HI-SPEED INDUSTRIAL SERVICE QualiTest® Diagnostics

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September 26, 2019

Nucor Roll Mill
Jackson-Flowood, MS

Subject: September vibration survey

Most of the machines surveyed were found to be in good condition with the exception of 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

Defects

Roll Stand 1A Planetary Gearbox
Overall vibration varies with each survey and may be influenced somewhat by speed and load. The vibrations in the planetary section still show signs of distress. We will continue to monitor this unit closely. Still rated as a **CLASS I** defect for now.

Roll Stand 2 MOTOR
Data of the motor indicates some signs of bearing issue possible in the motor. We will monitor this closely. Rated as a **CLASS I** defect for now.

Roll Stand 2 Cooling Fan Motor
Motor data suggests mechanical looseness of the motor fits and or fan hub. A rub can also cause this type of vibration. Vibration levels are not high levels as of now, but this issue will be monitored closely. Rated as a **CLASS II** defect.

Roll Stand 4
Gearbox is starting to show some signs of gear wear and or gear misalignment at the input to intermediate side. Speed and load may have some effect on the fluctuation of amplitude; however, signs of wear do exist. We will continue to monitor this issue closely. Rated as a **CLASS I** defect for now.

Roll Stand 5
Vibration has decreased slightly in the gearbox outboard side this survey. A dominant gear mesh vibration is present towards the output of the 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. Rated as a **CLASS I** defect for now.

Roll Stand 5 Cooling Fan Motor
There appears to be a vibration in this unit that may be due to imbalance of the fan wheel. There may also be a slight electrical issue in the motor as well, but the dominant vibration is due to the possible imbalance. We will monitor this closely. Rated as a **CLASS II** defect.

Roll Stand 6
A dominant gear mesh vibration is present towards the output of the gearbox. Overall vibration was about the same as last month. The up and down amplitude of this peak is likely due to change in tooth load and speed. This issue seems to have begun after gearbox was repaired. We will continue to monitor this very closely. Rated as a **CLASS I** defect.

Roll Stand 7
Output side of the gearbox casing was extremely high this survey. At the output side of the gear box casing the vibration was saturating the accelerometer. 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 vibration was so high this month, this is now rated as a **CLASS III** defect.

Roll Stand 13 Cooling Fan Motor
Cooling fan motor data is showing vibrations associated with rotor issues such as loose or broken rotor bars. This is causing a higher than normal 1 x rpm vibration. We will monitor this closely. Rated as a **CLASS I** defect for now.

West Reheat hydraulic pump

Equipment was not in service this survey; however, the following most likely still applies: The pump has a much higher vibration this survey. Increase from .3 to .6 ips-pk. Spectrum shows high vibration at 2 x pump vane pass frequency with rpm sidebands. This could be due to clogged filter if equipped or other issue such as pump wear. Inspect pump soon. Rated as a **CLASS III** defect.

Ejector Fan

The motor appears to be thrusting slightly again this month. Overall vibration levels are within acceptable limits this survey. This issue will continue to be monitored closely. Rated as a **CLASS I** defect.

Furnace CT Drive North

Large increase in 1 x rpm vibration in the motor outboard. This may be due to coupling issue, shaft run-out, loose base. Inspect the unit for these issues soon. Rated as a **CLASS II** defect.

Scale Pit NORTH Pump

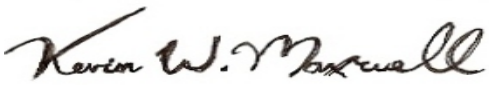
There is a high 1 x rpm vibration in the top end of the motor that may be due to an issue with the pump. For now, ensure that the pump is operating at the proper flow parameters. Pump may also have some imbalance or other mechanical problem which could cause this type of vibration. For now, this is a **CLASS II** defect.

South Quincy Air Compressor

Motor vibration has increased slightly this survey. Data has shown (in the past) high frequency electrical type vibration such as 2 x line frequency, stator slot pass, and or rotor bar pass frequency vibrations. This usually indicates an electrical issue is present such as winding issue, rotor issue, etc. We will monitor this issue closely. Rated as a **CLASS I** defect.

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,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

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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
STD1A - Stand 1A	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.049 In/Sec	.020 G-s
MIH	.041 In/Sec	.097 G-s
MIA	.072 In/Sec	.052 G-s
COH	.188 In/Sec	.084 G-s
GIA	.060 In/Sec	.055 G-s
GIH	.133 In/Sec	.389 G-s
GI2	.103 In/Sec	.256 G-s
GI3	.089 In/Sec	.220 G-s
GI4	.085 In/Sec	.747 G-s
GI5	.065 In/Sec	.019 G-s
GI6	.046 In/Sec	.057 G-s
GOH	.036 In/Sec	.026 G-s
STD2A - Stand 2A	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.051 In/Sec	.047 G-s
MIH	.049 In/Sec	.015 G-s
MIA	.083 In/Sec	.029 G-s
COH	.189 In/Sec	.035 G-s
STD1 - Stand 1	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.053 In/Sec	.066 G-s
MIH	.117 In/Sec	.053 G-s
MIA	.106 In/Sec	.151 G-s
GIA	.051 In/Sec	.037 G-s
GIH	.058 In/Sec	.061 G-s
COH	.115 In/Sec	.057 G-s
STD2 - Stand 2	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.112 In/Sec	.117 G-s
MIH	.066 In/Sec	.102 G-s
MIA	.190 In/Sec	.234 G-s
GIA	.068 In/Sec	.073 G-s
GIH	.049 In/Sec	.419 G-s
COH	.383 In/Sec	.470 G-s
STD3 - Stand 3	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.294 G-s
MIH	.083 In/Sec	.021 G-s
MIA	.117 In/Sec	.083 G-s
GIA	.024 In/Sec	.0046 G-s
GIH	.037 In/Sec	.045 G-s
COH	.277 In/Sec	.037 G-s
STD4 - Stand 4	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz
MOH	.073 In/Sec	.255 G-s
MIH	.074 In/Sec	.103 G-s
MIA	.227 In/Sec	.279 G-s
GIA	.120 In/Sec	.128 G-s
GIH	.073 In/Sec	.043 G-s
COH	.247 In/Sec	.074 G-s
STD5 - Stand 5	(19-Sep-19)	
	OVERALL LEVEL	1K-20KHz

	MOH	.054 In/Sec	.066 G-s
	MIH	.045 In/Sec	.124 G-s
	MIA	.071 In/Sec	.060 G-s
	GIA	.070 In/Sec	.011 G-s
	GIH	.046 In/Sec	.058 G-s
	GOH	.114 In/Sec	.127 G-s
	COH	.383 In/Sec	.037 G-s

STD6 - Stand 6 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.071 In/Sec	.100 G-s
MIH	.043 In/Sec	.078 G-s
MIA	.085 In/Sec	.073 G-s
GIA	.056 In/Sec	.033 G-s
GIH	.071 In/Sec	.026 G-s
GOH	.287 In/Sec	.369 G-s
COH	.209 In/Sec	.045 G-s

STD7 - Stand 7 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.117 In/Sec	.102 G-s
MIH	.111 In/Sec	.290 G-s
MIA	.063 In/Sec	.187 G-s
GIA	.102 In/Sec	.030 G-s
GIH	.197 In/Sec	.043 G-s
GOH	9.473 In/Sec	11.94 G-s
COH	.331 In/Sec	.110 G-s

STD8 - Stand 8 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.063 In/Sec	.061 G-s
MIH	.065 In/Sec	.069 G-s
MIA	.055 In/Sec	.139 G-s
GIA	.049 In/Sec	.032 G-s
GIH	.059 In/Sec	.295 G-s
COH	.199 In/Sec	.032 G-s

STD9 - Stand 9 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.061 In/Sec	.069 G-s
MIH	.082 In/Sec	.110 G-s
MIA	.061 In/Sec	.028 G-s
GIA	.087 In/Sec	.059 G-s
GIH	.086 In/Sec	.384 G-s
COH	.255 In/Sec	.066 G-s

STD11 - Stand 11 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.021 In/Sec	.021 G-s
MIH	.030 In/Sec	.094 G-s
MIA	.082 In/Sec	.053 G-s
GIA	.077 In/Sec	.086 G-s
GIH	.053 In/Sec	.119 G-s
GOH	.043 In/Sec	.308 G-s
COH	.124 In/Sec	.078 G-s

STD12 - Stand 12 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.027 In/Sec	.022 G-s
MIH	.025 In/Sec	.071 G-s
MIA	.031 In/Sec	.041 G-s
COH	.109 In/Sec	.060 G-s

STD13 - Stand 13 (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.079 In/Sec	.420 G-s
MIH	.113 In/Sec	.120 G-s
MIA	.133 In/Sec	.146 G-s
GIA	.073 In/Sec	.044 G-s
GIH	.039 In/Sec	.023 G-s

	GOH	.067 In/Sec	.053 G-s
	COH	.363 In/Sec	.449 G-s

STD14	- Stand 14		(19-Sep-19)
		OVERALL LEVEL	1K-20KHz
	MOH	.095 In/Sec	.121 G-s
	MIH	.072 In/Sec	.046 G-s
	MIA	.054 In/Sec	.143 G-s
	GIA	.179 In/Sec	.355 G-s
	GIH	.080 In/Sec	.140 G-s
	GOH	.070 In/Sec	.230 G-s
	COH	.349 In/Sec	.177 G-s

NORTH AC	- NORTH AIR COMPRESSOR QUINCY		(19-Sep-19)
		OVERALL LEVEL	1 - 20 KHz
	MOH	.167 In/Sec	.156 G-s
	MIH	.161 In/Sec	.263 G-s
	MIA	.212 In/Sec	.169 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.244 In/Sec	.579 G-s
	CIH	.213 In/Sec	.524 G-s
	COH	.197 In/Sec	.377 G-s

SOUTH AC	- SOUTH AIR COMPRESSOR QUINCY		(19-Sep-19)
		OVERALL LEVEL	1 - 20 KHz
	MOH	.294 In/Sec	.245 G-s
	MIH	.319 In/Sec	.108 G-s
	MIA	.250 In/Sec	.110 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.443 In/Sec	.504 G-s
	CIH	.529 In/Sec	.480 G-s
	COH	.361 In/Sec	.367 G-s

WEST AC	- WEST AIR COMPRESSOR QUINCY		(19-Sep-19)
		OVERALL LEVEL	1 - 20 KHz
	MOH	.138 In/Sec	.103 G-s
	MIH	.149 In/Sec	.134 G-s
	MIA	.272 In/Sec	.129 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.203 In/Sec	.698 G-s
	CIH	.229 In/Sec	.649 G-s
	COH	.254 In/Sec	.424 G-s

Database: nucorja9.rbm
Station: Roll Mill Utilities

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
HYDPMP1	- Hydraulic Pump East		(19-Sep-19)
		OVERALL LEVEL	1K-20KHz
	MOH	.175 In/Sec	.247 G-s
	MIH	.393 In/Sec	.294 G-s
	PIV	.245 In/Sec	.819 G-s

HYDPMP2	- Hydraulic Pump Center		(19-Sep-19)
		OVERALL LEVEL	1K-20KHz
	MOH	.177 In/Sec	.318 G-s
	MIH	.393 In/Sec	.232 G-s
	PIV	.244 In/Sec	1.710 G-s

DESFAN	- Desolution Fan		(19-Sep-19)
		OVERALL LEVEL	1K-20KHz
	MOH	.033 In/Sec	.041 G-s
	MIH	.033 In/Sec	.045 G-s

COMFAN	- Combustion Air Fan		(19-Sep-19)
		OVERALL LEVEL	1K-20KHz
	MOH	.140 In/Sec	.525 G-s

MIH	.112 In/Sec	.424 G-s
MIA	.186 In/Sec	.354 G-s
FIH	.088 In/Sec	.165 G-s
FOH	.129 In/Sec	.842 G-s

EJCFAN - Ejector Air Fan (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.068 In/Sec	.374 G-s
MIH	.062 In/Sec	.592 G-s
MIA	.068 In/Sec	.524 G-s
FIH	.043 In/Sec	.302 G-s
FOH	.102 In/Sec	.531 G-s

COLPMP2 - Furnace Cooling Pump center (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.179 In/Sec	.405 G-s
MIH	.163 In/Sec	.127 G-s
MIA	.094 In/Sec	.264 G-s

FCTSOUTH - Furnace CT Drive South (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.093 In/Sec	.050 G-s
MIH	.082 In/Sec	.064 G-s
MIA	.083 In/Sec	.088 G-s

FCTNORTH - Furnace CT Drive North (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.458 In/Sec	.079 G-s
MIH	.313 In/Sec	.149 G-s
MIA	.181 In/Sec	.062 G-s

SCLPMP2 - Scale Pit Pump North (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.356 In/Sec	.188 G-s
MIH	.277 In/Sec	.317 G-s
MIA	.192 In/Sec	.095 G-s
PIH	.185 In/Sec	.083 G-s

CTWTR2 - CT Pump West (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.106 In/Sec	.250 G-s
MIH	.060 In/Sec	.076 G-s
MIA	.107 In/Sec	.088 G-s

MILWTR2 - Mill Water Pump Center (19-Sep-19)

	OVERALL LEVEL	1K-20KHz
MOH	.099 In/Sec	.395 G-s
MIH	.045 In/Sec	.737 G-s
MIA	.066 In/Sec	.472 G-s

Clarification Of Vibration Units:

Acc --> G-s RMS

Vel --> In/Sec PK