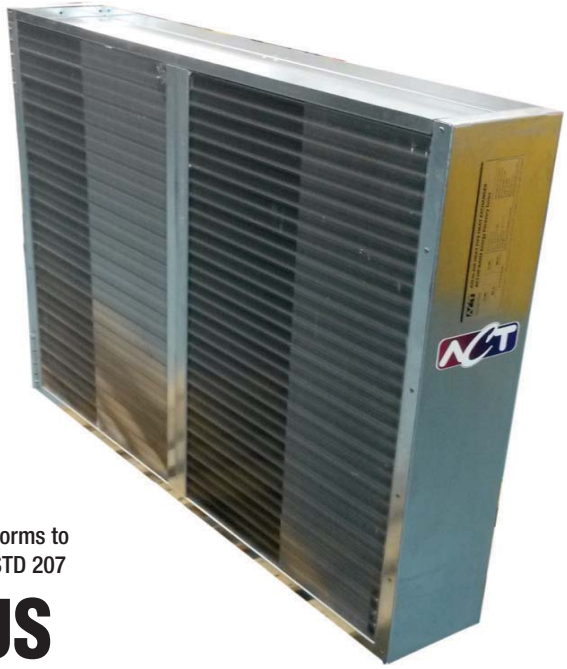
ADVANCED COOLING TECHNOLOGIES

The Thermal Management Experts | www.1-ACT.com

WAHX
(WRAP-AROUND)

Conforms to UL STD 207

SA44069



AAHX
(AIR-TO-AIR)

ENERGY RECOVERY HEAT PIPE HEAT EXCHANGERS

HVAC PRODUCT GUIDE

THERMAL MANAGEMENT EXPERTS

ADVANCED COOLING TECHNOLOGIES, INC. IS A PREMIER THERMAL MANAGEMENT SOLUTIONS COMPANY.

We serve our customers' thermal management and energy recovery needs in diverse Markets including Defense, Aerospace, Electronics, HVAC, Medical Devices, Enclosure Cooling and Calibration Equipment. We specialize in providing performance and cost optimized thermal management technologies and solutions that meet the unique needs of each customer.

Our diverse product portfolio maximizes our ability to meet our customers' performance, cost and reliability requirements. ACT is the only U.S.-based Heat Pipe manufacturer that routinely ships Heat Pipe products for terrestrial, spacecraft, and high temperature applications.

Our HVAC Wrap-Around and Air-to-Air Heat Exchanger products are in operation throughout the world, improving energy efficiencies of building HVAC systems and industrial processes.

ACT is strongly committed to our customers, employees, and community. Innovation, Teamwork and Customer Care are the core values that drive the continuous growth of our company.

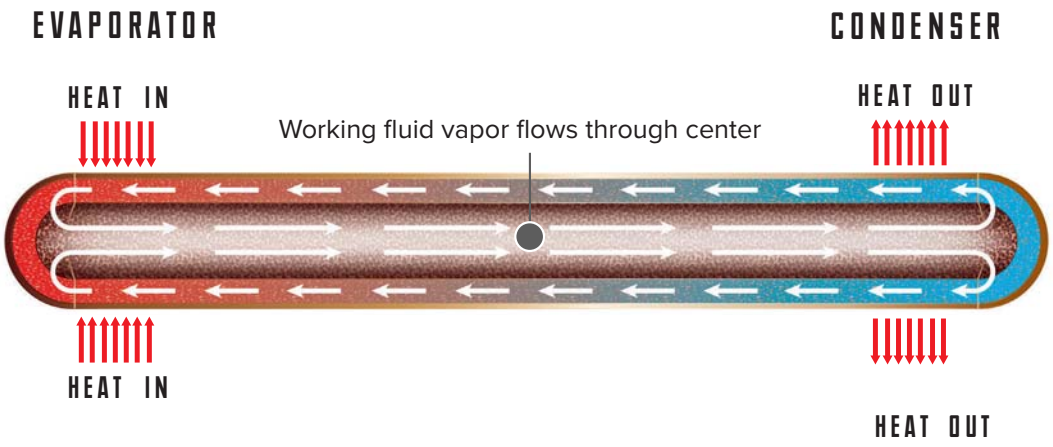
TABLE OF CONTENTS

HVAC HEAT PIPE OPERATION

HVAC HEAT PIPE OPERATING PRINCIPLE

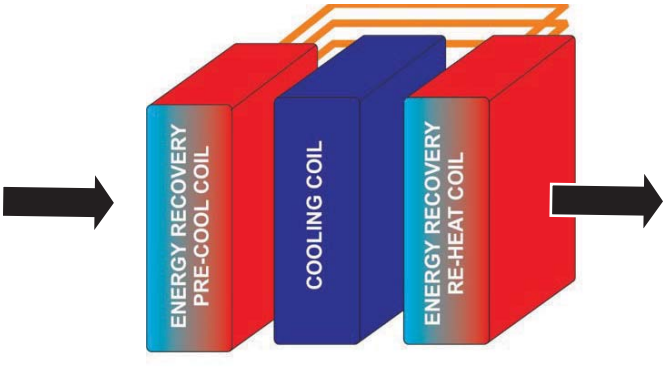
Heat pipes function by absorbing heat at the evaporator end of the cylinder, boiling and converting the fluid to vapor. The vapor travels to the condenser end, rejects the heat, and condenses to liquid. The condensed liquid flows back to the evaporator, aided by gravity.

The phase change cycle continues as long as there is heat (warm outside air) at the evaporator end of the heat pipe. This process occurs passively (no external electrical energy required).

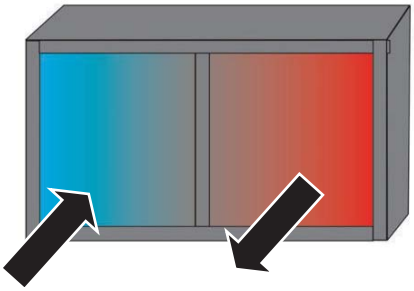


ACT HVAC ENERGY RECOVERY SYSTEMS

ACT ENERGY RECOVERY TYPES



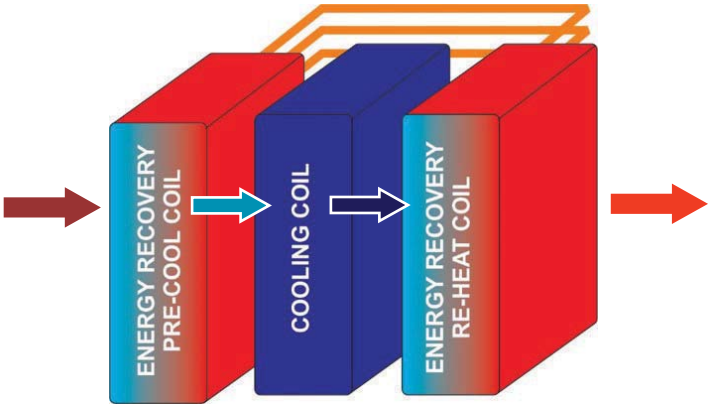
WRAP-AROUND HEAT PIPE EXCHANGERS (WAHX)

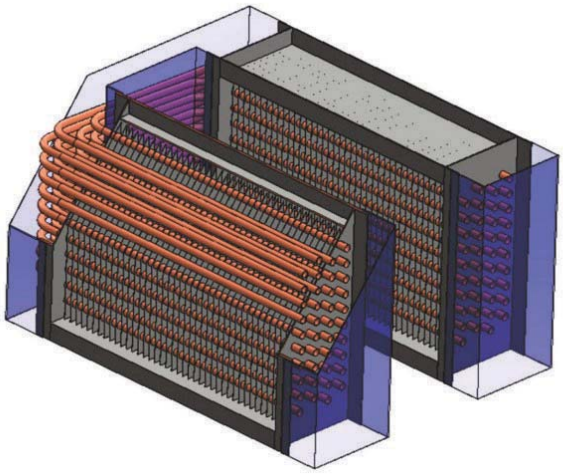


PASSIVE AIR-TO-AIR HEAT PIPE EXCHANGER (AAHX)

WRAP-AROUND HEAT PIPE (WAHX)

HOW DOES A WRAP-AROUND HEAT PIPE HEAT EXCHANGER WORK?





OUTSIDE AIR	DELTA T°	HEAT PIPE PRE-COOL		COOLING COIL	DELTA T°	HEAT PIPE RE-HEAT
102°/77.8°	15.6°	86.4°/73.7°		52.5°/52.4°	15.5°	68.0°/58.6°
92°/77.7°	15.2°	76.8°/69.4°		52.5°/52.4°	15.1°	67.6°/58.5°
82°/68.8°	11.3°	70.7°/65.2°		52.5°/52.4°	11.3°	63.8°/57.0°
72°/63.7°	7.5°	64.5°/61.0°		52.5°/52.4°	7.5°	60.0°/55.5°
62°/56.4°	3.6°	58.4°/55.0°		52.5°/52.4°	3.6°	56.1°/54.0°
52°/52.4°	0.0°	52.5°/52.4°		52.5°/52.4°	0.0°	52.5°/52.4°

AHU: 20,000 CFM
4 Rows of Heat Pipes
12 Fins per inch

WAHX CONFIGURATIONS

PIPE TO PIPE CONNECTION EVERY ROW EVERY PIPE

- Any Coil Dimensions
- Stackable
- Controllable

SPLIT LOOP THERMOSYPHON 2 PIPES PER ROW

- Any Length Coil
- Max 37” Fin Height
- Stackable
- Controllable

WRAP-AROUND HEAT PIPE (WAHX)

BENEFITS

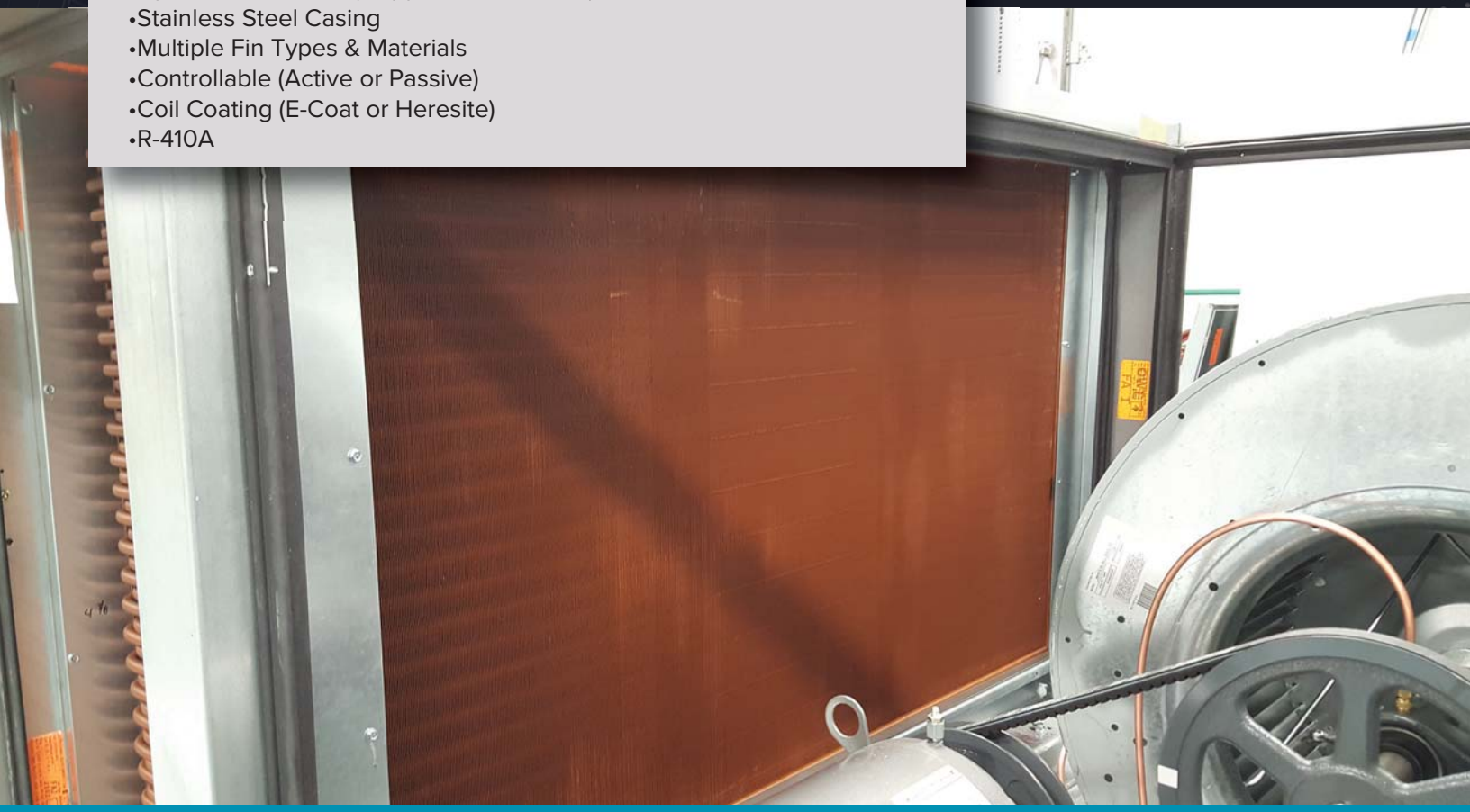
- Energy Savings
  - Free pre-cooling (lower tonnage AHU systems)
  - Free re-heat (no electric, steam or hot water cost)
- Passive System
  - No maintenance
  - No moving parts (except for control valves when applied)
- Enhanced Dehumidification
  - Lower entering air conditions (ex: 95° to 85°)
  - Lower cooling coil discharge temperature
- Neutral Air Discharge (free re-heat)
- Meets Energy Code Requirements for Chilled Water DOAS AHUs
- Lower Static vs. Other Energy Recovery Types

FEATURES

- 1/2” Rifled Copper Tubes for Enhanced Thermal Performance
- Aluminum Fins (8-14 Fpi)
- Galvanized Steel Casing
- Factory Installation, Field Installation or AHU Manufacturer Installation
- R-134a
- Up to 10 Rows

OPTIONS

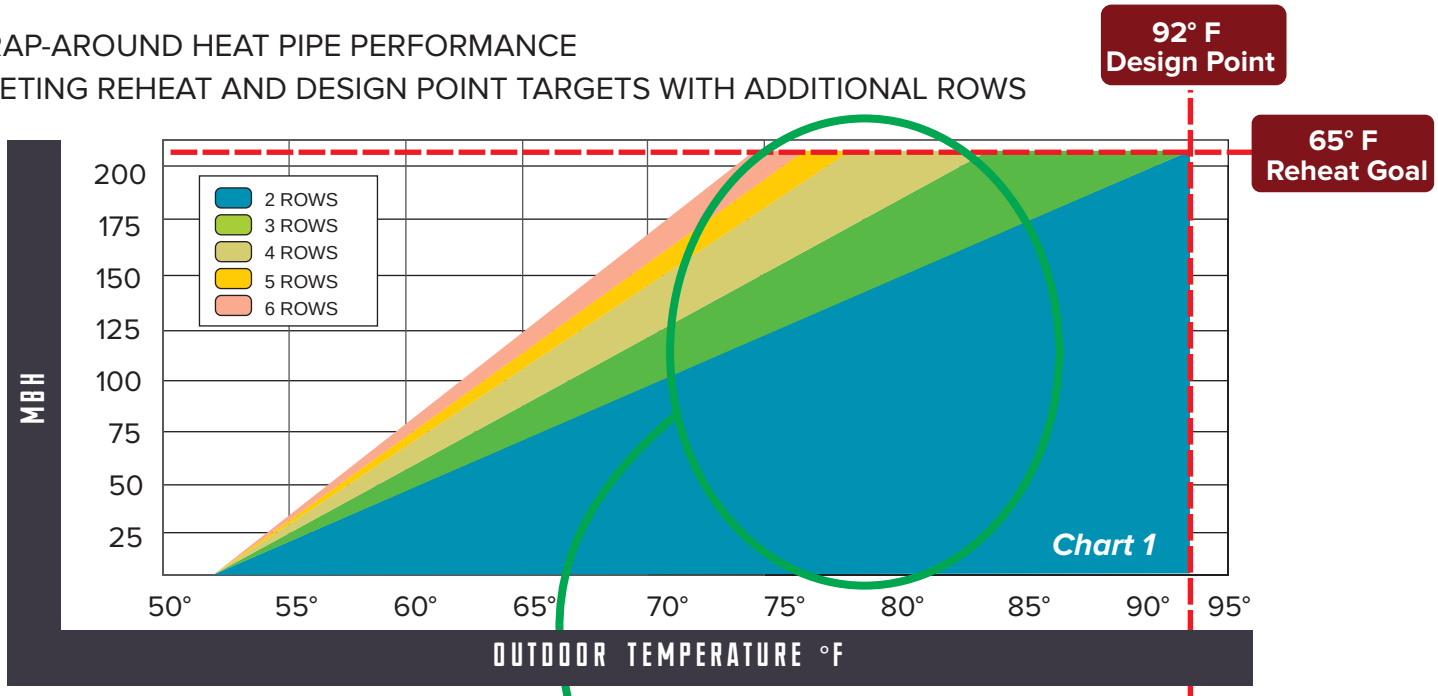
- Up to 1” Coil Tubes (Copper or Aluminum)
- Stainless Steel Casing
- Multiple Fin Types & Materials
- Controllable (Active or Passive)
- Coil Coating (E-Coat or Heresite)
- R-410A



WAHX HEAT PIPE WITH CONTROL

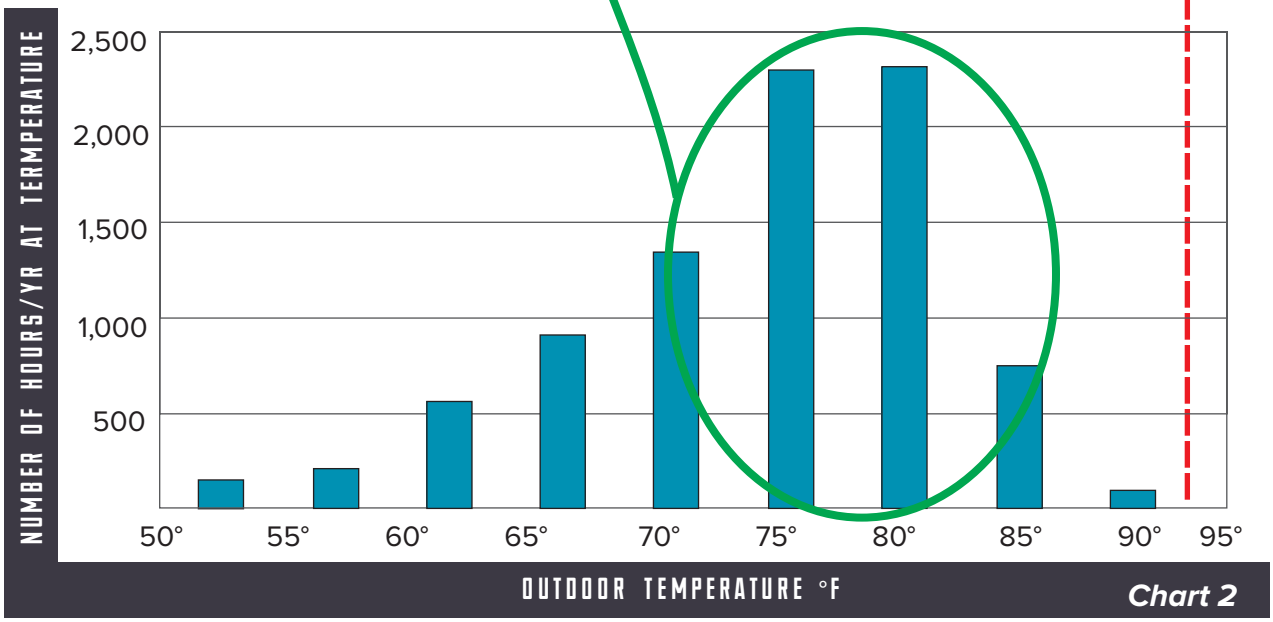
AVOID OVER-COOLING THE SPACE WHILE MAXIMIZING SAVINGS

WRAP-AROUND HEAT PIPE PERFORMANCE
MEETING REHEAT AND DESIGN POINT TARGETS WITH ADDITIONAL ROWS



FORT LAUDERDALE, FLORIDA
ANNUAL BIN TEMPERATURE DATA

For this example the largest band of energy savings occurs within the circle.



TECHNICAL PARAMETERS UTILIZED:

Annual Data *- Running Hours 24 Hrs/Day 7 Days/Week (Note: Temperatures below 57.5° F are not calculated).*

System Assumptions: 17,500 CFM system, operating in Fort Lauderdale Florida, Cooling Coil at 55° FDB/54.9°FWB.

WAHX HEAT PIPE WITH CONTROL

CONSIDER ACT'S CONTROL VALVES FOR OPTIMIZED WRAP-AROUND HEAT PIPE ENERGY PERFORMANCE

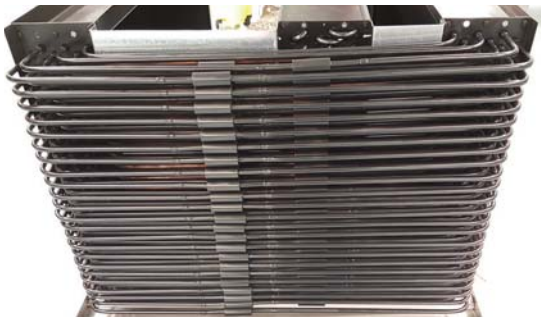
In order to capture and transfer even more energy, ACT's control valve options increase the ability of the WAHX to have a wider range of energy savings operation at lower entering air temperatures. ACT control valve options permit additional heat pipe rows, resulting in higher capacity WAHX systems with the capability of stopping refrigerant flow in selected rows to maintain a specified discharge temperature. WAHX control maximizes energy savings as the outside air temperature fluctuates.

SPLIT LOOP THERMOSYPHON WITH 100% REHEAT CONTROL WRAP-AROUND (ACT-SLT)

One valve per row, on/off or modulating, controlled by the Building Management System (BMS) based on the discharge air temperature.

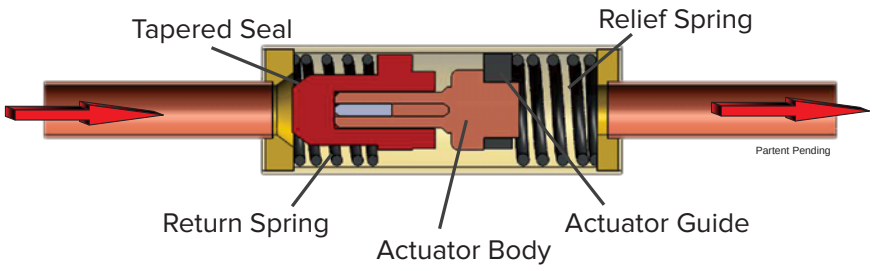
ACTIVE THERMAL CONTROL VALVE ACT-TAV

TAV controlled by ACT panel and stages can be controlled by BMS.



PASSIVE THERMAL CONTROL VALVE (ACT-TPV)

ACT-TPV is available in 5° temperature increments. No control signal is required (passive operation).

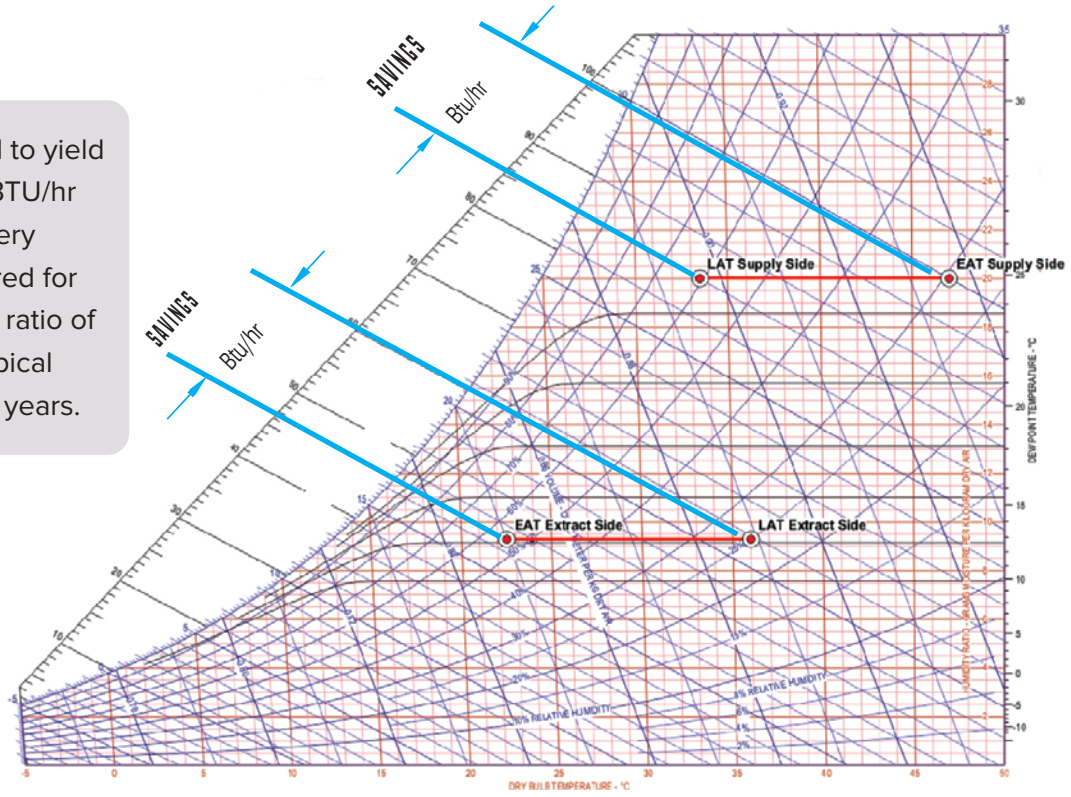


AIR-TO-AIR HEAT PIPE HEAT EXCHANGERS (AAHX)

HOW DOES AN AAHX WORK?

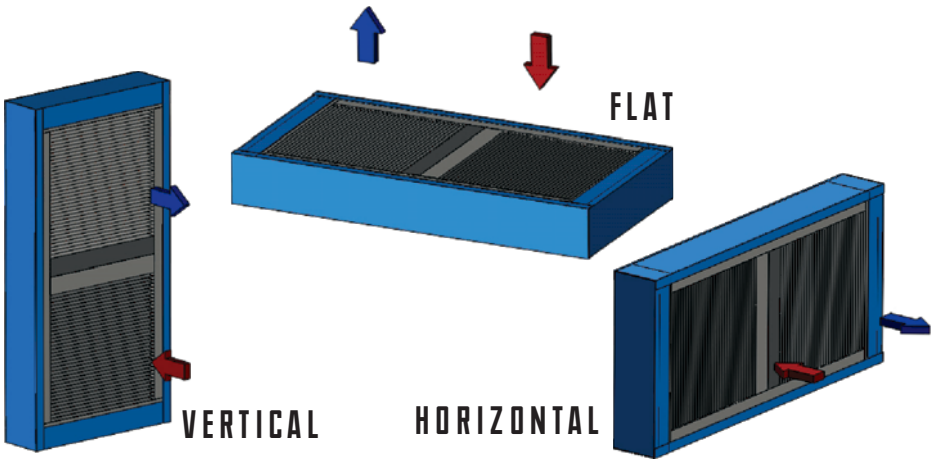
Captures space exhaust air energy and transfers via passive heat pipe to pre-cool or pre-heat incoming outside air.

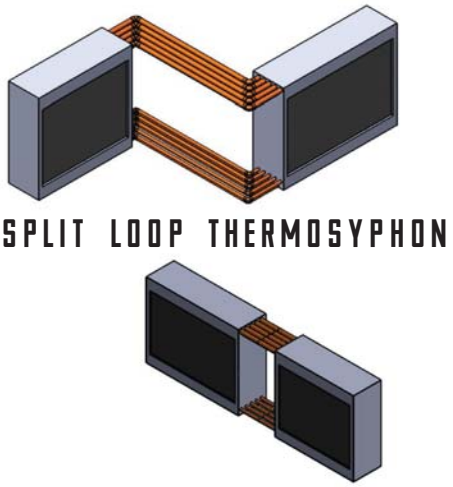
Every ACT AAHX is designed to yield the optimal effectiveness in BTU/hr savings. ACT's energy recovery systems are custom engineered for each project to yield the best ratio of cost versus performance. Typical system payback is under two years.



AIR-TO-AIR HEAT PIPE HEAT EXCHANGER INSTALLATION OPTIONS

The ACT Heat Pipe Heat Exchanger can be oriented to match the AHU or duct work.





AIR-TO-AIR HEAT PIPE HEAT EXCHANGERS (AAHX)

BENEFITS

- Energy Savings
  - Pre-cool and pre-heat with up to 75% effectiveness
  - During summer operation with 75° exhaust air, the AAHX can pre-cool entering 95° outside air down to 80°, saving on cooling load capacity
  - During winter operation with 70° exhaust air, the AAHX can pre-heat entering 0° outside air up to 52°, saving on heating load capacity
- Passive System
  - No maintenance
  - No moving parts
- Configuration
  - Any height or length (not round)
  - Splittable
  - Exhaust and supply can be different lengths and CFMs
  - From 2” to 15” in depth, requiring minimal AHU space
  - No cross air contamination

FEATURES

- 1/2” Rifled Copper Tubes for Enhanced Thermal Performance
- Aluminum Fins (8-14 Fpi)
- Galvanized Steal Casing
- Factory Installation, Field Installation or AHU Manufacturer Installation
- R-134a
- Up to 10 Rows

OPTIONS

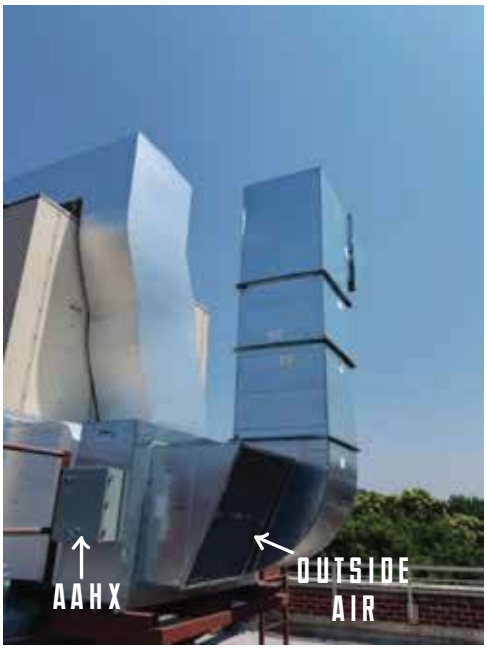
- Up to 1” Coil Tubes (Copper or Aluminum)
- Stainless Steal Casing
- Multiple Fin Types & Materials
- Controllable
- Coil Coating (E-Coat or Heresite)
- Tilt Option
- Pump Systems
- R-410A

TILT AIR-TO-AIR HEAT PIPE HEAT EXCHANGERS

CONTROL HEAT PIPE AAHX FUNCTION BY TILTING

Tilting the HP-AAHX will transfer operation from summer to winter by assuring the warm air stream is lower than the cold air stream.

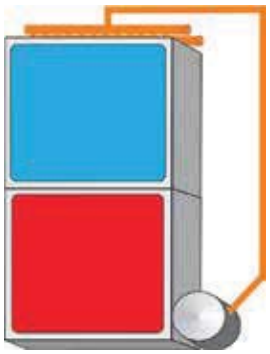
Features included: Steel housing, integrated flex duct, dual contacts, heavy duty actuator, and simple AHU installation.



PUMPED AIR-TO-AIR HEAT PIPE HEAT EXCHANGERS

ENERGY RECOVERY - PUMPED SYSTEM

- Summer/Winter Energy Recovery (pumps operate for one or both seasons)
- System can be split between ducts up to 30'+
- Low Pressure Drop
- Sizes up to 25,000 CFM+
- Positive Recovery Efficiency Ratio (RER)
- Low RPM pump configuration for long life



ONLINE SELECTION TOOLS

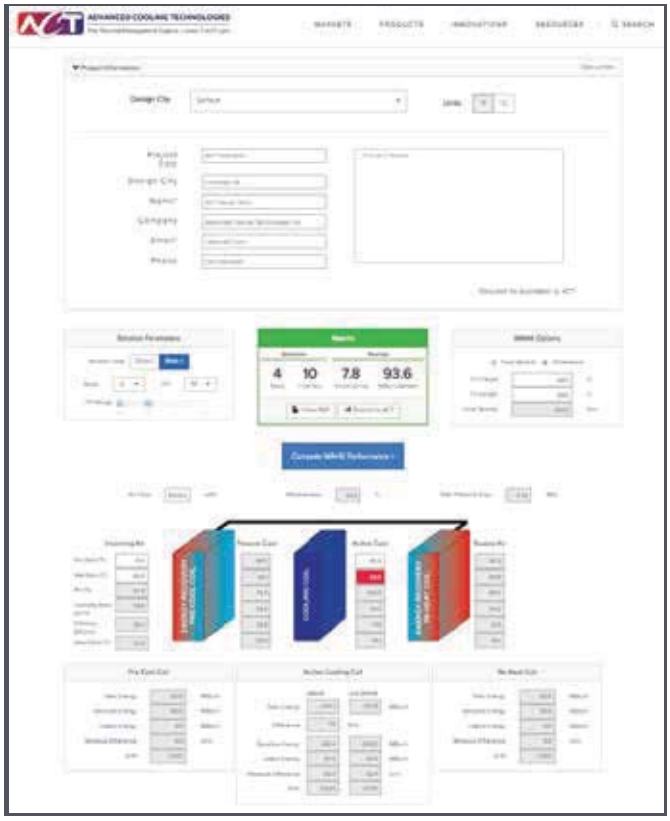
The WAHX and AAHX Selection Tools are intended to provide the designer with the capability to perform a preliminary design selection and to evaluate performance at various design conditions. It is also intended to be a tool to communicate engineering requirements and design targets to ACT for additional calculations and/or for preparing a quotation.

The WAHX Selection Tool can be set to English or Metric units. Multiple input variables can be selected from CFM's to DB/WB combinations for incoming Air, Active Coil and Supply Air to mention a few.

There are two useful output options for each Selection Tool. One is "Print to PDF", which will capture the on screen data in a savable format. The other is a "Submit to ACT" which will capture the screen data, including the product information that the user enters, and sends it to an ACT engineer for further assistance or quotation.

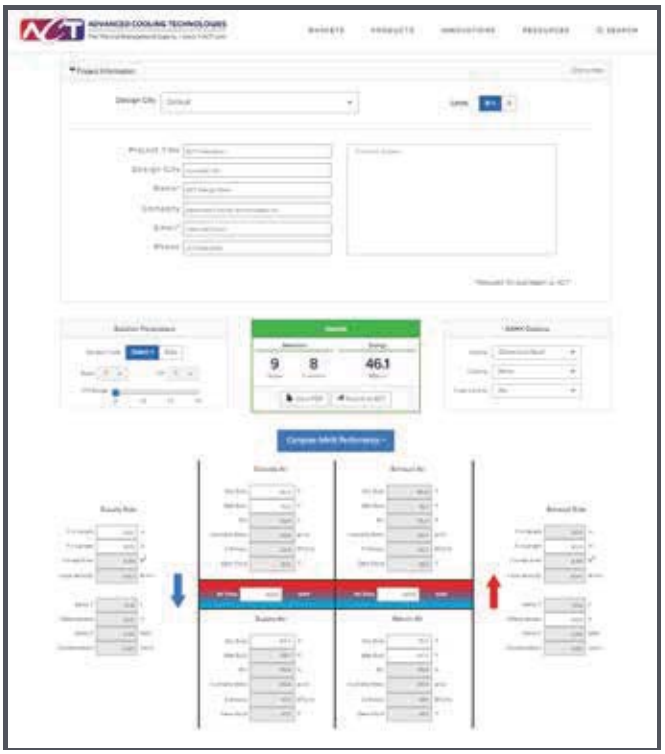
WAHX SELECTION TOOL

www.1-ACT.com/HVAC/WAHX

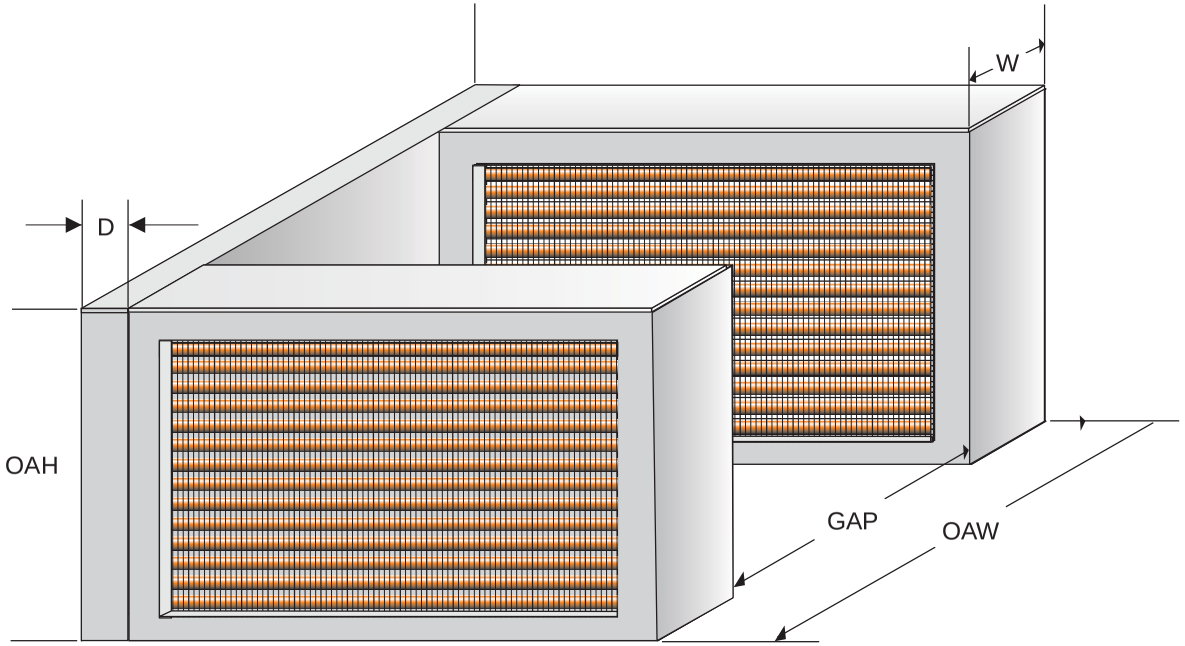


AAHX SELECTION TOOL

www.1-ACT.com/HVAC/AAHX



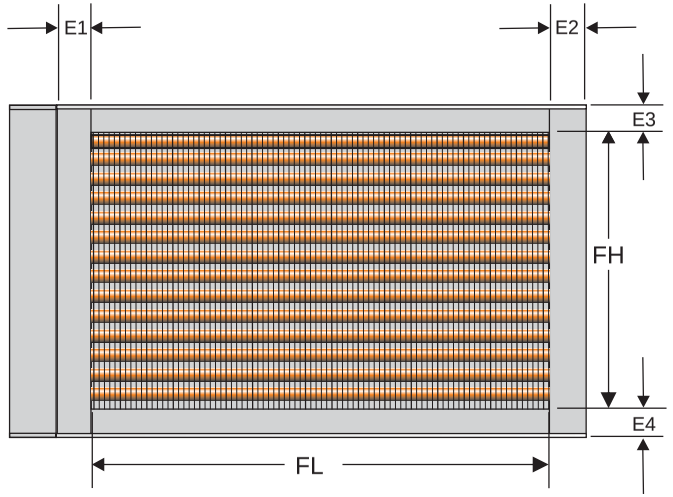
ACT WRAP-AROUND HEAT PIPE HEAT EXCHANGER DIMENSIONS



Note: Drawings are not to scale

Front View Dimension Table	
OAH: Total Height	Optional
OAL: Total Length	Optional
OAW: Total Coil Spacing	Optional
GAP	Optional
FH: Fin Height	Fin Height “MUST” be in multiples of 1.25”
FL: Fin Length	Optional
E1 - E2: Side Flange	Minimum of 1.5” or as specified
E3 - E4: Top - Bottom Flange	Minimum of 1.0” or as specified
D: Return Tube Depth	See table for minimum or as specified
W: Coil Width	See table for minimum or as specified

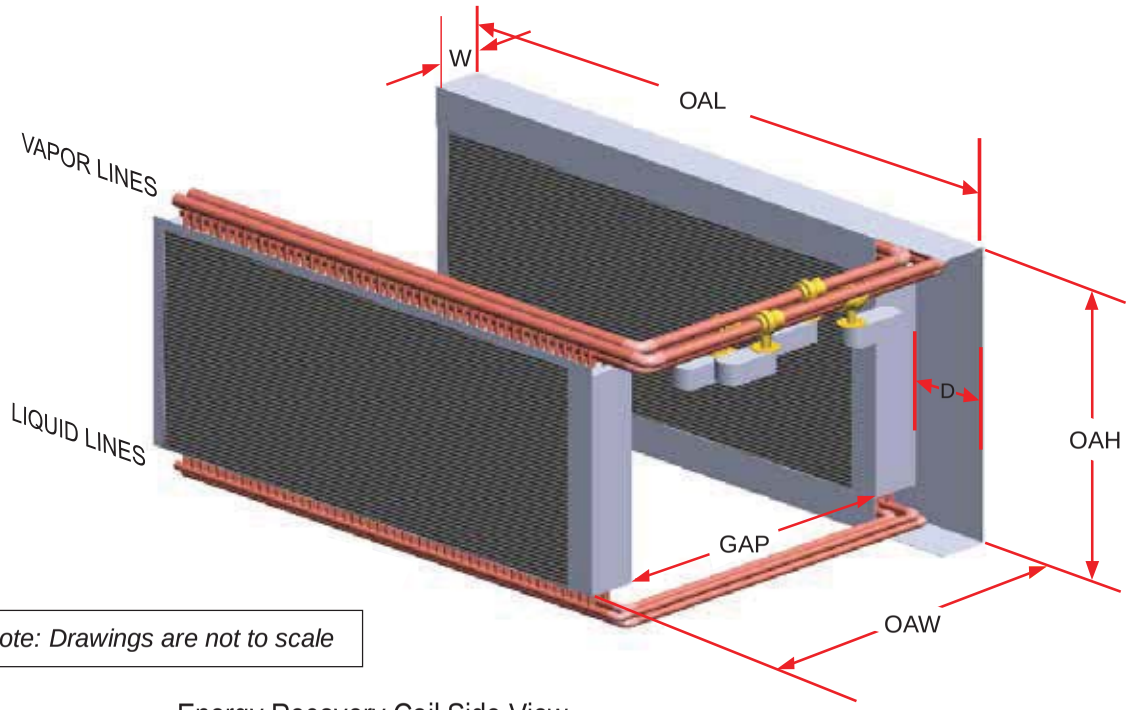
Energy Recovery Coil Side View



(D) Return Tube Depth Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
D	2.0”	2.0”	2.75”	2.75”	3.5”	3.5”	4.25”	4.25”	5.0”	5.0”

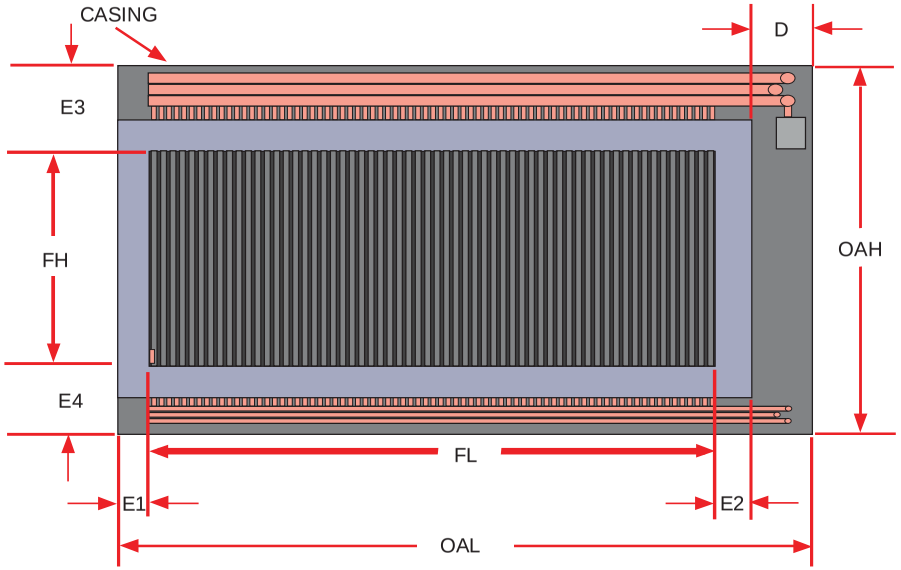
(W) Coil Width Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
W	1.5”	3.0”	4.0”	5.0”	6.0”	7.0”	8.0”	9.25”	10.5”	11.5”

ACT SPLIT LOOP THERMOSYPHON WRAP-AROUND HEAT PIPE HEAT EXCHANGER DIMENSIONS



Note: Drawings are not to scale

Energy Recovery Coil Side View



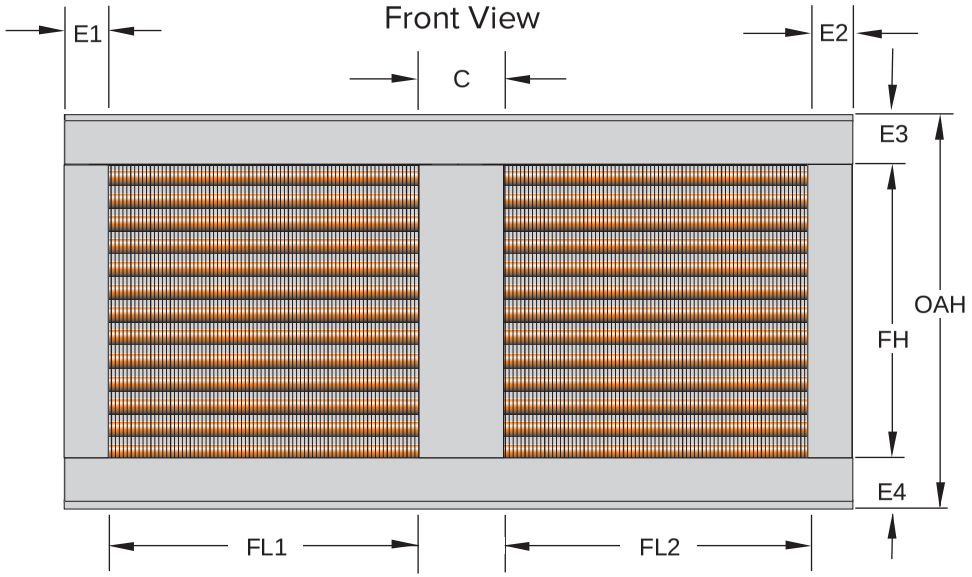
Front View Dimension Table	
OAH: Total Height	FH + 8.50”
OAL: Total Length	Optional
OAW: Total Coil Spacing	Optional
GAP	Optional
FH: Fin Height,*Max. 36.0”	Optional
FL: Fin Length	“MUST”be in multiples of 1.25”
E1 - E2: Side Flange	Minimum of 1.00” or as specified
E3 - Bottom Flange	Minimum of 4.50” or as specified
E4: Bottom Flange	Minimum of 4.00”
W: Coil Width	See table for minimum or as specified
D: Return Tube Depth	See table for minimum or as specified

** Note: Fin Height over 36.0” must be stacked*

(D) Return Tube Depth Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
No Control - D	2.0”	4.0”	5.0”	7.0”	8.0”	9.0”	10.0”	11.0”	12.0”	14.0”
With Control - D	4.0”	5.50”	6.75”	9.0”	11.25”	13.5”	15.75”	18.0”	20.25”	22.5”

(W) Coil Width Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
W	2.0”	3.5”	4.5”	6.0”	7.0”	8.0”	9.0”	10.0”	11.0”	12.0”

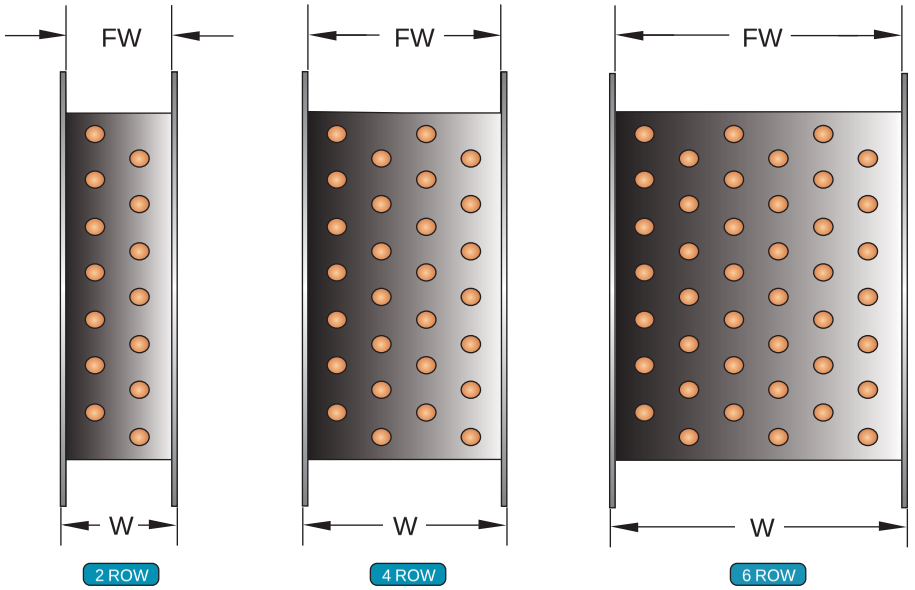
ACT AIR-TO-AIR HEAT PIPE HEAT EXCHANGER DIMENSIONS



Front View Dimension Table	
Fin Height "MUST" be in multiples of 1.25"	FH: Fin Height
Optional	FL1: Fin Length
Optional	FL2: Fin Length
Ttypically 2.0" or as specified	C: Center Divider Width
Minimum of 1.5" or as specified	E1 - E2: Side Flange
Minimum of 1.0" or as specified	E3 - E4: Top - Bottom Flange

Note: Drawings are not to scale

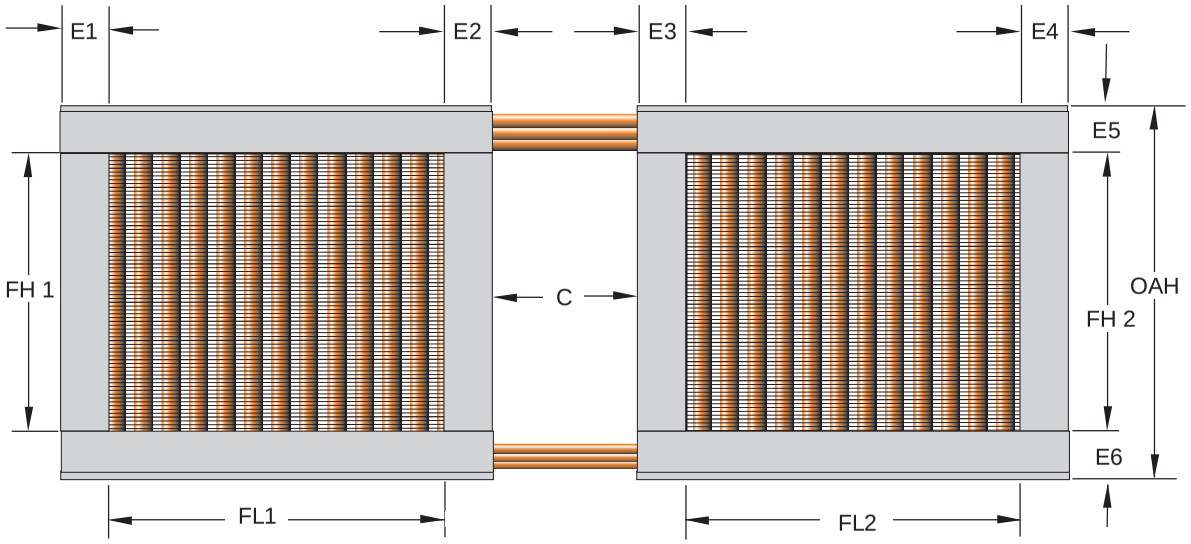
Side View 2 - 4 - 6 Row Heat Pipe Heat Exchangers



Side View Dimension Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
W	1.5"	3.0"	4.0"	5.0"	6.0"	7.0"	8.0"	9.25"	10.5"	11.5"
FW	1.08"	2.17"	3.25"	4.33"	5.42"	6.49"	7.58"	8.66"	9.75"	10.83"

ACT SPLIT LOOP THERMOSYPHON AIR-TO-AIR HEAT PIPE HEAT EXCHANGER DIMENSIONS

Front View

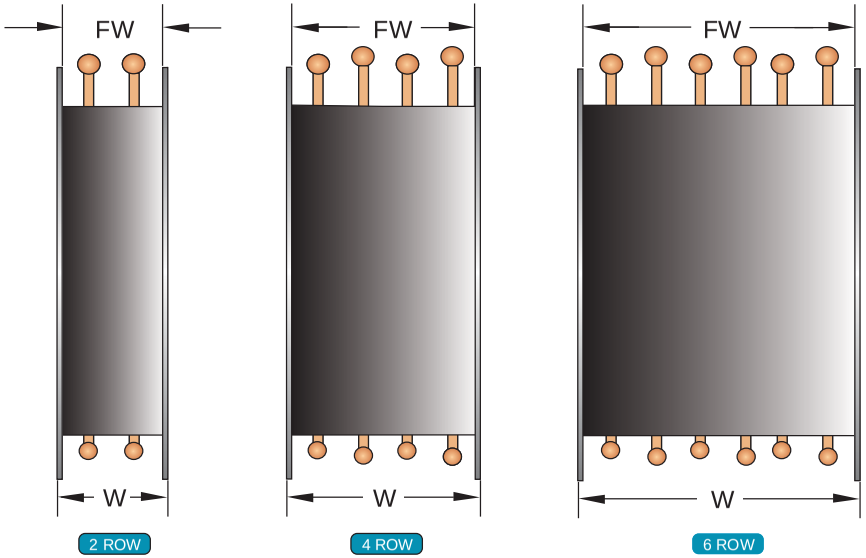


Front View Dimension Table	
Fin Height Optional	FH 1 & 2: Fin Height Maximum Must Stack AAHX over 37.5”
Fin Length Optional be in multiples of 1.25”	FL1: Fin Length
Fin Length Optional be in multiples of 1.25”	FL2: Fin Length
Typically >4.00” or as specified	C: Center Divider Width
Minimum of 1.00” or as specified	E1, E2, E3, E4: Side Flanges
Minimum of 4.50” or as specified	E5 - Top Flange
Minimum of 4.00” or as specified	E6 - Bottom Flange

** Note: AAHX-Split Loop Thermosyphon Systems can not exceed 36.0” in fin height. Units can be stacked*

Note: Drawings are not to scale

Side View Examples of 2 - 4 - 6 Row Heat Pipe Heat Exchangers



Side View Dimension Table by Number of Rows										
Rows	1	2	3	4	5	6	7	8	9	10
W	2.00”	3.50”	4.50”	6.00”	7.00”	8.00”	9.00”	10.0”	11.0”	12.0”
FW	1.08”	2.17”	3.25”	4.33”	5.42”	6.49”	7.58”	8.66”	9.75”	10.83”

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