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July 26, 2023

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 20-21, 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.

<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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Roll Stand 1A

Drive motor data is showing 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 need attention soon. We are monitoring this closely. Rated as a **CLASS II** defect.

Roll Stand 2

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

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

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

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

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

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

Motor was not in service this survey; however, the following likely 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 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.

Abbreviated Last Measurement Summary ************************************						
	Database:	nucorja9.rbm Poll Mill Polls				
	Station.	KOII MIII KOIIS				
MEASUREM	ENT POINT	OVERALL LEVEL HFD	/ VHFD			
STD1A	- Stand	1 2 (2111)-2	3)			
010111	bound	OVERALL LEVEL 1K-2	OKHz			
M	ЮН	.120 In/Sec .10	5 G-s			
M	ITH	.131 In/Sec .31	5 G-s			
M	IIA	.169 In/Sec .25	0 G-s			
C	ЮН	.155 In/Sec .10	3 G-s			
G	JIA	.246 In/Sec .58	4 G-s			
G	ЯIH	.471 In/Sec 4.84	7 G-s			
G	312	.318 In/Sec 2.38	3 G-s			
G	313	.311 In/Sec 2.02	6 G-s			
G	514	.304 In/Sec 3.11	6 G-s			
G	; 15	.220 In/Sec 1.86	3 G-s			
G	SI6	.104 In/Sec .62	7 G-s			
G	ЮН	.065 In/Sec .32	8 G-s			
STD22	- Stand	22 (2111)-2	3)			
010211	beana	OVERALL LEVEL 1K-2	OKHz			
м	ЮН	.047 In/Sec .09	8 G-s			
м	ITH	.065 In/Sec .26	4 G-s			
м	IIA	.076 In/Sec .11	3 G-s			
C	юн	.192 In/Sec .10	2 G-s			
STD1	- Stand	1 (2111)-2	3)			
		OVERALL LEVEL 1K-2	0KHz			
м	ЮН	.079 In/Sec .07	7 G-s			
M	ITH	.084 In/Sec .03	3 G-s			
м	IIA	.533 In/Sec .16	5 G-s			
G	JIA	.039 In/Sec .04	3 G-s			
G	ЯIН	.049 In/Sec .06	3 G-s			
C	юн	.105 In/Sec .07	4 G-s			
STD2	- Stand	2 (21-Jul-2	3)			
-		OVERALL LEVEL 1K-2	OKHz			
M	ЮН	.118 In/Sec .10	1 G-s			
M	ITH	.189 In/Sec .13	7 G-s			
M	IIA	.386 In/Sec .17	5 G-s			
G	JIA	.393 In/Sec .64	2 G-s			

	GIH COH		.211 In/Sec .598 In/Sec	.403 G-s .085 G-s
	6 h a m	1.0		T -1 02)
STD3	- Stand	1 3	(ZI	-JUI-23)
	MOH		098 Tr/Sec	149 C-s
	мтн		.096 In/Sec	.047 G-s
	MIA		.146 In/Sec	.091 G-s
	GIA		.036 In/Sec	.066 G-s
	GIH		.029 In/Sec	.132 G-s
	СОН		.188 In/Sec	.080 G-s
STD4	- Stand	14	(21	-Jul-23)
			OVERALL LEVEL	1K-20KHz
	MOH		.072 In/Sec	.044 G-s
	MIH		.105 In/Sec	.063 G-s
	MIA		.195 In/Sec	.317 G-s
	GIA		.131 In/Sec	.123 G-S
	COH		244 In/Sec	.114 G-S
	con		.244 11/560	.001 G 3
STD5	- Stand	15	(21	-Jul-23)
	MOH		OVERALL LEVEL	160 C c
	MOH		.070 IN/Sec	.100 G-S
	MTA		096 In/Sec	.107 G-S
	GIA		.130 In/Sec	.011 G-s
	GIH		.072 In/Sec	.088 G-s
	GOH		.210 In/Sec	.435 G-s
	СОН		.500 In/Sec	.052 G-s
STD6	- Stand	d 6	(21	-Jul-23)
			OVERALL LEVEL	1K-20KHz
	MOH		.146 In/Sec	.041 G-s
	MIH		.075 In/Sec	.040 G-s
	MIA		.157 In/Sec	.050 G-s
	GIA		.068 In/Sec	.046 G-s
	GIH		.049 In/Sec	.099 G-s
	GOH		.213 In/Sec	.690 G-s
	CON		.234 11/560	.039 G-S
STD7	- Stand	17	(21	-Jul-23)
	MOH		OVERALL LEVEL	IK-20KHZ
	MOH		.111 IN/Sec	.105 G-S
	MIA		.209 In/Sec	.446 G-s
	GIA		.078 In/Sec	.034 G-s
	GIH		.113 In/Sec	.057 G-s
	GOH		1.166 In/Sec	1.243 G-s
	СОН		.371 In/Sec	.091 G-s
STD13	- Stand	i 13	(21	-Jul-23)
			OVERALL LEVEL	1K-20KHz
	MOH		.083 In/Sec	.124 G-s
	MIH		.078 In/Sec	.083 G-s
	MIA		.223 In/Sec	.475 G-s
	GIA		.025 In/Sec	.071 G-s
	GOH		.021 In/Sec	.023 G-e
	СОН		.994 In/Sec	.194 G-s
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01014	- Stall	A 17	OVERALL LEVEL	1K-20KHz
	MOH		.111 In/Sec	.095 G-s
	MIH		.130 In/Sec	.134 G-s
	MIA		.302 In/Sec	.414 G-s
	GIA		.060 In/Sec	.116 G-s
	GIH		.032 In/Sec	.079 G-s
	GOH		.UZ4 IN/SeC	.UJD G-S

NORTH 2	AC	-	NORTH	AIR	COMPRESSOR Q	UINCY	(21-Jul-23)	
					OVERA	LL LEVEL	1 - 20 KHz	
	MOH				.107	In/Sec	1.059 G-s	
	MIH				.082	In/Sec	.494 G-s	
	MIA				.054	In/Sec	.619 G-s	
					OVERA	LL LEVEL	1K-20KHz	
	CIA				. 332	In/Sec	1.090 G-s	
	CIH				.164	In/Sec	.540 G-s	
	СОН				.179	In/Sec	.635 G-s	
0.0110011			0011001				(01 7-1 02)	
SOUTH A	AC	-	SOUTH	AIR	COMPRESSOR Q	UINCY	(21-Jul-23)	
					OVERA	LL LEVEL	1 - 20 KHz	
	MOH				.170	In/Sec	.389 G-s	
	MIH				.170	In/Sec	.686 G-s	
	MIA				.260	In/Sec	.217 G-s	
					OVERA	LL LEVEL	1K-20KHz	
	CIA				.216	In/Sec	.561 G-s	
	CIH				.146	In/Sec	.511 G-s	
	СОН				.226	In/Sec	.826 G-s	
	c	_				TNCV	(21 - 1-23)	
MEDI A	C		WEDT 7	111((OWEREDSON QU	TT TENZET	(2100123)	
	MOIT				0VERA.	TP/See		
	MOH				.212	In/Sec	.409 G-S	
	MIH				.204	In/Sec	.463 G-S	
	MIA				. 328	In/Sec	.320 G-s	
					OVERA	LL LEVEL	1K-20KHz	
	CIA				.280	In/Sec	.586 G-s	
	CIH				.281	In/Sec	.626 G-s	
	СОН				. 222	In/Sec	.593 G-s	

Database: nucorja9.rbm Station: Roll Mill Utilities

MEASUREMENT	POINT	OVERALL LEVEL	HFD / VHFD		
HYDPMP1 ·	- Hydraulic Pump	East	(20-Jul-23)		
		OVERALL LEVEL	1K-20KHz		
MOH		.087 In/Sec	.198 G-s		
MIH		.156 In/Sec	.126 G-s		
PIV		.286 In/Sec	1.451 G-s		
HYDPMP3 ·	- Hydraulic Pump	West	(20-Jul-23)		
		OVERALL LEVEI	1K-20KHz		
MOH		.105 In/Sec	.260 G-s		
MIH		.284 In/Sec	.227 G-s		
PIV		.286 In/Sec	1.440 G-s		
DESFAN	- Desolution Fan		(20-Ju1-23)		
		OVERALL LEVEI	1K-20KHz		
MOH		.042 In/Sec	.069 G-s		
MIH		.034 In/Sec	.038 G-s		
COMFAN - Combustion Air		Fan	Fan (20-Jul-23)		
		OVERALL LEVEI	1K-20KHz		
MOH		.231 In/Sec	.199 G-s		
MIH		.206 In/Sec	.188 G-s		
MIA		.166 In/Sec	.141 G-s		
FIH		.147 In/Sec	.486 G-s		
FOH		.182 In/Sec	.713 G-s		

EJCFAN -	Ejector Air Fan		(20-Jul-23)	
	-	OVERALL LEVEL	1K-20KHz	
MOH		.198 In/Sec	.176 G-s	
MIH		.181 In/Sec	.201 G-s	
MIA		.118 In/Sec	.230 G-s	
FIA		.078 In/Sec	.530 G-s	
FIH		.102 In/Sec	.649 G-s	
FOH		.244 In/Sec	.486 G-s	
COLPMP2 -	Furnace Cooling	Pump center	(20-Jul-23)	
		OVERALL LEVEL	1K-20KHz	
MOH		.220 In/Sec	.125 G-s	
MIH		.050 In/Sec	.371 G-s	
MIA		.068 In/Sec	.131 G-s	
FCTNORTH -	Furnace CT Drive	e North	(20111-23)	
remonin	runace or brive	OVERALL LEVEL	1K-20KHz	
MOH		445 In/Sec	080 G-s	
МТА		124 In/Sec	092 G-s	
		,		
SCLPMP2 -	Scale Pit Pump M	North	(20-Jul-23)	
	-	OVERALL LEVEL	1K-20KHz	
MOH		.264 In/Sec	.195 G-s	
MIH		.145 In/Sec	.324 G-s	
MIA		.122 In/Sec	.193 G-s	
CTWTR2 -	CT Pump West		(20-Jul-23)	
		OVERALL LEVEL	1K-20KHz	
MOH		.119 In/Sec	.273 G-s	
MIH		.144 In/Sec	.274 G-s	
MIA		.084 In/Sec	.264 G-s	
MTT WTD? _	Mill Wator Dump	Contor	(20	
MILWIRZ	MIII Water Fump	OVERALL LEVEL	1K-20KH-	
МОН		110 Tr/Sec	343 G-e	
мтн		.110 IN/Sec	963 G-s	
мта		038 In/Sec	908 G-s	
MILWTR1 -	Mill Water Pump	East	(20-Jul-23)	
		OVERALL LEVEL	1K-20KHz	
MOH		.087 In/Sec	.252 G-s	
MIH		.064 In/Sec	.346 G-s	
MIA		.040 In/Sec	.154 G-s	
Clarification O	vibration Units	5:		
ACC>	G-S KMS			
ver>	IN/SEC PK			