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August 30, 2021

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 27th, 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 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 closely. Rated as a **CLASS I** defect.

Roll Stand 2 Cooling Fan Motor
Cooling fan motor continues to be higher than normal. 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 increased 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 increased quite a bit this month. Overall amplitude at the outboard side horizontal was .76 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 decreased this month. 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 gerbox, 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 continue to monitor this closely. Rated as a **CLASS I** defect.

North Quincy Air Compressor

Motor and compressor end have increased 1 x rpm vibration this survey. Motor also has some increased rpm harmonics in spectrum this survey. For now, it is recommended to inspect coupling for wear and ensure all fasteners are tight. Ensure unit is aligned properly. 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
            Route No.  1:  RM ROLL DRIVES

    MEASUREMENT POINT             OVERALL LEVEL       HFD / VHFD
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    STD1A      - Stand 1A                        (27-Aug-21)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .073 In/Sec       .032 G-s
           MIH                     .061 In/Sec       .078 G-s
           MIA                     .140 In/Sec       .152 G-s
           COH                     .227 In/Sec       .173 G-s
           GIA                     .085 In/Sec       .184 G-s
           GIH                     .197 In/Sec       .090 G-s
           GI2                     .157 In/Sec       .168 G-s
           GI3                     .152 In/Sec       .205 G-s
           GI4                     .134 In/Sec       .103 G-s
           GI5                     .071 In/Sec       .126 G-s
           GI6                     .057 In/Sec       .189 G-s
           GOH                     .050 In/Sec       .036 G-s

    STD2A      - Stand 2A                        (27-Aug-21)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .050 In/Sec       .022 G-s
           MIH                     .045 In/Sec       .045 G-s
           MIA                     .139 In/Sec       .086 G-s
           COH                     .145 In/Sec       .028 G-s

    STD1       - Stand 1                         (27-Aug-21)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .090 In/Sec       .064 G-s
           MIH                     .073 In/Sec       .022 G-s
           MIA                     .316 In/Sec       .138 G-s
           GIA                     .033 In/Sec       .031 G-s
           GIH                     .066 In/Sec       .015 G-s
           COH                     .146 In/Sec       .190 G-s

    STD2       - Stand 2                         (27-Aug-21)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .111 In/Sec       .081 G-s
           MIH                     .146 In/Sec       .069 G-s
           MIA                     .246 In/Sec       .248 G-s
           GIA                     .076 In/Sec       .033 G-s
           GIH                     .068 In/Sec       .034 G-s
           COH                     .552 In/Sec       .047 G-s

    STD3       - Stand 3                         (27-Aug-21)
                                  OVERALL LEVEL     1K-20KHz
           MOH                     .086 In/Sec       .315 G-s
           MIH                     .108 In/Sec       .052 G-s
           MIA                     .201 In/Sec       .284 G-s
           GIA                     .059 In/Sec       .060 G-s
           GIH                     .039 In/Sec       .100 G-s
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	COH	.240 In/Sec	.060 G-s

STD4 - Stand 4 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.066 In/Sec	.022 G-s
MIH	.071 In/Sec	.021 G-s
MIA	.118 In/Sec	.105 G-s
GIA	.059 In/Sec	.109 G-s
GIH	.069 In/Sec	.055 G-s
COH	.220 In/Sec	.037 G-s

STD5 - Stand 5 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.047 In/Sec	.056 G-s
MIH	.075 In/Sec	.068 G-s
MIA	.098 In/Sec	.047 G-s
GIA	.082 In/Sec	.027 G-s
GIH	.096 In/Sec	.046 G-s
GOH	.478 In/Sec	.369 G-s
COH	.400 In/Sec	.037 G-s

STD6 - Stand 6 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.055 In/Sec	.111 G-s
MIH	.073 In/Sec	.046 G-s
MIA	.129 In/Sec	.042 G-s
GIA	.106 In/Sec	.013 G-s
GIH	.046 In/Sec	.045 G-s
GOH	.756 In/Sec	.951 G-s
COH	.224 In/Sec	.081 G-s

STD7 - Stand 7 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.040 In/Sec	.053 G-s
MIH	.112 In/Sec	.045 G-s
MIA	.069 In/Sec	.091 G-s
GIA	.074 In/Sec	.016 G-s
GIH	.044 In/Sec	.053 G-s
GOH	.429 In/Sec	.217 G-s
COH	.339 In/Sec	.136 G-s

STD8 - Stand 8 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.055 In/Sec	.048 G-s
MIH	.084 In/Sec	.094 G-s
MIA	.095 In/Sec	.315 G-s
GIA	.079 In/Sec	.107 G-s
GIH	.047 In/Sec	.108 G-s
COH	.235 In/Sec	.097 G-s

STD9 - Stand 9 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.071 In/Sec	.111 G-s
MIH	.092 In/Sec	.099 G-s
MIA	.084 In/Sec	.065 G-s
GIA	.066 In/Sec	.017 G-s
GIH	.087 In/Sec	.345 G-s
COH	.140 In/Sec	.124 G-s

STD11 - Stand 11 (27-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.024 In/Sec	.049 G-s
MIH	.033 In/Sec	.027 G-s
MIA	.054 In/Sec	.076 G-s
GIA	.050 In/Sec	.028 G-s
GIH	.041 In/Sec	.191 G-s
GOH	.033 In/Sec	.117 G-s
COH	.106 In/Sec	.032 G-s

STD13 - Stand 13 (27-Aug-21)

		OVERALL LEVEL	1K-20KHz
	MOH	.078 In/Sec	.078 G-s
	MIH	.055 In/Sec	.151 G-s
	MIA	.063 In/Sec	.068 G-s
	GIA	.060 In/Sec	.169 G-s
	GIH	.044 In/Sec	.303 G-s
	GOH	.046 In/Sec	.279 G-s
	COH	.300 In/Sec	.320 G-s

STD15 - Stand 15 (27-Aug-21)

		OVERALL LEVEL	1K-20KHz
	MOH	.101 In/Sec	.043 G-s
	MIH	.060 In/Sec	.026 G-s
	MIA	.098 In/Sec	.034 G-s
	GIA	.066 In/Sec	.685 G-s
	GIH	.038 In/Sec	.225 G-s
	COH	.129 In/Sec	.100 G-s

STD16 - Stand 16 (27-Aug-21)

		OVERALL LEVEL	1K-20KHz
	MOH	.077 In/Sec	.512 G-s
	MIH	.108 In/Sec	.760 G-s
	MIA	.132 In/Sec	.334 G-s
	GIA	.076 In/Sec	.120 G-s
	GIH	.067 In/Sec	.072 G-s
	GOH	.035 In/Sec	.093 G-s
	COH	.187 In/Sec	.042 G-s

NORTH AC - NORTH AIR COMPRESSOR QUINCY (27-Aug-21)

		OVERALL LEVEL	1 - 20 KHz
	MOH	.357 In/Sec	.277 G-s
	MIH	.306 In/Sec	.353 G-s
	MIA	.406 In/Sec	.267 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.465 In/Sec	.446 G-s
	CIH	.252 In/Sec	.413 G-s
	COH	.181 In/Sec	.382 G-s

SOUTH AC - SOUTH AIR COMPRESSOR QUINCY (27-Aug-21)

		OVERALL LEVEL	1 - 20 KHz
	MOH	.125 In/Sec	.869 G-s
	MIH	.100 In/Sec	.627 G-s
	MIA	.114 In/Sec	.476 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.271 In/Sec	.435 G-s
	CIH	.138 In/Sec	.390 G-s
	COH	.193 In/Sec	.340 G-s

WEST AC - WEST AIR COMPRESSOR QUINCY (27-Aug-21)

		OVERALL LEVEL	1 - 20 KHz
	MOH	.303 In/Sec	.192 G-s
	MIH	.260 In/Sec	.137 G-s
	MIA	.257 In/Sec	.100 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.340 In/Sec	.485 G-s

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

MEASUREMENT POINT	OVERALL LEVEL	HFD / VHFD

HYDPMP1 - Hydraulic Pump East (26-Aug-21)

		OVERALL LEVEL	1K-20KHz
	MOH	.091 In/Sec	.130 G-s
	MIH	.192 In/Sec	.111 G-s
	PIV	.278 In/Sec	.540 G-s

HYDPMP2 - Hydraulic Pump Center (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.064 In/Sec	.206 G-s
MIH	.179 In/Sec	.142 G-s
PIV	.288 In/Sec	1.169 G-s

DESFAN - Desolution Fan (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.037 In/Sec	.029 G-s
MIH	.038 In/Sec	.036 G-s

COMFAN - Combustion Air Fan (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.159 In/Sec	.172 G-s
MIH	.130 In/Sec	.187 G-s
MIA	.097 In/Sec	.172 G-s
FIH	.075 In/Sec	.285 G-s
FOH	.132 In/Sec	.673 G-s

EJCFAN - Ejector Air Fan (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.080 In/Sec	.316 G-s
MIH	.077 In/Sec	.273 G-s
MIA	.068 In/Sec	.191 G-s
FIA	.059 In/Sec	.120 G-s
FIH	.050 In/Sec	.242 G-s
FOH	.103 In/Sec	.549 G-s

COLPMP2 - Furnace Cooling Pump center (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.232 In/Sec	.106 G-s
MIH	.093 In/Sec	.277 G-s
MIA	.140 In/Sec	.111 G-s

FCTSOUTH - Furnace CT Drive South (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.424 In/Sec	.096 G-s
MIH	.197 In/Sec	.059 G-s
MIA	.554 In/Sec	.025 G-s

FCTNORTH - Furnace CT Drive North (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.378 In/Sec	.064 G-s
MIH	.284 In/Sec	.075 G-s
MIA	.190 In/Sec	.061 G-s

SCLPMP1 - Scale Pit Pump South (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.141 In/Sec	.537 G-s
MOV	.116 In/Sec	.698 G-s
MIV	.081 In/Sec	.125 G-s
MIH	.143 In/Sec	.199 G-s
MIA	.098 In/Sec	.245 G-s

CTWTR1 - CT Pump East/Middle Pump (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.093 In/Sec	.232 G-s
MIH	.090 In/Sec	.247 G-s
MIA	.089 In/Sec	.221 G-s

MILWTR3 - Mill Water Pump West (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.066 In/Sec	.282 G-s
MIH	.054 In/Sec	.530 G-s
MIA	.041 In/Sec	.239 G-s

MILWTR1 - Mill Water Pump East (26-Aug-21)

	OVERALL LEVEL	1K-20KHz
MOH	.079 In/Sec	.352 G-s

MIH	.054 In/Sec	.444 G-s
MIA	.030 In/Sec	.093 G-s

Clarification Of Vibration Units:

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