COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL STEAM HUMIDIFIERS

HCHH Shown

CARNES MICROPROCESSOR CONTROLLED STEAM HUMIDIFIERS use ordinary untreated tap water and convert it to mineral free steam for humidity control in commercial, industrial, institutional and residential applications.

ECONOMICAL

- **Disposable Cylinders Eliminate Periodic Maintenance for Reduced Maintenance Costs**
- **Fast and Easy Installation**
- **Reliable Electronic Components for Long Life**

EFFICIENT

- **Circuit Board Utilizes Microprocessor to Maximize Energy Conservation**
- **Exclusive Circuit Board Design with Attached True Touchscreen Control Display**

VERSATILE

- **Digital Output on a True Touchscreen Control Display Providing Status and Help Buttons For Operational Details and Troubleshooting**
- **Capacities up to 200 Pounds of Steam Per Hour Per Single Unit**
- **Utilize any On-Off Humidistat, Carnes Proportional Humidistat or External Signal from DDC Controls**

HBGH Shown

The simplicity and unique advantages of humidity from directly boiling water in disposable cylinders has been well known since Carnes pioneered the concept in North America in 1969. Pan type humidifiers require messy, time consuming cleaning that may require the use of acids. Electric heating elements in pan type units may also require replacement. Easily changeable steam cylinders containing electrodes can be replaced in less than five minutes.

Cut-away used steam cylinder showing mineral deposits.

FRONT PANEL DISPLAYS & CONTROLS

The display on the front panel of the humidifier cabinet contains the "On-Off-Drain" switch, the LCD True Touchscreen display and the "Fill", "Drain" and "High Water" LED's.

"ON-OFF-DRAIN" SWITCH

In the "On" position the humidifier will operate if all controls are calling for humidity. The "Off" position is used for seasonal shut down if desired. The "Drain" position is used to drain water from the steam cylinder for maintenance. The fill solenoid valve will be on whenever the drain is activated to reduce the drain water temperature.

LCD TRUE TOUCHSCREEN DISPLAY

The LCD True Touchscreen display offers a user friendly interface to control and monitor many aspects of the humidifier. The screen uses pressure sensitive technology. Depressing on the labeled buttons on the designated area of the screen will allow you to navigate through the different menu pages.

HOME SCREEN

The "Home Screen" page is the main screen through which most other pages can be accessed. The "Home Screen" displays the current steam output in Lbs./Hr. (or Kg/Hr.) To select either is available under the "Setting" menu. The main "Home Screen" features four navigation buttons, Carnes logo button (providing contact information to the factory and the company website), Steam Menu button, Menu button and a Settings Menu button. Tapping any of these buttons will show dialog explaining the subject or status of that button, and display pictures. The "Home Screen" will also display a "Service Required" indicator when a current service issue is indicated. The "Service Required" and Steam Output number will illuminate in "RED". Tap on the "Service Required" button, this will take you to the service required page and indicate what service issue is being detected.

"FILL" LED

The FILL LED is a blue light illuminated when the Fill Valve is activated. An activated Fill Valve allows water to flow into the cylinder of the humidifier.

"DRAIN" LED

The DRAIN LED is a red light illuminated when the Drain Valve is activated. An activated Drain Valve allows water to drain from the humidifier.

"HIGH WATER" LED

The HIGH WATER LED is an orange light illuminated when the High Water Sensor is activated. An activated High Water Sensor indicates that the water has risen to the maximum allowable level in the cylinder.

"CARNES®" LOGO

The Carnes logo on the "Home Screen" will take you to a page that displays the Carnes Company contact information (address, phone number and company website). This feature is for the purpose of contacting the factory for any start-up questions, troubleshooting or service issues that may arise.

"STEAM" MENU

The "Steam" menu page will display the status of the four basic controls (Control Humidistat, Hi-Limit Humidistat, Air Flow Switch and Door Interlock). The humidifier will only produce steam when the unit is switched into the "ON" position, and if all four controls are satisfied.

A green "✓" will be displayed to indicate if the control is sending a signal. A Red "X" will be displayed to indicate if the control is not sending a signal.

1. **Control Humidistat** - Explains the status of the Control Humidistat indicator light, and also shows the current demand of the Control Humidistat.

2. **Hi-Limit Humidistat** - Explains the status of the Hi-Limit Humidistat indicator light, and also shows the current demand of the High Limit Humidistat.

3. **Air Flow** - Explains the status of the Air Flow switch. The Air Flow switch must sense proper air flow in order for the humidifier to activate. Insufficient air flow or an improperly installed air flow switch will cause the indicator to change to a red "X" and the unit not operate.

4. **Door Interlock** - Explains the status of the Door Interlock switch. The Door Interlock needs to be engaged for the unit to operate.

MENU

The "Menu" page displays four features: Setpoint, Component Activity, Dim LCD and Help. Tapping any of these buttons will show dialog explaining the subject or status of that button and display pictures.

1. **"SETPOINTS"**

   The Setpoints page displays the Setpoints (the target steam output of the humidifier) associated with the unit. There are three different Setpoints, but only one Setpoint is active at any given time. Each Setpoint is accompanied by the current value of the Setpoint to the right, and an indicator that represents its status.

   A. **Max Setpoint**
   B. **Controlled Setpoint**
   C. **Reduced Setpoint**

   The Setpoints have the following priorities: The Reduced Setpoint has the highest priority and always overrides the Controlled Setpoint and the Max Setpoint when active. The Controlled Setpoint has the next highest priority, and always overrides the Max Setpoint. It should be noted that the Reduced Setpoint is always lower than or equal to the Max Setpoint (or Controlled Setpoint, if active) and the Controlled Setpoint is always lower or equal to the Max Setpoint.

2. **"COMPONENT ACTIVITY"**

   The Component Activity page lists all internal components that can switch on and off during operation. This includes the Fill Valve, Drain Valve, Contactor, High Water Sensor and Communication. Each component listed is accompanied by a green "✓" or a red "X" indicator representing whether or not the component is currently 'on'.

   A. Fill Valve
   B. Drain Valve
   C. Contactor
   D. High Water Sensor
   E. Communication

3. **"DIM LCD"**

   This feature will toggle the LCD screen to dim and turn off to save on the longevity of the screen. It also has an Auto-Dim feature that will turn off the screen after 15 minutes of none use in the "Setting" menu.

4. **"HELP" MENU**

   The help pages consist of buttons labeled with questions. When a button is pressed, information will be given answering and/or giving information about the subject in question. A basic help page consists of text and/or diagrams to help the user through basic problems.

"SETTINGS"

The Settings menu has pages where all operational values can be set. It is password protected.

1. **Max Output Adjust**
   The maximum steam output of the unit can be set on this page. The maximum output can be adjusted lower from the nominal output value of the unit (set at factory).

2. **Cylinder Life Counter**
   This page consists of a counter where the user can monitor the life, in hours, of the cylinder.

3. **Fan Speed Adjust**
   This page consists of a slider bar that can change the speed of the fans when the humidifier is connected to an optional blower box.

4. **Setpoint Timeout**
   This page is where the Setpoint Timeout value is set. The maximum amount of time allowed for the unit to reach Setpoint during a fill sequence is designated by the Setpoint Timeout.

5. **High Water Timeout**
   This page is where the High Water Timeout value is set. This is the maximum amount of time allowed for the unit to run in a "Reduced Setpoint" mode.

6. **Boil Down Timer**
   This page is where the Boil Down Timer is set. Setting the Boil Down Timer higher or lower will adjust the water level in the cylinder.

7. **Settings Password**
   This page is where the password for the settings menu can be changed or disabled. If the password for the Settings menu is forgotten, it can be reset at the circuit board.

8. **Calibration Password**
   This page is where the Humidifier Unit Code, a four digit number identifying the humidifier, is programmed into the unit.

9. **Corrective Drain Length**
   This page is where the Corrective Drain Length is set. This value represents how much water should be drained from the cylinder when the humidifier senses a corrective drain is needed.

10. **ON/OFF Setting Buttons**
    There are a few operational options that do not need separate pages, and therefore are only enabled/disabled via the ON/OFF Buttons.

    A. **Drain Valve**
    B. **72-Hour Drain**
    C. **LCD Auto-Dim**
    D. **Steam Output Units**

Additional information and details can be found in the Installation, Operation and Maintenance Manual (Form 16834).

▼ APPLICATIONS

COMFORT

Temperature and relative humidity affect the comfort and well being of all living things. High temperatures require low humidity to maintain comfort conditions, while low temperatures can more easily be tolerated at high relative humidity. Humidification occurs when air is moisturized by a humidification unit or when hygroscopic materials (materials containing moisture) lose moisture to drier air. Proper humidification is widely accepted as healthy, minimizing employee illness and lost work time.

MATERIALS STORAGE

Paper, fabrics, wood, plastic, chemicals and most other materials are hygroscopic. Their water content depends on the humidity of the air around them. If air is too dry, these substances lose moisture until an equilibrium is reached between hygroscopic materials and the air.

PROCESS

Process operations, such as data processing areas, are affected by two major humidity factors: **hygroscopic** material and generation of **static electricity**.
Hygroscopic material used in the process influences **material weights, dimensions** and **workability.**

Static Electricity can totally disrupt high speed process operations as found in a data processing center, paper or film handling business. Created by friction between two substances, static electricity can be prevented by proper humidification of the process environment.

RECOMMENDED TEMPERATURE AND HUMIDITY RANGE - *Table 1*

APPLICATION	TEMP F°	RH %
Computer Rooms	72±2	50±5
Office Buildings	70-74	20-30
Libraries & Museums	68-72	40-55
Archival Libraries & Museums	55-65	35
Art Storage	60-72	50±2
Stuffed Animals	40-50	50
Bowling Centers	70-74	20-30
Health Facilities		
Full Term Nursery	75	30min.-60max.
Special Care Nursery	75-80	30min.-60max.
Patient Rooms	75	30
Intensive Care	75-80	30min.-60max.
Operating Rooms	68-76	50min.-60max.
Recovery Rooms	75	50min.-60max.
Lasik Eye Centers		
Electrical Instrument Mfg.	70	50-55
Fur Storage	40-50	55-65
Photo Film Darkroom	70-72	45-55
Photo Print Darkroom	70-72	45-55
Photo Drying Room	90-100	35-45
Photo Finishing Room	72-75	40-55
Cellophane Wrapping	75-80	45-65
Animal Laboratories		
Mouse, Rat	64-79	40-70
Cat	65-85	30-70
Dog	65-85	30-70
Primate	65-84	30-70
Clean Rooms	67-77	40-55
Printing Plants		
Lithography	76-80	43-47±2
Rotogravure		45-50±2
Collotype	80±2	85±2
Platemaking	75-80±2	45±2
Telephone Terminal Rooms	72-78	30-40
Radio and TV Studios	74-78	30-40

± = plus or minus

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▼ OPERATION

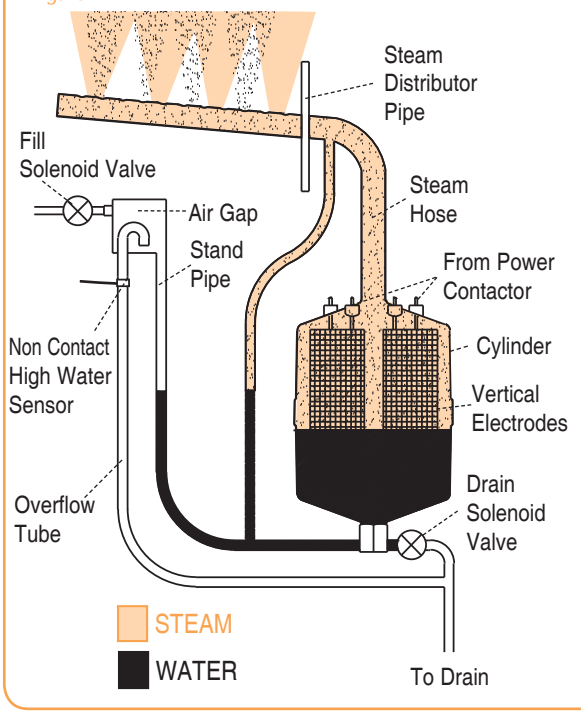
Upon a signal from external controls the circuit board opens a fill solenoid valve, allowing water to flow across an air gap into a standpipe. The standpipe provides a column of water to be fed into the cylinder using gravity. The air gap prevents back flow into the water supply and prevents the cylinder from becoming a pressure vessel. The steam cylinder operates at a pressure of approximately 1/2 psi.

The circuit board also closes a power contactor allowing current to flow to vertical electrodes sealed inside the cylinder. Current flows between the electrodes using minerals in the water as a conductor. The water is heated to boiling and converted to steam which leaves the cylinder through the flexible steam hose which is connected to the steam distributor pipe.

The circuit board reacts to current flow between the electrodes and automatically opens the fill solenoid valve when more water is required to maintain the desired output rate, and closes when the desired rate is reached. The operation of the drain solenoid valve is automatically controlled by the circuit board which responds to any changes in water conditions and drains the required quantity of water to provide stable operation and long cylinder life.

As mineral deposits build up within the cylinder the water level will slowly rise to contact clean electrode surfaces to maintain the desired steam output rate. When mineral deposits have covered all available electrode surface areas, current flow will be reduced to a level where the desired steam output cannot be reached and the service light will signal the need for maintenance. When the cylinder is filled with minerals it is easily changed in less than five minutes.

Figure A



▼ LOCATING THE HUMIDIFIER

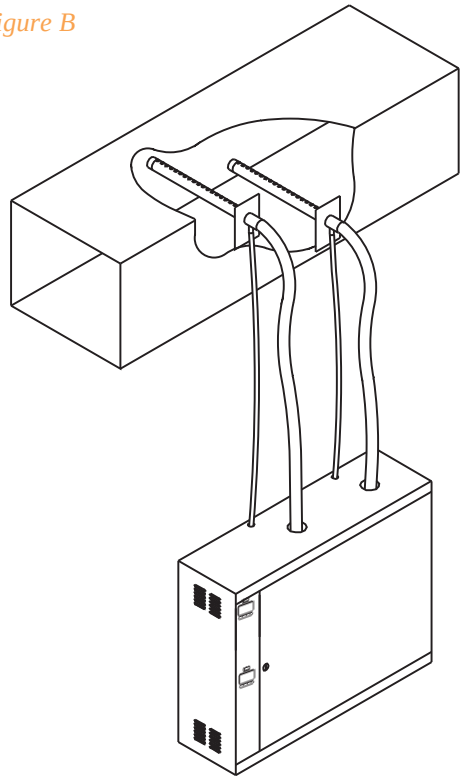
Locate the humidifier cabinet level and plumb on a surface as close to the steam distributor as possible at a convenient height for servicing. Allow 1" or more on the sides for ventilation and 16" from the bottom of the unit to the floor to allow for drain connections. Allow 14" in front of cabinet for door opening (Figure B).

The humidifier must never be located outside or where it may be exposed to freezing temperatures unless a heated, ventilated weatherproof enclosure by others is provided. Do not mount humidifiers on a hot or vibrating surface.

▼ STEAM DISTRIBUTOR PIPE LOCATION

Each steam cylinder requires a separate distributor pipe, steam hose and condensate return line. A cylinder may supply more than one distributor pipe by using an accessory "T" fitting but the output cannot be controlled separately. In a typical installation the humidifier is located below the duct as shown in Figure B. The distance between the humidifier cabinet and the steam distributor should be the minimum distance possible. Refer to Table 2 for maximum length that may be installed, based on static pressure to provide the most effective and efficient humidification.

Figure B



MAXIMUM STEAM HOSE LENGTH

Table 2

Duct Static Pressure "w.g."	0	1	2	3	4	5
Maximum Steam Hose Length (Ft.)	40	35	30	25	15	10

The maximum length of steam hose that may be installed as shown in Figure B is 12 feet. For steam hose lengths over 12 feet refer to Figure C. A drain "T" must be used to remove condensation that occurs in steam hose lengths over 12 feet. It is preferable to have the steam hose rise vertically from the cabinet and then slope downward to the distributor pipe as shown. If sufficient headroom is not available it is possible to install with an upward slope but the rise should be 2" in 12" to allow proper condensate drainage and steam flow.

Figure C

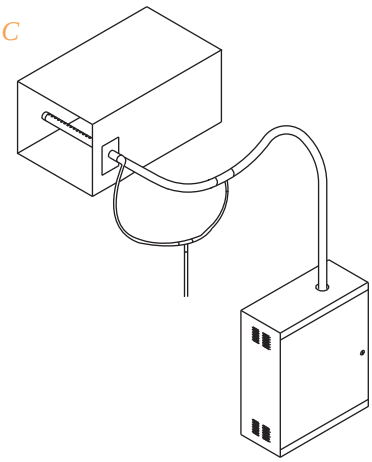


Figure D

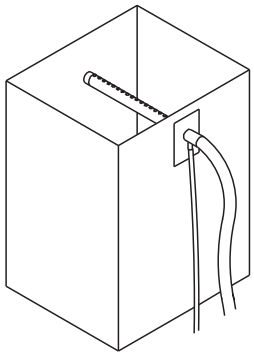


Figure E

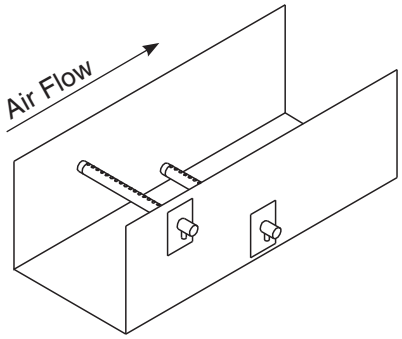
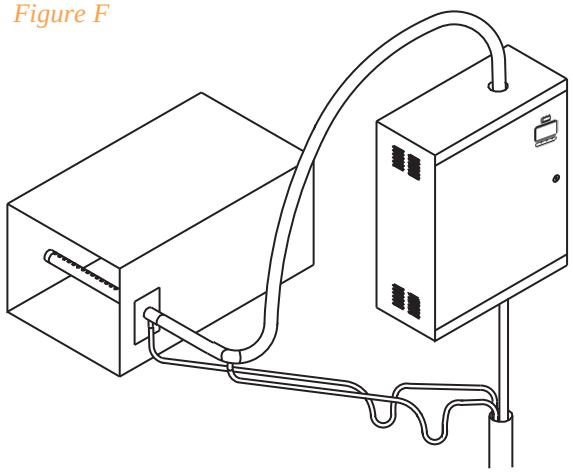


Figure F



▼ WATER SUPPLY REQUIREMENT

Carnes humidifiers will operate at water supply pressure from 20 to 120 psi and maximum water temperatures of 140°F. Water piping must be sized to allow the minimum flow rate shown in Table 3. This table does **NOT** indicate water consumption, only minimum flow rates. Actual consumption is determined by steam generated and water drained during the automatic or manual drain cycle.

Table 3

Model	Minimum Flow Rate	GPM
H_AH	18	.3-.5 gpm
H_DH	18	.3-.5 gpm
H_GH	24	.4-.7 gpm
H_HH	48	.8-1.0 gpm

In certain areas with extreme water conditions it may not be possible to operate the humidifier at all voltages. Table 4 shows acceptable water conductivity, measured in micromhos, in relation to the primary supply voltage. Water conductivity may be determined by contacting the local water utility or sending a six ounce sample to Carnes for a free analysis. Deionized water or water treated by a reverse osmosis process may have conductivity too low to operate. It may be possible to use a water softener to treat the water but contact the factory before installing the equipment.

ACCEPTABLE CONDUCTIVITY RANGES (Micromhos) *Table 4*

VOLTAGE		H_AH	H_DH	H_GH	H_HH
120	Min.	50	-	-	-
	Max.	1300	-	-	-
208	Min.	50	50	50	50
	Max.	1300	1300	1300	1300
230	Min.	50	50	50	50
	Max.	1300	1300	1300	1300
277	Min.	50	50	50	-
	Max.	1300	1300	1300	-
380	Min.	50	50	50	50
	Max.	1300	1100	1600	1600
415	Min.	50	50	50	50
	Max.	1300	1100	1600	1600
460	Min.	50	50	50	50
	Max.	1300	1100	1600	1600
575	Min.	50	50	50	50
	Max.	1100	900	1250	1250

CONTROL OPTIONS - *Figure G*

CONTROL HUMIDISTAT	AIR FLOW DETECTION	CONDENSATION PROTECTION
WALL HUMIDISTAT PROPORTIONAL CONTROL CARNES MODEL **HXHCG**	PRESSURE DIFFERENTIAL SWITCH CARNES MODEL **HXAAE**	DUCT ON-OFF HIGH LIMIT HUMIDISTAT CARNES MODEL **HXHAD**
OR	OR	OR
WALL HUMIDISTAT *(NEW)* PROPORTIONAL CONTROL CARNES MODEL **HXHAM**	AIR FLOW SWITCH CARNES MODEL **HXAAF**	DUCT PROPORTIONAL HIGH LIMIT HUMIDISTAT CARNES MODEL **HXHCH**
OR		OR
WALL HUMIDISTAT ON-OFF CONTROL CARNES MODEL **HXHAA**		DUCT PROPORTIONAL HIGH LIMIT HUMIDISTAT *(NEW)* CARNES MODEL **HXHAN**
OR		
DUCT HUMIDISTAT PROPORTIONAL CONTROL CARNES MODEL **HXHCH**		
OR		
DUCT HUMIDISTAT *(NEW)* PROPORTIONAL CONTROL CARNES MODEL **HXHAN**		
OR		
DUCT HUMIDISTAT ON-OFF CONTROL CARNES MODEL **HXHAB**		
OR		
TEMPERATURE COMPENSATED *(NEW)* PROPORTIONAL or ON-OFF HUMIDISTAT CARNES MODEL **HXHAMT**		

▼ CONTROL HUMIDISTAT

If an on-off humidistat is used the humidifier will generate steam at the preset output rate and cycle on or off as necessary to satisfy the conditioned area requirements. All humidifiers are preset at the factory for the maximum rating of the unit. The maximum output may be easily reset to a lower limit in the range of 25-100% using the touchscreen.

If Carnes proportional humidistat is used the humidifier will automatically vary the steam output rate in the range of 25-100% of the humidifiers maximum rating in response to the signal from the humidistat. Proportional control provides less cycling of the humidifier.

Either a wall humidistat or duct mounted humidistat in the return air may be used. The wall mounted humidistat is the most common as it allows the setting to be easily changed to accommodate changing requirements or to lower the relative humidity in the space to prevent condensation on windows during extremely cold weather. In applications where it may be desirable to prevent the occupants of a space from changing the setting, a duct mounted humidistat in the return may be used. This is normally mounted in the equipment room or in the duct where it is accessible only to maintenance personnel.

▼ AIR FLOW DETECTION

The humidifier control circuit should include some method to determine air flow. If the steam distributor pipe is located in a duct where there is no air flow and the control humidistat is calling for humidity, steam would be discharged into the duct where it would immediately condense. Air flow may be detected by several methods. The humidistat circuit may be interlocked by using a fan relay if the fan is direct driven. A fan relay is not recommended if a belt driven fan is used as a broken belt would stop air flow even though the fan relay was closed.

Among the alternatives are the use of a pressure differential switch that determines air flow by sensing a pressure differential caused by air movement in the duct. A paddle type switch is also available to determine air flow. The pressure differential switch is normally the preferred device as it is less susceptible to erratic operation caused by improper positioning in the duct system. Paddle switches require careful positioning in the duct to insure sufficient air flow to activate the switch.

▼ CONDENSATION PROTECTION

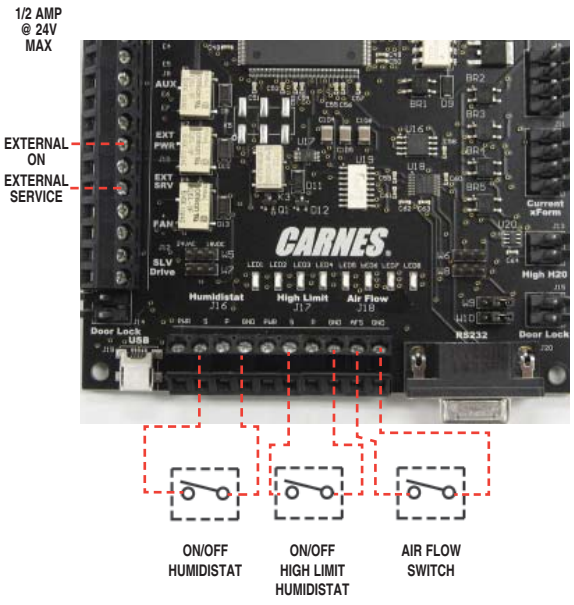
A third device may be desirable to provide condensation protection in the duct system. A high limit humidistat may be installed ten (10) feet downstream from the steam distributor pipe. This humidistat is normally set to 90-95% RH and opens the circuit if the humidity level in the duct exceeds the set-point. Use of this device is recommended particularly when the humidifier is used in applications where cooling air is being humidified or where a VAV system may throttle back to a point where air flow is insufficient to absorb the steam being introduced.

Either an on-off or proportional control high limit humidistat may be used with Carnes humidifiers. If a proportional humidistat is used the output of the humidifier will automatically be decreased to reduce the possibility of condensation. Two proportional humidistats may be used to control Carnes humidifiers if desired, one in the area to be humidified or return duct and another as a high limit in the supply duct. The humidifier will automatically select the lowest signal to control the humidifier output.

▼ CONTROL CONNECTIONS

Two cylinder humidifiers may be wired for simultaneous or separate operation. Controls should be connected to the terminals on the electronic circuit board. Avoid running control wiring near high voltage primary wires.

Figure H



MICROPROCESSOR CONTROL
CIRCUIT BOARD

▼ EXTERNAL DDC CONTROL SIGNALS

Carnes humidifiers can also accept a 0-10 volt DC signal to modulate the output of the humidifier. Polarity must be observed. Input impedance is 20K ohms. If a 4-20 mA input signal is provided to the humidifier a 470 ohm 1/4 watt resistor must be installed.

▼ EXTERNAL MONITORING

Terminals, shown in Figure H, are provided for indicating operation of the humidifier at a remote location. When the unit is operating, “EXT PWR” terminals are closed. Terminals are provided to indicate the need for service. When the output of the humidifier is less than 50% of set-point, “EXT SRV” terminals are closed. Each set of terminals are capable of switching 1/2 amp at 24 volts maximum.

MODELS AVAILABLE AND ELECTRICAL DATA - *Table 5*

	Model	Max Lb/Hr	Voltage	Phase	kW	Line Amp	Disc. Size	Optional Cir. Breaker*	Steam Cylinder	Cyl Wire Current
HBAH HCAH HSAH HTAH	H_AHAU	5	120	1	1.725	14.4	25	1-20 Amp	AX220	14.4
	H_AHBU	5	208	1	1.725	8.3	15	1-15 Amp	AX380	8.3
	H_AHDU	5	230	1	1.725	7.5	15	1-20 Amp	AX380	7.5
	H_AHFU	5	277	1	1.725	6.2	15	1-15 Amp	AX380	6.2
	H_AHLU	5	380	1	1.725	4.5	15	1-15 Amp	AX600	4.5
	H_AHQU	5	415	1	1.725	4.2	15	1-15 Amp	AX600	4.2
	H_AHMU	5	460	1	1.725	3.7	15	1-15 Amp	AX700	3.7
	H_AHNU	5	575	1	1.725	3.0	15	1-15 Amp	AX700	3
	H_AHAU	10	120	1	3.45	28.7	45	1-40 Amp	AX220	28.7
	H_AHBU	10	208	1	3.45	16.6	25	1-25 Amp	AX380	16.6
	H_AHDU	10	230	1	3.45	15.0	25	1-25 Amp	AX380	15
	H_AHFU	10	277	1	3.45	12.4	20	1-20 Amp	AX380	12.4
	H_AHLU	10	380	1	3.45	9.1	15	1-15 Amp	AX600	9.1
	H_AHQU	10	415	1	3.45	8.3	15	1-15 Amp	AX600	8.3
	H_AHMU	10	460	1	3.45	7.5	15	1-15 Amp	AX700	7.5
	H_AHNU	10	575	1	3.45	6.0	15	1-15 Amp	AX700	6
HBDH HCDH HSDH HTDH	H_DHBU	20	208	1	6.9	33.1	50	1-45 Amp	B380	33.1
	H_DHDU	20	230	1	6.9	29.9	45	1-40 Amp	B380	30
	H_DHFU	20	277	1	6.9	24.9	40	1-35 Amp	B380	24.9
	H_DHLU	20	380	1	6.9	18.1	30	1-30 Amp	B600	18.1
	H_DHQU	20	415	1	6.9	16.6	25	1-25 Amp	B600	16.6
	H_DHMU	20	460	1	6.9	15.0	25	1-25 Amp	B700	15
	H_DHNU	20	575	1	6.9	12.0	20	1-15 Amp	B700	12
	H_DHCU	20	208	3	6.9	19.1	30	1-25 Amp	B500	19.1
	H_DHEU	20	230	3	6.9	17.3	30	1-25 Amp	B500	17.3
	H_DHTU	20	380	3	6.9	10.4	20	1-20 Amp	B600	10.4
	H_DHWU	20	415	3	6.9	9.6	20	1-20 Amp	B600	9.6
	H_DHGU	20	460	3	6.9	8.6	15	1-15 Amp	B700	8.6
	H_DHHU	20	575	3	6.9	6.9	15	1-15 Amp	B700	6.9
	H_DHCU	30	208	3	10.3	28.7	45	1-40 Amp	B500	28.7
	H_DHEU	30	230	3	10.3	25.9	40	1-35 Amp	B500	25.9
	H_DHTU	30	380	3	10.3	15.6	25	1-25 Amp	B600	15.6
	H_DHWU	30	415	3	10.3	14.4	25	1-25 Amp	B600	14.4
	H_DHGU	30	460	3	10.3	13.0	20	1-20 Amp	B700	13
	H_DHHU	30	575	3	10.3	10.4	20	1-15 Amp	B700	10.4
HBGH HCGH HSGH HTGH	H_GHBU*	30	208	1	10.3	49.7*	80	2-35 Amp*	C62	24.8
	H_GHDU	30	230	1	10.3	44.9	70	1-60 Amp	C62	22.4
	H_GHFU	30	277	1	10.3	37.3	60	1-50 Amp	C62	18.6
	H_GHLU	30	380	1	10.3	27.2	45	1-40 Amp	C62	13.6
	H_GHQU	30	415	1	10.3	24.9	40	1-40 Amp	C62	12.5
	H_GHMU	30	460	1	10.3	22.5	35	1-30 Amp	C62	11.3
	H_GHNU	30	575	1	10.3	17.9	30	1-25 Amp	C62	9.0
	H_GHCU	40	208	3	13.8	38.3	60	1-60 Amp	C62	19.1
	H_GHEU	40	230	3	13.8	34.6	60	1-50 Amp	C62	17.2
	H_GHTU	40	380	3	13.8	20.9	35	1-35 Amp	C65	20.9
	H_GHWU	40	415	3	13.8	19.2	30	1-30 Amp	C65	19.2
	H_GHGU	40	460	3	13.8	17.3	30	1-25 Amp	C65	17.3
	H_GHHU	40	575	3	13.8	13.8	25	1-20 Amp	C65	13.8

* = Circuit Breaker is REQUIRED per NEC 48 amp guidelines.

MODELS AVAILABLE AND ELECTRICAL DATA - *Table 5*

	Model	Max Lb/Hr	Voltage	Phase	kW	Line Amp	Disc. Size	Optional Cir. Breaker*	Steam Cylinder	Cyl Wire Current
HBGH HCGH HSGH HTGH	H_GHCU	50	208	3	17.2	47.8	80	2-35 Amp	C62	23.9
	H_GHEU	50	230	3	17.2	43.2	70	1-60 Amp	C62	21.6
	H_GHTU	50	380	3	17.2	26.2	40	1-40 Amp	C65	26.2
	H_GHWU	50	415	3	17.2	24.0	40	1-40 Amp	C65	24
	H_GHGU	50	460	3	17.2	21.6	35	1-30 Amp	C65	21.6
	H_GHHU	50	575	3	17.2	17.3	30	1-25 Amp	C65	17.3
	H_GHCU*	60	208	3	20.7	57.4*	90	2-40 Amp*	C62	28.7
	H_GHEU*	60	230	3	20.7	51.9*	80	2-40 Amp*	C62	26
	H_GHTU	60	380	3	20.7	31.4	50	1-50 Amp	C65	31.4
	H_GHWU	60	415	3	20.7	28.8	45	1-45 Amp	C65	28.8
	H_GHGU	60	460	3	20.7	26.0	40	1-40 Amp	C65	26
	H_GHHU	60	575	3	20.7	20.8	35	1-30 Amp	C65	20.8
	H_GHCU*	80	208	3	27.5	76.5*	125	2-60 Amp*	C62	38.2
	H_GHEU*	80	230	3	27.5	69.2*	110	2-50 Amp*	C62	34.6
	H_GHTU	80	380	3	27.5	41.9	70	1-60 Amp	C12	21
	H_GHWU	80	415	3	27.5	38.4	60	1-60 Amp	C12	19.2
	H_GHGU	80	460	3	27.5	34.6	60	1-50 Amp	C12	17.3
	H_GHHU	80	575	3	27.5	27.7	45	1-40 Amp	C12	13.9
	H_GHCU*	100	208	3	34.4	95.6*	150	2-60 Amp*	C62	47.8
	H_GHEU*	100	230	3	34.4	86.4*	150	2-60 Amp*	C62	43.2
	H_GHTU*	100	380	3	34.4	52.3*	110	2-50 Amp*	C12	34.2
	H_GHWU	100	415	3	34.4	47.9	80	2-40 Amp	C12	24
	H_GHGU	100	460	3	34.4	43.3	70	1-60 Amp	C12	21.7
	H_GHHU	100	575	3	34.4	34.6	60	1-50 Amp	C12	17.3
HBHH HCHH HSHH HTHH	H_HHCU*	125	208	3	43	119.5*	200	4-40 Amp*	C62 (2)	29.8
	H_HHEU*	125	230	3	43	108*	175	4-40 Amp*	C62 (2)	27
	H_HHTU*	125	380	3	43	65.3*	100	2-50 Amp*	C12 (2)	16.3
	H_HHWU*	125	415	3	43	59.8*	90	2-45 Amp*	C12 (2)	15
	H_HHGU*	125	460	3	43	54.0*	90	2-40 Amp*	C12 (2)	13.5
	H_HHHU	125	575	3	43	43.2	70	2-30 Amp	C12 (2)	10.8
	H_HHCU*	150	208	3	51.7	143.5*	225	4-50 Amp*	C62 (2)	35.8
	H_HHEU*	150	230	3	51.7	129.7*	200	4-50 Amp*	C62 (2)	32.4
	H_HHTU*	150	380	3	51.7	78.6*	125	2-60 Amp*	C12 (2)	19.7
	H_HHWU*	150	415	3	51.7	71.9*	110	2-60 Amp*	C12 (2)	18
	H_HHGU*	150	460	3	51.7	64.8*	100	2-50 Amp*	C12 (2)	16.2
	H_HHHU*	150	575	3	51.7	51.9*	80	2-35 Amp*	C12 (2)	13
	H_HHCU*	175	208	3	60.3	167.3*	300	4-60 Amp*	C62 (2)	41.8
	H_HHEU*	175	230	3	60.3	151.3*	250	4-60 Amp*	C62 (2)	37.8
	H_HHTU*	175	380	3	60.3	91.6*	150	4-35 Amp*	C12 (2)	22.9
	H_HHWU*	175	415	3	60.3	83.9*	150	2-60 Amp*	C12 (2)	21
	H_HHGU*	175	460	3	60.3	75.6*	125	2-60 Amp*	C12 (2)	18.9
	H_HHHU*	175	575	3	60.3	60.5*	100	2-50 Amp*	C12 (2)	15.1
	H_HHCU*	200	208	3	68.9	191.2*	300	4-60 Amp*	C62 (2)	47.8
	H_HHEU*	200	230	3	68.9	172.9*	300	4-60 Amp*	C62 (2)	43.2
	H_HHTU*	200	380	3	68.9	104.7*	175	4-40 Amp*	C12 (2)	26.2
	H_HHWU*	200	415	3	68.9	95.9*	150	4-35 Amp*	C12 (2)	23.9
	H_HHGU*	200	460	3	68.9	86.4*	150	2-60 Amp*	C12 (2)	21.6
	H_HHHU*	200	575	3	68.9	69.2*	110	2-50 Amp*	C12 (2)	17.2

* = Circuit Breaker is REQUIRED per NEC 48 amp guidelines.

NOTES: Identifying and explaining the electrical data and unit detail in Table 8 on the previous page

"Model" and **"Optional Circuit Breaker"** columns designate presence, quantity and amp rating of optional circuit breakers. In addition, as an option, internally mounted, switchable on-off, circuit breakers are available in models preceded by **"HB" or "HT". PLEASE NOTE: Certain units require circuit breakers per NEC 48 amp guidelines.**

"Maximum Lb./Hr." designates maximum capacity of humidifier. Units are shipped from the factory preset at the maximum rate. The output rate may be easily reset after installation anywhere between 100% and 25% of maximum capacity.

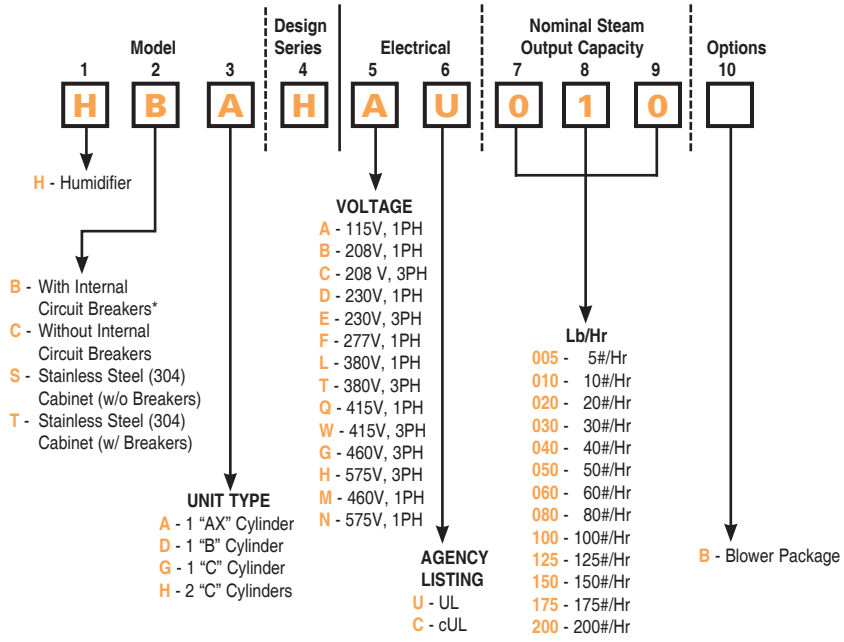
"Voltage" and **"Phase"** designate available phase and nominal voltages. Single phase units may be operated from two legs of a three phase supply but the load will be unbalanced.

"kW" ratings shown is at maximum output rate. If a unit is reset for less than maximum output, the kW is reduced proportionally.

"Line Amp" and **"Disc. Size"** are amp ratings shown for use in selecting electrical service requirements.

"Steam Cylinder" column shows the quantity and the model of steam generating cylinders mounted in the humidifier. Each cylinder requires its own steam distribution pipe, steam hose and condensate return line.

"Cylinder Wire Current" - as a process of troubleshooting, it may be necessary to confirm current flow through individual cylinder wires during operation. Match humidifier with electrical data.



***NOTE:** AN EXTERNAL FUSED DISCONNECT SWITCH, OR OTHER SIMILAR PROTECTION, AS REQUIRED BY LOCAL, AND NATIONAL ELECTRICAL CODES MUST BE SUPPLIED AND INSTALLED BY OTHERS. An optional circuit breaker (except for select models over 48 amps) is available in the unit to reduce the risk of costly damage in the event of internal failure. It is not meant to be the primary protection as may be required by local and national electrical codes. All units include electronic overload protection as a standard feature.

▼ UNIT VOLTAGE CHARACTERISTICS

Humidifiers may be ordered with the voltage nameplate ratings shown below. The units may be operated at nominal system voltage shown in Table 6.

Table 6

Unit Nameplate Voltage	Suitable Nominal System Voltages
120	115, 120
208	208
230	220, 230, 240
277	277
380	380
415	400, 415
460	440, 460, 480
575	550, 575, 600

▼ CYLINDER LIFE

Cylinders have an average life of 1150 hours when operating at maximum output with a water supply hardness of 150 ppm. Approximate cylinder life for other water hardness may be determined by multiplying 1150 by the correction factor shown in Table 7.

Table 7

Water Hardness (ppm)	Correction Factor
50	3.00
100	1.50
150	1.00
200	0.75
250	0.60
300	0.50

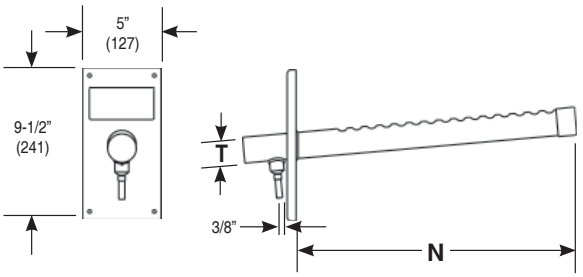
Cylinder life will be extended if operated at less than maximum output. Multiply the cylinder life calculated in Table 7 by the correction factory shown in Table 8.

Table 8

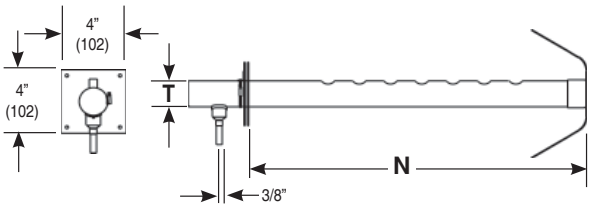
% of Maximum Output	Correction Factor
100	1.00
75	1.33
50	2.00

STEAM DISTRIBUTOR PIPES

Lengths 012-036



Lengths 048-120



Distributor Pipes for Models: H_AH, H_DH

PIPE	N	T
HXPBB012S	11-13/16 (300mm)	7/8
HXPBB018S	17-13/16 (452mm)	7/8
HXPBB024S	23-13/16 (605mm)	7/8
HXPBB030S	29-13/16 (757mm)	7/8
HXPBB036S	35-13/16 (910mm)	7/8

PIPE	Minimum** N	Maximum** N	T
HXPBB040S	35 (889mm)	38 (965mm)	7/8
HXPBB044S	39 (991mm)	42 (1067mm)	7/8
HXPBB048S	43 (1092mm)	46 (1168mm)	7/8
HXPBB052S	47 (1194mm)	50 (1270mm)	7/8
HXPBB056S	51 (1295mm)	54 (1372mm)	7/8
HXPBB060S	55 (1397mm)	58 (1473mm)	7/8
HXPBB064S	59 (1499mm)	62 (1575mm)	7/8
HXPBB068S	63 (1600mm)	66 (1676mm)	7/8
HXPBB072S	67 (1702mm)	70 (1778mm)	7/8
HXPBB076S	71 (1803mm)	74 (1880mm)	7/8
HXPBB080S	75 (1905mm)	78 (1981mm)	7/8
HXPBB084S	79 (2007mm)	82 (2083mm)	7/8
HXPBB088S	83 (2108mm)	86 (2184mm)	7/8
HXPBB092S	87 (2210mm)	90 (2286mm)	7/8
HXPBB096S	91 (2311mm)	94 (2388mm)	7/8
HXPBB100S	95 (2413mm)	98 (2489mm)	7/8
HXPBB104S	99 (2515mm)	102 (2591mm)	7/8
HXPBB108S	103 (2616mm)	106 (2692mm)	7/8
HXPBB112S	107 (2718mm)	110 (2794mm)	7/8
HXPBB116S	111 (2819mm)	114 (2896mm)	7/8
HXPBB120S	115 (2921mm)	118 (2997mm)	7/8

***See Note A*

Distributor Pipes for Models: H_GH, H_HH

PIPE	N	T
HXPBC012S	11-13/16 (300mm)	1-5/8
HXPBC018S	17-13/16 (452mm)	1-5/8
HXPBC024S	23-13/16 (605mm)	1-5/8
HXPBC030S	29-13/16 (757mm)	1-5/8
HXPBC036S	35-13/16 (910mm)	1-5/8

PIPE	Minimum** N	Maximum** N	T
HXPBC048S	43 (1092mm)	46 (1168mm)	1-5/8
HXPBC060S	55 (1397mm)	58 (1473mm)	1-5/8
HXPBC072S	67 (1702mm)	70 (1778mm)	1-5/8
HXPBC084S	79 (2007mm)	82 (2083mm)	1-5/8
HXPBC096S	91 (2311mm)	94 (2388mm)	1-5/8
HXPBC108S	103 (2616mm)	106 (2692mm)	1-5/8
HXPBC120S	115 (2921mm)	118 (2997mm)	1-5/8

*****NOTE A***

The mounting plate on these pipes is adjustable to compensate for slight variations in ductwork dimensions. The "N" dimension is shown at both maximum and minimum depending on position of mounting plate. An infinite variety of settings are available between the minimum and maximum. A mounting strap is provided on the end of the pipe to secure to the top or side of the duct for support.

MATERIAL

Standard distributor pipes are fabricated from stainless steel.

▼ FAN DISTRIBUTION UNITS

REMOTE MOUNTED

Humidifier Model	Nominal Steam Output Rate	Remote Mounted Fan Unit Model
H_AH	005, 010	HXBHB (1 Required)
H_DH	020, 030	HXBHB (1 Required)
H_GH	030, 040, 050, 060, 080, 100	HXBHC (1 Required)
H_HH	125, 150, 175, 200	HXBHC (2 Required)

Fan distribution units are available for use in areas which do not have duct systems or where duct air temperatures are too low to provide sufficient humidification. For example, in computer areas the desired relative humidity may not be possible in the conditioned space without causing condensation in the duct.

HUMIDIFIER MOUNTED

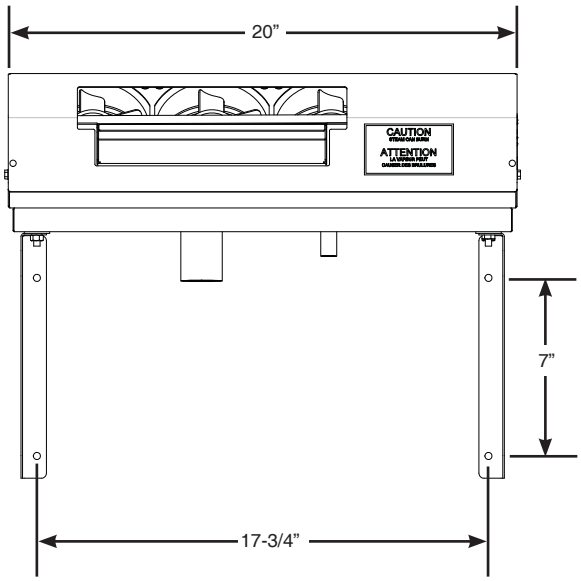
Humidifier Model	Nominal Steam Output Rate	Humidifier Mounted Fan Unit Model
H_AH	005, 010	AVAILABLE
H_DH	020, 030	AVAILABLE
H_GH	030, 040, 050, 060, 080, 100	AVAILABLE
H_HH	125, 150, 175, 200	NOT AVAILABLE

Fan distribution units must be mounted securely on a level and plumb surface at least three feet below the ceiling for a Model HXBHB and at least four feet below the ceiling for a Model HXBHC to prevent condensing on the ceiling surface. Allow 20 ft. in front of the HXBHB and 30 feet in front of the HXBHC for the steam to be absorbed into the air. Do not mount the units above any items that would be damaged if a water leak were to develop.

▼ OPTIONS

STANDARD MOUNTING: Factory attached to humidifier.
OPTION: Mounted remote from humidifier.
FAN VOLTAGE: 3 fans attached, 12 volt from humidifier

***NOTE:** *Selected control humidifiers (HXHAA-ON/OFF, HXHCG/Proportional or HXHAM), whether mounted or remote units, will be mounted external to fan distribution boxes for more consistent and accurate operation. Field wiring, by others, will need to be done for both mounted and remote units. (Note wiring diagram on door of fan distribution unit.)*

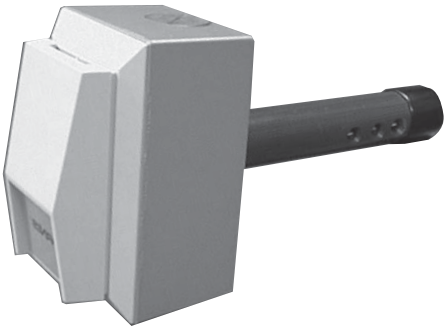


WALL HUMIDISTAT, PROPORTIONAL CONTROL

Model HXHAM

The Model HXHAM is a wall-mounted, microprocessor-controlled humidistat solution for cutting edge humidity control. The HXHAM employs a backlit LCD module, which displays both the ambient temperature and humidity of the surrounding air. The embedded software allows user navigation between temperature/humidity viewing mode and set-point adjustment mode, and also outdoor temperature and humidity viewing mode. Set-point range is 0 to 100%. An optional outdoor temperature compensation sensor can be added (HXHAMT).

DUCT HUMIDISTAT, PROPORTIONAL CONTROL



Model HXHAN

The Model HXHAN is an intelligent humidistat solution used exclusively for duct mounted installations. The humidistat is capable of providing both humidity and temperature measurements from inside the duct. The microprocessor control takes the temperature into consideration when calculating the humidity to provide an extra degree of precision. 0 to 100% set-point range.

WALL HUMIDISTAT, ON-OFF CONTROL

Model HXHAA

This attractive wall mounted humidistat is a convenient control for mounting in the conditioned space. Select a location four to five feet above the floor in freely circulating air of the temperature and humidity about average for the entire space to be controlled. Avoid locations near hot or cold air ducts and discharge air from the humidifier. Scale range is from 10%-90% RH Differential is 5% non-adjustable. Humidistat is **UL** listed. Case dimensions are 4-3/8" high, 2-7/8" wide and 1-5/8" deep including control knob.

WALL HUMIDISTAT, PROPORTIONAL CONTROL

Model HXHCG

The wall mounted HXHCG humidistat uses a monolithic sensor and electronic circuitry to provide accurate and reliable humidity sensing. Set-point range is 0 to 100%. The HXHCG has a concealed set-point adjustment with a locking cover to prevent tampering. Ambient operating conditions are from 0° to 85°C. Case dimensions are 2-13/16" x 4-1/2" x 1-1/4".

DUCT HUMIDISTAT, ON-OFF CONTROL

Model HXHAB

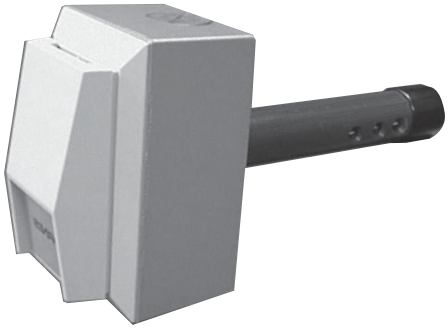
This duct mounted humidistat mounts in the return air duct to provide control of the humidifier. The control should be located in the duct where it will be affected by normal air flow. The maximum temperature at the nylon element must not exceed 125°F. The control can be mounted in any position, but where possible locate it on the side of the duct to make the set-point adjustment easily accessible. Scale range is 15%-50% RH Differential is 4%-6% non-adjustable. Humidistat is **UL** listed. Case dimensions are 3-3/4" high, 2-3/8" wide. Humidistat extends 7-1/2" into duct and projects 2-1/2" outside of the duct.

DUCT HIGH LIMIT HUMIDISTAT, ON-OFF CONTROL

Model HXHAD

The Model HXHAD humidistat is available for use as a safety precaution to prevent air in the duct from exceeding a preset level. Do not use the humidistat in air that is over 125°F or in locations where the unit could become wet. The control must be mounted a minimum of 10 feet downstream of the distributor pipe. Scale range is from 15%-95% RH Differential is 5% non-adjustable. Mounting plate dimensions are 6-1/2" wide, 4-3/4" high. Humidistat extends 1-1/4" into duct and projects 2-1/4" outside the duct.

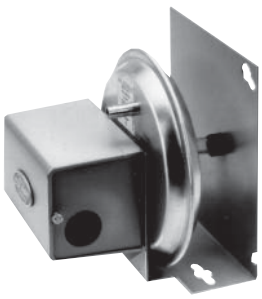
DUCT HUMIDISTAT OR HIGH LIMIT, PROPORTIONAL CONTROL



Model HXHCH

The Model HXHCH is designed to be mounted in a duct to provide a means of sensing relative humidity. Set-point range is from 0 to 100% R. H. Ambient operating conditions are from 0° to 85°C. The humidistat may be mounted in a return duct to provide a mean of sensing and controlling relative humidity. The humidistat may be mounted in a supply duct a minimum of 10 feet downstream from the distributor pipe when used as a high limit humidistat. Case dimensions are 2-13/16" x 4-1/2" x 2-1/4". The probe extends 5-3/4" into the duct.

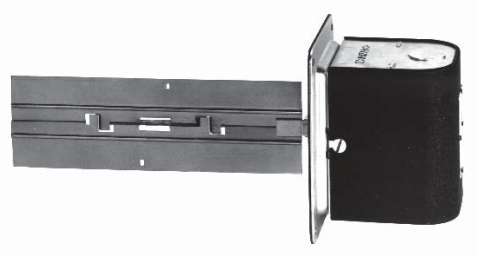
AIR FLOW SWITCH PRESSURE DIFFERENTIAL TYPE



Model HXAAE

Air flow in the duct may be sensed by using this differential pressure switch. The differential in pressure between the interior of the duct and ambient when air is moving in the duct closes a micro switch allowing the humidifier to operate. Air pressure differential as low as .07 w.g. and as high as 12.0 w.g. may be sensed with one model. The switch may be mounted with tubing connecting to the duct. Switch is **UL** listed.

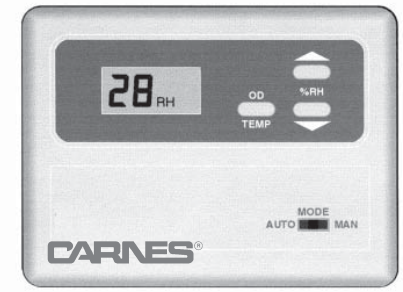
AIR FLOW SWITCH, VELOCITY TYPE



Model HXAAF

This air flow switch is installed in the duct to prevent humidifier operation when air flow is not occurring. This switch provides a positive and economical method to detect loss of air flow velocity. The switch may be installed on the side, top, or bottom of a horizontal duct. Installation can be made in a vertical duct if the air flow is upward. A horizontal flow velocity of 480 fpm or upward vertical flow of 910 fpm is required to operate the switch. Switch is **UL** listed. Case dimensions are 4-3/8 high, 3-13/16" wide. The paddle extends 7-23/32" into the duct.

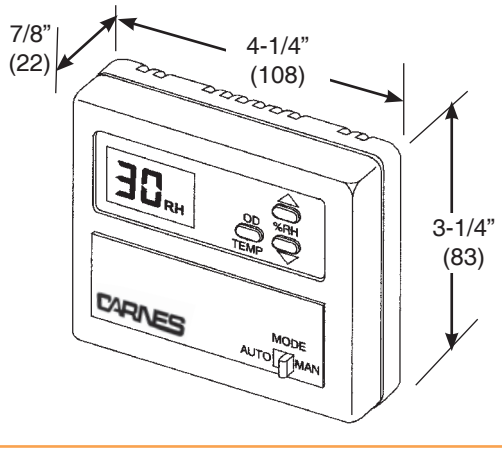
OUTDOOR AIR TEMPERATURE COMPENSATED DIGITAL HUMIDISTAT, ON-OFF CONTROL

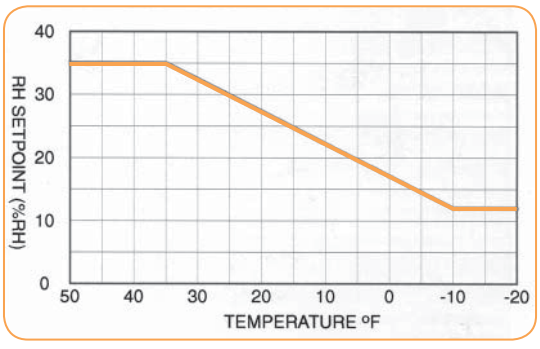


Model HXHAT

The HXHAT humidistat can be either wall or duct mounted and includes a remote outdoor temperature sensor for exterior wall or intake duct mounting. The humidistat can automatically change the set-point in response to changes in outdoor temperature or be set to maintain a set-point regardless of temperature changes. The LCD display shows set-point RH%, actual RH% or outdoor temperature (from -9 to 98°F). Relay contacts provide an on/off signal to the humidifier. Set-point range is from 30-65% RH. Default set-point is 40% RH.

The HXHAT will automatically reduce the RH set-point as the temperature drops below 35°F. The graph below shows the RH setting of 35° RH and as the temperature drops the RH set-point is adjusted by the computer as shown. Below -10° there is no adjustment.





STEAM HOSE

Carnes steam hose is made from EPDM compound to withstand the low pressure steam without deterioration. Model HXSAB steam hose has an I. D. of 7/8" for use with units that use "AX" or "B" steam cylinders. Model HXSAC has an I. D. of 1-5/8" for use with units that use "C" cylinders. The hose may be easily cut to the exact length at time of installation.

CONDENSATE RETURN LINE

Two models of condensate return line are available. Model HXRA has an I. D. of 3/8" and is used whenever steam distributor pipes are used with the humidifier. Model HXLA has an I. D. of 5/8" and is used with optional fan distribution units.

STEAM HOSE DRAIN "T" FITTINGS

Steam hose drain "T" are available for use when the duct is located below the top of the humidifier or where the length of steam hose is in excess of 12 feet.

Humidifier Model	Drain "T" Model	Dimensions
HBA, HCA HBD, HCD	HXTABB	7/8"x7/8"x3/8"
HBG, HCG HBH, HCH	HXTACB	1-5/8"x1-5/8"x3/8"

"T" FITTINGS

In some applications it may be desirable to have the steam generator cylinder feed two steam distributor pipes. "T" fittings can be installed in the steam hose and condensate return line.

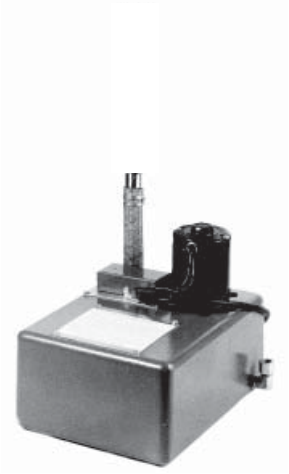
STEAM HOSE "T" FITTINGS

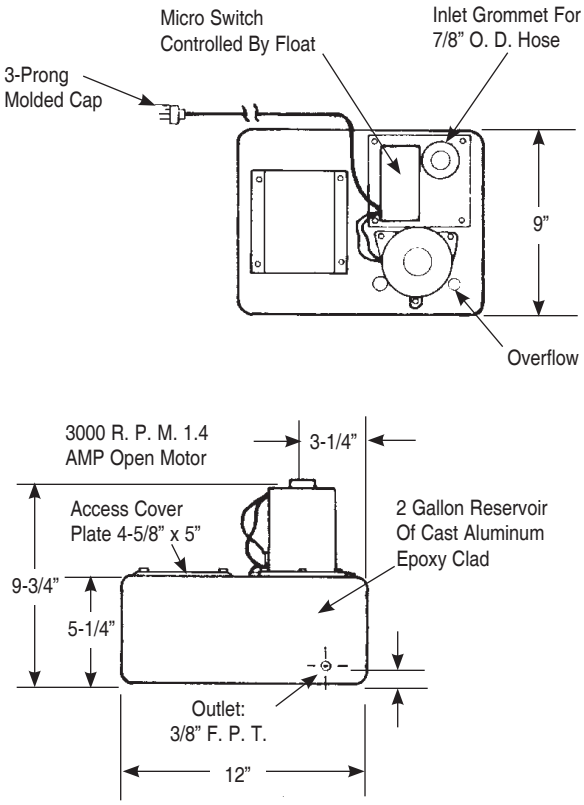
Humidifier Model	Drain "T" Model	Dimensions
HBA, HCA HBD, HCD	HXTABA	7/8"x7/8"x7/8"
HBG, HCG HBH, HCH	HXTACA	1-5/8"x1-5/8"x1-5/8"

CONDENSATE HOSE "T" FITTINGS

Humidifier Model	Drain "T" Model	Dimensions
ALL	HXTAD	3/8"x3/8"x3/8"

DRAIN WATER PUMP



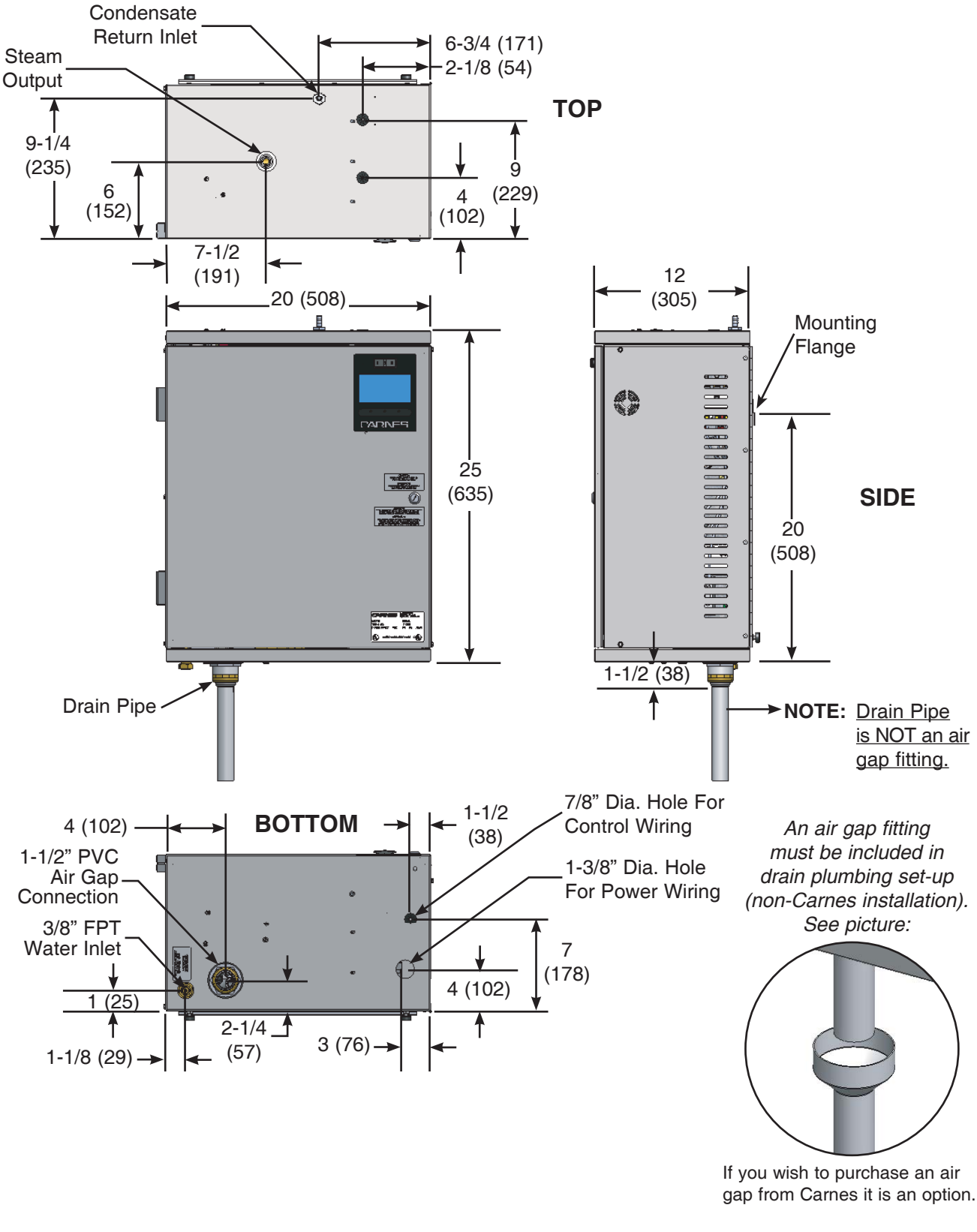


Model HXWA

A drain water pump is available for mounting directly below the humidifier cabinet. This pump is ideal for an application where the building drain is remotely located or is at a higher elevation than the humidifier drain connection. This unit operates on a float principle which automatically starts the pump when the reservoir is 3/4 full of water. The pump is capable of operation with a vertical lift up to 12 feet or horizontal run of 40 feet. The complete package includes drain pump with six feet of cord and plug for 115 volt operation.

Models Available		
HXCBAX145	HXCBB380	HXCBC6F
HXCBAX220	HXCBB500	HXCBC6X
HXCBAX380	HXCBB600	HXCBC61
HXCBAX500	HXCBB700	HXCCC62
HXCBAX600		HXCBC63
HXCBAX700		HXCBC64
		HXCBC65
		HXCBC12

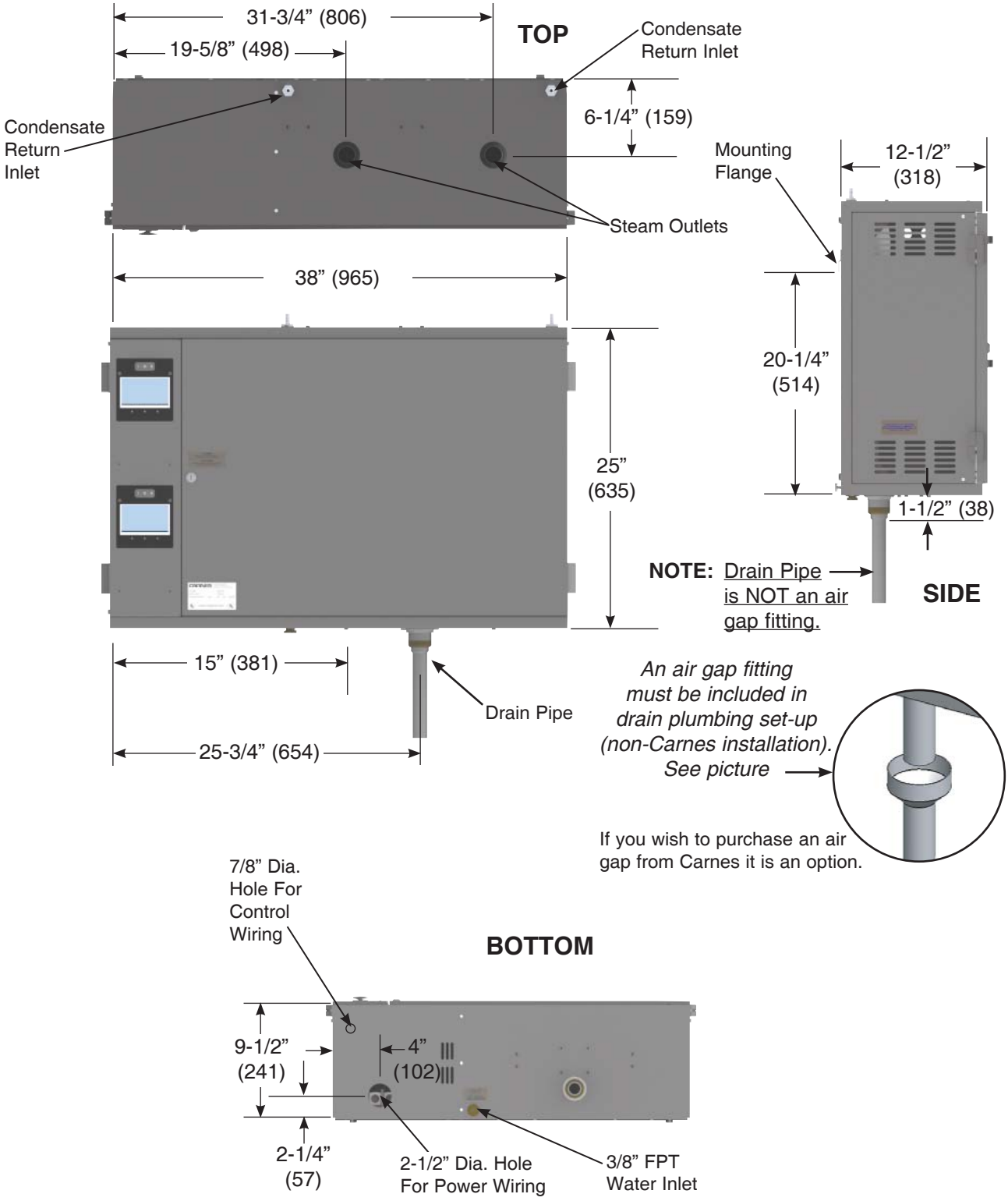
MODELS: H_AH
H_DH
H_GH



An air gap fitting must be included in drain plumbing set-up (non-Carnes installation). See picture:

If you wish to purchase an air gap from Carnes it is an option.

MODELS: H_HH


31-3/4" (806)
19-5/8" (498)
TOP
Condensate Return Inlet
6-1/4" (159)
Condensate Return Inlet
Steam Outlets
38" (965)
25" (635)
15" (381)
Drain Pipe
25-3/4" (654)
Mounting Flange
12-1/2" (318)
20-1/4" (514)
1-1/2" (38)
NOTE: Drain Pipe is NOT an air gap fitting.
SIDE
An air gap fitting must be included in drain plumbing set-up (non-Carnes installation). See picture
If you wish to purchase an air gap from Carnes it is an option.
7/8" Dia. Hole For Control Wiring
BOTTOM
9-1/2" (241)
4" (102)
2-1/4" (57)
2-1/2" Dia. Hole For Power Wiring
3/8" FPT Water Inlet

1. Provide self-contained microprocessor controlled steam generating humidifiers of the size(s) shown on plans as manufactured by Carnes Company, Verona, WI.
2. Carnes Humidifiers shall have the capacity to operate at 115, 208, 230, 277, 380, 415, 460 and 575 volt (or nominal value), 60 or 50 hz (cycle), single or 3 phase power. Specific combination of maximum output, voltage and phase for order application determined by electrical data chart.
3. The humidifier(s) shall be UL and cUL listed.
4. The humidifier(s) shall have a total Color "True Touchscreen" user interface. Features:
   a. True Touchscreen navigation for all aspects of operation and information access.
   b. Cylinder life-counter (hours of operation. Found by accessing Settings button.
   c. With Fan Distribution Unit, there is a fan speed Slide Bar control with CFM indication. Found by accessing Settings button.
   d. "Help" screen button.
   e. "Service Required" button and indicator and corresponding screen explaining service issues and possible troubleshooting tips.
   f. "Dim LCD" feature button.
   g. "Settings button - where all operational values can be set.
   h. "Setpoints" button - target steam output of the humidifier.
5. Steam shall be generated from tap water or softened water (see factory representative) in a factory sealed cylinder containing electrodes. Cylinders shall not require setting of electrode spacing, cleaning or maintenance and shall be of the disposable type.
6. The humidifier(s) shall include an automatic drain cycle controlled electronically to maximize energy efficiency. Drain cycle shall adapt to variations in water conditions (high/low conductivity and high/low hardness) and not require manual setting. There is also a default setting for a pulsing drain action to assist in keeping drain lines open.
7. In the event of over-current, the humidifier shall signal that a fault condition exists by message on touchscreen. Over-current protection shall be resettable. Replacement type fuses are not acceptable.
   Option: Humidifier(s) shall also include secondary magnetic overload switches (circuit breakers) that shall be manually resettable and shall be of the type that positively disconnects power to the steam cylinder.
8. Humidifier(s) shall include a door interlock safety switch to disconnect power to steam cylinder(s) when cabinet door is opened.
9. The system shall include one steam distributor pipe for each steam generating cylinder mounting in the duct as shown on the plans. Steam distributing pipe(s) shall be of corrosion resistant design (copper or stainless steel) and be designed to provide uniform distribution over the entire length of the pipe.
   Option: Supply and install remote (or humidifier mounted) fan distribution units to discharge steam directly into the conditioned space.
   Provide the following components:
   a. Three 12VDC fans operated by circuit board.
   b. Integral steam manifold trap.
   b. Remote mounted on/off, proportional control humidistat.
   Option: When plans call for a specific short absorption distance from dispersion system, a multi-tube Short Absorption Manifold is available sized specifically to duct dimensions, with horizontal stainless steel cross tubes and vertical headers.
10. The system shall include flexible hose to connect the steam cylinder(s) to the steam distributor pipe(s). A separate condensate return line shall return condensate to the humidifier for reuse to minimize consumption. If due to specific routing issues or application of unit, condensate line can not run back to unit, the line can go directly to the common drain, and the addition of a "circle" or "U" trap will be required (see IOM). Long distances from unit to common drain can be accommodated with accessory option Water Pump (HXWA). Hard tubing can be used for Steam Hose and Condensate Return to prevent sags, restrictions or obstructions (see IOM), but it is recommended a minimum of 12 inches of flexible hose be used from unit and before distributor pipe. We recommend a maximum distance of 30 feet from unit to distributor pipe(s) or short absorption manifold and proper routing and inclination of hoses and hard tubing be adhered to for proper, overall consistent and dependable operation.
11. The humidifier(s) shall incorporate a 1" air gap on the fill water line to prevent backflow. It is recommended that a drain air gap fitting be installed by a non-Carnes contractor to prevent backflow of water. Carnes offers an air gap fitting as a purchased option.
12. The humidifier cabinet(s) shall be constructed of 304 B 20 gauge stainless steel and shipped with Novacel 4228 protective film. The cabinet door shall be hinged and provided with a lock and key. The main door is also provided with a quick release pin for removal to provide easy access to internals. The True Touchscreen Home Page will show a digital LCD steam output meter calibrated in pounds of steam per hour (kg of steam per hour selection is included as a built in option), fill cycle, drain cycle and high water indicator lights will be visible with the cabinet door closed.
    Option: Humidifier cabinet(s) shall be constructed of 20 gauge steel with a stainless steel bottom pan, protected by a dipped electrostatic baked enamel undercoat with multi spec textured top coat with black accent architectural grade.
13. The humidifier(s) shall be controlled by a humidistat which operates through the solid-state circuit board. Humidifier(s) shall incorporate terminals for connection of humidistat, air flow switch and high limit control humidistat.
    Option: Provide the following accessory controls:
    a. Wall mounted humidistat, on/off control.
    b. Wall mounted humidistat, w/ LCD combo (NEW).
    c. Duct mounted humidistat, on/off control.
    d. Duct mounted humidistat, proportional control.
    e. Duct mounted humidistat w/digital humidity and temperature, combo (NEW).
    f. High limit duct mounted humidistat, on/off control.
    g. High limit duct mounted humidistat, proportional control.
    h. Pressure differential type air flow switch.
    i. Paddle type air flow switch.
    j. Wall or duct mounted temperature compensated, on/off or proportional control, digital display humidistat.
14. External Control Signals - All Carnes humidifiers will accept external DDC control signals of 0-10 volt DC. Signal to modulate the output of humidifier. Polarity must be observed and input impedance is 20K ohms. If 4-20 mA signal is provided a 470 ohm, 1/4 watt resistor must be installed. Humidifiers will also accept internal (BMS) building management system or (BAS) building automation system signal.
15. The fill water line shall include a strainer to remove sediment from incoming water and a flow regulating control to automatically compensate for water pressures from 20-120 psi.
16. Humidifier(s) shall include a "Service Required" button (illuminated in RED) on the total "True Touchscreen" home page which shall explain service issues and possible troubleshooting tips. The light shall be visible with the cabinet door closed and terminals shall be provided for remote signal. Terminals are also provided to indicate normal operation to a remote location.
17. Dedicated buttons with indicator lights on the steam page of the total "True Touchscreen" shall indicate status of the control humidistat, high limit humidistat, air flow switch and door interlock switch. Operation of fill solenoid, drain solenoid, power contactor and high water sensor shall be shown after accessing the "Component Activity" button on the home page of the total "True Touchscreen".
18. The humidifier(s) electronic circuit board shall include automatic controls to compensate for varying water conditions without changing cylinders or electrode spacing. The control shall activate the fill and drain solenoid valves to automatically maximize efficiency. Unit will perform system self-correction procedures to assist in preventing unit shutdown due to any fault in operational sequence. A drain pulsing feature is included to assist in expelling any blockage that may occur during a self-correcting drain cycle. If self-correction procedures are unable to correct problems after specific cycles, unit will automatically shutdown.
19. The humidifier(s) shall include a non water contact capacitance proximity high water sensor to prevent overfilling and loss of water.
20. The fill solenoid valve shall open whenever the drain solenoid is activated, whether in automatic or manual operation, to prevent discharge of boiling water into drainage system. Drain light shall indicate the switch is in drain position.
21. Humidifiers, dependent upon capacity, will have one (1) or two (2) cylinders for operation. If a capacity is desired of 125, 150, 175 or 200 lbs./hr., the units will be equipped with two (2) cylinders, each independently and separately controlled by their own control signal.
22. Automatic Drain of cylinder water will take place when there is a demand signal loss for 72 hours. Unit will remain in stand-by in the event that a quick start-up is required.