Vibration Monitoring of Air Handling Units

Applications

Air handling units are used to remove humidity and circulate air as part of a larger heating, ventilation, and air conditioning (HVAC) system. While air handling units can be found anywhere that has some kind of climate control system, they are particularly important in hospitals, laboratories, data centers, museums, and on production lines where air quality, and environmental, control is important.

Types

There are two types of air handling units: belt driven and direct/gear driven. A belt driven air handling unit utilizes belts looped over rotating shafts to run the unit’s motor. On the other hand, a direct/gear driven air handling unit’s motor is driven by gears that are in direct contact with each other.

Causes of Failure

Common causes of mechanical failure in air handling units are looseness, misalignment, defects, or ware problems.

Failures

There are many modes of failure in air handlers, including:

- Bearing defects
- Loose bearing hold-down bolts
- Worn, damaged, or broken belts
- Worn or damaged sheaves
- Misalignment between sheaves
- Bent shaft
- Wheel imbalance
- Motor imbalance
- Motor electrical faults
- Fan section not evenly supported
What Should Be Measured

To detect a potential failure before it happens, sensors should be placed to monitor bearings on both the motor and fan of the air handling unit. More specifically, if possible, sensors should be located on the motor inboard bearing, in the axial, horizontal, and vertical positions, the motor outboard bearing in the horizontal and vertical positions, the fan inboard bearing in the axial, horizontal, and vertical positions, and the fan outboard bearing on in the vertical and horizontal positions.

Analysis

Air handling unit motors generally run between 1,200 to 3,600 revolutions per minute (RPM), however, most motors will generally run 1,800 RPM. Fan speeds on the other hand tend to range between 480 RPM to 3,500 RPM. If excessive vibration peaks (amplitudes) are noticed at these frequencies, it could be an indication of problems.

Additionally, an air handling unit’s drive belt will run at speeds below 1,000 RPM and a dominant peak below that point may indicate belt problems such as a belt splice, a broken cord, or that the belt was spun on when the unit was started up.

Savings

Air handlers help to maintain comfortable indoor environments and can be even more vital in industries where strict air quality parameters are required, and, therefore, it is important that they be monitored regularly.

Vibration monitoring, especially continuous, wireless vibration monitoring, can lead to reduced, or eliminated, exposure to safety hazards, an ability to collect data from previously inaccessible areas of the air handling unit, and an inexpensive solution to a potentially very costly problem.

To illustrate the importance of continuously monitoring air handling units, a failure occurred in one air handling unit when a bolted connection supporting a fan shaft bearing failed causing an entire side of the fan to collapse which destroyed the fan wheel and caused major damage to the fan housing. The air handling unit was old and needed parts to be custom made, a process that was long and expensive. The unit was monitored, however, only monthly, and had it been monitored continuously, a change in vibration would have most likely been noticed before the unit failed.1

---