Allowable Pump Field Vibration

The Hydraulic Institute Standard 9.6.4 - 2000 specifies the Allowable Pump Field Vibration values for different types of pumps and applications. Figures 1 and 2 illustrate the values, direction and locations of the measurements for solid handling pumps similar to the types produced by Hayward Gordon.

The vibration values are for installations properly aligned, anchored and grouted. The Standard indicates that the values are not applicable to temporary factory setups used for performance tests. During performance tests which require vibration monitoring, we use the Standard values as reference only since the pumps are not anchored or grouted to the floor. In addition, the Standard does not consider the very popular V-belt drive arrangements; we suggest using “vertical” values for these installations. Measurements should be taken on the outboard bearing as illustrated in Figure 1, and if necessary, coupling guards should be removed. Use of hand held vibration detectors capable of measuring unfiltered velocity are acceptable.

Diagnosing Pump Vibration

Most hand held vibration detectors measure displacement as well as velocity and with both these measurements it is possible to determine an approximate value of the dominant frequency. The dominant frequency can be used to help identify the root cause of the pump vibration; i.e. bearings, misalignment, bent shaft, unbalance etc.

For example, if a given V-belt installation has a motor speed of 1750 rpm and a pump speed of 1550 rpm; and vibration readings of 0.250 in/sec, peak velocity, and 3.00 mils (0.002") peak to peak displacement are obtained at the outboard bearing of the pump, then the dominant frequency can be calculated using the following equation:

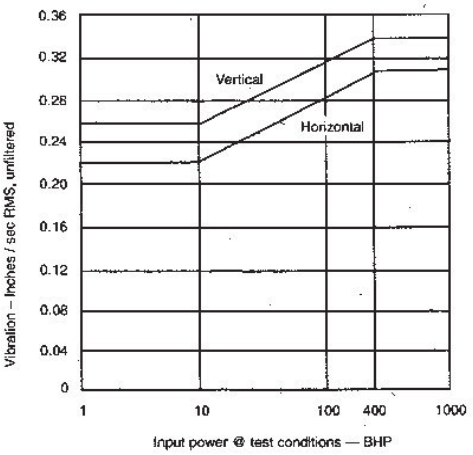
Dominant frequency (rpm) = Velocity (in/sec)/Displacement (mils) x 19099

Or

Dominant frequency (rpm) = 0.250 (in/sec)/3.00 (mils) x 19099= 1592 rpm

In this case, the Dominant frequency (rpm) is approximately equal to the rpm of the pump; this is usually noted as 1 x rpm. At 1 x rpm, and if these measurements were obtained in the radial direction, the most likely causes of vibration are an inertial unbalancing produced by hydraulic factors or dynamic unbalance of the rotating parts.

Figure 1



The measurements indicate the degree of vibration while the dominant frequency can identify the cause of vibration. In this case the vibration is probably caused by unbalance; however, it is still at an acceptable level.

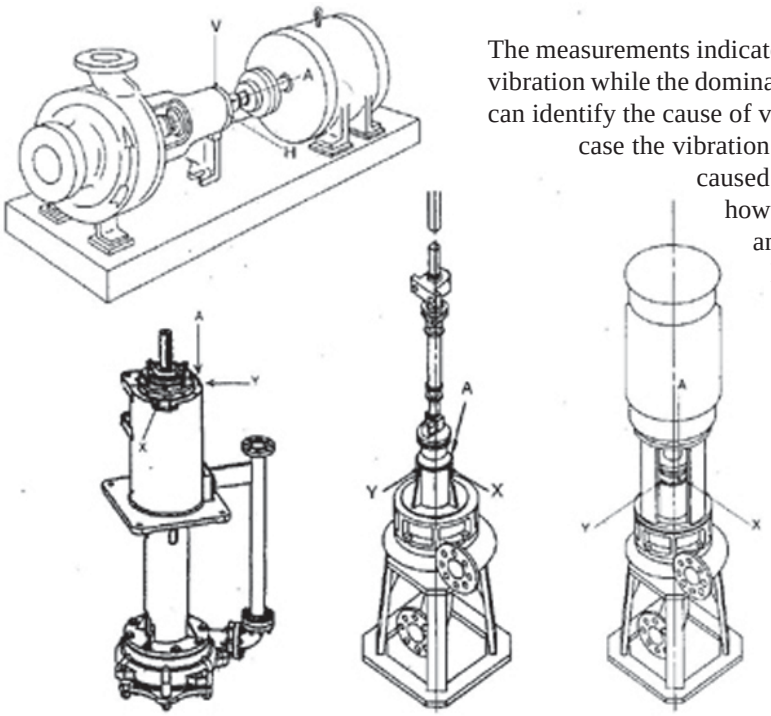


Figure 2 - End suction, solids handling, horizontal and vertical.