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TITLE

Motion Amplification Study, T.E. Maxson Waste Water Treatment Facility Memphis, TN

1: Executive Summary

Hi-Speed Industrial Service was called in to use its Motion Amplification Technology to inspect four Vertical Effluent Pumps. Motor rpm of all pumps is constant at 505 rpm (nameplate rpm). MA video was captured on each pump at 505 rpm.

2: Methodology of Data Acquisition

Initial approach was to video each pump and motor in the field of view. There appeared to be minimal motion on the pump frames except for Pump 4, so most video was focused on the motors.

3: Data Analysis & Results

Effluent Pump 1 CLICK ON IMAGE TO OPEN VIDEO



Figure 1: Motion Amplification, Effluent Pump 1

Notice in the MA video in Figure 1, the axial motion of the motor. This motion appear to be synchronous to the motor at a frequency of 4 x motor rpm. This may be vane pass frequency of the pump if the pump has four vanes. This could also be caused of some type of coupling issue. Coupling issues typically cause a 4 x rpm vibration. See spectral plot of the DE motor axial below.



Figure 2: Spectral plot DE motor axial

Vibration plot above shows a vibration peak at 4 x 8.5 Hz. which is motor shaft speed. Amplitude shows to be over 6 mil- pk.



Effluent Pump 2

Figure 3: Motion Amplification, Effluent Pump 2

Figure 3 above shows similar motion as #1 Pump in the axial position. There is some background motion in this video due to the wind blowing during the acquisition; however, it is clear that the motor has some axial movement. Amplitudes do not appear to be as high as Pump 1. Frequency of the motor vibration is at 4 x rpm same as Pump 1.



Figure 4: Motor DE axial spectral plot

Figure 4 shows a spectral plot of the DE of the motor at the axial position. The amplitude of vibration in this pump appears to be lower than Pump 1.

Effluent Pump 3



Figure 5: Motion Amplification, Effluent Pump 3

Figure 5 shows Pump 3 Motor having minimal movement except at the junction box. Junction box does appear to have some excessive motion.



Figure 6: Motion Amplification, Effluent Pump 4

Figure 6 MA video shows Pump 4 having some pump frame and motor motion. The frequency of vibration appears to be mainly at 1 x rpm. This vibration is present in both radial directions and axial as well. Arrow in picture shows where the vibration plots were measured from in the MA video. See vibration plots below.



Figure 6: Vibration plots

X axis is side to side and Y axis is axial or straight up and down. Notice peaks are at 8.49 Hz. which is very close to motor rpm



Figure 7, Motion Amplification Pump 4 (slightly different angle focused more on motor)

4: Conclusion(s) and Corrective Action(s)

In conclusion, there appears to be some axial vibration in Pumps 1 and 2. According to vibration data that was taken from Motion Amplification software, this appears to be occurring at 4 x motor/speed. This could be pump vane pass frequency if the impellers have four vanes. Coupling issue will also cause a 4 x rpm vibration as well.

Pump 3 had some minimal motor/pump vibration. Motion amplification did show some excessive motion on the electrical junction box on the side of the motor. This may need to be checked for loose fasteners.

Pump 4 has some 1 x rpm vibration according to vibration plots taken form the Motion Amplification. This vibration or motion shows to be at both radial directions and axial direction. This could be due issues in the pump. It is not uncommon for the motor to have vibrations cause by pump shaft issues such as bent shaft or bushing wear of the pump shaft. Unbalance of the impeller can also cause this type of vibration.

It is recommended to perform vibration analysis on each pump to help determine the exact amplitude and frequency of all vibrations occurring in these units.

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