Air humidification in hospitals

How to achieve the right balance between health and sustainability

Humidify for health

Since it was founded in 1973, CAREL has been at the forefront in the research and development of new technological solutions for controlling air humidity to ensure personal health and well-being.

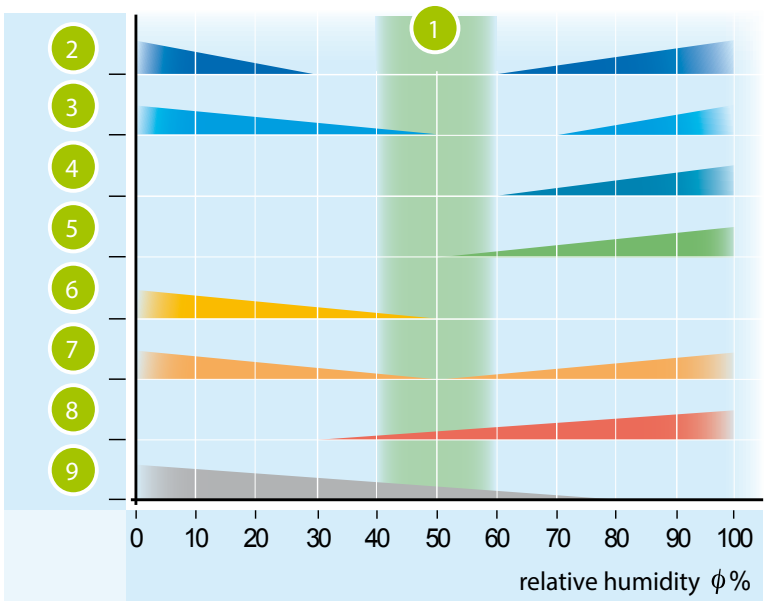
Control air relative humidity in healthcare facilities to ensure:

- patient health;
- correct operation of equipment;
- economic benefits.

Optimal relative humidity range

In the scientific literature, the Scofield-Sterling diagram is proposed as an analysis tool to identify the optimal range of relative humidity for indoor environments. This diagram shows the intensity of various phenomena as a function of the relative humidity level, distinguishing mainly between the effects on organisms and pollutants, and those on the human body.

The optimal range of relative humidity in terms of occupant health in an indoor environment is between 40 and 60%. Below 40%, humidity is too low, creating unfavourable conditions for health. Above 60%, humidity increases the risk of condensation, making it easier for mould and fungi to proliferate and spread.



Relative humidity 40-60%

Key:

1 - optimal zone
2 - bacteria
3 - viruses
4 - mould
5 - mites
6 - respiratory infections
7 - allergic rhinitis and asthma
8 - climate interactions
9 - ozone production

Hygiene

VDI 6022 hygiene certification: CAREL has always paid the utmost attention to the safety and hygiene of its solutions.

Sustainability

Sustainable air conditioning that ensures the desired IAQ set points and minimises energy and water consumption, in line with the latest sustainable building directives.

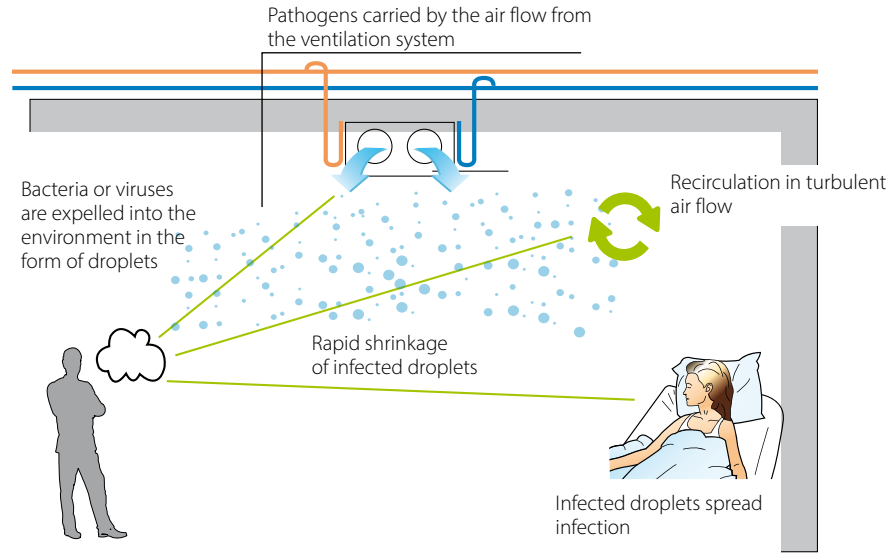
Reliability

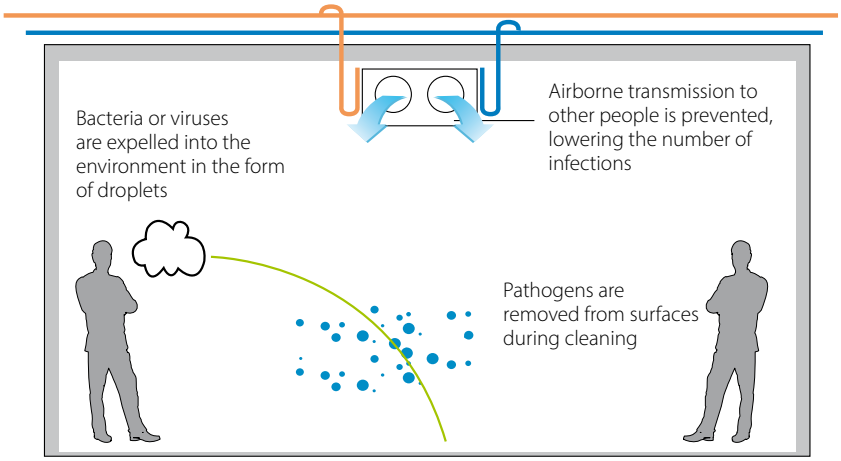
Humidity control continuity – 24/7 production and unit backup
Rugged design for heavy-duty use
Cloud-based monitoring system.

The impact of relative humidity on respiratory particles: droplets and aerosols

By simply talking, breathing or coughing, people can introduce vast quantities of germs into circulation, contained in thousands of tiny droplets of moisture that are carried in the air. These droplets evaporate more quickly the lower the humidity, rapidly decreasing in volume by up to 90%; when shrinking in this way, they can remain suspended in the air for a long time. Such dehydrated particles can travel considerable distances, increasing the chances of reaching and infecting an exposed individual.

If, however, the relative humidity is between 40 and 60%, the droplets remain approximately the same size (≈ 100 µm) and tend to precipitate much more quickly, typically in the space of 1-2 m from the source in the absence of prevailing air flow, meaning they can be eliminated much more effectively by conventional surface cleaning methods.

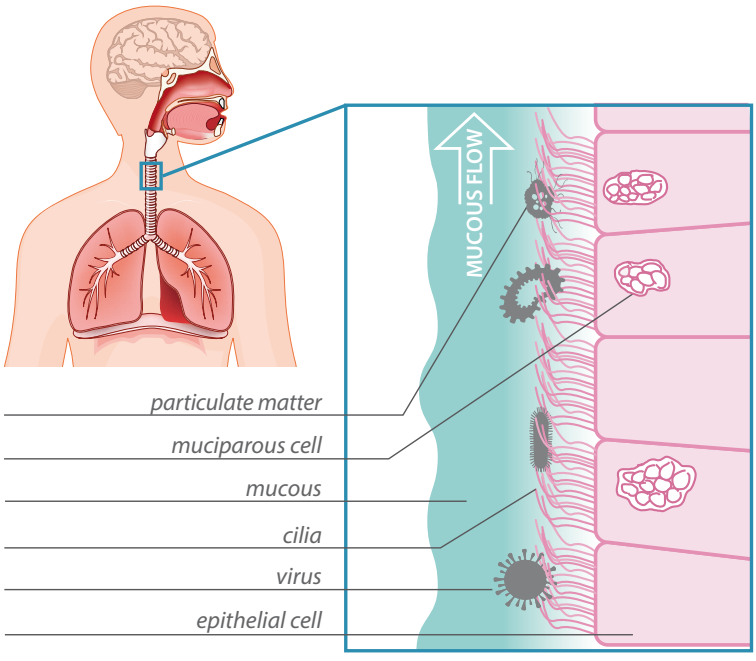




The impact of relative humidity on the human body

Airborne infections are spread by inhaling viruses and/or bacteria, passing through the respiratory system and depositing on the walls of the airways or in the alveoli of the lungs, where they can cause pneumonia or bloodstream infections. Our defences against these attacks are provided by the walls of the respiratory system itself, which continuously secrete a thin layer of mucosa; this both humidifies and warms the air we breathe in, trapping bacteria and continually pushing them upwards through the rhythmic movement of numerous epithelial cilia. This process, called "mucociliary clearance", allows the body to swallow the mucus containing the bacteria, rendering them ineffective when they enter the gut microbiome. The process is fundamental for human health, and is considerably impacted by air relative humidity.

Below 40%, the mucous layer dehydrates and the cilia are compressed and slow down until they stop moving, allowing viruses and bacteria to penetrate the cells of our airways and infect them (Taylor S., 2016).



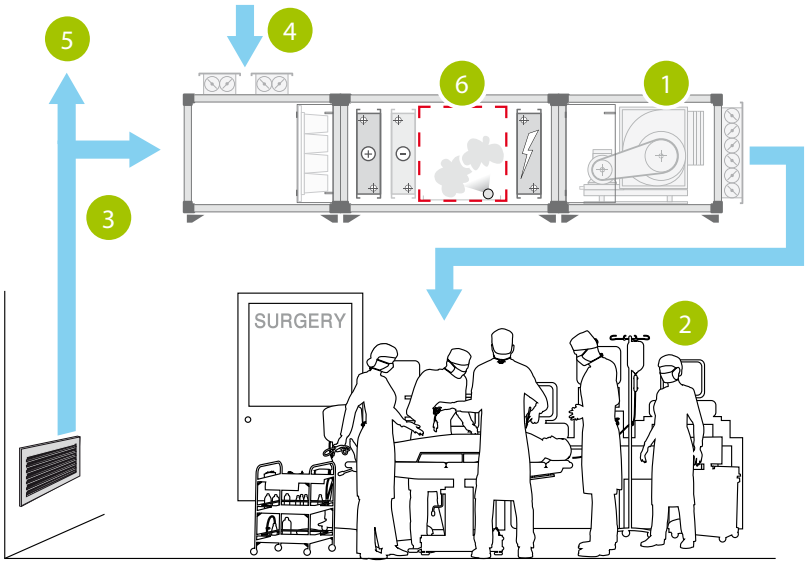
Humidify for correct operation of equipment

Air humidity can be one way to protect electronic equipment from damage caused by electrostatic discharges.

Electrostatic discharges (ESD) are a phenomenon that occurs when two objects with opposite charges come close to one another. Under the right conditions in terms of the total charge, the gap between them and the characteristics of the insulating medium that separates them - usually air - these charges may overcome the resistance of the insulation and move from one object to the other, generating an electrostatic discharge.

Proper relative humidity control is one very good way to solve the problem, as it affects the ability of our skin and bodies in general to accumulate electrostatic charges. Water helps to lower the resistance of air to electrical currents, making it harder for charges to accumulate until reaching dangerous values, rather aiding their gradual dispersion through the environment to areas of lower potential.

Given the delicate functions that many devices perform within hospitals, it is essential to avoid possible malfunctions due to dry air. It is recommended to keep relative humidity above 40%.



Relative humidity >40%

Key:

1 - air handling unit
2 - operating room
3 - recirculated air
4 - fresh air
5 - exhaust air
6 - humidification section

Economic benefits

The European Centre for Disease Prevention and Control estimates that more than 3.5 million cases of HAI (healthcare-associated infections) occur in the European Union each year, causing more than 90,000 deaths, exceeding the total of other infections, including influenza and tuberculosis. However, it is estimated that up to 50% of HAIs can be prevented by applying proper infection prevention and control measures.

Correct humidity control can significantly reduce the number of airborne infections (from 10 to 33% of the total) and consequently reduce the enormous cost that these have on society.
The economic implications of humidity control in healthcare facilities are difficult to estimate, given the indirect nature of their effects. Nonetheless, considering the above data and the enormous costs associated with HAIs, it is clear that the benefits for the budgets of healthcare facilities can be quite significant.

Humidify for personal comfort

Humidification is closely linked to the feeling of comfort and physical and mental well-being of the people who occupy and work in healthcare facilities.

The impact of relative humidity on the growth of mould and bacteria

Humidity control is important to prevent the growth of bacterial colonies and mould in buildings. Indeed, these need water and nutrients to grow; therefore, it is important to avoid the formation of areas where the humidity in the air can condense and stagnate, for example in air distribution ducts. Furthermore, when the indoor relative humidity exceeds approximately 80% for a prolonged period of time, mould can form, with the mould spores representing a health hazard if inhaled.

The impact of relative humidity on comfort and declines in performance

Sick building syndrome (SBS) is the name used to describe the illness reported by people who experience health problems and persistent discomfort when inside a building, yet without any identifiable causes or specific illnesses. The causes of this very real ailment are often attributable to defects in or incorrect use of the air handling system, to a lack of adequate fresh air flow, to the presence of volatile organic compounds (VOCs), mould and other materials and substances that release pollutants. Tests have shown that the symptoms of SBS are caused or worsened by low relative humidity: these include deterioration of the tear film and dryness of the eyes, irritation of the nose and throat, asthma, dry skin, headaches, tiredness and irritability. Low humidity alone has been shown to cause a 3-7% decrease in performance in subjects performing office tasks such as reading, revising documents, and simple calculations. When low humidity is combined with factors such as high temperatures and air pollution, these symptoms become even more acute (Wyon Davit P. at al, 2005).

CAREL solutions for air humidification

Isothermal humidifiers: humiSteam, heaterSteam, gaSteam and ultimateSAM

- Hygienically safe solution;
- Small installation space;
- Use main or demineralised water;
- Service continuity with backup & rotation.

Isothermal humidification is the most common way to control air relative humidity.

This works by delivering steam directly into a flow of air; the steam is immediately absorbed, thus increasing the humidity while keeping the temperature virtually constant.

Isothermal humidifiers differ in terms of the steam production technology used, such as immersed electrodes, heaters and gas-fired burners, each with its own specific features in terms of performance, reliability and operating costs.

The range is completed by distribution systems and accessories that can meet the requirements of all applications.

Adiabatic humidifiers: humiFog

- Low energy consumption;
- Accuracy up to ±1% RH and wide range of modulation;
- Up to 1,350 l/h.

atomising rack

droplet separator

humiFog is an adiabatic spray humidification system comprising a high-pressure volumetric pump and a distribution system with special atomising nozzles for fast absorption in the air. The pumping station, available in capacities up to 1,350 l/h and equipped with an inverter for maximum energy efficiency, delivers water at a pressure up to 70 bars, for very fine atomisation (average droplet diameter: 10-15 microns).

humiFog is suitable for both humidification and adiabatic cooling. Consequently, just one investment to manage humidification in winter and cooling in summer. The entire humiFog system is certified in accordance with the VDI6022 standard.

Humidification services: higher performance, less worries

CAREL offers a complete range of services for its entire range of humidifiers. The objective is to maintain the operating performance of the unit over time and increase its working life, through both activities carried out on-site and digital services for remote assistance.

Having your humidifiers cared for by CAREL offers the peace of mind that all operations will be performed by qualified technical personnel, with updated training by those who have complete know-how of the products, as well as the guarantee that only original spare parts will be used.

Savings for the customer

The correct configuration ensured by the commissioning service and the guarantee of correct operation ensured by the maintenance contracts also bring reductions in energy consumption; remote analysis, avoiding the need to go on-site to troubleshoot any problems, and real-time alarm notifications that allow immediate corrective actions to be taken, moreover reduce management costs.

CAREL humidification services

Providing products that meet customer needs is no longer sufficient on its own; CAREL also aims to guarantee high-performance service continuity over time, minimising any inefficiencies. This is why the proposal also includes services for humidification products, adaptable to different applications and needs, to support customer throughout the entire product life cycle.

Benefits

- Guaranteed performance and correct operation over time;
- Extended product life;
- Faster resumption of operation;
- Reduced management costs for unexpected events;
- Remote control of the unit, alarm notifications;
- Guaranteed service times;
- CAREL original spare parts.

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