PRODUCTS

THE DHP™ SERIES

Dehumidifier Heat Pipes

Or

Energy Recovery in Series with the Cooling Coil

Heat Pipe Technology, Inc.

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2021-07-29

DEHUMIDIFIER HEAT PIPES IN AIR CONDITIONING

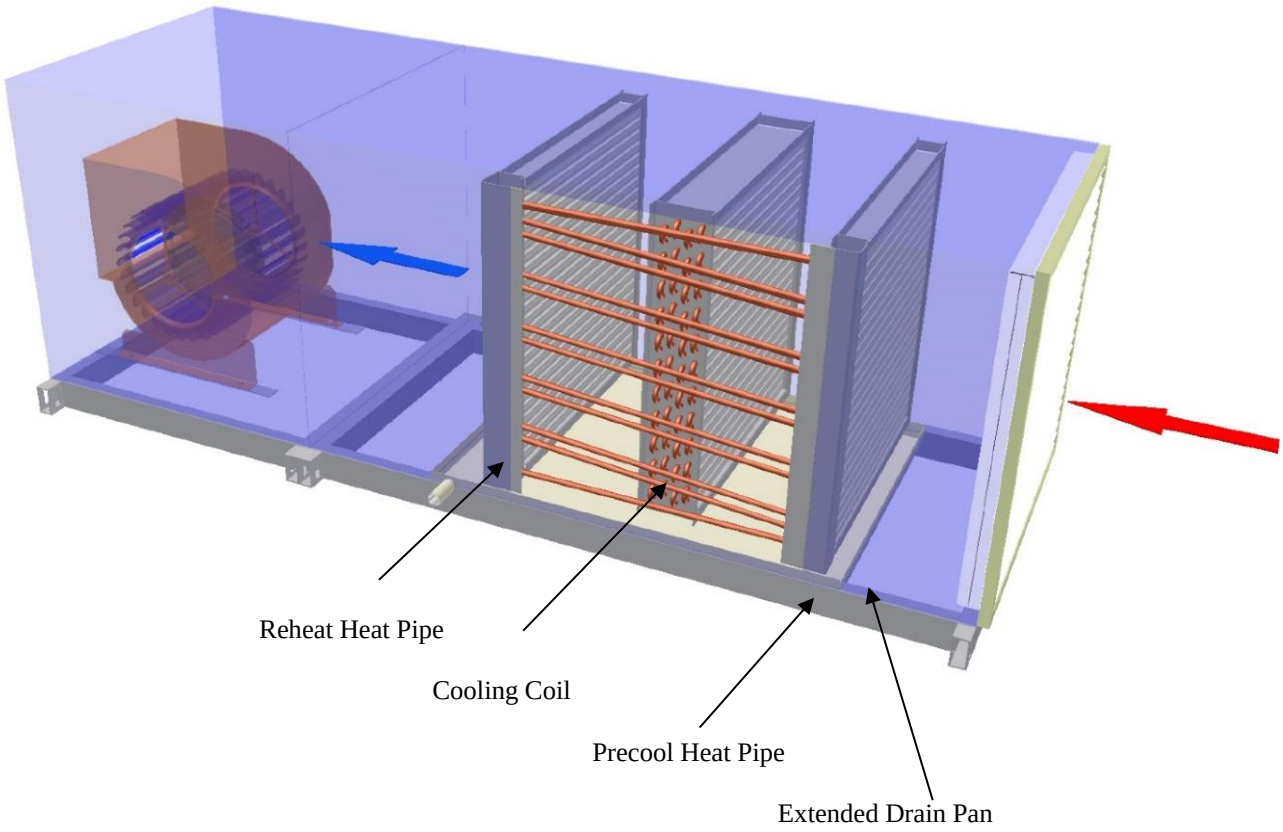
- **Made with high quality copper tubes for better heat transfer, reliability, and durability**
- **Highest heat transfer efficiency**
- **Low air pressure drop**
- **Tremendous increase in moisture removal capacity**
- **Lower supply air relative humidity**
- **Drier supply air**
- **Load reduction**
- **Replaces reheat**
- **Passive operation**
- **Requires only periodic cleaning**
- **Rapid ROI**
- **HPT factory, site or customer facility install**
- **ETL Listed**
- **Controllable**

DEHUMIDIFIER HEAT PIPES IN AIR CONDITIONING

HPT dehumidifier Heat Pipes are usually installed in A/C units in a ”wrap-around” configuration. The first Heat Pipe module precools the entering air before it goes through the cooling coil. The precooled air then approaches the cooling coil at a lower temperature, allowing it to be overcooled by the cooling coil before being reheated by the second Heat Pipe module. The function of the Heat Pipe is performed passively without any mechanical moving parts. The Heat Pipe is activated by the temperature difference between the air entering the precool Heat Pipe and the air leaving the cooling coil.

Dehumidifier Heat Pipes can be installed around chilled water cooling coils as well as direct expansion (DX) cooling coils.

Typical Installation of a Wrap-Around Heat Pipe in an Air Handling Unit



DHP™ Installation

Methods of Installation

Factory Installed Wrap-Around Dehumidifier Heat Pipes DHP-F™

NEW: A/C units are shipped by the manufacturer/contractor to the HPT facility in Tampa, Florida where they are factory retrofitted and then shipped to the final destination.

Site Installed Wrap-Around Dehumidifier Heat Pipes DHP-S™

Units are retrofitted on site by HPT Heat Pipe trained technicians. Air conditioning units are site inspected with all measurements taken; Heat Pipes are then designed and built to fit. A site installation crew from HPT is sent to install the Heat Pipes. Heat Pipes have been site installed by this method in many locations inside the United States, including Hawaii, as well as the Caribbean, Asia, and South America.

U-Frame Wrap-Around Dehumidifier Heat Pipes DHP-U™

U-Frame Heat Pipes are made-to-fit. They are designed for installation in an air handler or A/C unit at an equipment manufacturer's facility. These are ideal units for installation into custom or configured air handlers.

Vertical Tubes Wrap-Around Dehumidifier Heat Pipes DHP-V™

Vertical Tubes Wrap-Around Dehumidifier Heat Pipes are made-to-fit units designed either for site installation, installation at the HPT facility in Tampa, or at an OEM facility. These are ideal units for medium to large air handlers with varying reheat requirement. For best results, the reheat side of the system is elevated above the precool section.

Installation Requirements

A typical two-row Heat Pipe installation system (2 rows precooling, 2 rows reheating) requires 4" of space on both sides of the cooling coil. The Heat Pipes are typically mounted on both sides of the cooling coil. If required, and where space is available, Heat Pipes can be mounted in access sections provided by the manufacturer of the A/C unit or air hander.

One-row systems require approximately 2.25" minimum of space on both sides of the cooling coil.

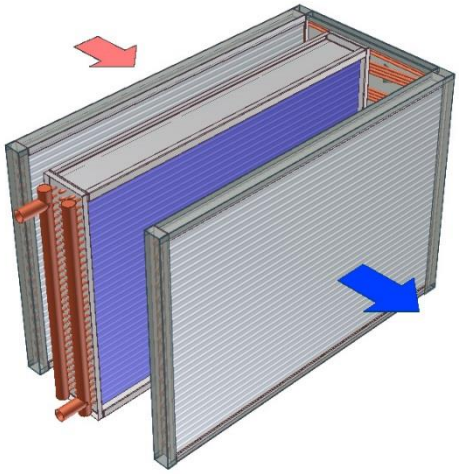
Two-row systems require 3.25" on both sides. Three-row systems require 4.25" on both sides. Four-row Heat Pipe systems require 5.5" on both sides of the cooling coil, and so on.

For OEM installation, HPT will ship DHP-U™ sections to the air hander manufacture. The AHU needs to be designed to allow for the DHP-U™ retrofit . Besides needing to have space before and after cooling to install the heat pipes' precool section and reheat sections, room is also needed at the back end of the cooling coil to allow for the encased connecting tubes. This space varies depending on number of rows and if controllable or not. Refer to HPT online selection software SelectPlus™ drawings for exact dimensions.

When considering fitting Heat Pipes into a unit, keep in mind the following:

1) ***Site Installation***

Since Heat Pipe connecting tubes are always at the back end of the cooling coil (the end of the cooling coil that does not have manifolds, see diagram to the right), there must be room at that end for installation of connecting tubes, and also room between the A/C unit and the nearest object next to it to allow for technicians to work on the connecting tubes, evacuate, and charge. and for future maintenance on valves if the system is controllable.



2) ***Factory Installation***

As in site Installation, controllable Heat Pipes need extra room for wiring and solenoid valve servicing after the A/C unit is installed on-site. The non-controllable Heat Pipes have no moving parts on the connecting tubes end. Access room to that end is recommended but not critical.

3) ***Airflow Direction***

Airflow direction is critical for heat pipe installation and must be indicated on units to be retrofitted at the factory. Heat Pipes will not work with a wrong airflow direction. This is even more critical for DHP-U™ since it is a finished unit and will be installed into AHU directly at a customer's facility.

4) ***Condensate Management***

Precool section of the DHP™ can and will condense moisture. Therefore provisions of moisture capture and drainage have to be taken into account for all DHP™ installations. It is also recommended that the reheat heat pipes section is installed over a drain pan for cleaning purposes.

Types of Units That Can Be Fitted with Heat Pipes

Wrap-around dehumidifier Heat Pipes can be installed in almost any air handler or A/C unit. HPT has extensive Heat Pipe installation experience with equipment manufactured by Carrier, Lennox, Daikin, Trane, JCI, Addison, TMI, Air Enterprises, Seasons-4, Haakon, Annexair, Venmar and many others. If in doubt, check with your local HPT representative or with the HPT's main office for installation requirements in specific units.

Below is a sample of units that can be fitted with wraparounds.

Types of Units That Can Be Fitted with Heat Pipes (continued)

Features and Benefits

Design Features

- ***Totally Passive***

  The standard dehumidifier Heat Pipes are totally passive with no moving parts.

- ***Versatile***

  Dehumidifier Heat Pipes can be designed to fit almost any size air handler. The amount of precool and reheat can be adjusted by correctly selecting the number of tube rows and the fin density. Dehumidifier Heat Pipes can be installed around cooling coils in air handlers, in DX, split, and packaged air conditioning units.

- ***Low Maintenance***

  Since Heat Pipes have no moving parts and are activated only by the difference in temperature between the air entering the precool Heat Pipe and the air leaving the cooling coil, they need very little attention. Only periodic cleaning is required.

- ***Durability***

  Since Heat Pipes are sensible energy transfer devices, Dehumidifier Heat Pipes stay dry most of the time. All HPT Heat Pipes are made of high quality copper tubes, and galvanic corrosion is not an issue in most applications. (For corrosive environments, coils coatings are available). Heat Pipes typically outlast the cooling coils of the air conditioning system in which they are installed.

- ***Compact***

  Since dehumidifier Heat Pipes wrap around the cooling coils, no additions to the air conditioning units are normally needed. Typically little room is needed inside A/C units to accommodate the Heat Pipes.

- ***Controllability***

  Controllability of Heat Pipes is offered as an option. This allows the operator to turn the Heat Pipes on-off or modulate their performance.

- ***Quality***

  With the Heat Pipe Technology name, you are guaranteed the best product. Product testing is part of our standard procedure to ensure top quality.

Benefits

- ***Increase Moisture Removal of A/C Units***

  The first module of the wrap-around Heat Pipe precools the entering air. This causes the approach temperature of the air to the cooling coil to be lower. If the cooling coil works at same capacity, the air leaves the cooling coil will be colder with a lower dew point and a lower absolute humidity ratio. That means more moisture will be removed from air.. Part of the cooling coil sensible capacity is converted into extra latent capacity. Because of this, a DX System, according to how it is controlled, may have a longer run time in order to satisfy the thermostat. Because of these two effects and depending on the design of the Heat Pipes, the cooling coil can extract over 30% to 100% more moisture than a cooling coil without Heat Pipes.

- ***Dryer Supply Ducts***

  After leaving the cooling coil, the air is reheated by the second Heat Pipe module. This lowers the relative humidity ratio of the supply air. In a typical system with 2 or 3 row DHP™, the relative humidity ratio is lowered from nearly 100% leaving the cooling coil to approximately 70% leaving the second Heat Pipe module. If the relative humidity ratio in occupied spaces and low velocity ducts and plenums exceeds 70%, fungal contamination (for example, mold, mildew, etc.) may occur. HPT Dehumidifier Heat Pipes help solve this problem.

- ***Humidity Control***

  Buildings in humid climates frequently encounter serious humidity problems that need to be addressed. Other buildings used for specific purposes like hospitals, certain food processing plants, and some manufacturing plants require humidity to be kept at a low level. HPT Dehumidifier Heat Pipes are usually the most efficient method of humidity control in these situations. By helping the A/C system remove more moisture from the air, the required humidity levels can be easily achieved.

- ***Energy Savings through Passive Precooling and Reheat***

  Since Heat Pipes provide reheat by utilizing the heat from the entering air, there is none or reduced requirement for active reheat?. The additional cooling needed to compensate for the reheat is also provided passively by the first Heat Pipe module as it extracts heat from the entering air. Using Heat Pipes to replace active reheat results in substantial savings. A payback of one year or less may be achieved when electric reheat is replaced with dehumidifier Heat Pipes.

- ***Energy Savings with Higher Thermostat Setting***

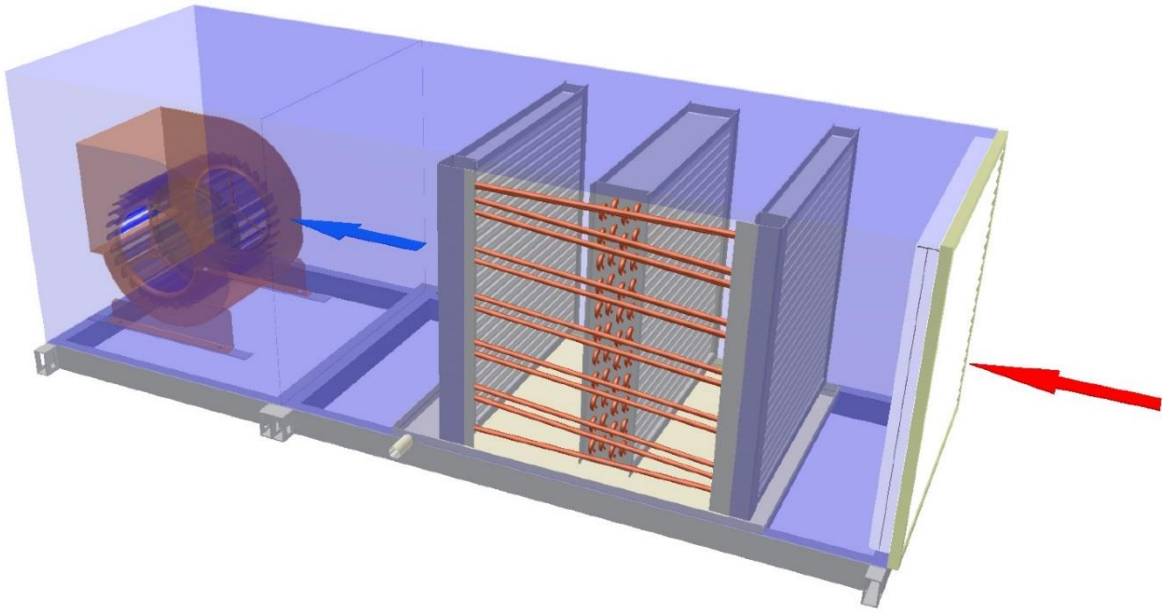
  As the relative humidity in a building is reduced by the addition of Heat Pipes, the thermostat can be set to a higher temperature while maintaining the same level of comfort and saving additional energy.

- ***Equipment Savings through Downsizing***

  To cope with high humidity loads, the most frequently used technique is to oversize the A/C unit and then reheat the overcooled air. This results in high operating costs as well as initial equipment cost. If dehumidifier Heat Pipes are used, oversizing and active reheating can be avoided. With a chilled water system, HPT Heat Pipes allow the designer not only to reduce the size of the cooling coil but also to reduce the chilled water requirement. Thus, a smaller chiller unit can be used.

DHP-F™: Factory Installed Wrap-Around Dehumidifier Heat Pipes

DHP-S™: Site Installed Wrap-Around Dehumidifier Heat Pipes



Wrap-Around Dehumidifier Heat Pipes installed in cooling coil section

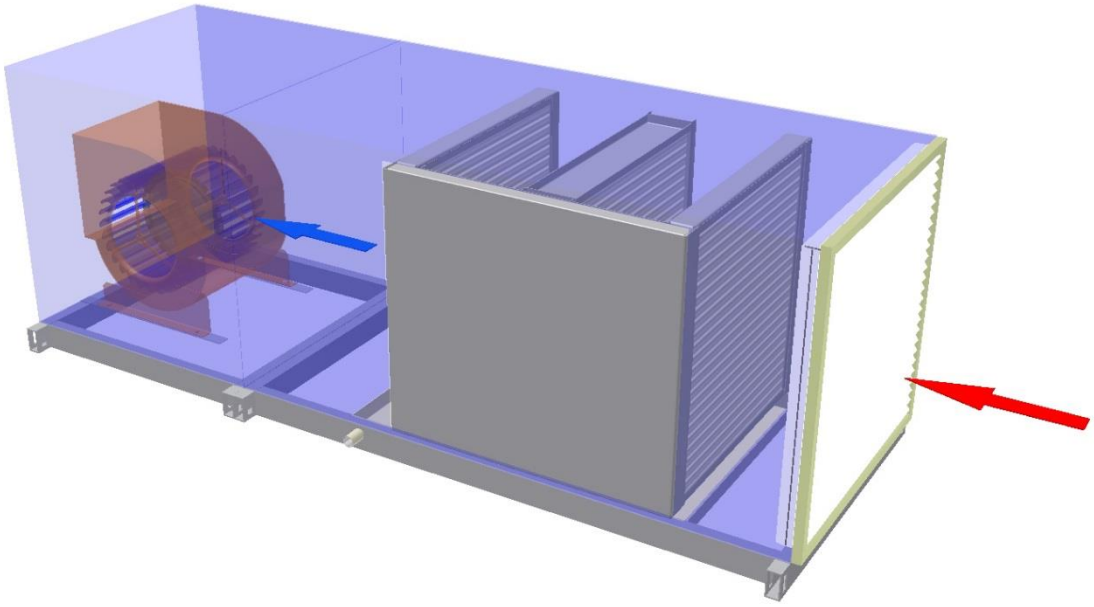
Features

Factory or site installed wrap-around Dehumidifier Heat Pipes are the most versatile Dehumidifier Heat Pipes. They can be installed around the cooling coil in most any air conditioning unit to remove more moisture and to provide the dehumidifying benefits of overcooling and reheat with no overcooling or reheat cost. Highly experienced HPT technicians install the Heat Pipes at both the HPT factory and on site assuring excellent installation and proper operation.

Applications

Typically installed in A/C manufacturers' catalog units: Chilled water air handlers and direct expansion (DX) equipment, both packaged and split systems.

DHP-U™: U-Frame Dehumidifier Heat Pipes



Features

These units are completely fabricated at the HPT factory and can be installed around a cooling coil without assistance by HPT technicians. They can be slid into place horizontally or dropped into place from above.

Applications

Typically installed by custom air conditioning unit manufacturers around chilled water or DX cooling coils.

Controllable Dehumidifier Heat Pipe Systems

DHP-FC™: Factory Installed Controllable Dehumidifier Heat Pipes

DHP-SC™: Site Installed Controllable Dehumidifier Heat Pipes

DHP-UC™: U-Frame Controllable Dehumidifier Heat Pipes

DHP-V™: Vertical Tube Wrap-Around Dehumidifier Heat Pipes

Features

Wrap-around heat pipes are normally installed as passive devices designed to match the requirements of their installation. Sometimes the need for maximum sensible cooling overrides the need for humidity control. Because of this, it is necessary to temporarily lower or shut off the reheat action of the heat pipe.

However, when reheat is shut off, the precool also shuts off, increasing the load on the cooling coil. Unless the cooling coil has extra capacity, the cooling coil leaving air temperature and dewpoint will be higher than with the heat pipe operating. There will still be more sensible cooling available than with the heat pipe operating, just not as much as it would first appear. For example, many cooling coils have a 55° F saturated leaving air temperature. With a typical two row wrap-around heat pipe, the reheat is about 10° F, warming the air to 65° F. Shutting off the reheat and the precool means a cooling coil with a fixed capacity, or one already operating at maximum capacity, may only be able to cool the air to a dew point between 58° F and 62° F. The need for the heat pipe performance to be less than the maximum but more than zero brings about the need for controllable heat pipes.

Applications

Typically used for applications where there is limited cooling capacity or where dehumidification needs to be closely controlled, or variable reheat requirement.

Following are the two main applications for controlling Dehumidifier Heat Pipes:

1. Electrically Operated Solenoid Valves, DHP-FC™, DHP-SC™, DHP-UC™

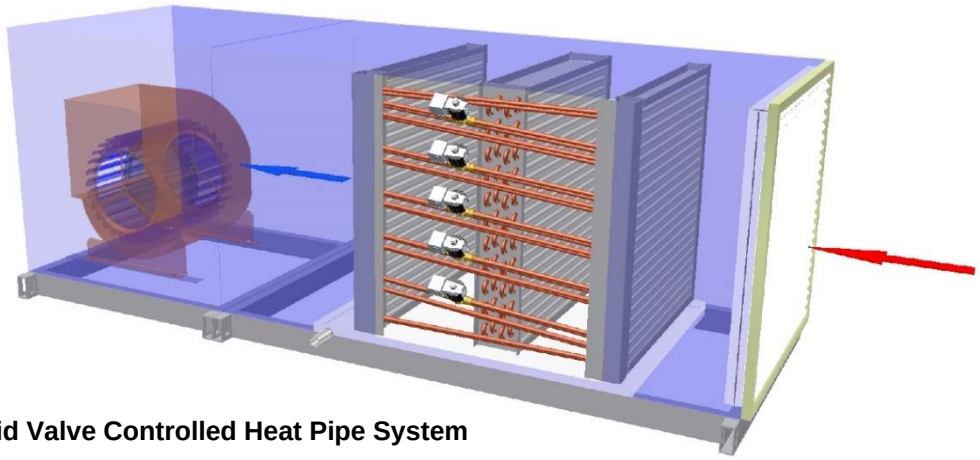
For remote control of an operating heat pipe, normally open (NO) electric solenoid valves can be installed in the liquid return lines of the individual heat pipe circuits. The number of valves needed is determined by the size of the heat pipe, the number of rows, and the degree of control desired. It may not be necessary to install controls on all circuits if partial control is sufficient. The total heat pipe system can have a mix of controlled and uncontrolled circuits for systems that do not require shutting off 100% of the heat pipe operation.

As the heat pipe size and/or number of rows increase, the number of valves increases. When the installation calls for approximately 15 or more solenoids, the 30 Watts of electrical power needed

to operate each also becomes an important consideration. In this case consideration should be given to 115 VAC solenoids to avoid the added cost of having to install large power transformers, or to consider a different control option.

Total No. of Stages	% Heat Pipe Effect
3	0, 33, 66, 100
4	0, 25, 50, 75, 100

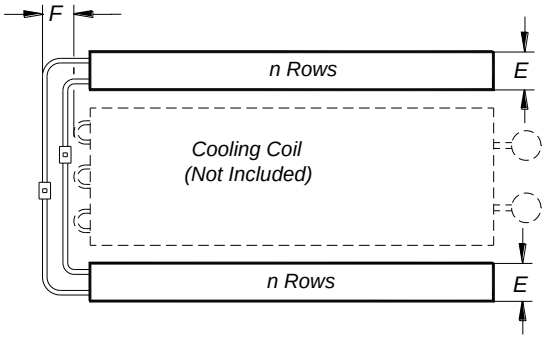
Valve Control Examples



Solenoid Valve Controlled Heat Pipe System

Heat pipes with control solenoids can be installed in factory fitted wrap-around heat pipes and in U-framed heat pipes. The size of the solenoids adds considerable depth to the heat pipe connection section (F dimension). The cooling coil may need to be ordered shorter than normal, or the AHU section ordered wider than normal, in order to accommodate the solenoids. In some cases, where this is not possible, an outside enclosure is built to house the connecting section of the heat pipes. In addition, this area must have access after the AHU is installed. One row of solenoids (for a one or two rows heat pipes) needs a connection section depth of 5 inches; two rows of solenoids (for a three or four rows heat pipes) need a depth of 9 inches. These dimensions are illustrated below.

Rows	E	F W/O Valves	F W/ Valves
1	2.25	1.50	5.00
2	3.25	2.00	5.00
3	4.25	2.75	9.00
4	5.50	3.25	9.00
5	6.75	4.00	13.00
6	8.00	4.50	13.00

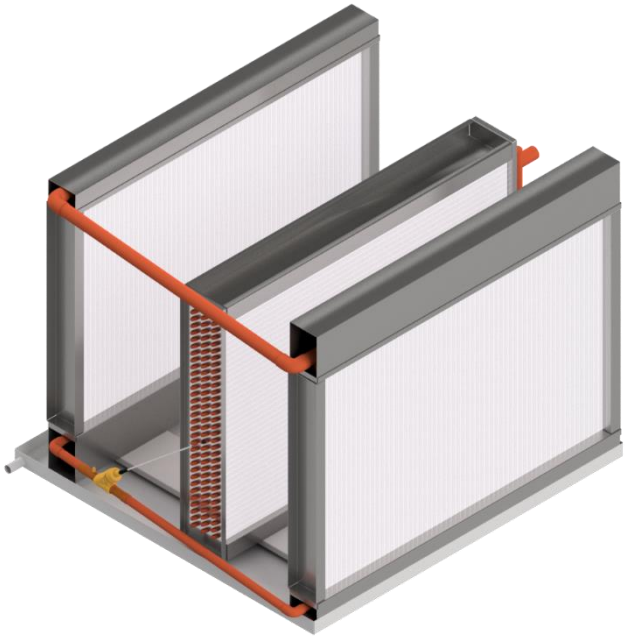


Dimensions for wrap-around heat pipes with solenoid valves

The circuiting required for installing solenoids lends itself to building the heat pipe with multiples of two rows only. A three row controllable requires the same number of solenoids as a four row controllable.

2. Vertical Tube Wrap-Around Dehumidifier Heat Pipes, DHP-V™

The manifolded heat pipe allows controllability by using a different heat pipe construction method. The heat pipe coils are built with vertical tubes manifold together at the top and at the bottom, creating a vapor line at the top and a liquid line at the bottom. There are only two lines per circuit crossing over between the two heat pipe sections, although they are quite a bit larger than the normal ½ inch crossover tubes used in regular heat pipe systems. The vapor line is typically 1.625 or 2.125 inches OD while the liquid line is typically 1.375 inches OD. By installing a proportional control electronic refrigeration valve in the liquid line, the liquid return can be controlled thus controlling the heat pipe performance. These heat pipes can be installed in multiple banks high.

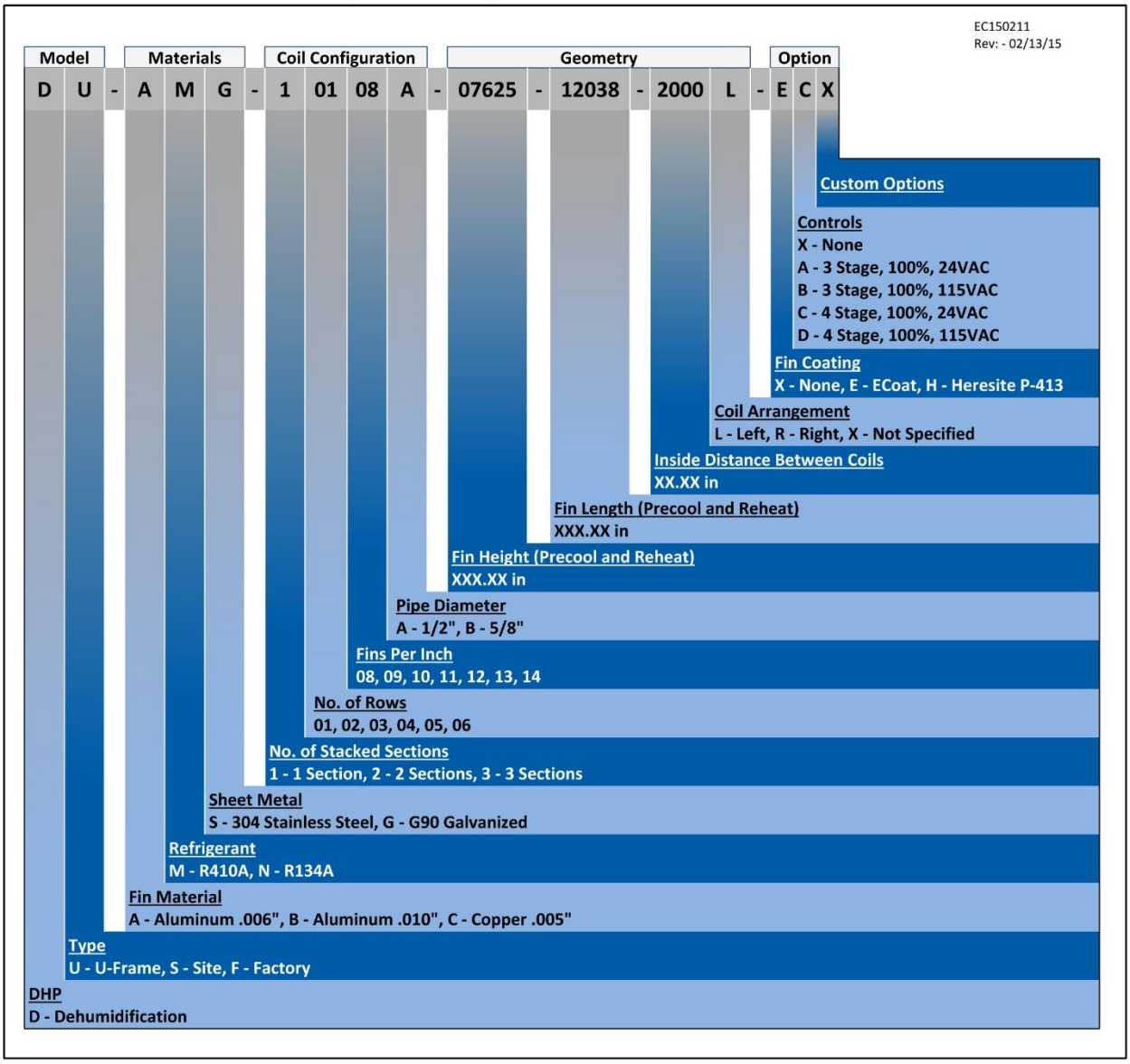


Schematic of a Vertical Tube Controllable DHP-V™, Heat Pipe and Cooling Coil

An electric step motor valve is typically used to provide modulating control. The valves are controlled from a separate HPT furnished control box including microprocessor(s), with signals originating from the Building Automation System, which provides the sensors and is programmed to operate the heat pipe system to control the supply leaving air temperature as required.

This design only uses electric power when the valve setting is changing. The top and bottom manifolds do reduce the available finned area, making this design most suitable for large installations. In units up to about 30 inches of finned height, solenoid valves should be considered; for larger units, manifolded heat pipes should be considered. There are also other considerations. This product is not available for selection in our online software SelectPlus™. Please contact HPT for advice.

Order Code - DHP (General)



ENGINEERING SPECIFICATIONS

Factory Installed Wrap-Around Dehumidifier Heat Pipes DHP Series

1. GENERAL

❑ Air Handler(s) ❑ Packaged Air Conditioning Equipment shall be equipped with

❑ Standard

❑ Tilted Enhanced

Dehumidifier Heat Pipes supplied by Heat Pipe Technology, Inc. to precool the return/outside air and reheat the supply air in a wrap-around configuration. The precool Heat Pipe module shall be located immediately before the cooling coil and the reheat module of the Heat Pipe shall be located immediately after the cooling coil. Heat Pipe circuits comprise multiple tubes connected in series, end-to-end to form a closed, continuous loop. Both vapor and liquid will travel in the same direction around the circuit in a single convectional path, making wicking and capillary action unnecessary for continuous heat transfer. Both Heat Pipe modules shall be inside the equipment cabinet. The interconnecting piping between the Heat Pipe modules shall be located within the assembled access/coil/access sections. If not, the piping shall be external, but enclosed within a removable, insulated enclosure supplied and installed by others. When possible, all interconnecting piping shall be located at the end of the cooling coil opposite from the coil header and piping connections. Any deviation from the specifications must be approved by the engineer no less than ten days prior to the project bid date. No consideration of alternates will be given after that time. Heat pipes shall be completely manufactured and fully assembled at the manufacturer's facility or on site by factory personnel. Conversion of third party coils is not acceptable.

2. CONFIGURATION IN MODULAR AIR HANDLERS

The precool Heat Pipe module shall be located immediately upstream of the cooling coil section and the reheat Heat Pipe module shall be located immediately downstream of the cooling coil section with drain pans, or a single extended drain pan, positioned beneath. ❑ For optimal accessibility between the cooling coil and the Heat Pipe modules, the air handler cooling coil section(s) shall be supplied with two (2) factory installed blank sections located immediately before and after the cooling coil section. Each section shall be provided with an integral condensate drain pan and drain pan condensate connection of the same construction as specified for the cooling coil. The precool Heat Pipe module shall be located within the provided blank section before the cooling coil section, and the reheat Heat Pipe module shall be located within the provided blank section after the cooling coil section.

3. OPTIONAL CONTROL VALVE FEATURE

All or a portion [SPECIFY] of the Dehumidifier Heat Pipe circuits shall be equipped with solenoid operated control valves to control the operation of the Heat Pipe circuits. The electrical power required by the solenoid valves shall be: ❑ 24 VAC ❑ 120 VAC. The solenoid valves shall be wired to a terminal block within a NEMA enclosure located on the: ❑ exterior surface of the equipment cabinet or ❑ interior as indicated.

The Building Automation System shall provide the sensors necessary for determination of heat pipe staged operation and the BAS computer shall be programmed to send the operating control signals to the solenoid valves as required for correct system operation. The control signal shall go through a BAS interface installed near the heat pipe NEMA box. All additional wiring, relays, transformers, power supply etc. necessary to interface with the equipment control system, shall be provided and installed by others. Closing of a valve shall inactivate the Heat Pipe circuit in which it is installed. The valves shall be normally open. The control valves shall be grouped such that each group of valves shall control a designated fraction of the Heat Pipe circuits. With all control valves open, the Dehumidifier Heat Pipe assembly will operate at full capacity. If all the circuits are equipped with control valves, then closing all the valves will stop all Heat Pipe operation. Manufacturer shall provide at least three (3) references for successful controllable wraparound heat pipe installations in operation for at least three (3) years.

4. HEAT PIPES

1) The Heat Pipe supplier shall have a minimum of 5 years of experience designing and installing Heat Pipes specifically for dehumidification applications.
2) The tubes shall be 1/2” OD copper, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.
3) The fin surface shall be continuous plate type ❑ aluminum ❑ copper fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.
4) ❑ The Heat Pipe modules shall have an optional protective coating of ❑ E-Coat, similar to Electrofin or ❑ phenolic, similar to Heresite. Heat pipes shall be dipped and completely submerged to insure full coverage of coating - spray coatings are not acceptable.
5) Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2013.
6) Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.
7) The Heat Pipes shall be installed as shown on the submittal drawings.
8) Frames, mounting structure, and drain pan extensions (if required) shall be minimum 16 gauge ❑ galvanized steel ❑ stainless steel.

9) Heat Pipe interconnecting piping and circuitry shall be as specified by Heat Pipe Technology design. Each circuit shall be individually processed, charged, hermetically sealed, and tested.

10) Scheduled effectiveness or heat recovery shall be met at a minimum and total pressure drop shall not be exceeded. The resulting Recovery Efficiency Ratio, or RER, shall therefore be met at a minimum.

11) The Heat Pipes shall be ETL listed to UL standard 207 and CSA C22.2.140.3.

12) The Heat Pipe heat exchanger shall have a five (5) year limited warranty. All components such as valves and dampers shall carry a 12 month warranty.

U-Frame Dehumidifier Heat Pipes (Installed by Other OEMs)

1. GENERAL

❑ Air Handler(s) shall be equipped with

- ❑ Standard
- ❑ Tilted Enhanced

Dehumidifier Heat Pipes supplied by Heat Pipe Technology, Inc. to precool the return/outside air and reheat the supply air in a wrap-around configuration. The Dehumidifier Heat Pipes shall be pre-fabricated in a U-Frame arrangement comprised of precool Heat Pipe and reheat Heat Pipe heat exchangers together in one assembly such that the assembly may be inserted into an air conditioning unit with the legs of the U-Frame unit on either side of the cooling coil of the air conditioning unit. The U-Frame assembly shall be configured such that the precool Heat Pipe shall be located immediately before the cooling coil and the reheat Heat Pipe shall be located immediately after the cooling coil. Heat Pipe circuits comprise multiple tubes connected in series, end-to-end to form a closed, continuous loop. Both vapor and liquid will travel in the same direction around the circuit in a single convectional path, making wicking and capillary action unnecessary for continuous heat transfer. The interconnecting piping between the Heat Pipe modules shall be located within the U-Frame unit. Any deviation from the specifications must be approved by the engineer no less than 10 days prior to the project bid date. No consideration of alternates will be given after that time. Heat pipes shall be completely manufactured and fully assembled at the manufacturer's facility or on site by factory personnel. Conversion of third party coils is not acceptable.

2. OPTIONAL CONTROL VALVE FEATURE

All or a portion [SPECIFY] of the Dehumidifier Heat Pipe circuits shall be equipped with solenoid operated control valves to control the operation of the Heat Pipe circuits. The electrical power required by the solenoid valves shall be: ❑ 24 VAC ❑ 120 VAC. The solenoid valves shall be wired to a terminal block within a NEMA enclosure located on the exterior surface of the equipment cabinet. All additional wiring, relays, transformers, and power supply etc. necessary

to interface with the equipment control system, shall be provided and installed by others. Closing of a valve shall inactivate the Heat Pipe circuit in which it is installed. The valves shall be normally open. The control valves shall be grouped such that each group of valves shall control a designated fraction of the Heat Pipe circuits. With all control valves open, the Dehumidifier Heat Pipe assembly will operate at full capacity. If all the circuits are equipped with control valves, then closing all the valves will stop all Heat Pipe operation. Manufacturer shall provide at least three (3) references for successful controllable wraparound heat pipe installations for at least three (3) years.

3. HEAT PIPES

1) The Heat Pipe supplier shall have a minimum of 5 years of experience designing and installing Heat Pipes specifically for dehumidification applications.

2) The tubes shall be ½" OD copper, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.

3) The fin surface shall be continuous plate type ❑ aluminum ❑ copper fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.

4) ❑ The Heat Pipe modules shall have an optional protective coating of ❑ E-Coat, similar to Electrofin or ❑ phenolic, similar to Heresite. Coils shall be dipped and completely submerged to insure full coverage of coating - spray coatings are not acceptable.

5) Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2013.

6) Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.

7) The frame shall be minimum 16 gauge ❑ galvanized steel ❑ stainless steel.

8) Heat Pipe interconnecting piping and circuitry shall be as specified by Heat Pipe Technology design. Each circuit shall be individually processed, charged, hermetically sealed, and tested. Interconnecting piping shall be fully enclosed to provide complete protection.

9) Scheduled effectiveness or heat recovery shall be met at a minimum and total pressure drop shall not be exceeded. The resulting Recovery Efficiency Ratio, or RER, shall therefore be met at a minimum.

10) The Heat Pipes shall be ETL listed to UL standard 207 and CSA C22.2.140.3.

11) The Heat Pipe heat exchanger shall have a five (5) year limited warranty. All components such as valves and dampers shall carry a 12 month warranty.

1. GENERAL

Air handlers shall be equipped with Dehumidifier Heat Pipes supplied by Heat Pipe Technology, to precool the return/outside air and reheat the supply air in a wrap-around configuration. Heat Pipe system shall be comprised of one, two, three, four or more circuits. Both Heat Pipe modules shall be located inside the equipment cabinet. The interconnecting piping- supplied and installed by others- between the Heat Pipe modules shall be located ❑ within the air handler, or ❑ external, but enclosed within a removable, insulated enclosure supplied and installed by others. All interconnecting piping shall be located at the back end of the cooling coil (not the headers end). Any deviation from the specifications must be approved by the engineer no less than ten days prior to the project bid date. No consideration of alternates will be given after that time. Heat pipes modules shall be designed, manufactured and assembled at the manufacturer's facility by factory personnel. Conversion of third party coils is not acceptable.

2. CONSTRUCTION

❑ Heat Pipe coil tubes shall be oriented vertical and the fins run horizontal. Each two rows shall be manifolded together into one liquid line at the bottom and one vapor line at the top and constitute one circuit. Combining headers of multiple circuits into one common vapor header and one common liquid header will reduce performance and is not permissible. Each heat pipe section shall be installed level end to end. Reheat section shall be installed with an elevational offset relative to the precool section, as specified by HPT, in order to enhance performance.

❑ Extended drain pans (provided by others) to be installed under and downstream of the precool section, or ❑ A moisture eliminator shall be installed immediately downstream of the precool section of the heat pipe to capture condensate that may spit from the heat pipe fins. Condensate shall drain out of the bottom into a drain pan (supplied by others). The moisture eliminator shall be capable of capturing at least 99.75% of condensate when the coil is producing condensate at a rate of 0 to 15 lbs. water/sqft/hour and coil airflow is ≤ 700 SFPM. Static pressure loss shall not exceed 0.18 in.wg. at 500 SFPM.

The moisture eliminator blades will be constructed of ABS plastic and meet UL Standard 94 classification V-0, which requires blades to self-extinguish within 10 seconds. It will incorporate an additive that protects against fungal and bacterial deterioration to provide long-term protection against fungal and bacterial attack and help prevent surface growth, permanent staining, embrittlement and premature product failure. The anti-fungal and anti-bacterial additive shall be mixed with the polymer and shall not be a coating, which could wear off over time.

3. CONFIGURATION IN MODULAR AIR HANDLERS

The precool Heat Pipe module shall be located immediately upstream of the cooling coil section and the reheat Heat Pipe module shall be located immediately downstream of the cooling coil section. For optimal accessibility between the cooling coil and the Heat Pipe modules, the air handler shall be supplied with two (2) factory installed blank sections located immediately before and after the cooling coil section. Each section shall be provided with an integral condensate drain pan and drain pan condensate connection of the same construction as for the cooling coil. The precool Heat Pipe module shall be located within the provided blank section before the cooling coil section, and the reheat Heat Pipe module shall be located within the provided blank section after the cooling coil section.

4. OPTIONAL CONTROL VALVE FEATURE

All or a portion [SPECIFY] of the Heat Pipe circuits shall be equipped with modulating control valves to control the operation of the Heat Pipe circuits. Each circuit shall have one modulating step motor valve in the lower liquid line in an accessible location. Each valve will connect to a printed circuit board in a NEMA 12 enclosure that contains the number of control boards to control all valves in the system and the appropriate power conversion. The customer supplied electrical power to the control panel power supply transformer shall be: ❑ 120 VAC ❑ 208 VAC ❑ 230 VAC 1 phase 60 Hz. The NEMA box shall be located on the ❑ exterior or ❑ interior surface of the equipment cabinet as indicated ❑ or on a nearby surface.

The Building Automation System (BAS) shall provide the sensors necessary for determination of heat pipe modulation operation and the BAS computer shall be programmed to send the operating control signals to the modulating valves' control boards as required for correct system operation. The control signal shall go through a BAS interface installed near the heat pipe NEMA box. The BAS control signal provided shall be ❑ 0 to 10 volt DC or ❑ 4-20 mA.

All additional wiring shall be provided and installed by others. With all control valves open, the wrap around heat pipe assembly will operate at full capacity. Modulating one valve closed restricts the liquid return flow and reduces the heat transferred by the heat pipe until closing the valve shuts off that circuit.

5. HEAT PIPES

1) The Heat Pipe supplier shall have a minimum of 5 years of experience designing and installing Heat Pipes specifically for dehumidification applications.
2) The tubes shall be 1/2" OD copper, of specific design for Heat Pipe application, permanently expanded onto the fin collar to form a firm, rigid, and complete pressure contact at all operating conditions. Aluminum tubes will not be allowed.
3) The fin surface shall be continuous plate type ❑ aluminum ❑ copper fins of specific design to produce maximum heat transfer efficiency for Heat Pipe applications. Airside pressure loss shall be as given on the schedule, or otherwise specified. Fin density and the number of rows of tubes shall be as specified.

4) ❑ The Heat Pipe modules shall have an optional protective coating of ❑ E-Coat, similar to Electrofin or ❑ phenolic, similar to Heresite. Heat pipes shall be dipped and completely submerged to insure full coverage of coating - spray coatings are not acceptable.
5) Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2013.
6) Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.
7) The Heat Pipes shall be installed as shown on the submittal drawings.
8) Frames, mounting structure, and drain pan extensions (if required) shall be minimum 16 gauge ❑ galvanized steel ❑ stainless steel.
9) Heat Pipe interconnecting piping and circuitry shall be as specified by Heat Pipe Technology design. Each circuit shall be, pressure tested, vacuumed, charged, and sealed.
10) Scheduled effectiveness or heat recovery shall be met at a minimum and total pressure drop shall not be exceeded. The resulting Recovery Efficiency Ratio, or RER, shall therefore be met at a minimum.
11) The Heat Pipes shall be ETL listed to UL standard 207 and CSA C22.2.140.3.
12) The Heat Pipe heat exchanger shall have a five (5) year limited warranty. All components such as valves and dampers shall carry a 12 month warranty.

Installation List

Recent Domestic Installations
Wrap-Around Dehumidifier Heat Pipes (DHP™)

State	City	Location
Alabama	Haynesville	Central Elementary
Arkansas	Searcy	John Soules Foods
	Little Rock	Blue Cross Blue Shield South Building
California	Los Angeles	Ronald Reagan UCLA Medical Center
Connecticut	Hartford	Connecticut Historical Society
	Putnam	Putnam High School
	New Haven	Helene Grant School
Delaware	Dover	Allen Frear Elementary School
Florida	Pensacola	Naval Air Station
	Citrus Springs	Citrus Springs Middle School
	Ocala	Life Care Center
	Pompano Beach	Unipharma LLC
	Orlando	Walt Disney World Animal Kingdom Lodge
	Clearwater	Morton Plant Hospital
	W. Palm Beach	West Palm Beach VA
	Marco Island	Marriott
	Biscayne	Florida International University
	Orlando	Walt Disney Work Kadini Village
	Mary Esther	Hurlburt AFB
	Gainesville	University of Florida - Fine Arts
	Miami	Wyndam Hotel
	Tampa	St. Joseph's Hospital
	Tampa	University of South Florida
Georgia	Columbus	Ft. Benning McBride Elementary
	Kennesaw	KSU Sturgis Library
	Ringgold & Lavonia	Welcome Center
	Atlanta	Federal Reserve Kitchen
	Tattnall & Hawkinsville	Lockheed Martin Space Fence
	Atlanta	Westminster School – Carlyle Fraser Library
	Cumming	Forsyth County Public Library
Hawaii	Honolulu	Kawananakoa Middle School
	Hilo	University of Hawaii Hilo Life Science
	Honolulu	Ala Moana Hotel
	Kaneohe	P-864 MALS 24 Aircraft Maintenance Facility
Illinois	Chicago	Nordstrom Tower
	Chicago	Mariano's New City Lincoln Park
Indiana	Clinton	Eli Lilly C92
	Bloomington	Indiana University Musical Arts Center

Iowa	Iowa City	University of Iowa Pool
Louisiana	New Orleans	New Orleans Airport
	Iberville Parish	Math, Science, and Arts (MSA) Academy
	Galliano	South Lafourche High School
	Houma	Terrabonne Criminal Complex
	New Orleans	Villa St. Maurice
	Lafayette Parish	Lafayette Parish School Board Career Center
Maryland	Parkville	Oak Crest Village Senior Living
	Stevensville	Stevensville Middle School
	Bowie	Bowie State University Center
Massachusetts	Cambridge	Massachusetts Institute of Technology Grad Student Dorm
	Wellesley	Benchmark Senior Living
Mississippi	Jackson	University of Mississippi Medical Center
	Gulfport	Naval Construction Battalion Center, Bldg. 418
	Meridian	Naval Air Station
New Jersey	Parsippany	AKF Biomet 3
New York	New York	Memorial Sloan Kettering Cancer Center Lab 64
	Saratoga Springs	Saratoga Hospital
	New York	Extell
	Staten Island	Curtis High School
North Carolina	Greenville	East Carolina University Student Union
	High Point	High Point University
North Dakota	Wahpeton	Wahpeton High School
Ohio	Cincinnati	GE Aviation
	University Heights	Cleveland Heights - University Heights High School
	Unilever	Cincinnati
Pennsylvania	Nazareth	Martin Guitar
	Philadelphia	Children’s Hospital of Philadelphia
	Bryn Mawr	Bryn Mawr College - Haffner Dormitory
Puerto Rico	San Juan	University of Puerto Rico – Institute of Neurobiology
	Guayama	Pfizer
South Carolina	Charleston	Boeing B860
	Clemson	Clemson University – Barnet Hall
Tennessee	Memphis	University of Memphis
Texas	Austin	The Independent
	Austin	Texas Facilities Commission – WPC Bldg. 8
	San Antonio	Alamo Stadium
	Plano	Granite Park Hilton Hotel
Wisconsin	Milwaukee	Milwaukee Center for Independence

Recent International Installations
Dehumidifier Heat Pipes (DHP™)

Country	State/Province	City	Location
Canada	Ontario	Guelph	University of Guelph
	Ontario	Ottawa	Canadian Science & Technology Museum
	Ontario	Thornhill	Atlas Global Healthcare
	Ontario	Toronto	Univ. of Toronto – Center for Engineering, Innovation, & Entrepreneurship
	Ontario	Niagara Falls	Niagara Region Police Station
	Ontario	Kitchner	Royal Bank of Canada
	Ontario	Ottawa	180 Wellington Building (Historic)
	Ontario	Toronto	Ryerson Biomedical Research Lab
	Quebec	Laval	Sanofi Canada
	Ontario	Brampton	Peel Memorial Hospital
	Ontario	Toronto	100 Adelaide
	Ontario	Ottawa	100 Maple Grove Road
	Ontario	Borden	Canadian Forces Military Police Academy
Colombia	Antioquia	Medellin	Museum of Modern Art
India		Hyderabad	Prayagh Nutri Products
		Chennai	Hospital
Korea	Gyeonggi-do	Siheung-Si	Daeduck Electronics Co., Ltd.
	Jongno-gu	Seoul	Seoul University Hospital
	Yuseong-ro	Daejeon	Electronics & Telecommunications Research Institute - R&D Center
Panama	Panama	Rio Nato	Playa Blanca Town Center
Philippines	Philippines	Manila	Manila Bay Resort
Singapore	Singapore		Regent Hotel
	Singapore		Nanyang Technical Univ. – Lecture Theatre
	Singapore		Hotel @ Victoria Street
Thailand	Prachuabkhirikhan	Hua Hin	Intercontinental Hotel
			CPF Animal Lab
		Phuket	Phuket International Hospital
		Rayong	PTT Maintenance & Engineering Co. Ltd.
		Chanburi	Thai Oil Public Company – Lab
		Bangkok	Bangkok Hospital
UAE		Abu Dhabi	Warner Brothers Theme Park
		Dubai	City Mall
		Abu Dhabi	Abu Dhabi University (College of Engineering)
		Abu Dhabi	Capital Mall
		Dubai	W Hotel
		Dubai	Dubai Port World
		Dubai	Stanford University
		Dubai	Nova Hospital
		Dubai	Audi Services Center
		Dubai	Grand Millennium Hotel

		Dubai	McDonald's @ Me'aisem City Centre
Qatar		Doha	Samrya Quartier Hotel
		Doha	Supreme Command Building
		Doha	Wakra Clinic
		Doha	Ministry of Finance, Phase II
		Doha	Aspire Academy
		Doha	MKM Towers
Oman		Muscat	Oman Convention & Exhibition Center
		Muscat	Royal Oman Police Officers Club
		Muscat	Special Task Force Complex at Nizwa
		Muscat	Park Inn Hotel
		Muscat	Fitout of Carrefour

Dehumidifier Heat Pipes

Heat Pipes Selection Procedure

The Heat Pipe cloud-based Software, SelectPlus™, developed and copyrighted by HPT is designed for selecting and sizing HPT's Dehumidifier Heat Pipes. Please logon to www.heatpipeselect.com to get your user name and password for full accessibility.

Dehumidifier Heat Pipes

Five-Year Limited Warranty

Subject to the following conditions, **Heat Pipe Technology, Inc. (HPT)**, warrants this product to be free from defects in material and workmanship for a period of FIVE YEARS for the heat exchangers only from the date of installation, but not to exceed 90 days from the date of shipment. Control valve(s) and control box carry a 12 month warranty. This warranty is in lieu of all other warrants not expressly set forth herein, whether expressed or implied by operation of law or otherwise. In the event this product fails under normal use and service within the applicable period, HPT will correct, repair or, at its sole discretion, replace the defective product or refund the purchase price of products which are returned freight prepaid to HPT for inspection, when accompanied by proof of purchase and written claims of defect, and which upon inspection by HPT, do comply with the terms of this warranty.

This warranty applies to the first retail buyer and extends to any subsequent owners of the systems.

The cost of replacement parts or components shall be determined by the price schedule in effect at the time of submission of warranty claim.

Repair or replacement parts will be furnished F.O.B. factory in all cases.

If HPT elects to replace or provide a refund, the defective product must be returned to HPT free and clear of liens or other encumbrances.

Limitations on Liability

This warranty does not cover and no warranty is made with respect to:

A. Failures not reported to HPT within the period specified above;
B. Failures or damage due to misapplication, misuse, abuse, improper storage or handling, abnormal conditions of temperature, water, dirt, corrosive substances or other contaminants;
C. Products which have been repaired with parts or materials not furnished or approved by HPT or by its authorized dealers or representatives, or products which have been in any way tampered with or altered;
D. Products damaged in shipment or storage or otherwise without fault of HPT;
E. Normal maintenance as outlined in the installation and servicing instructions or owner's manual including coil cleaning, filter cleaning and periodic flushing of systems;
F. Damage or repairs required as a consequence of faulty installation or application by others;
G. Damage or repairs required as a consequence of any misapplication, abuse, improper servicing, unauthorized alteration or improper operation;
H. Damage as a result of floods, winds, fires, lightning, accidents, corrosive atmosphere or other conditions beyond the control of HPT;
I. Damage resulting from freezing of domestic water or condensate, inadequate or interrupted water supply, use of corrosive water, fouling or restriction of the water circuit by foreign material or like causes;
J. Damage resulting from operation with an inadequate supply of air or water;
K. Dampers or other mechanical options.

HPT total responsibility for any claims, damages, losses or liabilities related to the product covered hereunder shall not exceed the purchase price of such product. In no event shall HPT be liable for any special, indirect, incidental or consequential damages of any character, including but not limited to loss of use of productive facilities or equipment, lost profits, property damage, transportation, installation or removal, lost production, or personal injury whether suffered by Purchaser or any third party. HPT disclaims all liability for any and all costs, claims, demands, charges, expenses or other damages, either direct or indirect, incident to personal injury or property damage arising out of any cause of action based on strict liability.

Some states do not allow the exclusion or limitation of incidental or consequential damages or limitations on how long an implied warranty lasts, so the exclusion or limitation above of consequential damages or the limitation of time above on implied warranties may not apply to you.

This warranty gives you specific legal rights and you may have other rights, which may vary from state to state.

Dehumidifier Heat Pipes

Warranty Registration

To ensure your warranty protection, please fill in the Warranty Registration Form and mail or e-mail it to:

Heat Pipe Technology, Inc.
6904 Parke East Blvd.
Tampa, FL 33610
info@heatpipe.com
Phone: (813) 470-4250

WARRANTY REGISTRATION FORM	
Customer Name:	
Customer Address:	
Phone: ( ) -	Fax: ( ) -
Please check one: ☐ Owner	☐ Dealer
Serial No:	Model No:
Type of Product:	
Date of Installation:	Dealer/Installer:
Name & Address of Dealer/Company You Purchased from	
Name:	
Address:	
Customer Signature:	