Six steps of humidification design

—to meet your facility's specific requirements

By Bob Nelson, DRI-STEEM Humidifier Company

Humidification systems are as varied as the buildings they serve. Schools, hospitals, offices, cleanrooms, museums, printing plants, food processing plants—every facility has unique humidification requirements. But they also share common requirements; among them are low first cost, minimum energy cost, high performance, and minimum maintenance cost.

Properly designed, a humidification system will optimize indoor air quality, improve manufacturing processes, and preserve expensive equipment. Despite these benefits, only two percent of facilities actually contain humidification systems, partly because commercial humidification systems are not widely understood.

Six variables most affect the performance of humidification systems: building construction, load, energy and water sources, placement and controls. The following six steps of humidification design will help you control these variables and aid you in the construction of an efficient, effective humidification system.

Step 1: Evaluate building structure to avoid moisture loss, condensation

Just as buildings are protected against unwanted heat loss—with insulation and double glazing—they can also be protected against unwanted humidity loss in new and retrofitted buildings. Insulation for walls, as well as steel roof and wall supports, should be protected with a vapor barrier on the warm side to avoid saturation from condensed water vapor. Double-glazed windows and hollow core steel doors also minimize condensation.

Step 2: Calculate humidification load for consistent humidity levels

A humidified building constantly loses moisture, primarily due to air changes. As a general rule, humidification load is based only on the amount of outside or make-up air entering a building or space. Loads are calculated based on the difference between desired conditions and entering conditions. Calculation methods vary, depending on whether the building uses mechanical, natural or economizer ventilation.

Step 3: Determine the most energy-efficient heat source

One of the most common and energy-efficient methods of humidification is to discharge steam from an in-plant boiler directly into a space or ducted air stream. Another way to use boiler steam is with an indirect steam-to-steam system to prevent the discharge of chemically-treated steam into an occupied or manufacturing space. These and other isothermal systems are ideal for commercial and industrial applications, primarily due to their high capacity, compact size, rapid response to control, and ability to achieve steam absorption within a short distance.

Another method, known as the adiabatic process, uses heat from the surrounding air to change water into vapor for humidification. Foggers, ultrasonic and pezio disk humidification are typical adiabatic systems, and perform best when the supply air is consistently warm and dry.

Step 4: Condition water source for optimum performance

Because water contains dissolved minerals, suspended materials, and dissolved organic material in varying amounts, the water used in a humidification system has a direct effect on system performance. Deionized water is purest and, along with water treated by reverse osmosis, is often recommended for hospitals, cleanrooms and other installations requiring very clean humidification steam.

The higher the mineral concentration in the water supply, the more downtime required for cleaning. Humidification systems that are continuously online should use demineralized water (deionized or reverse osmosis). Systems using softened water can operate several seasons without cleaning (yearly inspections are recommended).

Step 5: Determine equipment placement to ensure proper absorption

Humidification systems include a vapor or steam generator and a dispersion assembly. While the steam generator may be placed in numerous locations, placement of the dispersion assembly is crucial. Allow adequate absorption distance so that dispersed steam is absorbed into the airflow before it comes in contact with duct elbows, fans, vanes, filters or any object that may cause condensation and dripping.

Step 6: Establish control system parameters for best performance

As the final step to humidification design, the control system will determine day-to-day operation. Three primary factors affect performance and comfort level, and should be determined in the design process. These include desired relative humidity set point, acceptable RH fluctuation and space temperature.

Carefully considering these six steps will help you design an efficient, cost-effective humidification system that meets the specific requirements of the facility.

About the author:
Bob Nelson is director of sales and marketing for DRI-STEEM Humidifier Company. He has 21 years of experience in the HVAC industry, including 15 years in humidification and six years in building design.