Ensuring Healthy, Energy Efficient Buildings

Monitoring and maintaining efficient, healthy and productive indoor air environments are essential practices in today's commercial and industrial buildings. This article identifies what you should inspect on a regular basis, and the tools you need to get the job done quickly and accurately – all of which can fit easily into one shoulder bag.

Reading CO_2 levels in an office space with the portable Fluke 975 AirMeter tells you whether ventilation is sufficient. This tool also measures temperature, humidity, air velocity, and carbon monoxide levels.

What is acceptable Indoor Air Quality?

Over the years, indoor air quality (or IAQ) has been defined by a set of standards intended to promote occupant comfort and to avoid adverse health effects. Buildings should be dry, clean, temperate, free of pollutants, and properly ventilated. Occupant overcrowding, reduced ventilation, and increased use of untreated re-circulated air have a potential to increase concentrations of pollutants, including micro-organisms and allergens.

We rely on HVAC equipment to maintain acceptable temperature, humidity and ventilation levels for occupant health and comfort, and now more than ever, to help regulate building health. How easily this is achieved depends on many factors including geographic location, HVAC equipment selection, operating criteria and building design.

The solution has been to construct the tightest possible building envelope, then add a heating, cooling, filtration and ventilation system designed for comfort and efficiency. However, even the best designed HVAC system will not deliver the required IAQ results unless the system is properly maintained and adjusted.

Organisations sometimes alter buildings or add occupants without adjusting ventilation. And when occupants have a comfort issue, they will close or open a duct, window or door, leading to inefficiencies in the system. Taking the first step is logical: understanding how indoor air quality relates to HVAC systems. Proper design, maintenance and operation of HVAC systems are essential to indoor air quality.

Indoor air contaminants including tobacco smoke, chemical fumes, combustion particles, biological contaminants and mold spores can accumulate to levels that pose health and comfort problems if too little outdoor air enters the building.

Pollutants can be circulated from portions of the building used for specialised purposes, such as restaurants, print shops, and production areas into offices in the same building. Carbon monoxide and other components of automobile exhaust can be drawn from underground parking garages through stairwells and elevator shafts into office spaces.

Measuring air pressure, velocity and flow in a duct using the portable Fluke 922 Airflow Meter. Combining measurement capabilities into one tool saves inspection time.

Identify potential sources of indoor air pollution

Although the presence of such pollutants does not necessarily mean that you have an indoor air quality problem, being aware of the type and number of potential sources is an important step toward assessing the air quality in your facility. Measurement is essential, whether checking for roof-leak moisture, assessing dust levels, ensuring proper air flow, or measuring CO_2 levels to gauge fresh air exchange.

To conduct an indoor air quality inspection, get a map of the HVAC system, as installed, and use that to create an inspection route. Plan to take measurements in every zone of the building, especially in any areas where there have been complaints, as well as outside the building, as a baseline. Also use your own senses – look for signs of moisture leaks, smell the air for mold as well as chemical and exhaust fumes, and ask the people who frequent each area if they have experienced anything different, such as smells, headaches, or eye irritation.

By actively monitoring conditions, you will be able to promote a healthy, productive environment, and greatly reduce the number of occupant complaints. Measurements include temperature, relative humidity, airborne particle concentrations, airflow and ventilation, as well as levels of CO_2 and carbon monoxide gasses. Let us look at some of these in detail:

Temperature and humidity

Temperature and humidity are important comfort factors, and failure to manage them can create other problems, for example condensation and mold growth. When a surface temperature is at or below the dew point temperature, condensation will form on walls, windows, cold water pipes and duct work, and cause potential water damage and mold issues. Relative humidity must be kept low enough, for example around 40-45%, to ensure that surface temperatures do not approach dew point levels.

Air particles

Airborne particulates come in a variety of forms. Excessive levels can result in medical conditions such as Sick Building Syndrome, lower productivity, contaminated product, or all of the above. Knowing the breakdown of particle sizes is essential for you to diagnose what is polluting the air (mold particles are different in sizes than dust, for example), to trace particles to their source, and to verify that a fix has really lessened the count of particles.

Airflow and velocity

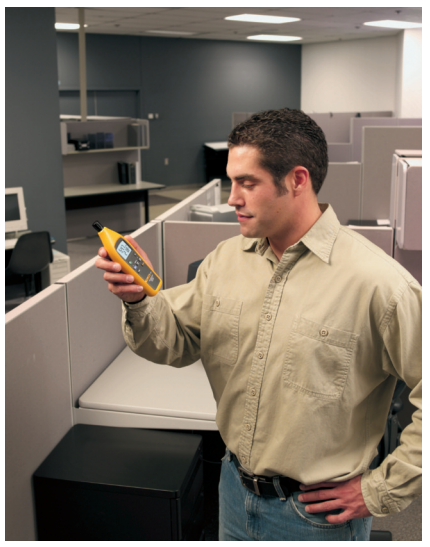
Air velocity is a key parameter in evaluating airflow system performance. As part of a basic testing, adjusting and balancing of HVAC air distribution systems, you can measure air velocity at grilles, registers, and diffusers within a duct or in open spaces.

Air velocities from registers and diffusers must create air patterns that evenly distribute and mix conditioned air to room air while avoiding uncomfortable velocities in the occupant zone. Since ventilation rates are based on maximum occupancy, over-ventilation will occur when spaces are not at maximum occupancy. When the current ventilation level is more than required, energy is wasted. Periodic measurements let you determine whether the space is properly ventilated, over-ventilated, or under-ventilated. With this kind of information, you can ventilate the space at the lowest possible heating and cooling cost.

Carbon Dioxide (CO_2)

CO_2 can be used as a gauge for determining the effective ventilation rate of occupied spaces and as a warning signal for combustion processes that may have gone wrong.

When proper ventilation rates are maintained, CO_2 levels created by human respiration should always be at acceptable, healthy levels. When CO_2 is used to control building ventilation rate, it is called demand controlled ventilation (DVC). The primary purpose of DVC is to avoid over-ventilation and thereby reduce energy costs when spaces are not at full occupancy.



A temperature/humidity meter, such as the Fluke 971, provides accurate readings of relative humidity and dew point temperatures to quickly identify conditions that promote mold growth.

Carbon Monoxide (CO)

Indoor combustion of fuels can be a source of increased concentrations of gasses and particulates. The major combustion by-product of concern is carbon monoxide (CO) – a colorless, odorless poisonous gas with potentially serious health consequences given adequate exposure. Check areas where combustion is occurring to find malfunctioning equipment, as well as occupied spaces adjacent to parking garages or warehouses. Simultaneous increases in both CO_2 and CO can indicate ventilation system problems. Harmful levels of CO indicate problems with the ventilation/exhaust system, or the presence of leaks.

What tools should you use to measure indoor air quality?

Everything you need for complete IAQ inspection throughout your facility can fit easily into one shoulder bag, including:

- An **indoor air quality meter** to check that temperature, humidity and ventilation are within comfortable and safe levels.
- A **particle counter** to verify filter effectiveness and to check that indoor air particulate levels are less than outdoor levels. It also helps you determine what types of particles you are dealing with, for example dust or mold.
- An **airflow meter** to measure the pressure and movement of air within the building to locate leaks in ducts, as well as malfunctioning ventilation and exhaust systems. Equipped with a velocity probe it allows for both quick spot measurements of air velocities or patterns and precise duct traversals.
- A **temperature/humidity meter** to determine whether areas of suspected mold growth have either fallen below dew point temperatures or have high relative humidity.
- A **CO meter** to check for excess levels of carbon monoxide in the area around boilers and furnaces. Some air quality meters also measure CO levels.

Choose these instruments carefully based on an in-depth understanding of their specifications and performance characteristics. Ideally, the tools should enable extensive data logging capability, downloadable to a PC via a USB interface. A bright, backlit display is useful for clear viewing in all environments. Another important consideration is the accuracy of the test instruments over time and in varying environmental conditions.

Airborne particles come in a number of shapes and sizes, which can be accurately identified and quantified with a particle counter, such as the Fluke 983 shown here.

By using these IAQ inspections tools properly, and maintaining and calibrating them as recommended, you will be able to:

- Respond to comfort-related calls from occupants
- Verify the operation of building HVAC control systems
- Determine whether adequate ventilation exists
- Test for dangerous carbon monoxide leaks
- Measure filter efficiency
- Check up on the effectiveness of repairs
- Promote indoor air comfort and quality

In response to the growing importance of air quality in industrial, commercial and residential buildings, Fluke offers a range of tools that monitor temperature, humidity, airflow and velocity, particulate, CO_2 and carbon monoxide levels. These accurate, rugged, and portable tools help you quickly and easily troubleshoot and maintain indoor air quality, as well as to verify the efficient operation of heating, ventilation and air conditioning systems.

Conclusion

Fluke is a leading worldwide provider of compact, professional electronic test tools. The company's products are used by technicians and engineers in service, installation, maintenance, manufacturing test, and quality inspection in a variety of industries throughout the world. Fluke, founded in 1948, currently has offices in 13 European countries and distributes its products to over 100 countries internationally. More information is available under www.fluke.eu.

AUTHOR DETAILS

Scott Williams,
Marketing Communications Account Manager,
Fluke Europe B.V.
Email: scott.williams@fluke.nl

New Range of MiniDataloggers

KIMO (UK) have announced their new Kistock range of MiniDataloggers. Available with or without display and suitable for extremes of temperature, these completely self-contained units let you monitor (continuously or on-demand) your manufacturing process, storage facility, transport cold chain, clean room, etc, etc. Models are available with storage capacities from 16,000 to 100,000 measurement points, internal or external sensors for temperature, humidity, light, current and voltage including 4-20mA/0-10V, so also permitting their use with any industry standard transmitters. They can also form a real-time acquisition system for up to five simultaneous parameters when connected to the USB port of your PC and configured in ONLINE mode. Data security is guaranteed with a new, proprietary anti-theft system with no padlock, as well as 21CFR Part 11 compliant software.

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Excieo Easy Peasy Lemon Squeezy New Human Vibration Meter

The Excieo from **Castle Group Ltd (UK)** is an ALL NEW human vibration meter designed specifically for conducting risk assessments to the new Control of Vibration at Work Regulations 2005. This all British product is built to make the measurement of hand arm and whole body vibration as simple as possible.

A novel approach to the user interface of the Excieo meter allows each measurement to be stored with an optional record number, employee name tool reference and location. This means the results can be automatically sorted, searched and interrogated to give daily exposure (A8) values or tool type data. This makes the meter very powerful for risk assessing but very simple to use.

Already taking the market by storm, this new instrument from Castle is loaded with features and uses the latest in DSP and processor technology to give it plenty of performance enabling it to comfortably meet the new ISO8041 Human Vibration Meter standard. The meter covers both Hand-Arm Risk Measurement (HARM) and Whole Body vibration with the use of the appropriate accelerometer pick-up.

Peter Jones, Health and Safety Manager for North Wales Fire and Rescue Service said, "The Excieo is very easy to use and understand and good to control. The storage of data is straight forward and downloading to the PC is fantastic. Once the data is sorted, we can copy the data straight out of the software and into Excel, which suits perfectly the way we prepare our assessments. We have also been delighted with the technical back-up and support from Castle staff."

Features of this new meter include a full set of frequency filters for multiple applications, instant templates for no-fuss measurements, parallel tri-axial measurement, time histories and a huge memory for vast storage of results. As a kit, the included software allows for reporting and data-management via USB and has a valuable feature allowing simple copy and paste into word processors or spreadsheets.

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