Sec	.105 G-s	
MIA - Motor IB Axial	.588 In/Sec	.093 G-s	
FCTNORTH - Furnace CT Drive North	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.513 In/Sec	.068 G-s	
MIH - Motor IB Horizontal	.338 In/Sec	.119 G-s	
MIA - Motor IB Axial	.112 In/Sec	.038 G-s	
SCLPMP1 - Scale Pit Pump South	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.135 In/Sec	.908 G-s	
MOV - Motor OB VERTICAL	.136 In/Sec	1.181 G-s	
MIV - Motor IB VERTICAL	.063 In/Sec	.258 G-s	
MIH - Motor IB Horizontal	.070 In/Sec	.312 G-s	
MIA - Motor IB Axial	.069 In/Sec	.094 G-s	
CTWTR2 - CT Pump West	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.192 In/Sec	.382 G-s	
MIH - Motor IB Horizontal	.137 In/Sec	.133 G-s	
MIA - Motor IB Axial	.073 In/Sec	.186 G-s	
MILWTR3 - Mill Water Pump West	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.087 In/Sec	.286 G-s	
MIH - Motor IB Horizontal	.042 In/Sec	.240 G-s	
MIA - Motor IB Axial	.041 In/Sec	.230 G-s	
MILWTR1 - Mill Water Pump East	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.067 In/Sec	.181 G-s	
MIH - Motor IB Horizontal	.064 In/Sec	.317 G-s	
MIA - Motor IB Axial	.035 In/Sec	.295 G-s	
EASTBOOST - East Booster Pump Small	(28-Jul-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.243 In/Sec	.239 G-s	
MIH - Motor IB Horizontal	.285 In/Sec	.182 G-s	
MIA - Motor IB Axial	.333 In/Sec	.109 G-s	

Clarification Of Vibration Units:

Acc	-->	G-s	RMS
Vel	-->	In/Sec	PK