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ELECTRODE VS RESISTIVE STEAM HUMIDIFIERS

Skills summary

■ What?

A comparison between electrode and resistive steam humidifiers, as well as humidifier installation safety tips.

■ Who?

Contractors, customers, HVAC&R mechanics/technicians

Electrode and resistive are the two main types of electric steam humidifier an HVAC&R contractor will buy and install. Both are versatile and come in a variety of sizes for either in-duct or in-room applications.

From a contractor's perspective, the main considerations when selecting a unit are often purchase cost and ease of installation. For a customer or end-user, the initial cost is also important, but so are on-going operating costs and maintenance requirements.

STEAM CREATION

The main differences between electrode and resistive technologies are how they heat the water to create steam, and how they control steam output.

Electrode humidifiers boil water by passing electrical current through it, therefore a water conductivity of 120 to 1250 μ Siemens/cm is required. The more current passes through the water, the greater the steam production. So, output increases with a higher water level or when higher mineral levels make the water more conductive.

To maintain an accurate output, the concentration of minerals in the water is flushed through an automatic drainage cycle and replacement with fresh water. This typically allows for humidity control of around \pm 5%RH.

Resistive humidifiers create steam through the transfer of heat from the resistance heater elements to the water. Steam output is controlled by applying more or less heat to the water rather than controlling water level or conductivity. This results in more accurate humidity control of around \pm 2%RH with mains water.

As the mineral content of the water has no impact on steam output, resistive humidifiers can also operate on RO water. As the mineral content of the water is very low, this virtually eliminates scale build-up, significantly reducing maintenance requirements. It also improves humidity control by removing the need for fresh (cold) water to be regularly introduced to reduce mineral levels. A consistent water temperature results in a consistent steam output and enables a resistive humidifier operating on RO water to control humidity to \pm 1%RH.



COSTS

Electrode humidifiers tend to have the lowest capital cost of the two technologies.

Installation costs for both electrode and resistive are comparable, plus both are simple to install as they require connection to power, water mains supply, and drain only.

The cost of operating a steam humidifier is largely determined by two things: the energy required to turn water from a liquid to a gas, and the cost of dealing with what's left behind in the humidifier after this has happened.

When run on mains water, the energy costs are the same for both humidifiers as they use the same amount of electricity to create the steam. However, if the resistive unit is run on RO water, electrical consumption is less, as very little hot water is sent to drain. Although energy consumption is improved using RO water, water consumption is increased as up to 50 per cent of the water is sent to drain as part of the initial RO filtration system process.

With an electrode boiler, as steam is produced, any minerals in the water build up within the plastic cylinder as limescale. When these cylinders are full of limescale, they are replaced, which is straightforward and offers the benefit of very rapid maintenance and minimal downtime for the humidification system. The disadvantage is that cylinders can be expensive and represent an ongoing spares cost.

As resistive steam humidifiers do not pass current through the water, they can operate with stainless-steel boiling chambers that can be cleaned rather than replaced. This avoids the expense of disposable cylinders reducing spares costs. So much so, that the initial cost of the more expensive resistive unit can be recouped within a short period of time.

So, although ongoing operating costs can be less with a resistive humidifier, servicing takes longer as the unit needs to be emptied of scale. However, some advanced systems reduce this service burden through innovative scale management features. These systems use an external scale collector, allowing limescale to be removed quickly and easily without needing to open the main body of the humidifier, greatly reducing service time.

SUMMARY

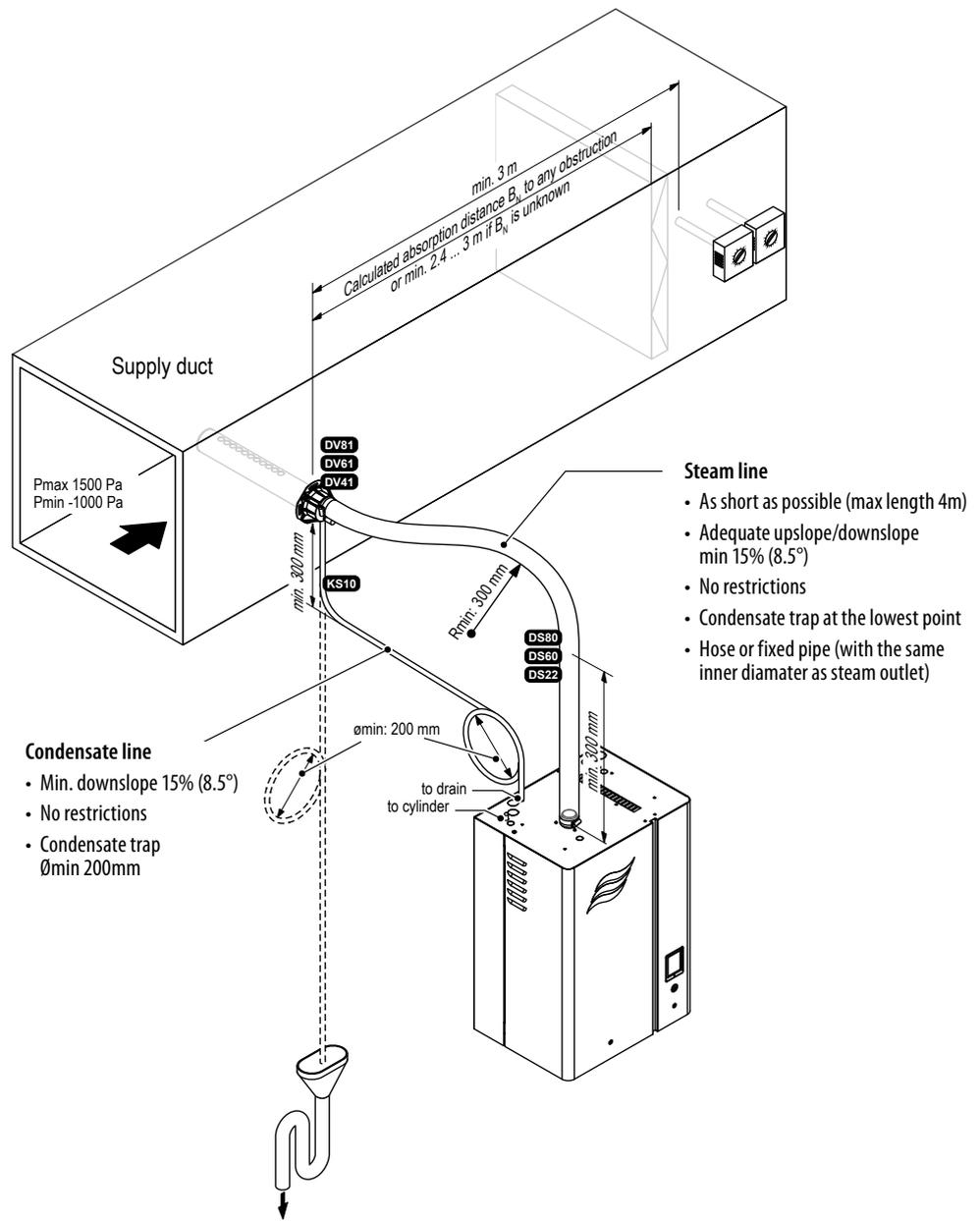
As we've seen, both technologies have advantages and disadvantages, and the choice of system largely depends on the end-user's needs. If very close humidity control is needed, resistive humidifiers with or without RO water could be the best option.

If close humidity control isn't important, but simple maintenance with minimal downtime is, an electrode boiler with its replaceable cylinders could suit.

But if a customer wants the lowest whole-life cost across capital, service, and consumables, then a resistive humidifier will provide this.

The most important thing to remember is to get good guidance from a competent humidifier supplier. From product selection to servicing there are often opportunities to up-sell to improve your

Overview steam installation for duct humidification



customers satisfaction and avoid many common errors along the way. A quality humidifier supplier will work alongside you to help you make the most from each project. Things to specifically look for in a supplier include a comprehensive range of approved products, a company which offers support, and advice on installation, commissioning, and servicing.

INSTALLING ELECTRIC HUMIDIFIERS: 10 THINGS A CONTRACTOR SHOULD KNOW

Installing electric humidifiers can be tricky as water supply, drainage, single and three-phase power, steam hoses, and controls are all involved. As humidifier projects don't come along very often for the average HVAC&R contractor, building-up enough experience to overcome the common pitfalls can be difficult.

Here's a list of ten useful tips that should assist with a smooth and successful humidifier installation.

Tip 1

Check the specification

The type of humidifier specified isn't always the most appropriate for the project. Check with the manufacturer that the model specified will meet the project's requirement given the actual design conditions. Ensure the acceptable humidity control will be met by the model suggested. Ask whether the level of expected maintenance and annual cost of consumable components is acceptable to the end-user.

Tip 2

Humidifier positioning

Humidifiers should be located where they can be easily accessed for servicing. Every humidifier needs to be maintained and inconvenient positioning may mean increased labour time or even a two-man job rather than one.

AS/NZS 3666 AIR-HANDLING AND WATER SYSTEMS OF BUILDINGS – MICROBAL CONTROL

Part 1

Sets forth requirements for the design, installation and commissioning of humidifiers, including ductwork design to avoid the ingress and accumulation of moisture and also drainage of ductwork where moisture is likely to accumulate.

Part 2

Sets out the requirements for regular routine operation and maintenance of various types of humidifiers.

Tip 3

Steam hose and condensate hose

Installing steam hose incorrectly between the humidifier and the steam lance in the duct can cause a drop-in humidifier efficiency and increased humidifier running costs. If the steam hose is too long, the steam will condense prior to being released inside the duct. This results in the humidifier working harder to provide the correct amount of humidity to maintain the required room condition.

Generally, steam hoses should not exceed 4m, always avoid sags or dead-legs where condensate can build-up without running to drain. This can cause a restriction in steam flow and a build-up of steam pressure in the system which will need to be relieved by the humidifier.

Condensate hose from the distributor pipe should be installed without any sags or dead-legs to ensure free flow of condensate to drain.

Tip 4

Steam distributor pipe

The steam distributor pipe's job is to disperse steam quickly and evenly in the airflow of the duct. It is important to consult the manufacturer's recommendations for the location of steam distributors. Understanding the conditions of the airflow will determine the positioning and type of the distributor pipe used. If a single pipe is being used, the positioning will typically be central in the duct, with the holes pointing upwards and at a right angle to the airflow. The pipe must always be angled to direct condensate into the drain.

Common problems occur when steam pipes are positioned too close to bends causing steam to condense on the duct prior to absorption. If it is necessary to mount a distributor pipe close to a bend, special "Optisorp" distributor pipes are available with multiple pipes and tiny inner nozzles that take only the hottest, driest steam from the centre of the lance. These quick-absorption manifolds can provide an evaporation distance of just 30cm.

Care should be taken to avoid placing lances too close to humidistats, attenuators, and air filters as wetting-out could occur.

Locating a steam pipe too high or low in a duct may also cause a problem. Stratification of the air with different humidity levels in the airstream could result in condensation on ductwork and poor humidity control.

Tip 5

Drainage

The water being released from a steam humidifier could be between 60–100°C, so consideration should be given to drain piping. Plastic pipes can melt and bend. Some steam humidifiers will temper water temperature prior to release so if this is an issue, select an appropriate model.

Don't position a humidifier above an open drain as steam rising from the drain can enter the unit, resulting in condensation and corrosion or electrical faults in the circuit boards. It's better to run a long drain and position the humidifier near the duct, so steam hose is an appropriate length, than position the humidifier near the drain and have excessively long steam piping.

Tip 6

Water quality

Check that the water supply is compatible with the humidifier to be installed.

Running a steam humidifier on hard water will inevitably result in an increased maintenance schedule. Limescale left behind after the water evaporates will need removing from the boiling chamber more frequently.

Careful consideration ought to be given to appropriate humidifier selection in hard water areas to reduce necessary servicing as much as possible. Installing an electrode boiler humidifier in such an area could cost the end-user dearly in replaceable boiling cylinders. Using a resistive humidifier with an easy-to-service, cleanable cylinder will present better value, even with its higher capital cost.

Water treatment, such as reverse osmosis or water softeners, can only be used with resistive element humidifiers and will reduce humidifier maintenance in hard water areas and also improve humidity control as they will be draining less to combat mineral build-up.

Tip 7

Control strategy

Employ a fully considered control strategy that involves modulating or on/off dependant on the steam capacity of the humidifier. Safety interlock protection is required to ensure that the humidifier cannot operate when the air handling system is switched off. Care needs to be taken with the location of controlling and high-limit sensors.

Tip 8

Power

Always consider the full power requirements of the humidifier. Is there enough electrical power available to supply unit selected? Also, is there a requirement for single-phase power? Humidifiers often need single-phase power for the control board and 3-phase power for the heating.

Tip 9

Commissioning

When commissioning a humidifier, it is important to consider it as part of the whole air-handling system. The humidifier is often accused of under or over-humidifying when air volumes and temperatures have not been checked beforehand.

If an external commissioning engineer is being used, check that all services are installed and available prior to him arriving on site. Also, scheduling in the controls company to be on site at the same time often makes for a speedy and accurate testing of the control signal and any remote-indication feedback to the BMS.

Tip 10

Good advice

Seek good advice from a competent humidifier supplier when tackling a humidifier project. From product selection to servicing, there are many common errors to avoid and often opportunities to up-sell and improve customer satisfaction. A quality humidifier supplier will work alongside the contractor to help them make the most from each project. ■

MORE INFORMATION

This month's Skills Workshop has been put together by Aireven – the exclusive distributor in Australia for Condair.

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