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January 20, 2022

Nucor Roll Mill Jackson-Flowood, MS

Subject: January vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on January 19, 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.

<u>Class I:</u> Defect is present, but effect on reliability is not clear; no immediate action is required. Continue to normally monitor.

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

<u>Class III</u>: 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.

<u>Class IV</u>; 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,

evin W. Maruell

ISO Certified Vibration Analyst, Category III



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Defects

Roll Stand 1A Planetary Gearbox

Vibration data is about the same this month. Spectral data of the first three sections at the input side are showing synchronous and non-synchronous peaks. This may indicate some gear and bearing issues. We will monitor this closely and recommend continuing to monitor temps closely and prepare to take actions as scheduling and parts become available. Rated as a **CLASS II** defect.

Roll Stand 2

Cooling fan motor frame appears to be loose and is causing high vibration in the cooling fan motor. Overall vibration is near .6 ips-pk. Inspect motor frame to Dc motor ensuring the frame is properly mounted. The drive end of the intermediate gearbox also shows gear mesh frequencies with 2 and 4 x input GMF being dominant. Input rpm sidebands were also present around the GMF harmonics. These peaks vary in amplitude according to speed and gear load. This may indicate some internal gear issues such as misaligned gears. We will continue to monitor the gearbox closely. Because of high cooling motor vibration, this is 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 some 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. This is rated as a **CLASS II** defect.

Roll Stand 6

Gear mesh vibration decreased this month. Overall amplitude at the outboard side horizontal was .24 ips-pk. 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. Because of the high amplitude this month, this issue is rated as a **CLASS II** defect.

Roll Stand 7

Gearbox vibration was down this month from .72 to .17 ips-pk. 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 16

Motor data is showing bearing defects in motor that are likely due to electrical fluting. There does not appear to be a grounding brush on this motor. Motor will likely need attention in the near future. Rated as a **CLASS II** defect.

Furnace Cooling Tower Drives North and South

Motors had higher vibrations this survey. 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.

Hydraulic Pump East

Pump has high vane pass harmonics this month. High acceleration amplitudes are also present. This is usually caused by restricted flow or internal pump wear. Check filter system ensuring pump is receiving proper flow for now. Rated as a **CLASS II** defect.

Abbreviated Last Measurement Summary ************************************			
Database: nucorjay.rom			
Station: ROII MILL ROILS			
ROULE NO. 1: RM ROLL DRIVES			
MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD	
STD1A - Stand 1A	(19-Jan-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.058 In/Sec	.039 G-s	
MIH - Motor IB Horizontal	.115 In/Sec	.218 G-s	
MIA - Motor IB Axial	.107 In/Sec	.125 G-s	
COH - COOLING FAN HORZ	.158 In/Sec	.058 G-s	
GIA - Gearbox IB Axial	.067 In/Sec	.306 G-s	
GIH - Gearbox IB Horizontal	.154 In/Sec	.170 G-s	
GI2 - Gearbox 2 BEARING Horizontal	.138 In/Sec	.101 G-s	
GI3 - Gearbox 3 BEARING Horizontal	.147 In/Sec	1.757 G-s	
GI4 - Gearbox 4 BEARING Horizontal	.098 In/Sec	.147 G-s	
GI5 - Gearbox 5 BEARING Horizontal	.067 In/Sec	.301 G-s	
GI6 - Gearbox 6 BEARING Horizontal	.047 In/Sec	.147 G-s	
GOH - Gearbox OB Horizontal	.038 In/Sec	.074 G-s	
STD2A - Stand 2A	(19-Jan-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.051 In/Sec	.012 G-s	
MIH - Motor IB Horizontal	.040 In/Sec	.074 G-s	
MIA - Motor IB Axial	.093 In/Sec	.052 G-s	
COH - COOLING FAN HORIZONTAL OUTBOARD	.082 In/Sec	.079 G-s	
STD1 - Stand 1	(19-Jan-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.089 In/Sec	.035 G-s	
MIH - Motor IB Horizontal	.099 In/Sec	.044 G-s	
MIA - Motor IB Axial	.325 In/Sec	.229 G-s	
GIA - Gearbox IB Axial	.038 In/Sec	.031 G-s	
GIH - Gearbox IB Horizontal	.067 In/Sec	.012 G-s	
COH - COOLING FAN HORZ	.077 In/Sec	.200 G-s	
STD2 - Stand 2	(19-Jan-22)		
	OVERALL LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.131 In/Sec	.061 G-s	
MIH - Motor IB Horizontal	.127 In/Sec	.047 G-s	
MIA - Motor IB Axial	.133 In/Sec	.063 G-s	
GIA - Gearbox IB Axial	.087 In/Sec	.034 G-s	
GIH - Gearbox IB Horizontal	.090 In/Sec	.046 G-s	
COH - Motor OB Horizontal	.559 In/Sec	.054 G-s	
STD3 - Stand 3	(19-Jan-22)		
5125 bland J	OVERALI. LEVEL	1K-20KHz	
MOH - Motor OB Horizontal	.064 In/Sec	.226 G-s	
MIH - Motor IB Horizontal	.108 In/Sec	.065 G-s	
MIA - Motor IB Axial	.265 In/Sec	.188 G-s	
GIA - Gearbox IB Axial	.038 In/Sec	.088 G-s	
GIH - Gearbox IB Horizontal	.032 In/Sec	.164 G-s	

СОН -	COOLING FAN MOH	.180 In/Sec	.043 G-s
STD4	- Stand 4	(19-Jan-22)	
		OVERALL LEVEL	1K-20KHz
мон -	Motor OB Horizontal	.061 In/Sec	.018 G-s
MIH -	Motor IB Horizontal	.074 In/Sec	.026 G-s
MIA -	Motor IB Axial	.167 In/Sec	.072 G-s
GIA -	Gearbox IB Axial	.070 In/Sec	.053 G-s
GIH -	Gearbox IB Horizontal	.056 In/Sec	.034 G-s
СОН -	COOLING FAN MOH	.324 In/Sec	.055 G-s
STD5	- Stand 5	(19-Jan-22)	
		OVERALL LEVEL	1K-20KHz
мон -	Motor OB Horizontal	.046 In/Sec	.034 G-s
MIH -	Motor IB Horizontal	.077 In/Sec	.326 G-s
MIA -	Motor IB Axial	.119 In/Sec	.086 G-s
GIA -	Gearbox IB Axial	.090 In/Sec	.0094 G-s
GIH -	Gearbox IB Horizontal	.098 In/Sec	.025 G-s
GOH -	Gearbox OB Horizontal	217 In/Sec	192 G-s
СОН -	COOLING FAN MOH	.164 In/Sec	.042 G-s
		,	
STD6	- Stand 6	(19-Jan-22)	
		OVERALL LEVEL	1K-20KHz
мон -	Motor OB Horizontal	.065 In/Sec	.016 G-s
MIH -	Motor IB Horizontal	.053 In/Sec	.017 G-s
MIA -	Motor IB Axial	.114 In/Sec	.028 G-s
GTA -	Gearbox IB Axial	099 Tn/Sec	161 G-s
CTH -	Coarbox IB Horigontal		025 C-s
CON -	Gearbox IB Horizontal	102 Tr/Sec	.025 G-S
GOH -	Gearbox OB Horizontal	.193 In/Sec	.140 G-S
сон -	COOLING FAN MOH	.1/2 In/Sec	.075 G-s
STD7	- Stand 7	(19-Jan-22)	
		OVERALL LEVEL	1K-20KHz
мон –	Motor OB Horizontal	.048 In/Sec	.063 G-s
	Noton TD Noni-contol		
мтн –	MOTOT IN HOTIZODIAI	063 Tn/Sec	228 C-e
MIH -	Motor IB Horizontal	.063 In/Sec	.228 G-s
MIH - MIA -	Motor IB Horizontal Motor IB Axial	.063 In/Sec .088 In/Sec	.228 G-s .271 G-s
MIH - MIA - GIA -	Motor IB Avial Gearbox IB Axial	.063 In/Sec .088 In/Sec .061 In/Sec	.228 G-s .271 G-s .0064 G-s
MIH - MIA - GIA - GIH -	Motor IB Horizontal Gearbox IB Axial Gearbox IB Horizontal	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec	.228 G-s .271 G-s .0064 G-s .034 G-s
MIH - MIA - GIA - GIH - GOH -	Motor IB Horizontal Motor IB Axial Gearbox IB Axial Gearbox IB Horizontal Gearbox OB Horizontal	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec .173 In/Sec	.228 G-s .271 G-s .0064 G-s .034 G-s .049 G-s
MIH - MIA - GIA - GIH - GOH - COH -	Motor IB Horizontal Motor IB Axial Gearbox IB Axial Gearbox IB Horizontal Gearbox OB Horizontal COOLING FAN MOH	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec .173 In/Sec .454 In/Sec	.228 G-s .271 G-s .0064 G-s .034 G-s .049 G-s .093 G-s
MIH - MIA - GIA - GIH - GOH - COH - STD8	Motor IB Horizontal Motor IB Axial Gearbox IB Axial Gearbox IB Horizontal Gearbox OB Horizontal COOLING FAN MOH - Stand 8	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec .173 In/Sec .454 In/Sec (19-Jan-22)	.228 G-s .271 G-s .0064 G-s .034 G-s .049 G-s .093 G-s
MIH - MIA - GIA - GIH - GOH - COH - STD8	Motor IB Horizontal Motor IB Axial Gearbox IB Axial Gearbox IB Horizontal Gearbox OB Horizontal COOLING FAN MOH - Stand 8	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec .173 In/Sec .454 In/Sec (19-Jan-22) OVERALL LEVEL	.228 G-s .271 G-s .0064 G-s .034 G-s .049 G-s .093 G-s
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MIH - MIA - GIA - GIH - GOH - COH - STD8 MOH - MIH -	Motor IB Horizontal Motor IB Axial Gearbox IB Axial Gearbox IB Horizontal Gearbox OB Horizontal COOLING FAN MOH - Stand 8 Motor OB Horizontal Motor IB Horizontal	.063 In/Sec .088 In/Sec .061 In/Sec .036 In/Sec .173 In/Sec .454 In/Sec (19-Jan-22) OVERALL LEVEL .052 In/Sec .059 In/Sec	.228 G-s .271 G-s .0064 G-s .034 G-s .049 G-s .093 G-s 1K-20KHz .023 G-s 108 G-s
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	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.058 In/Sec	.047 G-s
MIH - Motor IB Horizontal	.090 In/Sec	.059 G-s
MIA - Motor IB Axial	.104 In/Sec	.186 G-s
GIA - Gearbox IB Axial	.041 In/Sec	.043 G-s
GIH - Gearbox IB Horizontal	.047 In/Sec	.042 G-s
GOH - Gearbox OB Horizontal	.049 In/Sec	.033 G-s
COH - COOLING FAN MOH	.204 In/Sec	.177 G-s
	• • • • •	
STD14 - Stand 14	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.087 In/Sec	.058 G-s
MIH - Motor IB Horizontal	.081 In/Sec	.038 G-s
MIA - Motor IB Axial	.100 In/Sec	.115 G-s
COH - COOLING FAN MOH	.282 In/Sec	.234 G-s
GIA - Gearbox IB Axial	.083 In/Sec	.082 G-s
GIH - Gearbox IB Horizontal	.039 In/Sec	.094 G-s
GOH - Gearbox OB Horizontal	.039 In/Sec	.016 G-s
STD16 - Stand 16	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.143 In/Sec	.127 G-s
MIH - Motor IB Horizontal	.148 In/Sec	.327 G-s
MIA - Motor IB Axial	.151 In/Sec	.362 G-s
GIA - Gearbox IB Axial	.079 In/Sec	.089 G-s
GIH - Gearbox IB Horizontal	.063 In/Sec	.111 G-s
GOH - Gearbox OB Horizontal	.039 In/Sec	.072 G-s
COH - COOLING FAN MOH	.155 In/Sec	.054 G-s
NORTH AC - NORTH AIR COMPRESSOR QUINCY	(19-Jan-22)	
	OVERALL LEVEL	1 - 20 KHz
MOH - MOTOR OUTBOARD HORIZONTAL	.142 In/Sec	.740 G-s
MIH - MOTOR INBOARD HORIZONTAL	.159 In/Sec	.818 G-s
MIA - MOTOR INBOARD AXIAL	.171 In/Sec	.817 G-s
	OVERALL LEVEL	1K-20KHz
CIA - COMPRESSOR INBOARD AXIAL	.409 In/Sec	.490 G-s
CIH - COMPRESSOR INBOARD HORIZONTAL	.216 In/Sec	.531 G-s
COH - COMPRESSOR OUTBOARD HORIZONTAL	.260 In/Sec	.226 G-s
SOUTH AC - SOUTH AIR COMPRESSOR QUINCY	(19-Jan-22)	
	OVERALL LEVEL	1 - 20 KHz
MOH - MOTOR OUTBOARD HORIZONTAL	.104 In/Sec	1.127 G-s
MIH - MOTOR INBOARD HORIZONTAL	.228 In/Sec	1.382 G-s
MIA - MOTOR INBOARD AXIAL	.119 In/Sec	1.255 G-s
	OVERALL LEVEL	1K-20KHz
CIA - COMPRESSOR INBOARD AXIAL	.355 In/Sec	.659 G-s
CIH - COMPRESSOR INBOARD HORIZONTAL	.155 In/Sec	.580 G-s
CON - COMPRESSOR OUTROARD HORTZONTAT	348 TD/Sec	290 C-8

Station: Roll Mill Utilities Route No. 1: UTILITIES

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD
HYDPMP1 - Hydraulic Pump East	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.113 In/Sec	.219 G-s
MIH - Motor IB Horizontal	.208 In/Sec	.346 G-s
PIV - Pump IB Vertical	.263 In/Sec	3.008 G-s
HYDPMP2 - Hydraulic Pump Center	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.117 In/Sec	.240 G-s
MIH - Motor IB Horizontal	.304 In/Sec	.129 G-s
PIV - Pump IB Vertical	.306 In/Sec	.475 G-s
DESFAN - Desolution Fan	(19-Jan-22)	

	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.026 In/Sec	.042 G-s
MIH - Motor IB Horizontal	.028 In/Sec	.035 G-s
COMFAN - Combustion Air Fan	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.101 In/Sec	.182 G-s
MIH - Motor IB Horizontal	.086 In/Sec	.206 G-s
MIA - MOTOR IB Axial	.068 In/Sec	.148 G-s
FIH - Fan IB Horizontal	.064 In/Sec	.109 G-s
FOH - Fan OB Horizontal	.088 In/Sec	.268 G-s
FICENN - Ficator Air Fan	(19 - 7 - 7 - 22)	
		1K-20KH-
MOH - Motor OR Horizontal		
MUH - Motor UB Horizontal	120 Tp/Sec	.299 G-S
MIN - MOLOF IB HOLIZONIAL	.120 11/ Sec	.290 G-S
ELA For ID ANIAL	.094 III/Sec	.190 G-S
FIA - Fan ID Axiai	.000 IN/Sec	.097 G-S
FIH - Fan IB Horizontal	.0// IN/Sec	.435 G-S
FOH - Fan OB Horizontal	.139 In/Sec	.820 G-S
COLPMP2 - Furnace Cooling Pump center	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.194 In/Sec	.138 G-s
MIH - Motor IB Horizontal	.076 In/Sec	.050 G-s
MIA - Motor IB Axial	.140 In/Sec	.162 G-s
FORSOUTH - Furnage CT Drive South	(19 - 3 - 22)	
TOTOODIN TUIMUCE OF DITVE DOUCH	OVEDALL LEVEL	18-2088
MOH - Motor OB Horizontal		116 G-8
MUH - Motor IB Horizontal	130 Tr/Sec	118 G-s
MIN - Motor IB Avial	616 In/Sec	.110 G-S
MIR - MOLOI ID AXIAI	.010 11/360	.000 G-5
FCTNORTH - Furnace CT Drive North	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.437 In/Sec	.064 G-s
MIH - Motor IB Horizontal	.326 In/Sec	.127 G-s
MIA - Motor IB Axial	.137 In/Sec	.083 G-s
SCLPMP1 - Scale Pit Pump South	(19-Jan-22)	
······································	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.284 In/Sec	.382 G-s
MOV - Motor OB VERTICAL	.098 In/Sec	.803 G-s
MIV - Motor IB VERTICAL	.076 In/Sec	.106 G-s
MIH - Motor IB Horizontal	.168 In/Sec	.104 G-s
MIA - Motor IB Axial	.085 In/Sec	.127 G-s
CTWTR2 - CT Pump West	(19-Jan-22)	
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.134 In/Sec	.258 G-s
MIH - Motor IB Horizontal	.135 In/Sec	.091 G-s
MIA - Motor IB Axial	.154 In/Sec	.175 G-s
MILWTR3 - Mill Water Pump West	(19Tan-22)	
MILWING MIII WALEI FUMP WESC	OVERALI. LEVEL	1K-20KH-
MOH - Motor OB Horizontal		449 C-e
MIH - Motor IB Horizontal	.045 In/Sec	.356 G-s
MILWTR1 - Mill Water Pump East	(19-Jan-22)	1
	OVERALL LEVEL	1K-20KHz
MOH - Motor OB Horizontal	.065 In/Sec	.263 G-s
MIH - Motor IB Horizontal	.044 In/Sec	.232 G-s
MIA - Motor IB Axial	.036 In/Sec	.185 G-s

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