SENSAPHONE®
REMOTE MONITORING SOLUTIONS

6 Threats to HVACR Equipment and How to Avoid Them

As a facility manager, you are responsible for keeping your property's equipment and environmental systems functioning at all times to ensure the comfort and safety of workers, residents and visitors. Even when you aren't at work or on site, you have to maintain zero downtime for HVAC systems.

In addition to inconveniencing building occupants, HVAC system failure can also lead to operational downtime, expensive repairs, replacement equipment and facility cleanup. Even if you and your staff are on call 24/7, many issues like a slow leak or clogging coil are hard to spot until the equipment fails. And although an inefficient HVAC system might not fail outright, it uses unnecessary energy.

You can't control unexpected malfunctions. But you can be alerted immediately when an event occurs so you can take fast action to stop the damage and fix the problem. And you can monitor for conditions that signal an upcoming failure so you can use proactive maintenance to stay ahead of the curve.

Here are six threats to HVAC systems that can be prevented with a remote monitoring system.

- TEMPERATURE INSTABILITY
- HUMIDITY FLUCTUATION
- WATER LEAKS
- BOILER AND CHILLER FAILURE
- AIRFLOW IMPAIRMENT
- PHYSICAL SECURITY

Temperature Instability

An HVAC system's main job is to keep ambient temperature at a comfortable and safe range in all interior rooms, hallways and group areas. And as a facility manager, you also need to maintain set water temperature ranges in bathrooms, kitchens, laundry facilities, laboratories, and a myriad of other areas that rely on water.

Remote monitoring systems can notify you if air or water temperatures go above or below your preset range. These systems include sensors and a base unit. The sensors measure data, and the base unit records and analyzes that data and sends you alerts by phone, text or email.

In multi-area facilities like office buildings, hotels, apartment buildings and hospitals, you can inconspicuously place monitoring system base units in hidden areas like utility closets. The sensors can be wired up to 2,000' away from the base unit. The wiring is often run in drop ceilings or alongside other electrical wiring in the building. Be sure to choose a remote monitoring system that can communicate with the number of sensors you require for your installation. For example, the Sensaphone Sentinel system can connect to 12 sensors.

Monitoring Temperatures in Refrigerators & Freezers

If you work at a healthcare or food industry facility, it's your job to make sure the walk-in refrigerators and freezers temperatures are correct to store food at the proper temperature.

There are different ways to measure the temperature inside a cold storage area. Sensors measure either the air temperature in the refrigerator or freezer or one or more food items stored in the area. They constantly communicate those temperature readings to the remote monitoring system. They can be used with or without a temperature buffer, which acts as a cushion against temperature fluctuations in a freezer or refrigerator.

Frequent Temperature Monitoring Applications:

- **Ambient air temperature in lobbies, hallways, or any other room.**
- **Walk-in refrigerators/freezers**
- **Boiler water temperature**
- **Outside air temperature**

Water Leaks

Pooling or seeping water around HVAC equipment indicates a problem. However, water issues often begin silently and fester for some time without your knowledge. Early detection gives you enough lead time to prevent major water damage to equipment and surrounding areas.

Zone water detection sensors connect to a water-sensing rope. You can string together several water detection ropes from a single sensor for greater coverage. A spot water detection sensor monitors for the presence of water directly under the sensor.

It's important to place sensors properly. Water tends to puddle at the lowest point of the floor and underneath pipe junctions, air conditioning units, humidifiers and furnaces. Placing the sensor too high won't trigger an alarm until after a serious flood has occurred.

Recommended Water Leak Detection Rope Placement:

- ☐ **Around the perimeter of HVAC equipment**
- ☐ **Inside a drop ceiling**
- ☐ **Under a raised floor**
- ☐ **Around or under vital equipment that must remain dry**
- ☐ **Under pipes running through a critical area**

We recommend that you fit the perimeter around HVAC equipment with leak detection sensors. It is also a good idea to place leak detection sensors along pipes carrying fluids through any critical areas, like data centers.

Potential Water Sources:

- **Blocked or cracked drains, traps, pans, tubing**
- **Malfunctioning pumps**
- **Faulty evaporator coils**
- **Broken fittings, pipes, joints, gaskets**
- **Leaking humidifier**
- **Damaged compressor**

Airflow Impairment

Monitoring airflow, carbon monoxide (CO), and carbon dioxide (CO_2) levels tells you how well your HVAC system is working and lets you correct problems before they become dangerous. Measuring the rate of airflow helps you to gauge the overall health of the environment. Airflow management is critical because the sooner you learn about a ventilation failure, the faster you can act to prevent a complete shutdown.

> **Airflow management** / air·flow man·age·ment /
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> Making sure cool air is going to the server intakes and the hot air emanating from servers is properly exhausted.

CO is a highly toxic and potentially deadly gas that has no color or odor. It is produced by the incomplete burning of various fuels, including natural gas. According to the U.S. Occupational Safety and Health Administration (OSHA), CO poisoning not linked to fires kills more than 400 Americans each year and sends more than 24,000 others to hospitals and emergency rooms. If you are operating gas-powered equipment like furnaces and boilers, it is vital to measure for CO with a commercial grade sensor that detects the lowest parts per million (ppm).

OSHA also warns about the dangers of CO_2, which displaces oxygen in a room. High concentrations of CO_2 can cause death in less than 15 minutes. The U.S. Centers for Disease Control and Prevention (CDC) notes that CO_2 can cause oxygen deficiency because it is heavier than air and may accumulate in low ceiling spaces. Because it is difficult to physically notice when CO_2 levels are out of range, monitoring is vital to maintaining indoor air quality. Fast flow rates of CO_2 can cause a build-up of static electricity that can ignite any explosive mixtures present in the area.

Recommended Sensors for Airflow Management:

- **Airflow Sensor**
- **Differential Pressure Sensor**
- **Carbon Dioxide Sensor**
- **Carbon Monoxide Sensor**
- **Air Quality Sensor**

The following sensors are ideal for remote monitoring of airflow, CO and CO2. They provide real-time data and cause your monitoring system to alert when readings exceed a set level or range, which can indicate an HVAC problem.

AIRFLOW

Duct mount airflow sensors monitor the airflow inside ductwork. They detect the presence or absence of cool moving air and measure relative airflow from 0-16 meters per second. This is important because the cooling action of air increases with airspeed. They are especially useful for monitoring air conditioning in ducts.

PRESSURE

Differential pressure sensors measure air pressure in two areas and indicate if there is a difference between the readings. They are ideal for applications like cleanrooms where a specific pressure differential must be maintained to prevent a vacuum from a door opening that could pull dust or other pollutants into the space. The sensors are also used in air handlers. They can be placed in ductwork or mounted on a wall to measure ambient room pressure.

CO_2

CO_2 sensors can detect levels from 0-20,000 ppm. They can be used in a variety of locations, ranging from locations where CO_2 levels are constant to spaces where people are frequently entering and exiting.

The duct mount sensors are specifically designed to be mounted in a return air duct, while outdoor-rated CO2 sensors allow placement in locations where other sensors will fail.

CO

Because CO is insidious and dangerous, it is important to use a sensor that can monitor levels starting at 0 ppm, so you can be alerted as soon as possible in the event of a problem. As CO levels increase above 70 ppm, health symptoms become noticeable and can include headaches, fatigue and nausea. Sustained CO concentrations above 150 to 200 ppm can cause disorientation, unconsciousness and death.

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Humidity Fluctuation

Humidity is an environmental condition that is often overlooked, but it is as important to facility management as temperature. The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) recommends a humidity level of 41.9 ˚F dew point to 60% relative humidity, with an allowable range between 20-80%.

Of course, the ideal humidity range depends on the type of facility you are managing. Comfort is key in office buildings, hotels, entertainment venues and other places where people gather, so facility managers want to know if humidity readings are too high or low. Specialized facilities like greenhouses, hospitals and data centers have their own unique humidity requirements. Likewise, controlling humidity is important in inventory storage.

Humidity can be very temperamental. High humidity can cause condensation, and long-term condensation issues can lead to corrosion and breakdown of equipment and machinery components. It can also lead to the growth of toxic mold, slick surfaces and slippery floors.

Excessively low humidity causes constant static electricity discharges that can wear and damage electrical equipment. It wreaks havoc on computer components like CPUs, RAM drives, hard drives and motherboards. Static electricity sparks can also ignite flammable materials like chemicals, dust and high concentrations of oxygen and even cause an explosion.

The only way to maintain correct humidity levels is to use a quality system to monitor humidity from 0-100%. Humidity sensors placed properly throughout your facility will provide you with the information you need to detect HVAC equipment issues before they become expensive problems.

Recommended Sensors for Humidity Management:

- **Duct Mount Humidity Sensor**
- **Outdoor Humidity Sensor**
- **Dew Point Sensor**

We recommend the following sensors. Like the other environmental sensors, they provide real-time data and cause your monitoring system to activate an alert when readings exceed a set range.

DUCT MOUNT

Duct mount humidity sensors are designed to be mounted in a return air duct. They monitor relative humidity from 0% to 100%.

OUTDOOR

Outdoor humidity sensors monitor relative humidity from 0% to 100% in harsh locations. These sensors come in a rugged, weatherproof enclosure, so that they can be used in harsh environments like manufacturing facilities and processing plants.

DEW POINT

Dew point sensors measure the temperature at which the humidity in the air will condense and become dew. Dew point is critical in dehumidification systems in environments like manufacturing plants. It is also crucial in refineries that require dry air because moisture promotes rusting and fouling of sensors and actuators. These sensors feature a weatherproof enclosure for installation in harsh environments like manufacturing facilities or processing plants.

Boiler and Chiller Failure

It's important to perform regular maintenance to keep your boiler and chillers working as efficiently as possible. Boiler and chiller malfunctions often lead to complete or partial shutdown of the facility and work downtime. In addition to costly repairs, you waste a lot of energy when equipment is not running properly.

The Federal Energy Management Program's Operations and Maintenance Best Practices: A Guide to Achieving Operational Efficiency recommends that you do predictive maintenance. Predictive maintenance can detect the onset of an equipment failure so you can fix it before a complete malfunction occurs. Remote monitoring systems are extremely cost-effective diagnostic tools.

Along with regular inspection of the vessel itself and the safety valves, water cutoff devices, float operation, gauges and water level indicators, 24/7 remote monitoring and automatic data logging ensure proper operation.

We recommend that you use sensors to record conditions like pressure, water temperature, pH, pump status, tank levels and flow rate and review the data log and reports regularly to look for irregular patterns that can indicate a problem. This is important because changes in operating performance can be gradual and easily overlooked until a larger problem develops.

For example, you can monitor boiler room or chiller water temperature using a water incursion sensor. Another option is to set hi/lo thresholds to make sure the water is a comfortable temperature for everyday use, or the necessary temperature for food sanitation, commercial laundering and hospital use.

The system can show you drops in water pressure, indicating a problem with the boiler configuration or equipment. It can also provide the information you need to readjust the boiler during peak demand. In addition, you can receive alerts when there is unusually high water use, so you can make the necessary adjustments to keep up with demand.

Recommended Sensors for Boiler/Chiller Management:

- Vibration Sensor
- Pressure Sensor
- Contact Float Level Switch
- ORP Sensor
- pH Sensor
- Toroidal Conductivity Sensor

Here are some important sensors to help with boiler and chiller management:

VIBRATION

Vibration sensors monitor the vibration velocity on a non-rotating surface. Vibration analysis can help safeguard critical equipment and prevent equipment failure. Often when machine parts begin to fail, they start vibrating more. Although this change wouldn't be noticeable to the human eye or ear, a vibration sensor detects it and alerts you so that you can take action. They can also alert you when a machine has stopped entirely because it senses when a part's vibration drops below a certain value.

PRESSURE

Pressure sensors monitor for pump problems such as clogged intake or discharge lines, loss of suction or a burst pipe. Look for sensors with a pressure-measuring range of 0 to 200 psi that can operate in a wide temperature range, for example from -40 °F to 190 °F.

CONTACT FLOAT LEVEL

Contact float level switches offer a cost-effective way to monitor fluid levels. They are ideal for applications in small tanks where it is more convenient to install them through the sidewall. This style of float switch can be rotated to sense "normally open" or "normally closed." Combine two switches at different levels for high and low level or pump control or alarming.

OXIDATION-REDUCTION POTENTIAL

ORP (oxidation-reduction potential) sensors measure water cleanliness by detecting contaminants like microbes and carbon-based contaminants that consume oxygen. These contaminants can corrode the surface of the boiler or chiller and interfere with heat transfer, decreasing combustion efficiency.

At higher ORP levels, water more easily destroys foreign contaminants. Lower ORP levels mean there are more water contaminants. We recommend ORP sensors with a measuring range of 0 to 1000 mV or -500 to 500 mV, a replaceable salt bridge for extended service life, flow-thru, hot-tap or submersible mounting and automatic temperature compensation.

PH

Changes in pH can reduce water quality and damage boiler or chiller components. To keep pH in check, use an integral two-wire pH sensor with a measuring range of 0 to 14 pH and a replaceable salt bridge for extended service life. We also recommend using flow-thru, hot-tap or submersible mounting and automatic temperature compensation.

TOROIDAL CONDUCTIVITY

Toroidal conductivity sensors measure water purity by counting ions in the water. They are designed for use in chemically aggressive applications where conventional contacting sensors may become fouled or corroded.

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Physical Security

As a facility manager, protecting your HVAC operation is a top priority. However, remote monitoring systems can also perform physical security functions for extra peace of mind. For example, you can add sensors to the doors to equipment rooms and configure the monitoring system to alert you when those doors open after hours and on weekends.

You can also install passive infrared (PIR) sensor motion detectors inside and outside equipment rooms. They can interface with third-party IP cameras and report the data to your remote monitoring system to provide real-time visibility of the area.

To complement your facility's fire and suppression system, your remote monitoring system can detect the presence of smoke or fire and send a notification to the proper personnel. In addition, many fire alarm panels have auxiliary contact outputs that can be attached to your monitoring system for backup alarm notifications.

Recommended Security Sensors:

- Contact Magnetic Reed Door and Window Switch
- Infrared Motion Detector Sensor
- Smoke Detection Sensor
- Fire Detection Sensor

Take Control of Threats

In HVAC applications, a remote monitoring system interacts with sensors within your facility and provides on-demand live status and data acquisition from a smartphone app, mobile device or computer. Advanced monitoring systems like the Sentinel Pro also provide critical system-wide information by interfacing with existing HVAC equipment that uses a building automation system (BAS) or building management system (BMS).

You don't have to be on-site to manage complex networks, view real-time equipment status and get data points from your BAS. These systems can log unlimited amounts of data in the cloud, making it fast and easy to check specific equipment status, review alert history and trending reports.

With these systems, you and other designated personnel are instantly notified by call, text or email when sensor readings fall outside of preset parameters. Most modern systems require an internet connection, but cellular systems are available for areas where telephone and internet connections are unavailable.

Improve Efficiency

We recommend using a monitoring system that includes a data logger—an electronic device that communicates with the sensors to record their data over time. The data logger constantly checks sensor readings at set time intervals and records them with a time-date stamp.

A data logger helps you to identify trends and patterns in equipment and environmental conditions. The data can provide insight into potential problems so you can address them before a disaster occurs. For example, sensor readings falling out of the preset range can indicate the beginning of an equipment malfunction that can be repaired before it fails.

Automatic data logging also improves operational efficiency. Manually monitoring and recording sensor data takes a lot of time and detracts from employees' other important work duties. In addition, data recorded by the system is not subject to human error and is protected by higher-level security protocols. You can access data when you need it, and it comes in secure digital packets.

If you are required to report on operating conditions or demonstrate compliance, the data logger makes it easy to maintain records and generate time- and sensor-specific reports.

Have Questions? Need Advice?

If you would like to learn more about Sensaphone's HVACR monitoring solutions, call us at 877-373-2700 or visit www.sensaphone.com/industries/hvac

About Us

Since 1985, Sensaphone® has designed and built its full line of innovative remote environmental monitoring systems and early detection products that quickly and effectively provide alerts to problems at your facilities. Over 400,000 systems are in use today around the world with the highest customer satisfaction rates in the industry.

Sensaphone is a family-owned business, and products are manufactured in the USA.

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