HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

7030 Ryburn Dr. Millington, TN Phone: (901) 873-5300 Fax: (901) 873-5301 www.gohispeed.com

July 10, 2020

Nucor Roll Mill
Jackson-Flowood, MS

Subject: July 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 amplitudes are varying with survey while gearbox data show signs of distress. We will continue to monitor this unit closely. Still rated as a **CLASS I** defect for now.

Roll Stand 1 Motor
There is a significant amount of 360 Hz. vibration especially at the drive end axial of the motor. There are also several rpm sidebands around the 360 Hz. peak. This indicates a drive problem such as SCR card fault. There could also be an issue with armature. It is recommended to inspect the drive as soon as practical. This issue will be monitored closely. Because of the electrical vibration, this is rated as a **CLASS II** defect.

Roll Stand 2 int. Gearbox
Input rpm sidebands around the gear mesh frequencies indicate possible oscillation of the input gear set. This could be from an issue with the speed synch on the drives, drive line slop, or some other process issue. Gearbox may need an internal inspection in the future. Rated as a **CLASS I** defect.

Roll Stand 5
Vibration increased some 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 still appears to be a vibration in this unit that may be due to imbalance of the fan wheel. Inspect, clean fan wheel as time allows. Ensure all bolts are tight. 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 increased from 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 vibration increased this survey. 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. Rated as a **CLASS I** defect.

Roll Stand 9
Vibration has increased this survey in the input side of the gearbox. Overall amplitude much higher than normal. Data shows several harmonics at what appears to be gear mesh frequency of the input gear. It is unclear if process/load is affecting this sudden increase in amplitudes. An inspection of the gearbox may be needed in the near future. Rated as a **CLASS II** defect.

Roll Stand 13 Cooling Fan Motor
Fan appears to have vibration associated with fan imbalance. Resonance may also be a factor as this vibration does seem to vary slightly depending on the speed of the DC motor. We will monitor this closely. Rated as a **CLASS I** defect.

Ejector Fan

Overall vibrations are lower in the motor and fan since replacing the motor. There still seems to be higher than normal high frequency acceleration amplitude in the fan bearings especially the outboard bearing. We will monitor this issue closely. Rated as a **CLASS I** defect for now.

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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                      (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .075 In/Sec       .024 G-s
             MIH                    .061 In/Sec       .033 G-s
             MIA                    .108 In/Sec       .126 G-s
             COH                    .251 In/Sec       .093 G-s
             GIA                    .065 In/Sec       .106 G-s
             GIH                    .116 In/Sec       .096 G-s
             GI2                    .102 In/Sec       .057 G-s
             GI3                    .113 In/Sec       .210 G-s
             GI4                    .092 In/Sec       .200 G-s
             GI5                    .049 In/Sec       .089 G-s
             GI6                    .041 In/Sec       .064 G-s
             GOH                    .053 In/Sec       .028 G-s

      STD2A      - Stand 2A                      (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .050 In/Sec       .020 G-s
             MIH                    .037 In/Sec       .059 G-s
             MIA                    .046 In/Sec       .026 G-s
             COH                    .129 In/Sec       .042 G-s

      STD1       - Stand 1                       (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .063 In/Sec       .082 G-s
             MIH                    .084 In/Sec       .073 G-s
             MIA                    .222 In/Sec       .090 G-s
             GIA                    .076 In/Sec       .034 G-s
             GIH                    .070 In/Sec       .012 G-s
             COH                    .094 In/Sec       .089 G-s

      STD2       - Stand 2                       (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .067 In/Sec       .058 G-s
             MIH                    .093 In/Sec       .116 G-s
             MIA                    .093 In/Sec       .011 G-s
             GIA                    .158 In/Sec       .276 G-s
             GIH                    .232 In/Sec       .389 G-s
             COH                    .416 In/Sec       .051 G-s

      STD3       - Stand 3                       (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .071 In/Sec       .181 G-s
             MIH                    .114 In/Sec       .058 G-s
             MIA                    .155 In/Sec       .038 G-s
             GIA                    .097 In/Sec       .021 G-s
             GIH                    .048 In/Sec       .022 G-s
             COH                    .180 In/Sec       .025 G-s

      STD4       - Stand 4                       (08-Jul-20)
                                   OVERALL LEVEL     1K-20KHz
             MOH                    .060 In/Sec       .050 G-s
             MIH                    .075 In/Sec       .057 G-s
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MIA	.105 In/Sec	.076 G-s
GIA	.061 In/Sec	.022 G-s
GIH	.045 In/Sec	.020 G-s
COH	.312 In/Sec	.025 G-s

STD5 - Stand 5 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.053 In/Sec	.032 G-s
MIH	.043 In/Sec	.040 G-s
MIA	.080 In/Sec	.031 G-s
GIA	.090 In/Sec	.0042 G-s
GIH	.046 In/Sec	.055 G-s
GOH	.128 In/Sec	.148 G-s
COH	.560 In/Sec	.042 G-s

STD6 - Stand 6 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.054 In/Sec	.104 G-s
MIH	.041 In/Sec	.041 G-s
MIA	.100 In/Sec	.046 G-s
GIA	.067 In/Sec	.033 G-s
GIH	.050 In/Sec	.063 G-s
GOH	.294 In/Sec	.474 G-s
COH	.251 In/Sec	.029 G-s

STD7 - Stand 7 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.059 In/Sec	.154 G-s
MIH	.040 In/Sec	.070 G-s
MIA	.067 In/Sec	.141 G-s
GIA	.053 In/Sec	.081 G-s
GIH	.091 In/Sec	.052 G-s
GOH	.687 In/Sec	.315 G-s
COH	.367 In/Sec	.073 G-s

STD8 - Stand 8 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.075 In/Sec	.051 G-s
MIH	.068 In/Sec	.062 G-s
MIA	.063 In/Sec	.152 G-s
GIA	.108 In/Sec	.066 G-s
GIH	.116 In/Sec	.134 G-s
COH	.540 In/Sec	.057 G-s

STD9 - Stand 9 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.069 In/Sec	.071 G-s
MIH	.081 In/Sec	.200 G-s
MIA	.066 In/Sec	.066 G-s
GIA	.132 In/Sec	.041 G-s
GIH	.237 In/Sec	1.540 G-s
COH	.342 In/Sec	.414 G-s

STD10 - Stand 10 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.027 In/Sec	.027 G-s
MIH	.026 In/Sec	.043 G-s
MIA	.048 In/Sec	.034 G-s
GIA	.086 In/Sec	.516 G-s
GIH	.072 In/Sec	.339 G-s
COH	.148 In/Sec	.082 G-s

STD11 - Stand 11 (08-Jul-20)

	OVERALL LEVEL	1K-20KHz
MOH	.029 In/Sec	.061 G-s
MIH	.037 In/Sec	.027 G-s
MIA	.054 In/Sec	.023 G-s
GIA	.072 In/Sec	.084 G-s
GIH	.075 In/Sec	.290 G-s
GOH	.055 In/Sec	.292 G-s

	COH	.146 In/Sec	.010 G-s
STD13	- Stand 13		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.063 In/Sec	.257 G-s
	MIH	.084 In/Sec	.234 G-s
	MIA	.062 In/Sec	.138 G-s
	GIA	.058 In/Sec	.047 G-s
	GIH	.048 In/Sec	.051 G-s
	GOH	.058 In/Sec	.061 G-s
	COH	.317 In/Sec	.277 G-s
NORTH AC	- NORTH AIR COMPRESSOR QUINCY		(08-Jul-20)
		OVERALL LEVEL	1 - 20 KHz
	MOH	.131 In/Sec	.186 G-s
	MIH	.128 In/Sec	.357 G-s
	MIA	.200 In/Sec	.247 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.211 In/Sec	.454 G-s
	CIH	.208 In/Sec	.520 G-s
	COH	.148 In/Sec	.539 G-s
SOUTH AC	- SOUTH AIR COMPRESSOR QUINCY		(08-Jul-20)
		OVERALL LEVEL	1 - 20 KHz
	MOH	.065 In/Sec	1.056 G-s
	MIH	.175 In/Sec	.363 G-s
	MIA	.108 In/Sec	.357 G-s
		OVERALL LEVEL	1K-20KHz
	CIA	.194 In/Sec	.491 G-s
	CIH	.178 In/Sec	.422 G-s
	COH	.218 In/Sec	.459 G-s

Station: Roll Mill Utilities

MEASUREMENT POINT		OVERALL LEVEL	HFD / VHFD
DESFAN	- Desolution Fan		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.025 In/Sec	.055 G-s
	MIH	.021 In/Sec	.036 G-s
COMFAN	- Combustion Air Fan		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.101 In/Sec	.353 G-s
	MIH	.094 In/Sec	.224 G-s
	MIA	.059 In/Sec	.075 G-s
	FIH	.055 In/Sec	.066 G-s
	FOH	.071 In/Sec	.464 G-s
EJCFAN	- Ejector Air Fan		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.046 In/Sec	.243 G-s
	MIH	.047 In/Sec	.440 G-s
	MIA	.042 In/Sec	.412 G-s
	FIH	.033 In/Sec	.898 G-s
	FOH	.047 In/Sec	2.793 G-s
COLPMP2	- Furnace Cooling Pump center		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.303 In/Sec	.338 G-s
	MIH	.186 In/Sec	.459 G-s
	MIA	.150 In/Sec	.127 G-s
FCTSOUTH	- Furnace CT Drive South		(08-Jul-20)
		OVERALL LEVEL	1K-20KHz
	MOH	.126 In/Sec	.058 G-s
	MIH	.080 In/Sec	.021 G-s
	MIA	.152 In/Sec	.048 G-s

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FCTNORTH   - Furnace CT Drive North        (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .451 In/Sec       .048 G-s
        MIH                      .266 In/Sec       .124 G-s
        MIA                      .137 In/Sec       .134 G-s


SCLPMP1    - Scale Pit Pump South          (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .179 In/Sec       .276 G-s
        MOV                      .138 In/Sec       .561 G-s
        MIV                      .079 In/Sec       .114 G-s
        MIH                      .084 In/Sec       .084 G-s
        MIA                      .099 In/Sec       .066 G-s

CTWTR2     - CT Pump West                  (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .139 In/Sec       .436 G-s
        MIH                      .064 In/Sec       .819 G-s
        MIA                      .104 In/Sec       .560 G-s

MILWTR3    - Mill Water Pump West          (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .107 In/Sec       .354 G-s
        MIH                      .059 In/Sec       .723 G-s
        MIA                      .059 In/Sec       .270 G-s

MILWTR1    - Mill Water Pump East          (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .059 In/Sec       .155 G-s
        MIH                      .046 In/Sec       .247 G-s
        MIA                      .057 In/Sec       .078 G-s

EASTBOOST  - East Booster Pump Small       (08-Jul-20)
                                OVERALL LEVEL     1K-20KHz
        MOH                      .258 In/Sec       .247 G-s
        MIH                      .143 In/Sec       .189 G-s
        MIA                      .301 In/Sec       .106 G-s

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   Clarification Of Vibration Units:
      Acc      -->  G-s      RMS
      Vel      -->  In/Sec   PK
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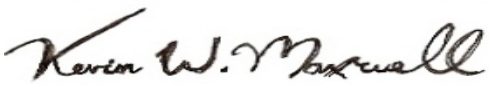
As always, it has been a pleasure to NUCOR Steel Flowood, MS. If there are any comments or questions, do not hesitate to contact us.

Sincerely,



ISO Certified Vibration Analyst, Category III

HI-SPEED INDUSTRIAL SERVICE

QualiTest® Diagnostics

Cell: 901-486-4565

Email: kwilliam@gohispeed.com