Engineering Humidification

FOR A BETTER ENVIRONMENT

from DRI-STEEM Humidifier Company Education Series

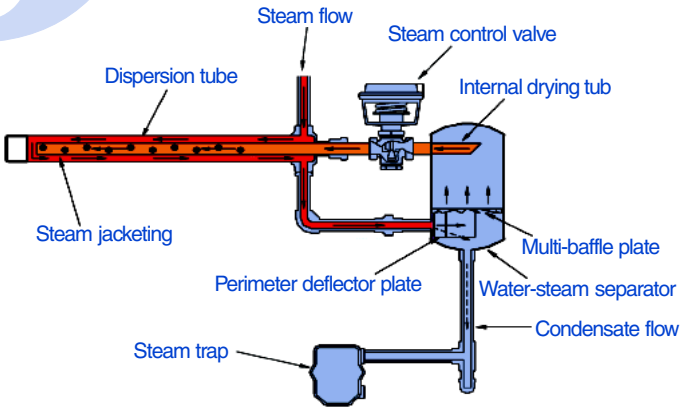
Nine pointers for successfully installing steam humidifiers

Because of ever-increasing technological advancements and greater concern about Indoor Air Quality (IAQ), the demand for proper humidification in businesses grows each year—requiring more engineers and contractors who can properly design and install humidification systems.

Although there are many humidification methods, steam humidifiers represent the largest portion of humidification equipment being installed in commercial and industrial applications. For that reason, in this article we will concentrate on the installation of nonresidential steam humidifiers.

Figure 1

A nonresidential boiler-steam humidifier



There are two basic types of steam humidifiers:

Boiler-steam humidifiers

These humidifiers (see Figure 1) discharge steam, created by an in-house boiler, into a ducted airstream or into spaces that don't have duct work. They consist of a small water-steam separator, a control valve, a steam trap, a strainer, and a dispersion tube. The dispersion tube, or disperser, has steam discharge holes along its length, and should span the full width of the duct. This tube is surrounded by a jacket of steam at supply pressure, keeping the inner dispersion tube hot to prevent humidification steam from condensing and dripping.

Self-generating humidifiers

These humidifiers (see Figure 2 inside) create their own steam by boiling water in an evaporating chamber. The steam is then discharged into a ducted airstream, or into spaces not served by ductwork. The self-generators vary in style depending on their source of heat energy for creating steam. They use electricity or a heat exchanger with either steam, hot water, or gas burners as the heat energy source. These units consist of an evaporating chamber containing an appropriate heating device; a water level control; a water makeup system; a steam conductor (flexible hose or rigid tubing) for carrying steam from the evaporating chamber to the duct dispersion tube; and, typically, a microprocessor-based control system.

Before installing a humidifier

Before installing a humidifier, read the manufacturer's literature. This will save time and avoid expensive corrections. Product literature should contain recommended humidifier location, piping method, dispersion tube installation, and electrical wiring methods.

Here are the nine pointers for successfully installing humidification systems:

1 Locate humidifier where noise won't be objectionable.

Boiler-steam humidifiers, due to pressurized steam passing through the control valve, will generate some noise. The higher the steam pressure and the greater the steam volume, the louder the sound. To reduce noise, locate humidifiers away from relatively quiet and occupied areas.

Some electric humidifiers generate noise from contactors cycling on and off. For very quiet areas, consider an electric unit with quiet SSR or SCR control rather than contactors.

2 Create access to equipment for convenient visual inspection and maintenance.

Boiler-steam humidifiers contain devices (such as a control valve, a steam trap, and a strainer) that require periodic maintenance. While these devices can operate for long periods of time without attention, they should be accessible for inspection.

Self-generating humidifiers are either cleanable or have disposable cylinders. Location should allow for easy access with ample space for servicing.

3 Protect areas surrounding humidifier from water damage.

The potential for water damage is always present with any steam or water appliance, but when the installation is properly planned, this risk can be virtually eliminated.

Valuable equipment and stored materials can be protected from water damage by locating humidifiers away from these areas or, when necessary, installing drip pans under humidifiers to contain water leaks.

4 Consider rigid pipe for the steam conductor.

When self-generating humidifiers are being used, rigid pipe (stainless steel or copper tubing, or steel pipe), though initially more expensive, offers several advantages:

- **Longer service life.** Flexible hose will need to be replaced eventually and may be more expensive over the long term.
- **Neater appearance.** In large capacity installations where several humidifiers and dispersers are required, a single rigid pipe, between the dispersers and the humidifiers and connected with the proper fittings, consumes less space and eliminates the clutter of running several hoses.
- **Easy to install at a uniform slope for condensate drainage.** Rigid pipe won't sag and create pockets, which can cause condensate to pool, resulting in spitting at the disperser.
- **Easy to insulate.** Insulating rigid pipe reduces steam loss due to condensation. Also, insulating pipe can result in considerable energy savings.

5 Design for proper condensate drainage.

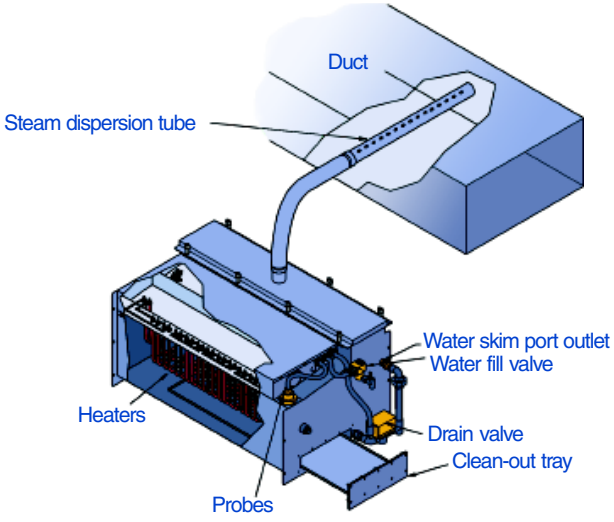
For self-generating humidifiers, condensate continually forms in dispersion tubes as well as in the steam conductors. This water must be drained to prevent it from being discharged into the duct. For reasons of energy economy, it should drain back into the evaporator. When this is impossible due to obstructions or elevation problems, condensate may be wasted to a drain.

There are two ways to return condensate to the evaporator. One method is to pitch the duct disperser and steam piping continuously back to the evaporator. When this is done, condensate flows counter to steam flow. This method works satisfactorily only when steam piping is adequately sized for humidifier capacity, and when a given minimum recommended pitch can be maintained. Otherwise, the velocity of the steam will carry condensate with it into the duct. Usually, humidifier manufacturers will recommend a maximum steam flow rate and a minimum pitch.

The other method, used with higher capacity systems, involves returning condensate through a separate line. With this method, the duct disperser has a drain connected to a condensate return line, and both are pitched so that condensate returns to the humidifier. This installation requires an air vent in the return line.

Figure 2

Electric hot element self-generating steam humidifier



When wasting condensate to an open drain, a P-trap is required to prevent steam from escaping into the room. The trap is usually constructed of metal tubing. Water column height in the P-trap must be sufficient to withstand the operating pressure inside the humidifier. Again, consult the manufacturer's recommendations.

6 If required, cool down discharged water.

Many humidifiers have periodic drain and flush cycles, or have automated skimming, where a portion of water in the tank is drained off to remove precipitated minerals. This water is typically 212 °F (100 °C) which, in many municipalities, by code may not be discharged to a sanitary system. In this situation, add a water tempering device to cool discharged water.

7 Install a duct high limit humidistat.

This device is a *must* for practically all installations and is mounted in the duct downstream of the steam disperser. It is usually set at 90% RH. If the duct RH rises above that setting, it will temporarily shut down the humidifier. To ensure proper operation, the sensor must be located far enough downstream of the disperser to allow steam to be fully absorbed and the humidity to equalize in the airstream. Otherwise, short cycling of the humidifier may occur, resulting in an unsatisfied humidification demand.

Most evaporative humidifiers can use an inexpensive on/off-type high-limit humidistat, except in variable air volume (VAV) systems. In this case, a modulating high-limit humidistat provides more satisfactory control.

8 Install an air flow proving switch.

If duct air flow stops for any reason, the humidifier must be shut down immediately to prevent water damage. This can be accomplished by using a duct-mounted air flow proving switch. Use a switch that is activated by the movement of a shaft, which has a vane or sail attached to it (often called a sail switch).

Another type is a diaphragm-operated switch, in which the static pressure inside the duct actuates the switch. The latter type isn't a good choice for VAV systems, because when the VAV box modulates the air flow, the duct static pressure remains high and allows the humidifier to continue to operate even though there may be an insufficient volume of steam-absorbing air flow. The sail-switch type is the best choice for VAV applications.

9 Place humidity sensor in center of room or in return air duct.

Humidity sensor or transmitter location has a significant impact on humidifier performance. Placing a sensor in the center of a room or inside a return air duct will give the best all-around control. Do not place a sensor near a supply duct, on a perimeter wall, in sunlight or near a heat-producing object. The humidity sensor should be located where it can measure an average space temperature and humidity.

Keeping these points in mind while installing a humidification system will save time and will help ensure proper and satisfying humidification.

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