10-POINT GUIDE TO SPECIFYING HUMIDIFIERS

Humidification, Dehumidification
and Evaporative Cooling

condair

GUIDING YOU THROUGH HUMIDIFICATION

Designing a humidification system to successfully meet a project's humidity control requirements must take into account many factors. Understanding the impact of these elements largely comes through experience.

However, as humidifier projects are relatively uncommon for most HVAC consultants, it can be difficult to build-up the expertise needed to specify a humidification system.

This document presents an overview of the most important elements of a humidifier project. It will enable a HVAC consultant to gather together the appropriate information about a project to design a humidification system.

This will include making informed decisions on humidification strategy, product sizing, technology selection, system design and necessary accessories.

It presents some rules of thumb and will prompt a consultant to review important aspects of a humidification project they may not have otherwise considered.

CONTENTS

1 WHY HUMIDIFY?

The need to maintain air humidity largely falls into one of three main categories: to improve or maintain manufacturing efficiency, to preserve articles that are susceptible to moisture loss and to protect human health.

Improving manufacturing efficiency

Any industry that deals with materials that are susceptible to moisture loss can benefit from humidity control. This includes industries such as print, pharmaceuticals, textiles and food production. A loss of moisture from a product can impact its physical integrity or quality, as well as reducing a manufacturing yield through weight loss.

In addition to moisture sensitive products, any manufacturing process that suffers from electrostatic issues may also humidify, as air with a humidity of above 40%RH is a natural dissipater of electrical charge. This would include industries such as electronics and data centres, as well as many packaging processes.

Cold water humidifiers can provide very economic cooling through evaporation. In industrial and commercial situations, this can greatly improve efficiency of operations by providing a more comfortable working environment without the overheads of expensive air conditioning.

Preservation

When materials suffer moisture loss, their integrity can weaken causing irreversible damage over time. Humidification for preservation is particularly important for the heritage sector, in buildings such as museums, art galleries, archives, stately homes and palaces. Valuable paintings, furniture, sculptures and any exhibit made of natural materials can be susceptible to damage through moisture loss.

Consistent humidity control for preservation is also important for musical instruments. Even the slightest dimensional change caused by the drying of wood, can result in an instrument becoming out of tune. For large instruments, like church organs, dimensional changes will inhibit performance as sliders and moving parts suffer increased friction.

Any building with wooden floors or walls may also require humidity control to prevent warping and damage.

Health

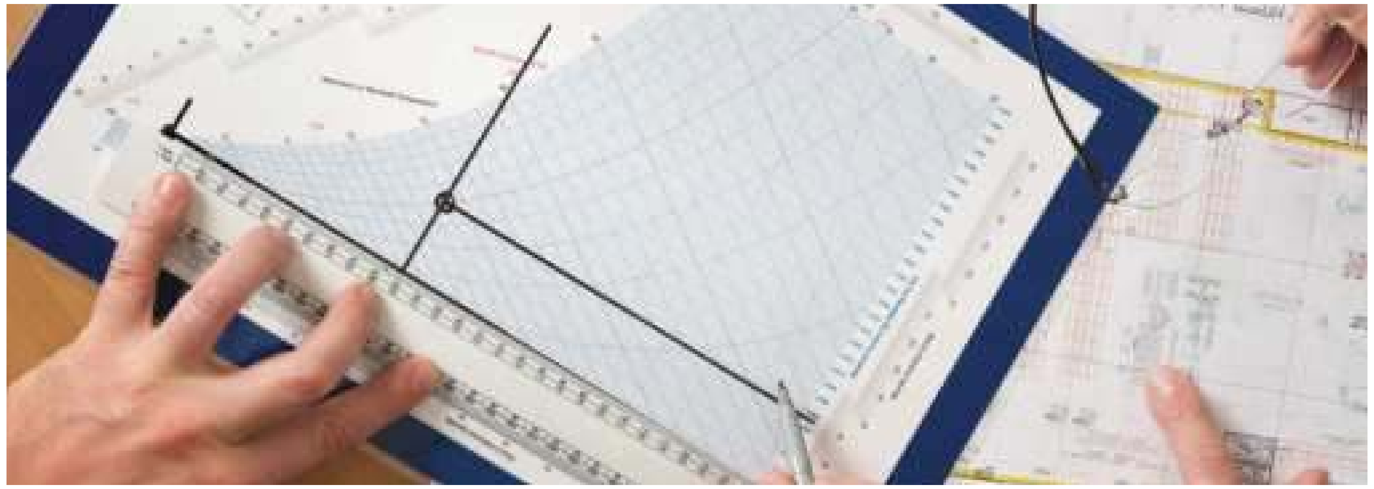
Many scientific studies have shown that the ideal indoor humidity for health is 40-60%RH. At this level our respiratory immune system functions optimally, and the quantity and infectious nature of many airborne viruses is significantly reduced.

If humidity falls below 40%RH, mucous membranes in our nose and throat will dry. This impairs the body's natural process of mucociliary clearance, whereby inhaled pollutants are captured and destroyed before they can cause an infection. Studies in aerosol science have also shown that the viruses people expel by speaking, coughing or breathing remain airborne for longer in dry air. This is due to the expelled droplets evaporating down to a smaller size. Thirdly, some viruses have been shown to survive and remain infectious for significantly longer when airborne in a humidity level of below 40%RH.

In any heated building without a humidifier, the indoor humidity will typically fall below this optimal threshold of 40%RH whenever the outdoor temperature falls to around 10°C or less. It is therefore important to humidify buildings for occupant health during the winter.

> "Improve or maintain manufacturing efficiency, to protect human health or to preserve articles."

WHAT INFORMATION DOES A PSYCHROMETRIC CHART PROVIDE?



A psychrometric chart shows the relationship between air temperature, air moisture content and relative humidity. It is typically used in a humidifier project to calculate the amount of water needed to raise the humidity from a low level to the desired humidity level, whilst also taking into account any resultant changes in temperature.

Processes (see Fig. 1)

A Isothermal humidification – the addition of steam increases the moisture content and relative humidity with minimal increase in temperature.

B Heating – the addition of heat energy increases temperature, reduces relative humidity without affecting moisture content.

C Dehumidification – the removal of moisture, reduces relative humidity with an increase in temperature from the heat released during the dehumidification process.

D Cooling – the removal of heat energy decreases temperature, increases relative humidity with the possibility of a reduction in moisture content through condensation during the cooling process.

E Adiabatic humidification/cooling – the evaporation of cold water increases moisture content and relative humidity, whilst the use of heat energy for the evaporation process reduces the air temperature.

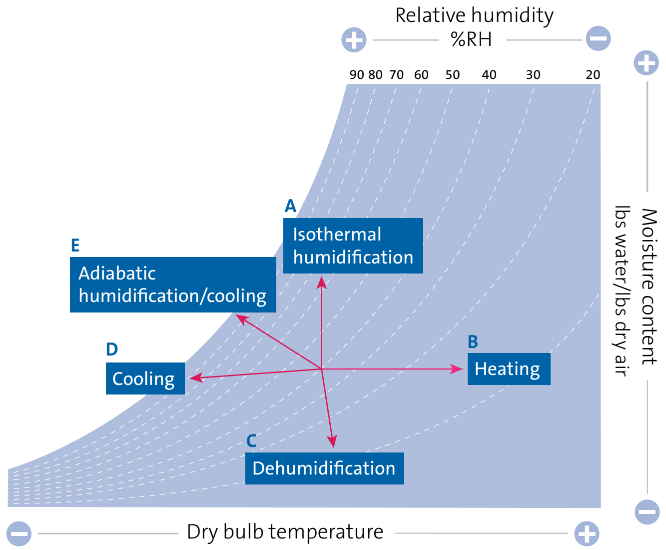


Fig 1 – the five main psychrometric processes.

Typical isothermal humidification process

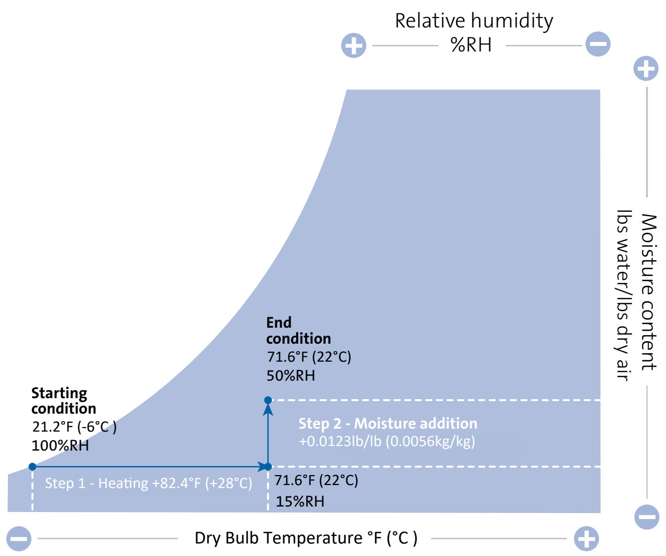


Fig 2 – the typical isothermal humidification process.

Typical adiabatic humidification process

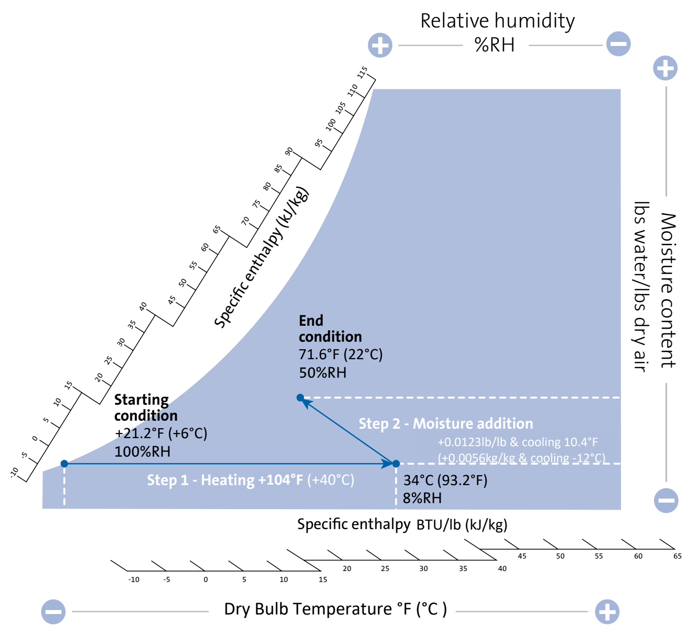


Fig 3 – the typical adiabatic humidification process.

Starting condition -21.2°F (6°C) 100%RH – should be based on the coldest possible outdoor temperature and the lowest RH or moisture content, likely to be experienced.

Step 1 Heating +82.4°F (28°C) – chart shows the pre-humidification RH level.

Step 2 Moisture addition 0.0123lbs/lb (+0.0056kg/kg) – to the required RH level. Chart shows the amount of moisture needed to raise the humidity to the desired level per kilo of dry air.

End condition 71.6°F (22°C) 50%RH

To use a psychrometric chart, you will need to know the:

1. Starting condition's temperature and RH. This is usually the coldest outdoor winter condition.

2. Desired end condition's temperature and RH during the same period as 1.

3 WHAT SIZE HUMIDIFIER DO I NEED?

AHU load calculation

$$\frac{\text{Airflow } (\text{ft}^3/\text{hr})\,\text{m}^3/\text{hr} \times \%\text{ of fresh air} \times \text{Moisture addition lb/lb (kg/kg)}}{\text{Specific volume ft}^3/\text{lb } (\text{m}^3/\text{kg})} = \text{Humidity load lb/hr (kg/hr)}$$

Example:

$$\frac{254{,}265.6\ \text{ft}^3/\text{hr}\ (7{,}200\ \text{m}^3/\text{hr}) \times 20\% \times 0.0056\ \text{lb/lb}\ (0.00254\ \text{kg/kg})}{13.45\ \text{ft}^3/\text{lb}\ (0.84\ \text{m}^3/\text{kg})} = 21.16\text{lb/hr}\ (9.6\text{kg/hr})$$

Direct room load calculation

$$\frac{\text{Room air volume ft}^3\ (\text{m}^3) \times \text{Air change rate per hr} \times \text{Moisture addition lb/lb (kg/kg)}}{\text{Specific volume ft}^3/\text{lb } (\text{m}^3/\text{kg})} = \text{Humidity load kg/hr}$$

Example:

$$\frac{123{,}601.3\ \text{ft}^3\ (3{,}500\ \text{m}^3) \times 2.5 \times 0.0056\ \text{lb/lb}\ (0.00254\ \text{kg/kg})}{13.45\ \text{ft}^3/\text{lb}\ (0.84\ \text{m}^3/\text{kg})} = 90.83\text{lb/hr}\ (41.2\text{kg/hr})$$

Sizing rules of thumb

- For every 35.31 ft^3/s (1 m^3/s) of fresh air, approx. 55.1 kg/hr (25 kg/hr) of humidity is needed
- For every 220.46 lbs (100 kg) of steam, approx. 75 kW of electrical power is needed
- For every 2.2 lbs (1 kg) of cold water evaporated, approx. 0.68 kW of evaporative cooling is produced

To perform a load calculation, you will need to know the:

- Volume of moisture needed to raise the humidity from the start to end condition for 2.2 lbs (1 kg) of dry air and the specific volume of air at this condition (from a psychrometric chart – see point 2).
- Volume of air being humidified.

4 SHOULD HUMIDIFICATION BE IN-ROOM OR IN-DUCT?

The answer to this question frequently depends on whether there is an existing air handling unit (AHU) and duct network in a building. If central air treatment plant is present, then it often makes sense to use this for humidification purposes, as part of a building's HVAC strategy.

If a building does not have a ducted air conditioning system, it is rarely practical or cost effective to install one for the sole purpose of humidity control. Under these circumstances, direct room humidifiers are normally employed.

The times when it might not be practical to humidify an existing AHU is when the required humidity control is very local to a specific area or when the volume of humidity required is very low. Under

these circumstances direct room systems can be a more practical and cost effective solution.

Conversely, if the amount of moisture needed to maintain humidity in the room is very high, it might be more than the AHU's airstream can physically accommodate. For instance, if there is significant heat gain within a room, the required humidity load can be high and the supply temperature from the AHU can be low, which limits the moisture it can carry.

Under these circumstances, in-room adiabatic systems can not only provide humidity control but also offer an additional source of cooling. They can also be used to "top-up" the humidity provided by an AHU humidification system, if one is present.

Condair offers free expert advice on humidifier sizing and selection.

WHICH TECHNOLOGY IS MOST SUITABLE FOR MY AHU PROJECT?

When deciding on a humidifier technology the most important considerations are often energy, accuracy of control, physical constraints and maintenance.


Resistive steam humidifier


Electrode boiler steam humidifier


Gas-fired steam humidifier


Live steam humidifier


Steam-to-steam humidifier


Evaporative humidifier

Energy

The energy needed to turn liquid water into its gaseous state is the same no matter what type of humidifier is being used. The energy required to boil 110.23 lbs (50 kg) of water into steam is the same as evaporate it, but for the latter, the energy source is thermal energy from the air rather than electricity or gas powering a heater.

So the main energy consideration for humidification isn't how much energy is used but rather where is it coming from and how much does it cost? Gas is frequently cheaper per kW than electricity so can result in lower operating costs. However, gas-fired steam humidifiers have a high capital cost, so the greater the output, the faster the payback time.

If the humidity duty is below 66.14lbs/hr (30kg/h), electric steam humidifiers are frequently the most cost effective option.

The economy of using gas as an energy source is not only relevant for steam but also adiabatic humidifiers. Unless waste heat is being used to pre-heat the air before the humidifier, a heater will be needed and this is frequently gas-fired.

Humidity control

Close humidity control requires a humidifier that has a consistent output, can respond rapidly to a sensor's signal for more or less humidity, and which can modulate fully from 0-100%.

The most accurate type of humidifier is a resistive steam humidifier that is being operated on a reverse osmosis water supply. As there is very little mineral build-up in the boiling chamber, there is no need for the humidifier to introduce fresh, cold water to manage mineral concentrations. This results in a very consistent boiling chamber temperature and accurate steam output.

Other types of humidifiers that offer close control (±1 to ±2%RH) are live steam humidifiers with rotary valves, air and water spray, hybrid spray humidifiers, and ultrasonic. However, with any type of humidifier, the degree of humidity control accuracy depends largely on any fluctuations in air-on conditions, and the precision of any sensors and controls.

Physical characteristics

Limited space within an AHU will frequently result in steam rather than adiabatic humidifiers being employed. Much less space is needed to accommodate a steam lance than a spray or evaporative unit. Constraints outside an AHU also impact selection. Steam humidifiers need to be located within 4m of the AHU, as longer steam pipe runs will result in the steam condensing and reduced efficiency.

Water quality & maintenance

Humidification in hard water areas can impact humidifier selection. Operating electrode boiler humidifiers on hard water will increase costs through frequent replacement of boiling cylinders. Resistive humidifiers can be cleaned or emptied of scale, making them more suitable for hard water.

Reverse osmosis (RO) water filters can be employed before the humidifier to remove minerals and prevent scale build-up. However, this does limit the effectiveness of electrode boiler humidifiers, as they need minerals in the water supply to conduct current. Spray humidifiers will typically always have an RO system, to prevent mineral dust being introduced to the AHU.

Evaporative humidifiers can offer less maintenance than steam humidifiers, as the minerals are largely flushed to drain. They also do not require RO water treatment, so minimise water consumption as well as maintenance.


High pressure humidifier


DL Series adiabatic humidifier

	Resistive electric steam	Electrode electric steam	Gas-fired steam	Live steam (rotary disc valve)		Steam-to-steam	Evaporative AHU	High-pressure AHU	DL Series AHU	
Ideal for	Close control, Hard water	Low to mid-sized capacity	High capacity	Available pure steam supply		Available impure steam supply	High capacity, Low maintenance, Cooling	Multiple AHUs, Cooling	Close control	**Ideal for**
Max output (single unit)	2-160kg/h	2-160kg/h	50-600 lbs/h	1-2,000kg/h		50-1050/h	30-1,200kg/h	30-1,300kg/h	4-2,000kg/h	**Max output (single unit)**
Modulation	0-100%	20-100%	20-100%	0-100%		15-100%	30-100%	5-100%	5-100%	**Modulation**
Control	±2%RH RO water ±5%RH mains water	±5%RH	±5%RH	±5%RH		±5%RH	±10%RH	±5%RH	±2%RH	**Control**
Water type	Mains / RO	Mains	Potable / RO / DI	NA		Potable / RO / DI	Mains / RO	RO	RO	**Water type**

WHICH TECHNOLOGY IS BEST FOR MY DIRECT ROOM PROJECT?

When deciding on a humidifier technology the most important considerations are often energy, accuracy of control, physical constraints and period of operation.


High pressure spray


High pressure spray


Compressed air & water spray


In-room steam humidifier


In-room steam humidifier


Mobile evaporative humidifier (PureHum 1000 Pro)

Area and output
Humidifier selection for direct room humidification is frequently driven by the size of the area needing humidity control and the required level of output.

For applications that need less than 44lbs/h of humidity, wall-mounted steam humidifiers with fan units can be an economic and practical solution. For very small areas, mobile humidifiers can offer around 4.4lbs/h.

Spray humidifiers are well suited to larger areas. They can provide multiple points of moisture introduction, therefore offering balanced humidity levels across any sized area, particularly high pressure systems with zone control.

Humidity control
For close humidity control, resistive steam humidifiers operated on RO water are often the best option. Ultrasonic and air and water spray humidifier can also provide rapid response to control signals and give fully modulated output, offering close control. Although not fully modulating, high pressure spray humidifiers can provide zone control, varying outputs across different areas, and more closely manage humidity from a single system.

Physical characteristics
If a room has a low ceiling height (<13ft), it can limit the choice of spray humidifier, as aerosols released from nozzles will need space to fully evaporate. For large areas, high pressure systems with multiple low capacity nozzles are a good option, and compressed air and water sprays offer highly directional aerosols. Alternatively, multiple steam or mobile humidifiers can be employed but are less practical for operation and maintenance.

For occupied noise-sensitive areas, such as offices, high pressure spray systems offer much quieter operation than compressed air and water humidifiers. Mobile and steam humidifiers also provide practically silent humidity control.

When employing spray humidifiers in areas operating at low temperatures (<5°C) an aerosol's ability to evaporate is paramount. The smaller droplet size and forceful absorption provide by compressed air and water systems make them ideal for areas such as cold stores. Industrial environments with high levels of air pollution, make any system with a fan less practical. Therefore fan-less high pressure or air and water humidifiers are preferable.

Temporary solutions
If an area only needs humidity control for a short period of time, mobile humidifiers offer the benefit of easy removal and storage.

	High pressure spray	Air & water spray	Resistive electric steam		Electrode electric steam	Mobile evaporative (PureHum 1000 Pro)	
Ideal for	Mid to large areas, Multiple areas, Cooling	Industrial areas, Close control	Small areas, Close control		Small areas	Small- Medium area Temporary / back-up solutions	**Ideal for**
Max output (single unit)	30-800lbs/h	60-600lbs/h	40lbs/h		40lbs/h	5.7 lbs/h	**Max output (single unit)**
Modulation	5-100%	0-100%	0-100%		20-100%	0- 100% (8:1)	**Modulation**
Control	±5-10%RH	±2%RH	±2%RH RO water ±5%RH mains water		±5%RH	±2%RH	**Control**
Est. mains water consumption @ 100lbs/h output	200	110	120		120	12 gal	**Est. mains water consumption @ 100lbs/h output**
Water type	RO	Mains / RO	Mains / RO		Mains	Potable / RO	**Water type**

7

WHAT SHOULD BE CONSIDERED WHEN INSTALLING AHU HUMIDIFIERS?

Steam humidification

Humidifier location
Locate the humidifier within 13ft of the AHU to prevent steam pipe condensation reducing efficiency.

Absorption distance
The area required for the steam to be fully absorbed by the airstream will depend on the temperature and humidity of the oncoming air, the length, number and type of steam pipes, and the velocity of the airflow. To avoid condensation, nothing should be located in this absorption area with no duct bends or transitions. Typically at 8 ft/s, 68°F (20°C) and 50%RH the absorption distance will be around 1m. This can be shortened by up to 70% with the use of advanced short absorption manifolds.

Short absorption manifold (SAM-e)

Standard steam distributor (xSD)

Laminar airflow
It is important that the air is flowing evenly prior to the steam lance to avoid turbulence directing the steam on to the duct metalwork and condensing.

Drip tray
Installing a drip tray and drain under the steam distributor is best practise.

Duct height
The minimum duct height for steam humidification is 9.8" to avoid issues with steam condensing onto duct surfaces.

Steam distributor position
Typically around 1/3 of the duct height from the floor. Minimum 3.35" from the floor and 6.5" from the ceiling. Too close to the floor can create turbulent airflow and condensation on the duct. Too close to the ceiling and steam released from the top of the lance will condense on duct. Ideally, steam distributors should cover at least 75% of the duct width.

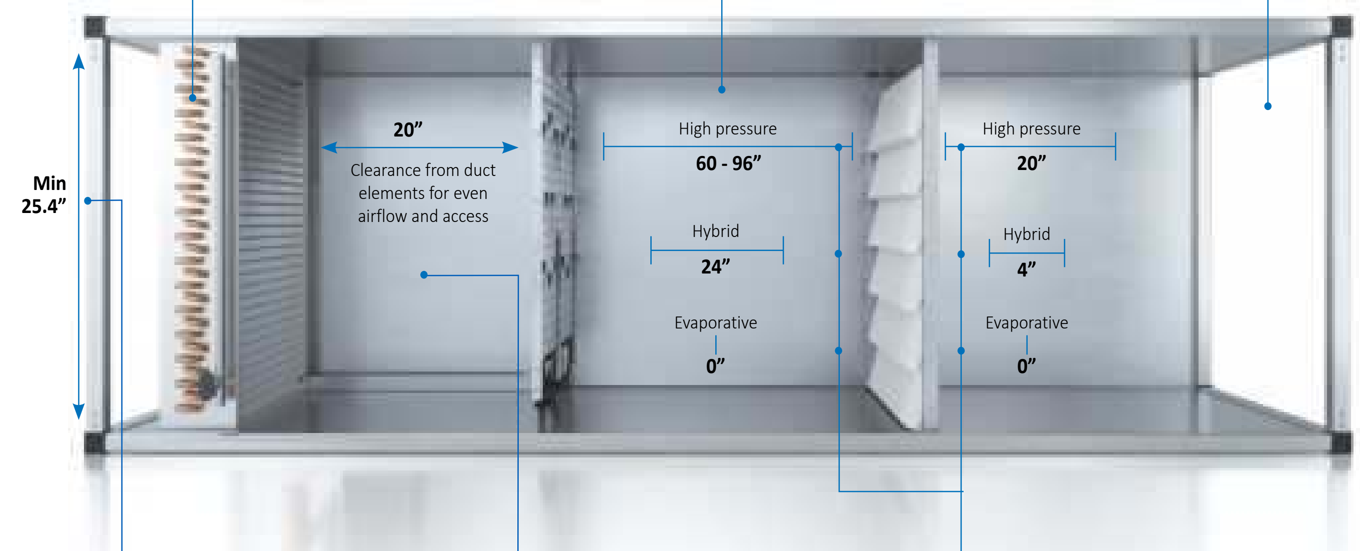
Filters, sensors and humidistats
If submicron filters are used after the humidifier, the absorption distance should be x2.5, to avoid moisture being removed by the filter. If sensors or high-end humidistats are placed in the duct, the absorption distance should be x5 to ensure proper mixing prior to the stat. Ideally sensors should be placed in the return air duct to provide accurate control information on the room condition.

Adiabatic humidification

Pre-heating
In order to absorb the moisture from the humidifier, the air will need to have sufficient capacity and therefore pre-heating is frequently required (see sections 2 and 5). This is particularly true in the winter, when the incoming, fresh air is cold and can hold little moisture.

Stainless steel section
Spray humidifiers will need a stainless steel duct section with a drain. Evaporative humidifiers do not require this, as there should be no physical wetting inside the duct from the humidifier.

Filters, sensors and humidistats
For evaporative and hybrid humidifiers, a filter can be fitted approximately 19.7" after the humidifier. For high pressure humidifiers, around 39.4" will be needed before a filter. Sensors and high limit humidistats should be positioned at least 118.1" from an evaporative humidifier or a spray humidifier's droplet separator. Ideally sensors should be placed in the return air duct to provide accurate control information on the room condition.



Duct
The minimum duct height for adiabatic humidification is 25.4" in order to accommodate the humidifier. The duct must also be strong enough to support the weight of the humidifier.

Laminar airflow and access
To provide access for maintenance and create even, laminar airflow across the duct prior to the humidifier, at least 19.7" clearance is required. A door will also allow easy access for maintenance.

Absorption and carry-over distance
High pressure spray humidifiers will need 31.5" between the spray nozzles and the droplet eliminator. An additional 19.7" will be required following the eliminator to accommodate any droplet carry-over from excessive airflow.

Hybrid spray humidifiers will need a minimum of 23.6" distance between spray nozzles and droplet evaporator, with just 3.9" for droplet carry-over. Evaporative humidifiers require no absorption or carry-over distance following the humidifier.

WHAT SHOULD BE CONSIDERED WHEN INSTALLING IN-ROOM HUMIDIFIERS?

Aerosol absorption
When injecting moisture directly into a room, it is important the steam or spray aerosol is fully absorbed by the air without contact to walls, ceilings or objects.

Depending on the output, room temperature and humidifier type, a spray nozzle's aerosol plume can be between 19.7" to 157.5".

A steam humidifier can need up to 78.7" clearance to ensure full absorption, but this will vary based on output. Mobile evaporative humidifiers can provide humidity with no aerosol.

Services
Humidifiers will need power, water and drain connections. If an in-room steam humidifier is being used, these services will need to be locally at the point of humidification.

For spray humidifiers, the drain connection is located with the pump or control panel. Water supply pipework is required to each nozzle and also a compressed air line for air and water spray systems. The need for an electrical connection to spray nozzles will depend on the use of a fan unit.

Mobile humidifiers can be operated with just an electrical supply, if water tanks are manually filled, or alternatively they can be plumbed-in but do not require a drain.

Hidden pipework for services should be considered in commercial or residential applications.

Location
In-room steam humidifiers will need to have at least 23.6" clearance from the ground to accommodate the drain. The drain should not be positioned directly under the unit to avoid any possibility of steam rising and condensing inside the humidifier. At least 1.9" clearance is needed to the walls and 15.7" to the ceiling to avoid steam condensing on surfaces, and up to 78.7" left clear at the front of the unit to allow full absorption of the steam.

Spray humidifiers will incorporate a pump station or control panel, typically located in a plant room, and a series of nozzles located in the area being humidified. Nozzles are strategically located to meet the individual requirement of a project. They can be secured on walls, ceilings or even on machinery. Clearance distances for spray nozzles will depend on the type being used and the capacity of the nozzle.

All humidifiers will need to be serviced, so locating humidifiers to give appropriate access for maintenance must be considered.

Zone control
If a large area needs humidity control or different areas have different humidity level requirements, using a zone control strategy can provide closer humidity control. For steam humidification, this would involve multiple in-room units, each with its own sensor.

For spray humidifiers, a single high pressure system can incorporate multiple sensors and valves to ensure nozzles release aerosols only when a specific area's humidity level requires. An alternative is the use of averaging sensors across an area, which activate all nozzles based upon the average conditions across a room.

Sensors
Sensors for in-room steam humidifiers are typically mounted near to the side of the humidifier itself. This allows for mixing of the humidity from the fan unit with the room air, prior to being registered by the sensor.

For spray systems, sensors should be located near to the critical point of the process requiring humidity control. They should not be located where external influences such as solar gain, radiated heat sources, drafts or cold bridging, from the surface it's mounted on, could affect readings.

9 WHAT HYGIENE MEASURES SHOULD BE CONSIDERED?

A properly designed and maintained humidification system fed with a clean, potable water supply, should provide a lifetime of hygienic operation. However, as with any element of a building's water system, proper risk assessments, active monitoring and preventative measures need to be carried out to mitigate any potential hygiene issues.

The five main points to consider in any risk assessment of a humidification system are:

1) Could water settle and stagnate?
This could be both inside a humidification system, during periods of operation or non-operation, as well as in pipework or tanks feeding the humidifier. Dips or dead-legs in pipework, where water can gather, must be avoided. Humidifiers ought to be designed to fully drain during non-operation and automatically purge or flush when appropriate, particularly cold water systems.

2) Is there a potential source of nutrients in the water?
Over time any still water will experience microbial growth but if there are additional sources of nutrients, such as a high level of airborne particulate matter or lime scale build-up, this can increase the risk.

3) Can the water temperature rise above 20°C?
Microbial growth will be accelerated at between 68 and 113°F (20 and 45°C. This circumstance is probable in any water tank exposed to room temperature conditions.

4) Is there any possibility of a respirable aerosol?
This could be from a spray nozzle or an accidentally produced splash during maintenance. The proximity of the aerosol to people and the probability of it being inhaled should be considered. For instance, an in-duct system presents less risk of a respirable aerosol than an in-room system.

5) Could a high risk person be exposed?
Any potential exposure to individuals who may suffer more serious illness from airborne risks, such as Legionella, ought to be considered. This could include the elderly, very young or infirm.

Hygiene features incorporated into humidification systems to mitigate the above risks as much as possible include:

- Steam humidification to ensure hygienic humidity control.
- UV water treatment on water supply lines, recirculating pipelines or inside water tanks.
- Silver ion water treatment through dosing or water contact.
- Automated flush and drain cycles during periods of non-operation, at set intervals or based upon water conductivity monitoring.
- Supply line water filtration, including reverse osmosis water treatment.
- Properly implemented maintenance routines, in line with the manufacturer's recommendations, including regular chlorination of cold water systems.

10 WHAT ASSOCIATED PRODUCTS AND SERVICES NEED TO BE CONSIDERED?

Water treatment
RO – Reverse osmosis water filtration removes virtually all the minerals from the supply water to greatly reduce maintenance and enhance hygienic performance in cold water systems.

UV – Ultraviolet sterilisation will kill bacteria in water. This is particularly beneficial in water tanks but is also used on water supply lines and recirculating water lines. Frequently used in the food sector.

Silver ion – Silver ionisation offers a powerful antimicrobial effect and is widely regarded as the most clinically effective prevention and remediation solution for Legionella.

Water softener – Used alongside high capacity (>500L/D) RO water systems to improve the performance of the RO membrane and prolong operational lifetime.

Pumps + tanks
Used when the water supply or pressure may be inconsistent or when high capacity water supply is required.

High-end humidistats
A sensor that sends an "off" signal to a humidifier in the event of an excessively high humidity level, indicating faulty operation.

Leak detector
A sensor that sends an "off" signal to a humidifier on detection of water.

Stands and enclosures
Provides proper operational positioning when wall-mounting is not an option, and protection from the elements when located outside.

Drain water cooling
Tempers hot (<194°F) drain water from steam humidifiers with fresh, cold water to provide <140°F drain water.

Commissioning
Should be carried out by the manufacturer to ensure humidification equipment is installed correctly, with optimum controls and operational performance.

Servicing
Routine professional maintenance is required for all humidification systems to maintain efficient and hygienic operation.

USA 1021 6th Street, Racine, WI 53403
Canada 2740 Fenton Road, Ottawa, Ontario K1T 3T7
Tel 1.866.667.8321 **Fax** 613.822.7964
Email na.info@condair.com **Website** www.condair.com

condair