

# Operating Rooms

## Controlling the Humidity with Desiccant-based Dehumidification

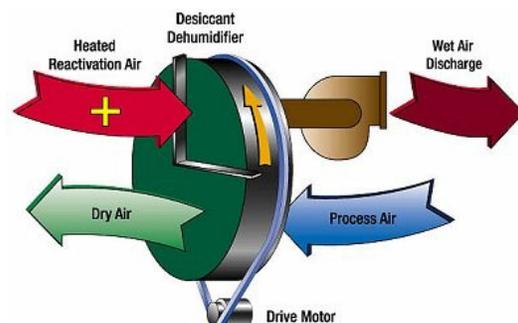


**The Problem:** Long gone are the days when satisfactory space conditions for the operating rooms were around 68°F to 72°F and 50% relative humidity. Today, due to the heavy, multiple layered gowning and the long procedures, most hospitals are requiring that their surgical suites be maintained at 60°F to 65°F or lower during the procedures. In addition to the concern for the surgeon's comfort, it is often necessary to maintain lower conditions in the operating rooms due to therapeutic reasons or to keep the adhesive cements used in orthopedics from setting too quickly. Even at these lower temperatures, the relative humidity in the space is still expected to be maintained near 50%. With conventional HVAC systems (i.e., chilled water or DX-based) this is very difficult to achieve, as the relative humidity will typically be found to be above 60%. These conditions result in less than a desirable operating room environment.

**The Solution:** By incorporating a desiccant-based dehumidification system into the mechanical design for the hospital's operating suite, the overall system can be designed for optimal and *active* humidity control. No longer does the surgical staff have to tolerate less than desirable space conditions. No longer would there be a threat of it "raining" in the operating room during surgeries (i.e., condensate forming and dripping from the metal fixtures on the ceiling). The common problem of the fogging of microscope lens would also be eliminated with the lowering of the dewpoint of the air in the operating rooms. By incorporating a desiccant system into the

mechanical design, the *absolute* humidity levels can be dropped much lower than the chilled water (or DX) coils are capable of achieving. Regardless of the temperature desired in the space, the humidity levels can be dropped to even lower levels. A desiccant system can be added to strictly condition the outside air requirements of the surgery suite, or it can be sized to treat the entire supply air requirements of the suite.

**Desiccant Technology:** A "desiccant" is any material that has a great affinity toward moisture. In the majority of the commercially available desiccant-based dehumidification systems, Silica Gel desiccant is used and is impregnated onto the substrate material of the rotor (or wheel). This desiccant rotor removes moisture in the vapor stage from the "process" airstream by adsorption. This is the airstream that is to be dehumidified, whether it is all outside air or a mixture of OA and return air. As the rotor rotates, the moisture-laden rotor then rotates through a section of the air handler known as the regeneration section. In this section, the rotor is dried with heat from either a gas fired burner, a steam coil, or even an electric resistance heater. This process operates continuously as long as there is a need for dehumidification.



**The Benefits:** There are many benefits that will result from the installation of desiccant-based dehumidification equipment. Some of these are as follows:

- Greater comfort for the physicians during surgical procedures

- Independent and superior humidity and temperature control
- Removal of moisture upstream of any air handlers, allowing for operation of dry cooling coils
- Surgical suite duct work stays dry to prevent mold growth
- Desiccant dehumidifier can be added to hospital's existing mechanical system
- Allows for chiller to operate at higher, more efficient temperatures
- Can accommodate additional chilled water requirements without adding additional chillers
- Makes efficient use of wasted excess boiler capacity during summer, off peak seasons, when using steam for desiccant regeneration
- Controlling latent loads with the desiccant system allows for precise and quick temperature changes (i.e., quicker cool down and recovery times)
- No more fogging of microscope lens
- No more "raining" from the operating room ceilings and/or fixtures



The true desiccant system is actively regenerated, as opposed to passively regenerated by the requirement of cooler, drier exhaust air. The actively regenerated system does not require exhaust air to function; however, energy can be recovered from the hospital's exhaust air if desired and practical. The actively regenerated desiccant system also includes two to three times the amount of desiccant material, as does an enthalpy, or energy recovery, rotor.



Many healthcare engineers and/or plant operations managers have a misunderstanding that a desiccant system is the same as an energy recovery (i.e., enthalpy wheel) system. While both systems include a rotor (or wheel) with a coating of desiccant material, the similarities of the two technologies stop there.



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