

PRODUCTS

SPLIT PASSIVE ENERGY RECOVERY HEAT PIPES

HRM-V Series



HEAT PIPE TECHNOLOGY
a subsidiary of MiTek® • a Berkshire Hathaway company

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Split Passive HRM-V Energy Recovery Heat Pipes

- **Passive, No Moving Parts**
- **Bi-Directional or Single Season Heat Transfer**
- **Made with High Quality Copper Tubes for Reliability and Longevity**
- **Multiple Circuits for Enhanced Performance**
- **Optional Control Valves for Capacity, Defrosting, or Economizer Control**
- **Separate Liquid and Vapor Lines for Maximum Performance**
- **Flexibility in Dimensions and Configurations**
- **No Cross Contamination Between Air Streams**
- **Applicable to Retrofits and New Construction**
- **Site Completion by Factory Technicians**

Split Passive HRM-V Energy Recovery Heat Pipes

SYSTEM DESCRIPTION

Heat Pipe Technology split passive (HRM-V) energy recovery heat pipes are an air to air heat exchange system designed to move heat from one air stream to another. Split passive HRM-V heat pipes provide economical and reliable recovery for summer only, winter only, or all season applications where supply and exhaust air streams are remotely located. These systems are designed for both process and comfort applications to pre-cool or pre-heat outside air using otherwise wasted heat from exhaust air. Natural thermosiphon is used to circulate refrigerant, from the supply air coil to the exhaust air coil where it changes phase from a liquid to a gas and back to a liquid. Because of this natural phase change unique to heat pipes, the HRM-V system can produce significantly higher heat transfer capabilities than a comparable water glycol system often yielding 40% or more. Best of all, because they have no moving parts HPT heat pipes require minimal maintenance and provide passive, reliable energy recovery.

Construction

Coil construction consists of tube and fin design with copper tubes and aluminum or copper fins. The coils are encased on top, bottom and sides with either galvanized or stainless steel casing for easy installation into air handling units or duct work. Headers are type L copper. Header size will vary based on the capacity of the coil. Each coil is divided into multiple circuits, to be piped in a counter flow arrangement, and individually charged for maximum heat transfer effectiveness. The tubes of the coil are configured vertically with fins oriented horizontally. The rows of tubes for each circuit are manifolded to a vapor header at the top of each circuit and a liquid header at the bottom of each circuit. Systems can be designed with two rows per header or one row per header depending on the performance requirements of the application. The HRM-V system can be configured with 2, 4, or 6 rows. However, a typical HRM-V heat pipe system will use 6-rows. Air pressure drop and fan power increase with each row. Coil depth is based on the number of rows.

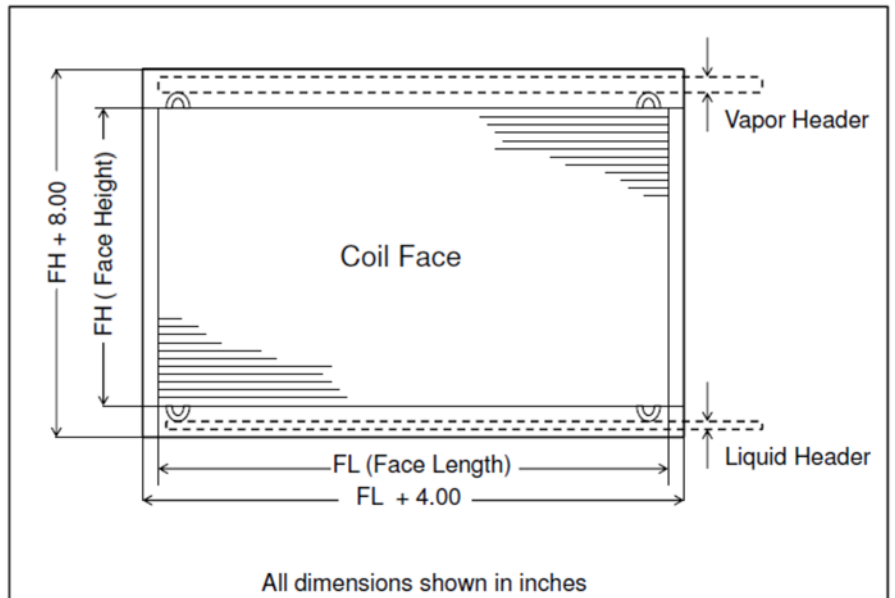


Figure 1 - Typical dimensions

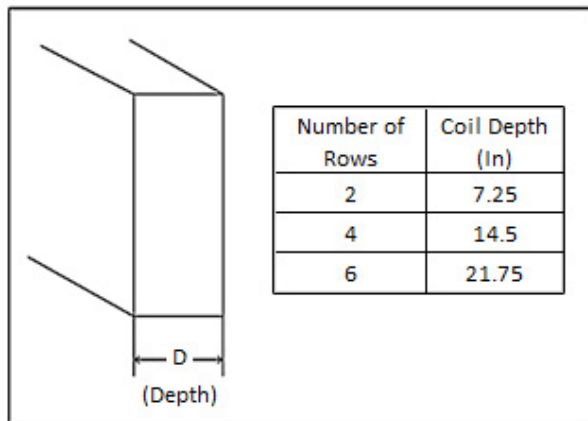


Figure 2 - Typical Dimensions

- **Tubes** – 1/2 inch OD copper
- **Fins** – aluminum or copper, sine wave pattern
- **Casing** – galvanized, or 304 stainless steel
- **Headers** – Type L, ACR copper, pipe sizes based on capacity
- **Coil Sizing**
 - **Face Height** – maximum face height is 30 inches per coil.
 - **Face Length** – maximum face length is 155 inches per coil
- **Coatings** – For contaminated air streams or applications close to salt water protective coatings are strongly recommended.

Installation Configurations

When installed on the same elevation, the HRM-V system can transfer heat in both directions making it ideal for summer and winter recovery. For installations where air stream is elevated, the HRM-V system can only transfer heat from the lower air stream to the higher air stream, therefore, limiting heat transfer to one season. HPT offers the following arrangements;

- Winter Only Recovery
- Summer Only Recovery
- Winter/Summer Recovery

A. Winter Only Recovery

When cooler outside air is above warmer exhaust air

-Maximum 100* ft equivalent horizontal separation

-Maximum 50 ft* equivalent vertical separation

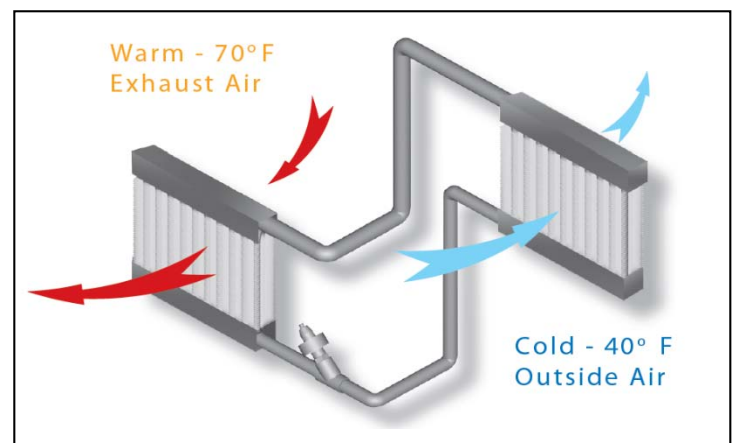


Figure 3

*Valves and elbows shorten this distance

B. Summer Only Recovery

When warmer outside air is below cooler exhaust air

-Maximum 100 ft* equivalent horizontal separation

-Maximum 50 ft* equivalent vertical separation

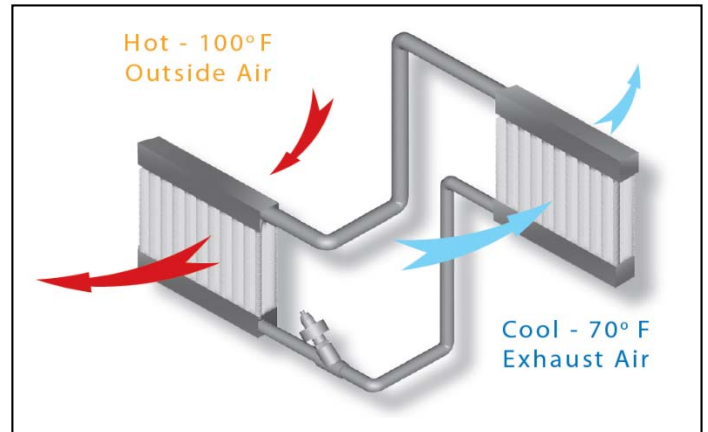


Figure 4

*Valves and elbows shorten this distance

C. Winter/Summer Recovery

When outside air is on the same elevation as exhaust air

-Maximum 40 ft equivalent horizontal separation

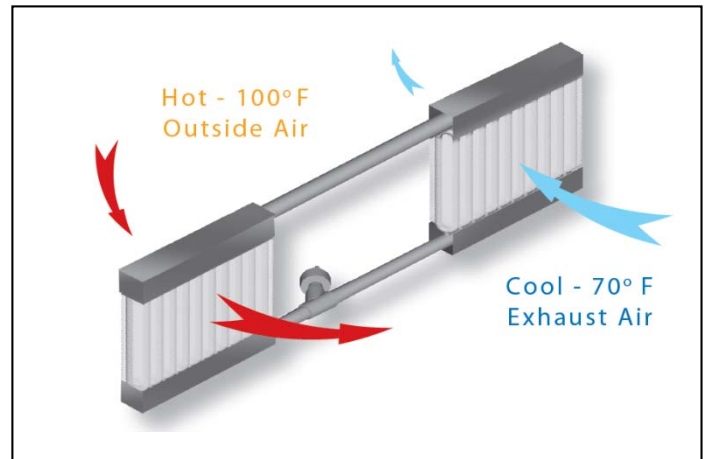


Figure 5

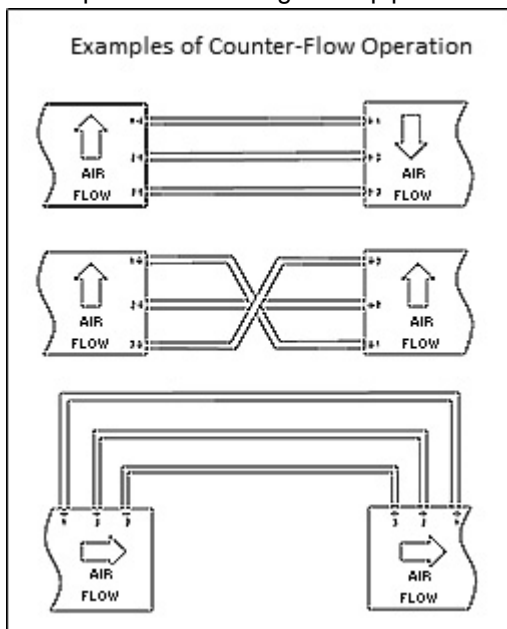
*Valves and elbows shorten this distance

Comfort Energy Recovery

HPT split passive energy recovery heat pipes can be used for comfort-to-comfort applications or for process applications. Comfort-to-comfort applications include heating only recovery for cooler climates, cooling only recovery for warm climates, or more often, both heating and cooling recovery. Split passive energy recovery heat pipe systems are being used for heating/cooling recovery from cold northern zones with harsh winters to the heat of more southern climates.

Process Energy Recovery

For process applications, heating/cooling recovery can also take place in either direction. Process applications frequently involve air temperatures elevated above normal room conditions. The heat pipes can be made to withstand temperatures up to 200°F. For air streams with corrosive components, the heat pipes can be provided with a protective coating. Heat pipes can also be fabricated with both fins and tubes made of copper.



Design Considerations

The HRM-V system allows for multiple coil sections to be utilized for applications with larger airflows. The HRM-V system design permits one supply coil to be used for each exhaust coil. Furthermore, supply and exhaust coils can be sized differently to handle unequal supply and exhaust airflows. Above in Figures 3-5 the different split passive energy recovery heat pipe orientations are shown. For maximum heat transfer, air streams must be piped in counter flow. Counter flow operation is where two air streams are arranged such that they flow in opposite directions through the heat pipe coils. If necessary, due to design considerations, the air streams may need to flow in the same direction through the heat pipe. In this case counter flow can still be achieved through connecting the liquid and vapor headers in a counter flow fashion. See Figure 6.

Figure 6 - Counter flow piping

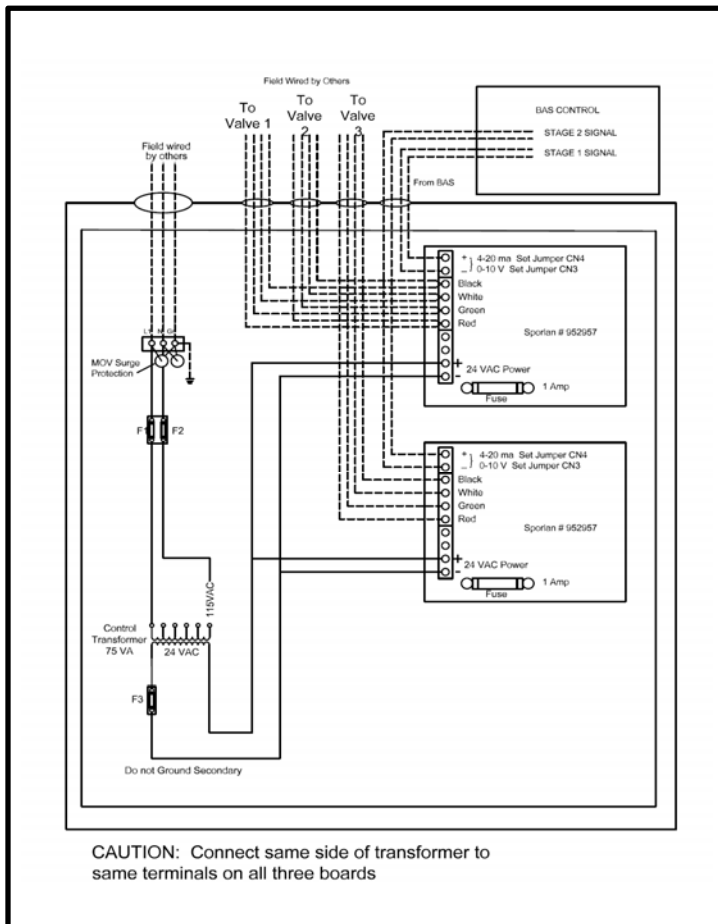
Operation

For an HRM-V system where coils are located on the same level, the system will transfer heat from whichever end is warmest in either direction. For a HRM-V system where the warmer airstream is lower, the system will transfer heat in one direction. Heat transfer is due to the entering air temperature difference and the latent heat of evaporization and condensation capabilities of the working fluid within the system. With a small difference in temperatures from one side to the other, a percentage of that difference is transferred to the other end. As the temperature difference increases, the difference in temperature across each end increases. Operation of heat pipes is automatic by refrigerant circulation and needs no further attention. The coils are fully pressure tested and will give many years of trouble-free operation.

System Control

If it is desired to control the heat pipes off or throttle back the heat transfer, this can be achieved through optional control valves or bypass dampers for the HRM-V system.

Modulating Control Valves - A control system with proportional valves for each circuit is available to control capacity. Advanced stepper modulating valves that manage the internal refrigerant flow and draw no power except when adjusting are available for frost protection and economizer operation. For heat recovery during the heating season, the leaving temperature of the exhaust air stream may be lowered to near freezing or below freezing. Such conditions normally result in the formation of frost on the exhaust side of the heat pipe with partial or complete blockage of the air stream. To remedy this situation, control valves can be installed in the liquid lines of each circuit. With all control valves open, the heat pipe system will operate at full capacity. With all valves closed no heat transfer takes place. The valves are equipped with over multiple steps each to modulate performance anywhere in between fully opened and fully closed positions. Closing valves in freeze protection mode ensures that the leaving temperature of the exhaust air stream is kept warm enough to prevent frost formation. As the leaving air (exhaust) temperature drops below 36°F, the valves should begin to modulate closed. The control valves must be controlled by the Building Automation System. The BAS can monitor the temperatures in and out of the coil and determine when to start modulating the valves. Control valves can also be used for capacity control, when outside air is suitable for direct cooling and will not need to be heated by the heat pipes.



Face and Bypass Dampers – Face and bypass dampers (provided and installed by others) can also be used for capacity, economizer or frost control. Bypassing the air around one end of the coil reduces the amount of air flow through that end of the coil, thereby reducing the heat that will be absorbed and transferred to the opposite side. In frost protection mode opening the bypass damper will reduce the heat transfer to a rate that will not cause frost to form while still transferring as much heat as possible. By monitoring the leaving air temperature from the exhaust heat recovery coil, frost can be prevented. Again, as the leaving air temperature drops below 36°F, the damper should modulate open and be fully open at 35 °F. The damper actuator must be controlled by the Building Automation System in the building. The BAS can monitor the temperatures in and out of the coil and determine when to start opening the bypass. Heat transfer can be variably controlled with this method, thus modulating performance under economizer conditions or completely bypassing supply air to prevent frosting in extreme cold conditions. If space is available, dampers are recommended for economizer operation because bypassing air can provide hours of free conditioning in moderate weather and helps save on air pressure drop. Economizer operation is optional.

Figure 7 – Example of 3 circuit, 3 valve, wiring diagram

Control Strategy by Season

Control of the split passive heat pipe heat recovery system shall be as dictated by needs such as frost control, and to perform energy transfer to fit the requirements of the specifications. The design engineer is responsible for providing the set points for operation. Controls are designed to allow the Building Automation System to interface and control the heat pipe circuits as required

Summer Control

During summer operation, all of the control valves can be opened whenever the outdoor air temperature or mixed air temperature, depending on design, rises above the temperature of the exhaust air stream. Typically, maximum heat pipe pre-cooling will be needed for summer recovery.

Winter Control

There are two common control strategies for winter operation with HRM-V split passive heat pipe systems. A simple approach is to control the stages of the system with outdoor air temperature, having a set point for each circuit. The second approach is to use the leaving air temperature of the air handler. This approach is more complex, but provides more precise control. For outdoor air temperature control, it will be necessary to estimate the outdoor air temperature at which the first call for heating in the building will occur. This temperature is typically around 50°F, but could be higher or lower depending on the construction of the building and the heat load. For example, with a 2 row circuit design using 50 °F as a starting point, and 70°F exhaust, each stage on the heat recovery system will produce about 3-4° F of pre-heat. With a three circuit system, 3 set points will be needed. The first stage would need to come on at 50°F, the second at 47° F, and the third at 44°F. These set points can be adjusted during the first winter of operation to provide better accuracy. Another method of control is to use the leaving air temperature set point. As the temperature reaches and goes below set point, the three stages of heat recovery can be used as the first stages of heat. Again, each stage will add 3-4°F to the leaving air temperature, so a dead band and/or time delay, will have to be entered appropriately for each stage to prevent short cycling.

Frost Control

When outdoor temperatures approach 0°F, enough heat will be transferred from the exhaust coil to the supply coil so that frost formation may occur on the exhaust coil. The point at which this begins depends on the system, location, and the air flow through each coil. To control frost, the downstream temperature on the exhaust coil must be monitored. As the temperature of the exhaust coil approaches freezing the temperature of the air leaving the exhaust coil will follow by about 4°F. Valves should begin to close one circuit at a time. For example, with a three circuit system, at 36° F leaving the exhaust coil, the valve on circuit 1 should begin to modulate closed. If the leaving temperature again reaches 35 °F, the valve on circuit 2 should begin to modulate closed and so on, until all valves are closed.

Scope of Work

Due to the split nature of the HRM-V system, a complete factory installation into an air handling unit is not always practical or feasible. More often the heat pipe coils are installed into air handling units, at HPT or at a manufacturer's facility, and then shipped to the project location where the remaining work is completed on site. Therefore, provisions should be made for field work by Heat Pipe Technology technicians and by a local mechanical contractor. Heat pipe coil installation is usually by the equipment vendor at the manufacturer's facility when systems are installed in air handling units. If practical, the air handling units can ship to HPT for factory coil installation at HPT's facility. Installation in duct work is typically by a local mechanical contractor. Below are guidelines for a standard scope of work involved for an HRM-V split passive heat pipe system installation.

Heat Pipe Technology - HPT will custom manufacture coils according to the design engineer's plans and specifications. Parts included shall be the exhaust and supply heat pipe coils, modulating stepper valves, and control box. Once the system has been installed and the air handlers are operational, a Heat Pipe Technology technician will travel to the project location and perform the following; verification of pressure test, evacuation of circuits, and charging. The HPT technician will inspect the system and installation to ensure there are no problems with the installation. HPT technicians will verify the pressure test that shall be left on the system by the mechanical contractor. Once verified to be leak free, each circuit will be evacuated and charged by the Heat Pipe Technology technicians with an amount of refrigerant to be calculated based on actual pipe lengths measured by Heat Pipe Technology technician. Due to variance from the estimated length the mechanical contractor may be required to supply additional refrigerant over the amount estimated.

Equipment Vendor - The equipment vendor may be required to provide space and/or install the heat pipe coils within their air handling units. The equipment vendor shall be responsible for providing mounting hardware as well as drain pans and drain connections for removing condensate.

Equipment Vendor or Mechanical Contractor - The equipment vendor or mechanical contractor shall be responsible for the installation of the heat pipe coils in the supply and exhaust air streams and/or the placement of air handling equipment containing heat pipe coils in a mechanical room according to the engineer's plan. The equipment vendor or mechanical contractor shall provide and install type L, ACR copper piping, fittings and valves between the coils, insulation for all exposed piping, condensate drains including appropriate traps for both coils, brazing equipment, and nitrogen for purge and pressure test per Heat Pipe Technology's specified pipe sizes and guidelines. The equipment vendor or mechanical contractor shall also provide the refrigerant to charge the system per Heat Pipe Technology's estimate amount plus any extra that may be needed due to changes in estimated piping lengths. Piping between the coils shall be run overhead and properly supported without creating traps as per Heat Pipe Technology drawings and guidelines. Brazing of the joints shall be with suitable silver brazing rod while purging the pipe with nitrogen. When the assembly of the piping is complete, the equipment vendor or mechanical contractor shall provide a pressure test with nitrogen of each circuit to 200 PSI. The pressure shall hold on the system for a period of at least 48 continuous hours before being read again. Pressure readings shall be made at a time of day and recorded to provide the same temperature on the system. After pressure testing, the access valves shall be shut and capped and the system left under pressure until verified by Heat Pipe Technology. The equipment vendor or mechanical contractor shall be responsible for repair of any leaks found by Heat Pipe Technology. The connecting piping shall not be insulated until the leak test is complete and approved by HPT. The equipment vendor or mechanical contractor shall have the refrigerant for charging available during the scheduled field work for use by Heat Pipe Technology.

Drain Pans

A drain pan is required to retrieve moisture from both supply and exhaust sides of the heat pipe coils. Intermediate drain pans are also required when heat pipes are installed in stackable sections. Due to the vertical orientation of the tubes, the fins are horizontal. Condensate does not drain to the bottom of the coil as it does with a conventional coil. The condensate can build on each fin until it is pushed away at the leaving face by airflow. Therefore, condensate management must be taken into account during the initial layout of the system. An extended drain pan that continues at least 3 feet past the leaving face of the coil is suitable for capturing condensate. For some applications where significant condensate is present, the coils may be tilted at an angle from the horizontal plane to help with condensate management.

Filters

To ensure a clean fin surface and optimal performance, suitable filters should be installed. Filter racks should be placed upstream of the supply and exhaust coils even if the exhaust is from clean indoor air. The types of filters should be compatible with the specific environmental conditions for a given application. It is recommended that inspection doors be installed adjacent to the heat pipe on both supply and exhaust sections.

Selection Criteria

The effectiveness of the heat pipe system expressed in a percent is the ratio of the amount of heat transferred to the amount of heat available. This percent effectiveness will remain close to constant, unless there is condensation on the coil, regardless of indoor or outdoor conditions. The predicted effectiveness is calculated for a system based on the above design parameters. Several factors go into the effectiveness calculation and if these factors change the expected effectiveness can change. Construction variables such as difference in coil dimensions between supply and exhaust will affect the calculated effectiveness. Unequal airflows between the supply and the exhaust will also change the effectiveness. If there is more air through the supply end than the exhaust end, which is common with fresh air systems, then the temperature across the supply end, and the related effectiveness, will be lower than that across the exhaust end. More air flow on one side will reduce the effectiveness on that side by the ratio of the air flows. If BTUH for one side: $BTUH = (1.05)(\Delta t)(CFM)$ equals BTUH for the other side and no condensation is taking place, then the measurement variables can be considered accurate.

- Face velocity
- Air pressure drop
- Tube size
- Number of Rows
- Fin Type and Density
- Working Fluid
- Ratio of supply and exhaust airflows

Split Passive HRM-V Energy Recovery Heat Pipes Features

Passive Operation

No energy input is required to operate the heat pipes. When two air streams pass through the heat pipe, with one air stream through one coil and the other air stream through the other coil, the temperature difference between the two air streams activates the heat pipes and causes them to exchange heat. Heat pipe operation utilizes the heat capacity available when the working fluid changes phase, from a liquid to a vapor and back again. Because heat pipes use a phase change fluid, more heat transfer is achievable than with convection flow.

Long Life

There is nothing in the heat pipes to break or fail! They provide passive heat recovery where the only moving parts are the working fluid inside the tubes and the air to be treated. To guard against corrosion, the heat pipes can be ordered with a protective coating.

No Cross Contamination

Split passive energy recovery heat pipes are suitable for all applications, especially those where cross contamination is not acceptable. Airstreams can be located remotely with a horizontal and/or vertical separation to completely isolate hazardous exhaust from fresh intake air. Heat Pipe Technology also offers coatings and special materials of construction to protect coils from contaminated exhaust airstreams.

Minimal Maintenance

Since the heat pipes have no moving parts (except for optional dampers or control valves) no complex maintenance is needed. A periodic cleaning is the only required maintenance. A coil cleaner may be applied for this purpose just as for any cooling coil.

Design Flexibility

Split passive energy recovery heat pipes are custom designed for your particular application. Heat Pipe Technology's manufacturing processes offer variations in materials of construction, fin density, circuiting, working fluids, and configurations. And since split passive heat pipe systems are suitable for remote supply and exhaust airstreams, they provide more design flexibility for applications where large ductwork cannot be positioned side-by-side.

Split Passive HRM-V Energy Recovery Heat Pipes **ENGINEERING SPECIFICATIONS**

Site or Factory Installed Energy Recovery Heat Pipes ***HRM-V Model with Modulating Control Valves***

1.0 GENERAL

Air Handler(s) Packaged Air Conditioning Equipment shall be equipped with Energy Recovery Heat Pipes supplied by Heat Pipe Technology, Inc. to transfer heat from the exhaust air to the incoming supply air. Supply and Exhaust heat pipe sections are separated horizontally a few feet on the same level or separated horizontally and vertically as specified.

1.1 CONSTRUCTION

Coil tubes shall be oriented vertical and the fins run horizontal. Each two rows shall be manifolded together into one liquid line at bottom and one gas line at top and constitute one circuit. Lines shall be sized according to the performance requirements of the circuit. Each heat pipe section shall be installed level and connected to the other section by two horizontal copper lines, for each circuit, one for liquid and one for vapor.

1.2 OPTIONAL MODULATING 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, between the two coils. Each valve will connect to a control printed circuit board in a NEMA box which also houses a 24 VAC transformer. Multiple circuit installations will have the several control boards in one NEMA box. 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 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 signal.

All additional wiring shall be provided and installed by others. With all control valves open, the energy recovery 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. Frost control, if needed, is accomplished by closing or shutting off one or more circuits. Economizer operation is also accomplished by shutting off circuits to achieve desired heat transfer.

- 2.0 The Heat Pipe supplier shall have a minimum of 5 years of experience designing, manufacturing, and installing Heat Pipes specifically for split energy recovery applications. Heat pipes must be manufactured and assembled at the heat pipe supplier's own facility by supplier's own staff.
- 2.1 The tubes shall be copper only, 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.
- 2.2 The fin surface shall be continuous plate type aluminum **or** 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.
- 2.3 The Heat Pipe modules are available with an optional protective coating.
- 2.4 Heat transfer fluid shall be classified as Safety Group A1 in ASHRAE Standard 34-2010.
- 2.5 Heat Pipe capacities, entering and leaving dry and wet bulb temperatures, and face velocity shall be as specified.
- 2.6 The Heat Pipes shall be installed as specified.
- 2.7 Frames and mounting structure shall be minimum 16 gauge galvanized steel **or** stainless steel.
- 2.8 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.
- 2.9 The heat pipe system shall be pressure tested on site under the supervision of the manufacturer's crew. Manufacturer's crew shall vacuum and charge the system. Vacuuming and charging by parties other than the manufacturer's own crew shall not be acceptable.

Split Passive HRM-V Energy Recovery Heat Pipes INSTALLATION LIST

Recent Installations

State	City	Location
Alberta	Edmonton	Edmonton Clinic
	St. Albert	Fountain Park Recreation Centre
Colorado	Colorado Springs	Valor Gym
	Denver	Data Center
Florida	Orlando	VA Hospital
	Gainesville	UF Pathogen
Idaho	Idaho Falls	Idaho National Laboratory
Illinois	Waukegan	Lake City Permit
	University Park	Governors State University
Indiana	South Bend	Notre Dame Innovation Park
Maryland	Germantown	Montgomery College
	Fairfax	Fairfax City Hall
	Towson	Towson University
Massachusetts	Chatham	Chatham WWTP
Minnesota	Hinckley	Hinckley Elementary School
Nebraska	Lincoln	McPhee Elementary School
	Lincoln	Whittier Building
New York	New York City	PS 276
North Carolina	Kings Mountain	Infocrossing Data Center
	Chapel Hill	University of North Carolina Locker Room
	Greenville	Vector Mau
North Dakota	Grand Forks	University of North Dakota Dorms
Ohio	Columbus	Franklin County Courthouse
Ontario	Scarborough	St. Sylvester School
Pennsylvania	Mansfield	Mansfield University
Tennessee	Franklin	Franklin Police Department
Texas	Houston	Lone Star College
Virginia	Charlottesville	University of Virginia IRDF
Washington	Lynnwood	Edmonds Community College
	Seattle	Madrona Pathfinder Elementary School
	Seattle	James Monroe Elementary School
	Seattle	Hawthorne Elementary School
Wisconsin	Wausau	Wausau School District
Wyoming	Laramie	University of Wyoming Berry Center

Split Passive HRM-V Energy Recovery Heat Pipes Data Gathering Worksheet

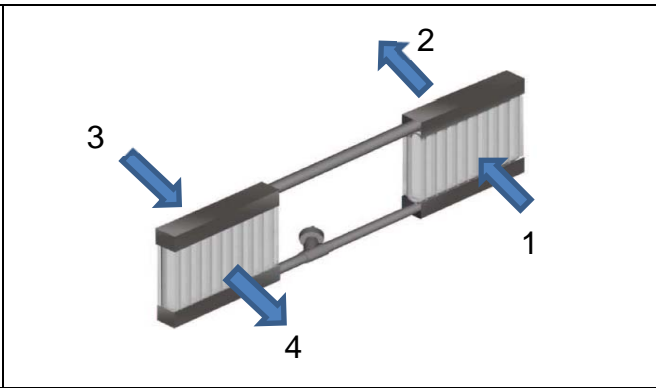
Company: _____

Phone: _____ Fax: _____

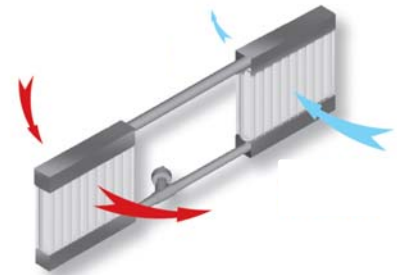
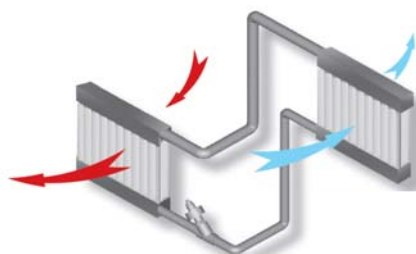
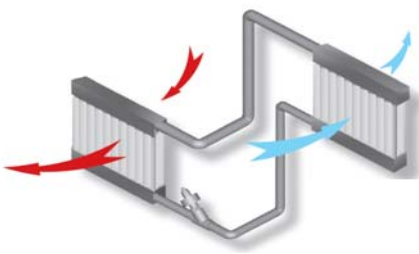
Job Name: _____

Model #: _____ Serial #: _____

Test performed by: _____ Date: _____



Heat Pipe Orientation



Exhaust below supply (winter only) Supply below exhaust (summer only) Winter and summer recovery

Test Data		Summer / Cooling				Winter / Heating			
		Temperature* (F °DB)	Temperature* (F° WB)*	APD* (in of H ₂ O)	Airflow* (CFM)	Temperature* (F° DB)	Temperature* (F° WB)	APD* (in of H ₂ O)	Airflow* (CFM)
Air Side	Entering @ 1								
	Leaving @ 2								
	Entering @ 3								
	Leaving @ 4								
Description	Number of Rows								
	Supply Dimensions								
	Exhaust Dimensions	_____ in. Face Height _____ in. Face Length							
Misc.	Describe Frost Control Scheme:								
	Air filters clean? <input type="checkbox"/> Yes <input type="checkbox"/> No Condensate drain pan installed? <input type="checkbox"/> Yes <input type="checkbox"/> No								

* Multiple readings up and down & side to side should be taken and then averaged out.

Split Passive HRM-V Energy Recovery Heat Pipes (Heat Exchangers Only) 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 from the date of installation but not to exceed 90 days from date of shipment for the heat exchangers only and 12 months for HPT supplied control valves and control box. 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 owners 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.

Split Passive HRM-V Energy Recovery Heat Pipes (Coils Only) 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: <input type="checkbox"/> Homeowner <input type="checkbox"/> 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:	