

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

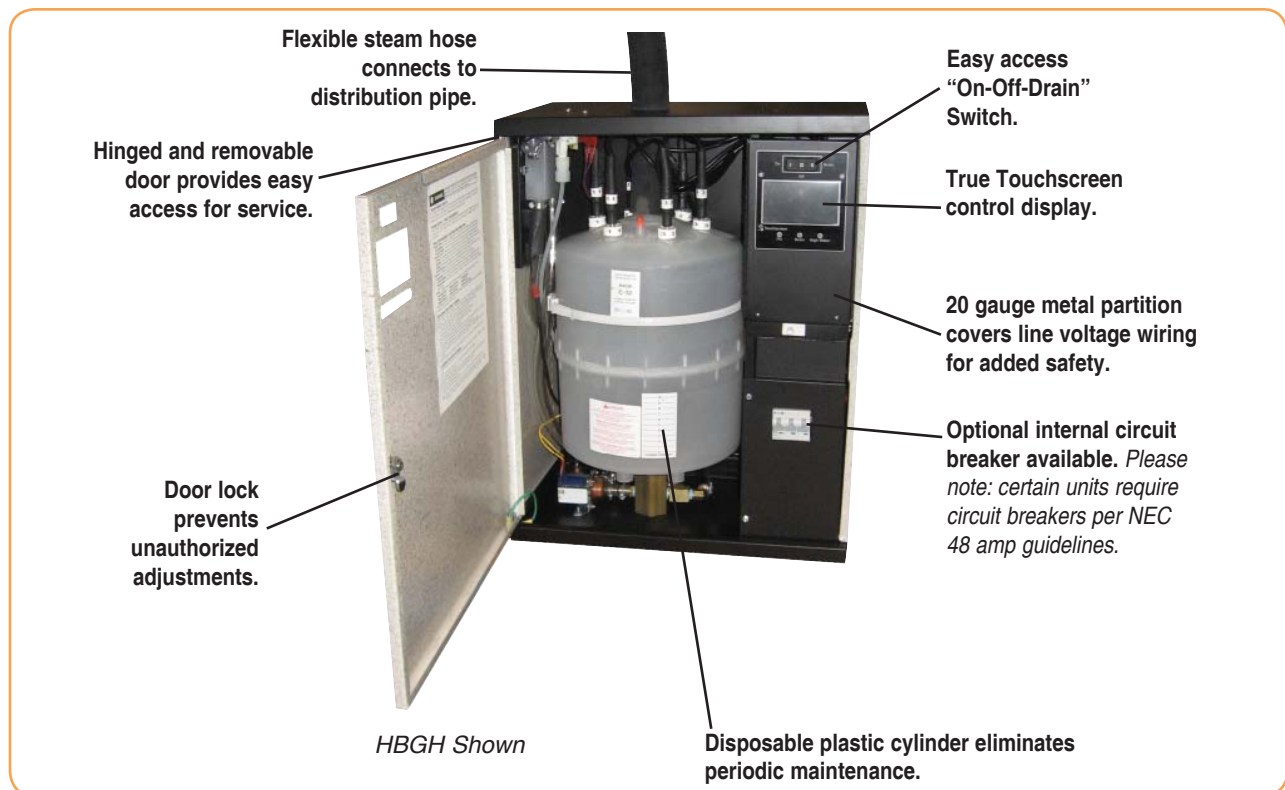
- Disposable Cylinders Eliminate Periodic Maintenance for Reduced Maintenance Costs
- Fast and Easy Installation
- Reliable Electronic Components for Long Life

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



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.



Figure P

“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

This LCD True Touchscreen display offers the necessary interface to control and monitor many aspects of the humidifier. On the home screen is the current steam output in Lbs./Hr. (or Kg/Hr). To select either is available in the settings menu. A “Service Required” indicator and button outlining current service issues, indicators for the four basic controls necessary for operation (control humidistat, high limit humidistat, air flow switch and door interlock), and various buttons which navigate to other menu pages when pressed are also available on the home page screen. The menu pages and their capabilities are detailed further in “True Touchscreen Menu Pages” section of this document.

“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. An analogous indicator, and a description of its operation, is offered in the “Component Activity” menu.

“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. An analogous indicator, and a description of its operation, is offered in the “Component Activity” menu.

“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. This can be a normal situation, particularly if the cylinder is being filled with mostly unconditioned water. An activated High Water Sensor can also be a sign that the cylinder is close to end-of-life and needs replacing, or, in rarer cases, the cylinder is not conductive enough for the fresh water entering the humidifier. An analogous indicator, and a description of its operation, is offered in the “Component Activity” menu. More information on troubleshooting High Water situations can also be found through the “Help” menu on the home screen.

HUMIDIFIER TRUE TOUCHSCREEN MENU PAGES

The humidifier True Touchscreen user interface uses color conventions to help the user navigate the controls. The colors of different buttons indicate the following.

1. **Gray** —



Dim LCD is the only gray button. More information is available in the “home” page description.

2. **Orange** —



Orange buttons represent the object or subject described across the button. Most orange buttons have an indicator next to them, which can change in color, e.g. green, yellow or gray. Pressing orange buttons will bring you to a page which describes the object or subject in question.

3. **Yellow** —



Yellow buttons navigate a user to a new page dedicated to a set of functions. For example, the “Humidistat Demand” button brings the user to a page that shows what percentage demands both the Control and High Limit Humidistats are currently requesting, and details their functions. The bottom of each page, other than the home screen, has a square “Back” or “Home” button dedicated to directing the user back to their previous page.

4. **White** —



White buttons are used for confirming or entering data into the touchscreen. For example, they are used to confirm a change to the “Max Output” parameter, or entering a password to access the “Settings” menu.

5. Maize —

How do I route my steam hose?

Help buttons are used exclusively in the “Help” page. These help buttons answer frequently asked questions about the operation, maintenance and troubleshooting of the humidifier. It is also a convenient place to look at humidifier electrical data when an IOM is not available.

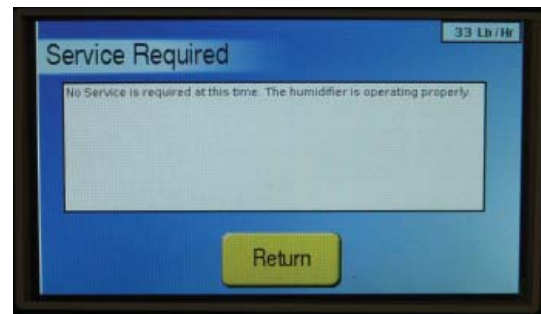
“HOME” PAGE



The home page is the main screen through which most other pages can be accessed. The large blue square to the left shows the steam output. The orange and yellow buttons on the home page are considered “Operational & Status” indicators. Touching any of these displays will show dialog explaining the subject or status of that button. The orange buttons also have indicator boxes to the left showing actual status. Green shows ready to operate.

1. **Dim LCD** (gray) - As a power saving feature, pressing the Dim LCD button will shut the backlight of the LCD off. Once off, pressing anywhere on the True Touchscreen will turn the backlight on. The humidifier can also automatically turn off the backlight after 15 minutes. See the “Settings” page for more information on enabling/disabling the Auto-Dim feature.
2. **Humidistat Demand** (yellow) - Brings the user to a page that shows what percentage demands both the Control and High Limit Humidistats are currently requesting, and further details their functions.
3. **Component Activity** (yellow) - Button lists the internal components used in the humidifier. Their respective indicators showing whether the components are activated or not. From this page, the user can view more information on the components and their functions.
4. **Setpoints** (yellow) - The three setpoints of the unit are listed on this page. The setpoint is the target Lb./Hr. output of the humidifier.
5. **Settings** (yellow) - Any settings of the humidifier, e.g. Max Output, Timers or Fan Speed, can be accessed through this page. This page is password protected. For more information, refer to the “Settings” page section.
6. **Help** (yellow) - Frequently asked questions about the humidifier can be answered through the Help page. It is a convenient resource to resolve many issues quickly and effectively.
7. **Service Required** (orange) - Invokes a page that describes what service is needed by the humidifier, if any. Indicator light to the left of the button turns red when service is needed, and will otherwise remain green. Refer to the separate “Service Required” page for more information.
8. **Steam** (orange) - Explains the status of the “Steam” indicator light. The humidifier will only produce steam if the “Steam” indicator light is green. The indicator will be brown when the On/Off/Drain switch is in the “Off” position. It will turn yellow if the switch is in the “On” position, but one or more of the four basic controls are not satisfied (Control Humidistat, High Limit, Air Flow, Door Interlock). The light will turn green if all of the above switches and controls are satisfied.
9. **Control Humidistat** (orange) - Explains the status of the Control Humidistat indicator light, and also shows the current demand of the Control Humidistat.
10. **High Limit Humidistat** (orange) - Explains the status of the High Limit Humidistat indicator light, and also shows the current demand of the High Limit Humidistat.
11. **Air Flow** (orange) - Explains the status of the Air Flow switch.
12. **Door Interlock** (orange) - Explains the status of the Door Interlock switch.

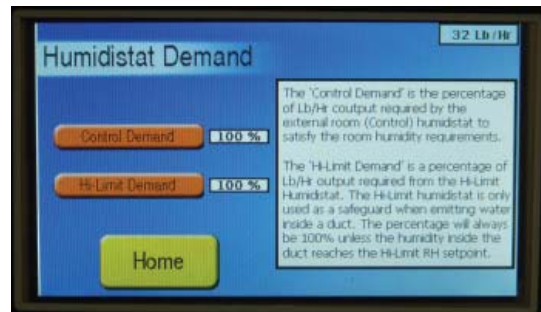
“SERVICE REQUIRED” PAGE



“SERVICE REQUIRED” PAGE

The “Service Required” page outlines any service issues that are in need of being resolved. Many issues can be traced back to variability in water parameters, and often the solution can be dealt with through the changing of cylinders or modifying timer values within the “Settings” page. This page is used to alert the user and direct them on the right path towards resolution.

“HUMIDISTAT DEMAND” PAGE



The Humidistat Demand page lists both the Control Demand and the High Limit Demand of the humidifier. Each demand signal is represented by an orange button, and next to each button is a numerical box specifying the percentage of demand each humidistat is currently calling for.

The Control humidistat, which provides the Control Demand, is normally the humidistat in the room being humidified. It is either installed in the room itself or the return air duct. The High-Limit humidistat, which provides the Hi-Limit Demand, is a safe-guard humidistat installed in the supply duct roughly 10-15 feet past the distribution tube. This humidistat is usually set to a high level (80-90%), and will shut down the humidifier if the humidity gets too high in the supply duct. Without a High-Limit humidistat properly installed, the supply duct could reach a humidity level where any steam entering the duct would readily condense.

Both Control humidistats and High-Limit humidistats are wired in the same way, only Control humidistats are wired to port J16 of the circuit board and High-Limit humidistats are wired to port J17. Both ports have the same number of pins and connection layout.

When using an on/off humidistat, the percentage should be either 100% or below 20%. In this case the control is either calling for full output or no output. On-Off humidistats are dry-contact switches. They will have two wires; each connected to pins 2 and 4 (in no particular order/polarity).

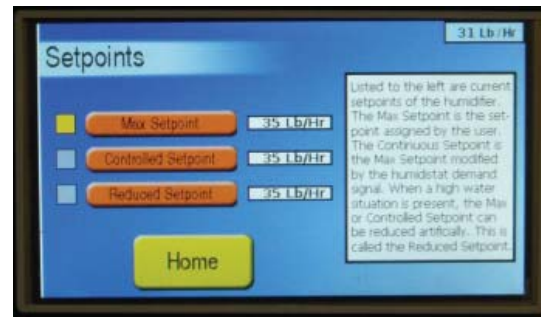
For a proportional humidistat, any percentage value is possible between 0% and 100%. In this case the humidifier can be modified to output any fraction of its max output. If the proportional control falls to 20% or below, the humidifier is shut off. The input signal of a proportional humidistat must be of the 0-10V DC variety. Proportional humidistats will have three wires, with 'power' going to pin 1, 'signal' to pin 3, and 'ground' to pin 4.

In lieu of a humidistat, a DDC signal from a building management system may also be used. Here, the 'signal' should be connected to pin 3, and 'ground' to pin 4. In this case, 'power' can be ignored. A DDC signal must be of a 0-10V DC variety, though a 4-20 mA control signal can be converted to a 0-10V signal by adding a 470 Ohm resistor between the 'signal' (pin 3) and 'ground' (pin 4).

in a high water situation, the fill valve is disabled for 5 minutes. At the end of 5 minutes the high water sensor light will go out, the fill valve will open, if there is a call for more humidity, and unit will continue normal operation. High water sensors can be cumulative depending on the condition of the water.

The other item present on this screen is the Communication button. The Communication button has a rotating indicator that represents whether the True Touchscreen controller on the circuit board is properly communicating with the microcontroller. If this icon is not rotating and has a red 'X' through it, the information on the screen is invalid and you should contact the factory.

“SETPOINTS” PAGE



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. For all setpoints, the following colors represent the status of the setpoints:

Gray – The setpoint is inactive because it is not currently necessary.

Green – The setpoint is active, and the humidifier is producing steam at or above the setpoint value.

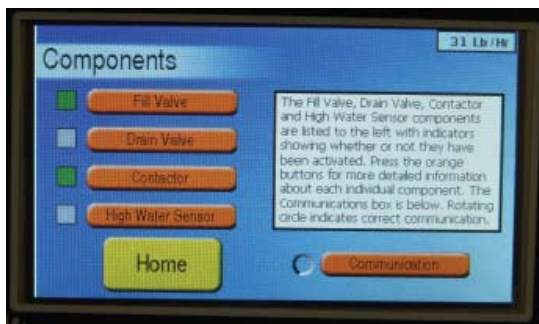
Yellow – The setpoint is active, but the humidifier is producing steam below the setpoint value.

Yellow/Black X – The setpoint is inactive because it is being overridden by a setpoint with a higher priority.

The three different types of setpoint are as follows: The **Max Setpoint** is the user-specified setpoint active when no external controls or internal reduction is taking place. The Max Setpoint is always modifiable via the “Max Output Adjust” within the settings menu. The **Controlled Setpoint** is the setpoint when a humidistat (Control or High Limit), reduces the target output of the humidifier due to changing room requirements. The **Reduced Setpoint** is active when the unit requires a reduction in output due to a high water situation.

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.

“COMPONENT ACTIVITY” PAGE



The Component Activity page lists all internal components that can switch on and off during operation. This includes the Fill Valve, Drain Valve, Contactor, and High Water Sensor. Each orange button in the component list is accompanied by a colored indicator representing whether or not the component is currently 'on'. Green indicates that the component is 'on', whereas gray indicates the component is 'off'. The Fill Valve is on when the unit is either filling or draining the cylinder. The Drain Valve is on when the humidifier is draining the cylinder. The Contactor is on when the humidifier is producing steam. The High Water Sensor is on when the humidifier has identified a high water situation. When

“SETTINGS”

The Settings menu is the page where all operational values can be set. It is password protected by default, with a default password of '1212'.



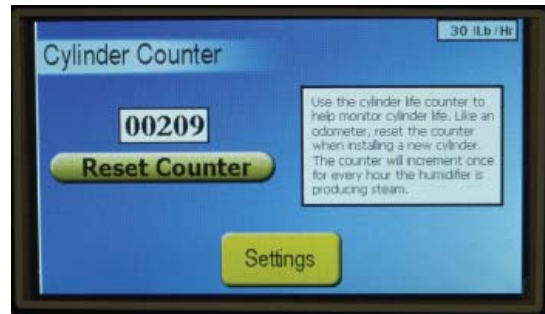
The password can be disabled under the 'Settings Password' on the second Settings page. See 'Settings Password' section for more details.

Any adjustment made to any setting can be done 'on-the-fly'. Which means when a change occurs, the humidifier will react accordingly without the need of shutting off the unit or even stopping steam output. In general, any page within the True Touchscreen system can be accessed, monitored, or changed 'on-the-fly'.

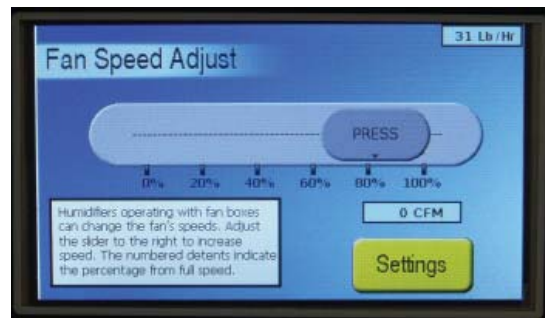
Max Output Adjust –

This page adjusts the Maximum Output of the humidifier. The Maximum Output can be adjusted lower from the nominal output value of the unit (set at the factory). The unit cannot be set lower than 20% of the nominal value

of the humidifier. The Maximum Output value, when changed, also changes the Max Setpoint value on the Setpoints page.

Cylinder Life Counter –

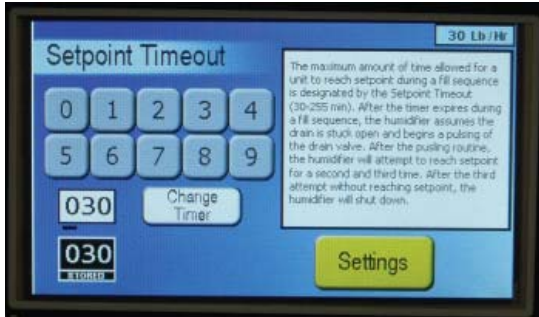
This page consists of a counter where the user can monitor the life, in hours, of the cylinder. When changing a cylinder, press the 'Reset' button on this page to reset the timer. The Cylinder Life Counter only counts the amount of actual runtime of the cylinder (the time when the contactor is pulled in). The counter value is saved even when the humidifier is powered down. The national average cylinder life is about 1150 hours, but this can vary greatly depending on individual water conditions.

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. This slider bar will not affect the operation of the humidifier if no blower box is attached. The bar can change the speeds of the fans from 0 to 100% of the max fan speed. Also displayed on this page is an estimate of the current fan air output, in Cubic Feet per Minute (CFM). This adjustment is particularly useful if the humidifier is of a smaller capacity, and less noise from the fans is appreciated.

Setpoint Timeout –

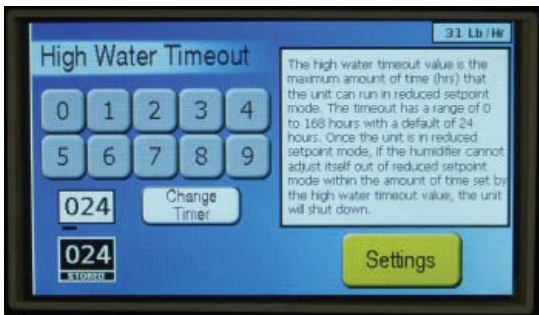
Setpoint Timeout



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. Its default value is 30 minutes, but can be set as high as 255 minutes. After the timer expires during a fill sequence, the humidifier assumes the drain valve is stuck open (due to sediment buildup), and begins pulsing the drain valve to attempt to unclog it. After the pulsing routine, the humidifier will attempt to reach setpoint for a second and third time. After the third attempt without reaching setpoint, the unit will shut down.

High Water Timeout –

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 (See Setpoints page). The timeout has a range from 0 to 168 hours, with the default being 24 hours. If the humidifier setpoint is artificially reduced due to a high water situation, the humidifier will continue to run. If the humidifier cannot work it's way back up the normal max/controlled setpoint, the humidifier will shut down after the High Water Timeout value elapses.

Boil Down Timer –

Boil Down Timer



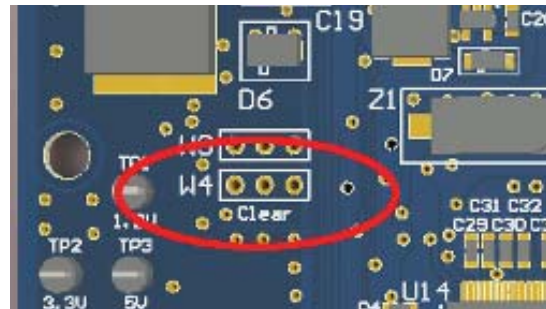
This page is where the Boil Down Timer is set. The Boil Down Timer is variable between 0 and 255 seconds, with a default value of 25 seconds. Setting the Boil Down Timer higher will result in an increased water level, and less-conditioned water. This may be helpful in reducing low water level induced arcing and corrosion of cylinders. More water is consumed by the humidifier when the Boil Down Timer value is increased.

Settings Password –

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. To do this, remove power to the humidifier, move the jumper on W4 from pins '1 and 2' to '2 and 3', and power the unit back on.



Return the jumper to pins '1 and 2' afterward. Pins '1 and 2' are to the left, and pins '2 and 3' are to the right.

The different yellow buttons on both setting pages allow for the changing of different values. Below is a brief summary of each, and more information can be accessed within the page itself.

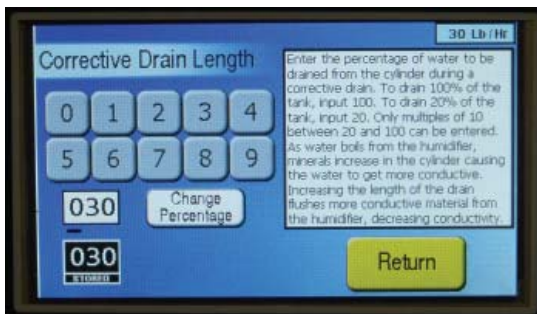
Calibration Password –

Change
Unit Code

This page is where the Humidifier Unit Code, the four digit number identifying the humidifier, is programmed into the unit. This page is password protected, and number should not be modified by the end user. Contact the factory if further information is needed.

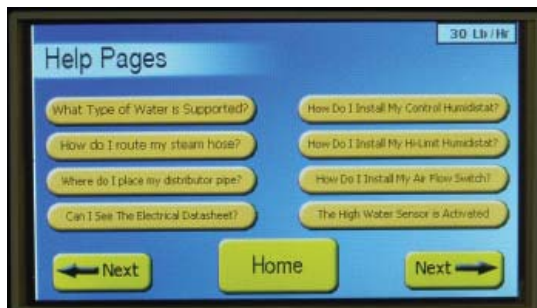
Corrective Drain Length –

Corrective
Drain Length

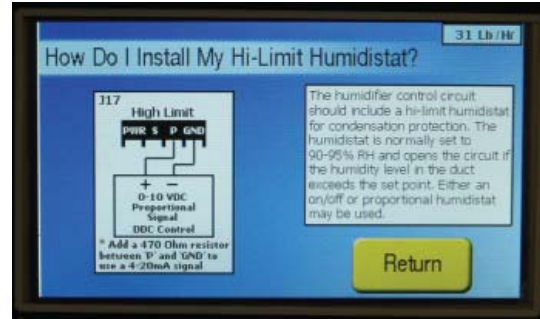


This page is where the Corrective Drain Length is set. This value represents how much water should be drained from the cylinder when the humidifier senses a corrective drain is needed. As water boils from the humidifier, minerals increase in the cylinder causing the water to get more conductive. Increasing the length of the drain flushes more conductive material from the humidifier, decreasing the water conductivity.

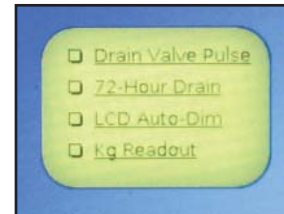
The input here is a percentage value. To set the Corrective Drain Length to drain 20% of the cylinder during a corrective drain, input 020. To drain all of the tank, input 100. 30 is the default value, and only multiples of 10 between 20 and 100 can be entered.

“HELP”

The help pages consist of maize color 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.



For example, in the picture above the question of how to install a high limit humidstat is answered with a diagram and corresponding text. Some pages consist of more buttons to help guide a user through different processes. These buttons can be used and referenced as needed.

Checkboxes –

There are a few operational options that do not need separate pages, and therefore are only enabled/disabled via checkboxes on the main Settings Page. Their functionality is described as follows:

The **Drain Valve Pulse** option is enabled by default. This option allows the drain valve to pulse when the humidifier executes a corrective drain. This actuates the water within the drain piping, allowing for minerals buildup to be discharged more easily. Enabling this option will make the unit noisier whenever a corrective drain is executed.

The **72-Hour Drain** is disabled by default. This option, when enabled, allows the humidifier to drain the cylinder completely after 72 hours of idle operation.

The **LCD Auto-Dim** is disabled by default. This option, when enabled, will automatically turn off the backlight of the LCD after 15 minutes of idleness. This feature can save on energy consumed.

The **Kg./Hr Readout** is disabled by default. This option, when enabled, will turn the steam readout on home page, and in the upper right hand corner of other pages, into Kg/Hr instead of Lb/Hr.

▼ 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

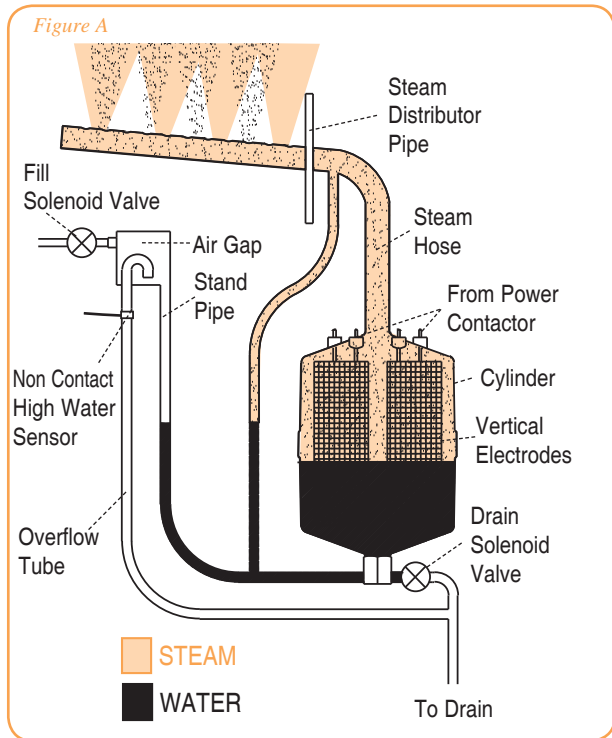
▼ OPERATION

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.



Reprinted with permission of the American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., Atlanta, GA 30329.

▼ LOCATING THE HUMIDIFIER

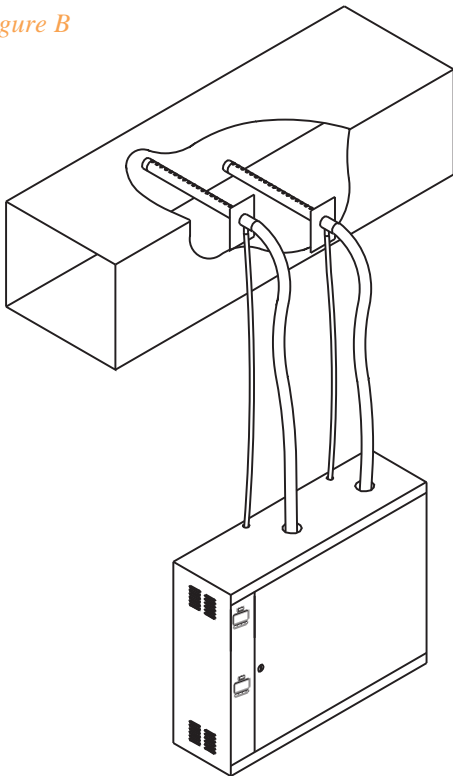
Locate the humidifier cabinet level and plumb on a surface as close to the steam distributor as possible at a convenient height for servicing. Allow 1" or more on the sides for ventilation and 16" from the bottom of the unit to the floor to allow for drain connections. Allow 14" in front of cabinet for 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 5 for maximum length that may be installed, based on static pressure to provide the most effective and efficient humidification.

Figure B



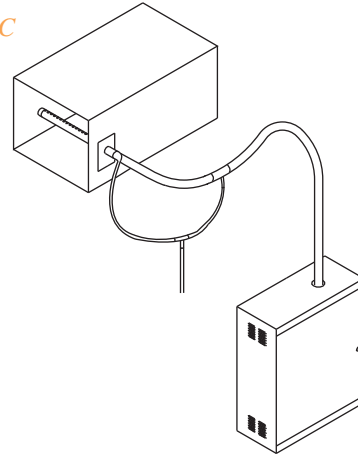
MAXIMUM STEAM HOSE LENGTH

Table 5

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

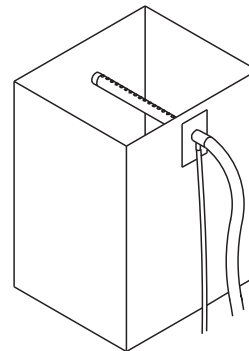
The maximum length of steam hose that may be installed as shown in Figure B is **12 feet**. For steam hose lengths over 12 feet refer to Figure C. A drain "T" must be used to remove condensation that occurs in steam hose lengths over 12 feet. It is preferable to have the steam hose rise vertically from 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



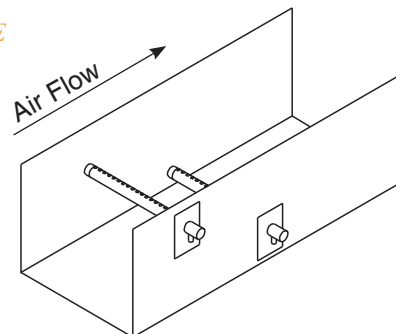
In a vertical duct with either upward or downward air flow the distributor pipe should be installed horizontally (Figure D), with output holes up.

Figure D



If multiple pipes are used they should be staggered as shown (Figure E).

Figure E



▼ STEAM DISTRIBUTOR PIPE LOCATION

(Continued)

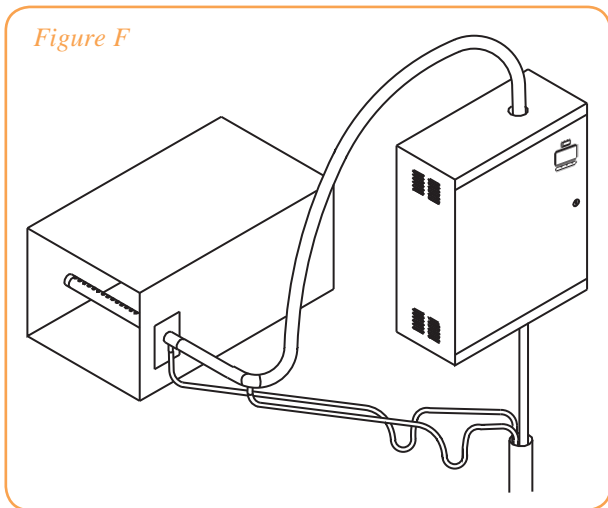
Steam distributor pipes must be located on a plumb surface so condensate that forms will run back into the return line. The pipe should be located in the center of the duct to insure even distribution of steam into the airstream. A minimum clearance of 4" must be maintained between the top of the duct and the distributor pipe.

The steam distributor pipes are usually located in the supply duct downstream of the fan. When installed in packaged units the distributor should be mounted just downstream of the fan discharge.

It is important to locate the distributor as far upstream as possible from any obstructions in the ductwork so that air can absorb moisture before it impinges on a surface and accumulates. There must be a *minimum* of six (6) feet between the distributor and any fans, coils, filters, dampers, elbows or outlets downstream to reduce the possibility of condensation.

It may be possible to minimize the absorption distance by using multiple distributor pipes. Duct air temperatures below 50-60°F may require a condensate drain pan supplied by others below the steam distributor pipe.

The steam distributor pipe may be located below the humidifier if the installation is made in accordance with *Figure F*. A trap may be necessary to prevent steam from flowing back through the condensate return line when hose goes directly to common drain.



It is very important that both the steam hose and condensate return line be installed so that sags and dips are prevented. The steam is at very low pressure and it cannot overcome resistance caused by water standing in the steam hose. Water accumulating in sags in the return line will restrict the flow and may cause water to backup and enter the duct from the distributor pipe.

If it is difficult to install the steam hose to prevent sags, it is recommended that copper tube be used as a substitute. If copper tube is used, a minimum of one inch of insulation must be applied to prevent excessive condensation. A short length of steam hose

must be used to connect the cylinder in the humidifier to the copper tube and another short length to connect the copper tube to the distributor pipe. Size 3/4" copper tube can be used with steam cylinders having output rates up to 30 pounds per hour. Size 1-1/2" copper tube should be used with steam cylinders over 30 pounds per hour. Length restrictions shown in Table 5 also apply to installations where copper tube is used and any 90° elbows add approximately three feet of equivalent length. Proper inclines of hard tubing is necessary for good performance and operation.

▼ 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 6. 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 6

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

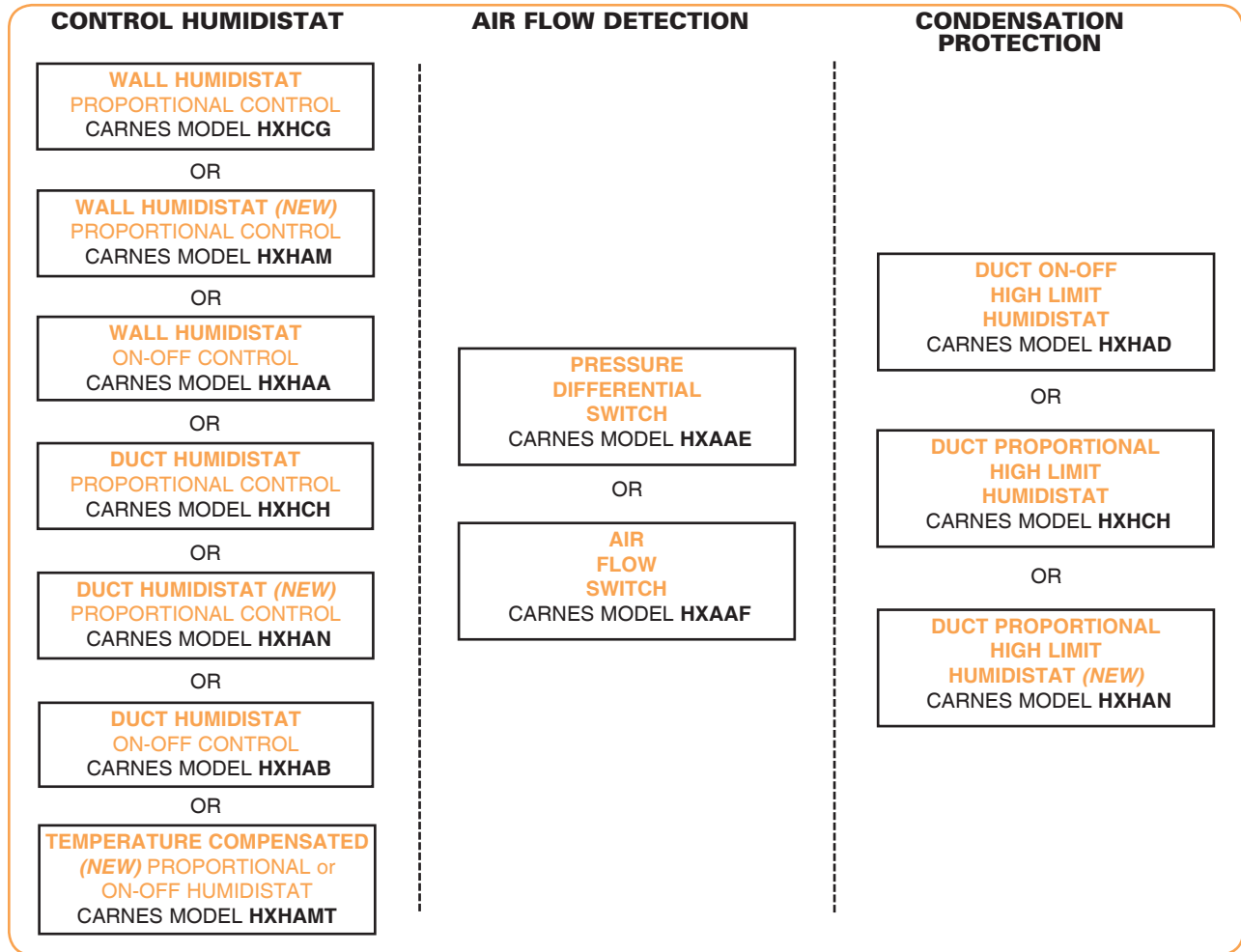
In certain areas with extreme water conditions it may not be possible to operate the humidifier at all voltages. Table 7 shows acceptable water conductivity, measured in micromhos, in relation to the primary supply voltage. Water conductivity may be determined by contacting the local water utility or 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 7

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

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

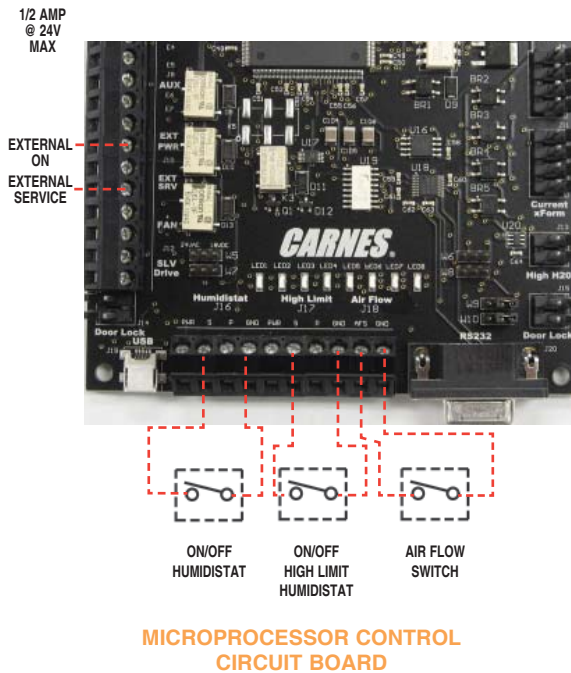
A third device may be desirable to provide condensation protection in the duct system. A high limit humidistat may be installed ten (10) feet downstream from the steam distributor pipe. This humidistat is normally set to 90-95% RH and opens the circuit if the humidity level in the duct exceeds the set-point. 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

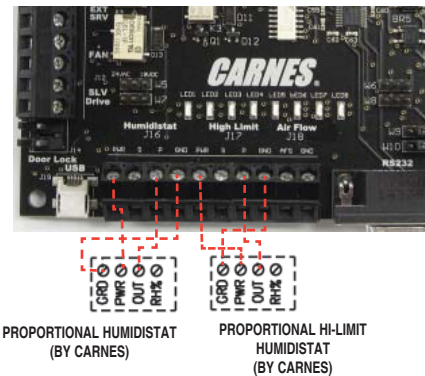
Two cylinder humidifiers may be wired for simultaneous or separate operation. Controls should be connected to the terminals on the electronic circuit board as shown below using recommended No. 20 AWG wire. Avoid running control wiring near high voltage primary wires.

Figure H



Connections shown in Figure H are for typical on-off controls. For Carnes proportional controls see Figure J. All controls are shipped with detailed wiring instructions.

Figure J

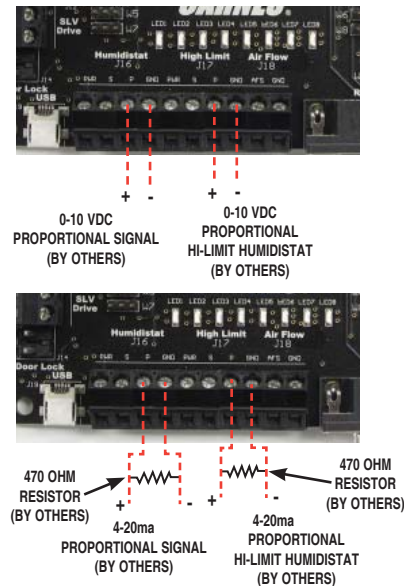


HXHAM control will vary slightly on the connection identifier, compared to above.

▼ 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 as shown below (Figure K).

Figure K



▼ 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 8

	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 8

	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.

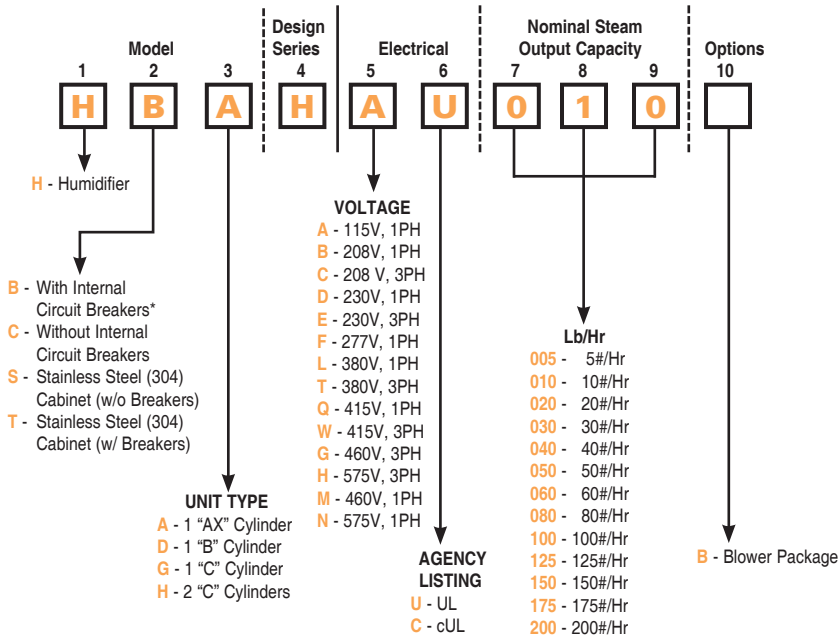
“**Voltage**” and “**Phase**” designate available phase and nominal voltages. Single phase units may be operated from two legs of a three phase supply but the load will be unbalanced.

“**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 9.

Table 9

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 10.

Table 10

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 10 by the correction factory shown in Table 11.

Table 11

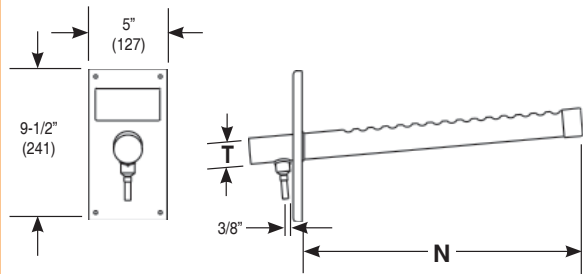
% of Maximum Output	Correction Factor
100	1.00
75	1.33
50	2.00



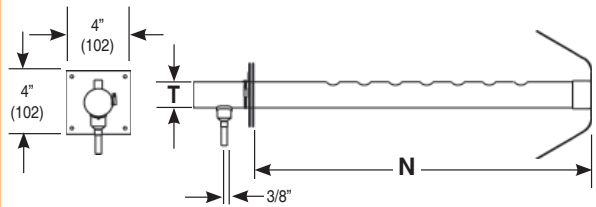
STEAM DISTRIBUTOR PIPES



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

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**		T
	N	N	
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

PIPE	Minimum**		T
	N	N	
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.

**See Note A

▼ 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.

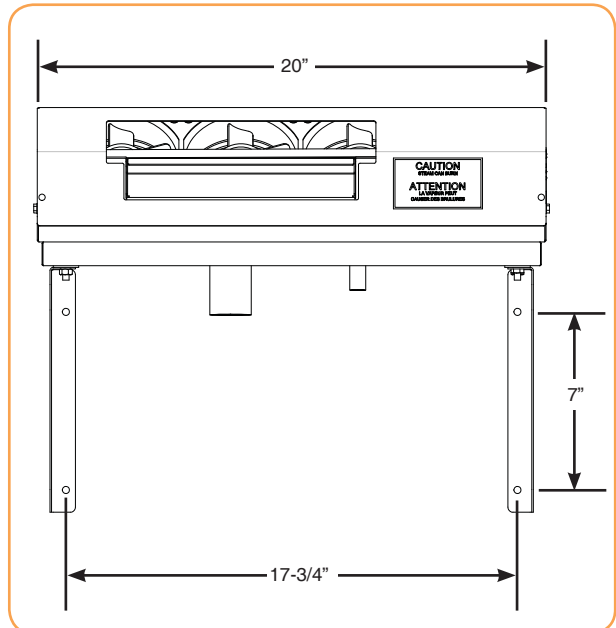
▼ OPTIONS

STANDARD MOUNTING: Factory attached to humidifier.

OPTION: Mounted remote from humidifier.

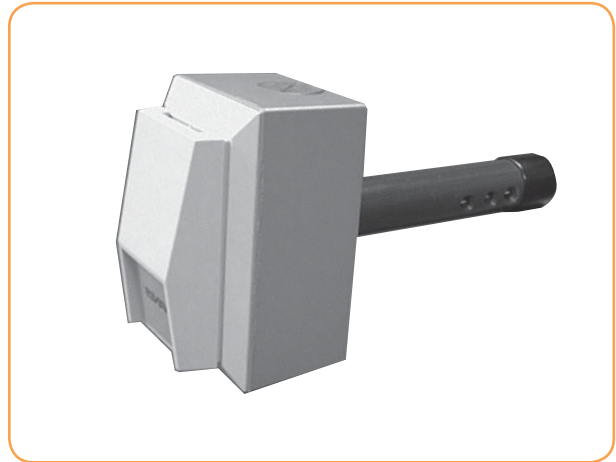
FAN VOLTAGE: 3 fans attached, 12 volt from humidifier

***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".

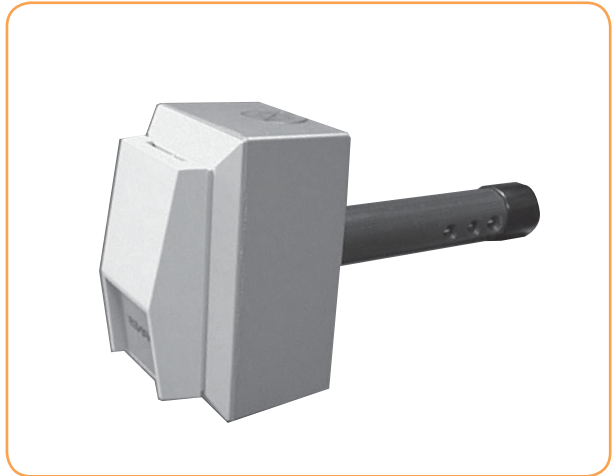
DUCT HUMIDISTAT, ON-OFF CONTROL



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 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.

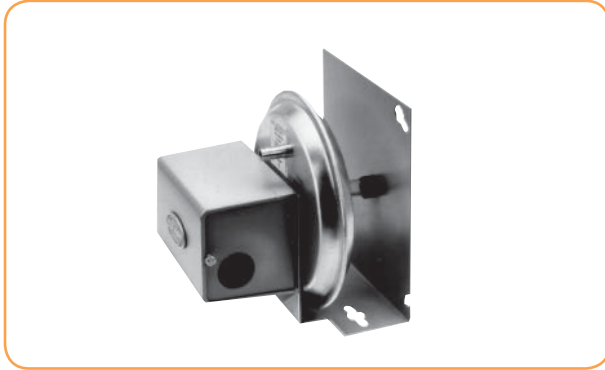
DUCT HIGH LIMIT HUMIDISTAT, ON-OFF CONTROL



Model HXHAD

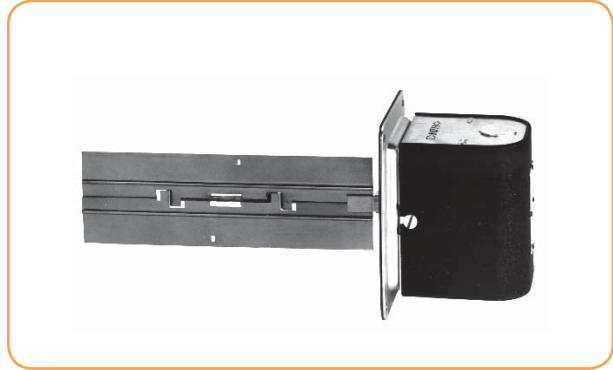
The Model HXHAD humidistat is available for use as a safety precaution to prevent air in the duct from exceeding a preset level. Do not use the humidistat in air that is over 125°F or in locations where the unit could become wet. The control must be mounted a minimum of 10 feet downstream of the distributor 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.

AIR FLOW SWITCH PRESSURE DIFFERENTIAL TYPE

**Model HXAAE**

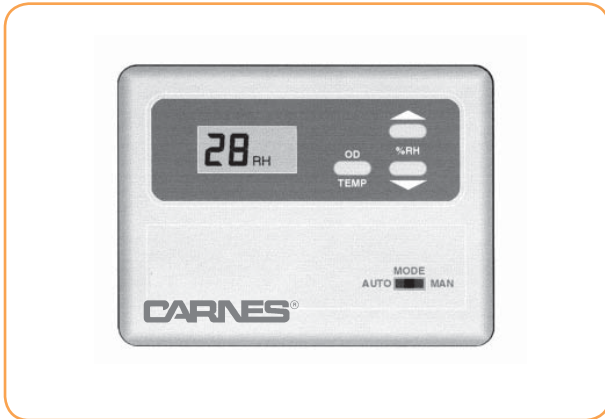
Air flow in the duct may be sensed by using this differential pressure switch. The differential in pressure between the interior of the duct and ambient when air is moving in the duct closes a micro switch allowing the humidifier to operate. Air pressure differential as low as .07 w.g. and as high as 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**

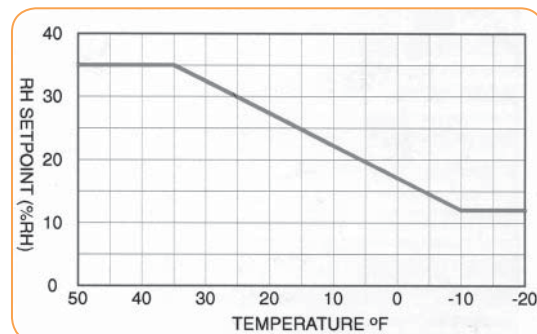
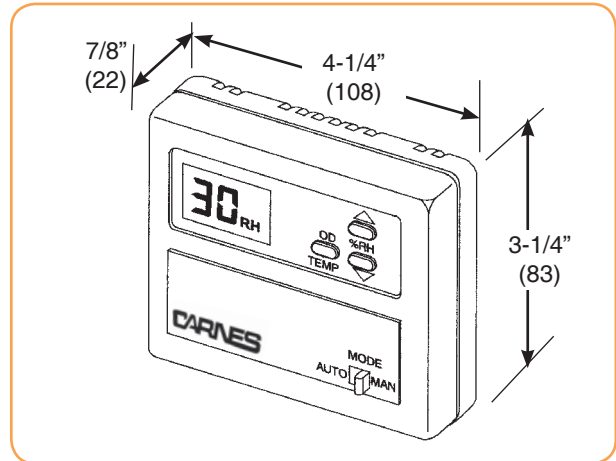
This air flow switch is installed in the duct to prevent humidifier operation when air flow is not occurring. This switch provides a positive and economical method to detect loss of air flow velocity. The switch may be installed on the side, top, or bottom of a horizontal duct. Installation can be made 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.

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"

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.

"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

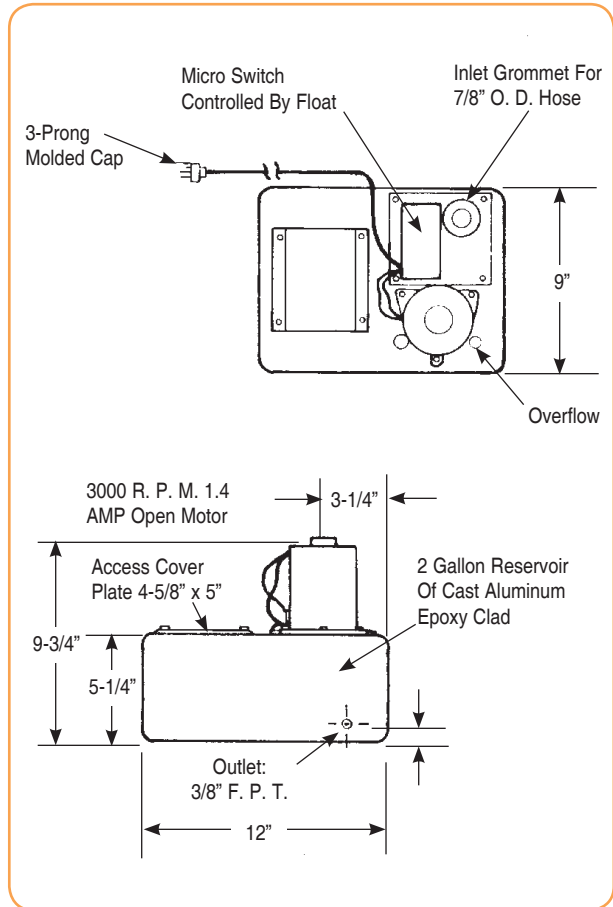
Humidifier Model	Drain "T" Model	Dimensions
ALL	HXTAD	3/8"x3/8"x3/8"

DRAIN WATER PUMP



Model HXWA

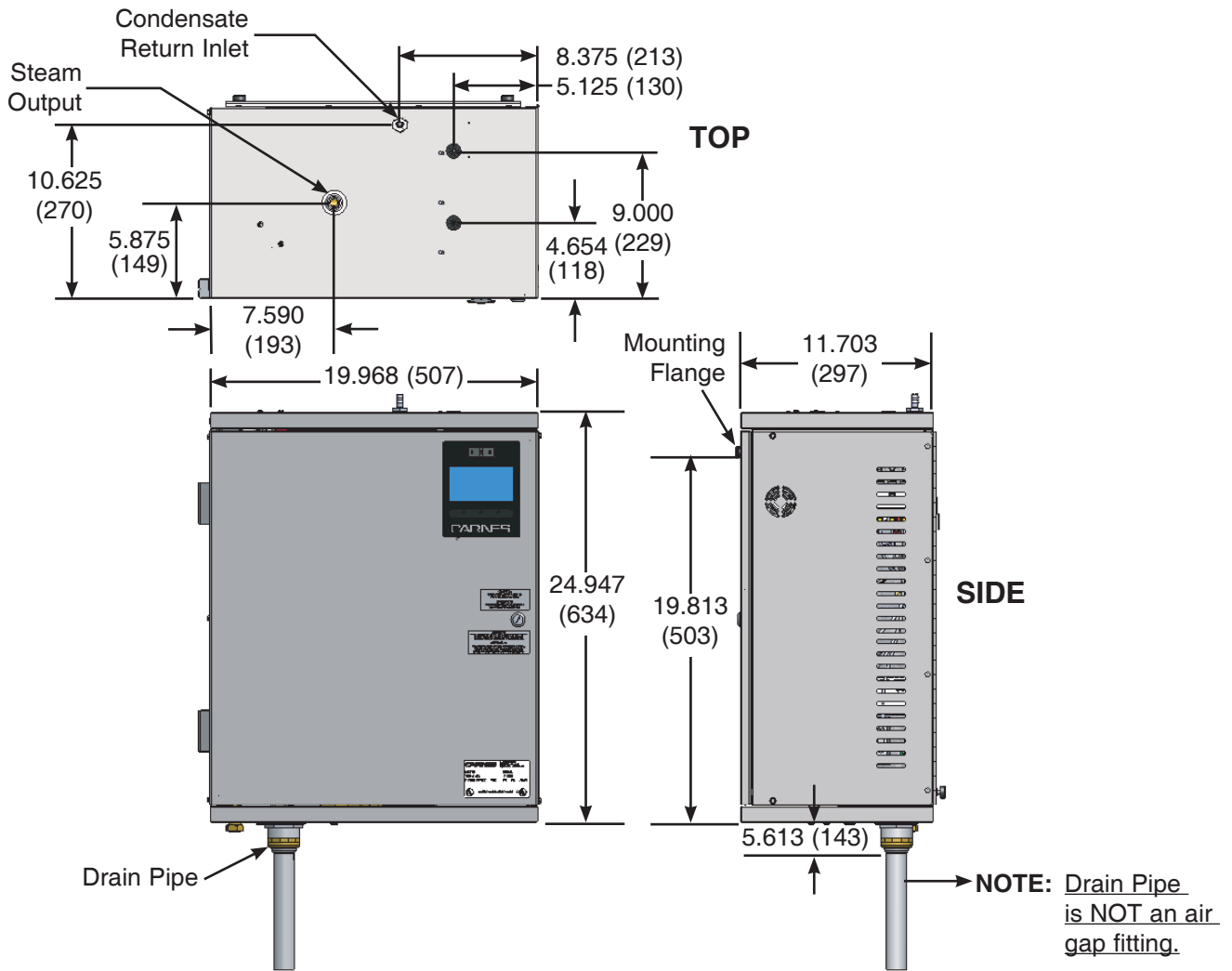
A drain water pump is available for mounting directly below the humidifier cabinet. This pump is ideal for an application where the building drain is remotely located or is at a higher elevation than the humidifier drain connection. This unit operates on a float principle which automatically starts the 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.



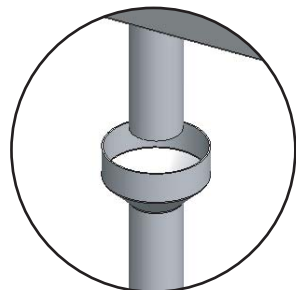
Models Available

HXCBAX145	HXCCB145	HXCBC6F
HXCBAX220	HXCCB220	HXCBC6X
HXCBAX380	HXCBB380	HXCBC61
HXCBAX500	HXCBB500	HXCCC62
HXCBAX600	HXCBB600	HXCBC63
HXCBAX700	HXCBB700	HXCBC64
		HXCBC65
		HXCBC12

MODELS: H_AH
H_DH
H_GH

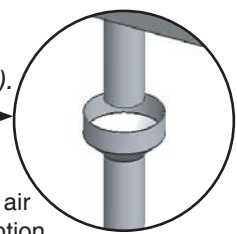
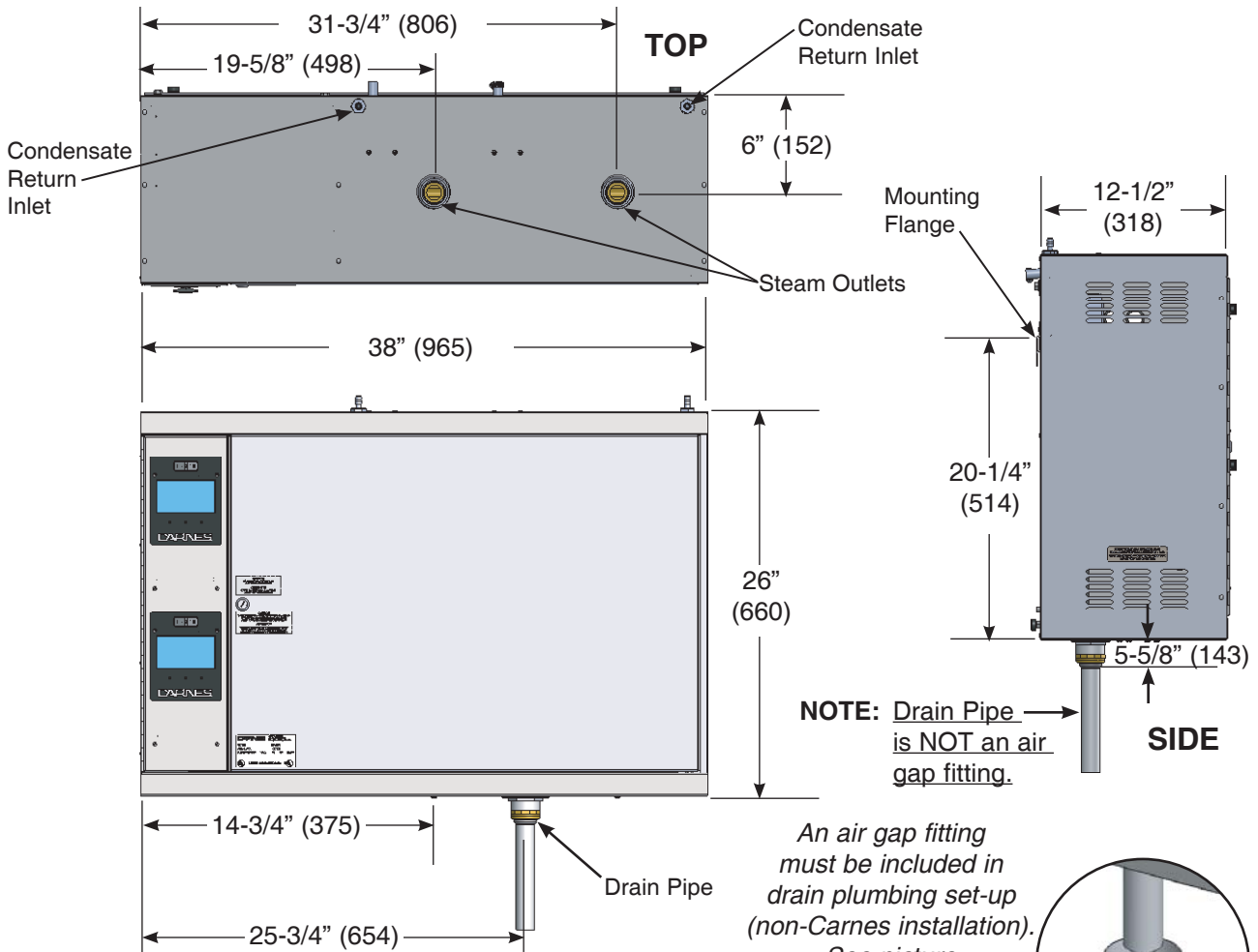


An air gap fitting must be included in drain plumbing set-up (non-Carnes installation). See picture:

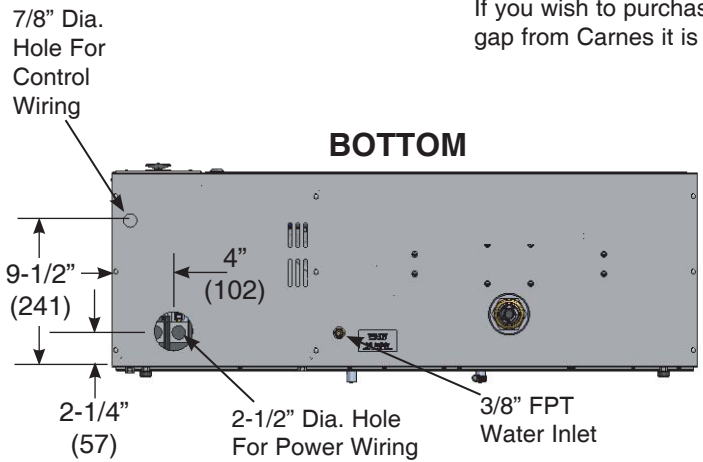


If you wish to purchase an air gap from Carnes it is an option.

MODELS: H_HH



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



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. "Humidistat Demand" indication button. Shows control humidistat and high-limit humidistat.
 - h. "Settings button - where all operational values can be set.
 - i. "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.

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 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. 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.
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 with indication light 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 home 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.