

READ AND SAVE THESE INSTRUCTIONS

DRI-STEEM[®]

STEAM INJECTION HUMIDIFIERS

**For Applications
With a Steam Boiler**

**Installation Instructions
and
Maintenance Operations
Manual**

DRI-STEEM[®]
HUMIDIFIER COMPANY

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TO THE PURCHASER AND THE INSTALLER

Thank you for deciding to purchase DRI-STEEM equipment. We have applied our best efforts to design and build this equipment to give you total satisfaction and many years of trouble free service. Avoiding certain pitfalls during installation and observing proper operating practices thereafter will assure you of achieving that objective. We therefore respectfully urge you to familiarize yourself with the contents of this bulletin.

DRI-STEEM Humidifier Company

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INSTALLATION

Placement of the Humidifier Within a System

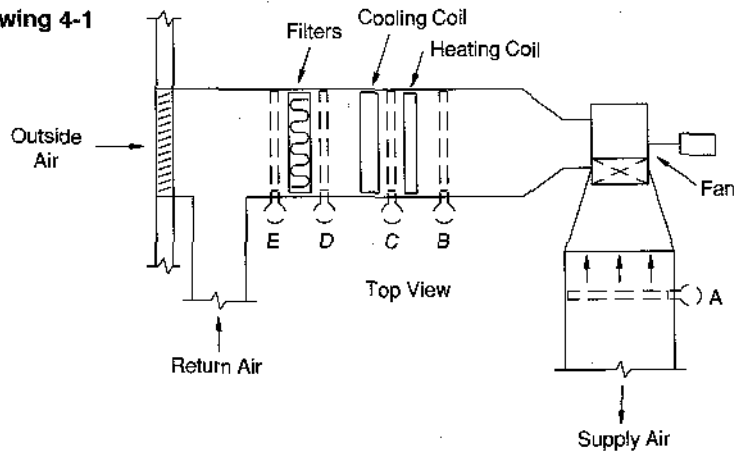
Usually, there is no *single* right or wrong placement for a humidifier. Much depends on the system design, its uses and its applications. However, the following are presented as practical alternatives to some of the most common situations.

Example 1: Placement in an Air Handling Unit

Location "A" is the first choice, assuming there is sufficient straight duct distance downstream of the humidifier for absorption to take place. If nearby downstream inner-duct objects (dampers, turning vanes, etc.) are present, the use of a "rapid absorption" design 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. Furthermore, wetted areas are potential producers of algae and/or bacterial. If the required duct relative humidity design

Drawing 4-1



OM-16

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. With certain humidifier designs, it is possible to complete absorption within a steam travel distance of 24 inches.

Location "C" is a possibility. However, when and if the heating coil is cold, it will condense some of the humidifying vapor. In the absence of a drain pan or waterproof floor, this may not be acceptable. If the coil is *always* heated during the humidifying season, it offers more absorption distance to protect the fan and would be a better location than "B".

Location "D" is a poorer location than "C" because the cooling coil will act as a moisture eliminator. Cooling coils have drain pans below them so water accumulation is not a danger. However, the condensed vapor represents a waste. Sometimes, even more important, is the fact that condensed water vapor can be very corrosive. There are cases on record where cooling coils have been destroyed, over time, with condensed humidification vapor felt to be the cause.

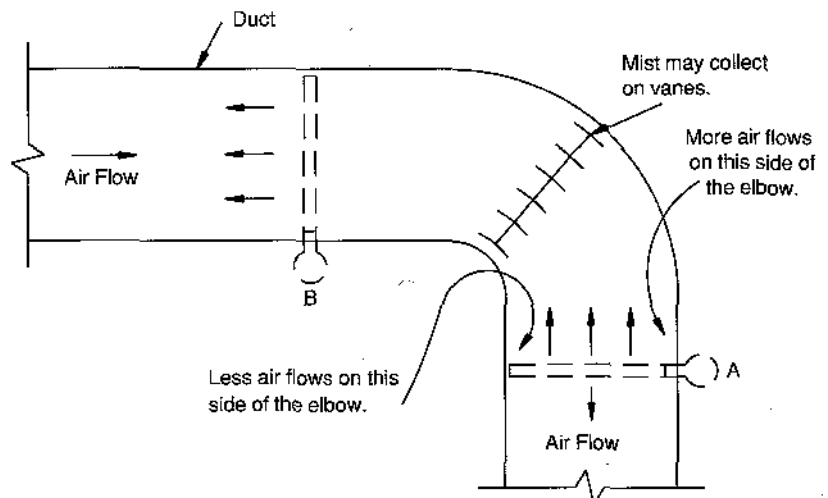
Location "E" would be an extremely poor choice because the filters would become saturated and/or covered with ice.

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 "rapid absorption" design may be required at "B". Discharging *against* the air stream gives slightly better mixing than discharging *with* the air stream.

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

Drawing 4-2



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INSTALLATION

Example 3: Placement in a Dual Duct System

In numerous cases, dual duct systems have been designed with a single humidifier installed in the hot deck. The results have not been successful. Those zones having a low heat loss are supplied predominantly with non-humidified, cool air and become short of moisture.

In this type of system, the hot and cold deck air temperatures usually are constant, and temperature control in each zone is accomplished at the zone mixing box in the space, by varying the ratio of hot vs. cold air.

As the heating-cooling load within the building changes, the ratio of the volumes of hot and cold air in the two decks swings along with it. Neither single location, hot deck or cold deck, will be satisfactory at all times for the

addition of humidity.

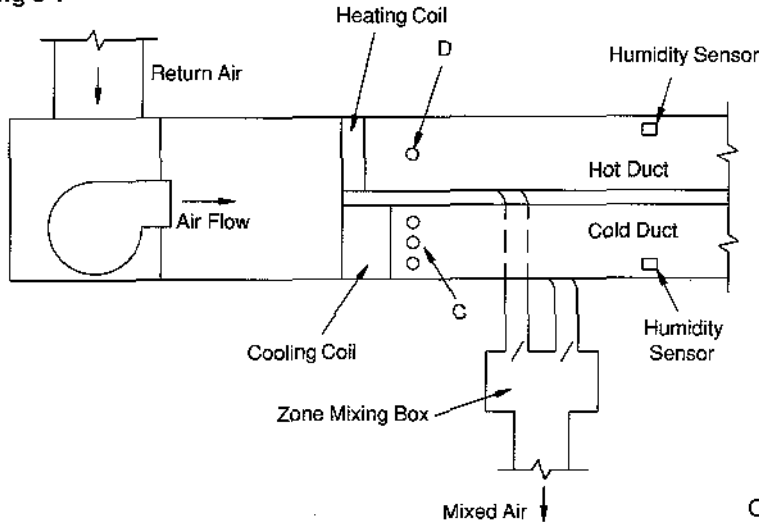
It is usually necessary, therefore, to treat each of the two decks separately, i.e., each with its own humidifier and sensing device (humidistat).

Usually each of the two humidifiers is selected for the total building humidification load. In other words, if the total load is 400 pounds per hour, *each* humidifier would have a capacity of 400 pounds per hour. This is done to assure adequate humidifier capacity at times of 100% hot deck air and vice versa. Special attention should be given to the steam absorption distance, particularly in the cold deck.

The downstream humidistat in each duct must be set for the room or space *duct equivalent* relative humidity. For example, in a system where the cold duct temperature is a constant 55°F, and the desired space conditions are 72°F and 45% RH, the duct humidistat must be set to control at 80% RH.

The humidistat must be far enough downstream to escape the moisture "cloud" in order to control accurately.

Drawing 5-1



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Example 4: Placement in a Multi-Zone System

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

Location "B" is not acceptable because it will cause wetting of the filters and the fan.

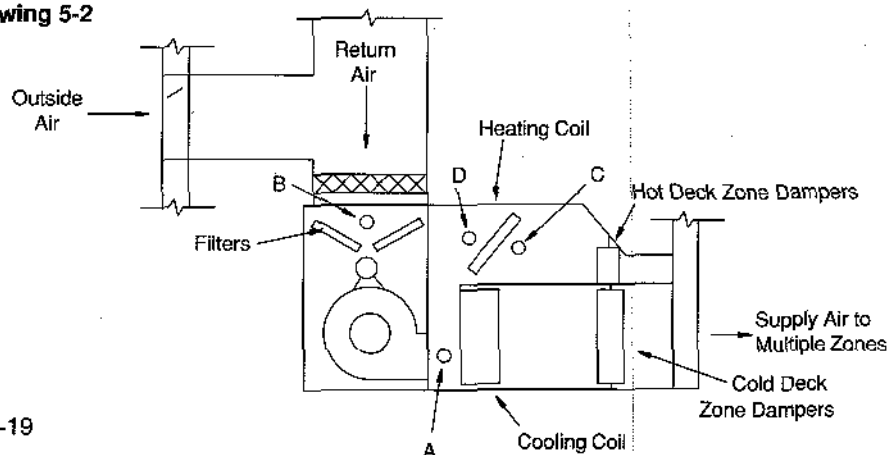
In some applications, the air quantity of one of the zones will be larger and may be sufficient to absorb all of the humidity required for all of the zones. This is easily checked by the use of Table 1-16,

page 16 of the DRI-STEEM catalog. If such is the case, that particular zone may be a more desirable location for adding humidity than within the air handling unit itself. While it is true that a differential in relative humidity between zones will exist for a period of time after start-up, it will eventually equalize as the system is operated.

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 damage will occur. In cases where the *duct* relative humidity exceeds 50%, multiple steam tubes should be used to shorten the absorption distance.

Location "C" is in a warmer location, but is a shorter distance to the dampers than "A". The same is true for location "D".

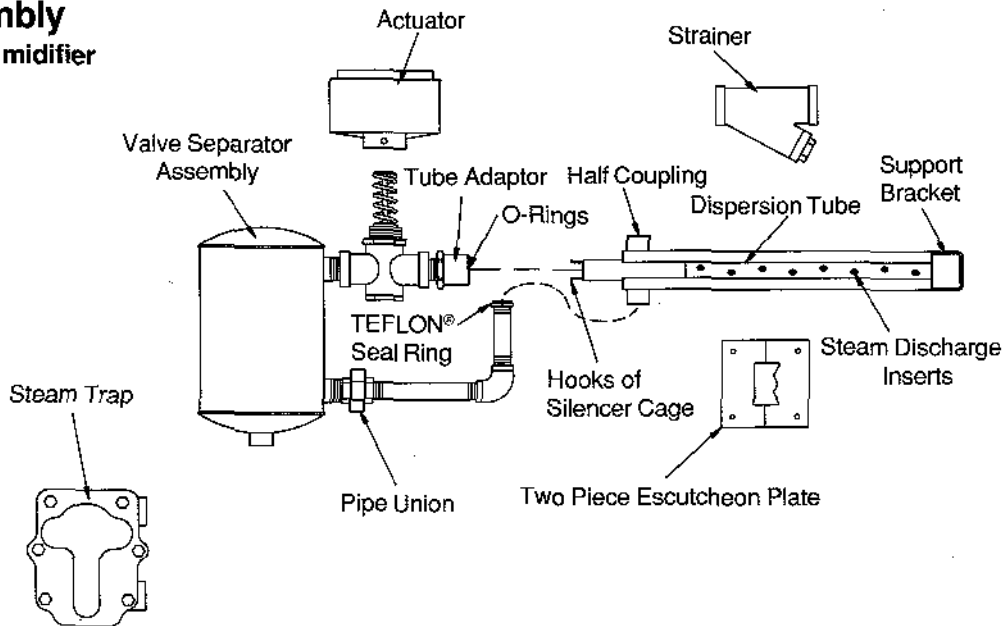
Drawing 5-2



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SINGLE TUBE HUMIDIFIER

Field Assembly Single Tube Humidifier



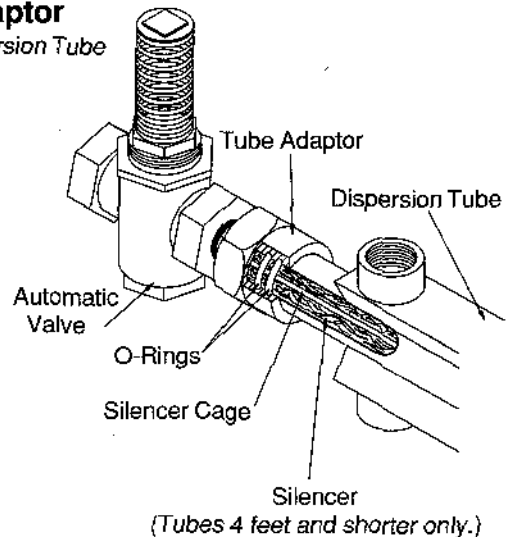
OM-7

Small units are shipped assembled - the following applies to larger units which 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).
3. Unscrew union ring, 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. (Refer to pg. 7)
4. Insert tube adaptor into dispersion tube (lubricate O-Rings). As this is being done squeeze hooks of silencer cage, (see note below), together and start them into the tube adaptor allowing them to snap over rear edge of adaptor -then complete pushing adaptor into tube, being careful to avoid damaging O-Rings.
5. Bring union halves together, tighten union ring, snug up TEFLON® seal ring (not too tight) and unit is ready to be installed in duct.
6. Install a support bolt in one of the three holes (upper, lower or end) of support bracket, cut holes in duct for insertion of dispersion tube and support bolt.
7. Secure unit in duct with nut and support bolt. Mount 2-piece escutcheon plate around tube and secure with sheet metal screws into duct. Where total air tightness is required seal around tube and bolt with suitable caulking.
8. Install steam strainer and steam trap. Connect to steam and condensate return mains. See pg. 8 for piping and installation notes.
9. Install control tubing (pneumatic) or wiring (electric) to valve actuator. Note: An air flow proving device (to prevent valve from opening unless air is moving in duct) should be installed.)

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

Tube Adaptor Single Dispersion Tube



OM-14

Installation of Tube Adaptor

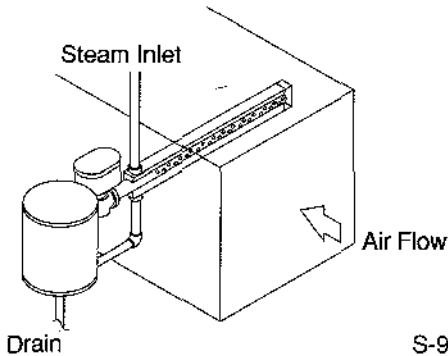
1. Install tube adaptor in valve, use pipe dope and tighten leak-tight.
2. Install O-rings in internal grooves of tube adaptor. NOTE: Lubricate O-rings before installing.
3. Insert silencer cage into adaptor and allow hooks to snap over rear edge of adaptor.
4. Slide tube over silencer into adaptor and O-rings, being careful not to damage O-rings.

IMPORTANT: In January of 1990 we redesigned our tube adaptors so that both single tube humidifiers and multiple tube humidifiers are able to use the same tube adaptor. When ordering replacement O-rings the adaptor must be identified by the tube size (60, 70, 80) and where the seal is being made, i.e. outside or inside of dispersion tube.

SINGLE TUBE HUMIDIFIER

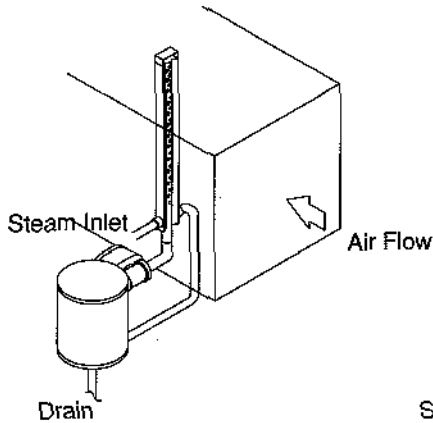
Configurations

Single Tube Humidifiers



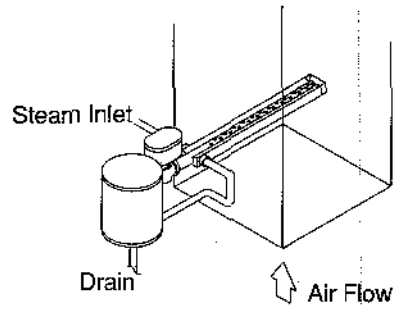
S-9

Right-Hand Configuration - Horizontal tube and horizontal steam discharge. This arrangement comprises the majority of uses. If not ordered otherwise, this is how units are shipped. Unit shown above is right-hand, to change, refer to changing from right to left on the bottom of this page.



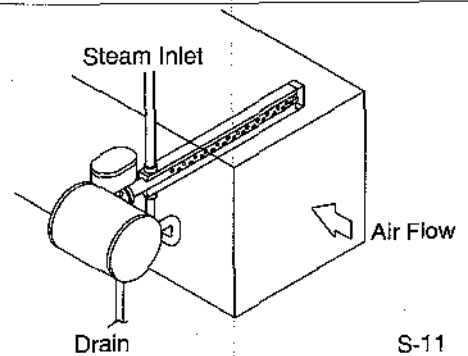
S-12

Vertical Tube - Used when there is no access to side of duct. Absorption of the steam will be improved if duct is tall and narrow rather than shallow and wide.



S-10

Vertical Discharge - Used in vertical ducts. To eliminate cold start dripping, inserts should always point up regardless of air flow direction (up or down).



S-11

Horizontal Separator - Used where height is at a premium (above ceilings etc.). Turning the separator on its side saves about 4 inches of height.

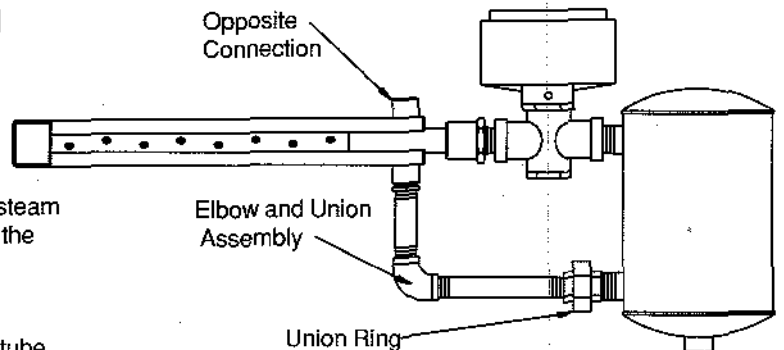
NOTE: All of the above variations are done by simply substituting pipe nipples of different lengths and in some cases, adding ells and nipples (Except for Fig. 4 needs horizontal type separator.)

NOTE: Steam should discharge against the air flow. Except when insulated. Insulated tubes should discharge with the air stream to prevent possible condensation on the metal jacket covering the insulation.

Changing From Right-Hand to Left-Hand Configuration

For various reasons it may be necessary to change the steam discharge direction to the opposite side of that for which the humidifier was ordered. Simply 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. Re-connect union halves and tighten union ring.
5. Humidifier now will discharge to opposite side.

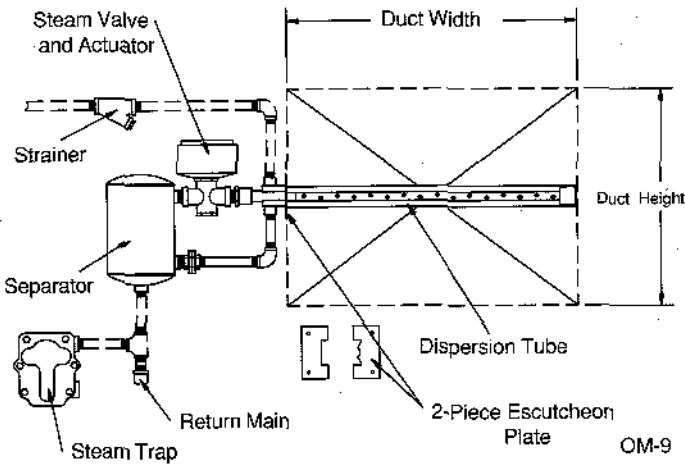


OM-8

SINGLE TUBE HUMIDIFIER

Piping and Installation

Single Tube Humidifiers

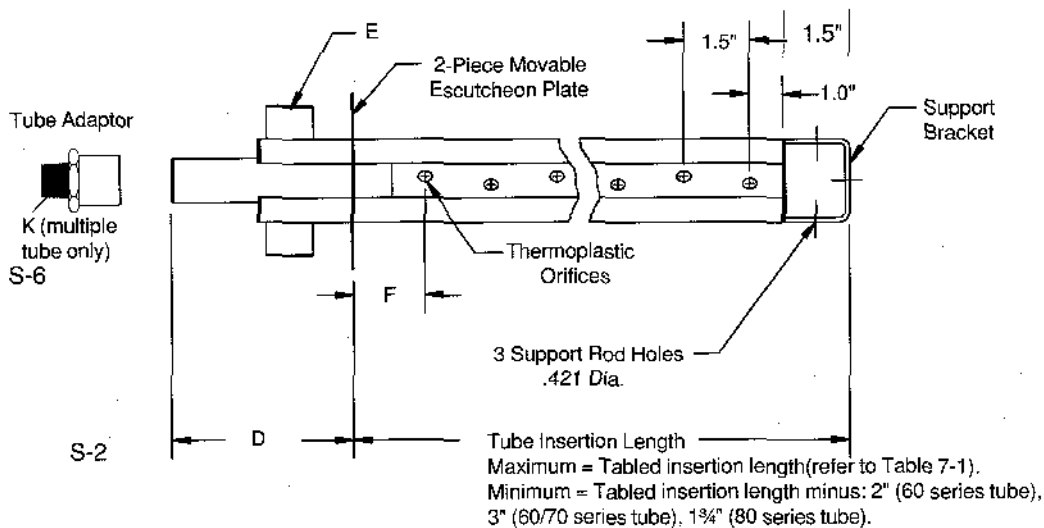


1. Humidifier steam supply should be taken off the top of the steam main. (instead of side or bottom) to ensure driest steam. Main should be dripped and trapped.
2. Humidifier steam trap must drain by gravity to return main having little or no back pressure. If condensate can't drain by gravity (must be elevated to return main) see pg. 14.
3. Air flow proving switch is recommended to prevent valve from opening unless air is moving in duct.
4. High limit (duct mounted) humidistat 15 feet or more downstream and set at 80-90% is recommended when duct air is below 70°F to prevent condensation in duct.
5. Steam thermoplastic inserts should point towards air stream for better steam-air mixing except if tubes have insulated jacket option (steam could condense on cool jacket).
6. *Temperature warm-up switch (to prevent possible cold start dripping)* is recommended when steam pressure is to be dropped to zero periodically. See page 13 for instructions.

NOTE: All dotted line piping by contractor.

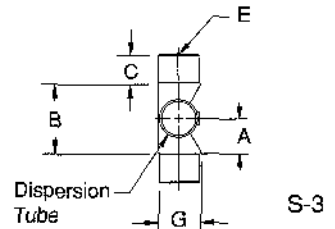
Mechanical Specifications

Dispersion Tube - Single and Multiple Tube Humidifiers



Section Through Tube

Non-Insulated



Insulated

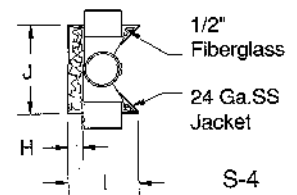


TABLE 7-1: Dispersion Tube Dimensions In Inches/(mm).

Tube No.	A	B	C	D	E	F	G	H	I	J	K	Tube Shipping Weight	
												Wt./Ft of Tube Lbs.	Kg
60	15/16" (23.8)	1-7/8" (47.6)	13/16" (20.6)	3-3/4" (95.2)	1/2" (12.7)	5" (50.8)	1-1/8" (28.6)	1/2" (12.7)	1-15/16" (49.2)	2-7/8" (73.03)	3/4" (19.1)	1.5	.68
70	1-3/8" (34.9)	2-3/4" (69.8)	13/16" (20.6)	4" (102)	3/4" (19.1)	5" (50.8)	1-7/8" (47.6)	1/2" (12.7)	2-5/8" (66.7)	3-3/4" (95.2)	3/4" (19.1)	2	.9
80	1-1/2" (38.1)	3" (76.2)	1-1/16" (27.0)	5-1/2" (140)	1-1/2" (38.1)	2" (50.8)	2-5/8" (66.7)	1/2" (12.7)	3-3/8" (96.7)	4" (101.7)	1-1/2" (38.1)	3	1.4

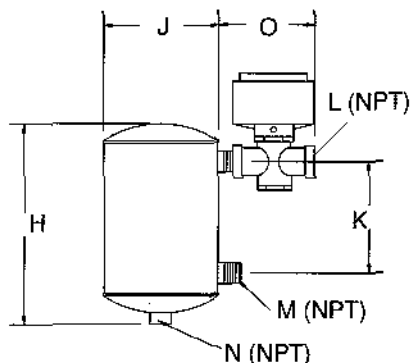
* 1" (25 mm) on 6" tube, 3" (75 mm) on 112" tube, before 4-91, 60/70 series tubes were 2" (50.8 mm).

Table 7-2: Standard Dispersion Tube Lengths in Inches (cm) - (For lengths other than shown consult factory.)

Tube No.	6 (15)	12 (30)	18 (46)	24 (61)	30 (76)	36 (91)	48 (122)	60 (152)	72 (183)	84 (213)	96 (244)	108 (274)	120 (305)	132 (335)	144 (366)
60	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
70			X	X	X	X	X	X	X	X	X	X	X	X	X
80						X	X	X	X	X	X	X	X	X	X

SINGLE AND MULTIPLE TUBE HUMIDIFIER

Separator



OM-10

TABLE 8-1: Separator Dimensions In Inches (mm).

Separator Size	H	J	K	L	M	N	O*	Shipping Wt.**	
								Lbs.	Kg.
5	9-1/2 (24.1)	5 (12.7)	5-1/4 (13.3)	1/2	Varies with valve size per manufacturer	3/4	4-1/2 (11.4)	19	8.6
6	10-1/2 (26.7)	6 (15.2)	5-1/2 (14.0)	3/4		3/4	6 (15.2)	21	9.5
7	11-1/2 (29.2)	7 (17.8)	6 (15.2)	3/4		3/4	7 (17.8)	24	10.9
8	13-1/4 (33.7)	8 (20.3)	7 (17.8)	1-1/4		3/4	8 (20.3)	43	19.5
9	14-1/2 (36.8)	9 (22.9)	7 (17.8)	2		3/4	9 (22.9)	52	23.5

*Standard pneumatic control valve

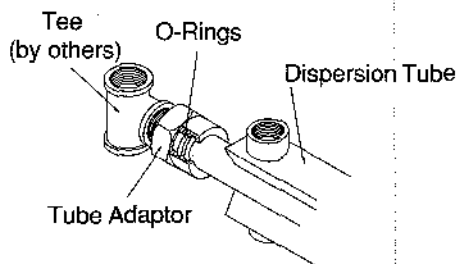
**Includes control valve, drain traps and strainer

Multiple-Tube Humidifiers 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, the following procedure is *usually* done. Assume you have five tubes to be installed in a 90" high airstream. Divide the 90" by 6=15", provide a full space 15" at the top and bottom and four spaces between tubes of 15" each. See sketch on page 9. Arrange tubes so steam will blow *against* the air unless tubes are factory insulated (option) in which case they should blow *with* the air to prevent possible condensation on metal jacket covering insulation.
3. Assemble the header based on the spacings determined in step 2. If the header pipe size has not been specified you may use Table 9-1 for this purpose. Table 9-1 is based on a maximum steam velocity of 7 to 10,000 feet per minute which is conservative and will produce low noise levels and uniform steam flow from tube to tube. If noise level is not important or if uniformity of flow is not critical, smaller header piping which will result in higher velocities may be used.
4. Install the tube adaptor fittings in the header. (See illustration in next column.) It usually works best to lay the header on the floor along with the tubes for steps 5, 6 and 7.
5. Install the tubes in the adapter fittings making sure the thermoplastic inserts are pointing in the proper direction.
6. Cut to length, thread and install the steam jacket piping.
7. Make the tube support strut using angle or channel iron and bolt each tube end in place.
8. Mount the tube bank in the duct or air handler and complete the steam and condensate piping.

Tube Adaptor - Multiple-Tube Humidifiers

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



OM-15

Installation

1. Install male pipe thread end of tube adaptor into pipe fitting. Dope threads and tighten leak tight.
2. O-rings are installed inside of tube adaptor. Note: Lubricate O-rings before installing.
3. Slide tube into adaptor being careful not to cut the O-rings when inserting tube.

IMPORTANT: In January of 1990 we redesigned our tube adaptors so that both single tube humidifiers and multiple tube humidifiers are able to use the same tube adaptor. When ordering replacement o-rings the adaptor must be identified by the tube size (60, 70, 80) and where the O-ring is installed, i.e. outside or inside of brass tube adaptor fitting.

MULTIPLE-TUBE HUMIDIFIERS

Figure 1

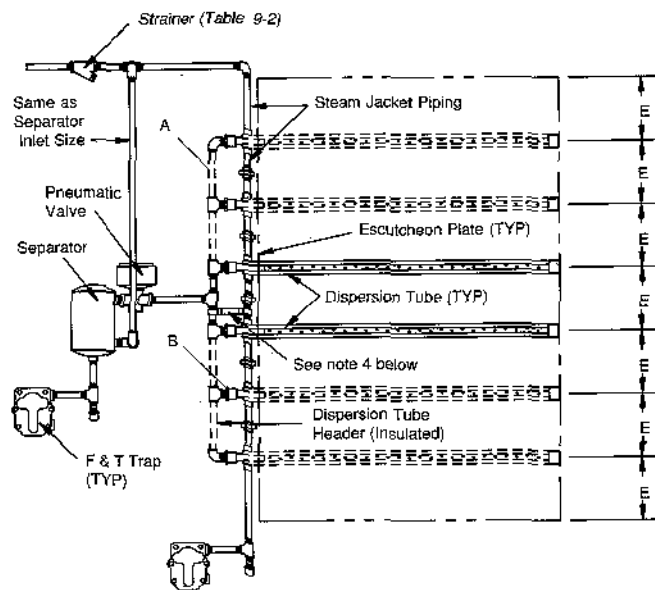
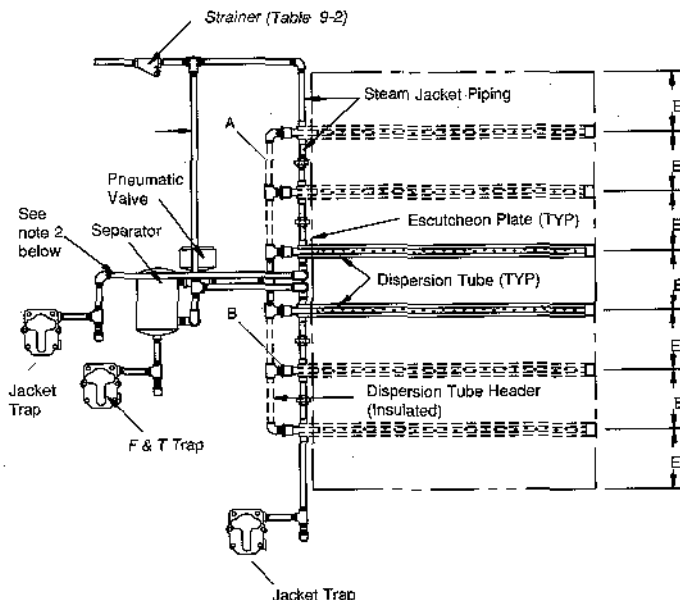


Figure 2



For B: Size 60 and 70 tubes = 3/4"
Size 80 tubes = 1 1/2"

Note 1: All piping done by contractor.

Note 2: When the total tube length exceeds 45 feet, (ex: six 8'0" tubes = 48 feet), two jacket traps should be used as in Fig. 2.

Note 3: To ensure uniform output from each tube, connect steam supply as near the middle of the header as possible.

Note 4: After the unit is installed, the steam jacket piping should be secured to the tube header piping to eliminate the possible separation of the two.

TABLE 9-1: Header Sizing

Total Capacity lbs/hr	A (Header)
Up to 140	1 1/4"
141 to 280	1 1/2"
281 to 490	2"
491 to 700	2 1/2"
701 to 980	3"
981 to 1323	3 1/2"
1324 to 1743	4"
1744 to 2752	5"
2753 to 3989	6"

TABLE 9-2: Steam Load (lbs/hr) for Strainer Sizing

Entering PSI	Strainer Size						
	3/4"	1"	1 1/2"	2"	2 1/2"	3"	4"
2	60	110	270	450	660	1070	1690
5	96	155	370	525	900	1420	2550
10	120	190	450	760	1100	1800	3000
15	137	230	540	900	1320	2060	3600
20	160	260	625	1150	1550	2310	4100
25	180	300	720	1200	1750	2690	4720
30	200	340	790	1350	2000	3120	5500
35	220	360	860	1450	2200	3500	6300
40	245	400	960	1620	2350	3700	6550
50	290	470	1100	1800	2500	4000	7100

MAXI-BANK® HUMIDIFIERS

Figure 1

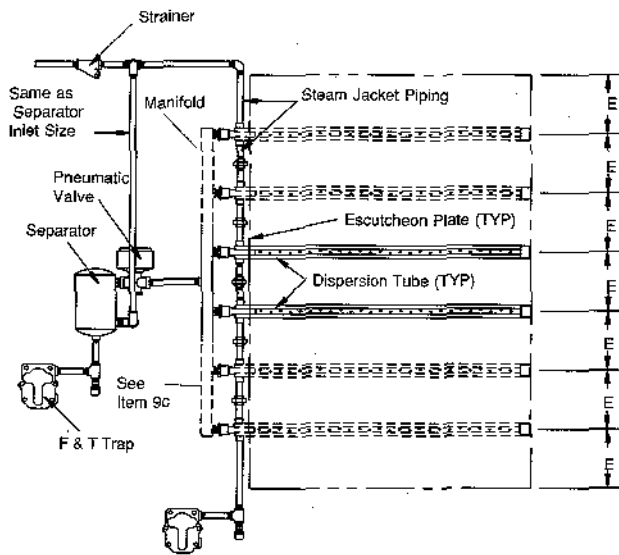
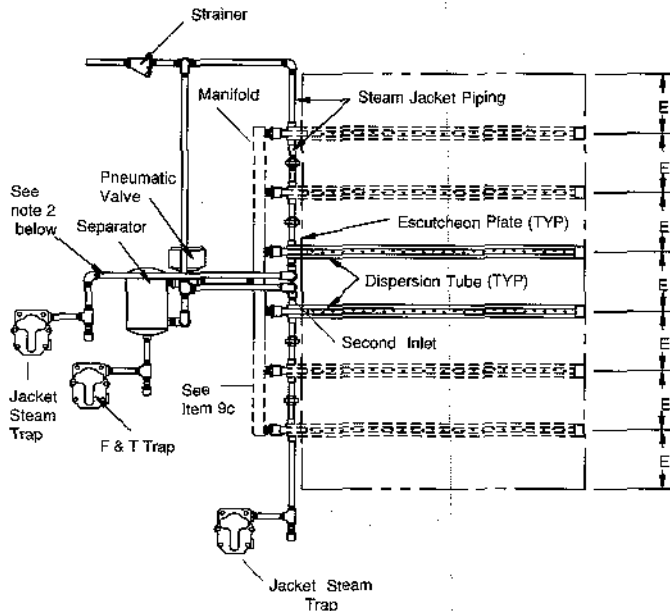


Figure 2



Installation

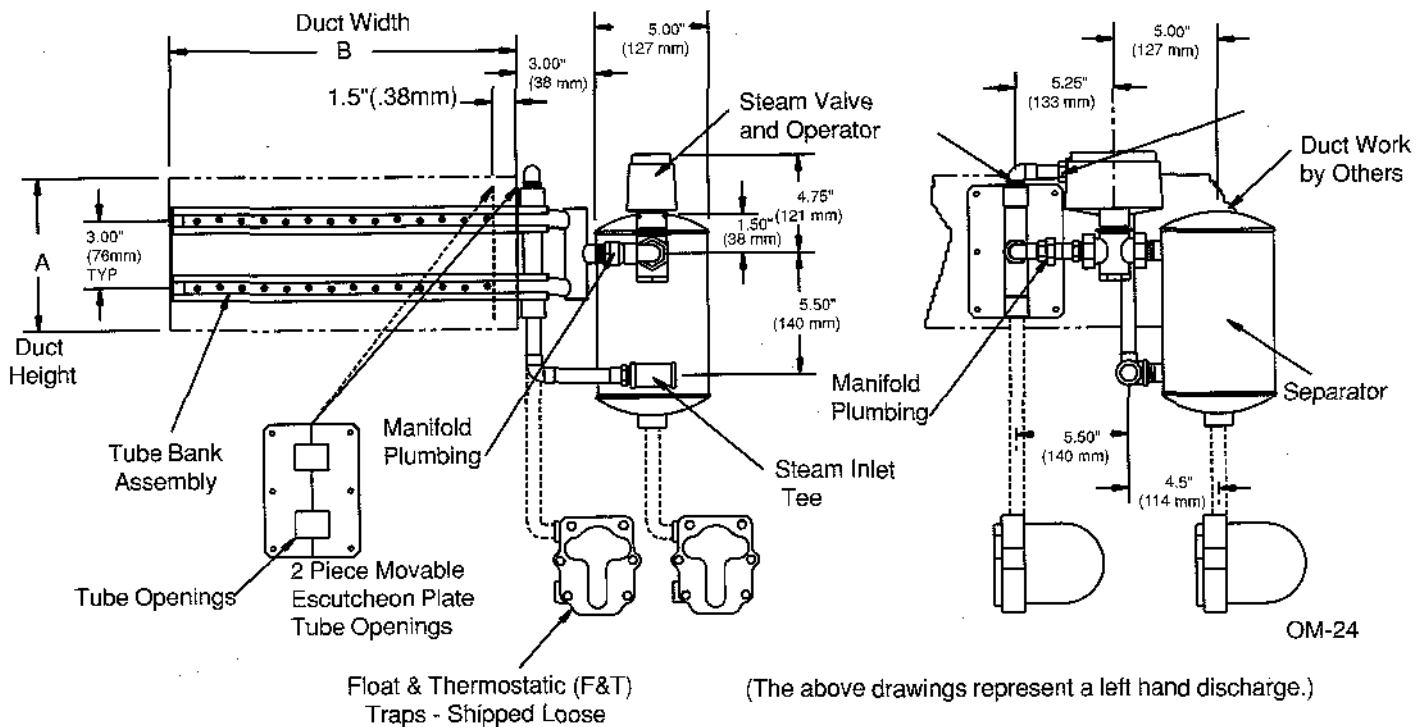
The tube bank is factory assembled and shipped intact except for the larger units which are broken down for shipment.

1. Unpack shipment and verify receipt of all MAXI-BANK components with packing list. Report any shortages at once.
2. For care in assembly, we recommend pre-assembly of dispersion tubes to MAXI-BANK manifold before dispersion tubes and manifold 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 manifold.
4. Install each dispersion tube into its appropriate tube adaptor on manifold being sure to lubricate O-rings in tube adaptors.
5. Proceed with the additional tubes, bring the jacketed union halves together, secure unions hand tight. 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 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 manifold, then tighten interconnecting tube jacket unions. When installing into a duct, use the 2 piece escutcheon plates around each tube and secure to duct with sheet metal screws. On duct application where total air tightness is required, seal around tube and bolts with suitable caulking.
8. Locate and install separator/valve assembly to MAXI-BANK mating union on manifold and tighten union.
9. Install strainer and necessary steam traps. Connect assembly to steam and condensate mains. 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) must drain by gravity to return main having little or no back pressure. If condensate cannot drain by gravity (must be elevated to return main) see page 14.

10. Connect the controlling device to valve actuator tubing (pneumatic) or wiring (electric).
11. Pressure test system and secure any fittings as necessary.

MINI-BANK®



MINI-BANK

Pre-Assembled Small Multiple-Tube Humidifier

The MINI-BANK is pre-tested and shipped as a unit. The tubes are always 3" on center and as the duct heights vary, more or fewer tubes are needed. For best mixing the tubes should span at least 90%, preferably 100% of the duct width. Two F&T traps and wye strainer are shipped loose for your convenience, to locate as necessary.

1. Unpack shipment and verify receipt of all components with packing list. Report any shortages at once.
2. The standard MINI-BANK discharges the steam to the right (viewed from the separator end) unless ordered otherwise. It can be altered right hand to left hand in the field.

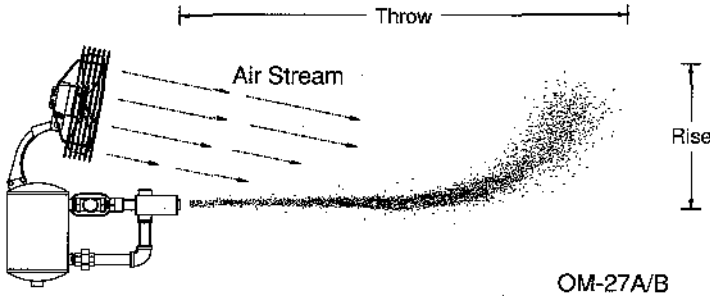
Slightly better mixing with less "fog travel" results when the steam blows *against* the air rather than *with* it. If, however, the factory-applied, insulated jacket option has been supplied, the steam should blow *with* the air to avoid steam contacting the cool metal jacket and condensing.

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

3. Install necessary length #10-32 support rod in end of tube bank, cut hole in duct for insertion of MINI-BANK and support rod into duct.

4. Install MINI-BANK into duct, positioning assembly so tube bank is perpendicular to top and bottom and horizontal or level across duct width. When securing MINI-BANK escutcheon plate if air tightness is required seal around escutcheon and support rod with suitable caulking.
5. Install steam strainer taking the steam supply to MINI-BANK off the top of steam main (instead of side or bottom) to ensure direct steam. Main should be dripped and trapped.
6. Locate and install the steam traps as necessary. MINI-BANK steam traps must 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 pg. 14.
7. Install control tubing (pneumatic) or wiring (electric) to valve actuator. Note: An air flow proving device (to prevent valve from opening unless air is moving in duct) should be installed.

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 for operation of fan.

Select a location and take note of the minimum steam vapor rise and throw distances. See the tables listed below.

Installation

1. Unpack shipment and verify receipt of all AREA-TYPE humidifier components with packing slip. Report any shortages at once.
2. After selection of location mount humidifier to supported steam and condensate piping as necessary.
3. Connect fan power as needed, electric 120v, 60 hz, below 1amp, pneumatic 2 cfm at 15 psig.
4. Connect the necessary control signal, lines wiring (electric) or tubing (pneumatic) to steam valve operator.
5. Position fan so air travel is directed over valve and jacketed muffler.
6. Secure any steam leaks as necessary.

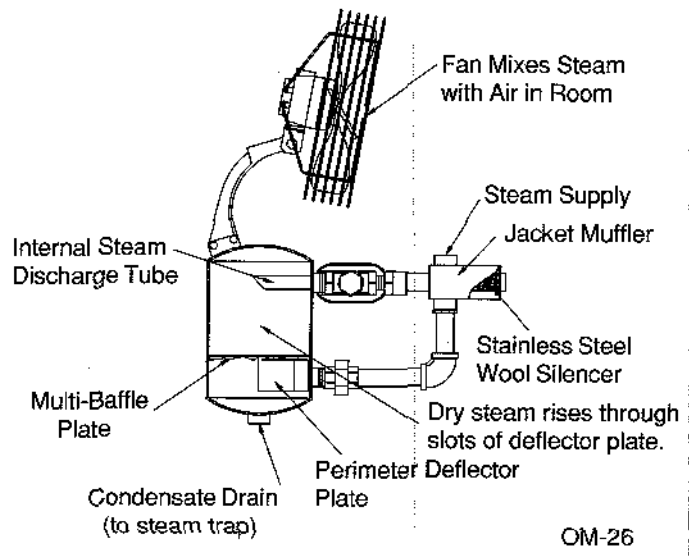


TABLE 12-1: Minimum Height in Feet From Humidifier to Ceiling (Rise)

Humidifier Size	Pounds Per Hour	Space Relative Humidity							
		30%	35%	40%	45%	50%	55%	60%	65%
6A	10 to 30	2	2.5	2.5	3	3.5	4	4.5	5
	31 to 60	2.5	3	3.5	4	4.5	5	5.5	6
	61 to 90	3.5	4	5	6	6.5	7	7.5	8
7A	81 to 130	2.5	3	3	3.5	4.5	5	6	7
	131 to 185	3.5	4	4.5	5	6	7.5	8	9
	186 to 230	5	6	7	7.5	8	8.5	9	10

TABLE 12-2: Minimum Horizontal Distance in Feet From Humidifier to Solid Object (Throw)

Humidifier Size	Pounds Per Hour	Space Relative Humidity							
		30%	35%	40%	45%	50%	55%	60%	65%
6A	10 to 30	9	9	10	11	12	14	16	19
	31 to 60	11	12	13	14	16	18	21	24
	61 to 90	16	17	19	21	24	27	30	33
7A	81 to 130	16	17	19	21	24	27	30	33
	131 to 185	18	20	22	24	27	30	33	37
	186 to 230	20	23	25	27	30	33	36	40

TEMPERATURE SWITCHES

Pneumatic Switch

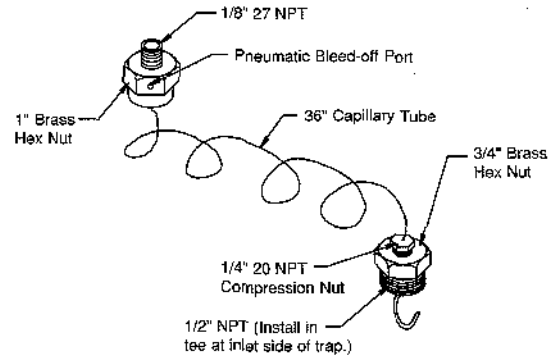
This device is a self contained, temperature actuated, normally open, air valve that closes when the capillary tube senses a temperature of approximately 220°F. It is designed to be used with pneumatic humidity control systems. It prevents the humidifier valve from opening until the unit is hot enough to prevent dripping and also will shut down the humidifier in the event of a flood of condensate caused by a steam system malfunction such as a priming boiler, flooded return main etc.

Installation

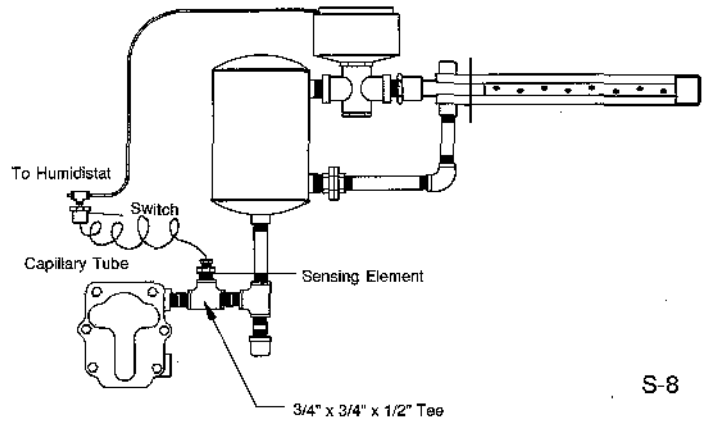
The sensing element of the device is to be installed in the return piping, on the inlet side of the steam trap.

When steam surrounds the sensing element, the fluid inside capillary tube expands and transmits pressure to a bellows. Movement of the bellows closes the bleed off port and allows air pressure to build up in the air tubing controlling the valve.

1. Provide a tee to receive the 1/2" NPT brass fitting as shown.
2. Crimping of the capillary tube will ruin the device.
3. Mount the switch in the air line between the humidifier valve and the humidistat.



S-7



S-8

Electrical Switch

This device is a temperature actuated make-break switch. The temperature at which it switches is adjustable and should be set at 220°F. It is designed to be used with electric humidity control systems.

The purpose of this device is to prevent the humidifier valve from opening until the humidifier has heated up to operating temperature. It also will shut down the humidifier in the event of a flood of condensate caused by a steam system malfunction such as a priming boiler, flooded return main etc.

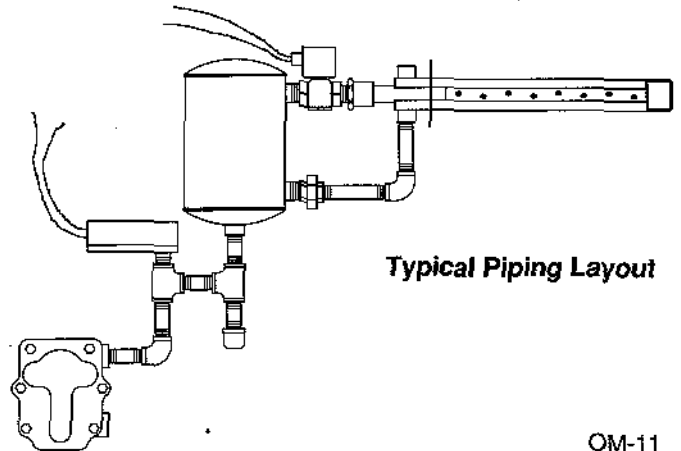
Installation

The sensing element of the device is to be installed in the 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.

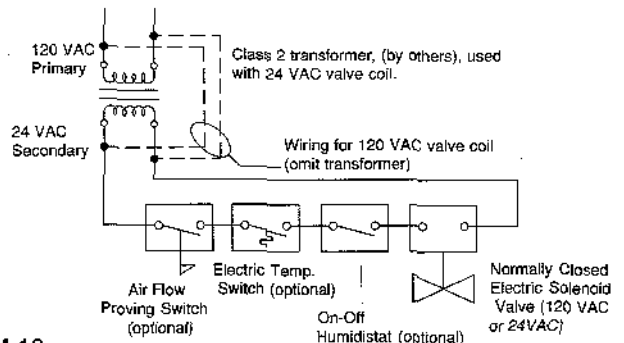
NOTE 1: All wiring per national and local electrical codes. (SIZE TRANSFORMER VA TO LOAD VA)

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



OM-11

Typical Wiring Diagram with Electric Solenoid Valve



OM-12

APPLICATION NOTES

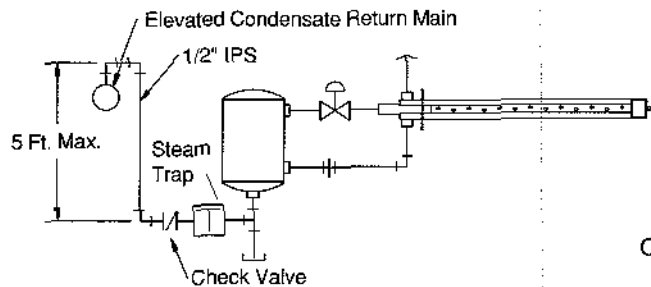
Elevating the Condensate From A Steam Humidifier

In certain installations of steam humidifiers, for structural reasons, it is not possible to drain the humidifier steam trap by gravity. The condensate must be lifted. Generally, this is not recommended because of possible water hammer, improper drainage when steam pressure is low, etc. But, when absolutely necessary, it can usually be done successfully by observing several rules.

Steam Pressure

Theoretically, one pound of pressure will raise water about 2 feet. In practice, because of pipe friction, pressure drop through a steam trap, back pressure in a return line, etc., a maximum lift of 1/2 foot per pound of steam pressure at the trap is recommended. For example, a

Drawing 14-1



OM-20

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 trap used should be of a type that is full open or closed as it operates, such as the inverted bucket or disk types. Float and thermostatic traps, where the degree of valve opening in the trap varies with the flow rate, impose an excessive pressure drop at low flow rates and may not do the job.

Pipe Size

The size of the vertical portion of the piping usually should not be larger than 1/2" IPS.

Check Valve (Swing Type)

A low pressure differential swing check valve should be provided, adjacent to the trap, to prevent backflow of condensate into the humidifier during periods of little or no steam pressure. Failure to do so could result in the accumulated backflow discharging from the humidifier when pressure is resumed. (See Drawing 14-1)

Eliminating Excess Heat From Steam-Jacketed Humidifiers

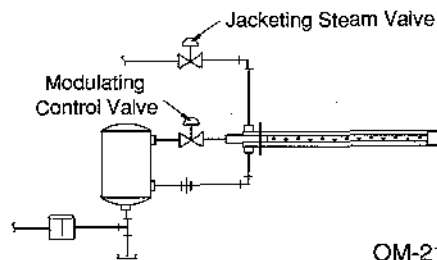
In certain applications of steam jacketed humidifiers, the heat given off by the steam heated tube (not the sensible heat of the steam) may be undesirable. While relatively insignificant in a single tube unit (usually less than 2°F), it can be several times that amount in a closely-spaced, multiple-tube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

This can be dealt with in several ways:

1. Manually valving off the steam supply during non-humidifying periods.
2. Insulating the tube exterior. (This will enlarge the tube profile, thus causing additional resistance to air flow.)
3. Providing an automatic shut-off valve for the jacketing circuit, in addition to the modulating control valve. This, of course eliminates the heat gain during the "off" humidification periods only. (See Drawing 14-2)

There are two methods of handling automatic jacketing steam valves. The basis for the decision between the two is one of valve cost - the larger the valve, the greater its cost.

Drawing 14-2



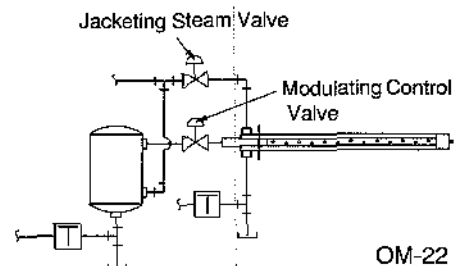
OM-21

In Drawing 14-2, 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 jacket valve. Otherwise, the maximum capacity will be reduced. Perhaps even more serious, the temperature of the jacketing steam may drop below that required to eliminate dripping.

Therefore, the valve must be amply sized. This is not particularly significant in a small capacity humidifier. However, in a large capacity humidifier, the required large size of the valve will cause it to be very expensive.

Drawing 14-3 shows a steam flow which

Drawing 14-3



OM-22

has been divided into two paths; one, a humidifying steam path (which passes through the separator), and the other, a jacketing steam path.

To assure air removal and the presence of jacketing steam, it is necessary to provide a second steam trap which serves the jacketing circuit. However, the jacketing valve need only be of 1/2" IPS to pass sufficient jacket steam.

In either case, but particularly as illustrated in Drawing 14-2, the jacketing valve should be two positional in operation and should be required to go to the full-open position prior to beginning the opening of the modulating valve.

MAINTENANCE PROCEDURE

1. **STRAINER** - When the system is new the screen should be inspected at least twice during the first year. If found fouled, more frequent inspection and cleaning should be provided.
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 be hot* and make noise at intervals and the discharge pipe from it will be progressively cooler beginning at the trap.
3. **VALVE (Pneumatic)** - Should be inspected annually to be sure 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 (Solenoid Type) - Inspect annually to verify proper functioning with steam tight shut off.

4. **SILENCER** - Should be inspected at least annually for cleanliness. Clean or replace as needed.
5. **TEFLON® SEAL RINGS** - After one year of service they may require replacement whenever disturbed because the *TEFLON® sometimes takes 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.

VALVE (Electric Modulating) - Should be inspected annually to be sure that the valve operates freely, closes off steam tight and that the stem packing is not leaking.

MAINTENANCE SERVICE RECORD

DATE INSPECTED	PERSONNEL	OBSERVATION	ACTION PERFORMED

Installation Date: _____ **Installer:** _____

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). • Not draining properly steam trap. • 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, repipe. • 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. 	<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 (Barber-Colman). • Humidity controller out of calibration.

TROUBLE SHOOTING GUIDE

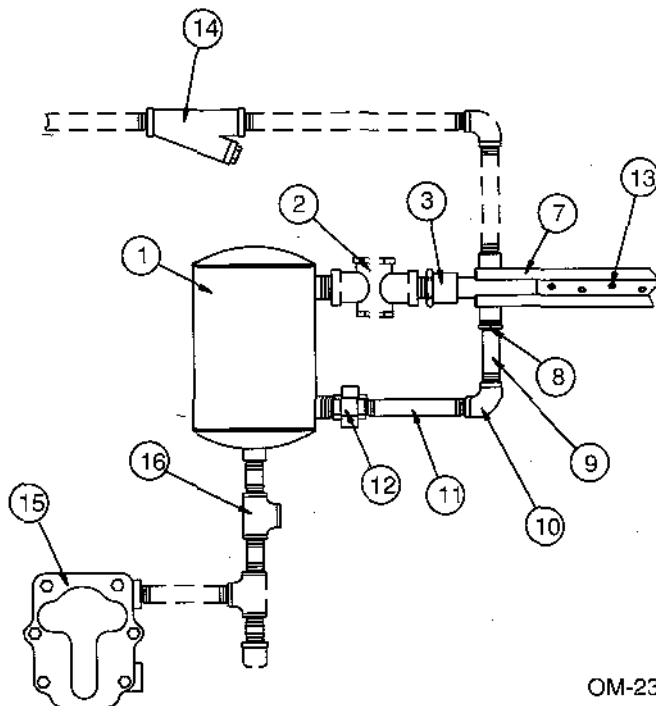
PROBLEM	POSSIBLE CAUSE	RECOMMENDED ACTION
<p>Hunting - Humidity Swings Above and Below Desired Set Point</p>	<ul style="list-style-type: none"> • Control system malfunctioning. • Automatic valve is hunting. 	<ul style="list-style-type: none"> • Faulty or inaccurate humidity controller, calibrate or replace. • Poor location of control components, relocate per catalog recommendations. • 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. • <i>Boiler pressure is swinging too widely, adjust.</i>
<p>Space Humidity Will Not Rise to Humidistat Set Point</p>	<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. 	<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, repipe. • 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. ELECTRIC • Incorrect control circuit voltage, change transformer. • Incorrect control signal, replace component(s) to make all components compatible. • <i>Improperly wired.</i> • 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. • <i>Compressed air pressure is too low, adjust.</i>
	<ul style="list-style-type: none"> • Foreign matter preventing valve from opening. • Excessive outside air volume. 	<ul style="list-style-type: none"> • Clean or replace valve. • Check fan, dampers VAV etc.

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"> • Move humidifier tubes to a point further upstream of internal devices. • Add dispersion tubes for shorter absorption distance. Consult DRI-STEEM Humidifier Company to determine the total number of tubes required. • Insulate ductwork. • Humidifier operates when blower is off. Provide interlock. • Valve is "hunting" (See previous page: Automatic Valve is Hunting). • Air temperature in duct is too low for steam quantity being emitted. • CFM of air in duct is too low for steam quantity being emitted. • Reduce pressure
Humidifier is Noisy	<ul style="list-style-type: none"> • Tube silencer missing. (Furnished on size 60 and 70 tubes four feet and under). • Dispersion tube output excessively high. 	<ul style="list-style-type: none"> • Install silencer. • Install additional tubes.

REPLACEMENT PARTS

SINGLE AND MULTIPLE TUBES



OM-23

No.	Description	Qty.	Part No.	Model	No.	Description	Qty.	Part No.	Model
1	5-1/2" vertical separator	0-1	162520-001	1/2" valve 5-60	8	1-1/2" - 1 1/2" NPT seal ring	0-1	306360-003	all 8-80
1	6-1/2" vertical separator	0-1	162540-001	1/2" valve 6-70	9	1/2" x 3-1/2" nipple - blk	0-1	201000-006	1/2" valve 5-60
1	6-3/4" vertical separator	0-1	162540-002	3/4" valve 6-70	9	3/4" x 3" nipple - blk	0-1	201200-005	all 6-70, 7-70
1	7-1/2" vertical separator	0-1	162560-001	1/2" valve 7-70	9	1-1/2" x 3-1/2" nipple - blk	0-1	202200-003	all 8-80
1	7-3/4" vertical separator	0-1	162560-002	3/4" valve 7-70	10	1/2" 90° elbow - blk -	0-1	201000-010	1/2" valve 5-60
1	7-1" vertical separator	0-1	162560-001	1" valve 7-70	10	3/4" 90° elbow - blk	0-1	201200-014	all 6-70, 7-70
1	8-3/4" vertical separator	0-1	162570-001	3/4" valve 8-80	10	1-1/2" 90° elbow - blk	0-1	202200-008	all 8-80
1	8-1" vertical separator	0-1	162570-002	1" valve 8-80	11	1/2" nipple - blk	0-1	201000	1/2" valve 5-60
1	8-1 1/4" vertical separator	0-1	162570-003	1 1/4" valve 8-80	11	3/4" nipple - blk	0-1	201200	all 6-70, 7-70
1	8-1 1/2" vertical separator	0-1	162570-004	1 1/2" valve 8-80	11	1-1/2" nipple - blk	0-1	202200	all 8-80
2	valve (Refer to specific order)				12	1/2" union - blk	0-1	201000-015	1/2" valve 5-60
3	1/2" NPT x 1" tube adaptor	0-1	203680-001	1/2" valve 5-60, 6-70, 7-70	12	3/4" union - blk	0-1	201200-020	all 6-70, 7-70
3	3/4" NPT x 1" tube adaptor	0-1	203680-002	3/4" valve 6-70, 7-70	12	1-1/2" union - blk	0-1	202200-009	all 8-80
3	3/4" NPT x 1 1/2" tube adaptor	0-1	203680-004	3/4" valve 8-80	13	60-70 tube insert	0	310280	all 5-60, 6-70, 7-70
3	1" NPT x 1" tube adaptor	0-1	203680-003	1" valve 7-70	13	80 tube insert	0	310290	all 8-80
3	1" NPT x 1 1/2" tube adaptor	0-1	203680-005	3/4" valve 8-80	14	y-strainer - 1/2"	0-1	300100-001	
3	1-1/4" NPT x 1 1/2" tube adaptor	0-1	203680-006	1 1/4" valve 8-80	14	y-strainer - 3/4"	0-1	300100-002	specify size per job
3	1-1/2" NPT x 1 1/2" tube adaptor	0-1	203680-007	1-1/2" valve 8-80	14	y-strainer - 1"	0-1	300100-003	
4	60-70 o-rings #018 (not shown)	0-2	300400-001	all 5-60, 6-70, 7-70	14	y-strainer - 1-1/2"	0-1	300100-005	
4	80 o-rings #026 (not shown)	0-2	300400-002	all 8-80	14	y-strainer - 2"	0-1	300100-006	
* 5	SST-silencer holder (not shown)	0-1	300200	all 5-60, 6-70, 7-70	14	y-strainer - 2-1/2"	0-1	300100-007	
* 6	med. gr. SST wool (not shown)	0-1	300210	all 5-60, 6-70, 7-70	15	F & T steam trap	0-1	300000	less than 15 psi
7	model 60 tube	0-1	161000	1/2" valve 5-60	15	inverted bucket trap	0-1	300010	15 psi or greater
7	model 70 tube	0-1	161500	all 6-70, 7-70	16	electric temperature switch			
7	model 80 tube	0-1	161750	all 8-80	16	pneumatic temperature switch			
8	1/2" - 14 NPT seal ring	0-1	306360-001	1/2" valve 5-60					
8	3/4" - 14 NPT seal ring	0-1	306360-002	all 6-70, 7-70					

Notes:
 1. Specify size of orifice bore in insert.
 2. Specify length of tube.
 *3. Only used in 60/70 tubes four feet or shorter.

REPLACEMENT PARTS

MINI-BANK

No.	Description	Qty.	Part No.
1	5" separator - weld	1	162520
2	1/2" B.C. valve body	1	500150
3	brass orifice	①	203450
4	F & T trap, not shown	2	300000
5	1/2" y-strainer, not shown	③	300100-001
6	pneumatic valve operator	1	500720
7	valve linkage, pneumatic	1	500740

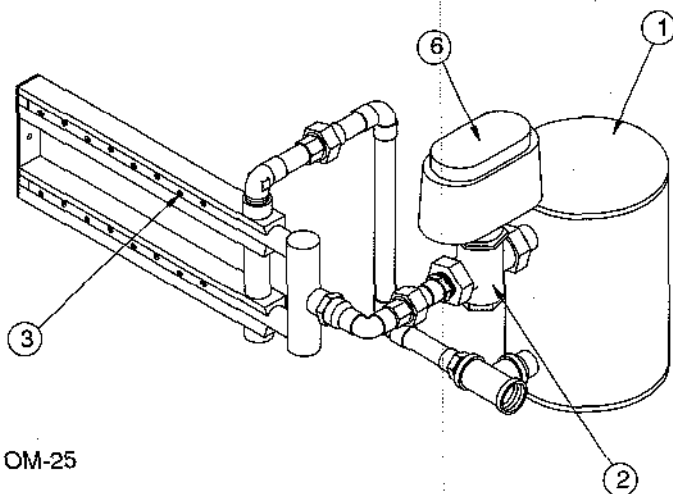
① varies with each order

③ shipped loose

Note:

18"-24" tube length/restrict orifice, 1 at each end

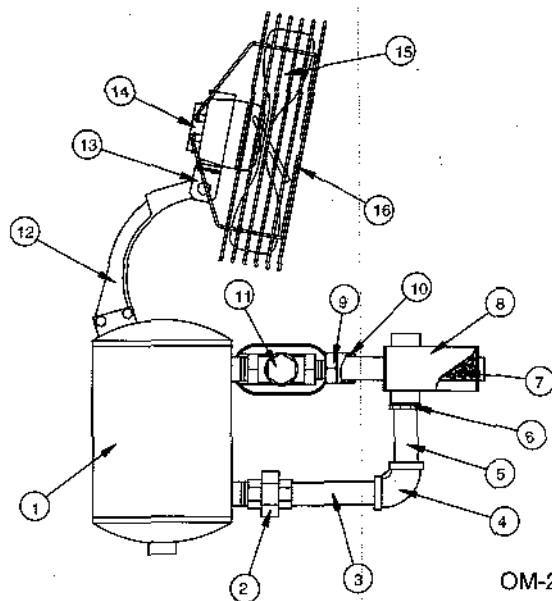
24"-48" tube length/restrict orifice, 2 at each end



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AREA-TYPE

No.	Description	Qty.	Part No.
1	6" area type sep., 1/2" NPT outlet	1	162645-001
1	6" area type sep., 3/4" NPT outlet	①	162645-002
1	7" area type sep., 3/4" NPT outlet (with electric fan)	①	162655
2	3/4" union - blk	1	201200-020
3	3/4" nipple - blk	1	201200
4	3/4" x 90° elbow - blk	1	201200-014
5	3/4" x 3-1/2" nipple - blk	1	201200-007
6	3/4" - 14 NPT seal ring	1	306360-002
7	med. gr. steel wool	3g.	300210
8	area type muffler	1	162680
9	mdl. 60/70 tube adaptor, 1/2" NPT	1	203600-001
9	md. 60/70 tube adaptor 3/4" NPT	1	203600-002
9	restricted tube adaptor, 1/2" NPT	1	203601-001
9	restricted tube adaptor, 3/4" NPT	1	203601-002
10	60/70 #120 O-ring	2	300400-003
11	valve, refer to specific order	1	
12	fan arm bracket	1	306390
13	motor bracket	①	123640
14	120 v. fan motor	①	400000
15	alum. fan blade	1	306380
16	fan guard	1	306370
19	fan - 3 speed, 120 v., not shown	1	400010



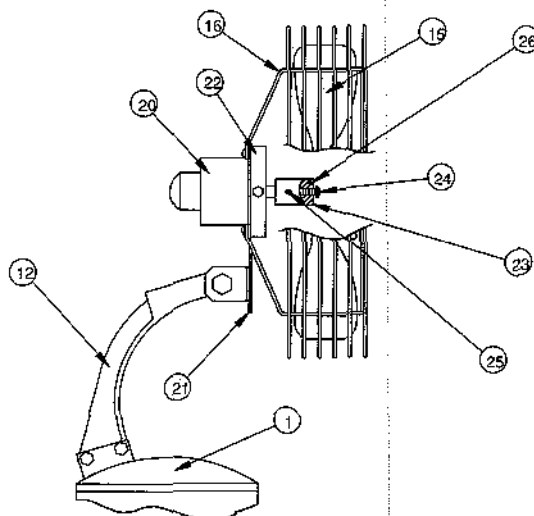
OM-28

AREA-TYPE PNEUMATIC FAN

No.	Description	Qty.	Part No.
20	fan motor	1	307030-001
21	fan mounting plate	1	162680
22	motor block	1	123670
23	fan blade bracket	1	123660
24	1/4" - 20 x 3/8" rd hd screw	1	700300-009
25	8-32 x 1/4" set screw	1	700720
26	1/8" dia. x 1/4" roll pin	1	700710
27	pneumatic air reg., not shown	1	307030-002
28	pneumatic air filter, not shown	1	307030-003
29	pneumatic fan air lube, not shown	1	307030-004

① Used on electric fan.

③ Tube adapter at full port unless stamped for restriction.



OM-29

WARRANTY

The DRI-STEEM Warranty

1. Warranty. DRI-STEEM Humidifier Company (the "Company") guarantees its products to be free of defects in materials and workmanship under the service for which they are intended. The Company will repair or replace without charge except for labor charges, products or parts which are found to be defective within one year from the date of shipment, or, at the option of the Company, will refund the purchase price.

2. Exclusions of other warranties. The warranty described in the above paragraph shall be IN LIEU OF any other warranty, express or implied, including but not limited to any implied warranty of MERCHANTABILITY or fitness for a particular purpose.

3. Limitation of Remedies. By purchasing the Company's products, the purchaser agrees with the Company that the purchaser's sole and exclusive remedy shall be for the repair or replacement of defective parts or products, without charge except for labor charges, as described in paragraph 1, above. The purchaser agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available to him.

DRI STEEM[®]
HUMIDIFIER COMPANY

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Fax: (612)949-2933

