Vibration Monitoring of Air Handling Units

Air Handling Units, or AHUs as they are often referred to, are widely employed across a variety of industries to circulate air as part of a heating, ventilating and air-conditioning system (HVAC). They are required to operate continuously providing consistent environmental parameters such as temperature, humidity and level of flow.

AHUs come in a variety of shapes and sizes. A typical unit consists of a large metal enclosure containing a fan or blower, coils that circulate steam or hot water for heating and chilled water for cooling and air filters. The complete fan and motor assembly, comprising bearings, shaft, pulley and belts are contained within the AHU enclosure, which will have removable panels to enable engineers to gain access to carry out any necessary maintenance procedures.

There are numerous applications whereby it is critical that safe, consistent indoor air quality is maintained 24/7 with any significant changes having the potential to cause huge repercussions concerning health and safety issues and inferior, damaged or loss of production. Take for example the consequences on a pharmaceutical production line where to ensure a quality product it is imperative to maintain air flow rate, temperature and humidity throughout a total production process, which could last in excess of 4 weeks. If there is a mechanical failure the cost of loss production could be exceedingly high, with other implications such as customer dissatisfaction and penalties resulting from late orders.

It therefore makes economic sense to monitor the rotating elements of the AHUs to enable vibration engineers to pick up early signs of any degradation in the equipment so maintenance can be planned and carried out with minimal expense and disruption to service.

PRODUCT OPTIONS

Hansford Sensors have supplied a wide variety of vibration sensors to this industry and various approaches have been applied. Typically AHUs include a Supply Fan and Extractor Fan and can either be Direct Drive or Non-Direct Drive. On direct drive fans a vibration sensor would be installed on both the Drive End (DE) and Non Drive End (NDE) bearing. For Non-Direct Drive Fans, in addition to monitoring the DE and NDE bearings you would install 2 sensors on the journal bearings of the gear shaft. Therefore, depending on the configuration of the fans employed a typical installation would need either 6 or 8 vibration.

A simple cost-effective On-Line option for monitoring AHUs requires 4-20mA sensors (HS-420 Series) mounted on to the bearings and shafts of the AHU with the velocity levels being fed back to a PLC or similar system where overall vibration trends can be monitored. This is a well established technique for identifying in particular out of balance and misalignment. A popular choice of sensor is the M12 Connector option used in conjunction with separate M12 cable assemblies. The main advantages of the M12 connector are its physically smaller size, associated cable assemblies have a tighter bend radius and it is a well accepted and proven connector used across many industries. Another sensor option to consider is a dual output sensor (HS-421 Series) which provides not only a 4-20mA output, but also an AC output along with, which allows the engineer to take more-in-depth vibration analysis via a Data Collector, including detecting bearing defects, mechanical looseness, along with more detailed information on out-of-balance and possible alignment issues.
Another method that can be applied is the use of fixed AC sensors (HS-100 Series) hard-wired back to switch boxes located in accessible, safe positions outside the AHUs. This set up enables vibration data to be collected safely from the same positions on a regular basis, although it should be noted that the readings are only applicable to the moment in time in which they were taken. Analysis of this data over time enables the maintenance engineer to obtain an effective picture of plant operating conditions and schedule any necessary maintenance procedures accordingly. For installations where there is limited access, for example, near the belt guards, a side entry sensor (HS-100S Series) can be used. A further choice suitable for the smaller AHUs is to install the compact small footprint sensor, the HS-130 Series. Switch boxes are available in a number of configurations and finishes ranging from the cost-effective HS-BE Series rated to IP55 and suitable for clean, indoor environments, to the painted mild steel (rated to the IP66), to the GRP for outdoor locations to the stainless steel boxes compulsory in many food processing and pharmaceutical installations.

INSTALLATION
There are many different methods available for installing the sensors. The accelerometer needs to be mounted directly to the machine surface on a flat, smooth, unpainted surface larger than the base of the accelerometer, free from grease and oil, as close as possible to the source of vibration and at right angles to the axis of rotation, to correctly measure the levels of vibration. This can be achieved in several ways:

a) The preferred mounting technique, where conditions allow, is to drill and tap a thread directly on the machine so an accelerometer with an integral ¼-28UNF, M6, M8 etc mounting thread can screwed in to place. The same drill and tap method can be applied when using a separate mounting stud and then connecting the accelerometer to the stud. Care needs to be taken to tighten sensor to specified torque levels as over-tightening can damage the sensor by stripping the thread and under- tightening will lead to inaccurate reading due to poor contact with the vibrating surface.

b) Where it is not possible to drill and tap, for example where warranty issues do not permit this, adhesive mounting can be employed. A metal filled epoxy adhesive provides suitable bonding for applications in temperature up to 100°C. We can provide HS-AA003 Metal Bonding Stud Adhesive, which provides sufficient adhesive to mount up to 25 studs.

The accelerometer cable should be clamped to the body of the accelerometer with a cable tie to prevent strain and excessive movement of the cable, which if left loose could result in false readings.

APPLICATIONS
Vibration monitoring of AHUs has proved to be very successful in providing a cost-effective solution to prevent potentially expensive machinery failures in critical applications and reducing the exposure of the engineer to safety hazards by enabling data to be collected from inaccessible points. There are many applications where it is vital to monitor air quality, often within tight tolerances. Hospitals are a good example, in the operating theatres to ensure the well-being of the patient and in the general wards and public areas where comfort of both patients and visitors needs to be considered. Laboratories are another key area where months of experiments and storage of data can be wiped out if certain environmental conditions are not maintained. Data Centres covering The Communications, Banking and Travel Sectors which over the years have become more reliant on technology store high volumes of sensitive data that needs to be stored safely and is a growing area for requiring monitoring of AHUs. Public libraries and museums which store priceless collections have also embraced the technology. Then of course there are the needs of the general public in both leisure and work environments who need to be kept in their 'comfort' zone and are often quick to complain if there are too hot or too cold. The opportunities are endless!
For more information on the extensive range of Hansford Sensors products, please visit [www.hansfordsensors.com](http://www.hansfordsensors.com).

About Hansford Sensors Ltd, the International Centre of Excellence for Vibration Monitoring

Hansford Sensors Ltd specialise in the design and manufacture of accelerometers for monitoring vibration and temperature levels of industrial machinery, playing a key part in the role of predictive maintenance. Products include intrinsically safe models for approved use in Group I (Mining) and Group II (Petrochemical). Hansford Sensors Ltd also supply multi-sensor switch boxes, vibration sensor modules, portable vibration meters, accessories for sensors, vibration condition monitoring protection systems and custom built vibration sensors.

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