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March 31, 2022

Nucor Roll Mill Jackson-Flowood, MS

Subject: March vibration survey

Below is a summary report for the monthly Roll Mill vibration survey that was performed on March 28, 2022. 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

Gearbox data shows vibration levels to be ok for this newly rebuilt gearbox. The only issue is the drive end (input side) has some vibration around 1300 Hz. This is high frequency acceleration and may be gear or bearing related. We will monitor this closely. Rated as a **CLASS I** 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 more this month. Last gear 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 again 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. Because of the high amplitude this month, this issue is rated as a **CLASS II** defect.

Roll Stand 7

Gearbox vibration was about the same this survey. Overall vibration at this point has been significantly low the past two surveys compared to average. 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 14

The vibration that was seen in the input axial of the gearbox last month was not present this survey. It is unclear if any actions were taken, but the change in vibration may be due to process load and speed. We will continue to monitor this closely and report any changes. Rated as a **CLASS I** defect.

Roll Stand 16

Drive motor has bearing issues. Vibration data indicates race defects in the motor bearings which likely caused by electrical fluting. Motor should be scheduled for replacement as scheduling allows. Ensure new motor has proper grounding/fluting protection. Rated as a **CLASS III** defect.

South Quincy Compressor

Inboard motor bearing vibration data shows some signs of defects in motor bearing. This appears to be minor as of now, and this issue will be monitored closely. Rated as a **CLASS II** defect.

Furnace Cooling Tower Drives North and South

Motors had lower vibrations this survey; however, 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 in spectral data. 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	Measurer	ment Summary ***************	****	*
D	atabase: tation:	nucorja9.rbm Roll Mill Rolls		
MEASUREMEN	T POINT	OVERALL	LEVEL HF	D / VHFD
STD1A	- Stand	1A	(28-Mar-	22)
		OVERAL	L LEVEL 1K-	20KHz
MOH		.052	In/Sec .0	44 G-s
MIH		.048	In/Sec .0	56 G-s
MIA		.118	In/Sec .0	84 G-s
COH		.161	In/Sec .0	44 G-s
GIA	•	.054	In/Sec .1	70 G-s
GIH		.116	In/Sec 1.6	61 G-s
GI2		.065	In/Sec .4	06 G-s
GI3		.087	In/Sec .8	42 G-s
GI4		.077	In/Sec ./	82 G-s
GIS		.035	In/Sec .1	66 G-S
GIO		.027	In/Sec .0	00 G-S
GOH	•	.027	117560 .1	05 G-S
STD2A	- Stand	2A	(28-Mar-	22)
-		OVERAL	L LEVEL 1K-	20KHz
MOH		.065	In/Sec .0	22 G-s
MIH		.044	In/Sec .0	87 G-s
MIA		.094	In/Sec .0	34 G-s
COH		.092	In/Sec .0	25 G-s
ദന്ന1	- Stand	1	(28-Mar-	221
SIDI	- Stand	L OVERAL	ZO-MAL- T. T.FVFT. 1K-	22) 20847
МОН		105	Tn/Sec 1	
мтн		137	In/Sec 0	25 G-s
MTA		104	In/Sec 0	61 G-s
GIA		.033	In/Sec .0	24 G-s
GIH		.069	In/Sec .0	15 G-s
COH		.079	In/Sec .0	13 G-s
0	- · ·		(00.11	
STD2	- Stand		(28-Mar-	22) 2084-
MOH		122		20KHZ 30 C-s
MUII		106	In/Sec .0	39 G-S 86 C-S
MTA		299	In/Sec 1	45 G-s
GIA		.074	In/Sec .0	28 G-s
GTH	-	.108	In/Sec 0	59 G-s
СОН		.190	In/Sec .0	35 G-s
		_		
STD3	- Stand	3	(28-Mar-	22) 20889-
		OVERAL		ZUKHZ
MOH		.066	IN/Sec .1	45 G-S
MIH	•	. 125	II/Sec .0	ST G-S
MIA CTA	•	.232	In/Sec .3	05 G-8 29 G-e
GIN	•			

	GIH		.040 In/Sec	.054 G-s
	СОН		.166 In/Sec	.025 G-s
STD4	- Stan	d 4	(28	3-Mar-22)
	MOH		OVERALL LEVEL	IK-20KHZ
	MOH		.033 IN/Sec	.010 G-S
	мта		148 In/Sec	.025 G-s
	GIA		.037 In/Sec	.127 G-s
	GIH		.056 In/Sec	.026 G-s
	СОН		.144 In/Sec	.036 G-s
			. ,	
STD5	- Stan	d 5	(28	8-Mar-22)
			OVERALL LEVEL	1K-20KHz
	MOH		.042 In/Sec	.035 G-s
	MIH		.066 In/Sec	.090 G-s
	MIA		.127 In/Sec	.092 G-s
	GIA		.077 In/Sec	.0097 G-s
	GIH		.095 In/Sec	.045 G-s
	GOH		.199 In/Sec	.152 G-s
	COH		.411 In/Sec	.051 G-s
STD6	- Stan	d 6	(28	8-Mar-22)
			OVERALL LEVEL	IK-20KHz
	MOH		.0/2 In/Sec	.020 G-s
	мін		151 Tp/Sec	.013 G-S
	GIA		.131 IN/Sec	.022 G-S
	GIN		.045 IN/Sec	.0048 G-s
	GOH		107 In/Sec	.018 G-s
	COH		252 In/Sec	076 G-s
	com		.232 11, 560	.070 0 5
STD7	- Stan	d 7	(28	-Mar-22)
			OVERALL LEVEL	1K-20KHz
	MOH		.043 In/Sec	.040 G-s
	MIH		.048 In/Sec	.080 G-s
	MIA		.165 In/Sec	.257 G-s
	GIA		.038 In/Sec	.0066 G-s
	GIH		.027 In/Sec	.032 G-s
	GOH		.146 In/Sec	.038 G-s
	COH		.352 In/Sec	.111 G-s
STD8	- Stan	d 8	(28	8-Mar-22)
			OVERALL LEVEL	1K-20KHz
	MOH		.036 In/Sec	.01/ G-s
	MIH		.04/ In/Sec	.072 G-s
			.080 In/Sec	.091 G-s
	GIA		.049 IN/Sec	.046 G-S
	COH		129 In/Sec	.004 G-s
	con		.125 11,560	.002 G 3
STD9	- Stan	d 9	(28	-Mar-22)
			OVERALL LEVEL	1K-20KHz
	MOH		.035 In/Sec	.032 G-s
	MIH		.151 In/Sec	.047 G-s
	MIA		.081 In/Sec	.059 G-s
	GIA		.092 In/Sec	.038 G-s
	GIH		.062 In/Sec	.056 G-s
	COH		.125 In/Sec	.069 G-s
STD10	- Stan	d 10	(28	8-Mar-22)
			OVERALL LEVEL	1K-20KHz
	MOH		.039 In/Sec	.0098 G-s
	MTH		.051 In/Sec	.016 G-s
	MIA		.0/4 IN/Sec	.UI6 G-S
	GIA		.041 IN/SEC	.UOL G-S
	GIU		153 Tr/Sec	.135 G-S
	2011			.040 G-S

STD11	•	-	Stand	11		(28-Mar-22)
					OVERALL LEVEI	1K-20KHz
	MOH				.016 In/Sec	.018 G-s
	MIH				.026 In/Sec	.031 G-s
	MIA				.033 In/Sec	.043 G-s
	GIA				.042 In/Sec	.021 G-s
	GIH				.037 In/Sec	.023 G-s
	GOH				.027 In/Sec	.049 G-s
	СОН				.181 In/Sec	.020 G-s
STD14		-	Stand	14		(28-Mar-22)
					OVERALL LEVEI	1K-20KHz
	MOH				.076 In/Sec	.149 G-s
	MIH				.069 In/Sec	.029 G-s
	MIA				.063 In/Sec	.096 G-s
	GIA				.018 In/Sec	.013 G-s
	GIH				.018 In/Sec	.023 G-s
	GOH				.025 In/Sec	.0073 G-s
	COH				.281 In/Sec	.183 G-s
STD15)	-	Stand	15		(28-Mar-22)
					OVERALL LEVEI	IK-20KHz
	мон				.080 In/Sec	.049 G-s
	MIH				.054 In/Sec	.018 G-s
	MIA				.068 In/Sec	.080 G-s
	GIA				.040 In/Sec	.082 G-s
	GIH				.049 In/Sec	.023 G-s
	СОН				.182 In/Sec	.096 G-s
STD16		_	Stand	16		(28-Mar-22)
			o cana	10	OVERALL LEVEL	1K - 20KHz
	мон				.109 In/Sec	.405 G-s
	MTH				.168 In/Sec	2.544 G-8
	MIA				.131 In/Sec	1.146 G-s
	GIA				.130 In/Sec	.169 G-s
	GIH				.050 In/Sec	.118 G-s
	GOH				.056 In/Sec	.061 G-s
	СОН				.205 In/Sec	.053 G-s
					,	
NORTH	AC	-	NORTH	AIR	COMPRESSOR QUINCY	(28-Mar-22)
					OVERALL LEVEI	1 - 20 KHz
	MOH				.184 In/Sec	1.417 G-s
	MIH				.172 In/Sec	1.343 G-s
	MIA				.338 In/Sec	1.232 G-s
					OVERALL LEVEI	1K-20KHz
	CIA				.278 In/Sec	.767 G-s
	CIH				.258 In/Sec	.426 G-s
	СОН				.290 In/Sec	.339 G-s
SOUTH	AC	-	SOUTH	AIR	OVEDATI TEVET	(28 - Mar - 22)
	мон				106 Th/Sec	1 236 C-C
	мтн				280 In/Sec	2 038 G-s
	МТА				107 In/Sec	1.036 G-s
					OVERALL LEVEL	. 1K-20KH-
	CTA				331 Tn/900	674 C-e
	Стр				307 Tn/Sec	457 C-e
	COH				318 Tn/Sec	273 C-0
	0.011				.510 11/560	.2,5 6 5
Station:	Roll M	Mi	ll Util	litie	25	
MEASU	REMEN	ים	РОІМТ		OVERALL LEVEL	нго / унго
					······································	

HYDPMP1	- Hydraulic Pump	East (2	28-Mar-22)
		OVERALL LEVEL	1K-20KHz
MOH		.084 In/Sec	.389 G-s
MIH		.187 In/Sec	.301 G-s
PIV		.340 In/Sec	2.268 G-s

HYDPMP2	2	-	Hydraulic Pump	Center		(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	MOH			.027	In/Sec	.189 G-s
	MIH			.184	In/Sec	.145 G-s
	PIV			.267	In/Sec	.367 G-s
DESFAN		-	Desolution Fan			(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	MOH			.037	In/Sec	.037 G-s
	MIH			.047	In/Sec	.039 G-s
COMFAN		-	Combustion Air	Fan		(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	MOH			.109	In/Sec	.183 G-s
	MIH			.101	In/Sec	.276 G-s
	MIA			.080	In/Sec	.207 G-s
	FIH			.055	In/Sec	.109 G-s
	FOH			.083	In/Sec	.090 G-s
EJCFAN		-	Ejector Air Fan			(28-Mar-22)
				OVERAL	LL LEVEL	1K-20KHz
	мон			.093	In/Sec	.262 G-s
	MIH			.121	In/Sec	.384 G-s
	MIA			.099	In/Sec	.303 G-s
	FIA			.053	In/Sec	.322 G-s
	FIH			.061	In/Sec	.424 G-s
	FOH			.117	In/Sec	.377 G-s
				_		
COLPMP2	2	-	Furnace Cooling	Pump ce	enter	(28-Mar-22)
				OVERAL	гг телет Та (Со	IK-ZUKHZ
	MOH			. 220	In/Sec	.130 G-S
	MIH			.070	In/Sec	.241 G-S
	MIA			.110	In/Sec	.150 G-s
FCTSOII	יט	_	Eurosco CT Driv	o South		(28-Max-22)
FCISOOI			Fullace CI DIIV	OVERAI		1K-20KH7
	MOH			427		
	MTU			100	In/Sec	.072 G-S
	мта			.198	In/Sec	.072 G-S
				.054	111, 000	.040 0 5
FCTNORT	гн	_	Furnace CT Driv	e North		(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	мон			.377	In/Sec	.067 G-s
	мін			.281	In/Sec	.123 G-s
	MIA			.144	In/Sec	.069 G-s
SCLPMP1	L	-	Scale Pit Pump	South		(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	MOH			.281	In/Sec	.291 G-s
	MOV			.211	In/Sec	.338 G-s
	MIV			.149	In/Sec	.087 G-s
	MIH			.152	In/Sec	.103 G-s
	MIA			.204	In/Sec	.061 G-s
CTWTR2		-	CT Pump West			(28-Mar-22)
				OVERAI	LL LEVEL	1K-20KHz
	MOH			.093	In/Sec	.282 G-s
	MIH			.101	In/Sec	.182 G-s
	MIA			.118	In/Sec	.232 G-s
	2	_	Mill Watar Dur	West		(28-Mam-22)
MILWIRS	2	-	MIII water Pump	OULDY	.T. T.R.7PT	1K-20KU-
	MOu			075KAI	Tu/goo	201 C
	MTU			.007		701 C-S
	MTA			0.054	In/Sec	260 C-s
				.040	111/ 580	.209 6-8
MILWTR1	L	_	Mill Water Pump	East		(28-Mar-22)
			···· ·	OVERAL	LL LEVEL	1K-20KHz
	мон			.077	In/Sec	.162 G-s

MIH MIA	.067 In/Sec .048 In/Sec	.365 G-s .124 G-s
EASTBOOST - East Booster	Pump Small OVERALL LEVEL	(28-Mar-22) 1K-20KHz
MOH	.547 In/Sec	.190 G-s
MIH	.331 In/Sec	.111 G-s
MIA	.407 In/Sec	.144 G-s

Clarification Of Vibration Units:

	Clarificat	ion Of	Vibrat	ion Uni
Acc> G-s RMS	Acc	>	G-s	RMS

Vel --> In/Sec PK