

READ AND SAVE THESE INSTRUCTIONS

DRI-STEEM[®]

STEAM INJECTION HUMIDIFIERS

**Installation Instructions
and
Maintenance Operations
Manual**

DRI-STEEM[®]



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TO THE PURCHASER AND THE INSTALLER

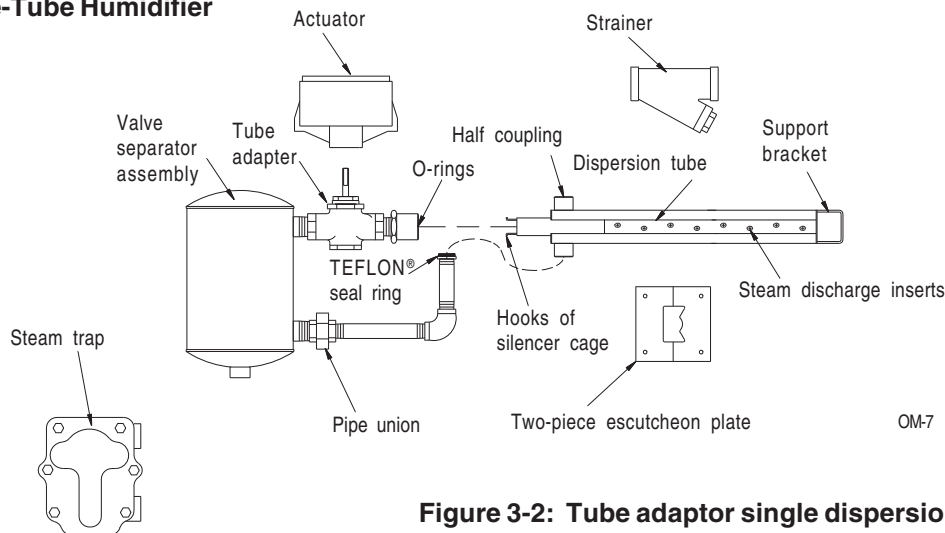
Thank you for purchasing our steam injection equipment. We have designed and built this equipment to give you total satisfaction and many years of trouble-free service. Observing the installation and operating practices described in this manual will assure you of achieving that objective. We urge you to become familiar with the contents of this manual.

DRI-STEEM Humidifier Company

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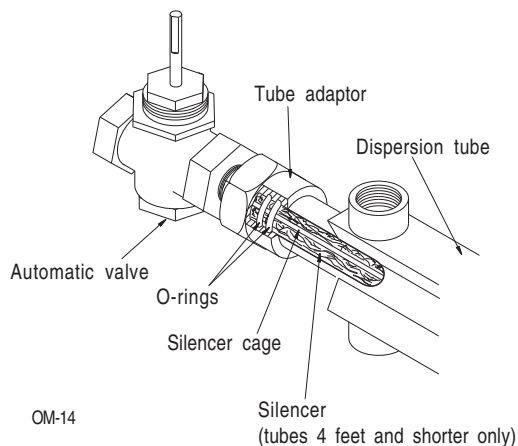
SINGLE-TUBE HUMIDIFIER

Figure 3-1: Single-Tube Humidifier



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Figure 3-2: Tube adaptor single dispersion tube



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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 toward the airstream for better steam-air mixing, except if tubes have fiberglass insulated-jacket option (steam could condense on cool jacket) in which case they should discharge with the airstream.
3. Unscrew pipe union, remove elbow and nipple portion, and install in half nipple of tube. **Note:** Before completing step 3, determine which way (right or left) steam holes should point and install in appropriate half nipple.
4. Install tube adapter in valve, use pipe dope and tighten leak-tight sealer.
5. O-rings are installed inside of tube adaptor. **Note:** Lubricate O-rings before installing.
6. Insert tube adaptor into dispersion tube. As this is being done, squeeze hooks of silencer cage together (see note below), and slide them into the tube adaptor, allowing them to snap over rear edge of adapter. Complete inserting adaptor into tube, being careful not to damage O-rings.
7. Bring union halves together, tighten union ring, and snug up TEFLON® seal ring (not too tight). The unit is ready to be installed in duct.

Installation

For questions about locating your humidifier in an air handling system, see Humidifier Placement on page 12.

1. Insert a support bolt in one of the three holes (upper, lower or end) of support bracket, 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.

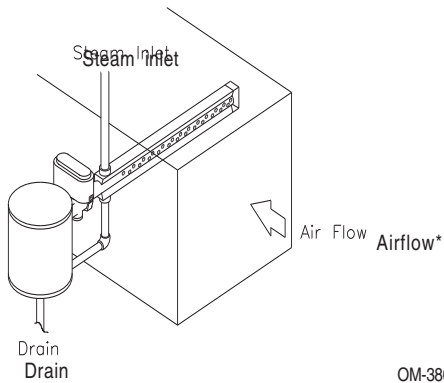
3. Install steam strainer and steam trap. Connect to steam and condensate return mains. See page 5 for piping notes.
4. Install control tubing (pneumatic) or wiring (electric) to valve actuator. **Note:** An airflow-proving device should be installed to prevent valve from opening unless air is moving in duct.
5. High-limit (duct mounted) humidistat installed down stream and set at 80-90% is recommended when duct air is below 70°F to prevent condensation in duct. (This device should be mounted far enough down stream to assure injected steam has been completely absorbed.)
6. A temperature switch (to prevent possible cold-start dripping) is recommended when steam pressure to the humidifier is cycled. See page 11 for more information.

Note: Silencers are furnished only with model 5-60 and 6-70 humidifiers having tubes equal to and shorter than 4 feet (all others do not have silencers unless specially ordered).

SINGLE-TUBE HUMIDIFIER

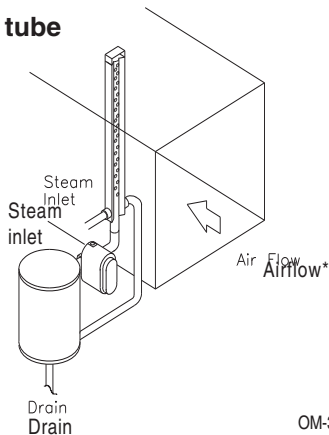
Configurations

Figure 4-1: Right-hand configuration



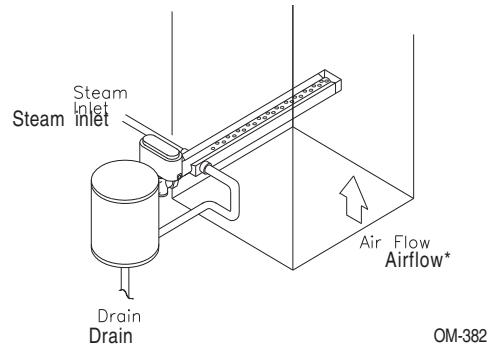
Horizontal tube and horizontal steam discharge. This arrangement comprises the majority of uses. Unless ordered otherwise, this is how units are shipped. Unit shown above is right-handed. To change from right to left, see the bottom of this page.

Figure 4-2: Vertical tube



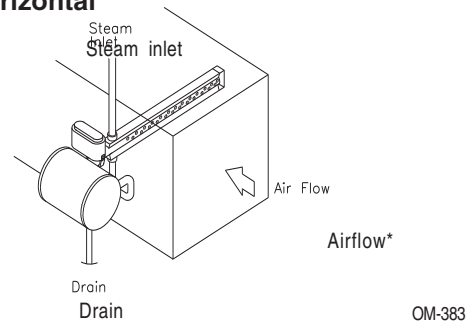
Used when there is no access to side of duct. Steam absorption will be improved if duct is tall and narrow rather than shallow and wide.

Figure 4-3: Vertical discharge



Used in vertical ducts. Tubelets *must* always point up regardless of air flow direction (up or down). (**Insulated discharge tube cannot be used when air flow is downward.**)

Figure 4-4: Horizontal separator



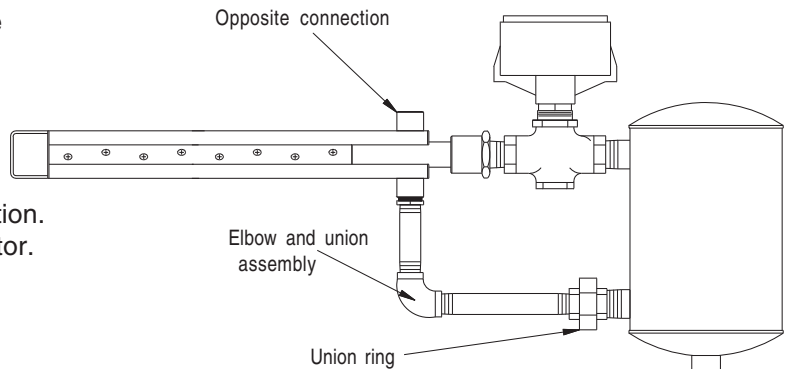
Used where space is at a minimum (above ceilings etc.). Turning the separator on its side saves about 4 inches of height. (This application requires a special horizontal type separator.)

***Note:** Steam should discharge against the airflow. Insulated tubes should discharge with the airflow to prevent condensation on the metal jacket covering the insulation. A minimum duct velocity of 300 FPM with insulated dispersion tubes is recommended.

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:

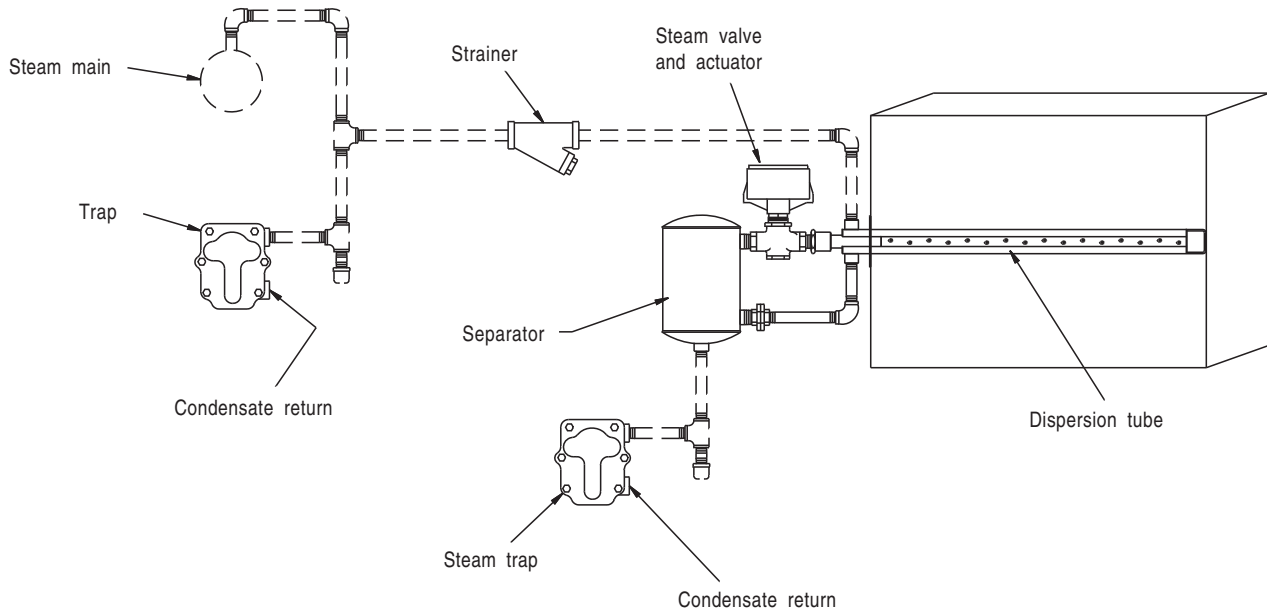
1. Unthread union ring.
2. Remove elbow and nipple assembly from dispersion tube and reinstall on opposite connection.
3. Rotate dispersion tube 180° in respect to separator.
4. Reconnect union halves and tighten union ring.
5. Humidifier now will discharge to opposite side.



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SINGLE-TUBE HUMIDIFIER

Figure 5-1: Single-Tube Humidifier



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Piping

1. Humidifier steam supply should be taken off the top of the steam main (not the side or bottom) to ensure driest steam. Main should be dripped and trapped (in accordance with ASHRAE recommendations).
2. Humidifier steam trap must drain by gravity to the return main having little or no back pressure. If condensate cannot drain by gravity (must be elevated to return main), see Elevating the Condensate from a Steam Humidifier on page 13.

Note: All dotted-line piping to be supplied by installing contractor.

MULTIPLE-TUBE HUMIDIFIER

Field Assembly

1. Unpack shipment and verify receipt of all components with packing list. Report any shortages at once.
2. Plan the tube bank. You will need to know the required spacing distance between tubes. If this information has not been provided, see note "For X" in figure 7-1 on page 7. 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. Refer to "configurations" on page 4.
3. Assemble the header based on the spacings determined in step 2. If the header pipe size has not been specified, see table 7-1 on page 7. This table is based on a maximum steam velocity of 7,000 to 10,000 feet per minute, 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 the tube adaptor fittings in the header tees. (See figure 6-1.) It usually works best to lay the header on the floor along with the tubes for steps 5, 6 and 7.
5. Install male pipe thread end of tube adaptor into pipe fitting. Dope threads and tighten leak tight sealer.
6. O-rings are installed inside of tube adaptor. **Note:** Use synthetic oil to lubricate O-rings before installing.
7. Slide tube into adaptor being careful not to damage the O-rings.
8. Install the tubes in the adaptor fittings, making sure the tubelets are pointing in the proper direction.
9. Cut to length, thread, and install the steam jacket piping.
10. Make the tube support strut using angle or channel iron, and bolt each tube end in place.

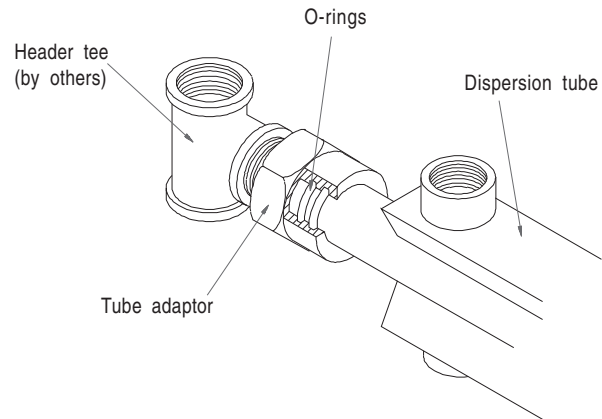
Installation

For questions about locating your humidifier in an air handling system, see Humidifier Placement on page 12.

1. Insert a support bolt in one of the three holes (upper, lower or end) of 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 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 page 7 for piping notes.

Figure 6-1: Tube adaptor for Multiple-Tube Humidifiers

(Used to connect unthreaded tube to threaded pipe fitting.)



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4. Install control tubing (pneumatic) or wiring (electric) to valve actuator. **Note:** An airflow-proving device should be installed to prevent valve from opening unless air is moving in duct.
5. High-limit (duct mounted) humidistat installed downstream and set at 80-90% is recommended when duct air is below 70°F to prevent condensation in duct. (This device should be mounted far enough downstream to assure injected steam has been completely absorbed.)
6. A temperature switch (to prevent possible cold-start dripping) is recommended when steam pressure to the humidifier is cycled. See page 11 for more information.

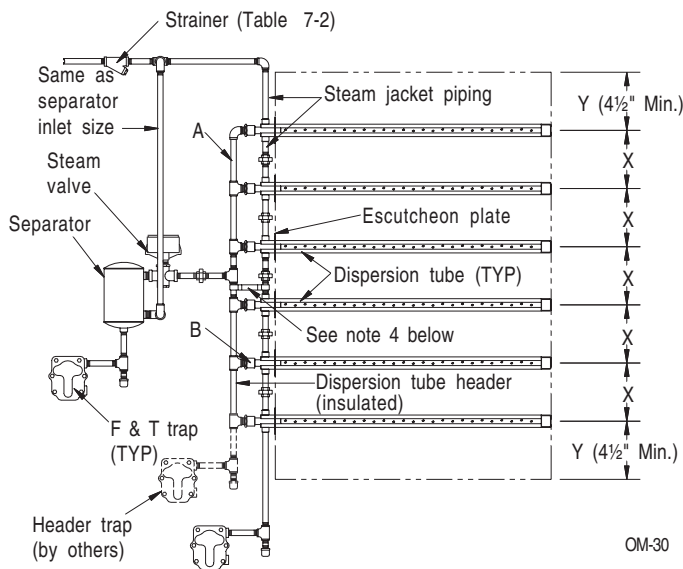
Note: Silencers are furnished only with model 5-60 and 6-70 humidifiers having tubes equal to and shorter than 4 feet (all others do not have silencers unless specially ordered).

MULTIPLE-TUBE HUMIDIFIER

Piping

- Humidifier steam supply should be taken off the top of the steam main (not the side or bottom) to ensure driest steam. Main should be dripped and trapped (in accordance with ASHRAE recommendations.)
- Humidifier steam traps must drain by gravity to the return main having little or no back pressure. If condensate cannot drain by gravity (must be elevated to return main), see Elevating the Condensate from a Steam Humidifier on page 13.
- 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 through a trap at this position. On small headers (2" or less in diameter) this trap may be omitted.

Figure 7-1: Multiple-Tube Humidifiers with total tube length less than 45 feet



- For A: See table 7-1.
 For B: Size 60/70 tubes = 3/4"
 Size 80 tubes = 1 1/2"
 For X: Clearance at top and bottom (Y) should be at least one-half the distance between tubes (X or 4 1/2", whichever is greater), but not greater than X. For size 60 tubes, X must be at least 6". For size 70 tubes, X must be at least 7". For size 80 tubes, X must be at least 9".
- Note 1: All interconnecting piping provided by installing contractor.
- Note 2: When the total tube length exceeds 45 feet, (example, six 8'0" tubes = 48 feet), two jacket traps should be used as in figure 7-2.
- Note 3: To ensure uniform output from each tube, connect steam supply as near to the middle of the header as possible – but not in direct alignment with another tube.
- Note 4: After the unit is installed, the steam jacket piping should be secured to the tube header.

Figure 7-2: Multiple-Tube Humidifier with total tube length more than 45 Feet

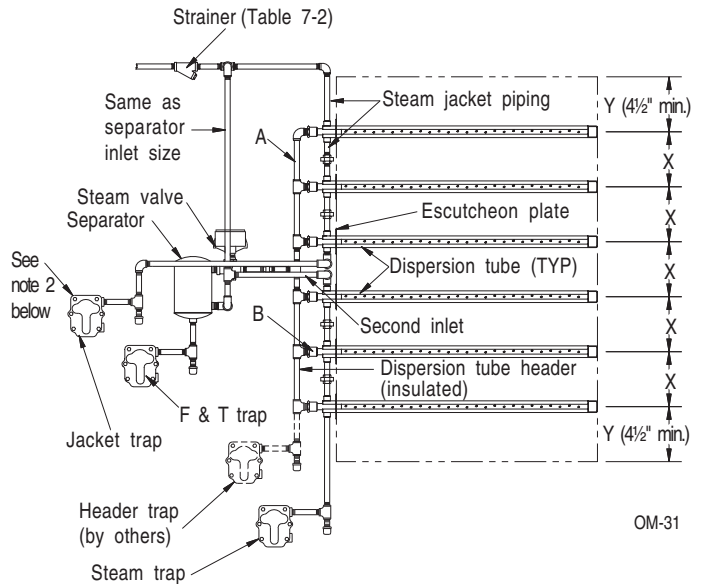


Table 7-1: Header sizing

Total capacity		Header	
(lbs/hr)	(kg/hr)	(inches)	(mm)
up to 280	up to 127	1 1/2	38
281 to 490	128 to 222	2	51
491 to 980	223 to 445	3	76
981 to 1743	446 to 791	4	102
1744 to 2752	792 to 1248	5	127
2753 to 3989	1249 to 1810	6	152

Table 7-2: Steam load for strainer sizing in lbs/hr (kg/hr)

Entering PSI	Strainer size						
	3/4"	1"	1 1/2"	2"	2 1/2"	3"	4"
2	60 (27)	110 (50)	270 (122)	450 (204)	660 (300)	1070 (485)	1690 (767)
5	96 (44)	155 (70)	370 (168)	525 (238)	900 (408)	1420 (644)	2550 (1157)
10	120 (54)	190 (86)	450 (204)	760 (345)	1100 (499)	1800 (816)	3000 (1361)
15	137 (62)	230 (104)	540 (245)	900 (408)	1320 (599)	2060 (934)	3600 (1633)
20	160 (73)	260 (118)	625 (284)	1150 (522)	1550 (703)	2310 (1048)	4100 (1860)
25	180 (82)	300 (136)	720 (327)	1200 (544)	1750 (794)	2690 (1220)	4720 (2141)
30	200 (91)	340 (154)	790 (358)	1350 (612)	2000 (907)	3120 (1415)	5500 (2495)
35	220 (100)	360 (163)	860 (390)	1450 (658)	2200 (998)	3500 (1588)	6300 (2858)
40	245 (111)	400 (181)	960 (435)	1620 (735)	2350 (1066)	3700 (1678)	6550 (2971)
50	290 (132)	470 (213)	1100 (499)	1800 (816)	2500 (1134)	4000 (1814)	7100 (3221)

MAXI-BANK® HUMIDIFIER

Figure 8-1: MAXI-BANK with total length of dispersion tubes less than 45 Feet

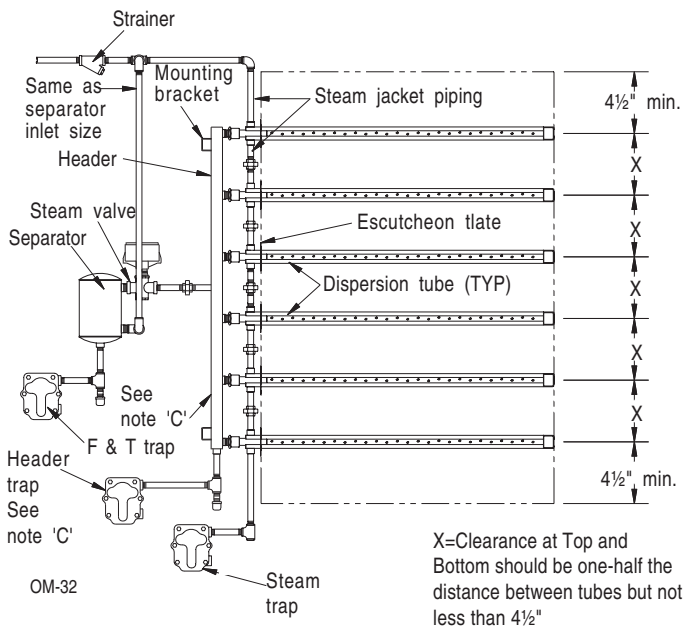
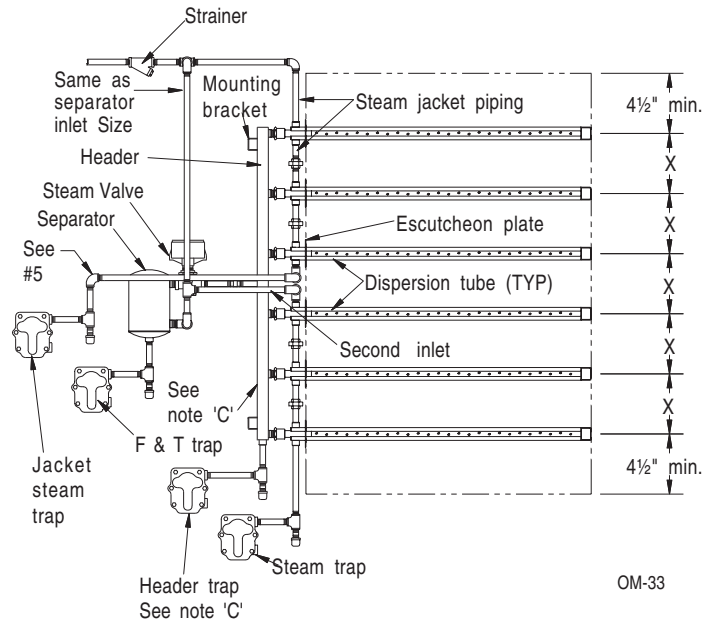


Figure 8-2: MAXI-BANK with total length of dispersion tubes more than 45 feet



Assembly and Installation

(On the MAXI-BANK humidifier, the header and steam-jacket-piping are provided by DRI-STEEM.) The MAXI-BANK is factory assembled and shipped intact, except for the larger units that are broken down for shipment.

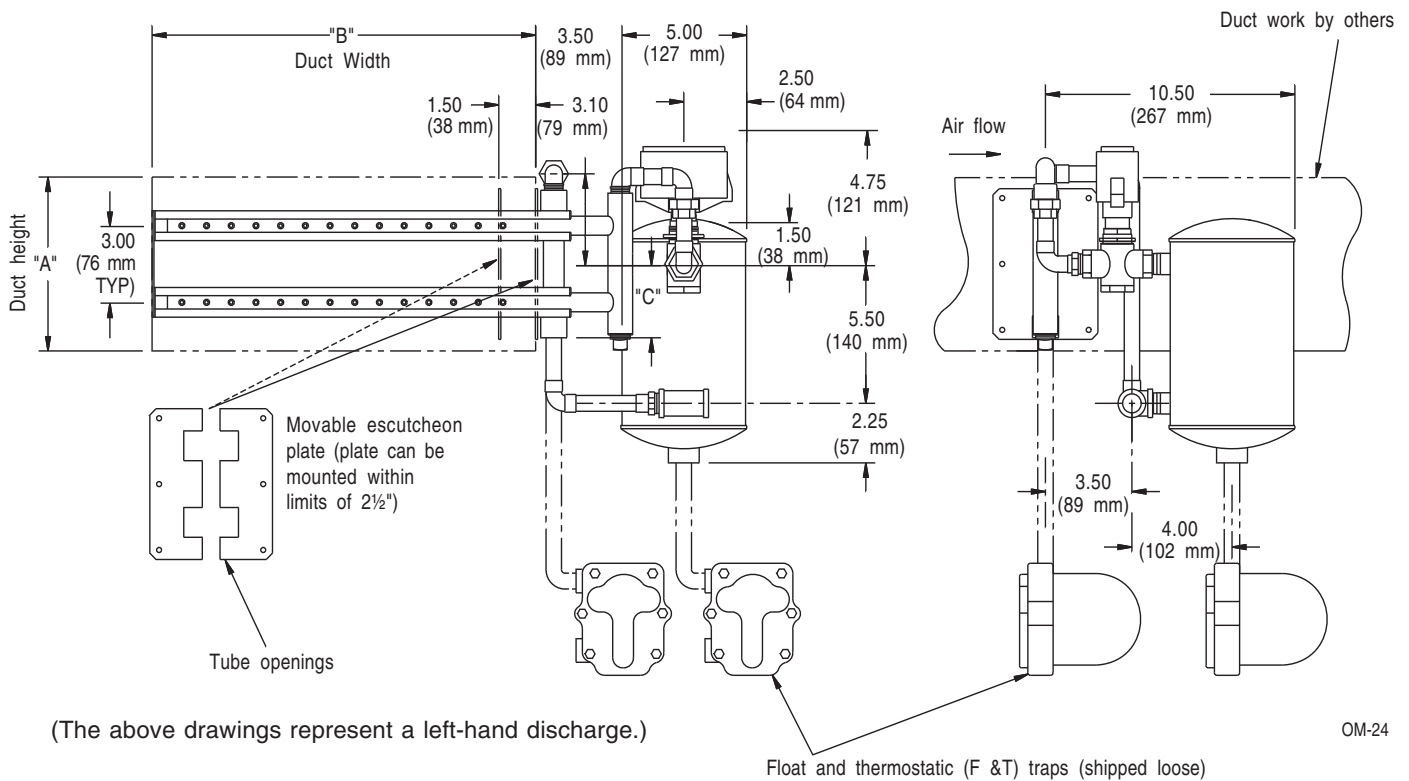
1. Unpack shipment and verify receipt of all MAXI-BANK components with packing list. Report any shortages at once.
2. To simplify installation, we recommend that dispersion tubes be assembled to the MAXI-BANK header before dispersion tubes and header are installed in duct or air handler.
3. Follow the pre-tagged component lettering and match up dispersion tubes (or sections of tubes) to their proper location on MAXI-BANK header.
4. Install each dispersion tube into its appropriate tube adaptor on header, being sure to lubricate O-rings in tube adaptors.
5. Proceed with the additional tubes, bring the jacketed union halves together, secure unions by hand.
Note: When the total length of dispersion tubes exceeds 45 feet, we recommend a second steam inlet to dispersion tubes and a second jacket steam trap, as shown in figure 8-2.
6. When all the dispersion tubes are assembled, place tube assembly into duct or air handler, securing assembly and tube ends to duct or 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.
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. Install control tubing (pneumatic) or wiring (electric) to valve actuator. **Note:** An airflow-proving device should be installed to prevent the valve from opening unless air is moving in duct.
11. Pressure test system and secure fittings as necessary.

Note:

- a. MAXI-BANK steam supply should be taken off the top of the steam main (instead of side or bottom) to ensure driest steam.
- b. MAXI-BANK steam trap(s) should drain by gravity to return main having little or no back pressure. If condensate cannot drain by gravity, (steam trap must be elevated to return main) see page 13.
- c. 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 through a trap at this position. On small headers (2" or less in diameter), this trap may be omitted.

MINI-BANK® HUMIDIFIER



Installation

The MINI-BANK is a pre-assembled small multiple-tube humidifier with tubes that are always 3" on center. The number of tubes depends upon the height of the duct. 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 standard MINI-BANK discharges the steam to the right-hand side (viewed from the separator end) unless ordered otherwise. It can be altered from right-handed to left-handed in the field.

Slightly better mixing with less "fog travel" results when the steam blows *against* the air rather than *with* it. If insulated jacket option has been supplied, the steam must blow *with* the air to avoid steam contacting the metal jacket that covers the insulation and condensing.

If a field change is necessary, disconnect two unions, unscrew piping from tube bank jacketing and re-install to opposite side. Rotate tube bank manifold, reconnect unions and secure.

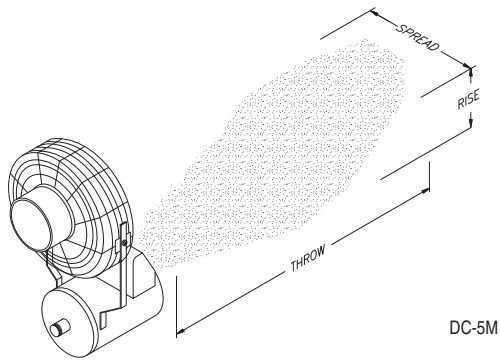
3. Install MINI-BANK into duct, positioning assembly so tube bank is perpendicular to top and bottom and horizontal or level across duct width. Support out-board end of dispersion tube bank with #10-32 bolt. When securing MINI-BANK escutcheon plate where air tightness is required, seal around plate and fastener with suitable caulk.

Table 9-1: MINI-BANK specifications

"A" Duct Height	Quantity of Dispersion Tubes Required	"B" Dispersion Tube Length	Shipping Weights
6-9" (15-23 cm)	2 tubes	From 6" to 36" in 2" increments. Plus 40", 44" and 48".	Calculate .3 lbs. per tube foot. Remainder (separator, valve, traps, etc.) weighs 8.5 lbs.
10-12" (24-31 cm)	3 tubes	For ducts larger than 24" x 48", use Multiple-Tube unit.	
13-15" (32-38 cm)	4 tubes		
16-18" (39-46 cm)	5 tubes	(From 15 to 91 cm in 5 cm increments. Plus 102, 112 and 12 cm. For ducts larger than 61 x 122 cm, use Multiple-Tube unit.)	Calculate 4.5 gm/cm per tube foot. Remainder (separator, valve, traps, etc.) weighs 4 kg.
19-21" (47-53 cm)	6 tubes		
22-24" (54-61 cm)	7 tubes		

4. Install steam strainer, taking the steam supply to MINI-BANK off the top of steam main (instead of side or bottom) to ensure driest steam. Main should be dripped and trapped.
5. Locate and install the steam traps as necessary. MINI-BANK 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 13).
6. Install control tubing (pneumatic) or wiring (electric) to valve actuator. **Note:** An airflow-proving device should be installed to prevent the valve from opening unless air is moving in duct.

AREA-TYPE HUMIDIFIER



The 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 either pneumatic or electrical supplies to operate the fan.

Select a location using minimum steam vapor rise and throw distances given in table 10-1.

Installation

1. Unpack shipment and verify receipt of all AREA-TYPE humidifier components with packing slip. Report any shortages at once.
2. After selecting a location, mount humidifier to supported steam and condensate piping as necessary.
3. Connect fan power as recommended minimum for 60 lbs/hr steam: 120v, 60 hz, below 1 amp (electric); and 2.5 cfm at 25 psi (pneumatic). Both types of fans will provide 700 cfm of air.
4. Connect the necessary control signal, wiring (electric) or tubing (pneumatic) to steam valve operator.
5. **Note:** Recommended maximum pressure is 15 psi. If pressure is greater than this, consult factory.

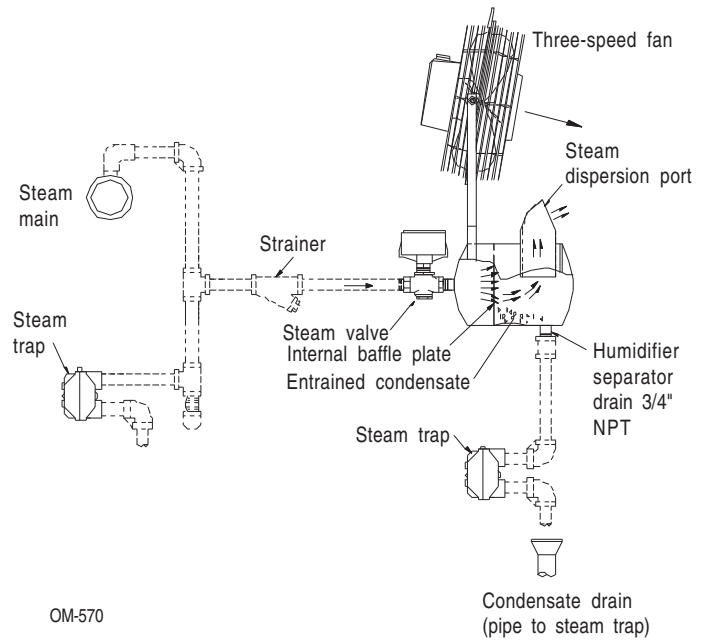


Table 10-1: Minimum distances for rise, throw and spread

Space Temp.	Space R.H.		50	100	150	200	250	285
			lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr	lbs/hr
60°F	30%	Rise	1 ft. (0.3 m)	4 ft. (1.2 m)	6 ft. (1.9 m)	7 ft. (2.2 m)	8 ft. (2.5 m)	9 ft. (2.8 m)
		Spread	2 ft. (0.6 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	7 ft. (2.2 m)	8 ft. (2.5 m)	9 ft. (2.8 m)
		Throw	6 ft. (1.9 m)	10 ft. (3.1 m)	12 ft. (3.7 m)	13 ft. (4.0 m)	15 ft. (4.6 m)	17 ft. (5.2 m)
	40%	Rise	1 ft. (0.3 m)	4 ft. (1.2 m)	6 ft. (1.9 m)	8 ft. (2.5 m)	9 ft. (2.8 m)	10 ft. (3.1 m)
		Spread	2 ft. (0.6 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	7 ft. (2.2 m)	9 ft. (2.8 m)	10 ft. (3.1 m)
		Throw	6 ft. (1.9 m)	10 ft. (3.1 m)	12 ft. (3.7 m)	14 ft. (4.3 m)	16 ft. (4.9 m)	18 ft. (5.5 m)
	50%	Rise	1 ft. (0.3 m)	4 ft. (1.2 m)	6 ft. (1.9 m)	8 ft. (2.5 m)	9 ft. (2.8 m)	10 ft. (3.1 m)
		Spread	2.5 ft. (0.8 m)	5 ft. (1.6 m)	5 ft. (1.6 m)	7 ft. (2.2 m)	9 ft. (2.8 m)	10 ft. (3.1 m)
		Throw	6 ft. (1.9 m)	10 ft. (3.1 m)	12 ft. (3.7 m)	14 ft. (4.3 m)	16 ft. (4.9 m)	18 ft. (5.5 m)
70°F	30%	Rise	1 ft. (0.3 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Spread	1.5 ft. (0.5 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Throw	4 ft. (1.2 m)	8 ft. (2.5 m)	10 ft. (3.1 m)	11 ft. (3.4 m)	12 ft. (3.7 m)	14 ft. (4.3 m)
	40%	Rise	1 ft. (0.3 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Spread	2 ft. (0.6 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Throw	4 ft. (1.2 m)	8 ft. (2.5 m)	11 ft. (3.4 m)	12 ft. (3.7 m)	13 ft. (4.0 m)	15 ft. (4.6 m)
	50%	Rise	1 ft. (0.3 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Spread	2 ft. (0.6 m)	3 ft. (0.9 m)	4 ft. (1.2 m)	5 ft. (1.6 m)	6 ft. (1.9 m)	7 ft. (2.2 m)
		Throw	4 ft. (1.2 m)	8 ft. (2.5 m)	11 ft. (3.4 m)	12 ft. (3.7 m)	14 ft. (4.3 m)	16 ft. (4.9 m)

TEMPERATURE SWITCHES

Pneumatic Temperature Switch

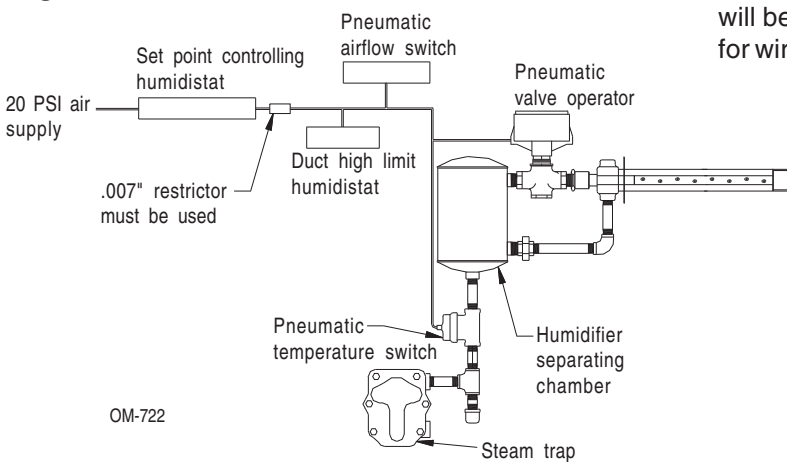
DRI-STEEM's Pneumatic Temperature Switch (PTS) is designed to be used with a pneumatic control system. It prevents condensate discharge from a steam injection humidifier during cold start or if the condensate-return-main becomes flooded. It accomplishes this by bleeding off the pneumatic signal from the controlling humidistat, preventing the pneumatic humidifier valve from opening until the steam trap has reached operating temperature.

The PTS has a self-contained air valve operated by a thermal disc that is normally open, bleeding off control air pressure. When steam comes in contact with the thermal disc, the fluid inside the disc expands, causing the air valve to close, thus allowing pneumatic control system air pressure to build up and to actuate the steam control valve.

Installation

Locate the tee containing the PTS in the condensate drainage pipe, between the separating chamber and the inlet to the steam trap. (See Figure 11-1.)

Figure 11-1: Location of the PTS



Electrical Temperature Switch

This device is a temperature-actuated make break switch. The temperature at which it switches is adjustable and should be set at 210°F. It is designed to be used with electric humidity control systems.

This switch prevents condensate discharge from a steam injection humidifier during a cold start or if the condensate return main becomes flooded.

Installation

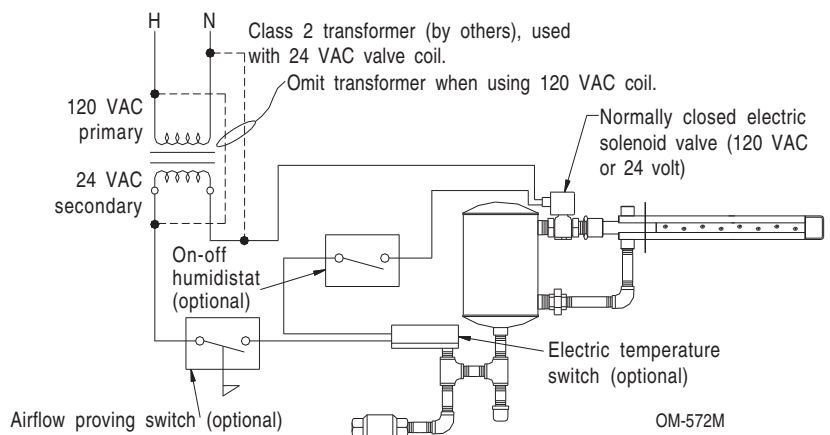
The sensing element of the device is installed in the condensate return piping on the inlet side of the steam trap. When steam surrounds the sensing element, the switch will "make," allowing the humidifier valve to open.

Provide a tee having a 1/2" NPT opening to receive the sensing element.

Note 1: All wiring should be installed according to national local and electrical codes. (SIZE TRANSFORMER VA TO LOAD VA)

Note 2: When the temperature switch is used with an ELECTRIC MODULATING valve, a special wiring diagram will be furnished with the valve. Use this typical diagram for wiring instructions.

Figure 11-2: Typical wiring diagram with electric solenoid valve and typical piping layout

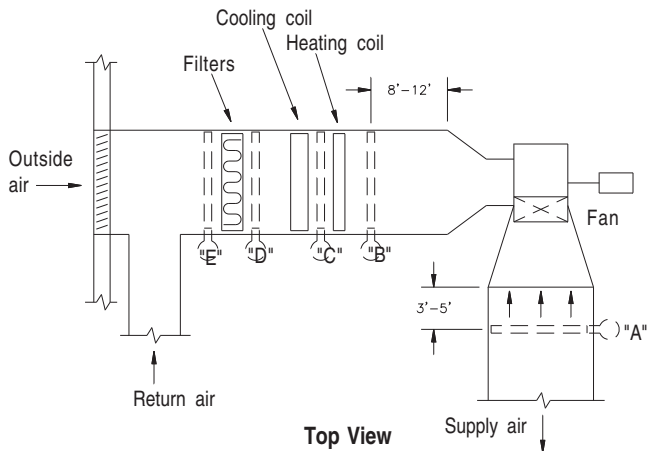


APPLICATION NOTES

Humidifier Placement

Usually, there is no single right placement for a humidifier. Much depends on the system design, its uses, and its applications. However, the following examples are presented as practical guidelines for some of the more common situations.

Figure 12-1: Example 1



Example 1: Placement in an air handling unit

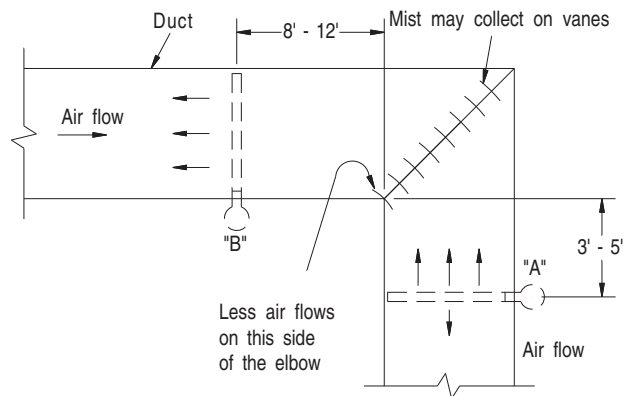
Location "A" is the first choice, assuming straight duct distance downstream of the humidifier is sufficient for absorption to take place. If nearby downstream inner-duct objects (dampers, turning vanes, etc.) are present, the use of a multiple tube should be considered, or another location selected.

Location "B" may be the next choice, assuming that steam absorption can be completed prior to entering the fan; otherwise, the fan may be damaged. If the required duct relative humidity design is high, due to coolness of the air, closely spaced multiple tubes may be required to accomplish rapid absorption in order to protect the fan.

Location "C" is a possibility. However, when and if the cooling coil is cold, it will condense some of the humidifying vapor.

Location "D" is a poorer location than "C" because the heating coil could eliminate the moisture. If heat is not required during all humidification periods, water could accumulate under the heating coils because they do not have drip pans below them. Moreover, the condensed vapor on coils represents a wasted humidification. Even more important is the fact that condensed water vapor can be very corrosive. Coils have been destroyed over time with condensed humidification vapor believed to be the cause. Location "E" would be an extremely poor choice because the filters would become saturated and/or covered with ice.

Figure 12-2: Example 2

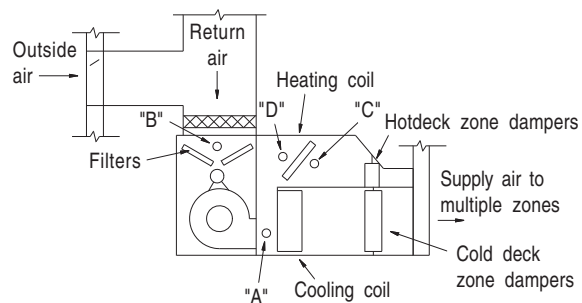


Example 2: Placement in an elbow

Because of possible wetting of turning vanes, the downstream side of an elbow (location "A") is a better choice than "B". In cases where it is structurally impossible to avoid location "B", a multiple tube design may be required at "B". Discharging against the airstream gives slightly better mixing than discharging with the airstream.

Since more air flow along the outside of a turn, better absorption will result if the humidifier discharges proportionately more steam in that part of the airstream.

Figure 12-3: Example 3



APPLICATION NOTES

Example 3: Placement in a multi-zone system

For reasons of economy, the objective when humidifying a multiple-zone system is to use a single humidifier rather than one for each zone. Applying a humidifier to this equipment is sometimes difficult because the system is so compact. It can usually be done, however, with satisfactory results.

Location "A" is generally the best. It affords the maximum absorption distance ahead of the zone dampers. Some loss of vapor may occur due to condensation on the cooling coil, but since there is a drain pan below the coil, no water will accumulate. In cases where the duct relative humidity exceeds 50 percent, multiple steam tubes should be used to shorten the absorption distance.

Location "B" is not acceptable because it will cause wetting of the filters and the fan. Location "C" is in a warmer location, but it is a shorter distance to the dampers than "A". The same is true for location "D".

Elevating the Condensate from a Steam Humidifier

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

Steam pressure

Theoretically, one pound of pressure will lift condensate about 2 feet. In practice, because of pipe friction, pressure drop through a steam trap, and back pressure in a return line, a maximum lift of six inches per pound of steam pressure at the trap is recommended. For example, a steam pressure of 5 psi will provide a maximum lift of 2-1/2 feet. Lifts in excess of 5 feet should not be attempted.

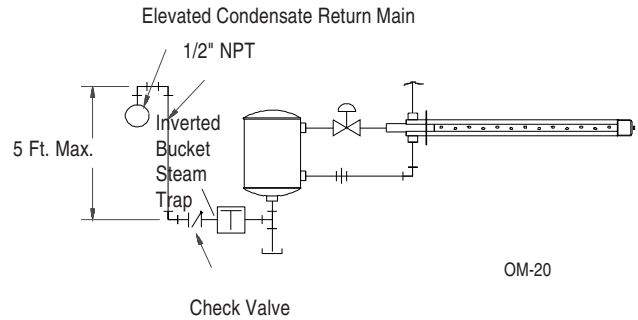
Steam trap

The steam trap should be an inverted bucket type. Float and thermostatic traps, are more prone to damage from water hammer often present in flooded trap condition found where condensate must be lifted.

Pipe size

The size of the vertical portion of the piping should be 1/2" NPT.

Figure 13-1: Elevating the condensate



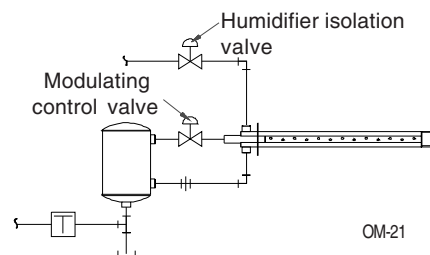
Check valve (swing type)

A low-pressure differential swing check valve should be installed, adjacent to the trap. This will prevent back-flow of condensate into the humidifier for periods of little or no steam pressure. Failure to do so could result in the accumulated back-flow discharging from the humidifier when pressure is resumed. (See Figure 13-1.) Spring type check valves are not recommended as they can reduce pressure available for condensate lifts.

Eliminating Excess Heat from Steam-Jacketed Humidifiers

In certain applications of steam jacketed humidifiers, the heat given off by the steam heated tube (not the sensible heat of the steam) may be undesirable. While relatively insignificant in a single tube unit (usually a rise of less than 2°F), it can be much greater in a closely-spaced, multiple-tube installation.

Figure 13-2: Single humidifying steam path



APPLICATION NOTES

Eliminating Excess Heat from Steam-Jacketed Humidifiers

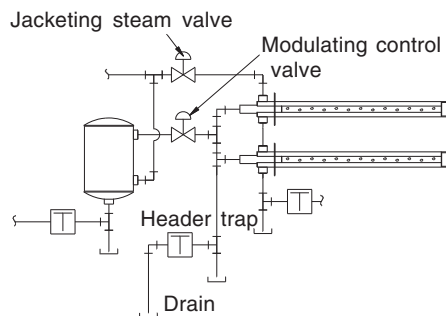
In certain applications of steam jacketed humidifiers, the heat given off by the steam heated tube (not the sensible heat of the steam) may be undesirable. While relatively insignificant in a single tube unit (usually a rise of less than 2°F), it can be much greater in a closely-spaced, multiple-tube installation.

This can be dealt with in several ways.

1. Manually turn off the steam supply valve during non-humidifying periods.
2. Insulate the tube exterior. (This will enlarge the tube profile, causing additional resistance to air flow.)
3. Provide an automatic shut-off valve for the jacketing circuit in addition to the modulating control valve. This will eliminate the heat gain during the "off" humidification periods only. (See Figures 13-2 on page 13 and 14-1 above.)
4. Figure 14-1, header trap is recommended when turning off jacket steam because the cooling of the tube may allow steam vapor to condense and accumulate.

In Figure 13-2, all of the steam (for jacketing *and* humidification) must pass through the jacketing steam valve, and it must do so with very little or no pressure drop across the valve. Otherwise, the maximum capacity will be reduced. More importantly, the temperature of the jacketing steam may drop below that required to eliminate dripping. Therefore, the valve must be amply sized. This is not significant in a small capacity humidifier. However, in a large capacity humidifier, the valve of the size required may be quite expensive.

Figure 14-1: Divided humidifying steam path



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Figure 14-1 shows a steam flow which has been divided into two paths: a humidifying steam path (which passes through the separator valve assembly), and a jacketing steam path.

To assure air removal and the presence of jacketing steam, it is necessary to provide a second steam trap for the jacketing circuit. However, the jacketing valve need only be of 1/2" NPT to pass sufficient jacket steam. In either case, but particularly as illustrated in Figure 13-2, the jacketing valve should be a two position type and be required to go to the full-open position prior to the opening of the modulating valve.

Note: To avoid metal fatigue, allow for thermal expansion of dispersion tube. Do not rigidly support dispersion tubes on both ends (allow one end to float).

MAINTENANCE

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. A "blowing" steam trap will be hot and noisy, and the discharge pipe from it will be hot for a continuous distance up to thirty feet. A properly operating steam trap will have about a two degree temperature drop measured across the trap from inlet to discharge.
3. **VALVE (Pneumatic):** Inspect annually to ensure that: (1) the valve closes off steam tight, (2) the stem packing is not leaking steam, and (3) the diaphragm in the actuator is not leaking air.
VALVE (Electric Modulating): Inspect annually to be sure that the valve operates freely, closes off steam tightly, and that the stem packing is not leaking.
4. **VALVE (Solenoid Type):** Inspect annually to verify proper functioning with steam tight shut off.
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 may require replacement if disturbed, since the TEFLON® can take a "set."
6. **O-RINGS (Dispersion Tube Adaptors):** Replace after two or three years of service.
7. **SEPARATOR:** No maintenance required.
8. **DISPERSION TUBE:** No maintenance required.

TROUBLE-SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
Humidifier Discharges Water in Duct	<ul style="list-style-type: none"> • Steam main overloaded with water due to boiler discharging water with steam (priming) or improper steam main dripping. • Steam trap not draining properly. • Steam pressure is too low (below 2 psi). • Condensate collecting at low, undripped points in steam main. • Steam jacketing of tube not up to proper temp. • Overloaded condensate return main. • Inadequate steam trap capacity. 	<ul style="list-style-type: none"> • Locate cause of priming and correct. • Replace trap, repair or clean as required. • Reduce back pressure of condensate return line. • Verify that steam shutoff valves are fully open. • Adjust pressure reducing valve. • Adjust boiler pressure. • Install drips and steam traps as required. • 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 too high, re-pipe. • Dispersion tube not level, reposition. • Replace with larger piping or pipe condensate to floor drain. • Replace orifices as necessary. • Replace with larger trap.
Humidifier Leaks Water	<ul style="list-style-type: none"> • Defective o-rings on tube adaptor. • Steam leak in outer jacket of dispersion tube. 	<ul style="list-style-type: none"> • Replace O-rings. • Repair leak, or replace tube. Note: Check installation to insure tubes are not rigidly anchored in place. Tubes must be allowed to flex in response to thermal expansion.
Humidity Exceeds Setting of Humidistat	<ul style="list-style-type: none"> • Automatic valve not fully closing. • Control system malfunctioning. • Leak in steam piping inside duct. 	<ul style="list-style-type: none"> • Foreign matter holding valve open, clean valve, check line strainer. • Valve spring broken, replace spring. • Valve stem packing 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 installed backwards, remount. • Adjust valve linkage. • Incorrect control voltage. • Incorrect control signal. • Improper wiring. • Incorrect humidity sensor. • Humidity controller out of calibration. • Repair leak.

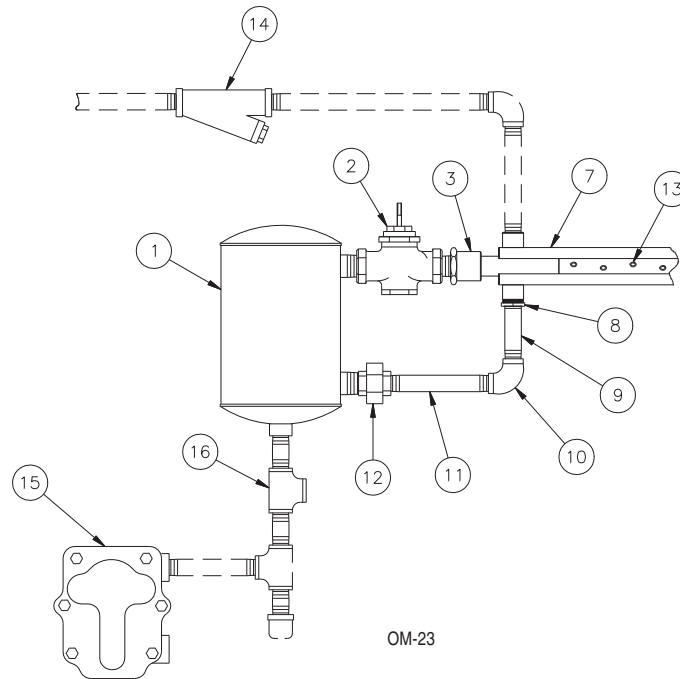
TROUBLE-SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
Hunting - Humidity Swings Above and Below Desired Set Point	<ul style="list-style-type: none"> • Control system malfunctioning. • Automatic valve is hunting. 	<ul style="list-style-type: none"> • Faulty or inaccurate humidity controller, calibrate or replace. • Poor location of control components, relocate. • Incompatible control components, change component(s). • Humidifier is oversized, change to 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	<ul style="list-style-type: none"> • Excessive outside air volume. • Steam pressure is too low. • Humidifier is undersized. • Automatic steam valve is not opening fully. • Control system is malfunctioning. • Foreign matter preventing valve from opening. • Excessive outside air volume. 	<ul style="list-style-type: none"> • Check fans, dampers, VAV, etc. • 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. • Replace valve with larger capacity valve. • Replace with larger humidifier. • Add additional humidifier. • Valve packing is adjusted too tightly, loosen and /or replace packing. • Adjust valve linkage. • Check pilot positioner settings. ELECTRIC • Incorrect control circuit voltage, change transformer. • Incorrect control signal, replace component(s) to make all components compatible. • Improperly wired. • Incorrect humidity sensor (Barber-Colman units only). Replace. • Humidity controller out of calibration or malfunctioning, repair or replace. • Malfunctioning humidifier temperature switch not allowing humidifier valve to open. Replace or readjust. PNEUMATIC • Humidity controller out of calibration or malfunctioning, repair or replace. • Obstructed air line-clean. • Malfunctioning pneumatic temperature switch, replace. • Air leak in actuator, repair or replace. • Compressed air pressure is too low, adjust. • Clean or replace valve.

TROUBLE-SHOOTING GUIDE

PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
Condensate in Duct	<ul style="list-style-type: none"> • Humidifier is mounted too close to internal devices (dampers, turning vanes, etc.) in duct. • Non-insulated duct passing through unheated area (duct surface temp. too low). • Air cannot absorb steam quantity being discharged. • Steam pressure is too high causing an excess of capacity. 	<ul style="list-style-type: none"> • Check fan, dampers VAV etc. • Move humidifier tubes to a point further upstream of internal devices. • Add dispersion tubes for shorter absorption distance. Consult DRI-STEEM to determine the total number of tubes required. • Insulate ductwork. • Humidifier operates when blower is off. Provide air flow proving switch. • Valve is "hunting" (See previous page: Automatic Valve is Hunting). • Air temperature in duct is too low for steam quantity being supplied. • CFM of air in duct is too low for steam quantity being supplied. • Reduce pressure
Humidifier is Noisy	<ul style="list-style-type: none"> • Tube silencer missing. (Furnished on size 60 tubes four feet and under). • Dispersion tube output excessively high. 	<ul style="list-style-type: none"> • Install silencer. • Install additional tubes.

REPLACEMENT PARTS



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Table 18-1: Single-Tube and Multiple-Tube

No.	Description	Qty.	Part No.	Model
1	Separator, 5 - ½" Vertical	0-1	162520-001	½" Valve 5-60
1	Separator, 6 - ½" Vertical	0-1	162540-001	½" Valve 6-60
1	Separator, 6 - ¾" Vertical	0-1	162540-002	¾" Valve 6-70
1	Separator, 7 - ½" Vertical	0-1	162560-001	½" Valve 7-70
1	Separator, 7 - ¾" Vertical	0-1	162560-002	¾" Valve 7-70
1	Separator, 7 - 1" Vertical	0-1	162560-003	1" Valve 7-70
1	Separator, 8 - ¾" Vertical	0-1	162570-001	¾" Valve 8-80
1	Separator, 8 - 1" Vertical	0-1	162570-002	1" Valve 8-80
1	Separator, 8 - 1¼" Vertical	0-1	162570-003	1¼" Valve 8-80
1	Separator, 8 - 1½" Vertical	0-1	162570-004	1½" Valve 8-80
2	Valve (Refer to specific order)			
3	Tube Adapter, ½" NPT X 1"	0-1	167080	½" Valve 5-60,6-70,7-70
3	Tube Adapter, ¾" NPT X 1"	0-1	167085	¾" Valve 6-70,7-70
3	Tube Adapter, ¾" NPT X 1½"	0	167090	¾" Valve 8-80
3	Tube Adapter, 1" NPT X 1"	0	167095	1" Valve 7-70
3	Tube Adapter, 1" NPT X 1½"	0-1	167100	¾" Valve 8-80
3	Tube Adapter, 1-¼" NPT X 1½"	0-1	167077-125	1¼" Valve 8-80
3	Tube Adapter, 1-½" NPT X 1½"	0-1	167105	1½" Valve 8-80
4	60-70 O-rings #120 (not shown)	0-1	300400-075	All 5-60,6-70,7-70
4	80 O-rings #128 (not shown)	0-1	300400-006	All 8-80
*5	SST Silencer Holder (not shown)	0-1	183100	All 5-60,6-70, 7-70
*6	Med. gr. SST Wool (not shown)	0-1	300210	All 5-60,6-70, 7-70
7	Model 60 Tube	0-1	161000	½" Valve 5-60
7	Model 70 Tube	0-1	161500	All 6-70, 7-70
7	Model 80 Tube	0-1	161750	All 8-80
8	Seal Ring ½" - 14 NPT	0-1	306360-001	½" Valve 5-60
8	Seal Ring ¾" - 14 NPT	0-1	306360-002	All 6-70, 7-70

No.	Description	Qty.	Part No.	Model
8	Seal Ring, 1-½" -11½" NPT	0-1	306360-003	All 8-80
9	Nipple - blk, ½" x 3-½"	0-1	201000-0069	½" Valve 5-60
9	Nipple - blk, ¾" x 3"	0-1	201200-005	All 6-70, 7-70
9	Nipple - blk, 1-½" x 3-½"	0-1	202200-003	All 8-80
10	Elbow - blk, ½" 90°	0-1	201000-010	½" Valve 5-60
10	Elbow - blk, ¾" 90°	0-1	201200-014	All 6-70, 7-70
10	Elbow - blk, 1-½" 90°	0-1	202200-008	All 8-80
11	Nipple - blk, ½"	0-1	201000	½" Valve 5-60
11	Nipple - blk, ¾"	0-1	201200	All 6-70, 7-70
11	Nipple - blk, 1-½"	0-1	202200	All 8-80
12	Union - blk, ½"	0-1	201000-015	½" Valve 5-60
12	Union - blk, ¾"	0-1	201200-020	All 6-70, 7-70
12	Union - blk, 1-½"	0-1	202200-009	All 8-80
13	Tube Insert, 60-70	0	310280	All 5-60, 6-70, 7-70
13	Tube Insert, 80	0	310290	All 8-80
14	Y-Strainer, ½"	0-1	300100-001	
14	Y-Strainer, ¾"	0-1	300100-002	
14	Y-Strainer, 1"	0-1	300100-003	Specify size per job
14	Y-Strainer, 1-½"	0-1	300100-005	
14	Y-Strainer, 2"	0-1	300100-006	
14	Y-Strainer, 2-½"	0-1	300100-007	
15	Steam Trap, F&T	0-1	300000	Less than 15 psi
15	Bucket Trap, Inverted	0-1	300010	Greater than 15 psi
16	Temperature Switch, Electric		400260-001	
16	Temperature Switch, Pneumatic		307076	

* Only used in 60/70 tubes four feet or shorter.

Notes:

1. Specify size of orifice bore in insert.
2. Specify length of tube.

REPLACEMENT PARTS

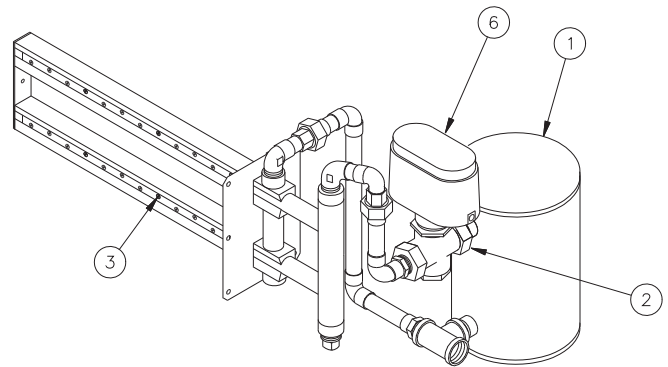
Table 19-1: MINI-BANK

No.	Description	Qty.	Part No.
1	5" Separator Weld	1	162520
2	Valve, ½" Pneumatic with Operator	1	510060
2	Valve, ½" Electric	1	510030
3	Orifice, Brass	*	203450
4	Trap, F & T (not shown)**	2	300000
5	Y-Strainer ½", (not shown)**	1	300100-001
6	Valve Operator, Electric	1	500760

* Varies with each order

** Shipped loose

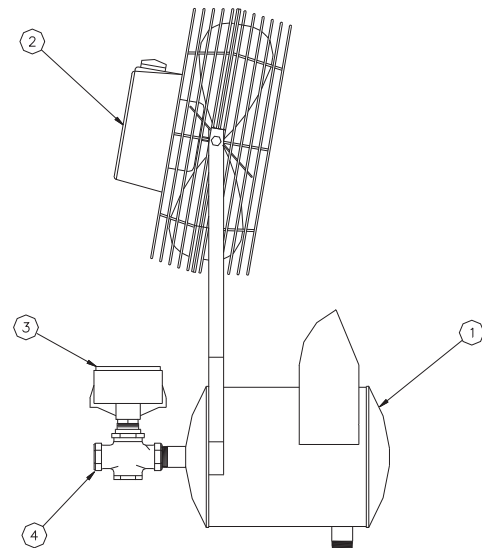
Note: 18"-24" tube length/restrict orifice, 1 at each end
24"-48" tube length/restrict orifice, 2 at each end



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Table 19-2: Area-Type Electric Fan

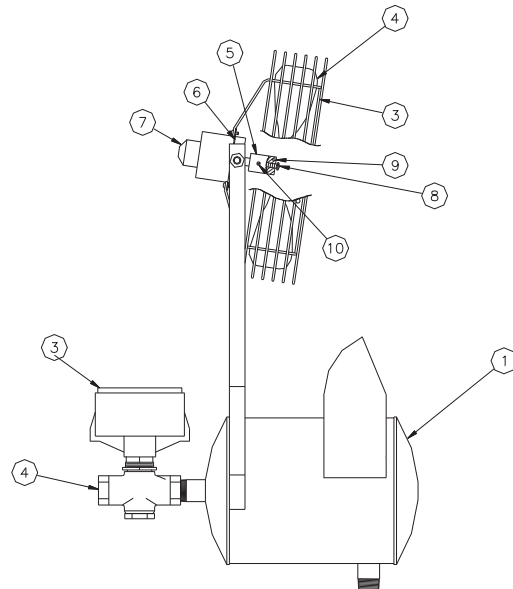
No.	Description	Qty.	Part No.
1	Separator (with ¾" NPT Supply)	1	162660-075
2	Fan, Three-Speed	1	400010
3	Valve Operator, Electric	1	500760
4	Valve, ½" NPT Pneumatic with Operator	1	510060
4	Valve, ¾" NPT Pneumatic with Operator	1	510061
4	Valve, 1" NPT Pneumatic with Operator	1	510063
4	Valve, ½" NPT Electric	1	510030
4	Valve, ¾" NPT Electric	1	510031
4	Valve, 1" NPT Electric	1	510032



DC-6M

Table 19-3: Area-Type Pneumatic Fan

No.	Description	Qty.	Part No.
1	Separator (with ¾" NPT Supply)	1	162660-075
2	Fan Guard	1	306370
3	Valve Operator, Electric	1	500760
4	Valve, ½" NPT Pneumatic with Operator	1	510060
4	Valve, ¾" NPT Pneumatic with Operator	1	510061
4	Valve, 1" NPT Pneumatic with Operator	1	510063
4	Valve, ½" NPT Electric	1	510030
4	Valve, ¾" NPT Electric	1	510031
4	Valve, 1" NPT Electric	1	510032
5	Bracket, Pneumatic Fan Blade	1	123660
6	Screw, 1/4" -20 x 3/8" Rd Hd	1	700300-009
7	Roll Pin, 1/8" dia x 1/4"	1	700710
8	Fan Blade, Aluminium	1	306380
9	Plate Weld, Fan Mounting	1	164570
10	Fan Motor, Pneumatic	1	307030-001



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MAINTENANCE SERVICE RECORD

DATE INSPECTED	PERSONNEL	OBSERVATION	ACTION PERFORMED

NOTES

TWO-YEAR LIMITED WARRANTY

DRI-STEEM Humidifier Company ("DRI-STEEM") 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 DRI-STEEM ships such product, whichever date is the earlier.

If any DRI-STEEM product is found to be defective in material or workmanship during the applicable warranty period, DRI-STEEM'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 DRI-STEEM's election. DRI-STEEM shall not be liable for any costs or expenses, whether direct or indirect, associated with the installation, removal or re-installation of any defective product.

DRI-STEEM's limited warranty shall not be effective or actionable unless there is compliance with all installation and operating instructions furnished by DRI-STEEM, or if the products have been modified or altered without the written consent of DRI-STEEM, or if such products have been subject to accident, misuse, mishandling, tampering, negligence or improper maintenance. Any warranty claim must be submitted to DRI-STEEM in writing within the stated warranty period.

DRI-STEEM's limited warranty is made in lieu of, and DRI-STEEM 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.

DRI-STEEM 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 DRI-STEEM has notice of the possibility of such damages.

By purchasing DRI-STEEM's products, the purchaser agrees to the terms and conditions of this limited warranty.

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