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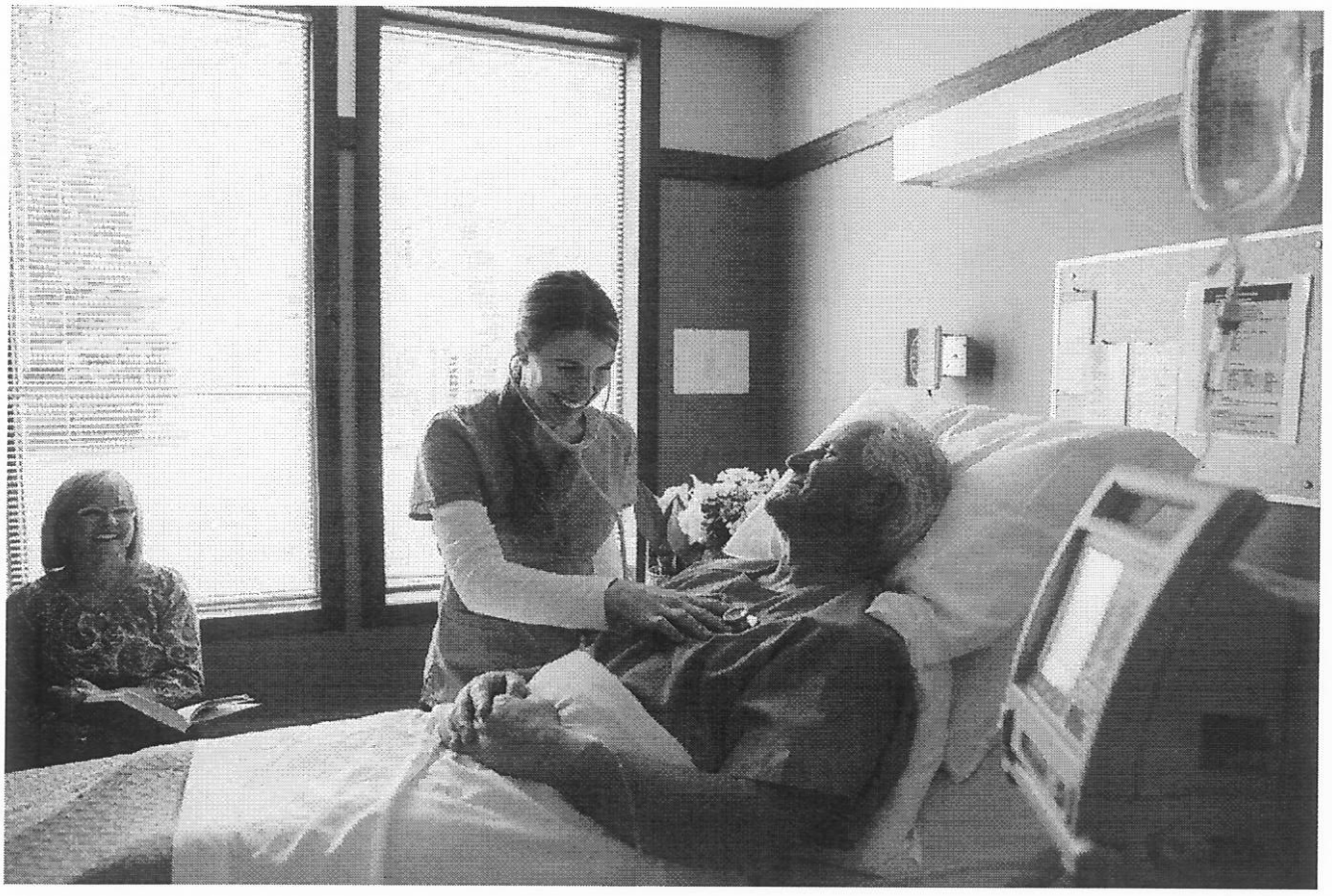
The Role of Air Conditioning in Hospitals and Health Clinics



Particularities and Challenges of Healthcare Facilities

Public buildings can all have their own challenges and particularities to deal with in terms of HVAC system design. In healthcare buildings, it is even more important to guarantee not only comfort but safety and health as well. Here is what makes healthcare facilities different from other buildings:

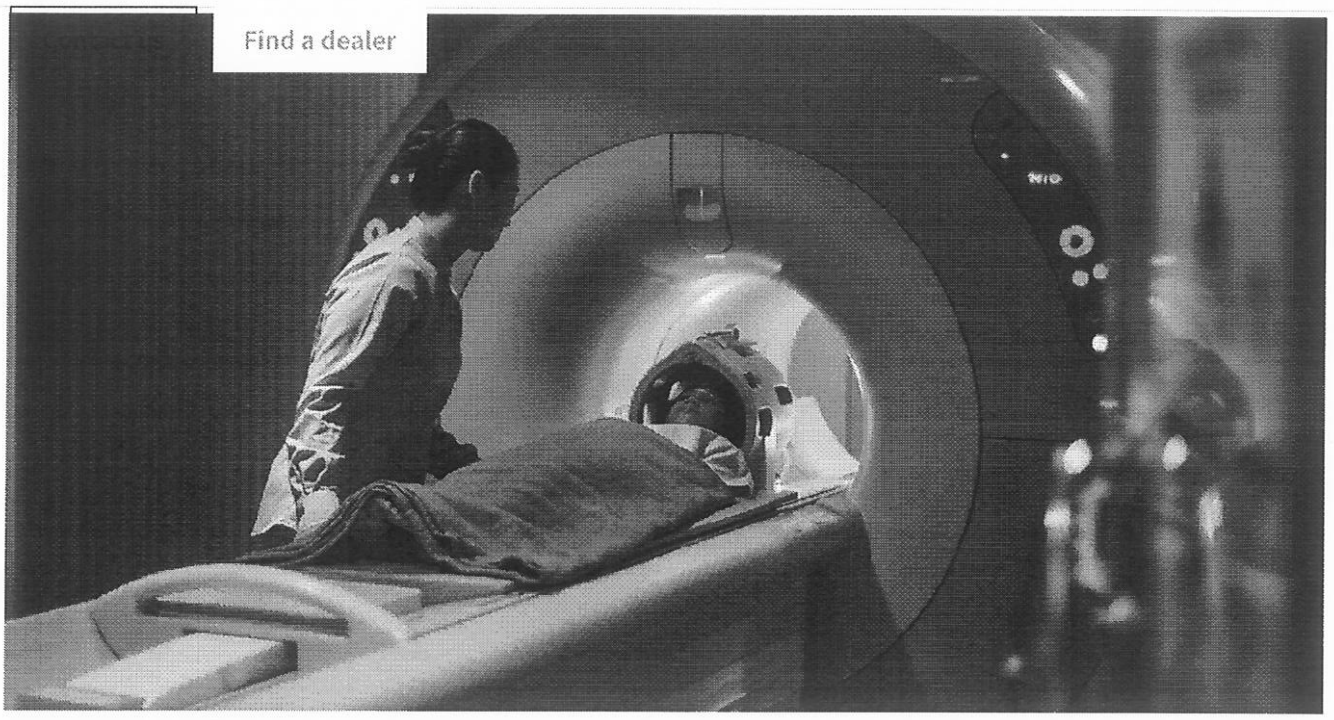
Hospitals and clinics tend to have separate spaces for different functions and, as such, they also have different HVAC requirements. There are wards, staff rooms, waiting rooms… Each of them has individual temperature, humidity and ventilation standards. Some areas are considered critical, such as operating rooms, isolation rooms, and laboratories. These rooms usually need more accurate control of all climate elements.

Technology and equipment in hospitals in clinics consume a great deal of energy, not to mention that HVAC systems need to run 24 hours a day. According to the Department of Energy (DOE), an average hospital uses 2.5 times more energy than other commercial buildings. To reduce the energy consumption impact, individualised controls are needed to turn down unoccupied spaces and apply special conditions at nighttime.

When it comes to HVAC systems in public spaces, the main focus may be put on comfort; but in the case of hospitals and clinics, **health and safety are what matter most**. As diseases and infections are treated, these need to be contained and prevented from spreading to immuno-compromised patients and to healthy visitors and staff. One of the key elements for ensuring safety is ventilation and air exchange strategies, as well as removing exhaust air effectively.

Comfort and climatisation also have health benefits for patients. Adverse environmental factors can aggravate inpatients' conditions or delay recovery. Safeguarding patients from heat and cold for thermal comfort may even be related to lower mortality rates in hospitals, according to the findings of a study published in the BioMed Central Journal (BMC).

Healthcare facilities may also have to deal with **higher concentrations of volatile organic compounds (VOCs) and chemical fumes** from laboratories and handling of medicine and other



Temperature

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Temperature is closely related to health, both physical and mental. As mentioned above, **extreme climate conditions can be detrimental to a patient's health** and recovery journey. According to ASHRAE, **air conditioning can accelerate recovery and can be regarded as a therapy factor**. For example, heat is considered a threat to the elderly, children, and people with preexisting health conditions; specifically, cardiac patients and persons with thyroid conditions are more sensitive to heat and have difficulties with heat regulation. On the other side, patients that undergo surgery or operations can be more susceptible to hypothermia. Air conditioning with a focus on temperature control is key in these cases, which are just a few examples of how patients can benefit from air conditioning.

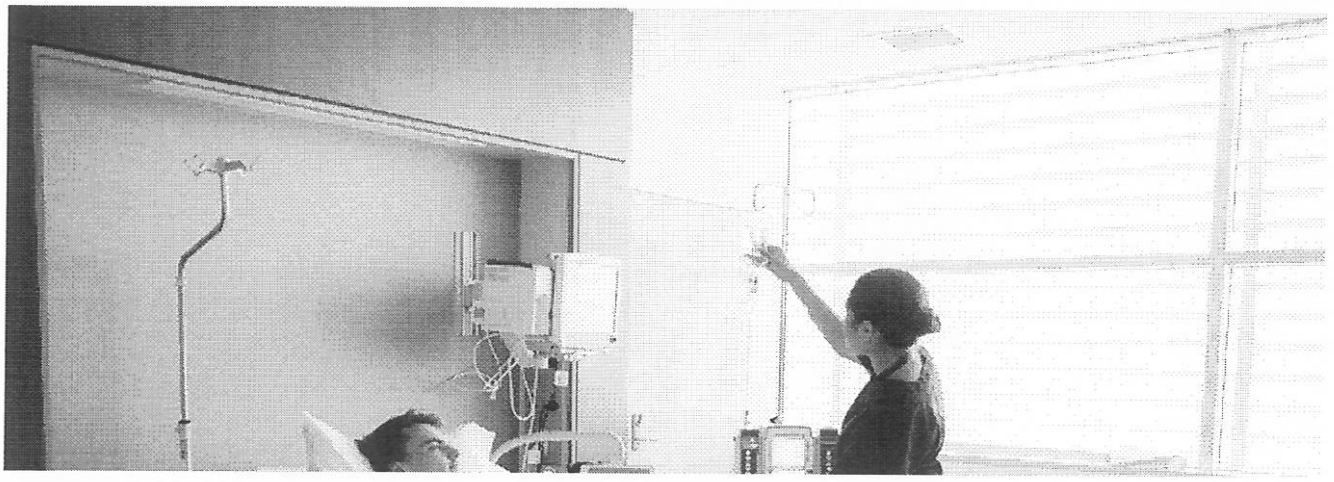
Keeping a comfortable temperature allows for a more pleasant environment, both for staff and visitors. In the case of staff, temperature and productivity are much more connected than we may

Humidity

When it comes to **relative humidity (RH) at healthcare facilities, it becomes slightly more challenging to regulate it** than in other buildings. The reason is that **the same humidity level can have positive effects on some persons, and negative effects on others**. ASHRAE's general recommendation for indoor humidity is to keep it below 60%, but not excessively dry. This general recommendation cannot be applied to healthcare facilities, where rooms may need different relative humidity depending on their function and the type of treatment patients may receive there. Some patients that are on treatment for respiratory issues benefit from a warm, humid climate to alleviate their discomfort; while others see an improvement in their symptoms when RH is at 30% (which is considered dry).

In relation to medical equipment, medicines and treatment, low humidity can create static electricity or increase the fire hazard risk of flammable chemicals.

Another challenge regarding humidity is that **dust and particles tend to float and remain airborne for longer in dry environments**, which makes cleaning and keeping infections at bay difficult if proper measures are not taken. It is also worth mentioning that some bacteria and viruses thrive and spread in high-humidity environments. It has been observed that infections increase in hospitals when RH is lower than 40%. This brings us to the next point, ventilation, which is how germs and contaminants in the air are kept in check.



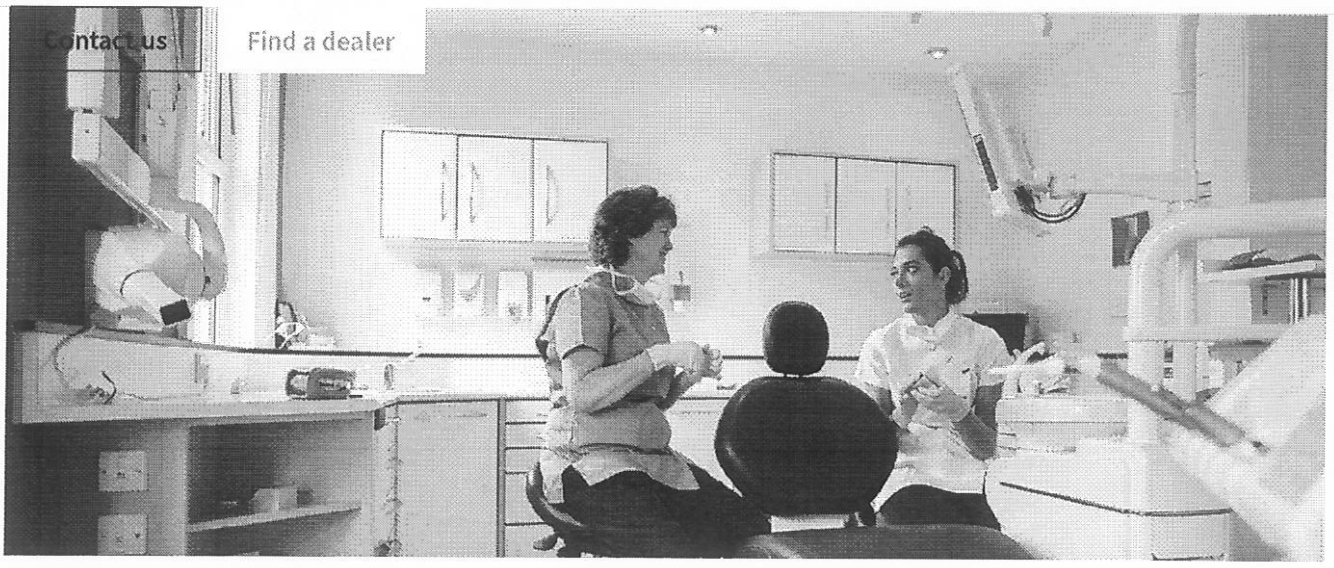
control airborn **keep infections from spreading.** Due to these increased needs, requirements ar r ventilation in healthcare are more rigorous than for other public buildings. There are different ways in which ventilation helps improve IAQ. One of the most common ones is **through air exchanges, by which fresh outdoor air is treated and introduced indoors**. ASHRAE's general recommendation is ensuring 0.35 air exchanges per hour (ACH); but as healthcare facilities have higher standards, the recommendation for the sector ranges between 2 and 12 ACH, the higher rate being for **airborne infection isolation rooms (AIIR)**. Through air exchanges, the concentration of air pollutants also becomes diluted.

A less known way ventilation works are through positive and negative air pressure. This technique is used in small clinics to large hospitals, and it consists of **changing air pressure to regulate the passage of fresh air into the room**. **Positive pressure rooms** have higher air pressure inside than their surrounding areas; this way, air easily escapes the room, but outdoor air will not get back in. This is useful for sterile environments where bacteria and viruses need to be prevented from entering. These rooms usually keep immuno-compromised patients safe from outdoor infections. Negative pressure rooms work in the opposite way, as they have lower air pressure than other rooms, and prevent air from escaping while letting fresh outdoor air in. **Negative pressure rooms** usually function as AIIR, to treat patients with infectious conditions and protect staff and other patients from contagion.

One point to note is that natural ventilation is usually avoided in these controlled areas, especially when taking into account that air-conditioned areas have a lower concentration of microbes than naturally ventilated rooms (according to a study that observed the spread of microbial contamination in hospitals).

Filtration

Air filtration constitutes **a barrier against airborne infections**, as well as reduces particles and dust in the air that may exacerbate respiratory conditions. The American Society for Health Care Engineering (ASHE) gives exhaustive guidelines for air filtration in specific areas. **High-Efficiency Particulate Air (HEPA) filtration systems have become one of the most known standards for filters** in recent years. HEPA filters have an efficacy of 99.97% against particles of 0.3 microns in diameter. This size of particulate matter poses one of the main challenges because of its evasiveness



Hitachi Air Conditioning for Healthcare Facilities and Hospitals

Complying with the high standards required to maintain health and safety within healthcare facilities and hospitals for the well-being of patients, staff and visitors is vital. With the range of **Hitachi VRF air conditioners**, there is a solution for all types of buildings and facility requirements:

VRF systems allow for multiple, individually controlled indoor units (IDU) to be connected to one outdoor unit (ODU), catering for numerous rooms at the same time.

Being individually controlled means that temperature and mode settings can be selected in line with the function or comfort needs of each room.

There is an IDU type to suit all rooms, meaning that one VRF system can potentially condition the reception areas, waiting rooms, examination areas and wards at the same time.

Hitachi VRF offers great design flexibility meaning that it is easier to achieve lower installation costs

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