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August 23rd, 2023

Nucor Roll Mill
Jackson-Flowood, MS

Subject: August vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on August 22, 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,

Kevin W. Maxwell

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Defects

Roll Stand 1A
Drive motor data shows some signs of bearing defects. 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, the noise floor and high g's are concerning and may indicate internal wear or defects in internal components. Motor will likely need attention in the next few months. We are monitoring this closely. Rated as a **CLASS II** defect.

Roll Stand 2
This equipment was not in operation this survey; however, the following still applies: 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
This equipment was not in operation this survey; however, the following still applies: 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
This equipment was not in operation this survey; however, the following still applies: 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
This equipment was not in operation this survey; however, the following still applies: 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 13
This equipment was not in operation this survey; however, the following still applies: The cooling fan motor has what appears to be a high 1 x rpm vibration. The frequency of the high vibration is at 58.12 Hz. or 3487 cpm. This would show the motor rpm to be 3487. **We need to confirm cooling fan motor speed.** If this speed is correct, then data would suggest an imbalance in the cooling fan. Inspect, clean, balance fan as needed. Rated as a **CLASS II** defect.

Roll Stand 14
This equipment was not in operation this survey; 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

This equipment was not in operation this survey; however, the following 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.

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 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.

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

MEASUREMENT POINT             OVERALL LEVEL       HFD / VHFD
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STD1A      - Stand 1A                        (22-Aug-23)
                               OVERALL LEVEL     1K-20KHz
       MOH                      .135 In/Sec       .094 G-s
       MIH                      .075 In/Sec       .349 G-s
       MIA                      .178 In/Sec       .362 G-s
       COH                      .142 In/Sec       .032 G-s
       GIA                      .116 In/Sec       .210 G-s
       GIH                      .302 In/Sec       .569 G-s
       GI2                      .256 In/Sec       .359 G-s
       GI3                      .205 In/Sec       .496 G-s
       GI4                      .186 In/Sec       .907 G-s
       GI5                      .125 In/Sec       .674 G-s
       GI6                      .087 In/Sec       .387 G-s
       GOH                      .074 In/Sec       .380 G-s

STD2A      - Stand 2A                        (22-Aug-23)
                               OVERALL LEVEL     1K-20KHz
       MOH                      .060 In/Sec       .021 G-s
       MIH                      .050 In/Sec       .063 G-s
       MIA                      .057 In/Sec       .159 G-s
       COH                      .639 In/Sec       .037 G-s

STD1       - Stand 1                         (22-Aug-23)
                               OVERALL LEVEL     1K-20KHz
       MOH                      .028 In/Sec       .028 G-s
       MIH                      .080 In/Sec       .018 G-s

NORTH AC   - NORTH AIR COMPRESSOR QUINCY    (22-Aug-23)
                               OVERALL LEVEL     1 - 20 KHz
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	MOH	.123 In/Sec	1.832 G-s
	MIH	.090 In/Sec	.702 G-s
	MIA	.078 In/Sec	.864 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.370 In/Sec	.631 G-s
	CIH	.207 In/Sec	.558 G-s
	COH	.167 In/Sec	.349 G-s

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

		OVERALL LEVEL	1 - 20 KHz
	MOH	.096 In/Sec	.145 G-s
	MIH	.131 In/Sec	.229 G-s
	MIA	.521 In/Sec	.202 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.423 In/Sec	.711 G-s
	CIH	.159 In/Sec	.402 G-s
	COH	.274 In/Sec	.273 G-s

WEST AC - WEST AIR COMPRESSOR QUINCY (22-Aug-23)

		OVERALL LEVEL	1 - 20 KHz
	MOH	.367 In/Sec	.487 G-s
	MIH	.233 In/Sec	.414 G-s
	MIA	.786 In/Sec	.164 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.453 In/Sec	.577 G-s
	CIH	.308 In/Sec	.576 G-s
	COH	.328 In/Sec	.426 G-s

Database: nucorja9.rbm
Station: Roll Mill Utilities

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD

HYDPMP1 - Hydraulic Pump East (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.090 In/Sec	.217 G-s
	MIH	.191 In/Sec	.303 G-s
	PIV	.357 In/Sec	3.236 G-s

HYDPMP2 - Hydraulic Pump Center (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.062 In/Sec	.338 G-s
	MIH	.158 In/Sec	.253 G-s
	PIV	.276 In/Sec	.900 G-s

DESFAN - Desolution Fan (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.033 In/Sec	.067 G-s
	MIH	.030 In/Sec	.031 G-s

COMFAN - Combustion Air Fan (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.130 In/Sec	.130 G-s
	MIH	.091 In/Sec	.212 G-s
	MIA	.067 In/Sec	.101 G-s
	FIH	.058 In/Sec	.254 G-s
	FOH	.078 In/Sec	.748 G-s

EJCFAN - Ejector Air Fan (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.213 In/Sec	.295 G-s
	MIH	.184 In/Sec	.251 G-s
	MIA	.122 In/Sec	.175 G-s
	FIA	.101 In/Sec	.395 G-s
	FIH	.122 In/Sec	.458 G-s
	FOH	.246 In/Sec	.511 G-s

COLPMP2 - Furnace Cooling Pump center (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.347 In/Sec	.147 G-s
	MIH	.063 In/Sec	.225 G-s
	MIA	.149 In/Sec	.141 G-s

FCTSOUTH - Furnace CT Drive South (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.367 In/Sec	.047 G-s
	MIH	.163 In/Sec	.073 G-s
	MIA	.472 In/Sec	.049 G-s

FCTNORTH - Furnace CT Drive North (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.608 In/Sec	.110 G-s
	MIH	.505 In/Sec	.097 G-s
	MIA	.106 In/Sec	.069 G-s

SCLPMP2 - Scale Pit Pump North (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.443 In/Sec	.126 G-s
	MIH	.130 In/Sec	.436 G-s
	MIA	.195 In/Sec	.103 G-s

CTWTR2 - CT Pump West (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.077 In/Sec	.327 G-s
	MIH	.060 In/Sec	.211 G-s
	MIA	.072 In/Sec	.088 G-s

MILWTR2 - Mill Water Pump Center (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.112 In/Sec	.593 G-s
	MIH	.075 In/Sec	.985 G-s
	MIA	.062 In/Sec	.774 G-s

MILWTR1 - Mill Water Pump East (22-Aug-23)

		OVERALL LEVEL	1K-20KHz
	MOH	.046 In/Sec	.337 G-s
	MIH	.057 In/Sec	.471 G-s
	MIA	.045 In/Sec	.160 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK