Hi-Velocity Systems™

Small Duct High Velocity Heating, Cooling and Home Comfort Systems

RBM Refrigerant Base Module

Installation Manual

RBM-50 (1.5-2 Tons)
RBM-70 (2.5-3 Tons)
RBM-100 (3.5-5 Tons)

Includes:
Pre-Piped TXV
Freeze-Stat
Drain Pan
Service/Access Port(s)
T-Mounting Brackets
Mounting Tape
Hole Plugs (2)

Manufactured By
Energy Saving PRODUCTS LTD

Refrigerant Base Modules (RBM)

The RBM Series cooling coil comes as a module and can be installed in the vertical or horizontal position on the return air side of the air handler. The RBM comes with T-mounting brackets, thermal expansion valve, access port(s), and an external freeze stat*. This module comes heat pump ready and has most components pre-piped. Only the access port(s) and freeze stat will need to be field installed. Fig. 01 shows an installed coil assembly and how each piece is connected.

RBM modules can be used on any R-410A condenser if R-410A refrigerant components are used. All Energy Saving Products R-Series modules come standard with R-410A refrigerant components.

***IMPORTANT: The Freeze Stat (anti-ice control) serves the purpose of preventing severe icing of the coil in the event of an undercharge or low load on the coil. This piece of equipment must be used at all times. Failure to properly install the freeze stat will result in RBM related warranty issues being voided.**

NOTE: Do not remove protective bubble wrap from Freeze Stat

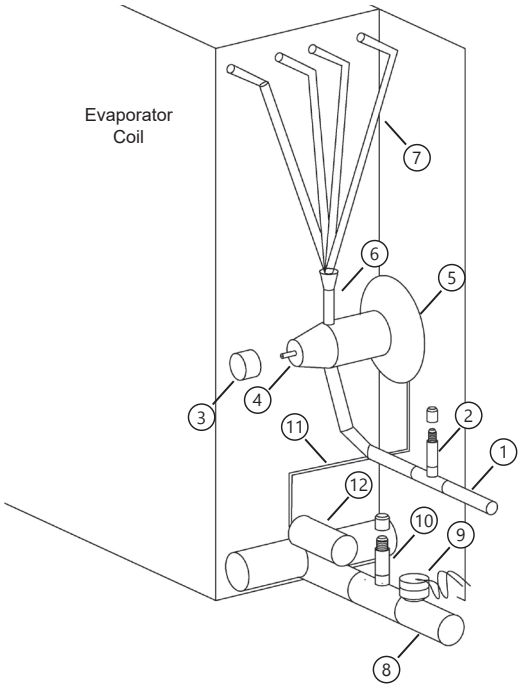


Fig. 01 - Coil Assembly

1) Liquid line	7) Distributor tubes
2) High side access port (if applicable)	8) Suction line
3) Adjustment stem cap	9) Freeze Stat (Anti-ice control)
4) Superheat adjustment stem	10) Low side access port
5) Thermal expansion valve (TX)	11) TX capillary tube
6) Refrigerant distributor	12) TX sensing bulb

Coil Configuration

The RBM module can be installed as a stand (return air base) for the air handler or as a side mounted coil. When the desired air inlet side has been determined, the module can be adapted. The module comes ready as left to up/right orientation (Fig. 02) but can easily be changed to a right to up/left orientation. (Fig. 03) See page 4 for steps to adapt the coil to up/left.

The RBM Module can be installed in four different configurations:

A - Entering air in through the left, leaving through the top.

B - Entering air in through the left, leaving through the right.

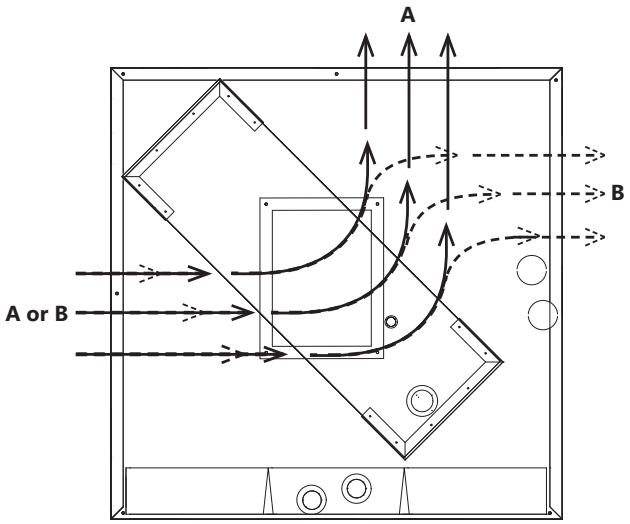


Fig. 02 - Up/Right Orientation

OR (WITH ADAPTATION)

C - Entering air in through the right, leaving through the top.

D - Entering air in through the right, leaving through the left.

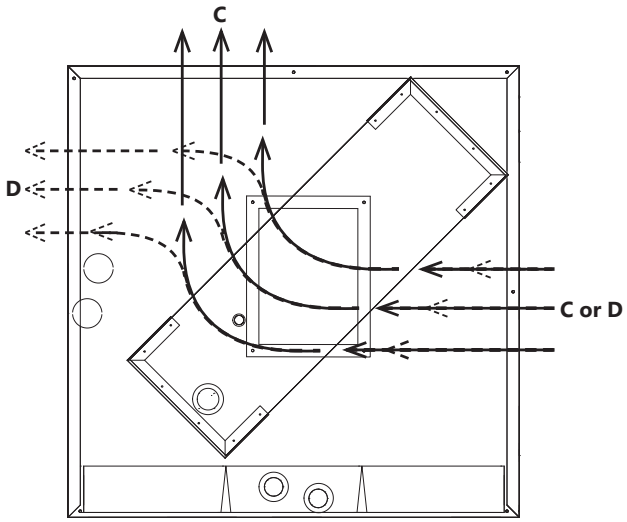


Fig. 03 - Up/Left Orientation

RBM Change Configuration

To change from up/right (standard) configuration to up/left configuration, follow the steps below.

1) Remove front door from module. (Fig. 04)

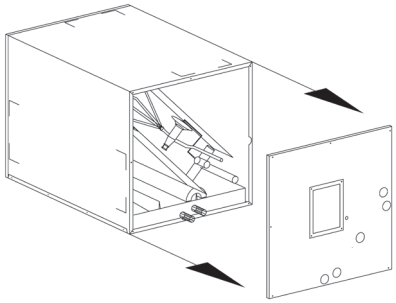


Fig. 04

2) Remove drain pan by sliding it out from the bottom of the coil casing, ensuring that the foam air dam is also removed. (Figs. 05a, 05b)

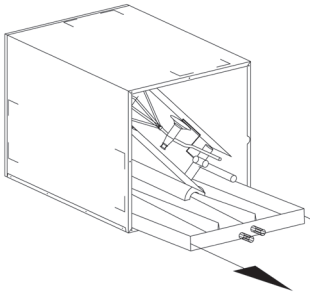


Fig. 05a

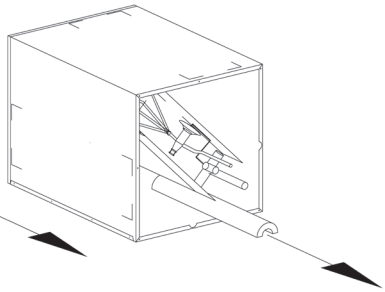


Fig. 05b

3) Rotate entire unit 90 deg. clockwise. (Fig. 06)

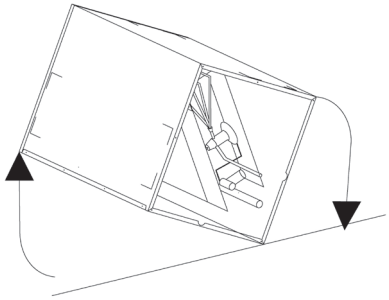


Fig. 06

4) Position the blue horse hair filter in front of the drain line inlets, to filter condensate and prevent any air from bypassing under the coil through the gap in the drain pan's air dam. (Figs. 07a, 07b)

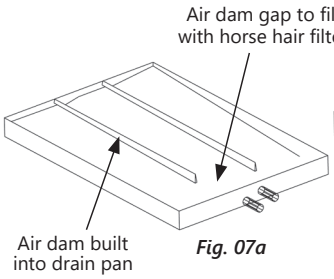


Fig. 07a

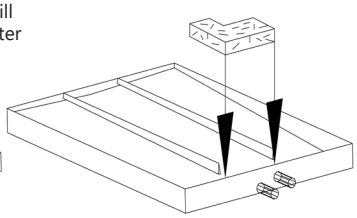


Fig. 07b

5) Replace the drain pan in (new) bottom location. (Fig. 08)

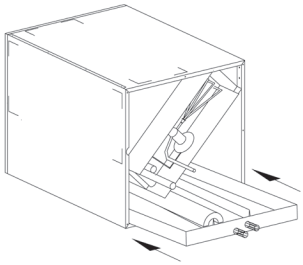


Fig. 08

6) Ensure the foam air dam is re-installed under the corner of the coil to prevent air from bypassing under the coil. (Fig. 09)

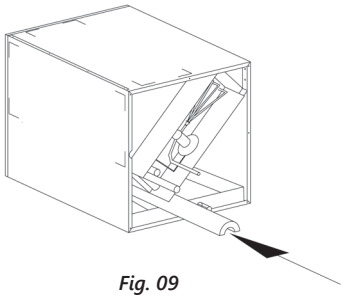


Fig. 09

7) Remove round knock-outs on the door to fit drain lines. Plug previously used drain holes with provided plugs. (Fig. 10)

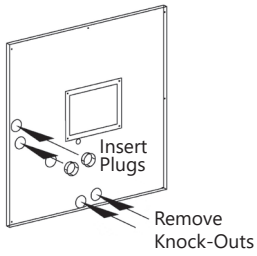


Fig. 10

8) Replace front door on module. (Fig. 11)

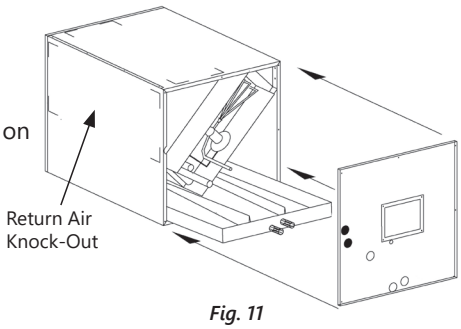
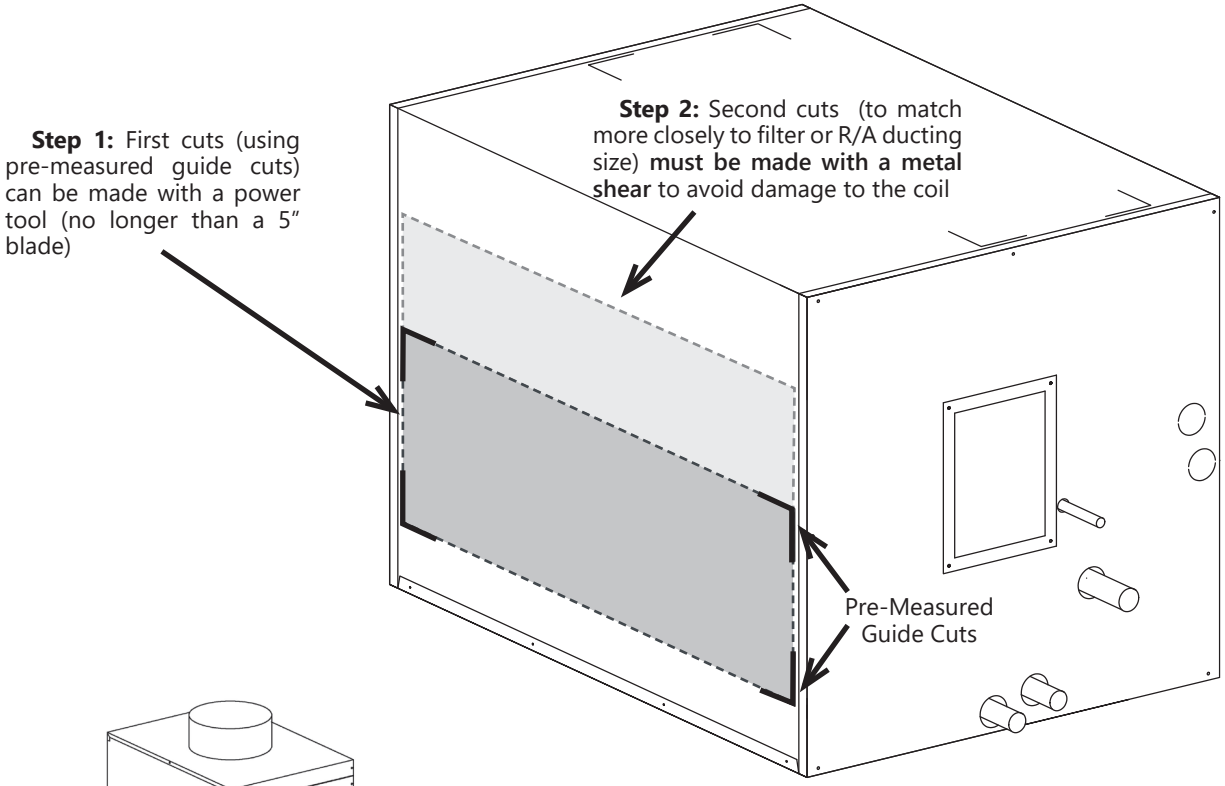


Fig. 11

Return Air Cutouts

Once the RBM coil configuration and placement of the return air ducting has been decided, the return air knockout(s) can be cut. The pre-measured guide cuts supplied with the RBM coil should always be used to make the first cut. For this first cut, do not use a saw blade longer than 5" (125mm) or damage to the coil can occur.

TO AVOID DAMAGE: After the first initial cut using the return air knockout(s) a metal shear must be used to make the return air cutout opening match more closely to the filter or return air ducting size to maximize flow capacity. Use this cut method for both coil inlet and outlet.



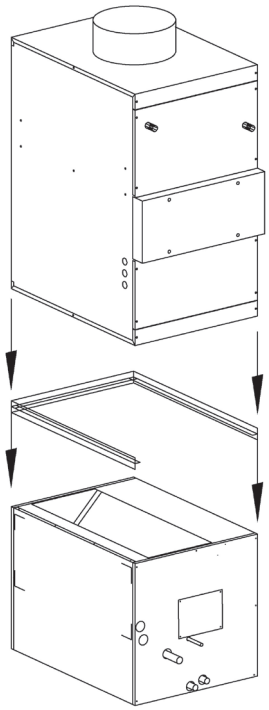


Fig. 12

Mounting Brackets

Mounting the cooling coil to the air handler can be done with the T brackets supplied (Fig. 12), ensure that no screws puncture the drain pan or coil. Use the provided mounting tape to air seal the RBM to the air handler. See specifications page for the dimensions of the air handler units and cooling modules.

Thermal Expansion Valve & Sensing Bulb

The Thermal Expansion (TX) Valve comes pre-installed inside the RBM Module. It is acccessible through the easy to remove front door or access hatch. The access hatch is used to access the TXV and the adjustment stem after the line sets are brazed on, and can be adjusted while the system is running. The TXV's sensing bulb is pre-installed on a clean, horizontal section of the suction line. It will be mounted on the top half of the pipe in the 2 o'clock or 10 o'clock position. (Fig. 13) When brazing near components always use a wet rag or heat dissipating paste to avoid damage or overheating any compontents. Failure to do so may void warranty.

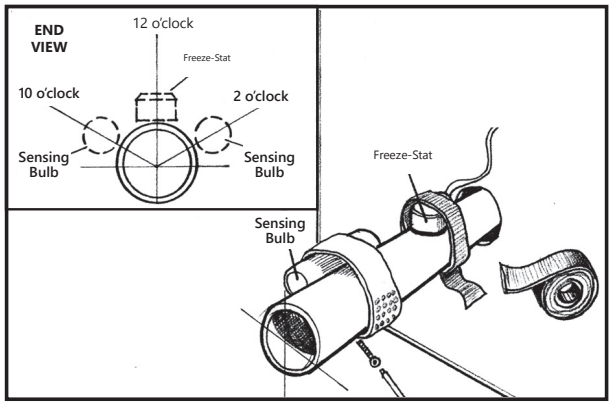


Fig. 13 - TX Sensing Bulb

Access Ports

When refrigerant lines are connected to the RBM coil, access port(s) must be connected as well. (Fig. 01 - reference 2 & 10) With the use of a tee and reducer this process is simplified. The access port(s) are required for system startup and for future trouble shooting or service. When reading refrigerant pressures/ temperatures, always read them at the evaporator access port.

External Equalizer Line

The external equalizer line comes pre-installed off of the TX Valve's body and runs to the suction line. It is required to compensate for refrigerant pressure drop through the coil.

Freeze Stat

The RBM Series cooling module comes with a freeze stat (anti-ice control). This freeze stat serves the purpose of preventing severe icing of the coil in the event of an undercharge or low load on the coil. **NOTE: <u>Do not</u> remove protective bubble wrap from Freeze-Stat.**

Important: The Freeze Stat (anti-ice control) must be used at all times. Failure to do so may void warranty.

During start-up, it is acceptable to jumper across the freeze stat. This will prevent the freeze stat from shutting the system off while charging a new system that may be low on refrigerant. Once charged and running, this jumper must be removed and the freeze stat connected to the FZ and FZ terminals on the Printed Circuit Board. Should wiring needs arise in which the outdoor unit is controlled through another means of wiring, the freeze stat should be connected in series on the input side of the control wiring. See freeze stat install location on page 3 (Fig. 01).

Refrigerant Bypass

All RBM coils come with a pre-installed check valve ready TX valve, used for AC only or heat pump condensing units. Third party TX valves may require a bypass check valve.

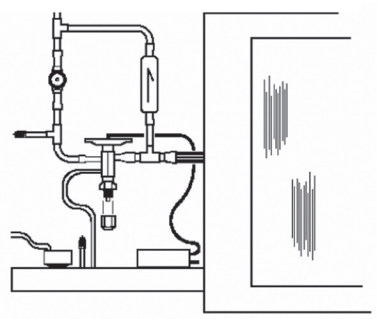


Fig. 14- Bypass check valve

Drain Connections, P - Trap & Secondary Drain Pan

Important: Piping the condensate lines on a return side cooling coil can be dramatically different, be sure to read info below.

The primary condensate drain **<u>must have a minimum 3" P-Trap installed</u>** (Fig. 15). The drain line must run at a slope of ¼" per foot in the direction of the drain. RBM modules come with a ¾" male CPVC primary and secondary outlet. It is good practice to install a clean out right above the P-Trap. Using a "tee fitting" and cap in the P-Trap's construction can be used as the clean out and as a way to prime the P-Trap if it ever dries out. <u>A wet P-Trap is important.</u> A dry P-Trap can be detrimental to proper drainage. If code requires a secondary drain line, run the secondary line using the same method as primary. Otherwise, capping off the secondary drain line is acceptable. <u>Do not run the secondary drain line to the secondary drain pan or use it as a vent to atmosphere!</u> An equipment stand/riser or rubber equipment mat may be necessary to elevate the module off of the ground to allow for a P-Trap.

Any installation that has the potential of property damage due to condensate <u>must</u> have a secondary drain pan installed. If the unit is installed in a high heat and/or high humidity location, extra insulation around the unit casing may be required. This will prevent excessive condensate from forming on the outer surface of the casing.

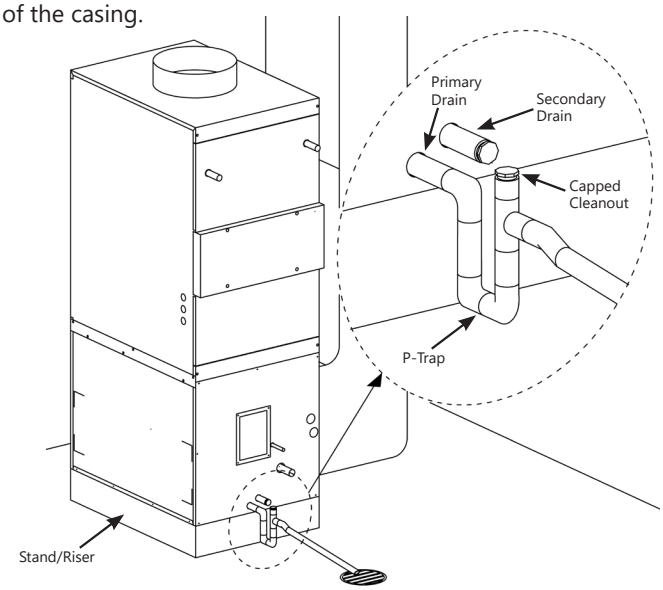


Fig. 15 - Example of Recommended Condensate Piping

Piping the RBM

Only refrigerant grade pipe and fittings are to be used with the RBM Module. Plumbing fittings may contain wax or other contaminants which are detrimental to the proper operation of the system. Insulate the suction line with a minumum of 3/8" insulation. In high heat areas, a minimum of 1/2" insulation may be needed. If the lines are run in an area where temperatures could exceed 120°F or runs longer than 50', then the liquid line may need to be insulated as well. Support the pipe every 5 feet, or whatever local code states.

Run the pipes in the most direct route possible, taking into account structural integrity, building details and local building codes. If the evaporator is located above the condenser, slope any horizontal runs toward the condenser. If the condenser is located above the evaporator, a P-trap must be installed at the bottom of the vertical riser. For long vertical risers, additional P-traps must be installed for every twenty feet. For lines running over 50', a suction line accumulator must be installed. Lines running over 100' are not recommended.

Pipe Sizing

Tables 01 and 02 contain line sizing information for the liquid and suction lines.

Table 01 – Liquid Line sizes

	Tons							
Distance	1	1½	2	2½	3	3½	4	5
1'–25'	¼	¼	5/16	⅜	⅜	⅜	⅜	½
26'–50'	5/16	5/16	⅜	⅜	½	½	½	½
51'–75'	⅜	⅜	⅜	½	½	½	½	½
76'–100'	⅜	⅜	½	½	½	½	½	½

Table 02 – Suction Line sizes

	Tons							
Distance	1	1½	2	2½	3	3½	4	5
1'–25'	⅝	⅝	¾	¾	¾	⅞	⅞	1
26'–50'	⅝	¾	¾	¾	⅞	⅞	1⅛	1⅛
51'–75'	¾	¾	⅞	⅞	1⅛	1⅛	1⅛	1⅛
76'–100'	¾	⅞	⅞	1⅛	1⅛	1⅛	1⅛	1⅛

The sizes given in the above tables are only for general reference, if the condenser manufacture requires a different size than specified in ***Table 01*** and ***Table 02***, their sizing shall be used whenever a discrepancy occurs.

Outdoor Unit Installation

Locate the outdoor unit in a suitable location, as close as possible to the air handler. Maintain the clearances recommended by the manufacturers of the outdoor unit, to ensure proper airflow. The outdoor unit must be installed level, in a properly supported location. A liquid line filter/drier is recommended to be installed.

Wiring Outdoor Unit

Make all connections to the outdoor unit with rain tight conduit and fittings. Most building codes require a rain tight disconnect switch at the outdoor unit as well (always check local codes). Run the proper size copper wires to the unit, and connect as per the manufacturer's recommendations.

Ensure that the unit is setup for a TX system. If not, a hard start kit may be required.

Evacuating

The system must be brazed under a nitrogen purge to prevent oxidation of the pipe during the brazing process. After the piping is installed and all components have been brazed together, a vacuum pump must be used to properly evacuate the system from both of the access ports to 1500 microns, to ensure system is free of contaminants. Add refrigerant to the system to bring the pressure above zero psig. After allowing the refrigerant to absorb moisture, repeat the above procedure. Evacuate the system to 500 microns on the second evacuation, and ensure that the system holds at the vacuum pressure. If not, check for leaks and evacuate again. If the vacuum holds, add refrigerant to raise the pressure to 2 psig. At this point open service valves on pre-charged condensing units.

The use of an electronic leak detector is recommended, as it is more sensitive to small leaks under the low pressures.

Charging

Once the system has been determined clean and ready for charging, refrigerant can be added. The service valves on the condenser must be open at this point. Never leave the system unattended when charging. With the system running, slowly add refrigerant. The typical operating point of an RBM coil is that of a saturated suction temperature of 34-40°F at 100-115 psig (1-4°C at 7-8 bar) and a suction line temperature of 38-44°F at 114-128 psig (3-7°C at 8-9 bar). In order to prevent overcharging during this stage, refrigerant should be added in steps. This will allow time for the system to settle and prevent 'overshooting' the ideal charge. Condenser pressures and temperatures remain similar to those in a conventional forced air system. It is recommended that the coil be charged on a high load day at the compressor's highest speed.

Most system start ups require only an adjustment to the refrigerant level of the system. Should further refinement be required, the TXV may be adjusted. A clockwise turn of the superheat adjustment stem (the direction in which the cap is screwed on) will result in a closing of the valve while a counterclockwise turn (the direction in which the cap was unscrewed) will result in opening of the valve. Always note system conditions before adjusting the valve and allow 5 minutes for the system to settle before making any further adjustments. Never adjust the TXV more than one quarter turn at a time.

Important: Failure to follow the proper evacuating and charging procedures may void warranty.

Charging (Continued)

The RBM coil can operate at a level that is different from most other conventional system coils. Typically, superheat levels are slightly lower at 6-10°F (1 - 3°C) of superheat. Adjustment of the valve also differs somewhat. Rather than having a large effect on the range of superheat, adjustment of the valve has a larger effect on the system pressures; superheat maintaining a fairly constant point. Opening the valve will increase suction pressures and decrease liquid pressures, while closing the valve will decrease suction pressures and raise liquid pressures.

Typical Operating Ranges

Saturated Suction Temperature	34 - 40°F (1 - 4°C)
Suction Line Temperature	38 - 44°F (3 - 7°C)
Superheat	6 - 10°F (1 - 3°C)
Suction Line Pressure (R-410A)	110-124 psig (7.5-8.5 bar)
Liquid Line Pressure (R-410A)	250-300 psig (17-20.5 bar)

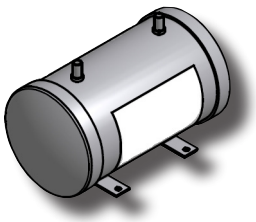
Heat Pumps

Traditionally, SDHV systems have been charged to special guidelines when used in conjunction with heat pumps. This charging procedure involved charging the units to normal cooling capacities and reviewing the operation in heating mode. If head pressures were found to be impinging on the high head pressure limits, a small amount of refrigerant was removed to prevent the unit from shutting down. The cause of high head pressures in heating mode is due to the disparity in sizes of the indoor and outdoor coils, along with the lower airflow rates of SDHV systems.

With the introduction of newer, larger heat pumps, this issue is more likely to be experienced. While some heat pump units may still be charged in the traditional method, the amount of refrigerant that is required to be removed for heating mode may leave the system drastically undercharged for cooling mode. For this reason it is highly recommended that a Bi-Flow Receiver be used with heat pump applications.

Bi-Flow Receiver

The Bi-Flow Receiver is designed for use with heat pump systems, up to 5 tons, and with any typical refrigerants. The receiver provides a location for the storage of excess refrigerant during the heating cycle, minimizing head pressures. During cooling mode, the receiver is empty, allowing the full refrigerant charge to be utilized for cooling.



The receiver is a horizontal tank with a pair of dip tubes extending to the bottom of the tank. These two tubes allow for liquid refrigerant to be drawn from the tank regardless of the direction of flow. For this reason, the receiver must be mounted so that the inlet/outlets of the tank come out of the top of the unit. Mounting brackets are located at the base of the unit for secure mounting. The receiver is to be located on the liquid line of the system, anywhere between the indoor and outdoor coils. As the unit is of a bi-flow design, it does not matter which end faces towards the indoor coil.

The inlet/outlet ports are constructed of steel and require the use of a 35-45% Silver Solder and Flux for brazing. The use of standard copper to copper solders may result in difficulty brazing and the potential for a failure at the weld. Ensure that the tank is protected from overheating while brazing and that any remaining flux is cleaned from the unit. If installing outdoors, ensure that the receiver is insulated and protected from the elements.

Return Air

When designing the return air for a Hi-Velocity System, there are a few things to consider. It is common to use centralized return air with systems that have rooms that are within a common area. Separate floors or rooms that have high loads and require a large amount of supply air flow should have their own return air, or be tied into the centralized return air to allow the air to return back to the air handler. Rooms or areas that cannot be tied into the return air should have an air transfer grill to allow the air to escape the room and flow back to a centralized return air.

Important: Return Air must be filtered before entering the cooling module.

Duct Sizing

The Return Air is to be sized on a 0.15 static pressure (37 pa) as compared to 0.10 static pressure (25 pa) for conventional forced air systems. The maximum length for an individual return air duct is fifty feet (15.24m).

Please note: It is VERY important NOT to undersize the return air, as this will create noise, increase motor power consumption, reduce airflow and increase the possibility of condensate carry-over.

Table 03 has recommended return air sizes for round and rectangular ducts. A variance of **+20%** is allowable for sizing return ducts that connect to the RBM or Hi-Velocity Systems unit.

Important: When connecting a round Return Air to the RBM coil, a round to rectangular transition is required.

Table 03 – Return Air Duct Sizes

Unit	Rigid Ø	Flex Ø	Min Sq. Inches (Sq. cm)
50/51/52	12″ (305mm)	14″ (356mm)	120 (774cm)
70/71	12″ (305mm)	14″ (356mm)	120 (774cm)
100/101	14″ (356mm)	16″ (406mm)	168 (1084cm)

Remember: When using flexible duct for return air, use one duct size larger due to the higher friction loss.

Where allowed by local codes, a single return air grill may be used. Note: Return air grill must have equal minimum of free air area to return air.

Important: When using flexible duct for return air, use one duct size larger due to the higher friction loss.

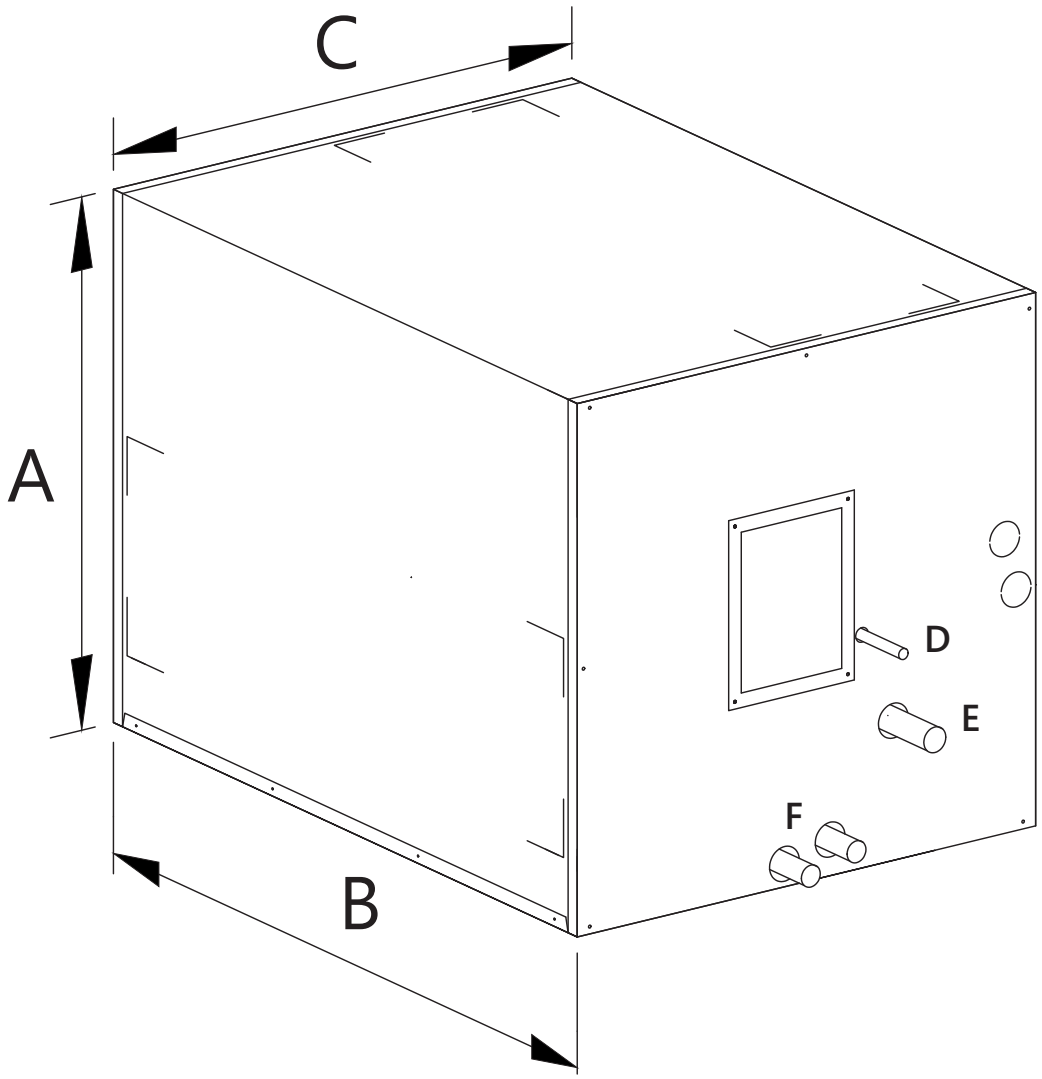
Specifications		RBM-50	RBM-70	RBM-100
Part Number		41090300050	41090300070	41090300100
Matching Air Handler		HE-Z/HE-B/HE/HV-50/51 CU-51 LV-Z/LV-B-750/751 LV-50	HE-Z/HE-B/HE/HV-70/71 LV-Z/LV-B-1050/1051 LV-70	HE-Z/HE-P/HE-B/HE/ HV-100/101 HE-P-240/241 (x2 Coils)
Tons[1]		1.5 - 2.0 (5.3 - 7.0 kW)	2.5 - 3.0 (8.8 - 10.6 kW)	3.5 - 5.0 (12.3 - 17.6 kW)
Refrigerant Type		R-410A	R-410A	R-410A
TX Cooling MBH[2]		18-24 (5.3-7.0 kW)	30-36 (8.8-10.6 kW)	42-60 (12.3-17.6 kW)
Latent Cooling MBH		6.8-8.9 (2.0-2.6 kW)	11.7-13.7 (3.4-4.0 kW)	16.0-22.2 (4.7-6.5 kW)
Fin Material		Aluminum	Aluminum	Aluminum
Tubing Material		Copper	Copper	Copper
Type of Fins		.006 Al (0.1524mm)	.006 Al (0.1524mm)	.006 Al (0.1524mm)
Connection Sizes	Liquid Line (Lq)	3/8″ (9.5mm)	3/8″ (9.5mm)	3/8″ (9.5mm)
	Suction Line (S)	7/8″ (22.3mm)	7/8″ (22.3mm)	7/8″ (22.3mm)
	Drain Connection	3/4″ M CPVC (19mm)	3/4″ M CPVC (19mm)	3/4″ M CPVC (19mm)
TXV with Built in Check Valve & Bypass		Pre-Installed	Pre-Installed	Pre-Installed
Freeze Stat		Yes	Yes	Yes
Access Ports		Yes	Yes	Yes
Shipping Weight		35 lbs (15.9 kg)	45 lbs (20.4 kg)	55 lbs (24.9 kg)
Module Size (L x W x H)		14 1/2″ x 18 1/4″ x 18 1/4″ (368mm x 464mm x 464mm)	19 1/2″ x 18 1/4″ x 18 1/4″ (495mm x 464mm x 464mm)	25 1/2″ x 18 1/4″ x 18 1/4″ (648mm x 464mm x 464mm)

(1) Minimum of **four HE outlets** per ton of cooling needed. (2″ Duct = Minimum **eight outlets** per ton)
(2) Smaller condensers may be matched to the air handler when needed (match TXV to condenser size)

MBH - Thousand British Thermal Units per Hour
TX - Thermal Expansion
TXV - Thermal Expansion Valve

RBM Series Sizing

Item	Length	Width	Height	Liquid Line	Suction Line	Drain Conn.
Refrigerant Modules	B	C	A	D	E	F
RBM-50	14 1/2" (368mm)	18 1/4" (464mm)	18 1/4" (464mm)	3/8" o.d.	7/8" o.d.	3/4" M CPVC
RBM-70	19 1/2" (495mm)	18 1/4" (464mm)	18 1/4" (464mm)	3/8" o.d.	7/8" o.d.	3/4" M CPVC
RBM-100	25 1/2" (648mm)	18 1/4" (464mm)	18 1/4" (464mm)	3/8" o.d.	7/8" o.d.	3/4" M CPVC



WARRANTY

Energy Saving Products Ltd. is proud to offer a limited warranty. This warranty applies strictly to the first purchaser at wholesale level and only to the Air Handler unit and module. It does not include connections, attachments and other products or materials furnished by the installer.

This warranty excludes any damages caused by changes, relocation to, or installation in a new site. This warranty does not cover any defects caused by failure to follow the installation and operating instructions furnished with the Air Handler. This warranty does not cover defects caused by failing to adhere to local building codes and following good industry standards. Failure to correctly install the Air Handler, or material related to the unit, may result in improper system performance and/or damages and will void this warranty. This warranty does not cover material installed in or exposed to a corrosive environment. This warranty does not cover products subjected to abnormal use, misuse, improper maintenance, or alteration of the product. Using the Air Handler and/or module as a source of temporary heating/cooling during construction will void this warranty.

A **Five (5) Year Limited Warranty** is extended on all components in products manufactured exclusively by Energy Saving Products. These components include Motors, WEG Controller, Circuit Boards, Dampers, Zoning Controls, Blowers, Motor & Blower Assemblies, Heating Coils, Chilled Water Coils, and Air Conditioning Coils. Note: If any product is installed in or exposed to a corrosive environment, warranty will be void.

A **Three (3) Year Limited Warranty** is extended on Electric Strip Heaters.

A **One (1) Year Limited Warranty** is extended on replacement parts.

Products sold by Energy Saving Products but manufactured by others, will carry the original manufacturer's warranty.

TERMS & CONDITIONS

- **Warranty will not be considered unless a contractor has contacted Energy Saving Products Ltd. Technical Support department for assistance, and received a tech code.**
- Any repair performed under warranty must be approved by Energy Saving Products Ltd. for this warranty to be valid.
- The liability of Energy Saving Products Ltd. is limited to and shall not exceed the cost of pre-approved replacement parts.
- This warranty does not cover shipping costs to and from the factory, labor costs or any other cost associated with the installation of the replacement part.
- Inoperative parts must be returned to Energy Saving Products Ltd. with an ESP RMA Form that includes model, serial number, and a detailed description of the entire problem. Inoperative parts must be returned in testable condition.
- Energy Saving Products Ltd. is not liable for any other damages, personal injury, or any other losses of any nature.

Follow these steps for Service or Repair:

1. Contact the installer of the product or a licensed service company
2. Contact the distributor
3. Contact Energy Saving Products Ltd. Mon-Fri 8 am – 4:30 pm MT 1-888-652-2219

This warranty replaces all other warranties expressed or implied.

www.hi-velocity.com

Energy Saving Products Ltd, established in 1983, manufactures the Hi-Velocity Systems™ product line for residential, commercial and multi-family markets. Our facilities house Administration, Sales, Design, Manufacturing, as well as Research & Development complete with an in-house test lab. Energy Saving Products prides itself on Customer Service and provides design services and contractor support.

For all of your Heating, Cooling and Indoor Air Quality needs, the Hi-Velocity System is the right choice for you!

Hi-Velocity Systems™

Small Duct Heating, Cooling and IAQ Systems

Build Smart, Breathe *Easy*

Hi-Velocity HE-Z Air Handlers, Green Technology

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