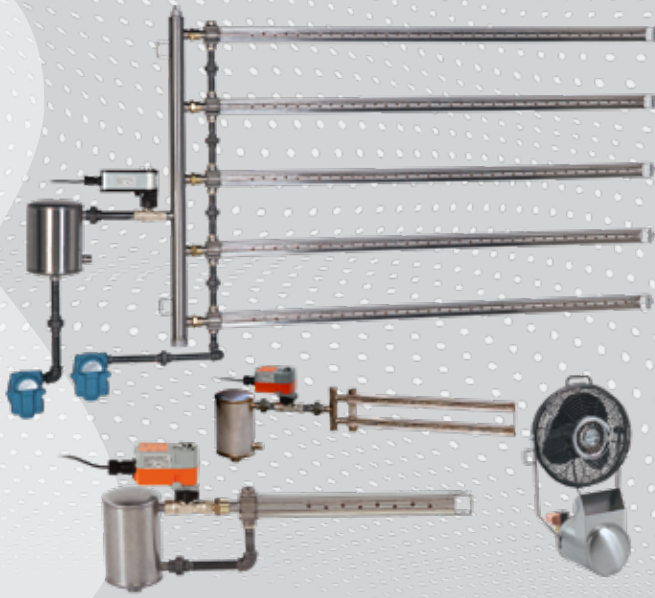


Steam Injection

For use with steam boilers



 *Installation, Operation, and
Maintenance Manual*

Read and save these instructions

Warnings and Cautions

 WARNING	CAUTION
Indicates a hazardous situation that could result in death or serious injury if instructions are not followed.	Indicates a hazardous situation that could result in damage to or destruction of property if instructions are not followed.

 WARNING	
 Attention installer Read this manual before installing, and leave this manual with product owner. This product must be installed by qualified HVAC and electrical contractors and in compliance with local, state, federal, and governing codes. Improper installation can cause property damage, severe personal injury, or death as a result of electric shock, burns, or fire. DriSteem® technical support: 800-328-4447 Read all warnings and instructions Read this manual before performing service or maintenance procedures on any part of the system. Failure to follow all warnings and instructions could produce the hazardous situations described, resulting in property damage, personal injury, or death. Failure to follow the instructions in this manual can cause moisture to accumulate, which can cause bacteria and mold growth or dripping water into building spaces. Dripping water can cause property damage; bacteria and mold growth can cause illness.	
  Hot surfaces and hot water Steam Injection humidifiers have extremely hot surfaces. Water in steam pipes and dispersion assemblies can be as hot as 212 °F (100 °C). Discharged steam is not visible. Contact with hot surfaces, discharged hot water, or air into which steam has been discharged can cause severe personal injury. To avoid severe burns, allow the system to cool before performing service or maintenance procedures on any part of the system.	

Table of contents

OVERVIEW	2
Introduction	2
Available models	3
Basic components	4
Principle of operation	5
Humidifier placement	6
Sensor placement	9
Pressurized steam piping guidelines	10
Condensate drain piping and trapping	14
SINGLE-TUBE HUMIDIFIER	17
Configurations	17
Assembly	18
Installation	19
Piping notes	20
Field piping	21
MULTIPLE-TUBE HUMIDIFIER	25
Field assembly	25
Installation	26
Piping notes	27
Field piping	28
MAXI-BANK HUMIDIFIER	33
Maxi-bank option field assembly and installation	33
Maxi-bank option field piping	36
MINI-BANK HUMIDIFIER	41
Assembly and installation	41
Field piping	43
AREA-TYPE HUMIDIFIER	44
Installation	44
Field piping	45
Rise, spread, and throw dimensions	46
OPERATION	47
Humidifier start-up and shut-down	47
Eliminating excess heat from steam jacketed humidifiers	48
MAINTENANCE	49
Maintenance procedures	49
TROUBLESHOOTING	50
Troubleshooting	50
REPLACEMENT PARTS	53
Single-tube and Multiple-tube humidifiers	53
Area-type humidifier	55
Mini-bank humidifier	56
WARRANTY	58
Two-year Limited Warranty	58
Extended warranty	58

ATTENTION INSTALLER

Read this manual before installing.
Leave manual with product owner.

DriSteem Technical Support

800-328-4447

Where to find more information

On our website:

The following related documents can be viewed from our website, www.dristeem.com

- [Steam injection brochure](#)
- [Steam injection catalog](#)

DriCalc sizing and selection software

DriCalc, our software for humidification system sizing and selection, can be ordered at www.dristeem.com.

Call us at 800-328-4447

Obtaining documents from our website or from DriCalc sizing and selection software is the quickest way to view our literature.



Introduction

SUITABLE FOR A WIDE RANGE OF APPLICATIONS

Steam Injection humidifiers from DriSteem® use steam from an external source, such as an in-house boiler or a district steam system. DriSteem's Steam Injection humidifiers are adaptable to virtually any size application, and a wide variety of models accommodate a broad range of steam absorption requirements.

STEAM JACKETED DISPERSION TUBE MODELS FOR DUCTS AND AIR HANDLERS

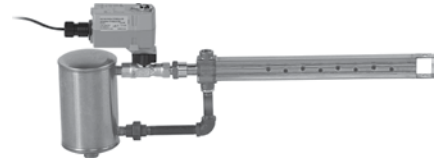
Single-tube, Mini-bank®, and Multiple-tube humidifiers are designed for ducts and air handlers, and capable of a wide range of guaranteed non-wetting distances.

AREA-TYPE FOR OPEN SPACES

Area-type™ Steam Injection humidifiers are designed for open spaces such as warehouses and manufacturing spaces that do not have a duct system. The steam discharged from the humidifier is quietly dispersed by a fan without introducing water droplets into the air.



**FIGURE 2-1:
STEAM INJECTION HUMIDIFIERS**



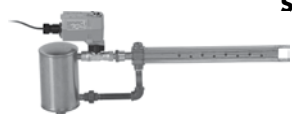
Each Single-tube, Mini-bank®, and Multiple-tube humidifier has the same basic components: a stainless steel separator, a steam valve, and one or more jacketed dispersion tubes.

For open spaces, boiler steam can be dispersed by the fan of an Area-type model.

Available models

FIGURE 3-1: STEAM INJECTION HUMIDIFIER MODELS

All Steam Injection humidifiers shown here, except Area-type, are available with options for applications requiring stainless steel steam components.



SINGLE-TUBE HUMIDIFIER

- Suitable for small- to medium-capacity systems, 1.5–525 lbs/hr (0.7–238 kg/h)
- Moderate to long non-wetting distance
- Pre-assembled separator/tube assembly



MINI-BANK HUMIDIFIER

- Suitable for small-capacity systems, 1.6–84 lbs/hr (0.7–38 kg/h)
- Short to moderate non-wetting distance
- Sized for small ducts
- Pre-engineered and pre-assembled header/tube assembly, ready for mounting and hookup



MULTIPLE-TUBE HUMIDIFIER

- Suitable for small- to large-capacity systems, 6.5–3989 lbs/hr (2.3–1809 kg/h)
- Sizes to fit small ducts and large air handlers
- Short to moderate non-wetting distance
- Field assembled (with interconnecting piping and header supplied by contractor)
- Maxi-bank™ option:
 - Pre-assembled, except when height exceeds 85" (2159 mm)
 - Includes 304 stainless steel header, with option for 316 stainless steel
 - Includes black iron piping, with options for 304 or 316 stainless steel

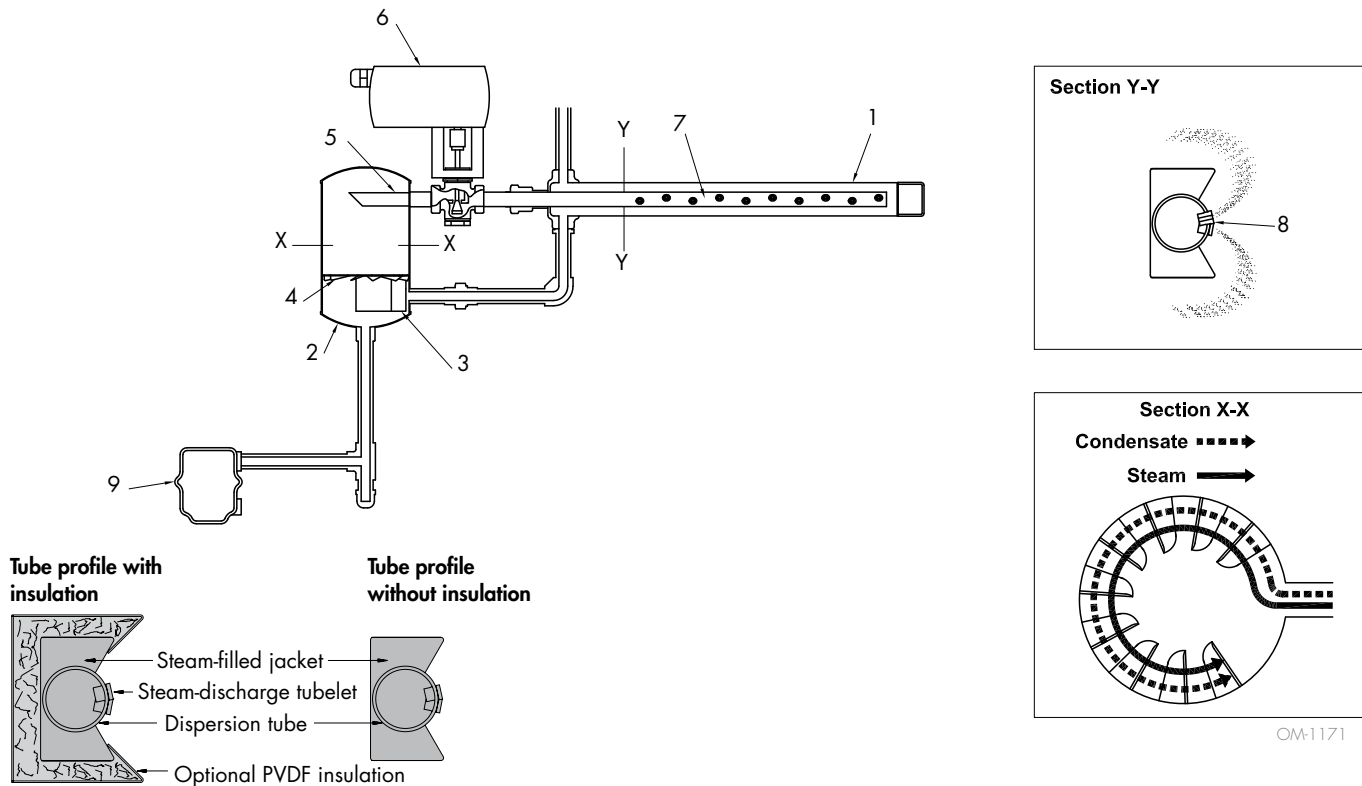


AREA-TYPE HUMIDIFIER

- Suitable for medium-capacity systems, 1.8–286 lbs/hr (0.8–130 kg/h)
- Used in open spaces
- Application-dependent non-wetting distances

Basic components

FIGURE 4-1: STEAM INJECTION HUMIDIFIER COMPONENTS

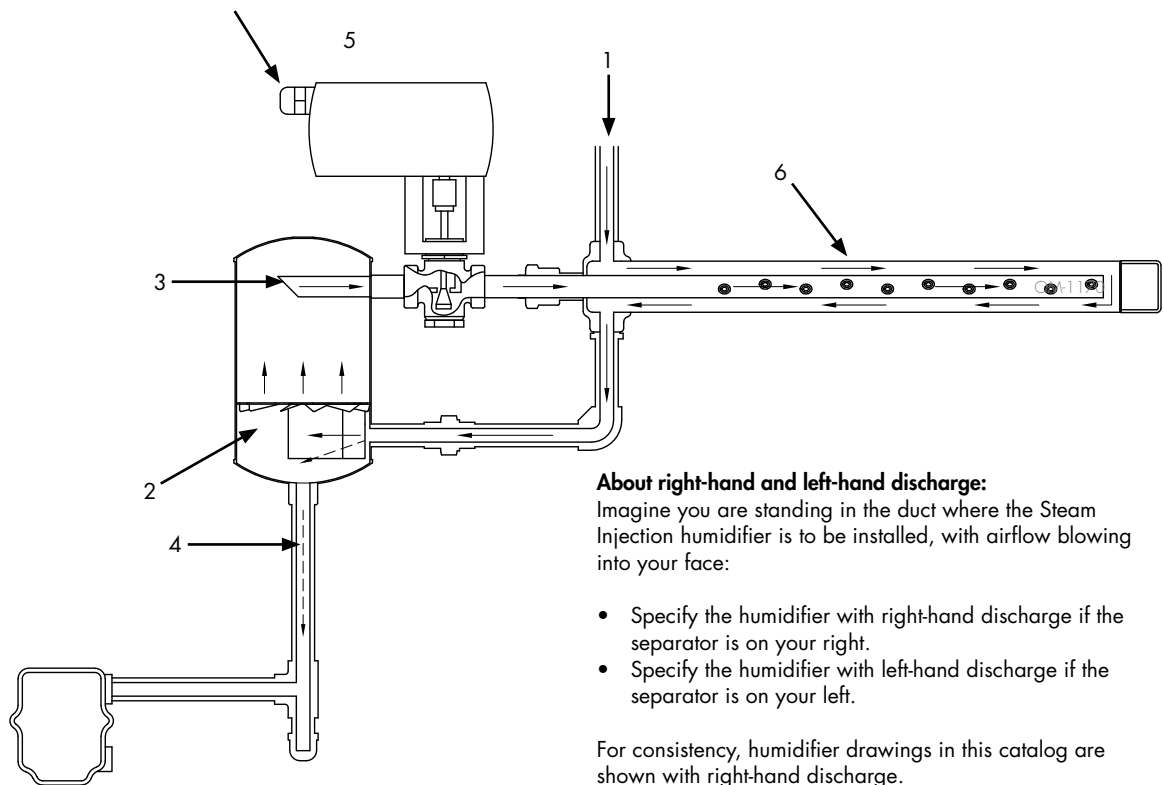


1. **Steam jacket**
A chamber that jackets the inner dispersion tube with hot steam to eliminate condensation and dripping
2. **Steam separator**
Separates steam from condensate
3. **Deflector plate**
Inside the steam separator, deflects condensate into a circular pattern and toward the drain
4. **Multi-baffle plate**
Allows only steam to rise into the upper region of the separator
5. **Internal drying tube**
Excludes any remaining condensate, allowing only dry steam to leave the separator
6. **Steam valve**
Controls the amount of steam allowed into the dispersion tube
7. **Dispersion tube**
Provides uniform steam dispersion across the duct width
8. **Thermal-resin tubelet**
Unique tubelets extend into the dispersion tube center so only the hottest, driest steam is discharged into the air. These tubelets also have an exceptional ability to trap noise generated by the valve, making DriSteem's Steam Injection humidifiers the quietest in the industry.
9. **Steam trap**
Allows only condensate to pass to the condensate return system

See Figure 5-1 for a description of how these components operate together.

Principle of operation

FIGURE 5-1: STEAM INJECTION HUMIDIFIER PRINCIPLE OF OPERATION



1. Boiler steam enters the humidifier at line pressure and flows through a chamber (jacket) surrounding an inner dispersion tube. The jacket of steam preheats the dispersion tube so that when steam enters the dispersion tube (at Step 5 below) it does not condense as it would if the tube were cold, thereby eliminating condensation and dripping.
2. After flowing through the steam jacket, steam with entrained condensate slows from entering the larger space of the separator and from hitting the perimeter deflector plate, and begins to spin and separate.
3. Separated steam rises through slots in the multi-baffle plate to the separator upper region, and enters the internal drying tube that excludes any remaining condensate, allowing only dry steam to leave the separator.
4. Separated condensate drains from the separator to the steam trap.
5. The steam valve controls the amount of steam allowed into the preheated dispersion tube. The steam valve is typically controlled in one of two ways:
 - By a signal from a building automation system
 - By a humidity controller connected to the steam valve
6. Steam is discharged uniformly through the tubelets into the airstream.

Humidifier placement

USE THESE EXAMPLES AS GUIDELINES

Proper humidifier placement is crucial for successful system operation. Usually, there is no single correct placement for a humidifier. Much depends on system design and application. The following paragraphs and dispersion assembly placement examples are presented as guidelines for common situations.

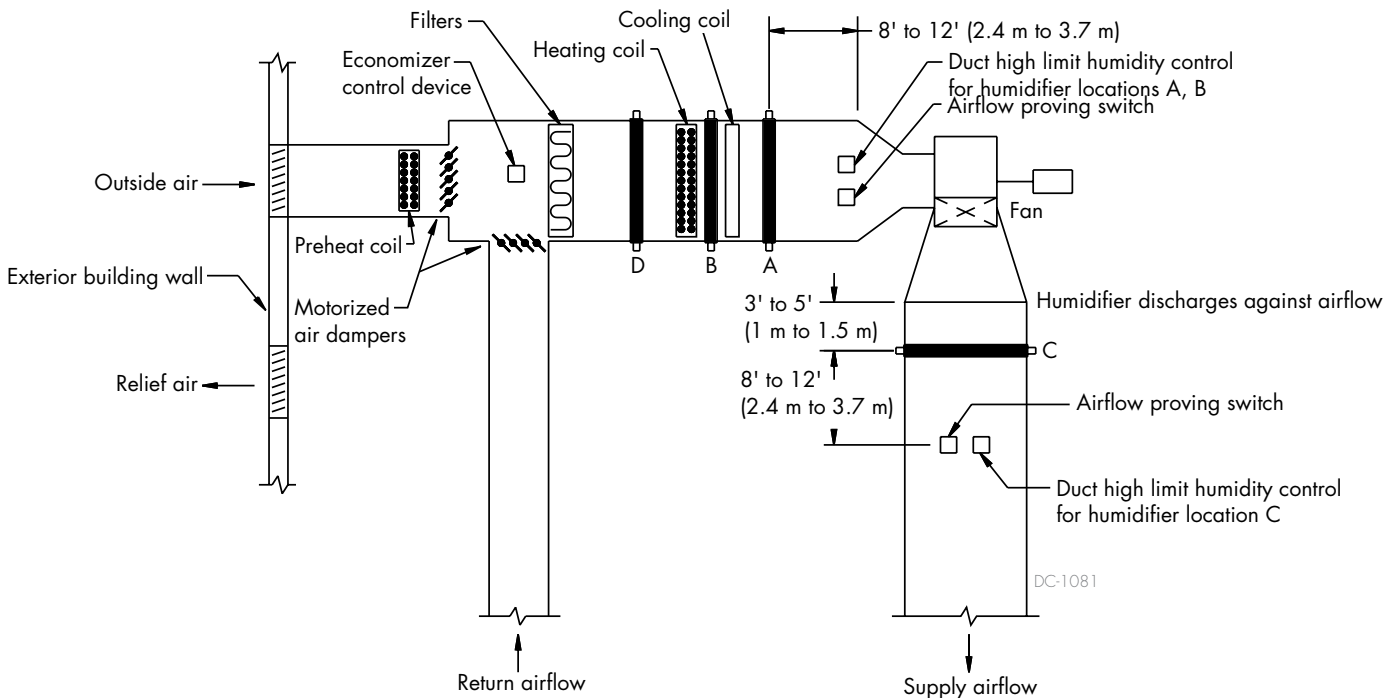
FIRST, CHECK AVAILABLE ABSORPTION DISTANCE

Available absorption distance affects system choice. Dispersed steam must be absorbed into the airflow before it comes in contact with any duct elbows, fans, vanes, filters, or any object that can cause condensation and dripping.

PLACING A STEAM INJECTION HUMIDIFIER IN AN AHU (SEE FIGURE 6-1)

- Location A is the best choice. Installing downstream from heating and cooling coils provides laminar flow through the dispersion unit; plus, the heated air provides an environment for best absorption. Use a multiple tube dispersion unit to ensure complete absorption of steam vapor before fan entry.
- Location B is the second-best choice. In change-over periods, the cooling coil will eliminate some moisture for humidification.
- Location C is the third-best choice. Air leaving a fan is usually very turbulent and may cause vapor to not absorb at the expected absorption distance. Allow for more absorption distance if installing downstream from a fan.
- Location D is the poorest choice. The cooler air at this location requires an increased absorption distance.

FIGURE 6-1: PLACING A STEAM INJECTION HUMIDIFIER IN AN AIR HANDLING UNIT (AHU)

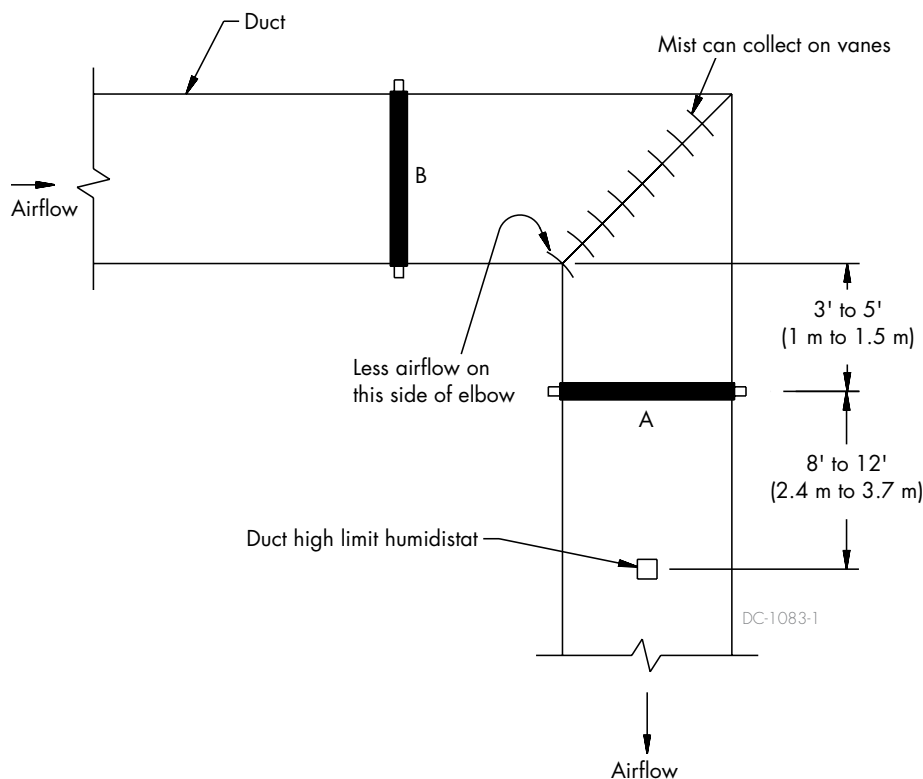


Humidifier placement

PLACING A STEAM INJECTION HUMIDIFIER NEAR AN ELBOW (SEE FIGURE 7-1)

- Location A is the best choice. Better absorption occurs on the downstream side of an elbow than on the upstream side.
- Location B is the second-best choice. Installing upstream from an elbow can cause wetting at the turning vanes. In cases where it is structurally impossible to avoid Location B, use a multiple tube humidifier to ensure complete absorption. Also, since more air flows along the outside of a turn, better absorption occurs if the humidifier discharges proportionately more steam in that part of the airstream.
- At both locations, discharging steam against or perpendicular to the airstream gives slightly better mixing and absorption than discharging with the airstream.

FIGURE 7-1: PLACING A STEAM INJECTION HUMIDIFIER ASSEMBLY NEAR AN ELBOW

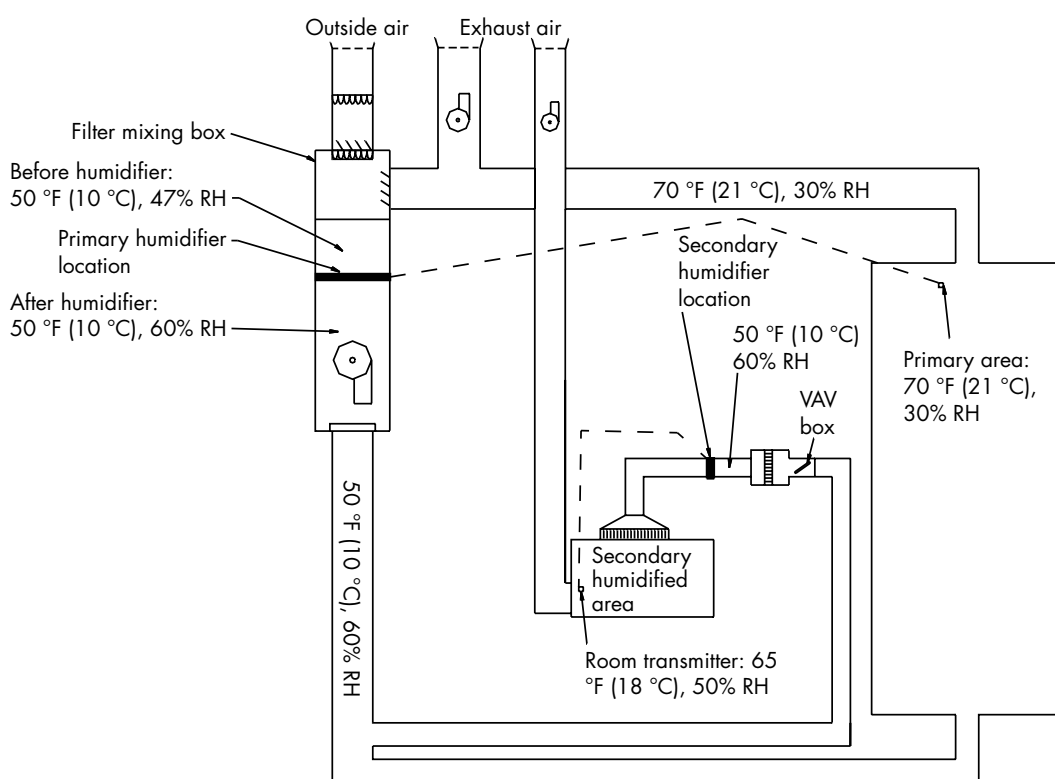


Humidifier placement

PLACING A STEAM INJECTION HUMIDIFIER IN A PRIMARY/SECONDARY SYSTEM (SEE FIGURE 8-1)

This type of system is commonly applied to facilities where most of the building requires one humidity level (typically to meet comfort requirements) and part of the building requires additional humidity. In Figure 8-1, the primary humidification system is within the main air handling unit. The secondary humidification system is located close to the point of steam discharge into the secondary area.

FIGURE 8-1: PLACING A STEAM INJECTION HUMIDIFIER IN A PRIMARY/SECONDARY SYSTEM



Sensor placement

SENSOR LOCATION IS CRITICAL

Sensor location has a significant impact on humidifier performance. See the recommendations below and Figure 9-1.

Note: DriSteem recommends that you do not interchange room and duct humidity devices. Room humidity devices are calibrated with zero or little airflow, whereas duct humidity devices require air passing across them.

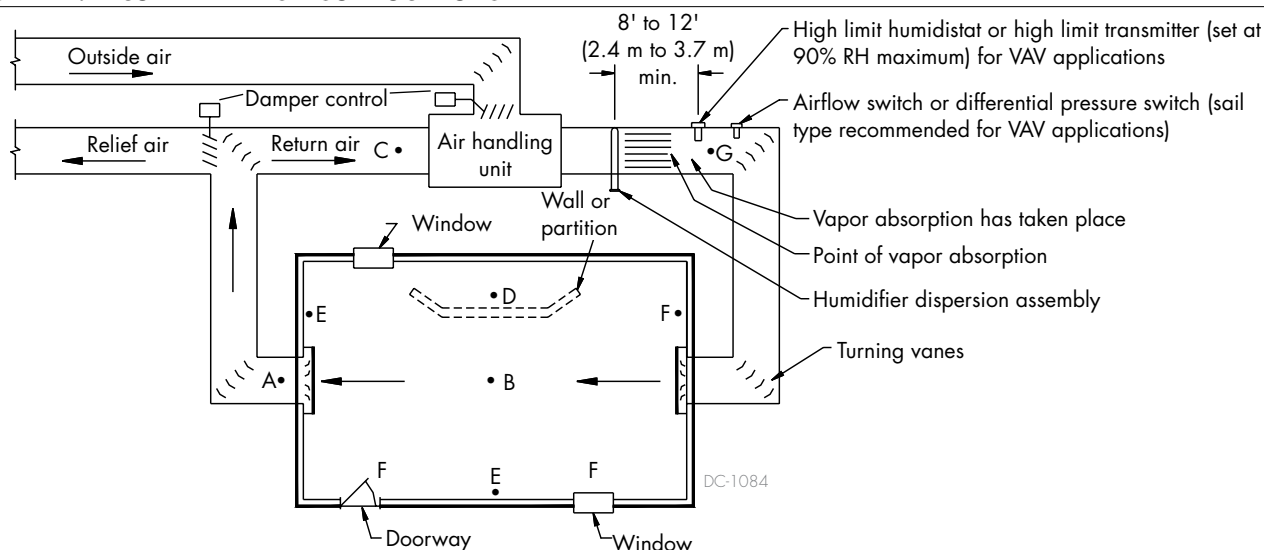
Recommended humidity control (transmitter/humidistat) locations:

- A** Ideal. Ensures the best uniform mix of dry and moist air with stable temperature control.
- B** Acceptable, but room environment can affect controllability, such as when sensor is too close to air grilles, registers, or heat radiation from room lighting.
- C** Acceptable. Provides uniform mixture of dry and moist air. If extended time lag exists between humidity generation and sensing, extend sampling time.
- D** Acceptable (behind wall or partition) for sampling entire room if sensor is near an air exhaust return outlet. Typical placement for sampling a critical area.
- E** Not acceptable. These locations might not represent actual overall conditions in the space.
- F** Not acceptable. Do not place sensors near windows, door passageways, or areas of stagnant airflow.

Recommended safety (airflow and high limit) sensor location:

- G** Best sensing location for high limit humidistat or humidity sensor and airflow proving switch.

FIGURE 9-1: RECOMMENDED SENSOR LOCATIONS



Other factors affecting humidity control

Humidity control involves more than the controller's ability to control the system. Other factors that play an important role in overall system control are:

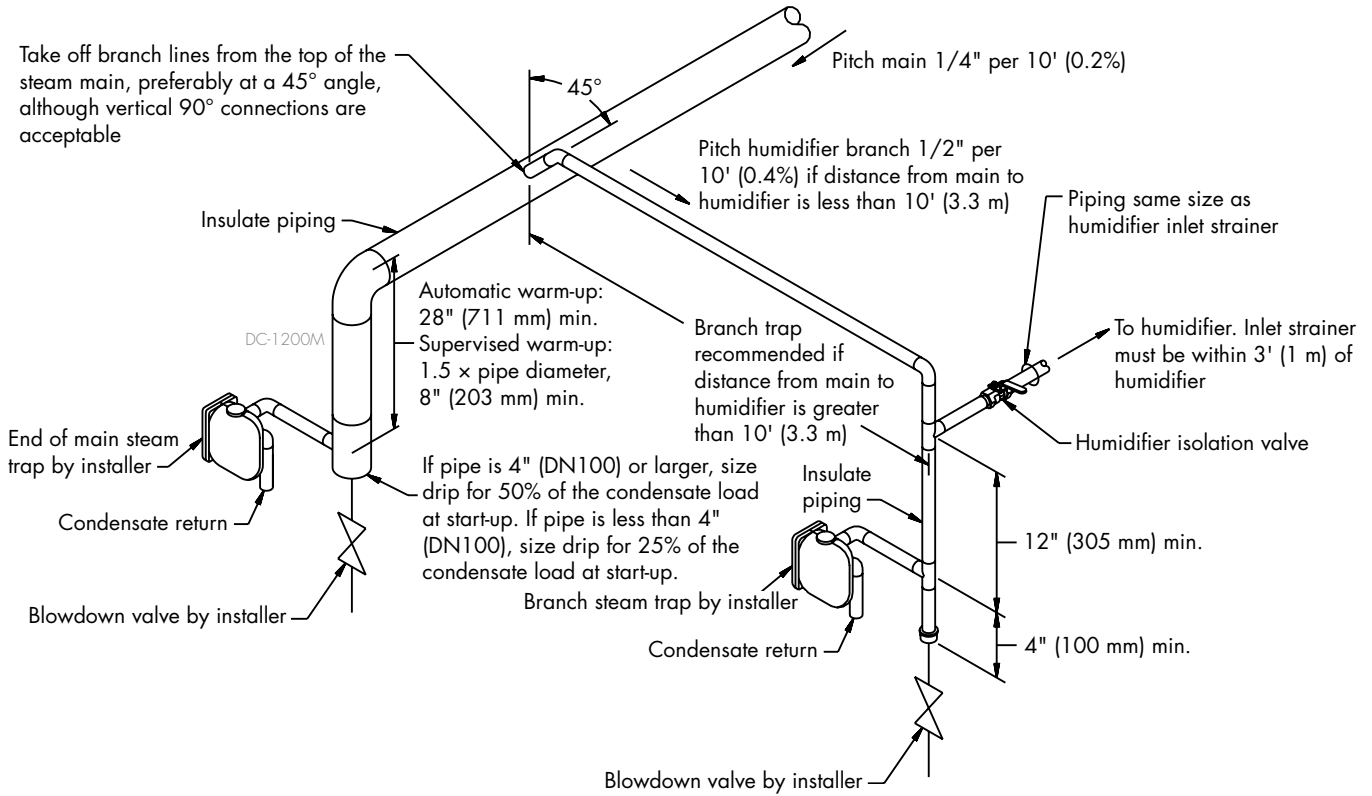
- Size of humidification system relative to load
- Overall system dynamics associated with moisture migration time lags
- Accuracy of humidistats and humidity transmitters and their location
- Dry bulb temperature accuracy in space or duct
- Velocities and airflow patterns in ducts and space environments
- Electrical noise or interference

Pressurized steam piping guidelines

- Size piping in accordance with ASHRAE recommendations.
- Humidifier's steam supply should be taken off top of steam main (not side or bottom) to ensure the driest steam. Main should be dripped and trapped (in accordance with ASHRAE recommendations).
- Humidifier steam trap(s) must drain by gravity to return main having little or no back pressure. If condensate cannot drain by gravity, then it must be elevated to return main (see Figure 12-1 for instructions).
- If steam pressure is less than or equal to 15 psi (103.4 kPa), use float and thermostatic (F&T) traps for the humidifier.
- If steam pressure is greater than 15 psi (103.4 kPa), use inverted bucket traps for the humidifier.
- If lifting condensate, use an inverted bucket trap and check valve regardless of steam pressure. See Figure 12-1 for instructions.
- Condensate from unavoidable heat loss in the distribution system must be removed promptly to eliminate water hammer and degradation of steam quality and heat transfer capability. Install drip legs at all low points and natural drainage points in the system, such as at ends of mains; bottoms of risers; and ahead of pressure regulators, control valves, isolation valves, pipe bends, and expansion joints.
- On straight, horizontal runs with no natural drainage points, space drip legs at the following intervals:
 - Not exceeding 300' (91 m) when the pipe is pitched down in the direction of the steam flow
 - At a maximum of 150' (46 m) when the pipe is pitched up, so that condensate flow is opposite of steam flow.
- These distances apply to systems where valves are opened manually to remove air and excess condensate that forms during warm-up conditions. Reduce these distances by about half in systems that are warmed up automatically.
- Insulate piping well to avoid unnecessary heat loss.
- Pitch return lines downward in the direction of the condensate flow at 1/2" per 10' (0.4%).

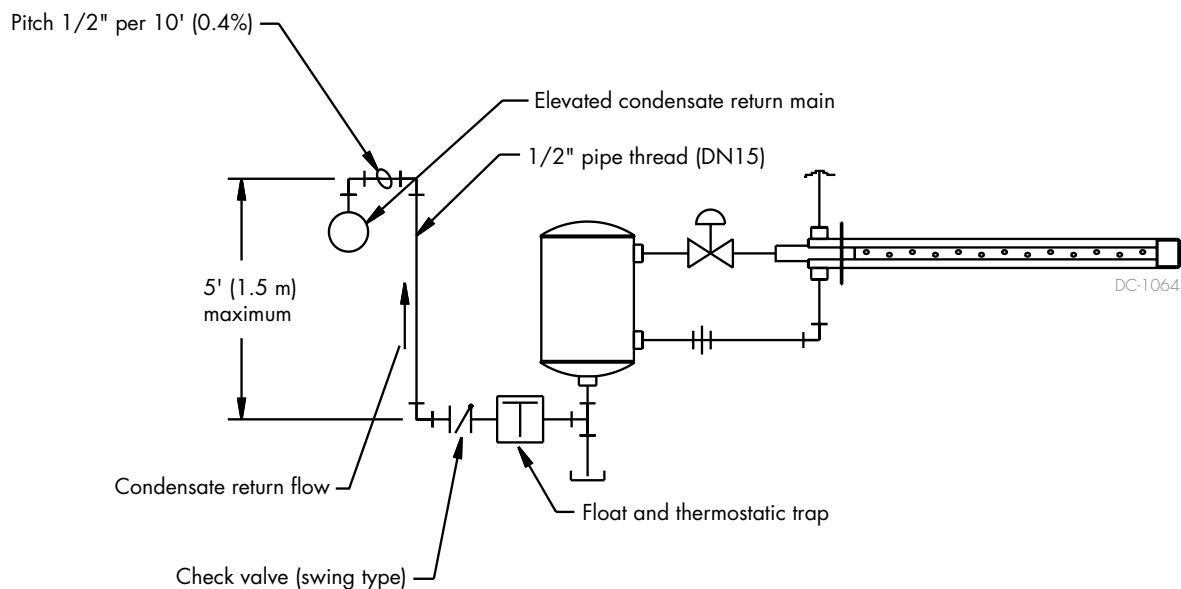
Pressurized steam piping guidelines

FIGURE 11-1: FIELD PIPING OVERVIEW



Pressurized steam piping guidelines

FIGURE 12-1: ELEVATING CONDENSATE FROM A STEAM INJECTION HUMIDIFIER



In certain installations, it is not possible to drain the humidifier steam trap by gravity. The condensate must be lifted. Generally, lifting condensate is not recommended, but it can be done successfully by observing the following rules:

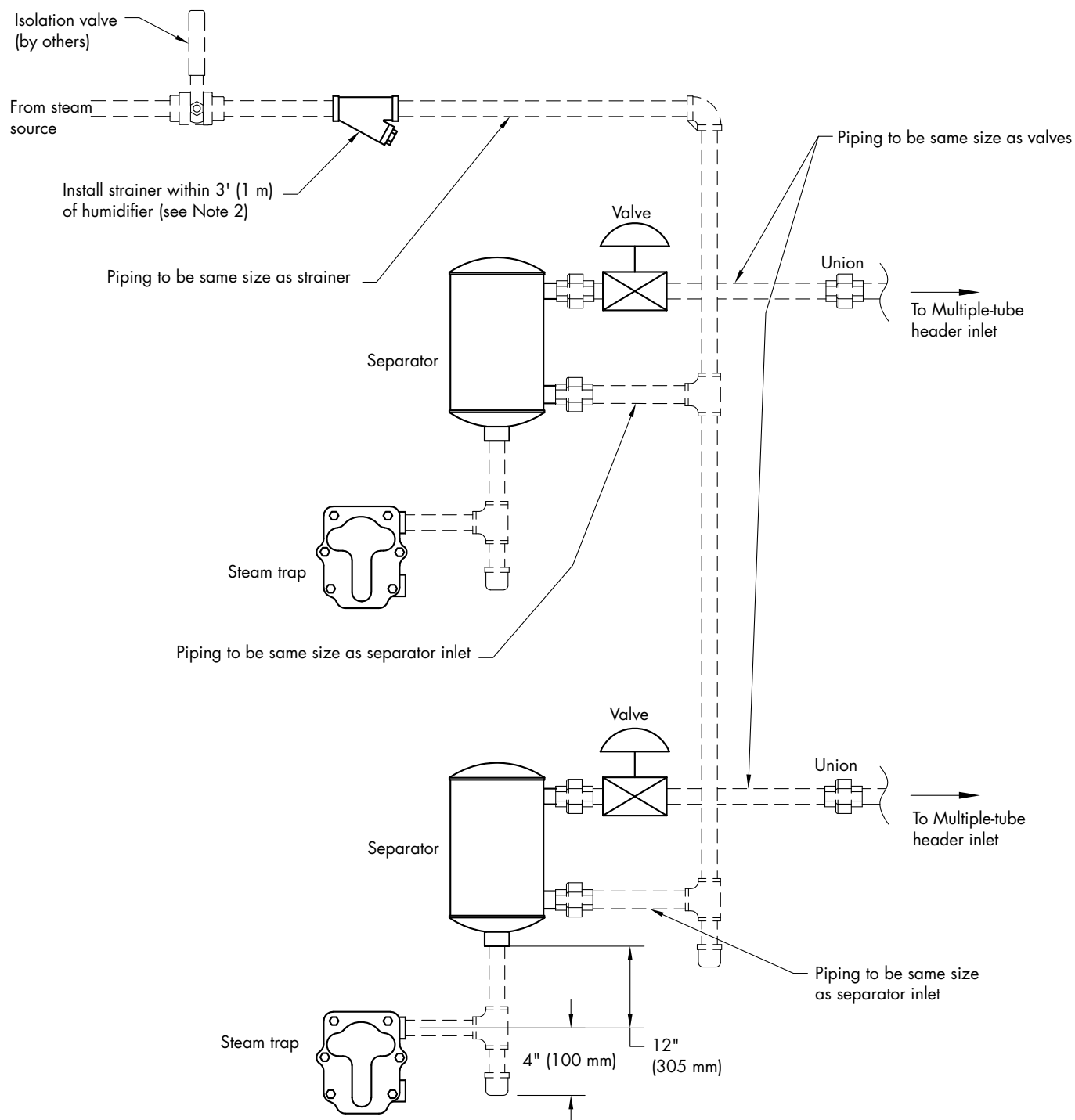
- **Steam pressure.** Theoretically, one pound (6.9 kPa) of steam pressure will lift condensate about 2' (0.6 m). But in practice, because of pipe friction, pressure drop through a steam trap, and back pressure in a return line, we recommend maximum lift of 6" per pound (0.2 m per 6.9 kPa) of steam pressure at the trap. For example, a steam pressure of 5 psi (34.5 kPa) will provide a maximum lift of 2.5' (0.76 m). Lifting condensate more than 5' (1.5 m) should not be attempted.
- **Pipe size.** The size of the vertical portion of the piping should be 1/2" pipe thread (DN15).
- **Check valve (swing type).** A low-pressure differential swing check valve should be installed adjacent to the trap. This will prevent backflow of condensate into the humidifier during periods of little or no steam pressure. Failure to do so could result in accumulated backflow discharging from the humidifier when steam pressure is resumed. Spring-type check valves are not recommended, as they can reduce pressure available for condensate lifts.

Condensate lifting recommendations:

1. Condensate can be lifted for all steam jacket piping.
2. Condensate could be lifted for connection to separator, but performance could vary based on variable pressure at the separator.
3. Condensate cannot be lifted for connection on headers for Multiple-tube humidifiers (including Maxi-bank option).

Pressurized steam piping guidelines

FIGURE 13-1: MULTIPLE VALVE PLUMBING GUIDELINES



Notes:

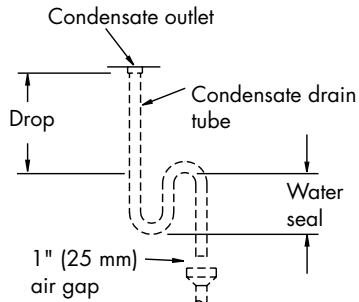
1. Dashed lines indicate provided by installer.
2. Steam valve and strainer sizes are provided by DriCalc, DriSteam's free sizing and selection software, available at www.dristeam.com.

DC-1488

Condensate drain piping and trapping

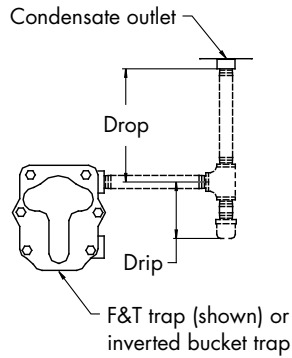
FIGURE 14-1: CONDENSATE DRAIN PIPING AND TRAPS FOR STEAM INJECTION HUMIDIFIERS

P-trap dimensions

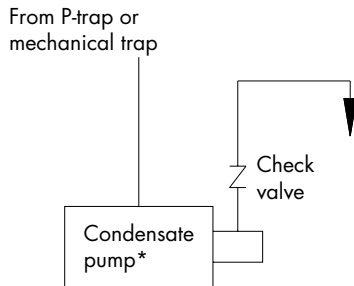


Mechanical trap dimensions

Typical model



Lifting condensate



Notes:

- * Use condensate pump rated for 212 °F (100 °C) and suitable for lifting 250 gph (16 L/m) at required head (60 kPa). Stainless steel condensate pump recommended when pumping condensate from systems using optional stainless steel components.
- If wasting condensate to drain, temper condensate to local code to prevent damage to drain plumbing.
- Dashed lines indicate provided by installer.

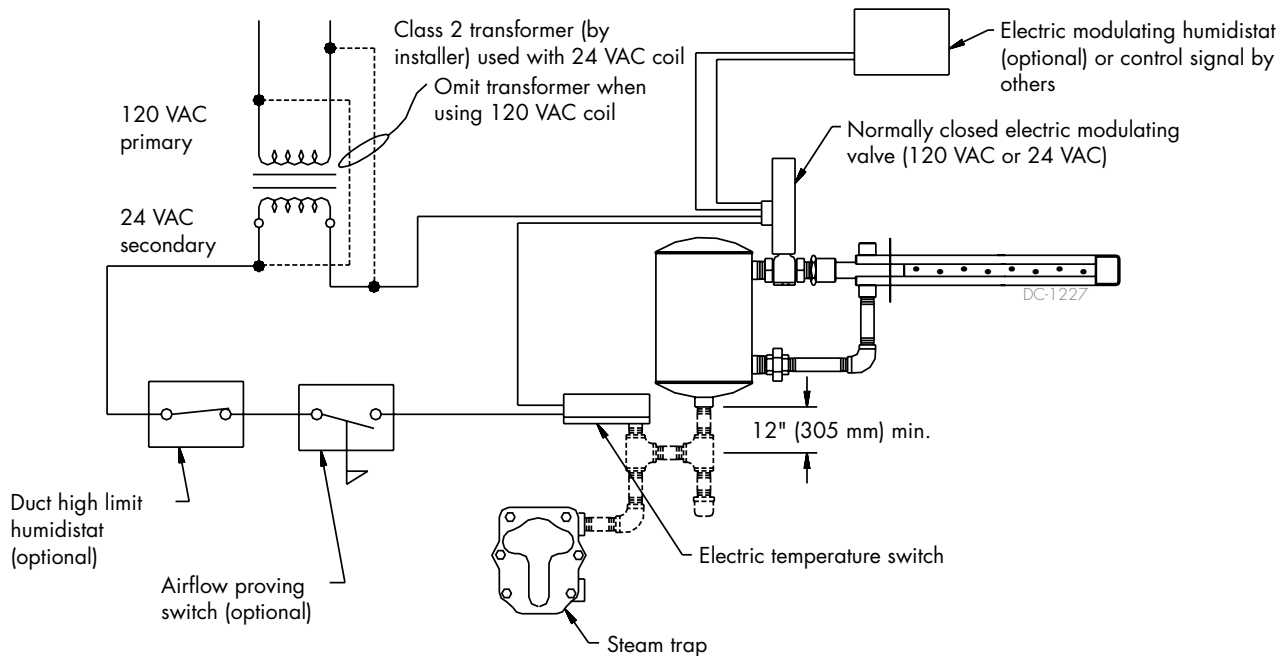
Condensate drain piping and trapping

Table 15-1:
Condensate drain piping and traps for Steam Injection humidifiers

	Single-tube, Mini-bank, and Multiple-tube humidifiers						Area-type humidifier
	Piping from separator***		Piping from steam jackets		Piping from header		Piping from separator
	Typical model	Models with optional stainless steel components	Typical model	Models with optional stainless steel components	Typical model	Models with optional stainless steel components	
P-trap water seal	Do not use	Do not use	Do not use	Do not use	Do not use	Do not use	Use with minimum: Drop: 8" (203 mm) Seal: 10" (254 mm)
F&T trap	Drop: 12" (305 mm) Drip: 4" (102 mm)	Do not use	Drop: 12" (305 mm) Drip: 4" (102 mm)	Do not use	Use with minimum: Drop: 12" (305 mm) Drip: 4" (102 mm)	Do not use	Do not use
Return condensate to boiler via nonpressurized return line?	Yes	Yes	Yes	Yes	Yes	Yes	No
Return condensate by condensate pump?	Yes	Yes**	Yes	Yes**	Yes	Yes**	Yes
Drain condensate to open drain?	Yes†	Yes†	Yes†	Yes†	Yes†	Yes†	Recommended†
Notes: ** DriSteem recommends using a stainless steel condensate pump when pumping condensate from systems using optional stainless steel components. *** During consistent load, there may not be enough steam pressure in the separator to lift condensate from the separator using steam. † If wasting condensate to drain, temper condensate to local code to prevent damage to drain plumbing.							

Temperature switches

FIGURE 16-1: ELECTRIC MODULATING TEMPERATURE SWITCH LOCATION

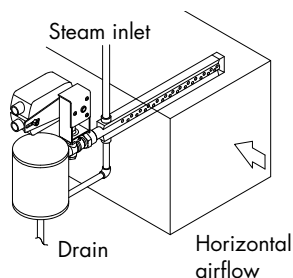


Electric temperature switches:

- The electric temperature switch prevents condensate discharge from a steam injection humidifier during a cold start or if the condensate return main becomes flooded. DriSteem's electric temperature switch is a temperature-actuated make-break switch designed for use with electric humidity control systems. The temperature at which it switches is adjustable and should be set at 210 °F (99 °C).
- This switch prevents condensate discharge from a steam injection humidifier during a cold start or if the condensate return main becomes flooded.
- Install the sensing element of the device in the condensate return piping on the inlet side of the steam trap (see drawings), including a tee with a ½" pipe thread (DN15) opening to receive the sensing element. When steam surrounds the sensing element, the switch will "make," allowing the humidifier valve to open.
- Install all wiring according to national and local electrical codes, and SIZE TRANSFORMER VA TO LOAD VA.
- When using the temperature switch with an electric modulating valve, use the special wiring instructions furnished with the valve.

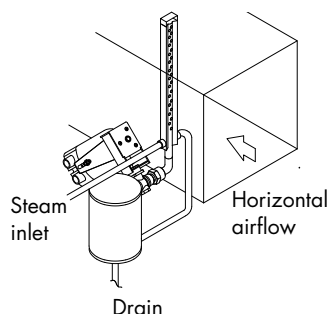
Configurations

FIGURE 17-1: SINGLE-TUBE HUMIDIFIER INSTALLATION CONFIGURATIONS



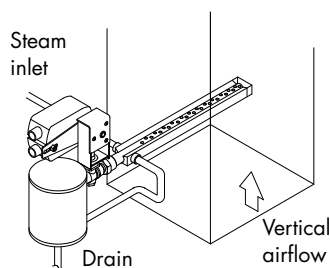
Horizontal tube/horizontal airflow

Typical configuration. Single-tube humidifiers are shipped this way unless ordered otherwise. See Page 24 for more information about this configuration. This is a right-hand configuration; to change to a left hand configuration, see Figure 17-2.



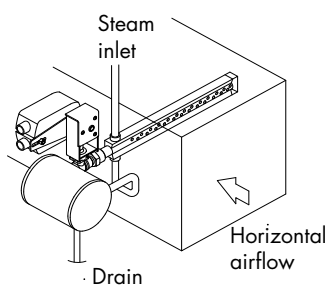
Vertical tube/horizontal airflow

Use this configuration when there is no access to side of duct or when duct is tall and narrow, to improve steam absorption. See Page 24 for more information about this configuration.



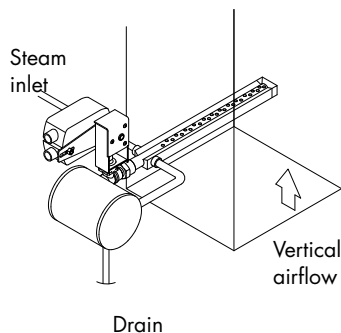
Horizontal tube/vertical airflow

Use this configuration in vertical airflow ducts. See Page 26 for more information about this configuration.



Horizontal separator/horizontal airflow

Use this configuration when space is tight, such as when installing above ceilings. This application requires a separator designed for horizontal installation. See Page 25 for more information about this configuration.

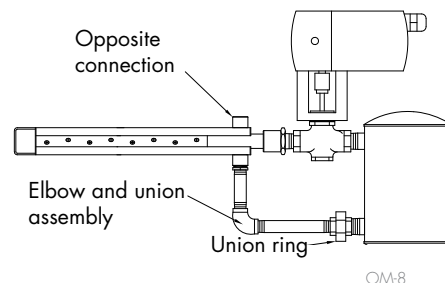


Horizontal separator/vertical airflow

Use this configuration in vertical airflow ducts and when space is tight, such as when installing above ceilings. This application requires a separator designed for horizontal installation.

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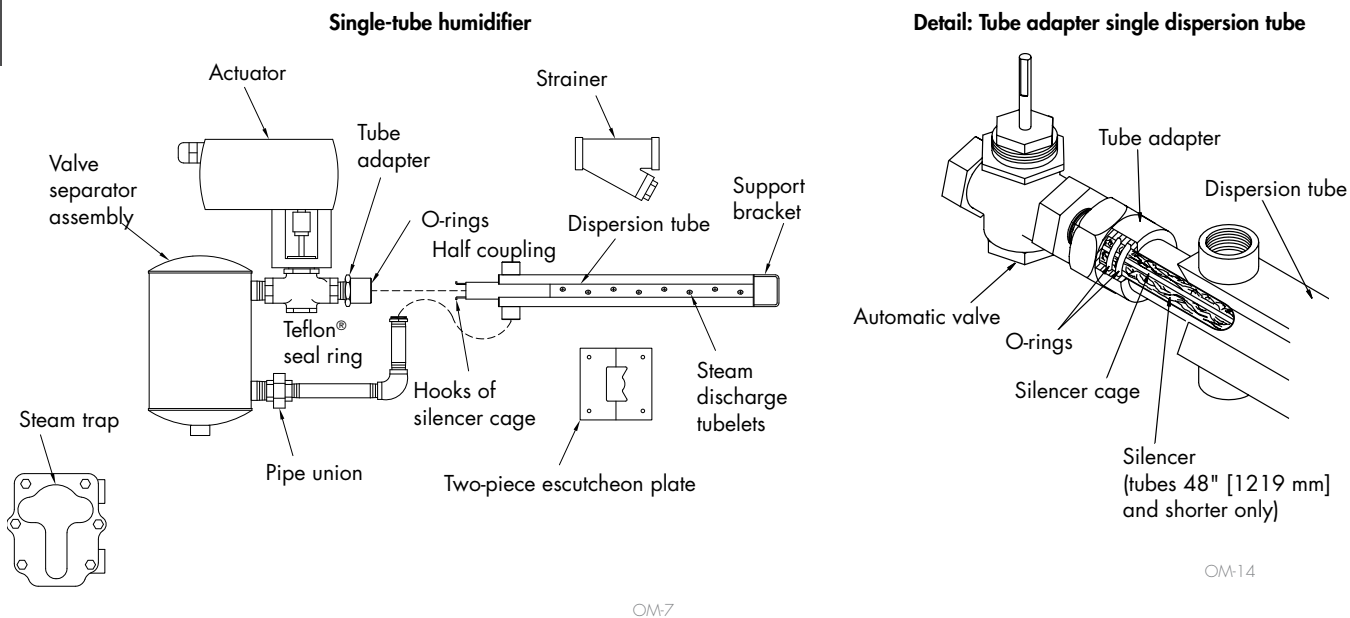
FIGURE 17-2: CHANGING FROM RIGHT-HAND TO LEFT-HAND CONFIGURATION



It may be necessary to change the steam discharge direction at the job site. To do so, follow these directions:

1. Non-threaded union ring.
2. Remove elbow and nipple assembly from dispersion tube and reinstall on opposite connection.
3. Rotate dispersion tube 180° with respect to separator.
4. Reconnect union halves and tighten union ring.
5. Humidifier now will discharge to opposite side.

Assembly

FIGURE 18-1: SINGLE-TUBE HUMIDIFIER FIELD ASSEMBLY

SINGLE-TUBE HUMIDIFIER FIELD ASSEMBLY

Small units are shipped assembled; the following applies to larger units that are disassembled for shipment.

1. Unpack shipment and verify receipt of all components with packing list. Report any shortages at once.
2. Match up dispersion tube with its proper valve-separator assembly (tubes and separators are match-tagged).
Tubelets should point against the airflow for better steam-air mixing, except if tubes have fiberglass insulated-jacket option, then tubelets should discharge steam with the airflow to prevent condensation from forming on cool jackets. See the installation examples on the following pages before beginning assembly.
Note: Before completing Step 3, determine which way (right or left) tubelets should point, and install in appropriate half coupling (see Figure 4-1).
3. Unscrew pipe union, remove elbow and nipple portion, and install in half coupling of tube.
4. Install tube adapter in valve (use pipe dope) and tighten.
5. Lubricate O-rings and install inside tube adapter.
6. Insert tube adapter into dispersion tube. As this is being done, if unit has a silencer, squeeze hooks of silencer cage together and slide them into the tube adapter, allowing them to snap over rear edge of adapter. Complete inserting adapter into tube, being careful not to damage O-rings.
Note: Unless special-ordered, silencers are furnished only with Model 60 and Model 70 tubes equal to or shorter than 48" (1219 mm), and only with black iron piping.
7. Tighten pipe union.
8. Thread Teflon seal ring into half coupling.
9. Torque Teflon seal ring to 15 ft-lbs (20.3 N-m).
Note: Once tightened, do not attempt to re-tighten the Teflon seal, or the seal could be damaged.
10. Install the assembly in the duct. See "Installation" on the next page.

Installation

1. Insert a support bolt in one of the support bracket's three holes (upper, lower or end); cut holes in duct for inserting dispersion tube and support bolt.
2. Secure unit in duct with nut and support bolt. Mount two-piece escutcheon plate around tube and secure into duct with sheet metal screws. Where an airtight seal is required, use a suitable caulk around duct wall penetrations.
3. Install steam strainer and steam trap. Connect to steam and condensate return mains. See the drawings on the following pages and text below for detailed piping instructions.
4. Wire control to valve actuator.
5. Install an airflow proving switch to prevent the valve from opening unless air is moving in duct. See "Humidifier placement" on Pages 6–8 for location recommendations.
6. Install a duct-mounted high-limit humidistat downstream from the humidifier. Set humidistat at 80-90% RH to prevent condensation forming in duct. Mount this humidistat far enough downstream to ensure that injected steam has been completely absorbed before the humidistat. See "Humidifier placement" on Pages 6–8 for location recommendations.
7. Install a temperature switch to prevent possible cold-start dripping when steam pressure to the humidifier is cycled. See "Temperature switches" on Page 16 for more information.
8. Install the humidistat and/or sensors according to the recommendations on Page 9.

For more installation information

- See "Humidifier placement" on Pages 6–8 for information about choosing an installation location.
- See "Sensor placement" on Page 9.
- See "Pressurized steam piping guidelines" on Pages 10–13.
- See "Temperature switches" on Page 16.

WARNING

Improper mounting hazard

Mount humidifier per the instructions in this manual and to a structurally stable surface. Improper humidifier mounting can cause the humidifier to fall resulting in severe personal injury or death.

WARNING

Excessive moisture hazard

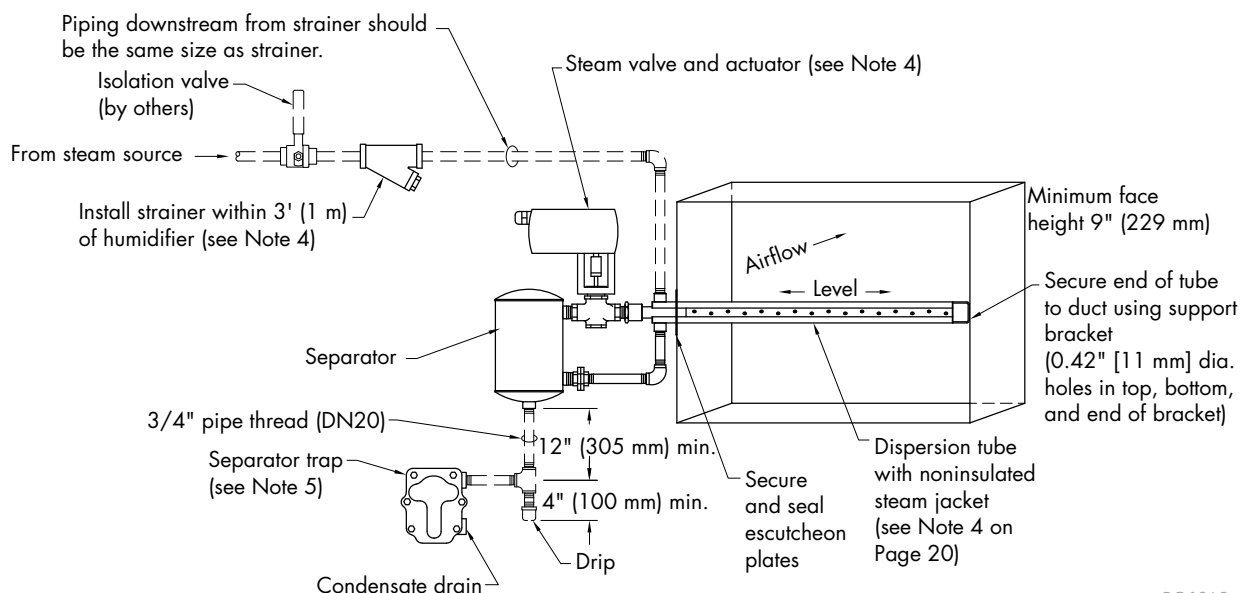
DriSteem strongly recommends installing a duct airflow proving switch and a duct high limit humidistat. These devices prevent a humidifier from making steam when there is low airflow in the duct or when the RH level in the duct is too high. Failure to install these devices can result in excessive moisture in the duct, which can cause bacteria and mold growth or dripping through the duct.

Piping notes

1. Refer to field piping drawings on Pages 21–24.
2. To avoid metal fatigue, allow for thermal expansion of dispersion tube.
3. Dashed lines in drawings indicate provided by installer.
4. Horizontal airflow:
Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. Therefore, when using noninsulated steam jackets in a horizontal airflow (as shown in the piping drawings on Pages 21–24), position tubelets (steam orifices) so they face into the airflow.
However, if the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. When using insulated steam jackets in a horizontal airflow, position tubelets so they discharge steam with the airflow, and add 24" (610 mm) to the non-wetting distance.
5. Vertical airflow:
Always position tubelets (steam orifices) pointing up when installing in a vertical airflow.
Important: If installing insulated steam jackets in a vertical airflow, install only in an upflow application and add 24" (610 mm) to the non-wetting absorption distance. **Do not install insulated steam jackets in a vertical downflow application.**
6. For horizontal tube installations, center tube within duct height.
For vertical tube installations, center tube within duct width.
7. Use a float and thermostatic (F&T) trap for the humidifier. If lifting condensate, use a check valve regardless of steam pressure (see Figure 12-1).
8. See also the "Pressurized steam piping guidelines" on Pages 10–13.

Field piping

FIGURE 21-1: SINGLE-TUBE HUMIDIFIER WITH HORIZONTAL DISPERSION TUBE AND VERTICAL SEPARATOR INSTALLED IN A HORIZONTAL AIRFLOW



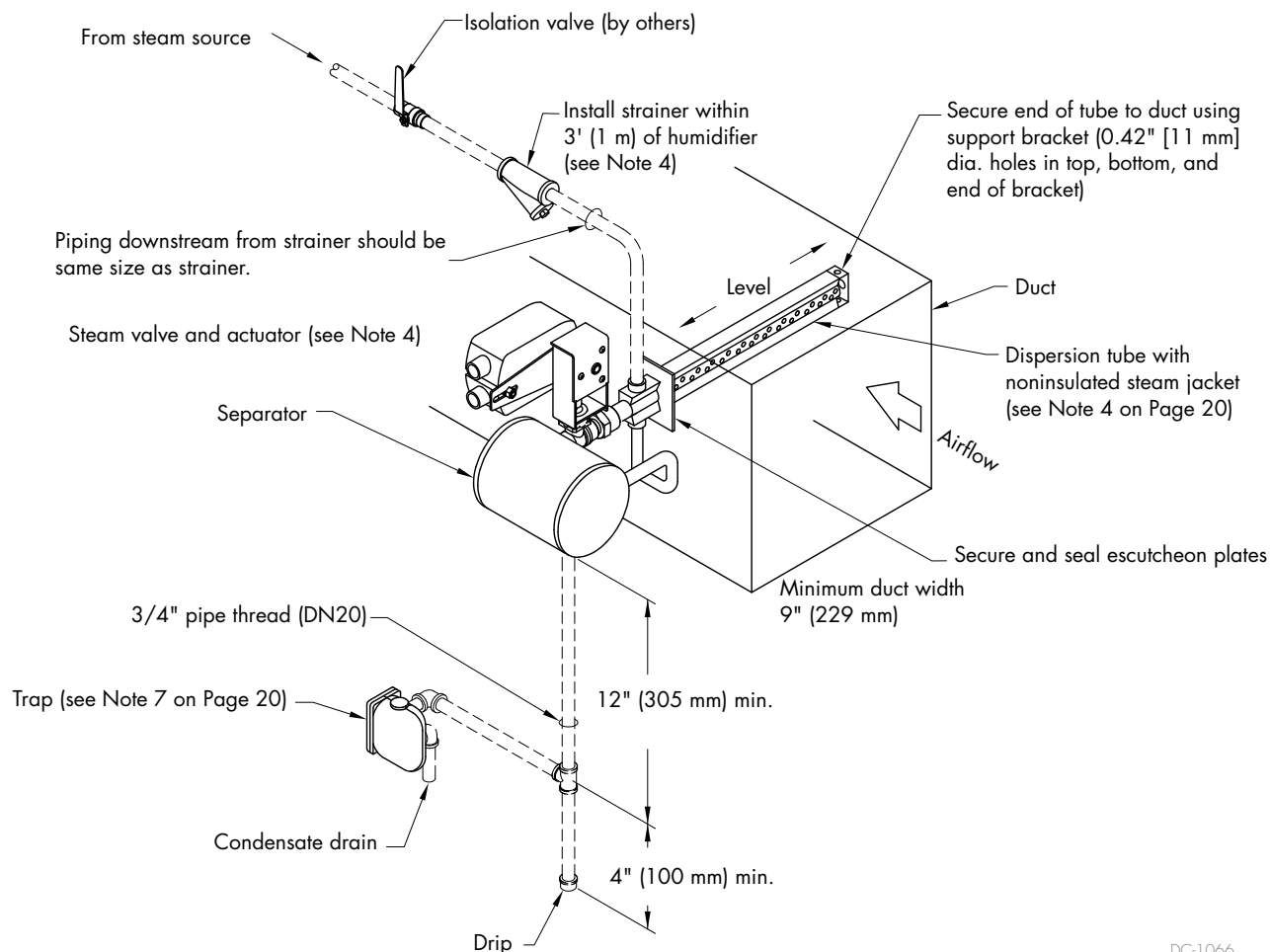
DC-1065

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 20, and see Pages 14 and 15 for more information about trap types and trap piping.

Field piping

FIGURE 22-1: SINGLE-TUBE HUMIDIFIER WITH HORIZONTAL DISPERSION TUBE AND HORIZONTAL SEPARATOR INSTALLED IN A HORIZONTAL AIRFLOW



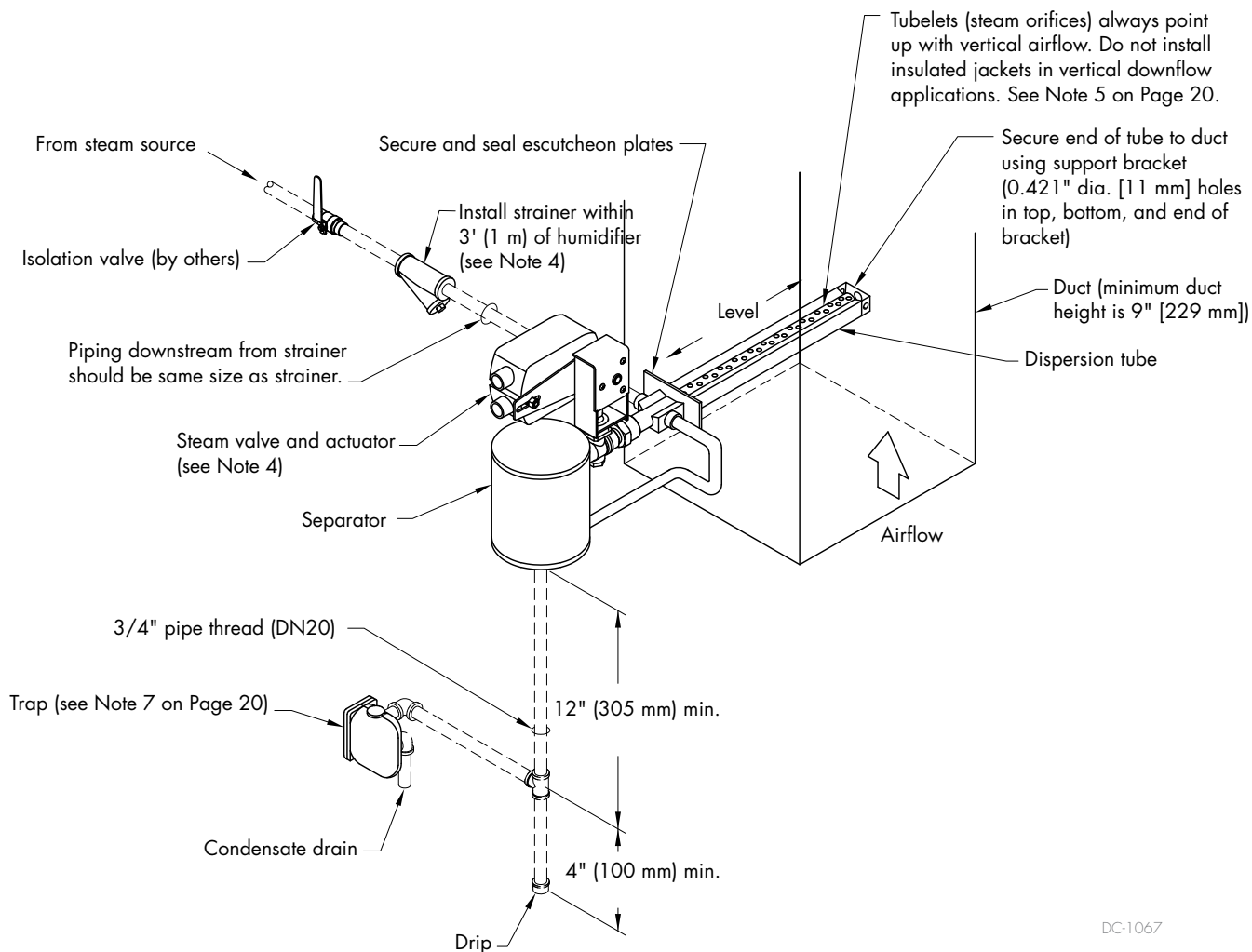
DC-1066

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 20, and see Pages 14 and 15 for more information about trap types and trap piping.

Field piping

FIGURE 23-1: HORIZONTAL DISPERSION TUBE INSTALLED IN A VERTICAL AIRFLOW



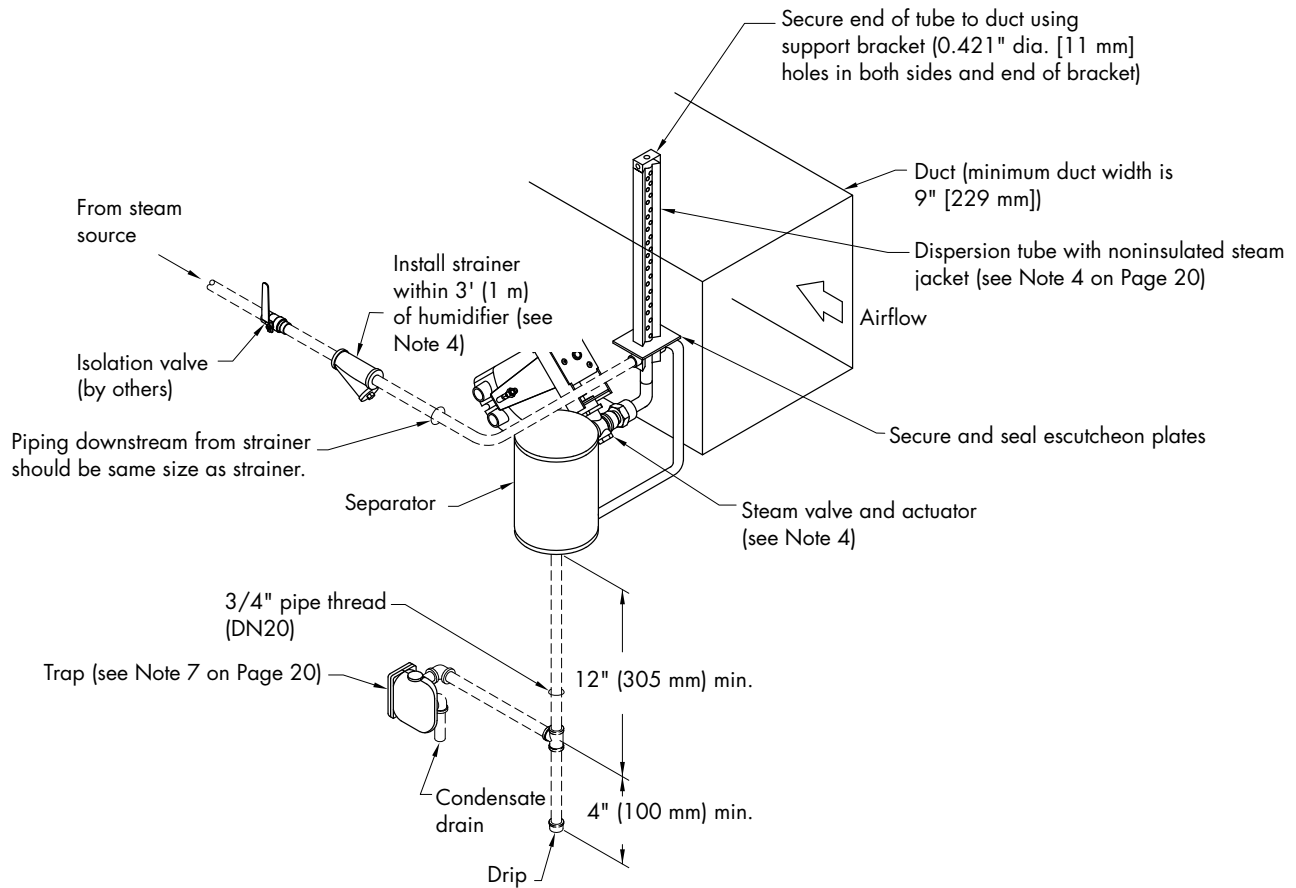
DC-1067

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 20, and see Pages 14 and 15 for more information about trap types and trap piping.

Field piping

FIGURE 24-1: VERTICAL DISPERSION TUBE INSTALLED IN A HORIZONTAL AIRFLOW



DC-1068

NOTES:

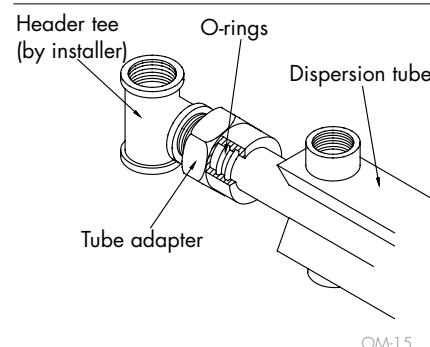
1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 20, and see Pages 14 and 15 for more information about trap types and trap piping.

Field assembly

Note: For Maxi-bank option, follow the “Maxi-bank option field assembly and installation” instructions on Page 33.

1. Unpack shipment and verify receipt of all components with packing list. Report any shortages at once.
2. Plan the tube bank. You need to know the required spacing distance between tubes. See Table 26-1. Arrange tubes so steam will discharge against the airflow, unless tubes are insulated (optional), in which case they should blow with the air to prevent condensation on metal jacket covering insulation.
3. Assemble header based on spacings determined in Step 2 above. If header pipe size has not been specified, see Table 25-1. This table is based on a maximum steam velocity of 7,000 to 10,000 fpm (36 to 51 m/s), which will result in lower noise levels and produce uniform steam flow from all tubes. If noise level is not important or a uniform flow is not critical, a smaller header size may be used.
4. Install tube adapter fittings in header tees. (See Figure 25-1.) It usually works best to lay the header on the floor along with the tubes for Steps 5–7.
5. Install male pipe thread end of tube adapter into pipe fitting. Dope threads and tighten leak tight sealer.
6. O-rings are installed inside of tube adapter.
NOTE: Use synthetic oil to lubricate O-rings before installing.
7. Insert tube adapter into dispersion tube. As this is being done, if unit has a silencer, squeeze hooks of silencer cage together and slide them into tube adapter, allowing them to snap over rear edge of adapter. Complete inserting adapter into tube, being careful not to damage O-rings.
NOTE: Unless special-ordered, silencers are furnished only with Model 60 and Model 70 tubes equal to or shorter than 48" (1219 mm), and only with black iron piping.
8. Slide tube into adapter being careful not to damage O-rings.
9. Install tubes in adapter fittings, making sure tubelets are pointing in proper direction.
10. Cut to length, thread, and install steam jacket piping.
NOTE: When the total tube length of dispersion tubes exceeds 45' (13.7 m), we recommend installing an additional steam inlet to the dispersion tubes and an additional steam jacket trap. One for each additional 45' of total tube length. Divide the tubes into equal groups. See Figures 29-1 and 32-1.
11. Make tube support strut using angle or channel iron, and bolt each tube end in place.

FIGURE 25-1: TUBE ADAPTER FOR MULTIPLE-TUBE HUMIDIFIERS



Use the tube adapter to connect a non-threaded tube to a threaded pipe fitting.

Table 25-1:
Multiple-tube humidifier header sizes

Total capacity		Header size	
lbs/hr	kg/h	inches	DN
up to 280	up to 127	1.5*	38*
up to 490	up to 222	2.0	50
491 to 980	223 to 444	3.0	80
981 to 1743	445 to 790	4.0	100
1744 to 2752	791 to 1248	5.0	125
2753 to 3989	1249 to 1809	6.0	150

* Non Maxi-bank only

Installation

NOTE: For Maxi-bank option, follow the “Maxi-bank option field assembly and installation” instructions on Page 33.

1. Insert a support bolt in one of the three holes (upper, lower or end) of the support brackets; cut holes in duct for inserting dispersion tube and support bolt.
2. Secure unit in duct with nuts and support bolts. Mount two-piece escutcheon plate around each tube and secure into duct with sheet metal screws. Where an airtight seal is required, use a suitable caulk around duct wall penetrations.
3. Install steam strainer and steam trap. Connect to steam and condensate return mains. See the drawings on the following pages and text on the next for detailed piping instructions.
4. Wire control to valve actuator.
5. Install an airflow proving switch to prevent the valve from opening unless air is moving in duct. See “Humidifier placement” on Pages 6–8 for location recommendations.
6. Install a duct-mounted high-limit humidistat downstream from the humidifier. Set humidistat at 80-90% RH to prevent condensation forming in duct. Mount this humidistat far enough downstream to ensure that injected steam has been completely absorbed before the humidistat. See “Humidifier placement” on Pages 6–8 for location recommendations.
7. Install a temperature switch to prevent possible cold-start dripping when steam pressure to the humidifier is cycled. See “Temperature switches” on Page 16 for more information.
8. Install the humidistat and/or sensors according to the recommendations on Page 9.

For more installation information

- See “Humidifier placement” on Pages 6–8 for information about choosing an installation location.
- See “Sensor placement” on Page 9.
- See “Pressurized steam piping guidelines” on Pages 10–13.
- See “Temperature switches” on Page 16.
- See the Maxi-bank option beginning on Page 33.



WARNING

Improper mounting hazard

Mount humidifier per the instructions in this manual and to a structurally stable surface. Improper humidifier mounting can cause the humidifier to fall resulting in severe personal injury or death.



WARNING

Excessive moisture hazard

DriSteem strongly recommends installing a duct airflow proving switch and a duct high limit humidistat. These devices prevent a humidifier from making steam when there is low airflow in the duct or when the RH level in the duct is too high. Failure to install these devices can result in excessive moisture in the duct, which can cause bacteria and mold growth or dripping through the duct.

Table 26-1:
Multiple-tube humidifier minimum tube spacing

Tube model	Minimum tube spacing (X*) Multiple-tube humidifier		Minimum tube spacing (X*) Multiple-tube humidifier with optional stainless steel piping	
	inches	mm	inches	mm
60	6	152	9	229
70	9	229	9	229
80	9	229	12	305

* See Multiple-tube humidifier drawings on the following pages for center-to-center distance X.

Piping notes

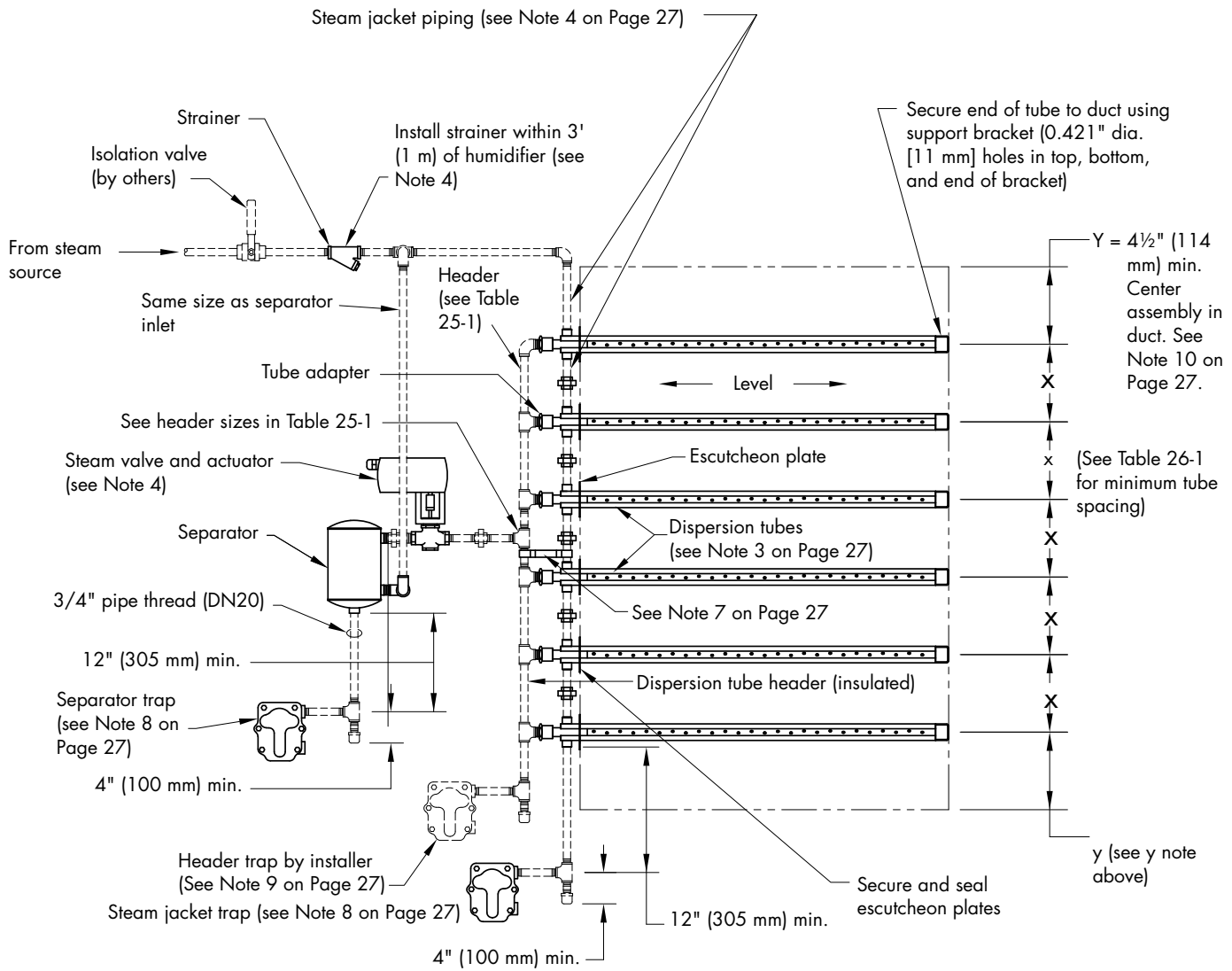
NOTE: For Maxi-bank option, see the "Maxi-bank option piping notes" on Page 33.

For total dispersion tube lengths of more than 45' (13.7 m), see Step 10 note on Page 25.

1. Refer to piping drawings on Pages 28 through 32.
2. See also the "Pressurized steam piping guidelines" on Pages 10 through 13.
3. Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. Therefore, **when using noninsulated steam jackets in a horizontal airflow** (as shown in the drawings), position dispersion tubelets (steam orifices) so that they face into the airflow. If the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. Therefore, **when using insulated steam jackets in a horizontal airflow**, position dispersion tubelets so that they discharge steam with the airflow, and also add 24" (610 mm) to the non-wetting absorption distance.
4. Jacket piping size:
 - 1/2" pipe thread (DN15) for Model 60 tubes
 - 3/4" pipe thread (DN20) for Model 70 tubes
 - 1 1/2" pipe thread (DN40) for Model 80 tubes
5. To ensure uniform output from each tube, connect steam supply as close to the middle of the header as possible, but not in direct alignment with a dispersion tube.
6. See header sizing in Table 25-1.
7. After the unit is installed, secure steam jacket piping to the tube header.
8. Use float and thermostatic (F&T) traps for the humidifier. If lifting condensate, use a check valve regardless of steam pressure (Figure 12-1).
9. Due to the pressure drop across the valve, the steam pressure at the header trap is minimal; therefore, you cannot lift condensate or return condensate to a pressurized return by steam pressure from this trap. However, with condensate free steam, no trap is required if load is less than 500 pph, and between 500 and 1000 pph a trap is optional. Above 1000 pph, a trap is recommended.
10. X = distance between tubes, center to center
 Y = clearance at top and bottom = at least 1/2 of X or 4 1/2" (114 mm), whichever is greater, but not greater than X
 See the minimum tube spacing in Table 26-1.
11. When installing in a vertical airflow:
 Always point tubelets (steam orifices) up when installing in a vertical airflow.
Important: If installing insulated steam jackets in a vertical airflow, install only in an upflow application and add 24" (610 mm) to the non-wetting absorption distance. **Do not install insulated steam jackets in a vertical downflow application.**

Field piping

FIGURE 28-1: MULTIPLE-TUBE HUMIDIFIER, TOTAL TUBE LENGTH LESS THAN OR EQUAL TO 45' (13.7 M)



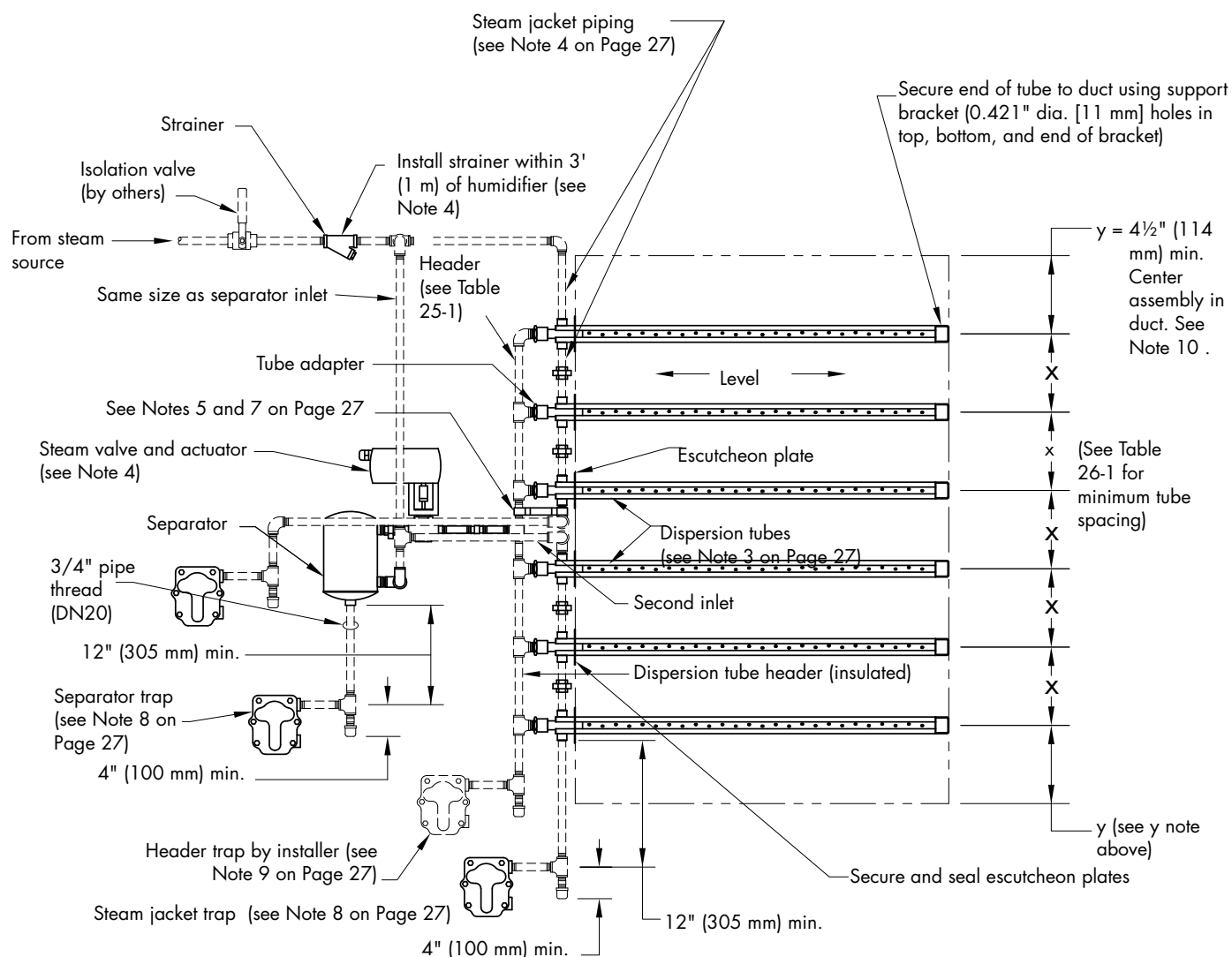
DC-1070

Notes:

1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer (see Maxi-bank option beginning on Page 33). Right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc DriCalc sizing and selection software (Note 3).

Field piping

FIGURE 29-1: MULTIPLE-TUBE HUMIDIFIER, TOTAL TUBE GREATER THAN 45' (13.7 M)



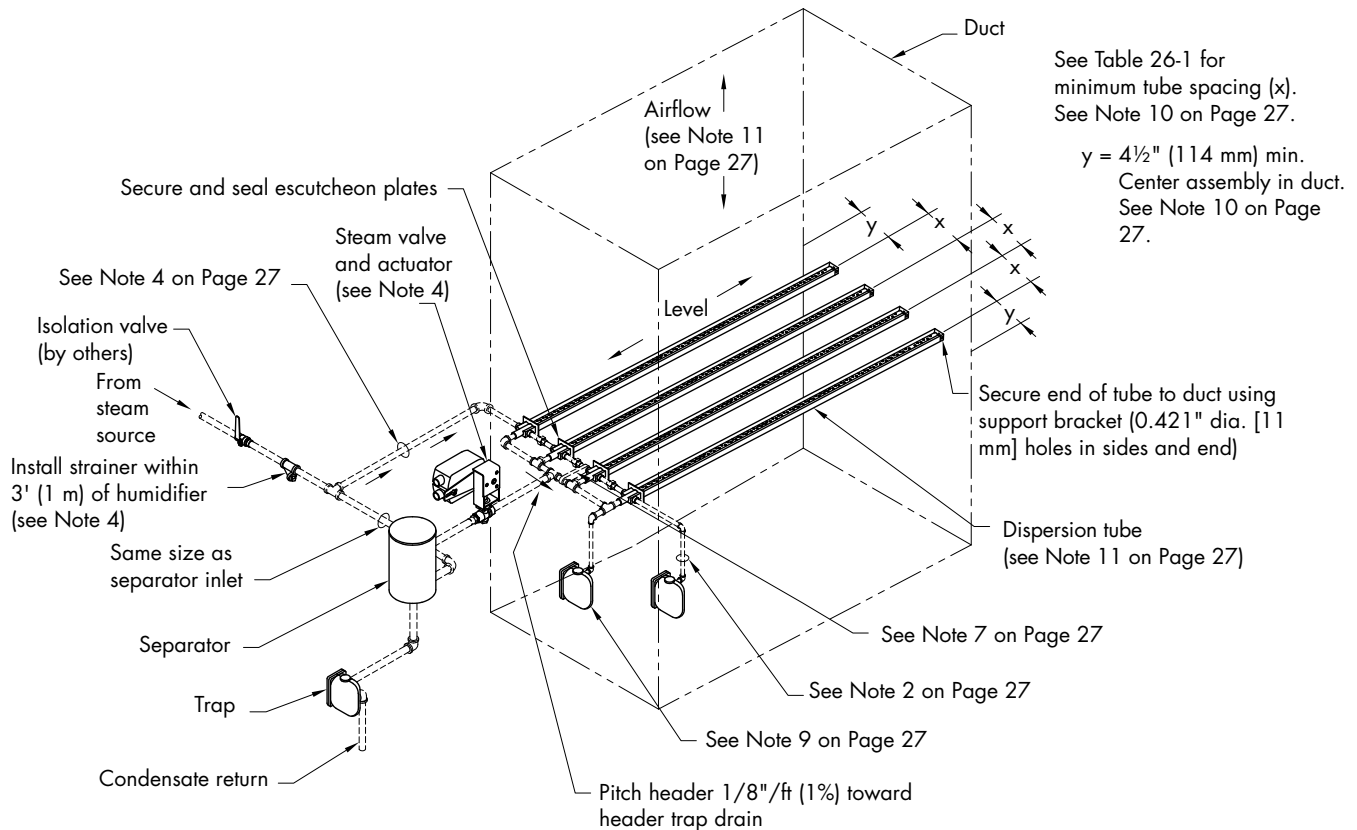
DC-1071

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer (see Maxi-bank option beginning on Page 33). Right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 27, and see Pages 14 and 15 for more information about trap types and trap piping.

Field piping

FIGURE 30-1: MULTIPLE-TUBE HUMIDIFIER INSTALLED IN A VERTICAL AIRFLOW



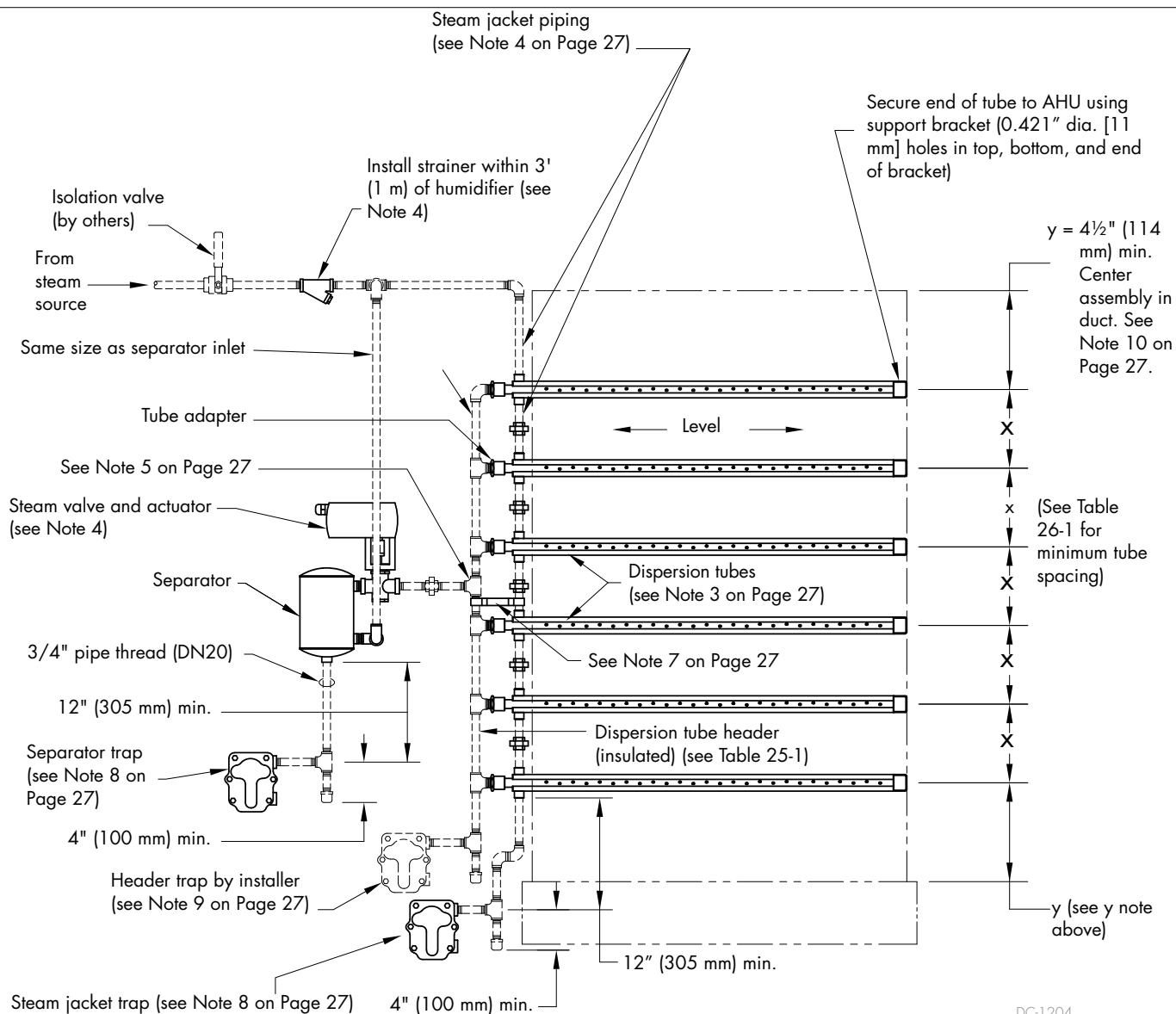
DC-1074

Notes:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer (see Maxi-bank option beginning on Page 33). Right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Piping notes" on Page 27, and see Pages 14 and 15 for more information about trap types and trap piping.

Field piping

FIGURE 31-1: MULTIPLE-TUBE HUMIDIFIER WITH TOTAL TUBE LENGTH LESS THAN OR EQUAL TO 45' (13.7 M) IN A AHU

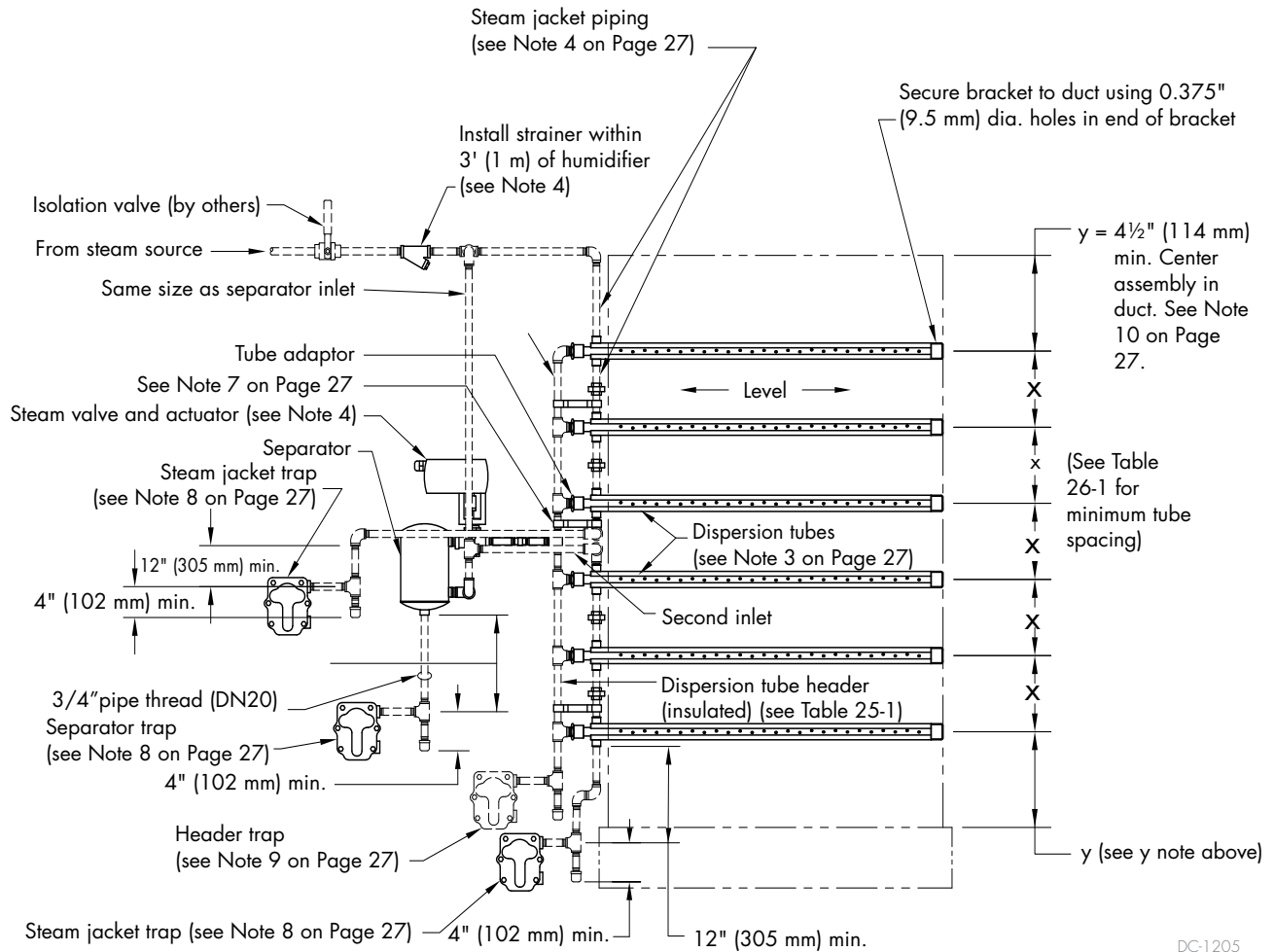


NOTES:

1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer (see Maxi-bank option beginning on Page 33). Right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See Pages 14 and 15 for more information about trap types and piping.

Field piping

FIGURE 32-1: MULTIPLE-TUBE HUMIDIFIER WITH TOTAL TUBE LENGTH GREATER THAN 45' (13.7 M) IN A AHU



DC-1205

NOTES:

1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer (see Maxi-bank option beginning on Page 33). Right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See Pages 14 and 15 for more information about trap types and piping.

Maxi-bank option field assembly and installation

The Maxi-bank humidifier's header piping and steam-jacket piping are provided by DriSteem. The Maxi-bank is factory assembled and shipped intact, except for larger units that are broken down for shipment. If the unit you are installing is already assembled, skip installation steps that do not apply.

1. Unpack shipment and verify receipt of all Maxi-bank components with packing list. Report any shortages at once.
2. To simplify installation, we recommend that dispersion tubes be attached to the Maxi-bank header before dispersion tubes and header are installed in a duct or air handler.
3. Follow the pre-tagged component lettering and match up dispersion tubes (or tube sections) to their proper location on the Maxi-bank header.
4. Install each dispersion tube into its appropriate tube adapter on the header, being sure to lubricate O-rings in the tube adapters.
5. Proceed with the additional tubes. Bring the jacketed union halves together and secure unions by hand.
NOTE: When the total tube length of dispersion tubes exceeds 45' (13.7 m), we recommend installing an additional steam inlet to the dispersion tubes and an additional steam jacket trap. One for each additional 45' of total tube length. Divide the tubes into equal groups. See Figures 37-1 and 39-1.
6. When all the dispersion tubes are assembled, place the tube assembly into the duct or air handler, securing the assembly and tube ends to the duct or a fabricated structure. Install tubes level.
7. Position and secure header, then tighten interconnecting tube jacket unions. When installing into a duct, use the two-piece escutcheon plates around each tube and secure to duct with sheet metal screws. In duct applications where air tightness is required, seal around tube and bolts with suitable caulk.

For more installation information

- See "Humidifier placement" on Pages 6–8 for information about choosing an installation location.
- See "Sensor placement" on Page 9.
- See "Pressurized steam piping guidelines" on Pages 10–13.
- See "Temperature switches" on Page 16.

WARNING

Improper mounting hazard

Mount humidifier per the instructions in this manual and to a structurally stable surface. Improper humidifier mounting can cause the humidifier to fall resulting in severe personal injury or death.

WARNING

Excessive moisture hazard

DriSteem strongly recommends installing a duct airflow proving switch and a duct high limit humidistat. These devices prevent a humidifier from making steam when there is low airflow in the duct or when the RH level in the duct is too high. Failure to install these devices can result in excessive moisture in the duct, which can cause bacteria and mold growth or dripping through the duct.

Maxi-bank option field assembly and installation

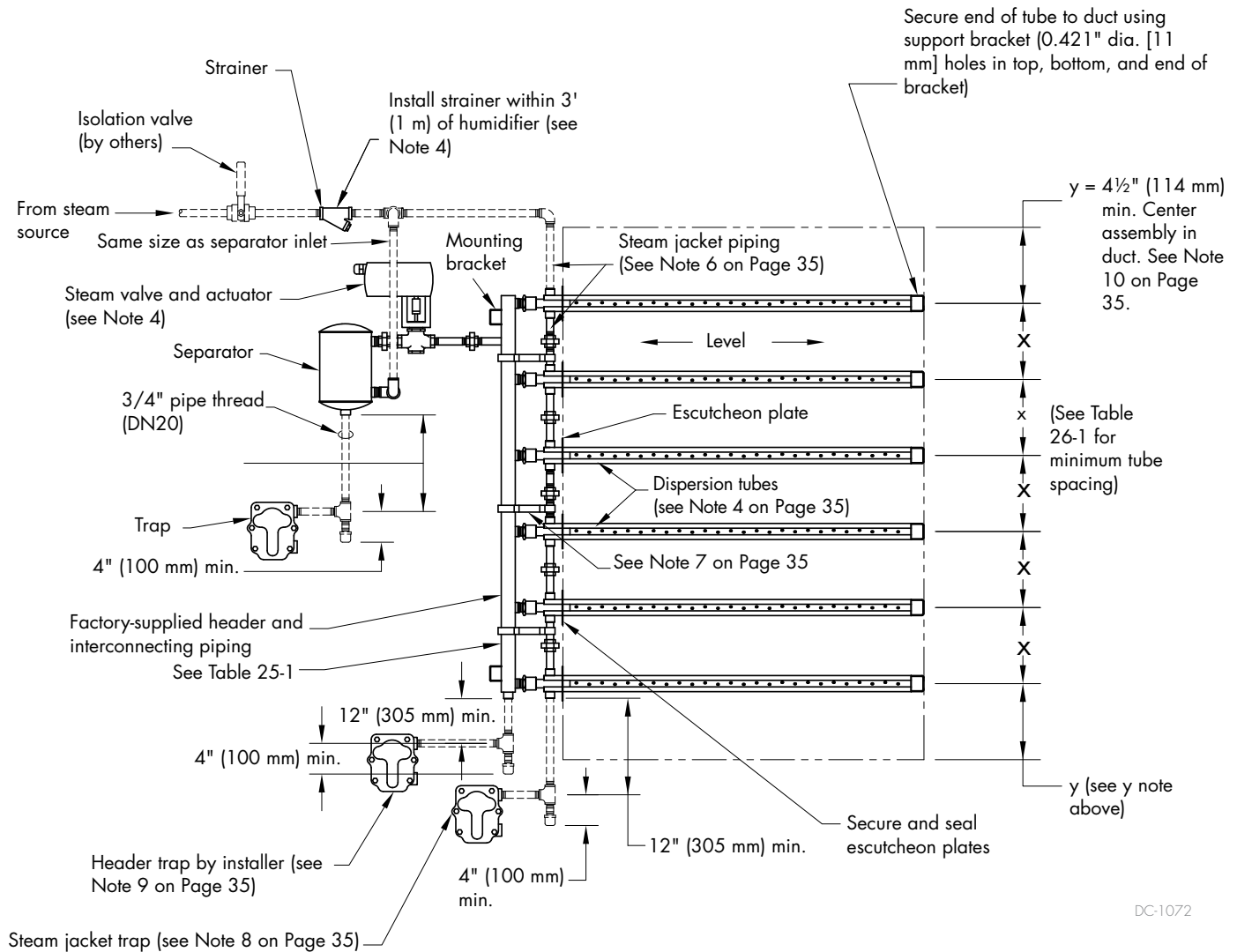
8. Locate and install separator/valve assembly to Maxi-bank mating union on header and tighten union.
9. Install strainer and necessary steam traps. Connect assembly to steam and condensate mains.
10. Wire control to valve actuator.
11. Install an airflow proving switch to prevent the valve from opening unless air is moving in duct. See "Humidifier placement" on Pages 6–8 for location recommendations.
12. Install a duct-mounted high-limit humidistat downstream from the humidifier. Set humidistat at 80-90% RH to prevent condensation forming in the duct. Mount this humidistat far enough downstream to ensure that injected steam has been completely absorbed before the humidistat. See "Humidifier placement" on Pages 6–8 for location recommendations.
13. Install a temperature switch to prevent possible cold-start dripping when steam pressure to the humidifier is cycled. See "Temperature switches" on Page 16 for more information.
14. Install the humidistat and/or sensors according to the recommendations on Page 9.
15. Pressure test system, and secure fittings as necessary.

Maxi-bank option piping notes

1. Refer to piping drawings on Pages 36–40.
2. Dashed lines in drawings indicate provided by installer.
3. For total dispersion tube lengths of more than 45' (13.7 m), see Step 5 note Page 33.
4. When installing in a horizontal airflow:
Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. Therefore, **when using noninsulated steam jackets in a horizontal airflow** (as shown in the drawings on Pages 36–39), position dispersion tubelets (steam orifices) so that they face into the airflow. If the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. Therefore, **when using insulated steam jackets in a horizontal airflow**, position dispersion tubelets so that they discharge steam with the airflow, and also add 24" (610 mm) to the non-wetting absorption distance.
5. When installing in a vertical airflow:
Always point tubelets (steam orifices) up with vertical airflow.
Important: If installing insulated steam jackets in a vertical airflow, install only in an upflow application and add 24" (610 mm) to the non-wetting absorption distance. Do not install insulated steam jackets in a vertical downflow application.
6. Jacket piping size:
 - 1/2" pipe thread (DN15) for Model 60 tube(s)
 - 3/4" pipe thread (DN20) for Model 70 tube(s)
 - 1 1/2" pipe thread (DN40) for Model 80 tube(s)
7. After the unit is installed, secure steam jacket piping to the tube header.
8. Use float and thermostatic (F&T) traps.
If lifting condensate, use a check valve regardless of steam pressure (see Figure 12-1).
9. The header trap is required to collect condensate from the header assembly. Due to the pressure drop across the valve, the steam pressure at the header trap is minimal; therefore, you cannot lift condensate by steam pressure, or return condensate to a pressurized return, from this trap. On small headers (2" or less in diameter), this trap may be omitted.
10. X = distance between tubes, center to center
 Y = clearance at top and bottom = at least $\frac{1}{2} X$ or 4 1/2" (114.3 mm), whichever is greater, but not greater than X
 See the "Minimum tube spacing distance" table on Page 38.
11. See "Pressurized steam piping guidelines" on Pages 10–13.
12. Drawings represent right-hand discharge.
13. See Table 25-1 for header sizing.

Maxi-bank option field piping

FIGURE 36-1: MAXI-BANK OPTION, TOTAL TUBE LENGTH LESS THAN OR EQUAL TO 45' (13.7 M)



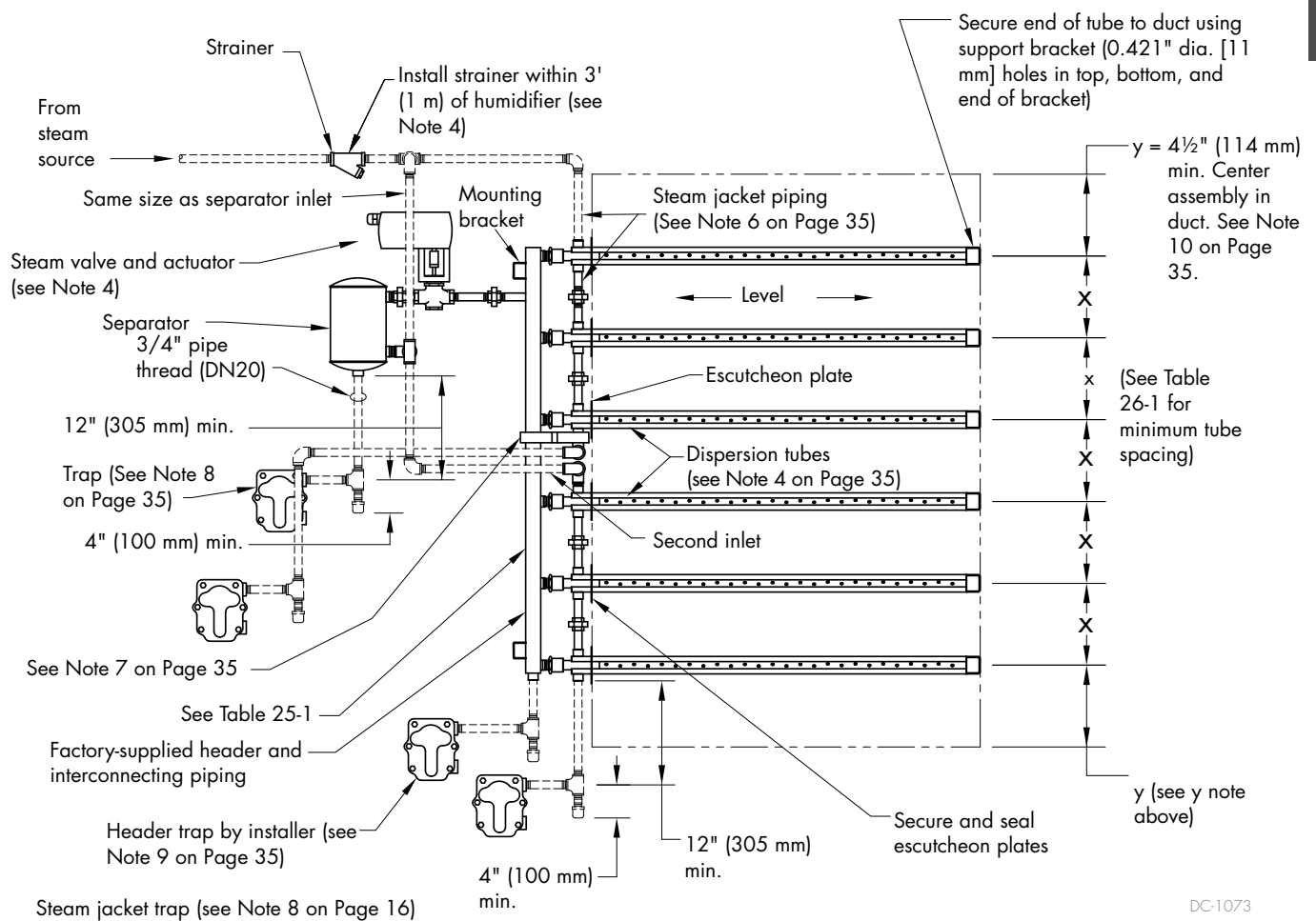
DC-1072

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Maxi-bank option piping notes" on Page 35, and see Pages 14 and 15 for more information about trap types and trap piping.

Maxi-bank option field piping

FIGURE 37-1: MAXI-BANK OPTION, TOTAL TUBE LENGTH GREATER THAN 45' (13.7 M)



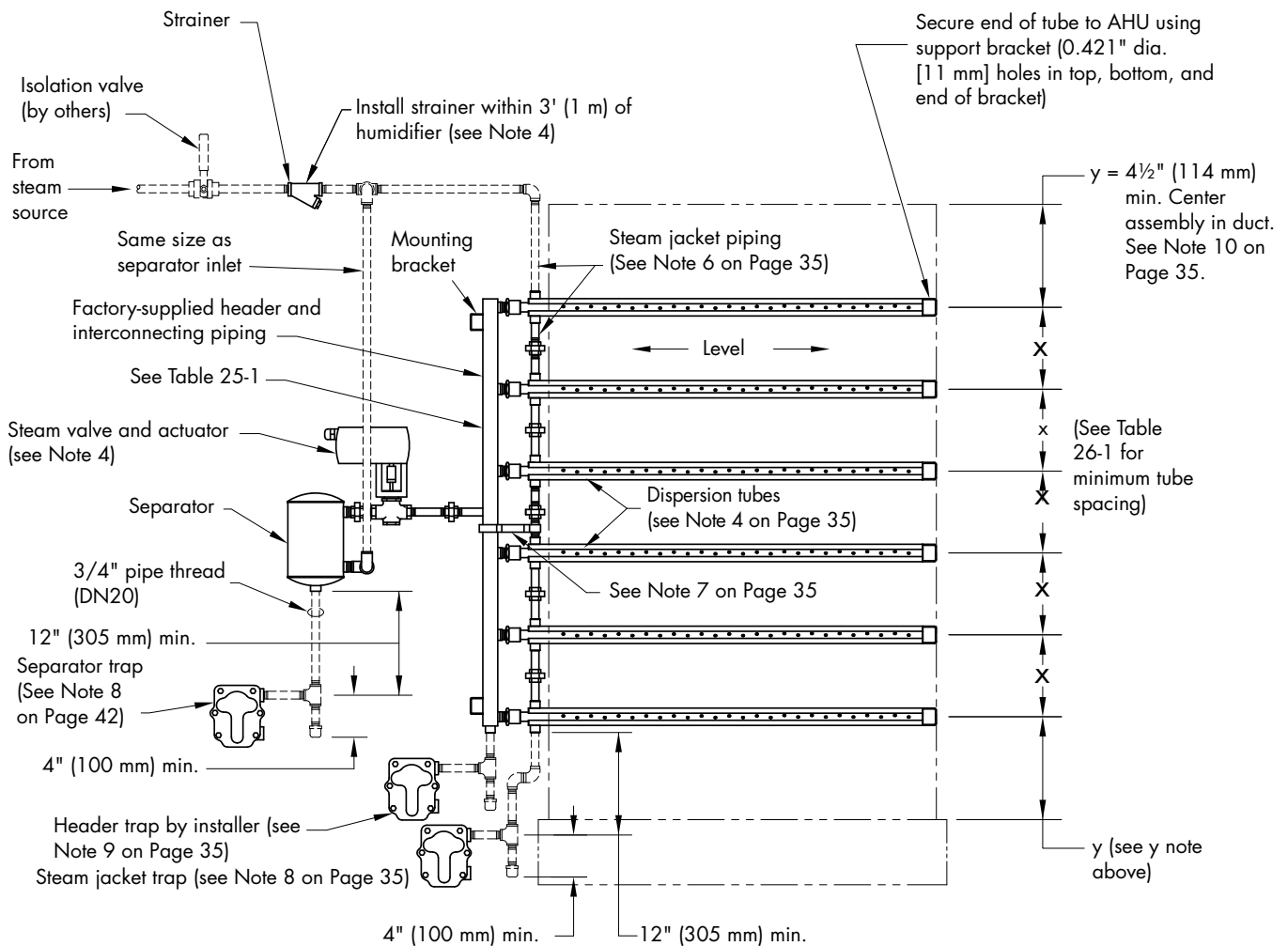
DC-1073

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Maxi-bank option piping notes" on Page 35, and see Pages 14 and 15 for more information about trap types and trap piping.

Maxi-bank option field piping

FIGURE 38-1: MAXI-BANK OPTION, TOTAL TUBE LENGTH LESS THAN OR EQUAL TO 45' (13.7 M) IN AN AHU



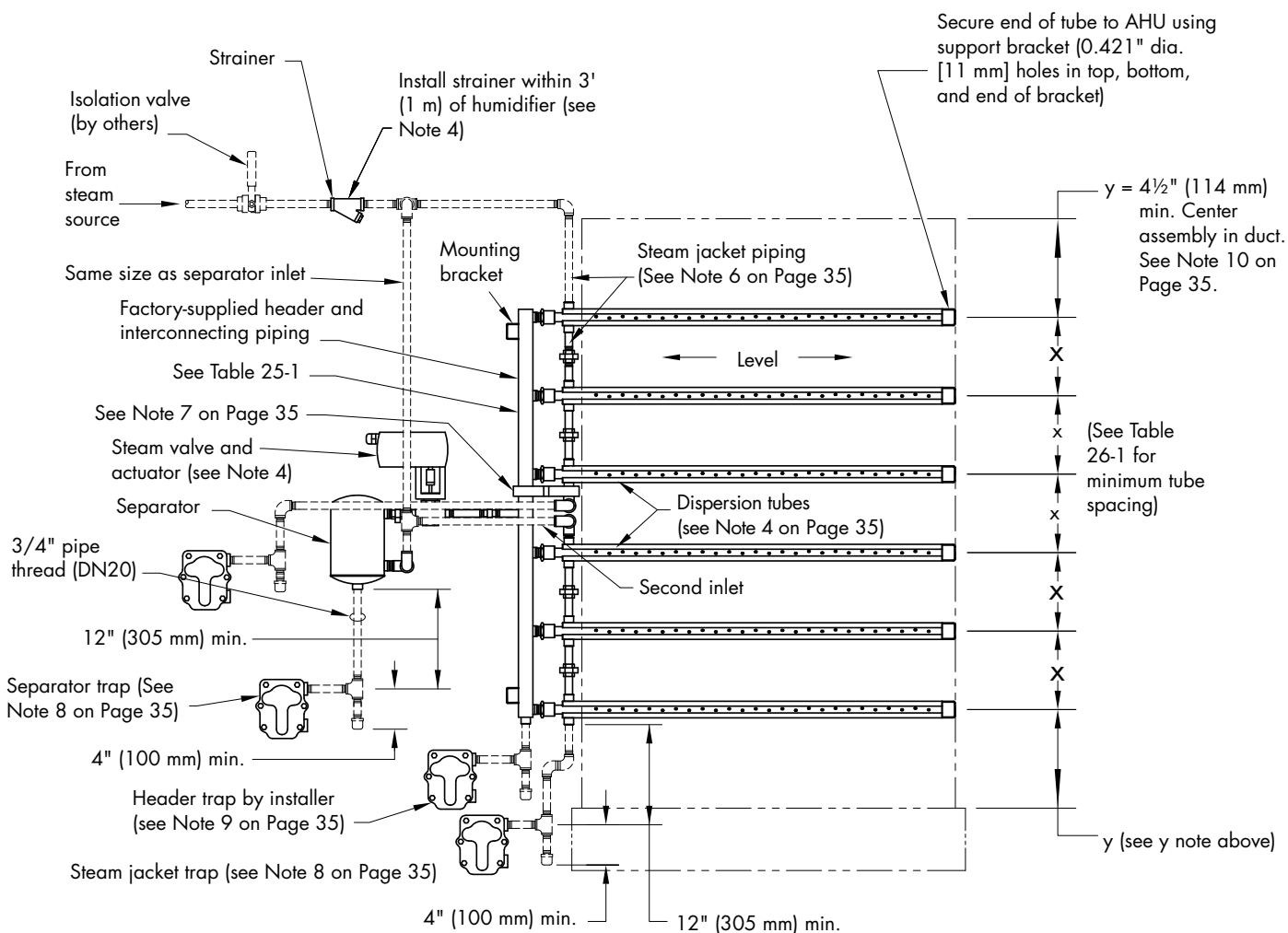
DC-1207

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Maxi-bank option piping notes" on Page 35, and see Pages 14 and 15 for more information about trap types and trap piping.

Maxi-bank option field piping

FIGURE 39-1: MAXI-BANK OPTION, TOTAL TUBE LENGTH GREATER THAN 45' (13.7 M) IN AN AHU



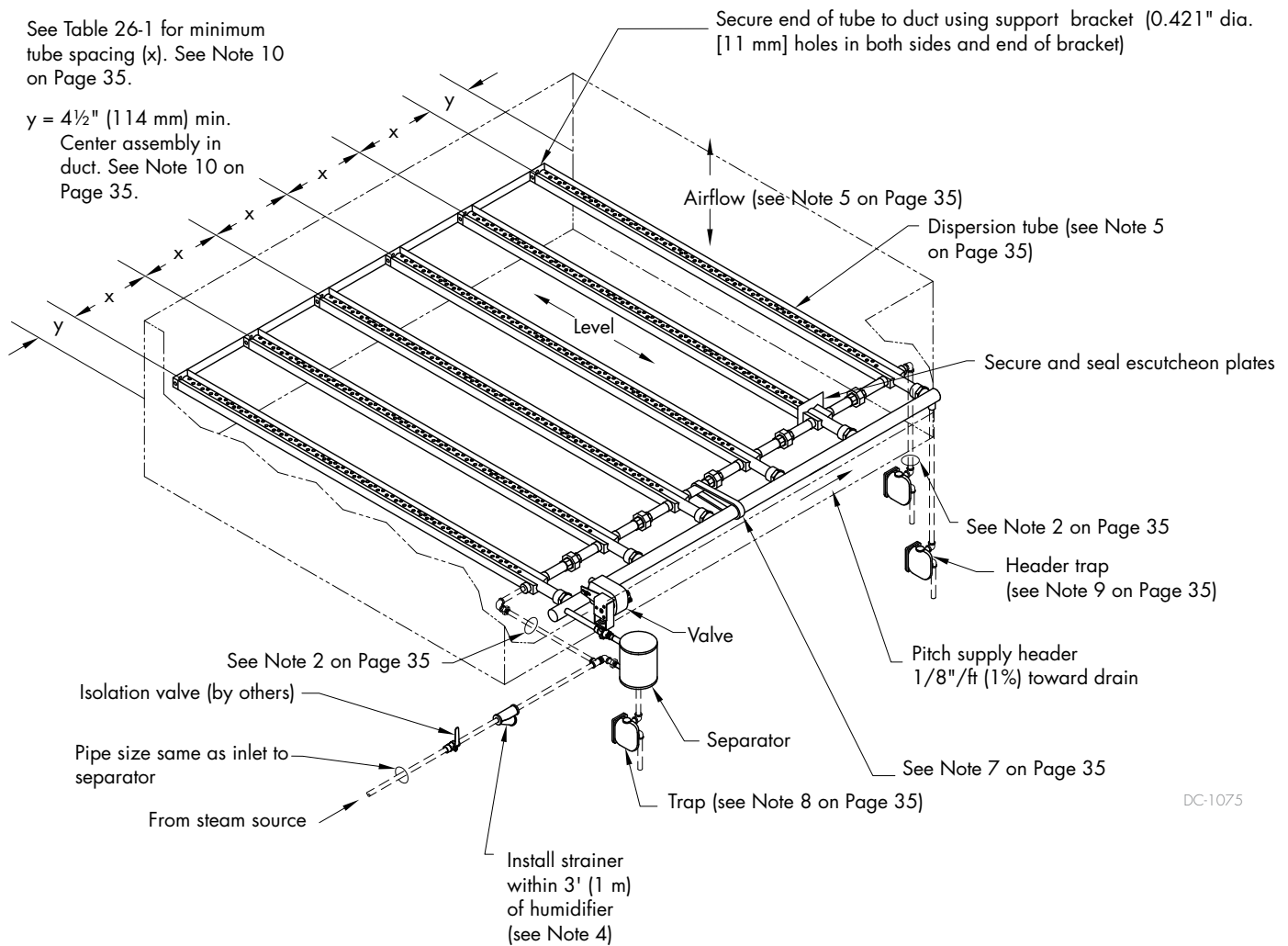
DC-1208

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Maxi-bank option piping notes" on Page 35, and see Pages 14 and 15 for more information about trap types and trap piping.

Maxi-bank option field piping

FIGURE 40-1: MAXI-BANK OPTION INSTALLED IN A DUCT VERTICAL AIRFLOW



DC-1075

NOTES:

1. To avoid metal fatigue, allow for dispersion tube thermal expansion.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. DriCalc® sizing and selection software is free and available at www.dristeem.com.
4. Steam valve and strainer sizes are provided by DriCalc sizing and selection software (Note 3).
5. See "Maxi-bank option piping notes" on Page 35, and see Pages 14 and 15 for more information about trap types and trap piping.

Assembly and installation

The Mini-bank humidifier is a pre-engineered and pre-assembled header/tube assembly with tubes that are always 3" (76.2 mm) on center. The number of tubes depends upon the duct height. For best mixing, the tubes should span at least 90% (preferably 100%) of the duct width.

1. Unpack shipment and verify receipt of all components with packing list. Two F&T traps and one wye strainer are shipped loose for field installation. Report any shortages at once.
2. The Mini-bank can be configured to discharge steam against or with the airflow: Position the tube bank assembly at the desired orientation, slide the tube bank through the opening in the duct wall, join the tube bank assembly to the separator/valve assembly, and tighten the union.
3. Slightly better mixing with less "fog travel" results when the steam blows against the airflow. If the insulated jacket option has been supplied, the steam must blow with the airflow to avoid steam contacting and condensing on the metal jacket.
4. If a field change is necessary, loosen the union, and rotate the tube bank manifold, and tighten the union.
5. Install the Mini-bank humidifier in the duct, positioning the assembly so the tube bank is perpendicular to the top and bottom of the duct and level across the duct. Support the dispersion tube bank out-board end with a No. 10-32 bolt. To secure the Mini-bank escutcheon plate air tight, seal around the plate and fastener with suitable caulk.
6. Install the steam strainer, taking the steam supply to the Mini-bank humidifier off the top of steam main (instead of the side or bottom) to ensure the driest steam. The main should be dripped and trapped. See "Pressurized steam piping guidelines" on Pages 10–13.
7. Locate and install the steam traps as necessary. The Mini-bank humidifier steam traps should drain by gravity to return main having little or no back pressure. If condensate cannot drain by gravity, it must be elevated to return main (see Page 11).

Continued

For more installation information

- See "Humidifier placement" on Pages 6–8 for information about choosing an installation location.
- See "Sensor placement" on Page 9.
- See "Pressurized steam piping guidelines" on Pages 10–13.
- See "Temperature switches" on Page 16.

WARNING

Improper mounting hazard

Mount humidifier per the instructions in this manual and to a structurally stable surface. Improper humidifier mounting can cause the humidifier to fall resulting in severe personal injury or death.

WARNING

Excessive moisture hazard

DriSteam strongly recommends installing a duct airflow proving switch and a duct high limit humidistat. These devices prevent a humidifier from making steam when there is low airflow in the duct or when the RH level in the duct is too high. Failure to install these devices can result in excessive moisture in the duct, which can cause bacteria and mold growth or dripping through the duct.

Installation

8. Wire control to valve actuator.
9. Install an airflow proving switch to prevent the valve from opening unless air is moving in duct. See "Humidifier placement" on Pages 6–8 for location recommendations.
10. Install a duct-mounted high-limit humidistat downstream from the humidifier. Set humidistat at 80-90% RH to prevent condensation forming in the duct. Mount this humidistat far enough downstream to ensure that injected steam has been completely absorbed before the humidistat. See "Humidifier placement" on Pages 6–8 for location recommendations.
11. Install a temperature switch to prevent possible cold-start dripping when steam pressure to the humidifier is cycled. See "Temperature switches" on Page 16 for more information.
12. Install the humidistat and/or sensors according to the recommendations on Page 9.

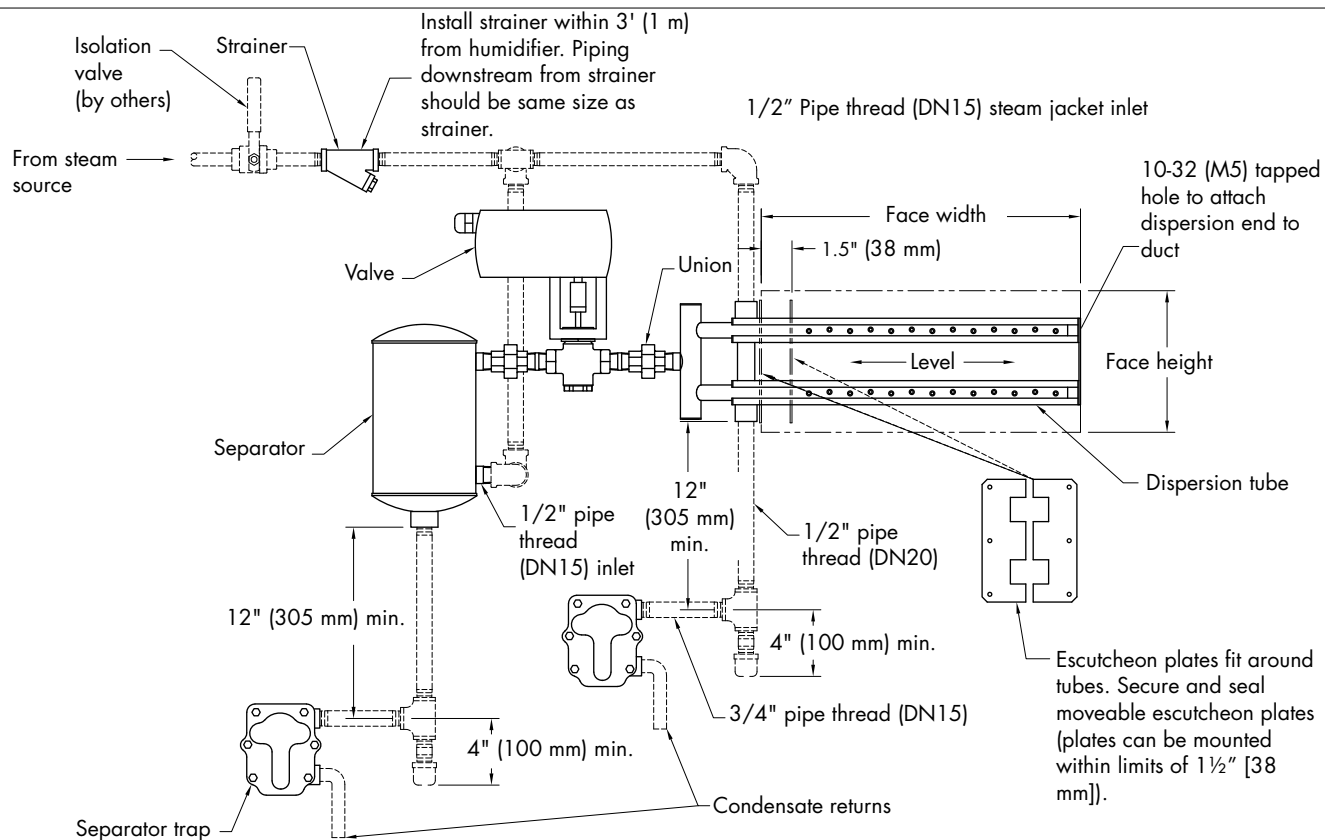
Table 42-1:
Mini-bank humidifier specifications

Face height		Required number of tubes	Face width
inches	mm		
6-9	150-230	2	6" to 48" in 1/2" increments (150 mm to 1220 mm in 13-mm increments) For face dimensions larger than 48" x 24" (w x h) (1220 mm x 610 mm), use Multiple-tube humidifier.
10-12	250-305	3	
13-15	330-380	4	
16-18	405-460	5	
19-21	480-535	6	
22-24	560-610	7	

Note: See Figure 12-2 for face height and face width.

Field piping

FIGURE 43-1: MINI-BANK HUMIDIFIER IN A DUCT HORIZONTAL AIRFLOW



OM-7480

NOTES:

1. To avoid metal fatigue, allow for thermal expansion of dispersion tubes.
2. Dashed lines indicate provided by installer; right-hand discharge shown.
3. Drawing represents a left-hand discharge.
4. Slightly better mixing with less visible vapor travel occurs when discharged steam blows against the airflow, rather than with the airflow. Therefore, **when using noninsulated steam jackets in a horizontal airflow**, position dispersion tubelets (steam orifices) so that they face into the airflow.
If the dispersion tube has an insulated jacket, the discharged steam must blow with the airflow to avoid condensation that may occur when discharged steam contacts the cooler insulated jacket. Therefore, **when using insulated steam jackets in a horizontal airflow**, position dispersion tubelets so that they discharge steam with the airflow, and also add 24" (610 mm) to the non-wetting absorption distance.
5. Center tube assembly within duct height.
6. If steam pressure is less than or equal to 15 psi (103.4 kPa), use float and thermostatic (F&T) traps for the humidifier.
If steam pressure is greater than 15 psi (103.4 kPa), use inverted bucket traps for the humidifier.
If lifting condensate, use an inverted bucket trap and check valve regardless of steam pressure. (see Figure 12-1)
7. See the previous page for face width and face height dimensions.
8. See "Pressurized steam piping guidelines" on Pages 10–13.

Installation

ASSEMBLY AND INSTALLATION

Area-type humidifiers are factory assembled and shipped as a complete unit, with steam trap and wye strainer shipped loose. Each humidifier requires a steam supply, condensate return, and electrical supplies to operate the fan.

1. Select a location using Table 46-1.
2. Unpack shipment and verify receipt of all Area-type humidifier components with packing slip. Report any shortages at once.
3. Mount humidifier to supported steam and condensate piping as necessary.
4. Connect fan power as recommended for a minimum 60 lbs/hr (27.2 kg/h) of steam: 120v, 60 hz, below 1 amp. The fan will provide 700 cfm (0.33 m³/s) of air.
5. Connect the necessary control signal wiring to steam valve operator.
Note: Recommended maximum steam supply pressure is 15 psi (105 kPa).
6. See components and installation drawing in Figure 45-1.
7. See "Sensor placement" on Page 9.



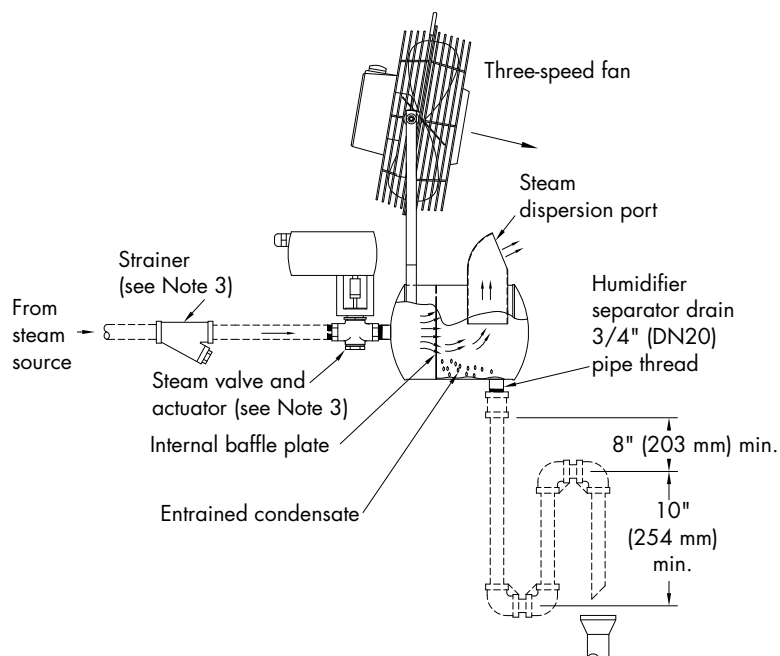
WARNING

Improper mounting hazard

Mount humidifier per the instructions in this manual and to a structurally stable surface. Improper humidifier mounting can cause the humidifier to fall resulting in severe personal injury or death.

Field piping

FIGURE 45-1: AREA-TYPE HUMIDIFIER COMPONENTS AND INSTALLATION OVERVIEW



DC-1179

Table 45-1:
Area-type dispersion fan specifications

Electric fan motor	120 V 50/60 Hz 0.75 A
Blade diameter	12" (305 mm)
Speeds	3
Control	Rotary switch

NOTES:

1. Dashed lines indicate provided by installer.
2. DriCalc® sizing and selection software is free and available at www.dristeem.com.
3. Steam valve and strainer sizes are provided by DriCalc (Note 2).
4. See "Piping notes" on Page 20, and see Pages 14 and 15 for more information about trap types and trap piping.

Rise, spread, and throw dimensions

The table below lists the Area-type humidifier's minimum rise, spread and throw non-wetting dimensions. Surfaces cooler than ambient temperature, or objects located within this minimum dimension, may cause condensation and dripping.

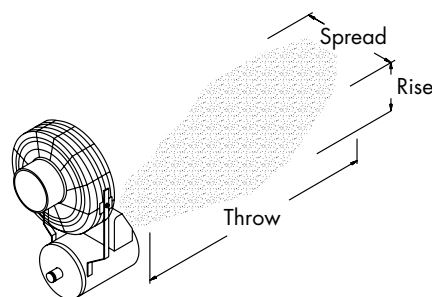
Rise: Minimum non-wetting height above the steam chute

Spread: Minimum non-wetting width from the steam chute

Throw: Minimum non-wetting horizontal distance from the steam chute

The greater the space relative humidity, the higher and farther the discharged steam will carry and rise in the space until becoming absorbed.

FIGURE 46-1: AREA-TYPE RISE, SPREAD, AND THROW



DC-5M

Table 46-1:

Area-type humidifier minimum distances for rise, spread, and throw*

Maximum steam capacity		60 °F (16 °C)																	
		30% RH						40% RH						50% RH					
		Rise		Spread		Throw		Rise		Spread		Throw		Rise		Spread		Throw	
lbs/hr	kg/h	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
50	20	1.0	0.3	2.0	0.6	6.0	1.8	1.0	0.3	2.0	0.6	6.0	1.8	1.0	0.3	2.5	0.8	6.0	1.8
75	34	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	4.0	1.2	8.0	2.4
100	45	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	5.0	1.5	10.0	3.1
150	68	6.0	1.8	5.0	1.5	12.0	3.7	6.0	1.8	5.0	1.5	12.0	3.7	6.0	1.8	5.0	1.5	12.0	3.7
200	90	7.0	2.1	7.0	2.1	13.0	4.0	8.0	2.4	7.0	2.1	14.0	4.3	8.0	2.4	7.0	2.1	14.0	4.3
225	102	7.0	2.1	7.0	2.1	13.0	4.0	8.0	2.4	7.0	2.1	14.0	4.3	8.0	2.4	7.0	2.1	14.0	4.3
250	110	8.0	2.4	8.0	2.4	15.0	4.6	9.0	2.7	9.0	2.7	16.0	4.9	9.0	2.7	9.0	2.7	16.0	4.9
285	130	9.0	2.7	9.0	2.7	17.0	5.2	10.0	3.1	10.0	3.1	18.0	5.5	10.0	3.1	10.0	3.1	18.0	5.5

Maximum steam capacity		70 °F (21 °C)																	
		30% RH						40% RH						50% RH					
		Rise		Spread		Throw		Rise		Spread		Throw		Rise		Spread		Throw	
lbs/hr	kg/h	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m	ft	m
50	20	1.0	0.3	1.5	0.5	4.0	1.2	1.0	0.3	2.0	0.6	4.0	1.2	1.0	0.3	2.0	0.6	4.0	1.2
75	34	2.0	0.6	2.0	0.6	6.0	1.8	2.0	0.6	2.5	0.8	6.0	1.8	2.0	0.6	2.5	0.8	6.0	1.8
100	45	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4	3.0	0.9	3.0	0.9	8.0	2.4
150	68	4.0	1.2	4.0	1.2	10.0	3.1	4.0	1.2	4.0	1.2	11.0	3.4	4.0	1.2	4.0	1.2	11.0	3.4
200	90	5.0	1.5	5.0	1.5	11.0	3.4	5.0	1.5	5.0	1.5	12.0	3.7	5.0	1.5	5.0	1.5	12.0	3.7
225	102	5.0	1.5	5.0	1.5	11.0	3.4	5.0	1.5	5.0	1.5	12.0	3.7	5.0	1.5	5.0	1.5	12.0	3.7
250	110	6.0	1.8	6.0	1.8	12.0	3.7	6.0	1.8	6.0	1.8	13.0	4.0	6.0	1.8	6.0	1.8	14.0	4.3
285	130	7.0	2.1	7.0	2.1	14.0	4.3	7.0	2.1	7.0	2.1	15.0	4.6	7.0	2.1	7.0	2.1	16.0	4.9

* With fan on high speed

Humidifier start-up and shut-down

HUMIDIFIER START-UP

1. Open steam jacketing shut-off valve, if applicable.
2. Inspect steam valve for proper operation.
Inspect to be sure the valve operates freely, closes off steam tightly, and that the stem packing is not leaking.
3. Inspect steam traps and verify all are working properly. A blocked steam trap will be cold. A “blowing” steam trap will be hot and noisy, and the discharge pipe will be hot for a continuous distance up to 30' (9 m). A properly operating steam trap will have about a two-degree temperature drop measured across the trap from inlet to discharge.
4. Verify airflow proving switch and high limit humidistat, if applicable, are working properly.

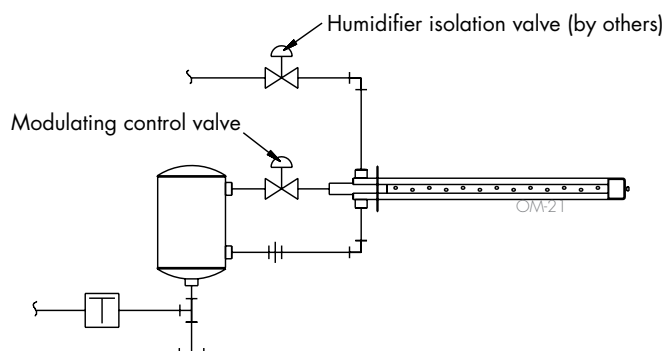
HUMIDIFIER SHUT-DOWN

Close humidifier steam supply shut-off valve.

See “Maintenance procedures” on Page 49.

Eliminating excess heat from steam jacketed humidifiers

FIGURE 48-1: SINGLE HUMIDIFYING STEAM PATH



See Figure 48-1.

In some applications with steam-jacketed humidifiers, the heat given off by the steam-heated tube (not the steam's sensible heat) may be undesirable. While relatively insignificant in a single-tube unit (usually a rise of less than 2 °F [1 °C]), it can be much greater in a closely-spaced, multiple-tube installation. This can be dealt with in several ways:

1. Manually turn off the steam supply valve after the humidification season.
2. Insulate the tube exterior.
Note: Insulation will enlarge the tube profile, causing additional resistance to airflow.
3. Provide an automatic shut-off valve for the jacketing steam circuit in addition to the modulating control valve. This will eliminate heat gain during the "off" humidification periods only. The jacketing steam valve should be a two-position type, with a minimum Cv of 5, and set to the full-open position prior to opening the modulating valve.

As shown in Figure 48-1, all steam (for jacketing and humidification) must pass through the jacket steam valve. It must do so with little or no pressure drop across the valve, or maximum capacity will be reduced. More importantly, with just one supply source for jacket and humidification steam, the jacket steam temperature may drop below the temperature required to eliminate dripping. Therefore, the valve must be amply sized. This is not significant in a small-capacity humidifier. In a large-capacity humidifier, the required valve size may be quite expensive.

Maintenance procedures

1. Strainer: Inspect the screen at least twice during the first year. If fouled, it should be inspected more frequently and cleaned as needed.
2. Steam trap: At least twice a year, verify that the steam trap is functioning properly. A blocked steam trap will be cold. An improperly operating steam trap with steam exiting the trap will be hot and noisy, and the discharge pipe from it will be hot for a continuous distance up to 30' (9 m). A properly operating steam trap will have about a 2 °F (1 °C) temperature drop measured across the trap from inlet to discharge.
3. Electric modulating valve:
Inspect annually to ensure that:
 - a. The valve operates freely.
 - b. The valve tightly closes off steam.
 - c. The stem packing is not leaking steam.

Valve (solenoid): Inspect annually to verify proper function with steam-tight shutoff.

4. Silencer: Inspect at least annually for cleanliness. Clean or replace as needed.
5. Teflon seal rings: After one year of service, verify that rings are properly functioning. They require replacement if disturbed, since the Teflon can take a "set" and not return to its uncompressed shape.
6. O-rings (dispersion tube adapters): Replace after two or three years of service.
7. Separator: No maintenance required.
8. Dispersion tube: No maintenance required.

Troubleshooting

Table 50-1:
Steam Injection troubleshooting guide

Problem	Possible cause	Action
Humidifier discharges water in duct	Steam main overloaded with water due to boiler discharging water with steam (priming) or improper steam main dripping	Locate cause of priming and correct
	Steam trap not draining properly	- Replace trap, repair, or clean as required - Reduce back pressure of condensate return line
	Steam pressure is too low (below 2 psi [14 kPa])	- Verify that steam shutoff valves are fully open - Adjust pressure reducing valve - Adjust boiler pressure
	Condensate is collecting in low, undrilled points in steam main	Install drips and steam traps as required
	Steam jacketing of tube not up to proper temperature	- Excessive lifting of condensate. Reroute piping or raise steam pressure. - Short circuiting inside tube jacketing. Replace tube. - Improper steam trap location. Relocate and/or add additional trap. - Condensate return line pressure is too high. Re-pipe. - Dispersion tube is not level. Reposition.
	Overloaded condensate return main	Replace with larger piping, or pipe condensate to floor drain.
	Inadequate steam trap capacity	- Replace steam trap orifices as necessary. - Replace with larger trap.
Humidifier leaks water	Defective O-rings on tube adapter	Replace O-rings
	Steam leak in outer jacket of dispersion tube	Repair leak, or replace tube. Note: Check installation to ensure tubes are not rigidly anchored in place. Tubes must be allowed to flex in response to thermal expansion.
Humidity exceeds setting of humidistat	Automatic valve not fully closing	- Foreign matter is holding valve open. Clean valve; check line strainer. - Valve spring is broken. Replace spring. - Valve stem packing is adjusted too tightly. Loosen and/or replace packing. - Steam pressure exceeds close-off rating of valve spring. Replace actuator or valve spring with one that is compatible with the higher steam pressure. - Valve is installed backers. Remount. - Adjust valve linkage.
	Control system is malfunctioning	- Incorrect control voltage. Verify and correct. - Incorrect control signal. Verify and correct. - Improper wiring. Verify and correct. - Incorrect humidity sensor. Verify and correct. - Humidity controller out of calibration. Calibrate.
	Leak in steam piping inside duct	Repair leak.

Continued

Troubleshooting

Table 50-1:
Steam Injection troubleshooting guide (continued)

Problem	Possible cause	Action
Hunting: Humidity swings above and below desired set point	Control system is malfunctioning.	- Faulty or inaccurate humidity controller. Calibrate or replace. - Poor location of control components. Relocate. - Incompatible control component(s). Change component(s).
	Automatic valve is hunting.	- Humidifier is oversized. Change to a smaller valve. - Pressure-reducing valve is not accurately controlling steam pressure. Repair or replace. - Boiler pressure is swinging too widely. Adjust.
Space humidity will not rise to humidistat set point	Excessive outside air volume	Check fans, dampers, VAV, etc.
	Steam pressure is too low.	- Manual steam valve is partially closed. Open. - Strainer screen is partially clogged. Clean. - Boiler pressure is too low. Adjust. - Pressure reducing valve is not accurately controlling steam pressure. Repair or replace. - Boiler pressure is swinging too widely. Adjust. - Check fans, dampers, VAV, etc. - Piped incorrectly. Re-pipe. - Steam piping is undersized.
	Humidifier is undersized.	- Replace valve with larger capacity valve. - Replace with larger humidifier. - Add additional humidifier.
	Automatic steam valve is not opening fully.	- Valve packing is adjusted too tightly. Loosen and/or replace packing. - Adjust valve linkage. - Check pilot positioner settings.
	Control system is malfunctioning.	- Incorrect control circuit voltage. Change transformer. - Incorrect control signal. Replace component(s) to make all components compatible. - Improperly wired. Rewire. - Incorrect humidity sensor (Barber-Colman units only). Replace. - Humidity controller is out of calibration or is malfunctioning. Repair or replace. - Malfunctioning humidifier temperature switch is not allowing humidifier valve to open. Replace or readjust.

Continued

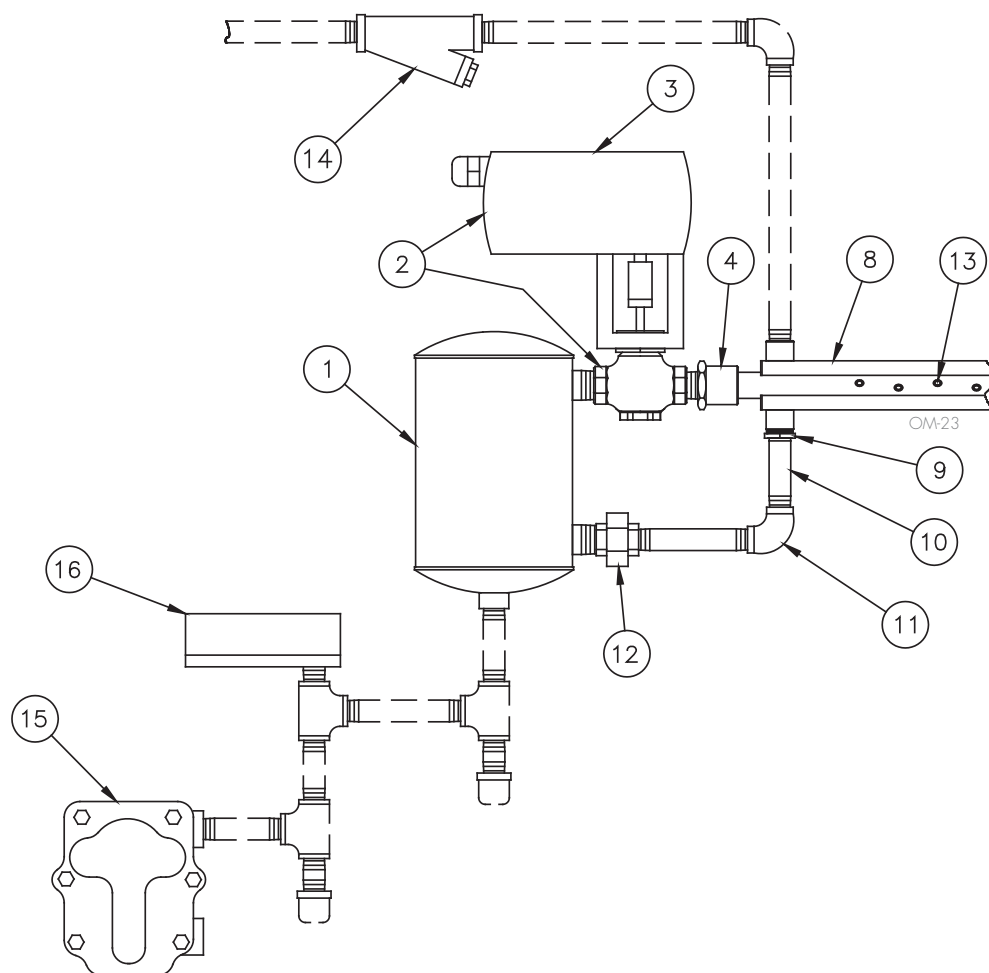
Troubleshooting

Table 50-1:
Steam Injection troubleshooting guide (continued)

Problem	Possible cause	Action
Space humidity will not rise to humidistat set point (continued)	Foreign matter is preventing valve from opening.	Clean or replace valve.
	Excessive outside air volume.	Reduce air volume.
Condensate in duct	Humidifier is mounted too close to internal devices (dampers, turning vanes, etc.) in duct.	- Check fan, dampers, VAV, etc. - Move humidifier tubes to a point farther upstream from internal devices. - Add dispersion tubes for shorter absorption distance. consult DriSteem to determine the total number of tubes required.
	A noninsulated duct is passing through an unheated area (duct surface temperature is too low).	Insulate ductwork.
	Air cannot absorb steam quantity being discharged.	- Humidifier is operating when blower is off. Install airflow proving switch. - Valve is hunting. See previous page for instructions. - Air temperature in duct is too low for steam quantity being supplied. - Air cfm in duct is too low for steam quantity being supplied.
	Steam pressure is too high, causing excess capacity.	Reduce steam pressure.
Humidifier is noisy	Tube silencer is missing.	- Install silencer. - Note: Unless special-ordered, silencers are furnished only with Model 60 and Model 70 tubes equal to or shorter than 48" (1219 mm), and only with black iron piping.
	Dispersion tube output is excessively high.	Install additional tubes.

Single-tube and Multiple-tube humidifiers

FIGURE 53-1: SINGLE-TUBE AND MULTIPLE-TUBE HUMIDIFIER REPLACEMENT PARTS



Single-tube and Multiple-tube humidifiers

Table 54-1:
Single-tube and Multiple-tube humidifier replacement parts

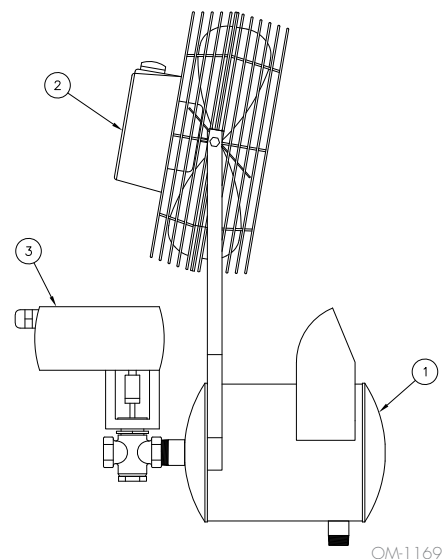
No.	Description	Part No.
1	Separator (vertical separator shown)	Consult factory
2	Valve/actuator assembly (refer to specific order) Valve/actuator assembly or actuator alone are available as replacement parts. Valve body alone is not available as a replacement part.	Consult factory
3	Actuator	Consult factory
4	Tube adapter	Consult factory
5	O-ring, 1" I.D., black EPDM, for Model 60 and Model 70 tubes (not shown)	300400-007
	O-ring, 1½" I.D., black EPDM, for Model 80 tubes (not shown)	300400-006
6	Silencer holder, stainless steel (not shown)	183100
7	Medium grit stainless steel wool (not shown)	300210
8	Replacement tube	Consult factory
9	Seal ring, brass, 1/2" (DN15), for Model 60 tube	306360-001
	Seal ring, brass, 3/4" (DN20), for Model 70 tube	306360-002
	Seal ring, brass, 1½" (DN40), for Model 80 tube	306360-003
	Seal ring, 316 stainless steel, 1/2" (DN15), for Model 60 tube	306360-007
	Seal ring, 316 stainless steel, 3/4" (DN20), for Model 70 tube	306360-004
	Seal ring, 316 stainless steel, 1½" (DN40), for Model 80 tube	306360-006
10	Nipple	Consult factory
11	Elbow	Consult factory
12	Union	Consult factory
13	Tubelet	Consult factory
14	Y-strainer	Consult factory
15	Steam trap, float and thermostatic (F&T) (shown), cast iron, 3/4" (DN20), for ≤15 psi	300000-DB
	Steam trap, float and thermostatic (F&T) (shown), cast iron, 3/4" (DN20), for < 75 psi	300002
	Steam trap, float and thermostatic (F&T), stainless steel, 3/4" (DN20), for < 65 psi	300027
16	Temperature switch, electric	400260-001

Area-type humidifier

Table 55-1:
Area-type humidifier with electric fan replacement parts

No.	Description	Part No.
1	Separator (with 3/4" NPT [DN20] supply)	Consult factory
2	Fan, three-speed	400010
3	Valve actuator	Consult factory
4	Valve, 1/2" NPT (DN15) pneumatic with operator	Consult factory
	Valve, 3/4" NPT (DN20) pneumatic with operator	Consult factory
	Valve, 1" NPT (DN25) pneumatic with operator	Consult factory
	Valve, 1/2" NPT (DN15) electric	Consult factory
	Valve, 3/4" NPT (DN20) electric	Consult factory
	Valve, 1" NPT (DN25) electric	Consult factory

FIGURE 55-1: AREA-TYPE HUMIDIFIER WITH ELECTRIC FAN



Mini-bank humidifier

Table 56-1:
Mini-bank humidifier replacement parts

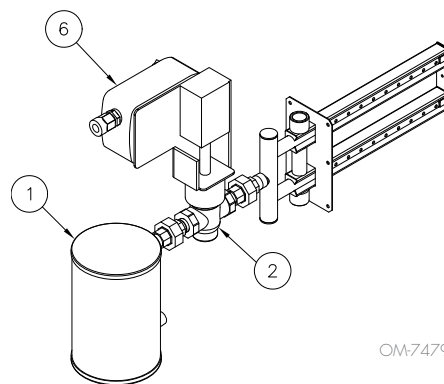
No.	Description	Part No.
1	5" (127 mm) separator	162520
2	Valve, 1/2" (DN15)) pneumatic with operator	Consult factory
	Valve, 1/2" (DN15) electric	Consult factory
3	Orifice, brass (not shown)*	203450
4	Steam trap, float and thermostatic (F&T), for ≤ 15 psi (not shown)**	300000-DB
	Steam trap, float and thermostatic (F&T), stainless steel, 3/4" (DN20), for < 65 psi**	300027
5	Y-strainer, 1/2" (DN15) (not shown)**	300100-001
6	Valve actuator	Consult factory

NOTES:

* Varies with each order

** Shipped loose

FIGURE 56-1: MINI-BANK HUMIDIFIER
REPLACEMENT PARTS



OM-7479

Notes

Expect quality from the industry leader

Since 1965, DriSteem has led the industry with innovative methods for humidifying and cooling air with precise control. Our focus on ease of ownership is evident in the design of the Ultra-sorb steam dispersion panels, which feature cleanable, stainless steel construction. DriSteem also leads the industry with a Two-year Limited Warranty and optional extended warranty.

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For the most recent product information visit our website: www.dristeem.com

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Form No. SHOM-EN-REVH-2026-0126
Part No. 890000-401 Rev H

TWO-YEAR LIMITED WARRANTY

DRI-STEEM Corporation ("DriSteem") warrants to the original user that its products will be free from defects in materials and workmanship for a period of two (2) years after installation or twenty-seven (27) months from the date DriSteem ships such product, whichever date is the earlier. If any DriSteem product is found to be defective in material or workmanship during the applicable warranty period, DriSteem's entire liability, and the purchaser's sole and exclusive remedy, shall be the repair or replacement of the defective product, or the refund of the purchase price, at DriSteem's election. DriSteem shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or reinstallation of any defective product. The Limited Warranty does not include cylinder replacement for electrode steam humidifiers or media replacement for Wetted Media Systems.

DriSteem's Limited Warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by DriSteem, or if the products have been modified or altered without the written consent of DriSteem, or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to DriSteem in writing within the stated warranty period. Defective parts may be required to be returned to DriSteem. Excluded from the Limited Warranty are all consumable and wear and tear items such as cylinders, membranes, filters, or media replacements. These items are subject to usual wear and tear during usage.

DriSteem's Limited Warranty is made in lieu of, and DriSteem disclaims all other warranties, whether express or implied, including but not limited to any IMPLIED WARRANTY OF MERCHANTABILITY, ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, any implied warranty arising out of a course of dealing or of performance, custom or usage of trade. DriSteem SHALL NOT, UNDER ANY CIRCUMSTANCES BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, LOSS OF PROFITS, REVENUE OR BUSINESS) OR DAMAGE OR INJURY TO PERSONS OR PROPERTY IN ANY WAY RELATED TO THE MANUFACTURE OR THE USE OF ITS PRODUCTS. The exclusion applies regardless of whether such damages are sought based on breach of warranty, breach of contract, negligence, strict liability in tort, or any other legal theory, even if DriSteem has notice of the possibility of such damages.

By purchasing DriSteem's products, the purchaser agrees to the terms and conditions of this Limited Warranty.

EXTENDED WARRANTY

The original user may extend the term of the DriSteem Limited Warranty for a limited number of months past the initial applicable warranty period and term provided in the first paragraph of this Limited Warranty. All the terms and conditions of the Limited Warranty during the initial applicable warranty period and term shall apply during any extended term. An extended warranty term of an additional twelve (12) months or twenty four (24) months of coverage may be purchased. The extended warranty term may be purchased until eighteen (18) months after the product is shipped, after which time no extended warranties are available. When a DriSteem humidifier is purchased with a DriSteem RO system, an extended twenty-four (24) month coverage is included.

Any extension of the Limited Warranty under this program must be in writing, signed by DriSteem, and paid for in full by the purchaser.