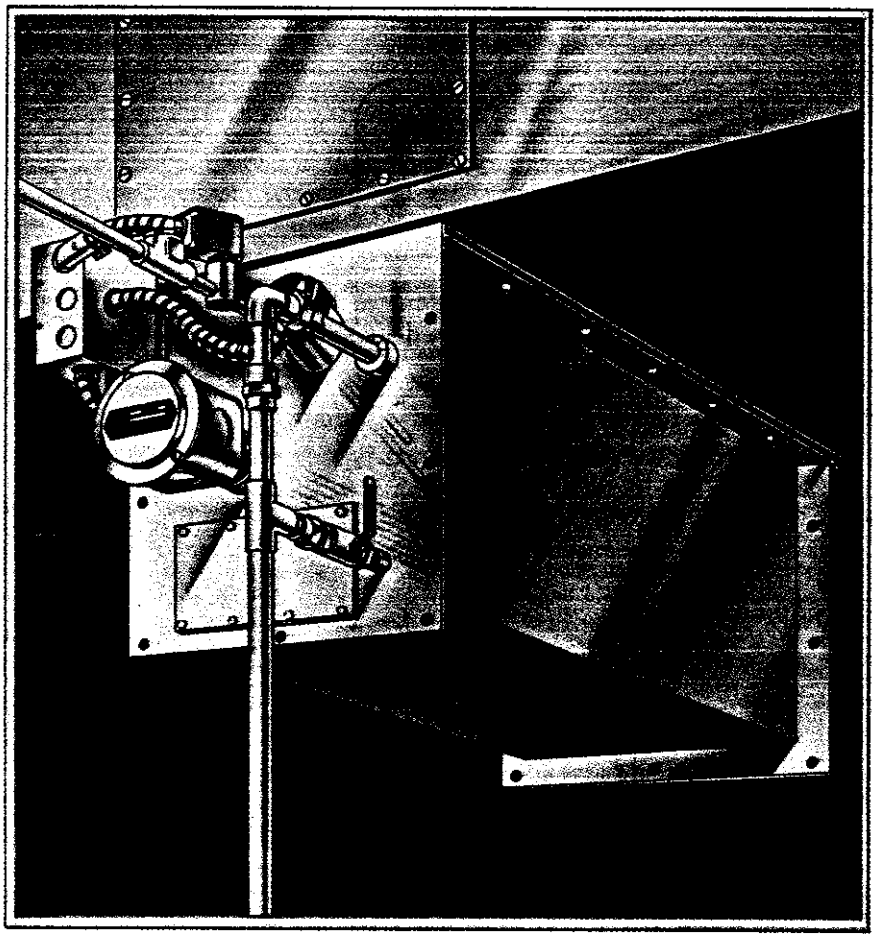
READ AND SAVE THESE INSTRUCTIONS

VAPORSTREAM®

ELECTRIC STEAM HUMIDIFIERS



Installation Instructions

Maintenance and Operations Manual

DRI-STEEM®
HUMIDIFIER COMPANY
BOX 621 • HOPKINS, MINNESOTA 55343

Please Note:

This humidifier is designed for use with either softened or unsoftened water. Its probe type level control system requires water conductivity to function and therefore will not operate on water treated by the reverse osmosis or deionizing process. However, special design Vaporstream humidifiers are available for use with these water types.

FORWARD

To the Purchaser and the Installer

Thank you for deciding to purchase Vaporstream 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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VAPORSTREAM

ELECTRIC STEAM HUMIDIFIERS

COMMERCIAL – INSTITUTIONAL
INDUSTRIAL
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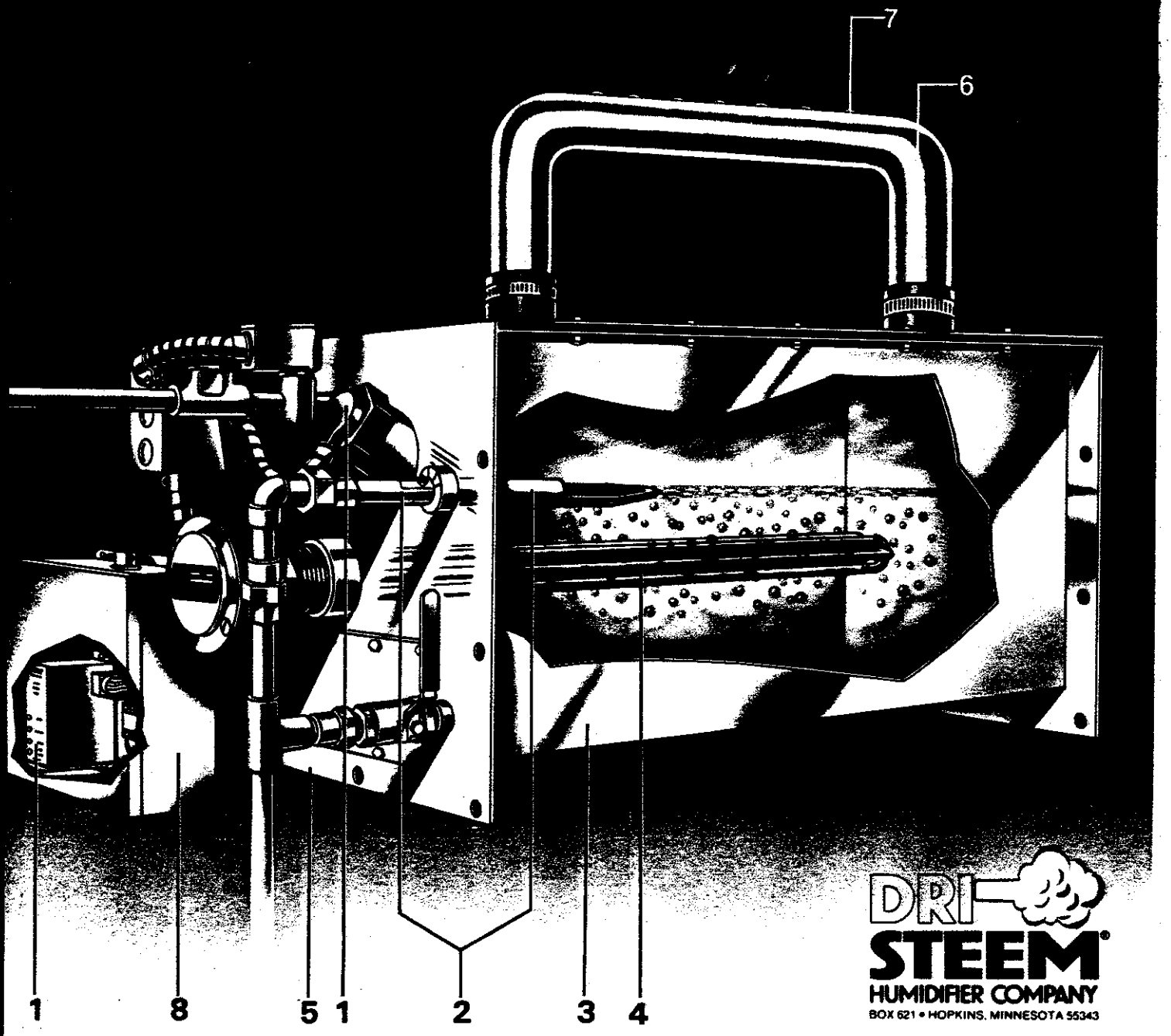
APPLICATIONS



DRI-STEEM®
HUMIDIFIER COMPANY
BOX 621 • HOPKINS, MINNESOTA 55343

(1) Exclusive water-level conductivity probe control system

(2) Exclusive, adjustable water surface skimmer

(3) Maintenance-free stainless steel construction

(4) Stainless steel immersion heating elements

(5) Access, clean out plate

(6) Dispersion tubes custom designed to fit each application

(7) Exclusive brass snap-in inserts provide proportional steam dispersion across the duct

(8) Separate control enclosure, shipped loose for field mounting.

VAPORSTREAM®

Seven reasons you can count on Vaporstream Electric Steam Humidifiers to do the job reliably, efficiently and economically.

Exclusive water-level conductivity probe control system

Conductivity probes have long been established as a highly dependable method of controlling liquids and fill functions. The *exclusive* VAPORSTREAM probe system consists of 3 stainless steel probes, molded in a Thermoset plastic threaded plug. The stainless steel probes are Teflon® coated for easy cleaning. Both the probe mounting fixture and the plug are indexed for proper and easy remounting after cleaning.

The 3 probe sensors perform all of the necessary functions of water level control.

Probe A provides low water protection for the heating element(s). When the water level is below Probe A no conductivity is established thus preventing the heater(s) from being energized.

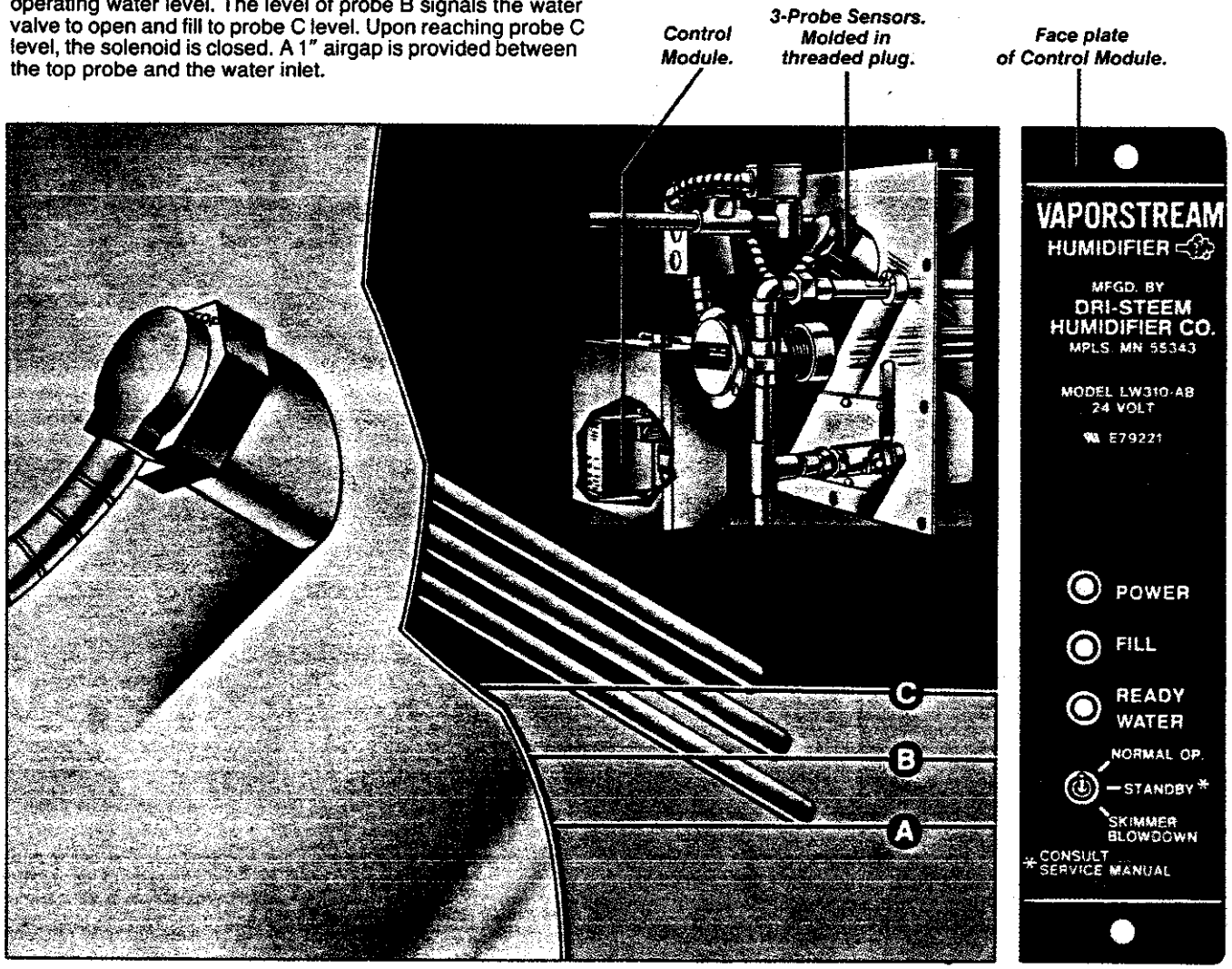
Probes B and C perform the functions of maintaining proper operating water level. The level of probe B signals the water valve to open and fill to probe C level. Upon reaching probe C level, the solenoid is closed. A 1" airgap is provided between the top probe and the water inlet.

Liquid Level Control

The Control Module is a liquid level control designed for VAPORSTREAM Humidification Systems. The Control Module performs all of the necessary logic and timing functions to provide total level control and heater interlock. Additionally, the Control Module incorporates a manual Skimmer Blowdown cycle.

The Control Module monitors the three probes and uses the information to determine if the heater(s) should be allowed to come on and whether the Fill valve should be open or closed.

The control automatically maintains the water level between the upper two probes. A two second delay is incorporated in the upper probe to insure that splashing does not cause an incomplete fill. The heating elements continue to stay 'ON' during the fill cycle thus providing continuous out-put when there is a call for humidification.



Operation Control Module

Power Light:
Indicates that power to the humidifier is ON

Fill Light:
Indicates that the water solenoid valve is OPEN

Ready Water:
Indicates that the unit has sufficient water level present to allow the heater(s) to operate safely. The function of this interlock is not to control the heater, but to serve as a means to disable the heater control circuit if the water level drops below bottom probe.

Three Position Manual switch

NORMAL OPERATION: When the switch is in normal operating position, humidifier is in full operation, automatically maintaining water level and capable of generating steam on the call for humidity.

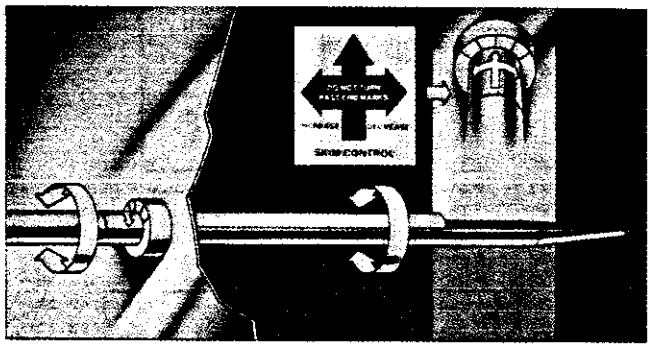
STANDBY: Switch is moved to 'STANDBY' position for regular inspection. The Standby Switch interrupts the control circuit voltage to the humidifier only.

SKIMMER BLOW-DOWN In 'SKIMMER BLOW-DOWN' mode the HEAT relay is locked out and the FILL valve is opened. The system is then overfilled and the skimmer is flushed. If the switch is left in this position for five minutes, a 'safety timer' terminates the function to prevent wasting water.

After flushing, switch must be returned manually to NORMAL OPERATION.

Exclusive, adjustable water surface skimmer

A simple ingenious system that removes surface minerals continuously and automatically.



A simple outside adjustment control permits the increase/decrease of skimming flow. The skimmer also serves as an overflow. The continuous skimming of the surface mineral accumulation reduces the need to clean.

Maintenance-free stainless steel construction

Type 304, 14 gauge stainless steel eliminates corrosion and rusting. Compact design permits easy mounting directly on, or in air ducts (or in air handling unit).

Stainless steel immersion heating elements

All units come with Stainless Steel clad immersion heating elements constructed to 80 watts per square inch specification.

Access, clean out plate

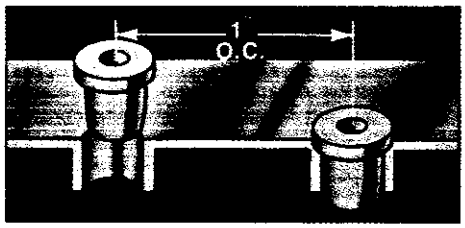
Bottom opening for fast, simple cleaning and regular inspection. Bolted cover may be quickly and easily removed by regular maintenance staff using standard tools.

Dispersion tubes custom designed to fit each application

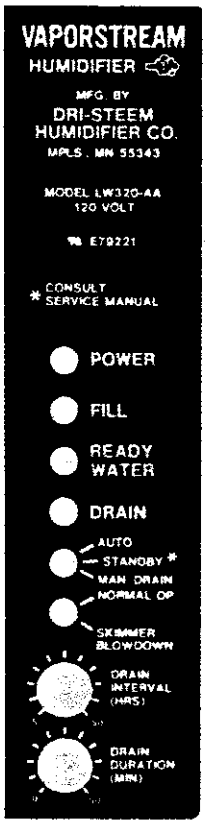
1½" diameter, custom designed tube or tube arrangement disperses steam throughout the active zone of the air stream.

Exclusive brass snap-in inserts provide proportional steam dispersion

All VAPORSTREAM dispersion tubes utilize brass inserts with precision orifices of varying diameters to provide proportional dispersion across the entire length of the tube.



OPTIONAL: Automatic Drain Down



This unique automatic control provides a drain and flush sequence at predetermined intervals and is recommended for use in areas with water harder than 15 grains per gallon.

A built-in cumulative timer tracks the number of hours that the system has been operating. When the pre-set time has accumulated, the circuit overrides normal operation and the humidifier is drained and flushed. The time between Drain/Flush cycles is user adjustable from 5 to 50 hours.

The duration of the Drain/Flush cycle is adjustable from 1 to 50 minutes. The Drain valve will open and allow the water to be dumped once the cycle has been activated. Halfway through the cycle the Fill valve will turn on to provide the flushing action. At the end of the cycle the control will automatically close the drain valve, refill the system, restart the cumulative timer and return to normal operations. All operational features as described in the Standard Control Module section are also provided when the timer and drain control module is used.

TO DRAIN FOR SERVICE:

Placing the mode switch into "MAN. DRAIN" will lock the Fill and Heat relays and activate the Drain relay, opening the drain valve.

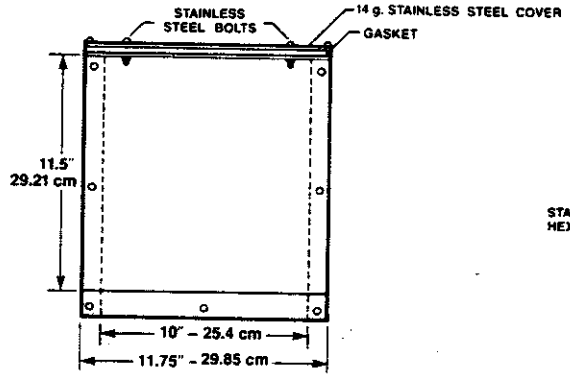
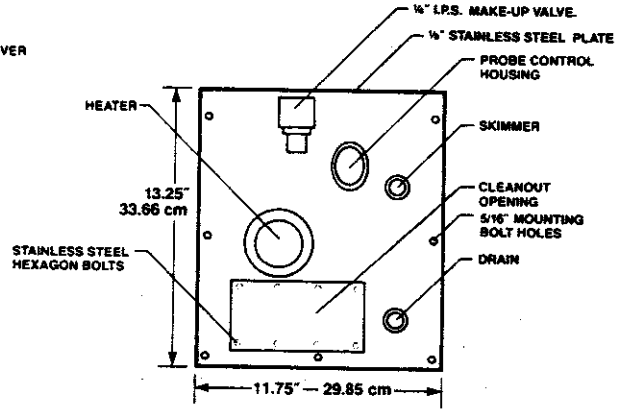
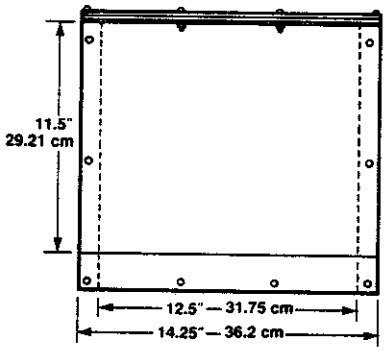
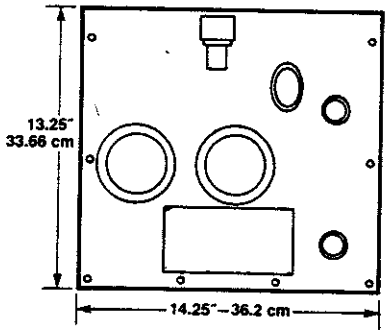
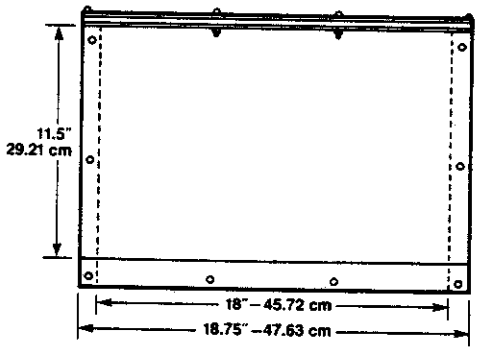
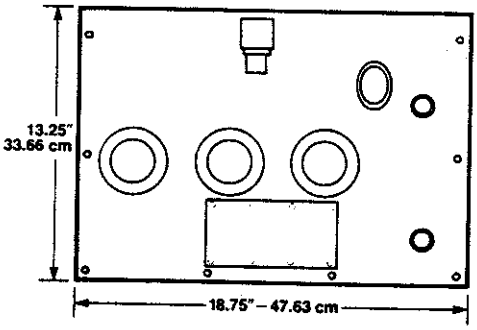
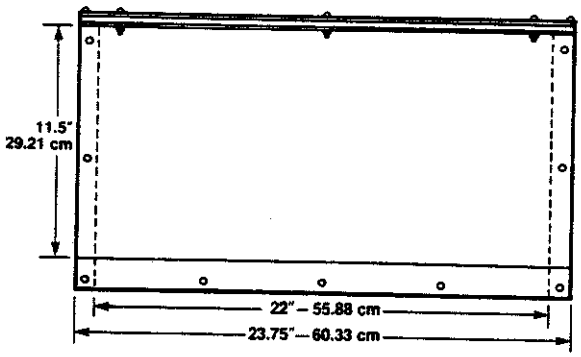
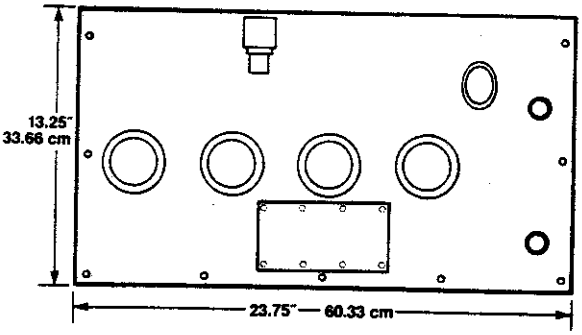
Charts showing the recommended intervals and drain down duration settings for various water hardnesses.

GR./GAL.	Drain interval* (hours)
14	24
16	22
18	19
20	18
22	16
24	14
26	13
28	12
30	11
32	10

Total KW	Drain duration (minutes)
2-8	5
9-24	10
28-40	15
42-60	20
64-80	25

***NOTE: Due to differing water conditions, these are starting points. Field adjustments may be needed to suit a particular water condition.**

VAPORSTREAM®

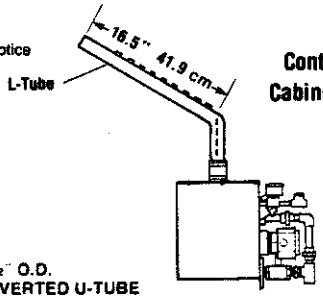
	Back View	Front View
One Heater Units		
Two Heater Units		
Three Heater Units		
Four Heater Units		

Mechanical Specifications					Electrical Specifications									Capacities
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
					Single Phase ☐				Three Phase ☐					Capacities-Hr.†
Model	Dim. "A" inch-cm	Dim. "B" inch-cm	Wt. Empty lbs-kg	Wt. Full lbs-kg	120V Amps	208V Amps	240V Amps	480V Amps	208V Amps	240V Amps	480V Amps	Total Unit KW	Control Cabinets	Lbs. KG
VPC-2	8 20.32	(L-Tube)	28 12.4	50 22.7	16.6	9.6	8.3	4.2	5.5	4.8	2.4	2	*	5.7 2.59
-3	8 20.32	(L-Tube)	28 12.4	50 22.7	25.0	14.4	12.5	6.3	8.3	7.2	3.6	3	*	8.5 3.86
-4	8 20.32	(L-Tube)	28 12.4	50 22.7	33.3	19.2	16.7	8.3	11.1	9.6	4.8	4	*	11.4 5.17
5	16 40.64	10.5 26.67	36 16.3	79 35.8	41.6	24.0	20.8	10.4	13.9	12.0	6.0	5	*	14.2 6.44
6	16 40.64	10.5 26.67	36 16.3	79 35.8		28.8	24.9	12.5	16.6	14.4	7.2	6	*	17.0 7.71
7	16 40.64	10.5 26.67	36 16.3	79 35.8		33.7	29.1	14.6	19.4	16.9	8.45	7	*	19.9 9.03
8	16 40.64	10.5 26.67	37 16.8	80 36.3		38.5	33.3	16.7	22.2	19.2	9.6	8	*	22.7 10.30
9	24 60.96	20.5 52.07	47 21.32	112 50.8		43.2	37.5	18.8	25.0	21.7	10.8	9	*	25.5 11.57
10	24 60.96	20.5 52.07	47 21.32	112 50.8		48.0	41.7	20.8	27.7	24.1	12.1	10	*	28.4 12.88
12	24 60.96	20.5 52.07	47 21.32	112 50.8				25.0	33.3	28.9	14.5	12	*	34.1 15.47
14	40 101.6	32.5 82.55	54 25.0	162 73.5				29.2	38.8	33.7	16.9	14	*	39.7 18.01
16	40 101.6	32.5 82.55	54 25.0	162 73.5				33.3	44.4	38.5	19.3	16	*	45.4 20.59
18	40 101.6	32.5 82.55	54 25.0	162 73.5				37.5		43.3	21.7	18	*	51.1 23.18
20	40 101.6	32.5 82.55	55 25.0	163 73.9				41.7		48.0	24.1	20	*	56.8 25.76
VPC 2-2	8 20.32	(L-Tube)	35 15.9	62 28.1	33.2	19.2	16.6	8.4	11.0	9.6	4.8	4	÷	11.4 5.17
3-3	8 20.32	(L-Tube)	35 15.9	62 28.1	50.0	28.8	25.0	12.6	16.6	14.4	7.2	6	÷	17.0 7.71
4-4	8 20.32	(L-Tube)	35 15.9	62 28.1	66.6	38.4	33.4	16.6	22.2	19.2	9.6	8	÷	22.7 10.30
5-5	16 40.64	10.5 26.67	46 20.9	100 45.4	83.2	48.0	41.6	20.8	27.8	24.0	12.0	10	÷	28.4 12.88
6-6	16 40.64	10.5 26.67	46 20.9	100 45.4		57.6	49.8	25.0	33.2	28.8	14.4	12	÷	34.1 15.47
7-7	16 40.64	10.5 26.67	46 20.9	100 45.4		67.4	58.2	29.2	38.8	33.8	16.9	14	÷	39.7 18.01
8-8	16 40.64	10.5 26.67	48 21.78	102 46.3		77	66.6	33.4	44.4	38.4	19.2	16	÷	45.4 20.59
9-9	24 60.96	20.5 52.07	56 25.4	137 62.1		86.4	75.0	37.6	50.0	43.4	21.7	18	÷	51.1 23.18
10-10	24 60.96	20.5 52.07	56 25.4	137 62.1		96	83.4	41.7	55.4	48.2	24.1	20	÷	56.8 25.76
12-12	24 60.96	20.5 52.07	56 25.4	137 62.1				50	66.6	57.8	28.9	24	÷	68.2 30.94
14-14	40 101.6	32.5 82.55	77 34.9	212 96.2				58.4	77.6	67.4	33.7	28	÷	79.5 36.06
16-16	40 101.6	32.5 82.55	77 34.9	212 96.2				66.6	88.8	77.0	38.5	32	÷	90.9 41.23
18-18	40 101.6	32.5 82.55	77 34.9	212 96.2				75.0		86.6	43.3	36	÷	102.0 46.27
20-20	40 101.6	32.5 82.55	79 35.8	214 97.1				83.4		96.4	48.8	40	÷	113.6 51.53
VPC 2-2-2	8 20.32	(L-Tube)	44 20.0	83 37.6	49.8	28.8	24.9	12.6	16.5	14.4	7.2	6	÷	17.0 7.71
3-3-3	8 20.32	(L-Tube)	44 20.0	83 37.6	75.0	43.2	37.5	18.9	24.9	21.6	10.8	9	÷	25.5 11.57
4-4-4	8 20.32	(L-Tube)	44 20.0	83 37.6	99.9	57.6	50.1	24.9	33.3	28.8	14.4	12	÷	34.1 15.47
* 5-5-5	16 42.64	10.5 26.67	62 28.1	140 63.5	124.8	72.0	62.4	31.2	41.7	36.0	18.0	15	÷	42.6 19.32
* 6-6-6	16 42.64	10.5 26.67	62 28.1	140 63.5		86.4	74.7	37.5	49.8	43.2	21.6	18	÷	51.1 23.18
* 7-7-7	16 42.64	10.5 26.67	62 28.1	140 63.5		101.1	87.3	43.8	58.2	50.7	25.3	21	÷	59.6 27.03
* 8-8-8	16 42.64	10.5 26.67	64 29.0	142 64.1		115.5	99.9	50.1	66.6	57.6	28.8	24	÷	68.2 30.94
9-9-9	24 60.96	20.5 52.07	72 32.7	188 85.3		129.6	112.5	56.4	75.0	65.1	32.4	27	÷	76.7 34.79
10-10-10	24 60.96	20.5 52.07	72 32.7	188 85.3		144	125.1	62.4	83.1	72.3	36.1	30	÷	85.2 38.65
12-12-12	24 60.96	20.5 52.07	72 32.7	188 85.3				75.0	99.9	86.7	43.2	36	÷	102.0 46.27
14-14-14	40 100.6	32.5 82.55	96 43.6	290 131.5				87.6	116.4	101.1	50.7	42	÷	119.3 54.11
16-16-16	40 100.6	32.5 82.55	96 43.6	290 131.5				99.9	133.2	115.5	57.8	48	÷	136.3 61.83
* 18-18-18	40 100.6	32.5 82.55	96 43.6	290 131.5				112.5		129.9	65.0	54	÷	153.3 69.54
* 20-20-20	40 100.6	32.5 82.55	99 44.9	293 132.9				125.1		144.6	72.3	60	÷	170.4 77.29
*VPC 14-14-14-14	40 100.6	32.5 82.55	110 49.9	347 157.4				116.8	155.2	134.8	67.6	56	*	159.0 72.11
*VPC 16-16-16-16	40 100.6	32.5 82.55	110 49.9	347 157.4				133.2	177.6	154.0	77.2	64	*	181.8 82.46
*VPC 18-18-18-18	40 100.6	32.5 82.55	110 49.9	347 157.4				150		173.2	86.8	72	*	204.0 92.53
*VPC 20-20-20-20	40 100.6	32.5 82.55	114 51.7	351 159.2				166.8		192.8	96.4	80	*	227.2 103.06

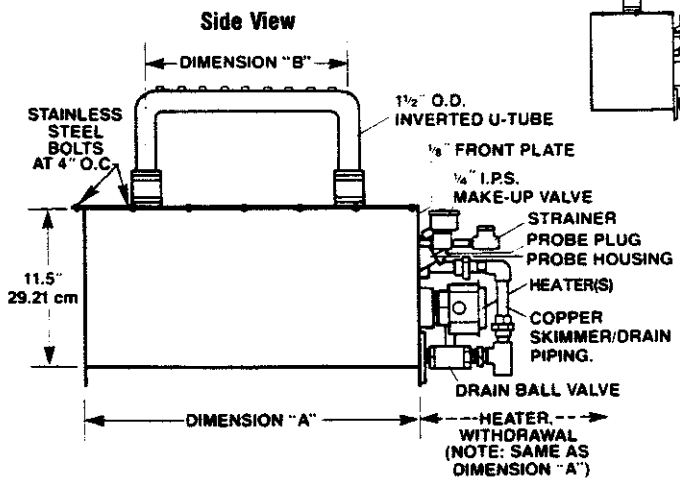
* Two Inverted U-Tubes furnished.

☐ Alternate voltages available upon request.

Dimensions and specifications subject to change without notice



		Inches	cm	Shipping Wt. lbs	kg
Control Cabinets	Series*	10"W 12"H 5"D	25.4W x 30.48H x 12.7D	22 lbs	10KG
	Series†	14"W 16"H 6"D	35.56W x 40.64H x 15.24D	32 lbs	14.5KG
	Series▪	20"W 20"H 6"D	50.8W x 50.8H x 15.24D	55 lbs	25KG



Electrical Diagrams:

Each unit comes with electrical diagrams designed for the specific unit equipment. One diagram is in the information packet; a second diagram is attached to the inside cover of the control panel

Notes: Capacities.

†Approximately 172 BTU's are required to raise the temperature of one pound of water from 40°F to 212°F. An additional 970 BTU's are required to change this one pound of water to water vapor.

A factor to consider when calculating humidifier capacity is the heat loss from the humidifier chamber to the air surrounding it. This will vary with air temperature and velocity. Calculations show that for a condition of 70°F air and 1000 feet per minute velocity, the loss will be about 5%.

The addition of 1" of rigid fiberglass insulation on all surfaces except top and front will cut this loss to about 1%.

1. GENERAL

The humidification load is a function of air change, the moisture content of the outside air, and the desired indoor relative humidity. No building is air tight and there is a constant movement of air from the outdoors into the structure and out. This air movement is caused by thermal exchange, wind pressure or fans. In all cases, the cold dry air moving into the building results in a lowering of the moisture level inside the building, which must be raised by a humidifier if desired levels are to be maintained.

The basic variable for determining the amount of moisture that must be added, to maintain a desired humidity level inside of a building, is the amount of cold dry air entering the building. The amount of moisture that must be added, therefore, is always the quantity of air moving into the building, multiplied by the difference in total desired water vapor content of the air inside the building, and that of the outdoor air at design conditions. The migration of moisture through the structure walls is usually of small magnitude and is generally not considered in the design computations. In certain cases a product load may also be computed. An example would be a paper warehouse where large quantities of paper are moved in and out.

2. COMPUTING THE AMOUNT OF COLD DRY AIR ENTERING THE BUILDING

There are two generally accepted methods of calculating the amount of cold dry air entering the building. The first is the air change method, the use of which should be limited to residential or other types of small, non-ventilated buildings. The second method is the fan quantity method, and this should be used for all buildings that introduce outside air and/or exhaust air by the use of fans.

The methods should be employed as follows:

A. Air Change Method

Compute the CFH of outside air entering the building by the following formula:

CFH = No. of air changes per hour x room volume in cubic feet

The number of hourly air changes employed should be:

- One air change = absolute minimum
- 1½ air changes = fairly tight structure
- Two air changes = structure not very tight–loose fitting windows, etc.

For example: A residence of 2500 square feet floor area and an average ceiling height of 8 feet will have a volume of 20,000 cubic feet.

Assuming that the residence is a fairly tight structure, the CFH of outside air entering the structure will be:

CFH = 1.5 x 20,000 = 30,000

RECOMMENDED *WINTER HUMIDITY LEVELS FOR VARIOUS TYPE OF COMMERCIAL AND INSTITUTIONAL BUILDINGS

TABLE 1-14

Type of Building	Recommended Dry Bulb Range °F DB	Recommended Relative Humidity % R.H.	Recommended Design Humidity Ratio "W"	
			Grains/lb. Dry Air	Lbs. per lb. Dry Air
Office Buildings				
General offices	70-74	40-45	60	0.0086
Computer Rooms	70-74	40-60	80	0.0114
Schools	70-74	40-45	60	0.0086
Library	70-74	40-50	64	0.0091
Museum	70-74	40-50	64	0.0091
Hospital				
Operating Rooms	65-72	50-60	82	0.0117
Patient Rooms	70-74	40-45	60	0.0086
Nursery	74-76	50-55	74	0.0106
Premature Nursery	74-76	50-60	82	0.0117
Delivery Rooms	65-72	50-60	82	0.0117
Intensive Care	70-80	30-60	90	0.0128
Recovery Rooms	72-74	50-60	82	0.0117
Nursing Homes				
Patient Rooms	70-74	40-45	60	0.0086
Motels	70-74	40-45	60	0.0086
Residences	70-74	40-45	60	0.0086
Apartments	70-74	40-45	60	0.0086
Dormitory Rooms	70-74	40-45	60	0.0086
Restaurants	70-74	40-45	60	0.0086
Department Stores	70-74	45-50	68	0.0097
Retail Grocery Stores	70-74	40-45	60	0.0086
Prisons	70-74	40-45	60	0.0086
Automotive Show Rooms	70-74	35-40	55	0.0078
Convention Centers	70-74	35-40	48	0.0068
Theatres	70-74	35-40	54	0.0077
Banks	70-74	40-45	60	0.0086
Television Studios	70-74	40-45	60	0.0086

*Consult "Condensation Prediction" Table 3-15 before applying these recommendations.

B. Fan Quantity Method

Determine the CFH of the incoming air by ascertaining the maximum CFM of outside air entering the building through the supply air fan(s) and multiply by 60. Compare this with the quantity being exhausted by the exhaust fan(s) and use whichever quantity is the greater.

Verify that CFH quantity calculated is at least one air change; if not, use a quantity of one air change per hour.

This procedure should be followed for each zone, floor, or air handling system where humidity is to be added.

3. DESIGN CONDITIONS

The moisture levels of the outdoor air and the desired level of the indoor air must be determined as follows:

A. Indoor Design Conditions

See Table 1-14 and choose correct type of building.

These are generally accepted design conditions. However, adjustments can be made when desired.

B. Outdoor Design Conditions

Consult Table 2-15 and determine moisture content of outside air.

4. CONDENSATION PREDICTION

See Table 3-15. This table should always be consulted to be sure that the inside design relative humidity is not too high.

MOISTURE CONTENT OF AIR IN GRAINS PER POUND OF DRY AIR

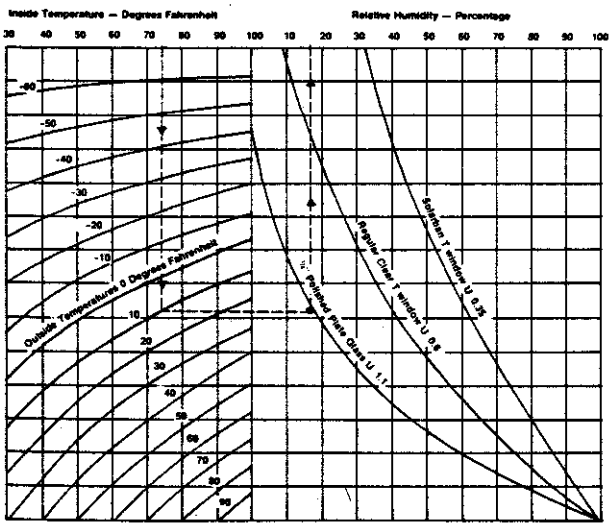
TABLE 2-15

°F	RELATIVE HUMIDITY — % RH																		
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
-20	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
-15	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2
-10	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3
-5	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	3	4	4	4
0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5
5	0	1	1	1	2	2	2	3	3	4	4	4	5	5	5	6	6	6	7	7
10	1	1	1	2	2	3	3	4	4	5	5	6	6	6	7	7	8	8	9	9
15	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	9	10	11	11	12
20	1	2	2	3	4	5	5	6	7	8	8	9	10	11	12	12	13	14	14	15
25	1	2	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	17	18	19
30	1	2	3	5	6	7	8	10	11	12	13	14	16	17	18	20	20	22	23	24
35	2	3	4	6	8	9	11	12	14	15	17	18	20	21	23	24	26	27	29	30
40	2	4	5	7	9	11	13	14	16	18	20	22	23	25	27	29	31	32	34	36
45	2	4	6	9	11	13	15	18	20	22	24	26	29	31	33	35	37	40	42	44
50	3	5	8	10	14	16	19	22	24	27	30	32	35	38	41	43	46	49	51	54
55	3	7	10	13	17	20	23	26	29	33	35	39	42	46	49	52	55	59	62	65
60	4	8	12	16	20	23	27	31	35	39	43	47	51	55	59	62	66	70	74	78
65	5	9	14	18	23	28	33	37	42	46	51	56	60	65	70	74	79	84	88	93
70	6	11	17	22	28	33	39	44	50	55	61	66	72	77	83	88	94	99	105	110
75	7	13	20	26	33	40	46	53	59	66	73	79	86	92	99	106	112	120	126	132
80	8	16	24	31	39	47	55	62	70	78	86	94	101	109	117	125	133	140	148	156
85	9	19	28	37	47	56	65	74	83	93	102	111	120	130	139	148	157	167	175	185

NOTE: VALUES HAVE BEEN SHOWN TO NEAREST WHOLE NUMBER FOR SIMPLICITY

WINDOW CONDENSATION PREDICTION

TABLE 3-15



5. COMPUTING THE LOAD ON THE HUMIDIFIER

The total amount of MOISTURE THAT MUST BE ADDED is given by the formula:

$$WT = \frac{\text{CFM} \times 60 \text{ min/hr} \times \text{Air Density} \times \text{Moisture Difference}}{7000 \text{ grains/pound}}$$

in which —

WT = Weight of moisture to be added

CFM = Cubic feet of outdoor air per minute entering building

Air Density = Weight of air per cubic foot in pounds per cubic foot. (This varies with air temperature and altitude, but the usage of 0.075 lbs/cu.ft. is generally accepted as producing satisfactory results in temperatures down to −20°F and altitudes to 5000 feet.)

Moisture Difference = The difference, in grains, in the moisture content of the air between design indoor conditions and design outdoor conditions.

Example No. 1:

A residence in Washington, D.C., with a design indoor temperature of 75°F, a desired relative humidity of 40%, a glass "U" value of 0.60, an outside design temperature of +10°F and a calculated air change of 500 CFM.

Compute the amount of moisture that must be added to maintain the desired conditions.

1. Consult the "recommended indoor design conditions," Table 1-14 which indicates 60 grains/pound.

2. Consult the "condensation prediction," Table 3-15 which indicates 40% relative humidity can be maintained at +10°F without condensation.

3. Consult the "moisture content of air," Table 2-15 which indicates 53 grains per pound at 75°F and 40% RH.

4. Consult the "moisture content of air," Table 2-15 at +10°F and 50% RH which indicates 5 grains per pound.

Solve for humidity load:

$$\text{Load} = \frac{500 \times 60 \times .075 \times (53-5)}{7000} = 15.42 \text{ lbs/hr}$$

Example No. 2

A library in Chicago with a design indoor temperature of 70°F and 7000 CFM of outdoor air, no exterior glass, and an outdoor design temperature of 0°F.

1. Consult Table 1-14, "recommended indoor design conditions" which indicates 64 grains/pounds.

2. Consult Table 2-15, "moisture content of air" at 0°F and 50% RH which indicates 3 grains/pound.

Solve for humidity load:

$$\text{Load} = \frac{7000 \times 60 \times .075 \times (64-3)}{7000} = 274.5 \text{ lbs/hr}$$

VAPORSTREAM®

SELECTING THE LOCATION

A. It is very important that the humidifier be located where the water vapor being discharged will be carried off with the air stream and will not cause condensation or dripping from the duct.

B. In general, the electric evaporative humidifier is best placed where the air can most readily absorb the moisture being added without causing condensation at or after the unit. This will normally be after the heating coil or where the air temperature is highest.

C. Do not place in an outside air intake unless air is tempered with a preheat coil.

D. If the air passing over the humidifier will be cooler than 60° F., check the ability of the air to absorb the moisture. For example: 2000 cfm of air at 55° F. and 40% R.H. passes over a 6 KW humidifier that is adding 120,000 grains per hour.

The new condition after the humidifier is calculated as follows:

$$\frac{2000 \text{ (cfm)} \times 60 \text{ (min)}}{13.33 \text{ (cu.ft./lb.)}} = 9000 \text{ lbs. air}$$

9000 x 26 grains/lb (from Table 2-15)	= 234,000 grains
plus humidifier moisture	120,000 grains
Total moisture after humidifier	354,000 grains

354,000 ÷ 9000 lbs. = 39 grains/lbs.

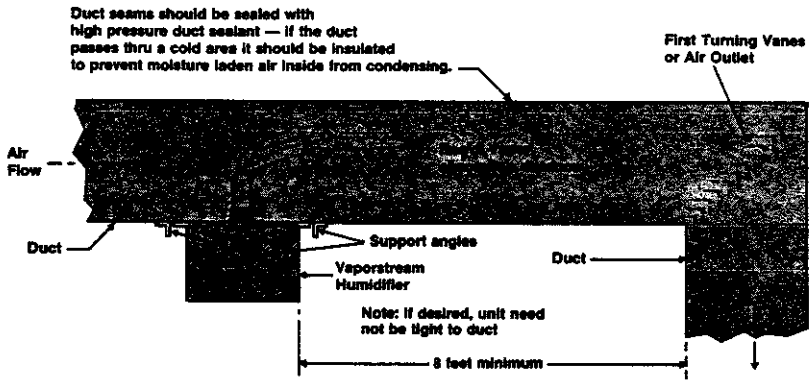
From Table 2-15 it is seen that the new condition after the humidifier will be about 56° F. and 60% R.H. which means that the air is capable of absorbing the moisture being added.

E. Do not place the unit too near to the intake of a high efficiency filter. The filter will remove the visible moisture and become waterlogged. Allow at least 8 feet from the humidifier to the filter.

F. Do not place unit where discharged vapor will impinge on a metal surface. Allow at least 8 feet from the humidifier to such a surface.

G. Do not place the unit too close to a split in the duct. The unit may put more moisture in one branch than the other. Allow at least 8 feet from the humidifier to the split and center the humidifier upstream from the split.

VAPOR ABSORPTION DISTANCE

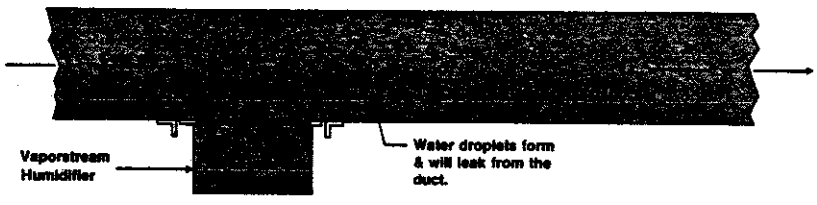


A distance of air travel is required for the steam to "disappear" or go into the gaseous state.

While visible, the steam will collect on internal devices such as turning vanes resulting in dripping.

A minimum of 8 feet is recommended.

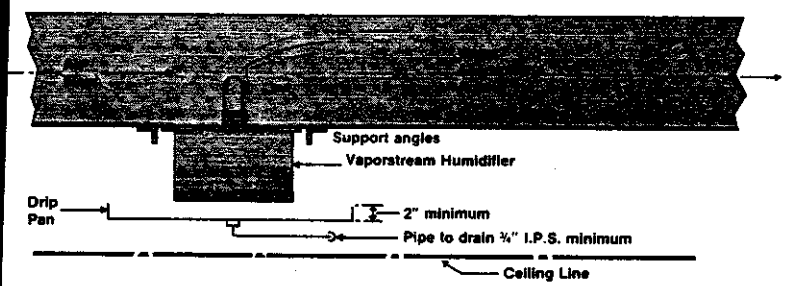
INSTALLATION IN COLD AIR STREAM



When a humidifier is installed in a duct that will carry cold air periodically, the dew point temperature should be determined.

If the psychrometric chart reveals that saturation may occur, protection should be provided. A high limit humidistat or a thermostat, set to cut off the humidifier at a safe temperature, can be used for this purpose.

INSTALLATION ABOVE VALUABLE EQUIPMENT

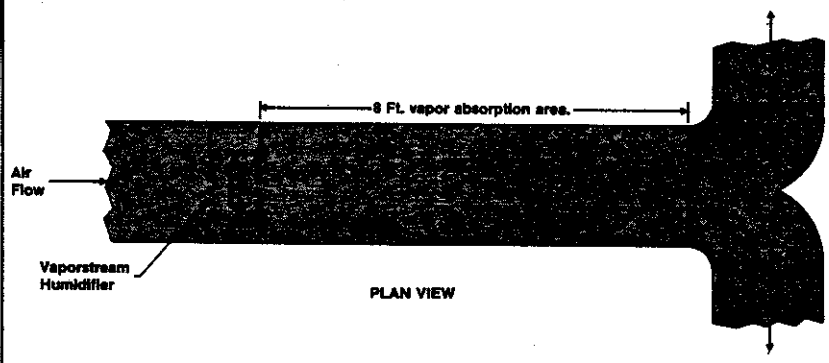


Water piping and humidifiers should not be installed above expensive apparatus or equipment. A broken water pipe, leaking valve gland, condensation or other water leaks may occur causing serious damage and costly repairs to the equipment below.

Where this type of installation cannot be avoided install a drip tray constructed of galvanized sheet steel under the humidifier, valve, etc. to catch any possible water drip.

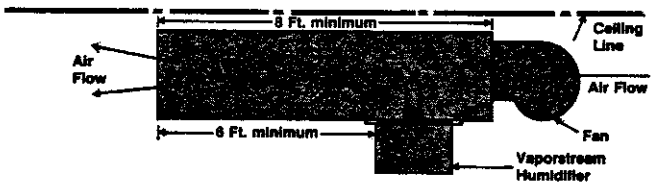
It is advisable to end the drain above an open floor drain. The overflow from the Vaporstream should be piped to a floor drain rather than the drip pan.

INSTALLATION AHEAD OF DUCT SPLIT



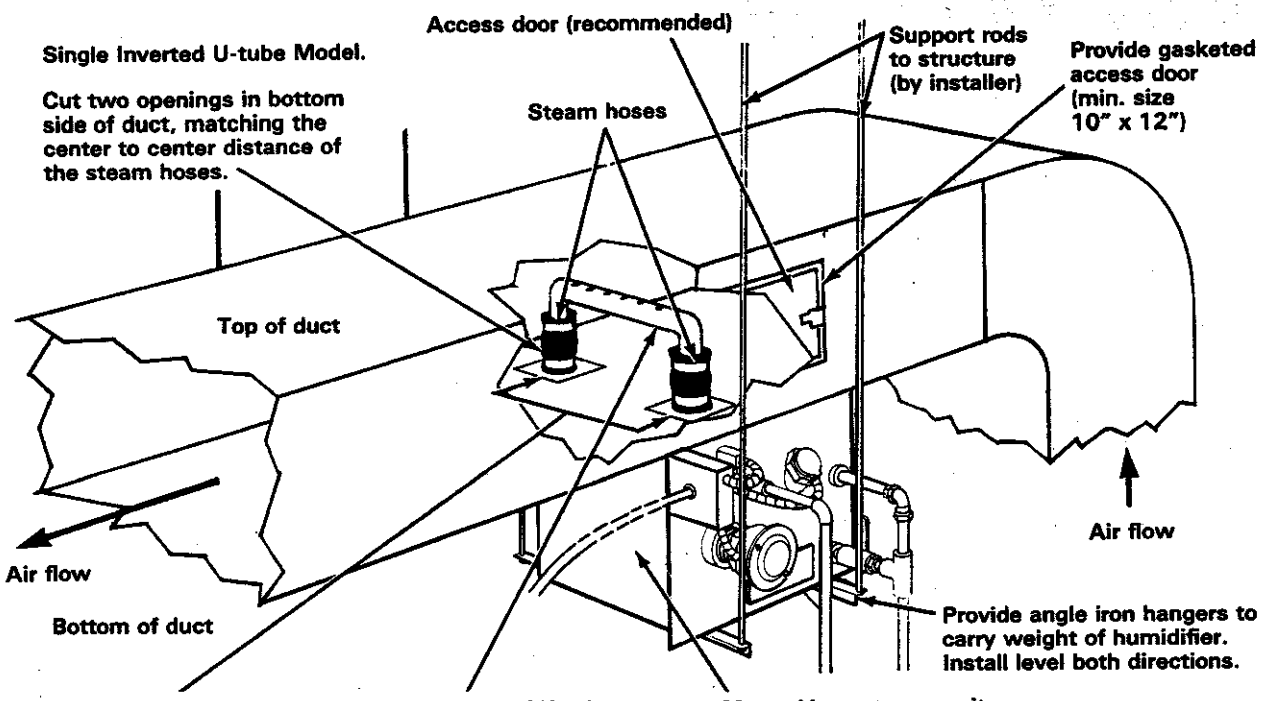
When a Vaporstream humidifier is installed upstream of a duct split, a minimum distance of 8 feet should be provided between the humidifier and the split. The humidifier should span most of the duct width or be centered upon it to equalize the humidifying effect between the two branches.

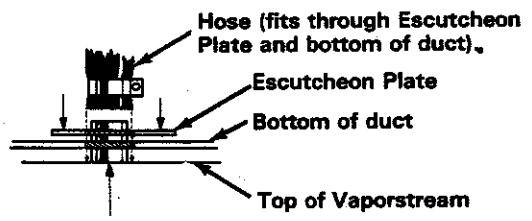
RECIRCULATION UNIT



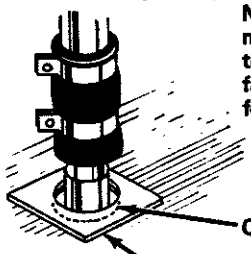
In an application where no duct system exists, or if the duct air is too cool for proper humidity absorption, a recirculation fan can be used. The fan circulates room temperature air across the Vaporstream humidifier and discharges humidified air into the space. The point of discharge should be carefully selected to avoid condensation on surfaces of the building or equipment.

MOUNTING UNIT ON UNDERSIDE OF DUCT –





Indicates diameter of opening

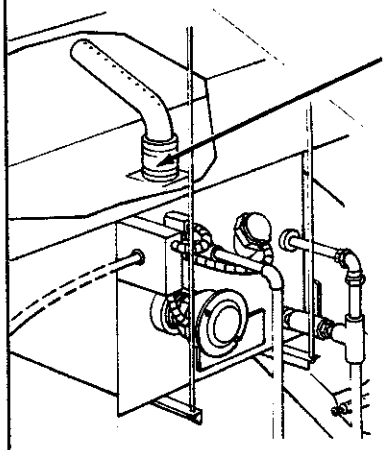


NOTE: Where space permits, mounting the humidifier 6" to 12" below bottom of duct facilitates removal of cover for periodic inspection.

Opening in bottom of duct

Escutcheon plates (furnished with unit)

MOUNTING L-TUBE UNDER DUCT



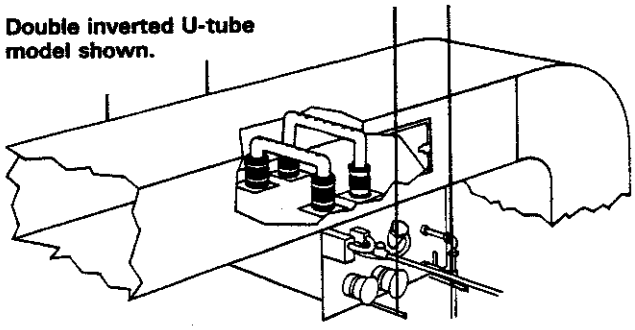
Cut single opening near edge of duct.

The L-tube may be longer than the duct width itself. If so, place L-tube at an angle so that maximum width of duct is spanned.

All callouts for mounting unit shown in above examples apply.

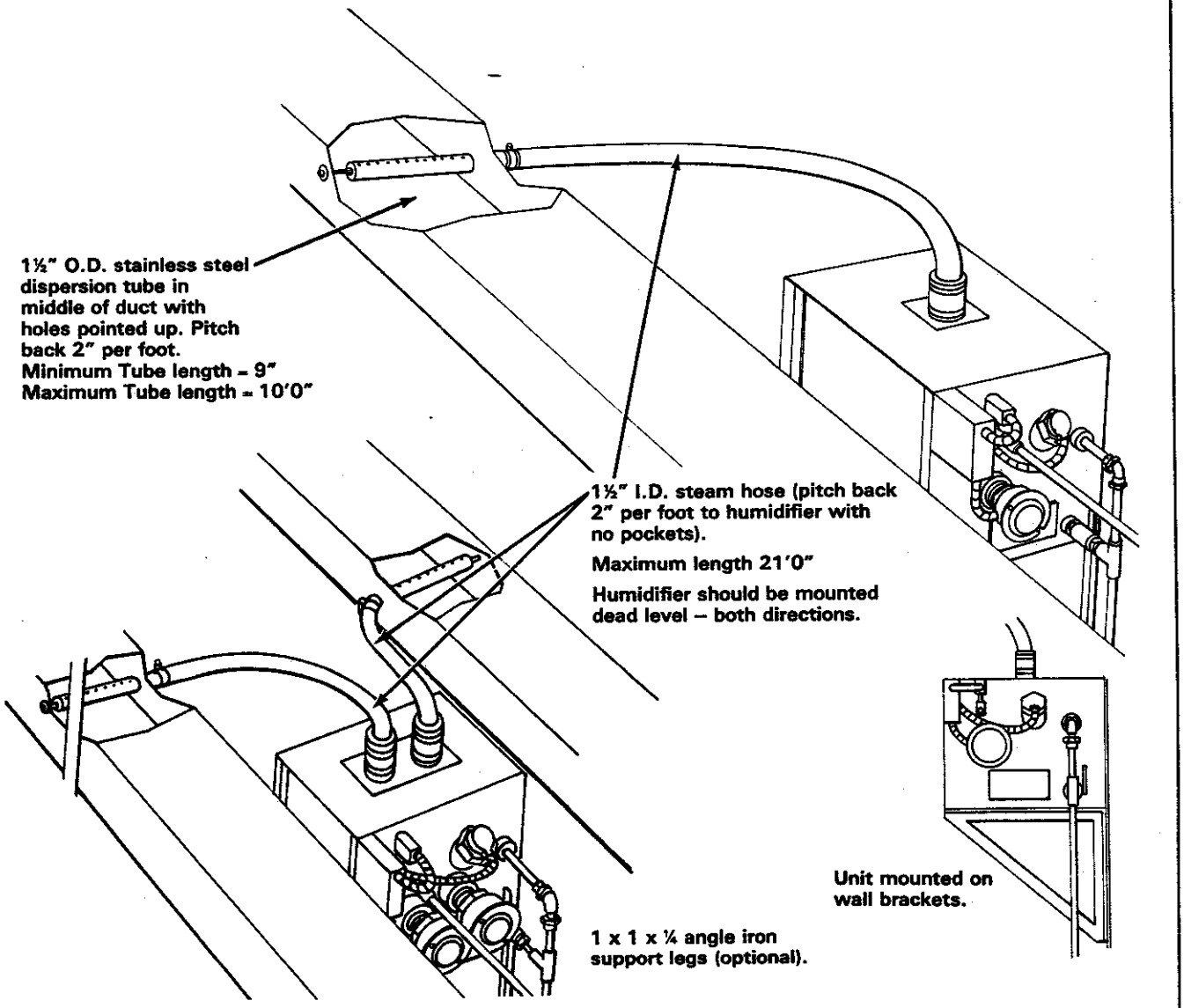
MOUNTING MULTIPLE TUBE UNIT UNDER DUCT

Double inverted U-tube model shown.

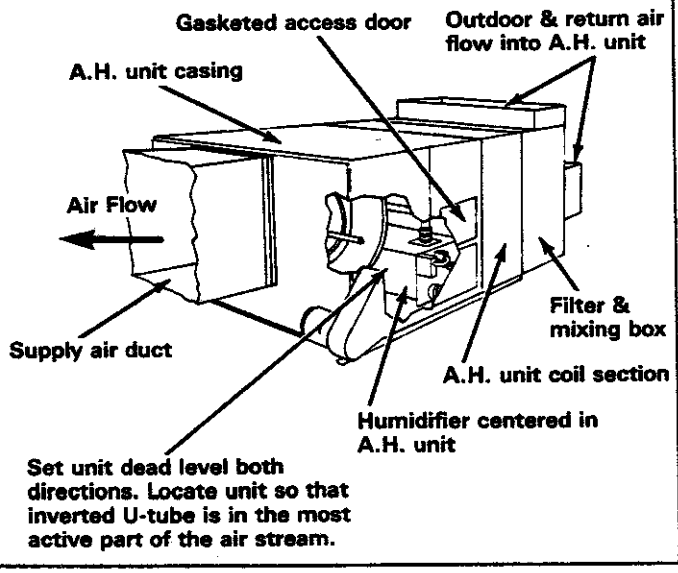


All callouts shown on above example apply to multiple tube units.

MOUNTING UNITS AWAY FROM DUCT(S) BY USE OF STEAM HOSE



MOUNTING IN AIR HANDLING UNIT



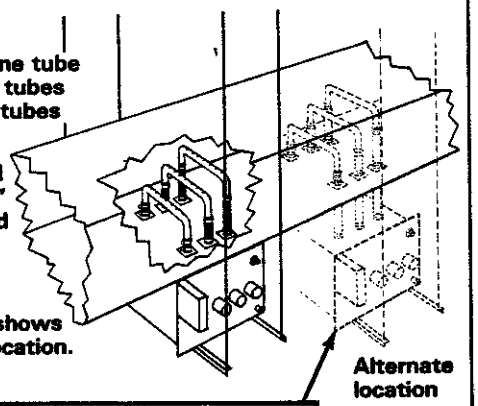
MULTIPLE INVERTED U-TUBES FOR "TALL" AIR STREAMS

Recommendation

Up to 24" tall – one tube
24" to 48" – two tubes
Over 48" – three tubes

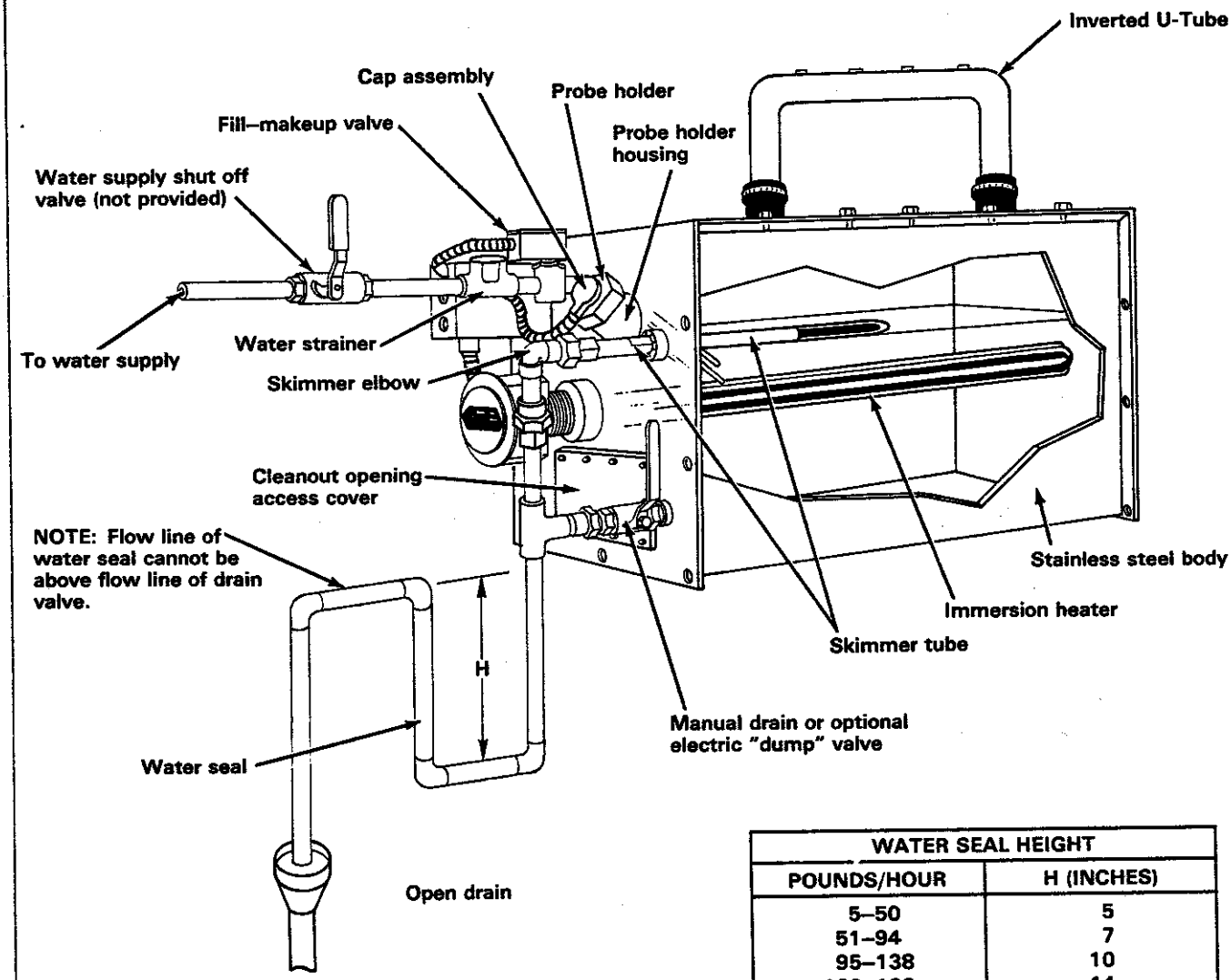
U-tubes extended upwards over 12" should be secured to duct.

Ghosted version shows alternate lower location.



NOTE: Where space permits, mounting the humidifier 6" to 12" below bottom of duct facilitates removal of cover for periodic inspection.

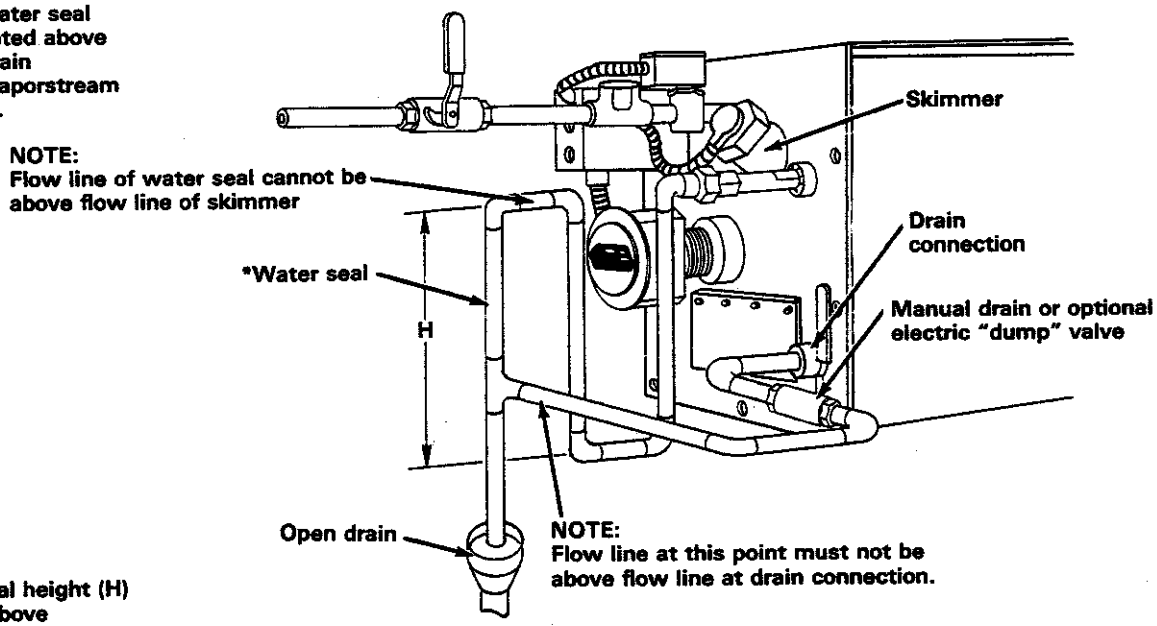
COMPONENTS AND PIPING METHODS



WATER SEAL HEIGHT	
POUNDS/HOUR	H (INCHES)
5–50	5
51–94	7
95–138	10
139–183	14
184–227	18

ALTERNATE WATER SEAL AND VALVE PIPING

Used when water seal must be elevated above flow line of drain connection (Vaporstream close to floor).



*For water seal height (H) follow chart above

VAPORSTREAM®

Drain Piping

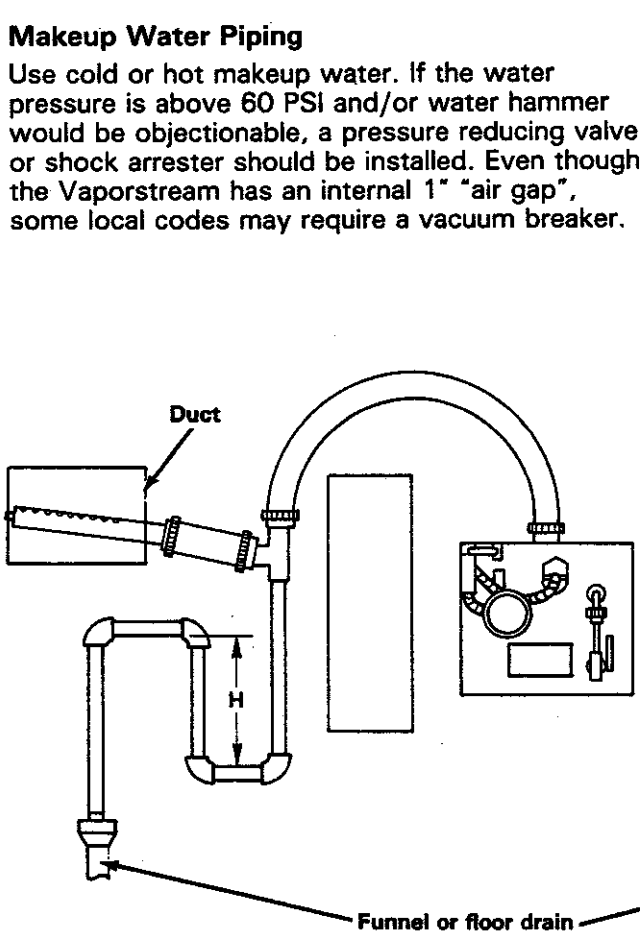
A drain line should be extended from the skimmer connection to a sanitary waste. A water seal must be provided in the drain line of sufficient height to contain the pressure developed within the humidifier. Without this, steam will be forced through the drain line which could be objectionable. The depth of the water seal must be sufficient to overcome the static pressure of the air handling system plus the pressure developed by the humidifier itself. Consult table on page 14 for height of water seal.

Makeup Water Piping

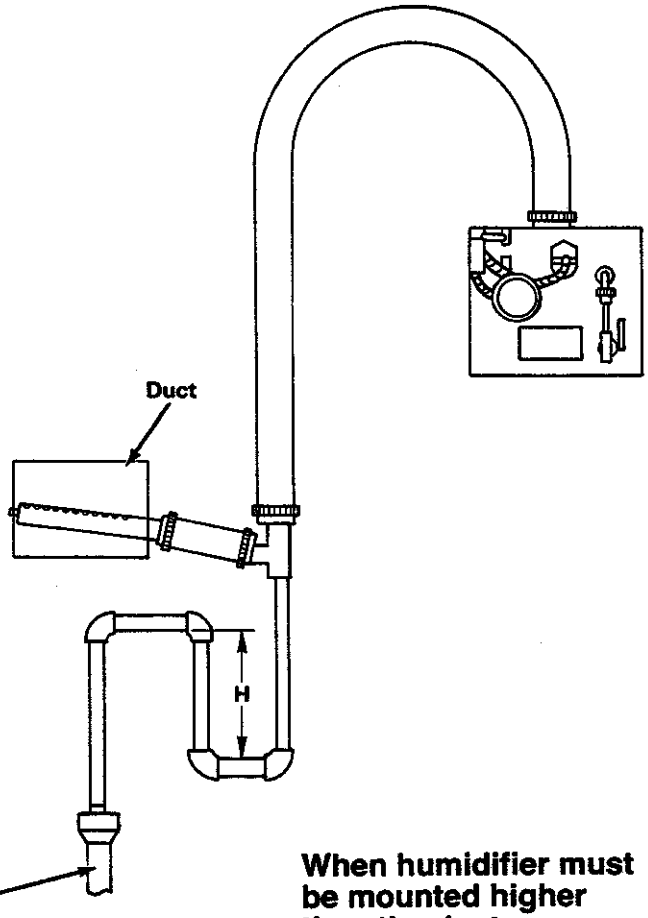
Use cold or hot makeup water. If the water pressure is above 60 PSI and/or water hammer would be objectionable, a pressure reducing valve or shock arrester should be installed. Even though the Vaporstream has an internal 1" "air gap", some local codes may require a vacuum breaker.

Steam Hose Piping

When the remote mounted steam hose method is used, the stainless steel dispersion tube and the connecting hose must be installed at a pitched level. Both the dispersion tube and the connecting hose should be pitched back to the humidifier. A 2" per foot of length drop is recommended. When this is not possible due to duct elevation or obstruction, alternate arrangements may be used. The following drawings illustrate the recommended hose connection methods to remove condensate build-up.



When obstruction prevents dispersion tube from being continuously pitched back to humidifier.



When humidifier must be mounted higher than the duct.

H = water seal height
see chart on page 14

VAPORSTREAM®

INSTALLING THE VAPORSTREAM

Location

When selecting the location, first consideration should be given to rapid, thorough absorption of the steam. The warmest air will most readily absorb the steam. The most *active* part of the air stream will provide the best mixing of the steam and air. Avoid *dead* spots such as the inside curve of an elbow or an area immediately downstream of a baffle plate. Since the "fog" will travel some distance before "disappearing" and will saturate objects it touches while visible, avoid discharging the steam closer than 8–10 feet upstream of fans, filter, dampers, etc. unless the air temperature is warmer than 90°F. If so, 4–5 feet is permissible.

When the remote mounting method with the steam hose kit is used, condensate will drain into the duct unless the dispersion tube holes are pointed up and the tube and steam hose are pitched properly. Preferably the condensate should drain back to the humidifier in the steam hose. When obstructions prevent this, an alternate method is used (see page 15). Waterlogged low points in the hose will cause "gurgling" and in severe conditions periodic "slugs" of condensate will be discharged into the duct.

The location selected must also provide for electrical service, cold water for makeup and sanitary waste.

Mounting

For proper operation of the electrode probe water level control and the skimmer system the humidifier should be mounted dead level.

Access for periodic removal of the top cover is recommended. In most cases, scale that forms on the heating elements continuously flakes off as it forms and the loose scale that settles to the bottom can be raked or flushed out through the front face cleanout opening. However, removal through the top cover is easier.

If the Vaporstream is to be installed above expensive materials or devices, a drain pan of sufficient size and depth to retain rapid or sudden drainage of the contents of the humidifier should be provided. The drain pan should be drained to a sanitary waste.

Makeup Water Piping

Cold or hot makeup water. If the water pressure is above 60 PSI and/or water hammer would be objectionable, a pressure reducing valve or shock arrester should be installed. Even though the Vaporstream has an internal 1" "air gap", some local codes may require a vacuum breaker.

Drain Piping

A drain line should be extended from the skimmer connection to a sanitary waste. A water seal should be provided in the drain line of sufficient height to contain the pressure developed within the humidifier. Without this, steam will be forced through the drain line which could be objectionable. The depth of the water seal must be sufficient to overcome the static pressure of the air handling system plus the pressure developed by the humidifier itself. See table on page 14.

Electrical

The current characteristics, and capacity requirements should be checked against the nameplates. The control cabinet should be mounted in a location convenient for service. All wiring must be in accordance with all governing codes and the Vaporstream wiring diagram. The diagram is inside of the control cabinet. The wiring between the control cabinet and humidifier must be 105°C rated wire.

The basic water level control and low water protection circuit found on page 20 is common to all VPC model Vaporstream humidifiers.

Please Note:

This humidifier is designed for use with either softened or unsoftened water. Its probe type level control system requires water conductivity to function and therefore will not operate on water treated by the reverse osmosis or deionizing process. However, special design Vaporstream humidifiers are available for use with these water types.

Caution: Only qualified electrical personnel should perform Installation and Startup Procedures.

VAPORSTREAM®

STARTUP AND CHECKOUT PROCEDURES

1. Mounting

Check mounting to see that unit is level and securely supported before filling with water.

2. Piping

Verify that all piping connections have been completed as recommended and that water pressure is available.

3. Electrical

Verify that all wiring connections have been made in accordance with the Vaporstream wiring diagram.

4. Control Circuits

a) Adjust humidistat to "call" setting.
b) Open shut off valve on water supply line.
c) Set control module switch to "standby" position.
d) Set main disconnect switch to "on" position; control module "power" lamp should now light.
e) Set control module switch in "normal op" position. The "fill" lamp should now light and the makeup valve should now open.
f) Filling should continue until the uppermost electrode has been in water contact for two seconds. At that point, the "fill" lamp should go out, the "ready water" lamp should light and the heating element contactor(s) should pull in.
g) Check low water cut off circuit:
    1. Close manual stop valve on water supply.
    2. Open ball valve and start draining unit. For units equipped with Automatic drain down, open "dump valve" to drain unit as follows: Set main disconnect switch to "off", jumper terminals "7" and "10" and set main disconnect back to "on". Dump valve should now open.
    3. As water level drops past center electrode "fill" lamp will light; when water level drops past lowest electrode "ready water" light will go out and the heating element contactor(s) will drop out.
    4. When step 3 has been satisfactorily completed, close drain valve or remove jumper and refill unit as in step "e".
h) Fill water seal in drain line by setting control module switch in "skimmer blowdown" position until water flows from drain pipe, reset to "Normal Op." and unit is ready to operate.
i) Check out function of field installed safety controls such as fan proving switch; contactor(s) should drop out when proving switch is "open".
j) Check heater draw by testing and recording voltage and amperage in each phase. Readings should match nameplate readings – nameplate is located on the humidifier housing.
k) Inspect installation for leaks by operating the Vaporstream. Any stream or air leaks should be sealed.

VAPORSTREAM®

RECOMMENDED MAINTENANCE

Vaporstream is designed to deal with dissolved minerals in one of two ways depending on the degree of hardness. For light to moderate hardness (up to 15 grains per gallon), the surface skimmer action plus annual cleaning is usually adequate. For high mineral content water (above 15 grains per gallon), a time clock and solenoid "dump" valve is recommended in addition to the surface skimmer, along with annual cleaning. If the Vaporstream was originally purchased without a timer and dump valve they usually can be easily added in the field. Consult factory for details.

The frequency of cleaning will be dictated by water condition and evaporation load.

Note: When performing maintenance on the Vaporstream, always place control module switch in "standby" or place main disconnect in "off" position and close manual water shut-off valve.

Monthly or as required

1. Cleaning probes – remove the cap assembly and unscrew the probe holder from the Vaporstream unit. The scale will easily flake off from the teflon coated sensing portion. The uncoated sensing portion (bottom ⅜") of the probe should be brushed clean with stainless steel wool. Reinstall the probe holder with arrows up and "top" marking at the top.

2. Cleaning skimmer tube – remove the elbow section of the skimmer and rotate tube so that loosened material will drop out. Loosen deposits with a long tool such as screwdriver or section of small diameter pipe and reassemble elbow. Skimmer drainage should be verified by visual inspection once per week. Water should drain from skimmer drain pipe after each fill cycle.

Adjusting the Surface Skimmer

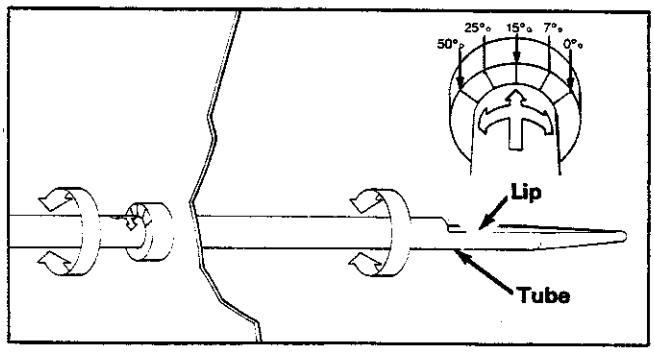
The elevation of the lip of the skimmer tube in respect to the water line, determines the quantity of "skimming" that takes place with each fill cycle. The height is field adjustable by rotation of the tube.

As evaporation takes place, a portion of the dissolved minerals precipitate (come out of solution) and remain on the water surface.

Each time the Vaporstream refills, it fills to an elevation above the lip of the skimmer tube. A portion of the refill water than flows to drain carrying the floating mineral with it. This action constantly reduces the mineral concentration thereby reducing the frequency of cleaning needed.

The heated water that flows to drain is a cost of operation. Cleaning the humidifier is also a cost as well as an inconvenience. It is, therefore, recommended that the user, at the time of initial startup, observe and adjust the skimming quantity. By doing so, a balance between minimized mineral build-up and conservation of waste water can be achieved.

The quantity of skimming water drained off per fill cycle is adjusted by rotation of the skimmer tube which alters the height of the overflow lip. It is factory set to skim about 15% of the total evaporating capacity of the unit. For example: A Model VPC 10-10 having an output capacity of 56.8 pounds per hour would skim about 8.5 pounds (one gallon) per hour.



SURFACE SKIMMER

To adjust, loosen the union nut and rotate the tube to the desired percentage of skimming rate. Markings on the unit indicate the following:

50% 25% 15% 7% 0%

Allow the Vaporstream to operate five or ten days and then inspect it. If a mineral buildup is evident, increase the skim amount. If not, it should be reduced. Repeat the above process several times or until it is felt the proper adjustment has been attained.

Note: In those cases of extremely high mineral content where the surface skimmer will not control mineral build-up a timer and "dump" valve are recommended. This feature is described on page 5.

VAPORSTREAM®

TROUBLESHOOTING GUIDE

	Control Module Lights				
Problem	**PWR**	**FILL**	**R/W**	**Possible Cause**	**Recommended Action**
Humidifier will not heat	Off	Off	Off	Control transformer	Verify control voltage across term 6 & 7
	On	Off	On	Humidistat is not calling	Set Humidistat to call. Inspect for faulty Humidistat
				Safety controls open (High limit, air proving, etc.)	Check safety controls
				Faulty Contactor(s)	Jumper term 8 & 9 contactor should pull in
				Faulty Control Module	Verify control voltage between term 6 & 8
				Probe Corrosion	Replace probes*
Humidifier will not fill	On	On	Off	No water pressure	Check manual water supply valve
				Faulty water fill valve	Verify action of fill solenoid valve by turning control module switch from standby to normal op. Audible click should be heard as solenoid operates.
				Plugged strainer	Check strainer
				Plugged valve	Check valve
				Faulty control module	Verify control voltage across term 5 & 6
Humidifier does not stop filling	On	On	Off	Lack of tank to probes continuity	Jump terminals 1 & 4. If water stops, verify tank ground to term 4
				Fill valve is stuck open	Check valve for foreign matter holding valve open
Low output	On	Off	On	Electric drain valve not seating	Clean diaphragm and seat of valve
	On	Off	On	Too much skimmer/drain	Reduce skimmer drain amount
				Fill valve is stuck open	Check valve for foreign matter holding valve open
Unit short cycles				Probes may be incorrectly wired	Confirm wiring of terminal 1 to 4

*Although the 3 stainless steel probes will eventually erode – due to corrosion – this generally doesn't occur until after about 5000 hours of operation.

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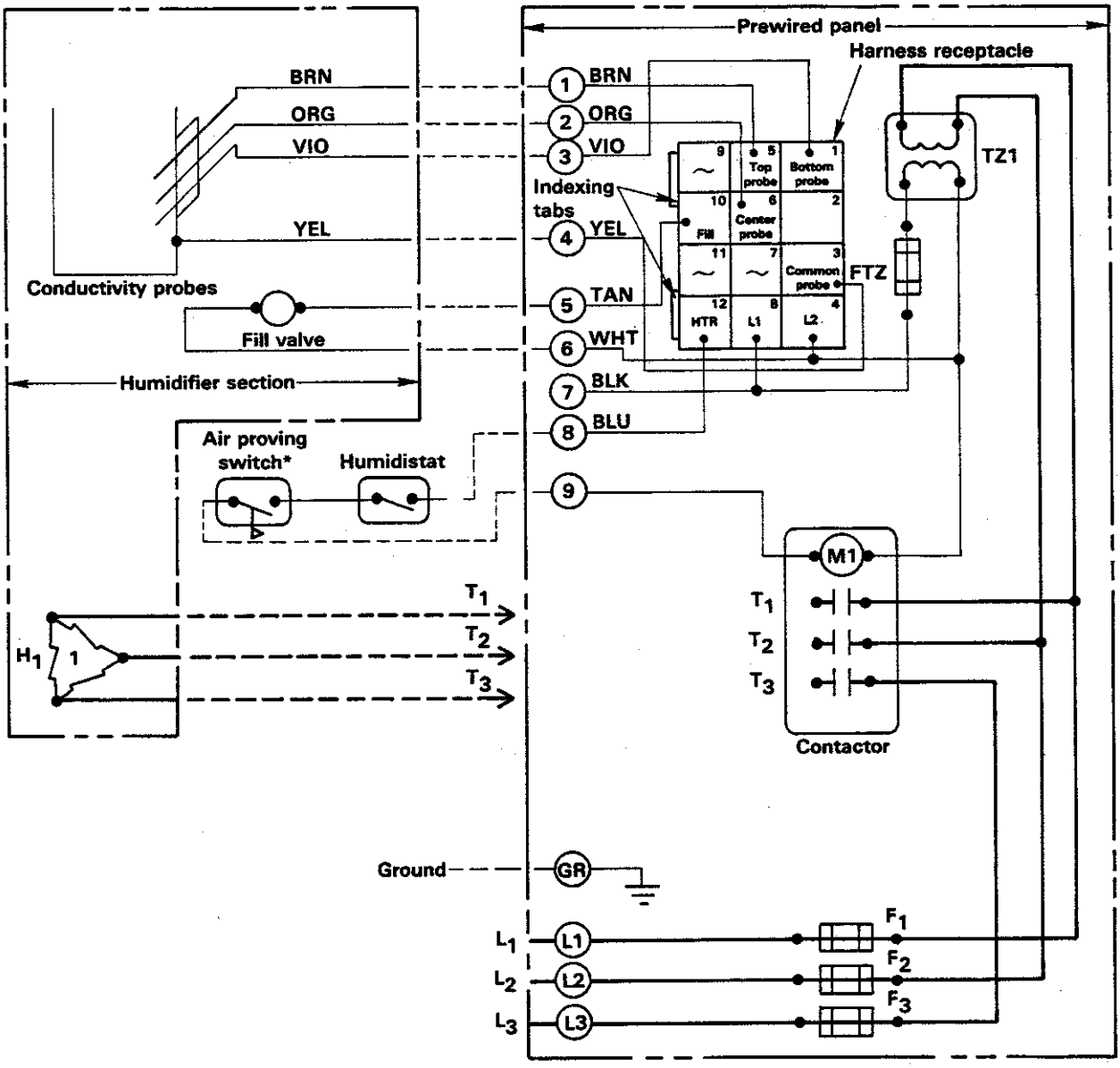
VAPORSTREAM HUMIDIFIER WIRING DIAGRAM

3Φ 1 HEATER 1 STAGE

Shown are two typical wiring diagrams. They provide the wiring schematics for the Control Cabinet. The diagram on page 20 shows the standard circuit for a Vaporstream *without* a timer and dump valve. The diagram on page 21 shows the circuit *with* a timer and dump valve. Please refer to the diagram furnished with the humidifier for specific questions concerning the unit being installed.



LEGEND:

* OPTIONAL
POWER WIRING
CONTROL CIRCUIT WIRING
FIELD WIRING

NOTE:
ALL WIRING PER NATIONAL AND LOCAL ELECTRICAL CODES

DIAGRAM NO.
J311F

CURRENT DRAW
_____ UNIT AMPS _____ PER HEATER AMPS

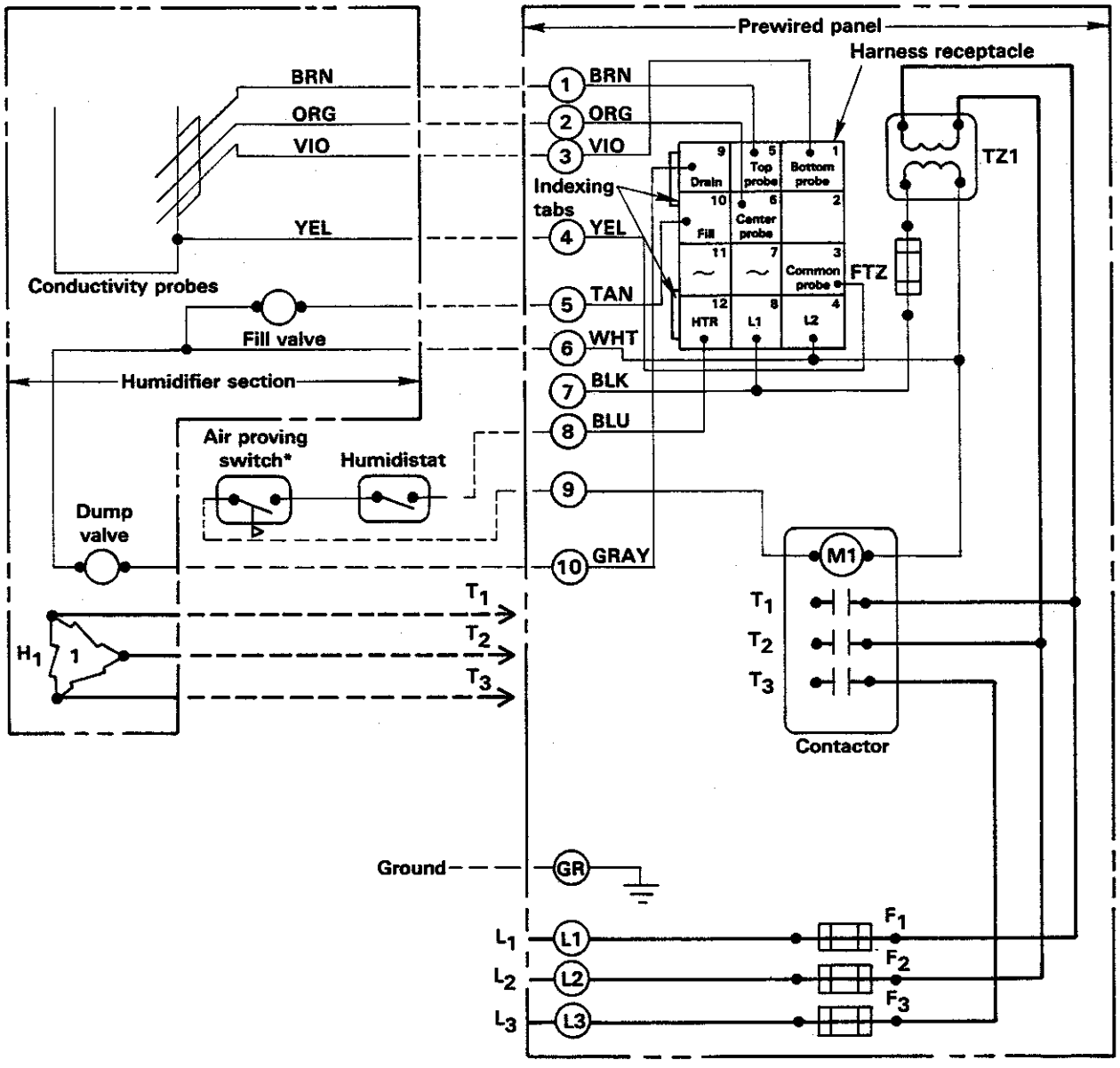
PRIMARY VOLTAGE _____ CONTROL VOLTAGE _____

MODEL NO. _____ JOB _____ ORDER NO. _____

VAPORSTREAM®

3Φ 1 HEATER
1 STAGE
WITH TIMER AND DUMP VALVE

VAPORSTREAM HUMIDIFIER WIRING DIAGRAM



LEGEND:

* OPTIONAL
——— POWER WIRING
——— CONTROL CIRCUIT WIRING
— — — FIELD WIRING

NOTE:
ALL WIRING PER NATIONAL AND LOCAL ELECTRICAL CODES

DIAGRAM NO.
J311FT

CURRENT DRAW
_____ UNIT AMPS _____ PER HEATER AMPS

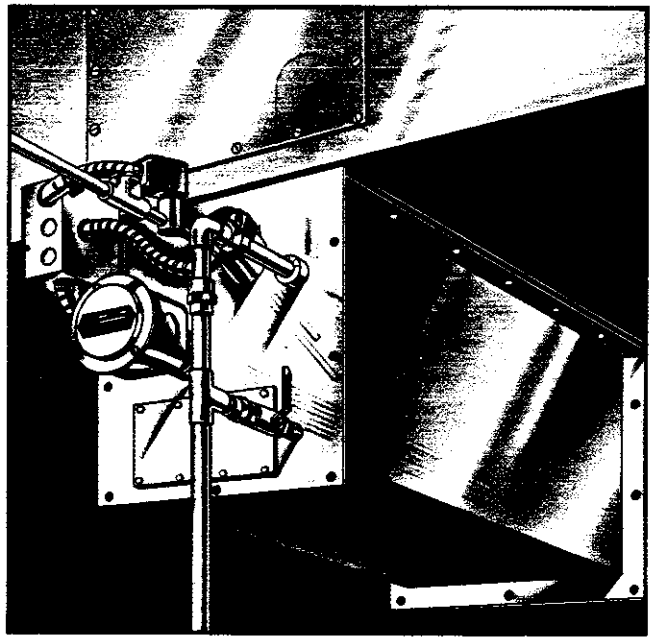
PRIMARY VOLTAGE _____ CONTROL VOLTAGE _____

MODEL NO. _____ JOB _____ ORDER NO. _____

VAPORSTREAM®

Maintenance Service Record

Date Inspected	Personnel	Observation	Actions Performed



VAPORSTREAM WARRANTY

DRI-STEEM HUMIDIFIER COMPANY guarantees every VAPORSTREAM humidifier:

1. To be manufactured of material as advertised and to be free of defects. We agree to replace any parts that are found to be defective within one year from the date of sale.

2. To function as claimed in product literature and to produce catalog capacities when properly installed.

3. The above provisions are in lieu of all other guarantees, obligations liabilities or warranties, expressed or implied.

For additional engineering specifications and free consultation on your humidification applications, write or call DRI-STEEM HUMIDIFIER COMPANY or your local DRI-STEEM/VAPORSTREAM representative.

TELEPHONE: 1-800-328-4447
In MN, call (612) 935-6986
TELEX 290675

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