

The Unico System[®]

INSTALLATION MANUAL FOR 'M' SERIES AIR HANDLER UNITS

BULLETIN 30-020

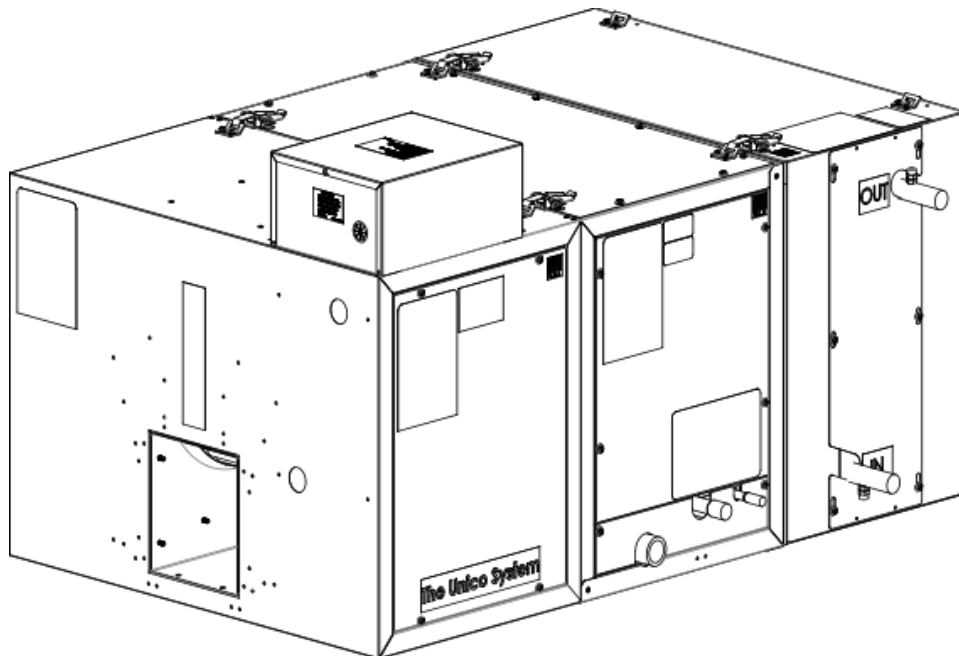


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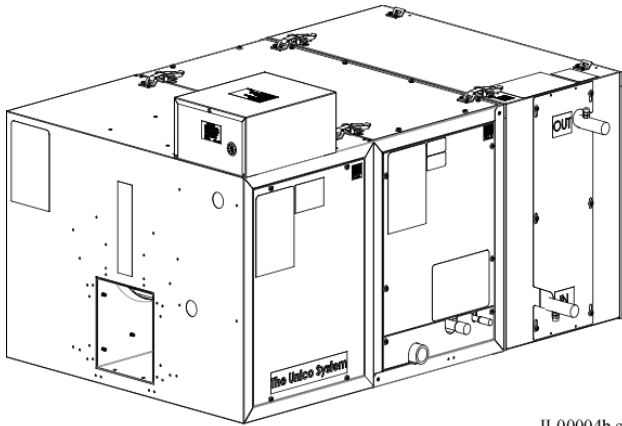
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Certified to UL Standard 1995
 Conforms to CAN/CSA Standard C22.2 NO. 236



Unico products comply with the European regulations that guarantee product safety.

Installation Instructions



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INTRODUCTION

General. The information on the following pages is to help the installer save time, provide the best possible installation and insure continuous trouble-free operation.

The *Unico System* is a complete indoor comfort system that includes an indoor air handling unit and small duct system. The air handler and duct system were designed to operate together to provide the proper airflow in every installation. The conditioned air is supplied through a series of 2-inch ducts as a stream of air that entrains and mixes the room air. This process of aspiration produces a more even temperature distribution in the room.

The Unico 'M' Series air-handling units consist of various modules that are easily latched together. The modules can be arranged in a vertical-up-flow, vertical-counter-flow and horizontal-flow configuration. They can be combined as a heating-only, cooling-only, or heating and cooling air handler unit. See Fig. 1.

All insulated *Unico System* modules feature closed-cell insulation for improved sound attenuation. There is no exposed fiberglass insulation.

Each module is available in four sizes: 2430, 3036, 3642, and 4860. There are three basic modules: a blower module, a cooling module, and a heating module. The blower module includes the blower wheel, blower housing, motor, and electrical control box.

NOTICE TO INSTALLER AND EQUIPMENT OWNER: RETAIN THIS MANUAL AT THE JOB.

SUFFICIENT BUILDING INSULATION IS ESSENTIAL FOR THE MOST ECONOMICAL OPERATION.

The cooling module includes a cooling-only refrigerant coil, a heat pump coil, or a chilled water coil. The heating module is supplied as an empty cabinet with room for a slide-in hot water coil.

The modules can be arranged to provide only the options needed as shown in Figure 1 (with details on pages 26 and 27). Heating-only systems require the blower module, the heating module, and a hot water coil. Cooling-only systems include the blower module and a cooling module. For heating and cooling all the modules are combined with coils. The system may even be used for ventilation-only, using just the blower module.

Unico designed and built blowers feature direct drive motors or EC motors and are located in the air stream. Each blower wheel is balanced to Unico specifications. The blowers feature a twist-and-lock motor mount for easy maintenance (see page 21). The motorized blower assembly consists of the motor, which is mounted to the inlet ring, and the wheel, which is mounted to the motor shaft.

Scope. These instructions apply to the Unico M-Series air handler units. For heat pump coils, refer to *Bulletin 30-024* for additional instructions. Installation instructions for the air distribution system are covered in *Bulletin 30-005*. Before beginning any installation, a detailed system layout must be done in accordance with the *System Sizing and Layout Procedure, Bulletin 40-040* and the *Component Layout Instructions, Bulletin 40-030*.

General Precautions and Safety Tips. Do not attempt to install or startup unit without first reading and understanding the appropriate sections in this manual.

Before operating, be sure the unit is properly grounded.

Installation should be in accordance with all local codes and regulations and with the National Board of Fire Underwriters regulations. In case of conflict, local codes take precedence.

All electrical wiring should be in accordance with the latest edition of the National Electrical Code and all local codes and regulations. The unit is safety certified to UL 1995 and listed with ETL.

Always install a secondary drain pan when an overflow of condensate could cause damage.

Options. Other options and modules are also available to add additional features or to simplify installation. These include an electric duct heater, multiple return plenum, and a vertical plenum stand. Please refer to the latest Unico Catalog for information on these and other options.

Unpacking. All modules are inspected prior to shipping and are carefully packaged in individual cartons. Inspect all cartons prior to unpacking. Notify carrier of any damage.

Open each carton to remove the modules. Inspect unit for visible signs of concealed damage and notify carrier of any such damage.

All materials are sold FOB Factory and it is the responsibility of the consignee to file any claims with the delivering carrier for materials received in damaged condition.

PART NUMBERS

This manual does not always include the latest revision letter when referring to *UPC* part numbers. Refer to the latest Price List and Spec Sheets for the current *UPC* revision letter. For example, in *UPC-00x* the 'x' indicates the latest revision.

LOCATION

Locate the air handler to minimize the number of plenum elbows and fittings while keeping the supply duct runs as short as possible. (See *Bulletin 40-030, Component Duct Layout Design*). Provide minimum clearance on both sides for servicing the unit as shown in Fig. 2.

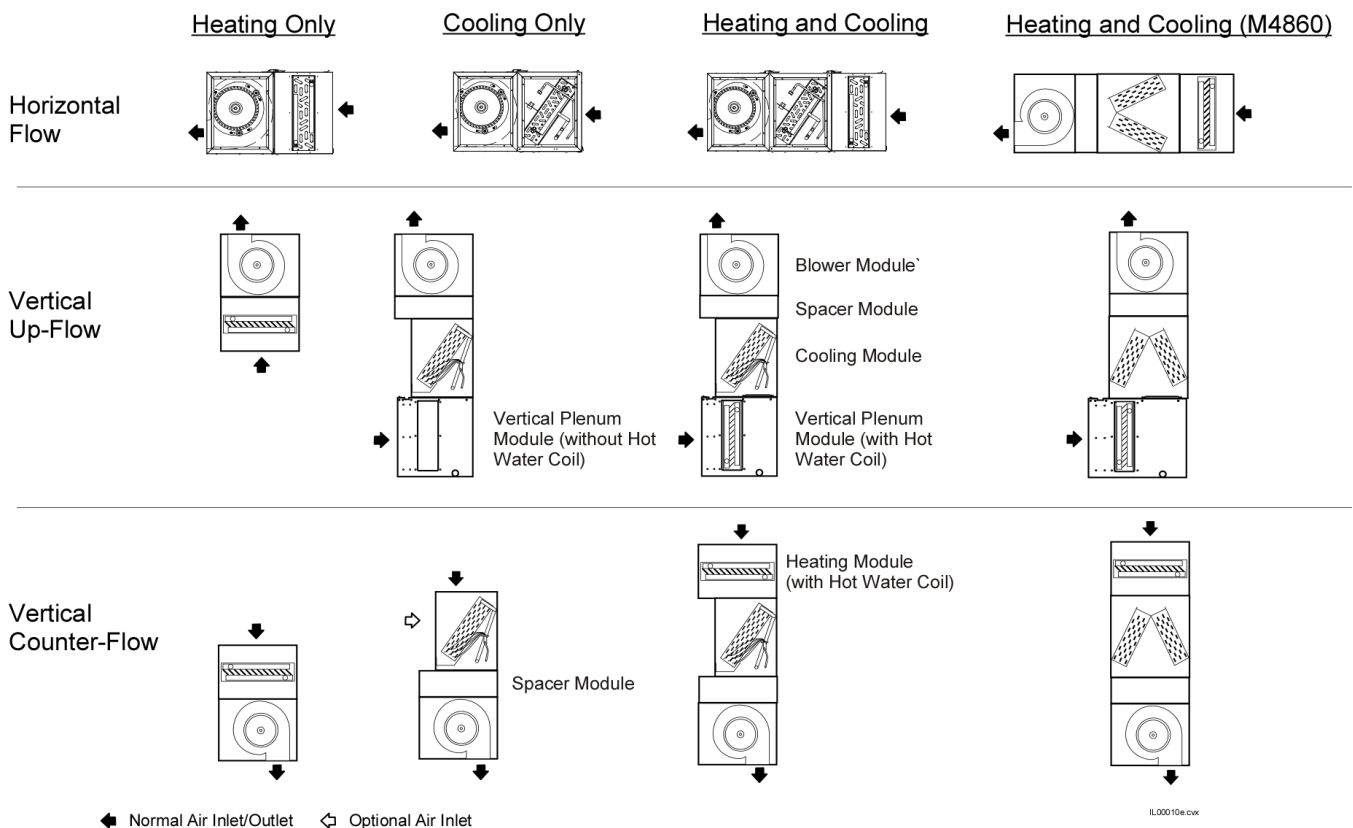
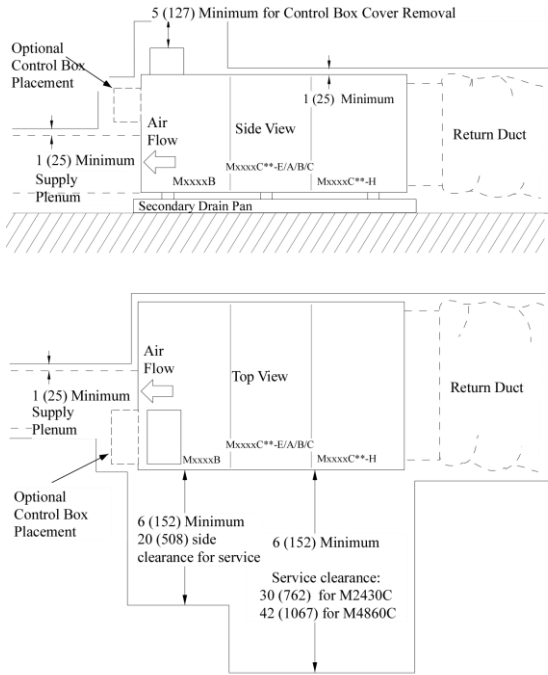


Figure 1. Basic Module Arrangement



All dimensions in inches (mm).

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Figure 2. Minimum Clearances

If installing the unit in an attic, avoid placing the unit above a bed or other place where noise is critical. The ideal location is above a central hall, a closet, a bathroom, or any normally unoccupied space.

The unit can also be installed in a closet, crawlspace, or basement. If the local codes allow, the unit may be installed in the garage provided the ductwork is well sealed, especially the return duct.

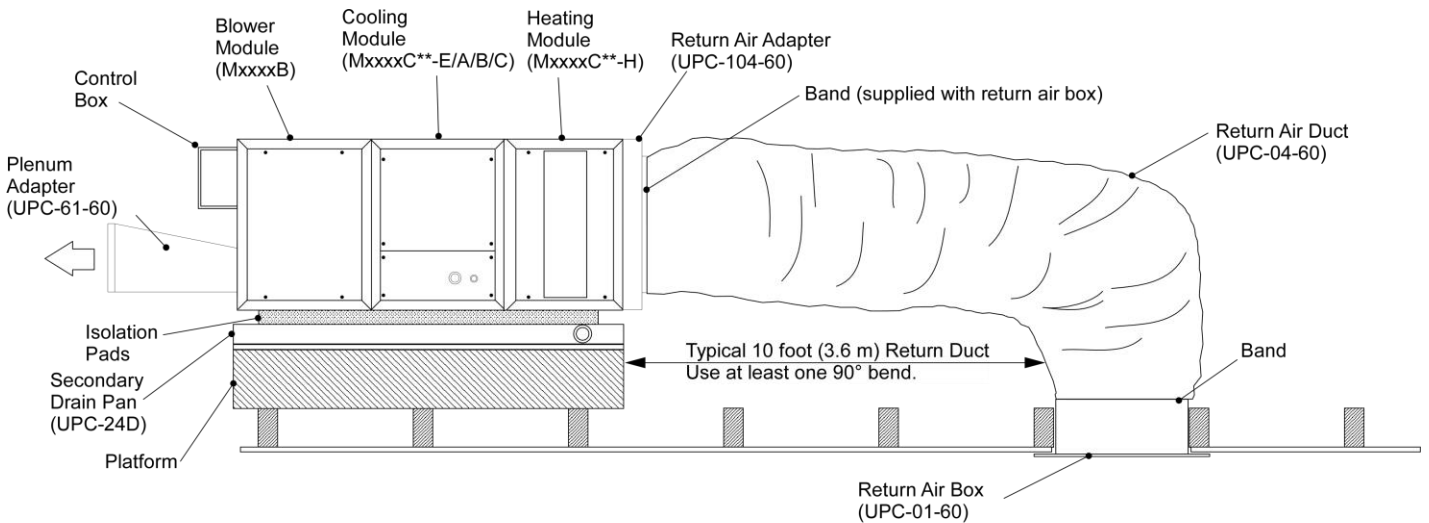
Although the unit is not designed for outdoor use, it may be located outside provided adequate weather protection is used; typically, a roof installation requires mounting on blocks with a sheet metal cover or cap to protect the unit from rain and extreme weather conditions.

Table 1. Return Air Box Opening

| Model | Return Air Box Part No. | Size of opening, inches (mm) |
|-------|-------------------------|------------------------------|
| 2430 | UPC 01-2430 | 14 3/8 × 25 1/2 (365 × 648) |
| 3036 | UPC-01-3036 | 14 3/8 × 30 1/2 (365 × 775) |
| 3642 | UPC 01-3642 | 14 3/8 × 30 1/2 (365 × 775) |
| 4860 | UPC-01-4860 | 24 3/8 × 30 1/2 (619 × 775) |
| | UPC-01-4860NC | 20 3/8 × 30 1/2 (518 × 775) |

Be sure to position the return air box and filter near the unit allowing at least one 90° bend in the return duct for proper acoustical performance (refer to Figure 3 for a typical horizontal attic installation). The section on Return Air Ducts in the manual provides more details.

All modules except the 4860 cooling module are designed to fit through a 14-inch (356 mm) opening, typical of a joist spaced at 16-inch (406 mm) center distance. The 4860 module requires an 18.5-inch (470 mm) opening. If no access is provided, an opening must be cut. It is suggested to use the opening required for the return air box, especially in an attic installation. The opening for the return air box is listed in Table 1. If the joists or studs are less than 16-inches (406-mm) center-to-center or running the wrong direction it will be necessary to cut and header the joists.



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Figure 3. Typical Horizontal Attic Installation

EC MOTOR TEMPERATURE LIMITS

The Unico EC motor includes an electronic circuit board that is sensitive to overheating if the air temperatures surrounding the motor are above a certain value. The motor will not function above its maximum operating temperature and will have some reduction in motor life between the maximum operating temperature and the recommended temperature limit. Depending on the application, this may or may not be acceptable.

Recommended temperature limit. For maximum motor life, we recommend that the Unico EC motor be limited to applications with less than 130°F (54°C) air temperature. Therefore, the Unico EC motor can be used with all heat pump and electric heating applications without problem. It may also be installed with a hot water coil with air temperature leaving the coil less than 130°F (54°C). This is generally with water temperature less than 135°F (57°C) but it depends on the water and air flow. Consult the hot water coil specifications to determine air temperatures based on water flow and air flow rate.

Maximum operating temperature limit. The absolute limit for the motor is 150°F (65°C) air temperature, above this point the motor will automatically begin to slow down. The motor may be used in applications with air temperature around the motor between 130 to 150°F (54 to 65°C), typical for boiler systems with water temperatures between 135 and 160°F (57 to 70°C). However, expect the life of the motor to be reduced by as much as 50%. In most applications, with unit operating intermittently, the amount of time that the motor operates in heating is very small so the reduction in motor life will not be significant. Only for extended continuous heating applications, will the reduction be noticeable. The reduction in motor life can be minimized by using setback boiler temperatures while operating with maximum airflow at the highest water temperatures.

UNIT ASSEMBLY

The units may be assembled either horizontally or vertically. Refer to Fig. 1 for your particular flow arrangement. Assemble the units' two modules at a time. If you use a refrigerant coil, the anti-frost switch wires must be routed to the control box as you connect the modules.

Anti-Frost Switch Wires. Remove the coil access panel and unravel the anti-frost switch wires. Connect the modules together, then feed the wires through the bushing in the motor partition panel.

Fastening Modules Together. To fasten the modules together tilt the units to insert the connection flange over the mating flange as shown in Fig. 4. It may be necessary to squeeze the units together as you are inserting the flange to compress the rubber gaskets. If the hook flange has a small gap, use a large flat bladed screwdriver to pry the gap apart. Secure the modules together with the latches, compressing the gasket further. It is also recommended to tape the seams of the modules after latching.

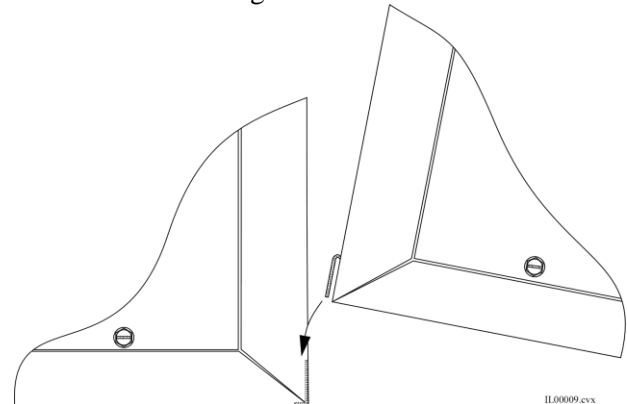


Figure 4. Module Flange Connection

Horizontal Installations

Most systems are installed in the horizontal configuration, with the air going from right to left when looking at the connections (as shown in figure 1). All the modules are factory set for horizontal airflow. It is not recommended to flip the cooling module to reverse the flow direction of the air. When connecting the modules be sure to arrange the heating module on the inlet (return) side of the cooling module.

The 4860 cooling module also includes a spacer module which has a small drip shelf (shipped loose) that must be installed on the air exit side of the drain pan (shown in figure 5).

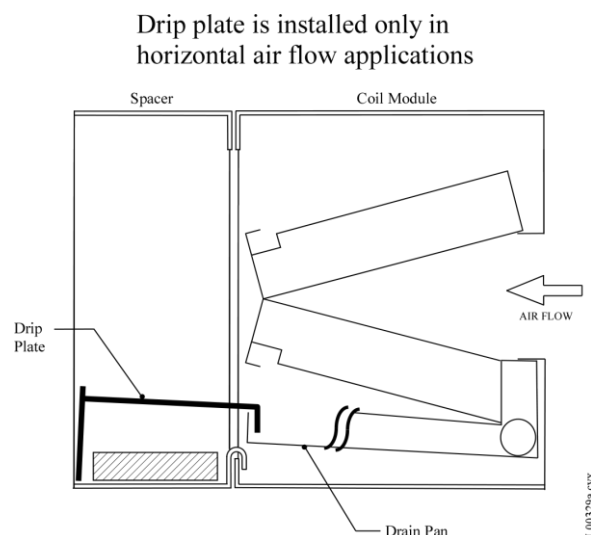


Figure 5. 4860 Drip-plate installation (horizontal)

When installing the heat module or return air plenum module upstream of the cooling module, it is necessary to first install a hook flange to the bottom of the cooling coil (Figure 6).

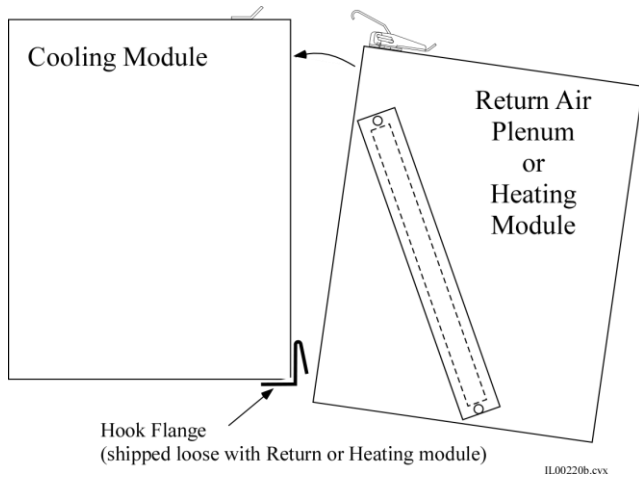


Figure 6. Hook Flange Location

Vertical Installations

As shown in figure 1, the modular system can also be configured for vertical up-flow or down-flow. The arrangement of modules is different so be sure to follow these instructions.

In most cases connecting the modules is straight forward – just use the arrangement shown in figure 1. However, if you are using a 2430, 3036 or 3642 cooling module, the top access panel of the cooling module will need to be repositioned as shown in figure 7.

For vertical up-flow the return air may enter through the bottom or side return opening of the 2430, 3036 or 3642 cooling module although the bottom opening is preferred. The 4860 cooling only has one return opening for either horizontal or vertical applications. The 4860 drain pan is ‘L’ shaped and will work properly when the module is turned 90 degrees.

CAUTION

TO PREVENT WATER DAMAGE AND TO ALLOW PROPER CONDENSATE DRAINAGE, DO NOT TURN OR ROTATE THE 2430, 3036 OR 3642 COOLING MODULE ON ITS SIDE.

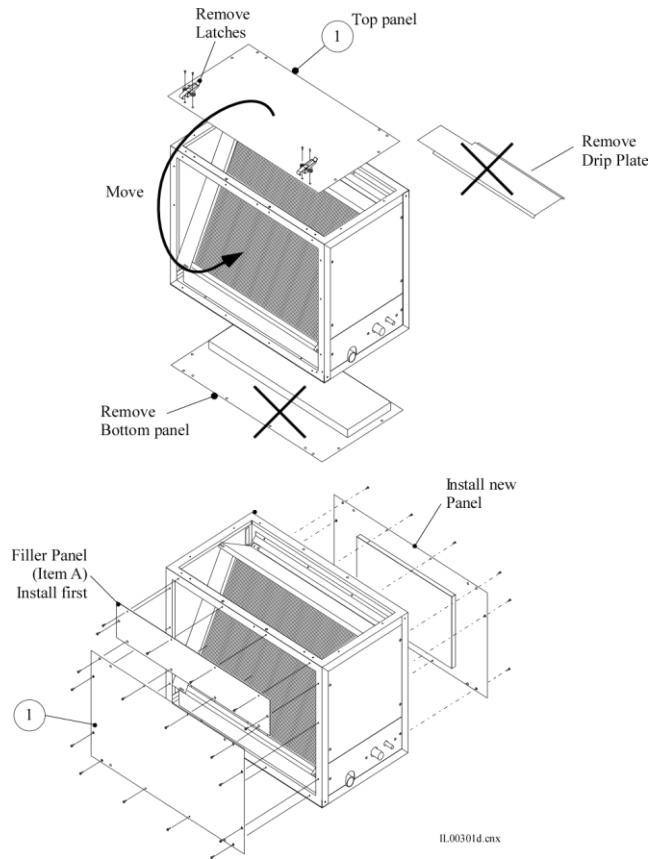


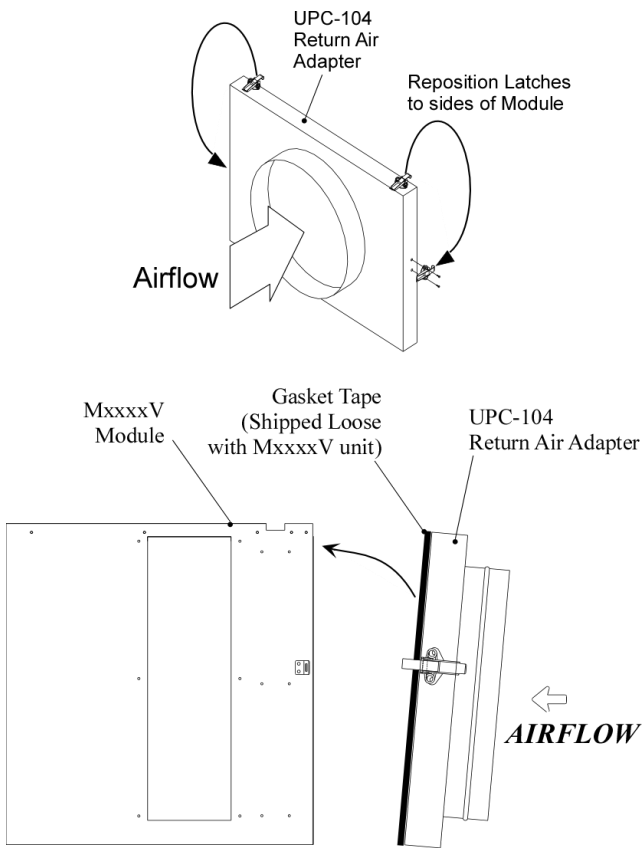
Figure 7. Cooling Module Configuration (2430, 3036, 3642 only)

Vertical Plenum Module

For vertical up-flow installations, we recommend using the vertical return plenum module (MxxxxV1). The spacer shown in figure 1 is included with the MV module (except for the 4860 unit, where it is included with the cooling module). If you are not using the MxxxxV1 module for the 2430, 3036 or 3642, you will need to use the vertical conversion kit, which includes the extra panels needed. You will also need to provide a field fabricated mount for the unit.

The vertical plenum module includes a filter and a space for a hot water coil. If the unit is installed in an area where water may cause damage, be sure to set the unit inside a drain pan.

The return air opening for the vertical plenum module is in the front. If connecting to a flexible duct, you will need the return air adapter. The return air adapter attaches to the front of the return plenum module using latches, which need to be moved from the top to the sides (figure 8).



Typical Vertical System Layout

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Figure 8. UPC-104 Return Air Adapter Installation

Assembling the AHU for vertical up-flow

Position the base, either the vertical module or a field fabricated unit, where desired. Then set the cooling module on top of the base as shown in Figure 9. Use gasket tape under the cooling cabinet to prevent air leaks.

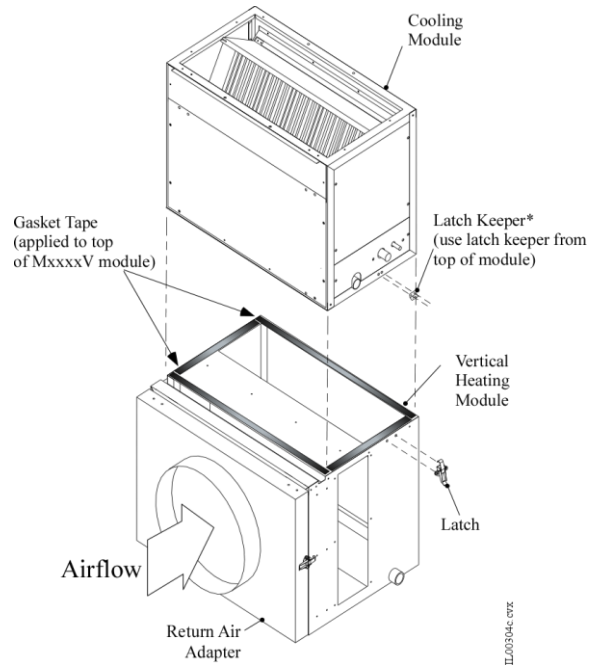


Figure 9. Installing the Cooling Module

Then set the spacer section on top of the coil, securing it with the corner brackets as shown in Figure 10. The blower module goes on top. The blower module can be turned 180 degrees to position the motor to the other side, or top position the blower discharge towards the front.

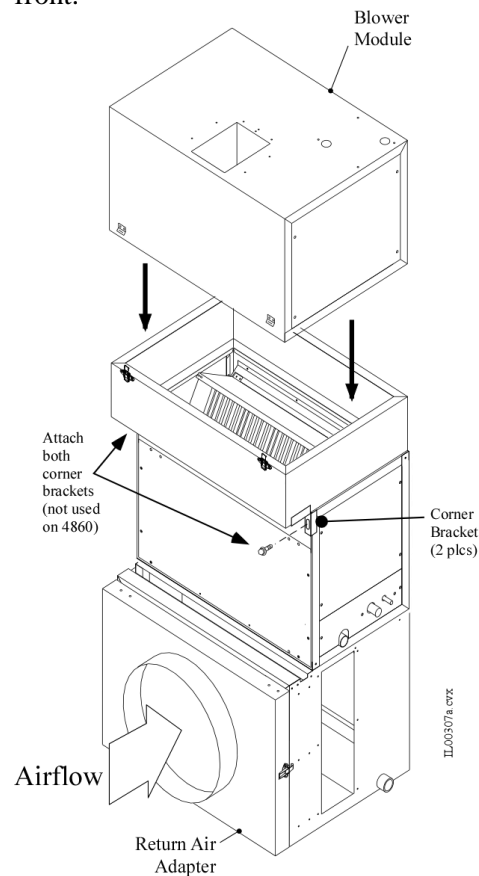


Figure 10. Installing the Blower Module

Heating-Only Systems For heating-only systems, the installation is similar to the cooling-only or heating-and-cooling system, except that the cooling module is removed from the system.

For the 2430, 3036 and 3642 systems, use a vertical spacer kit such that the spacer overhangs the back of the vertical plenum and the filter access is not covered over.

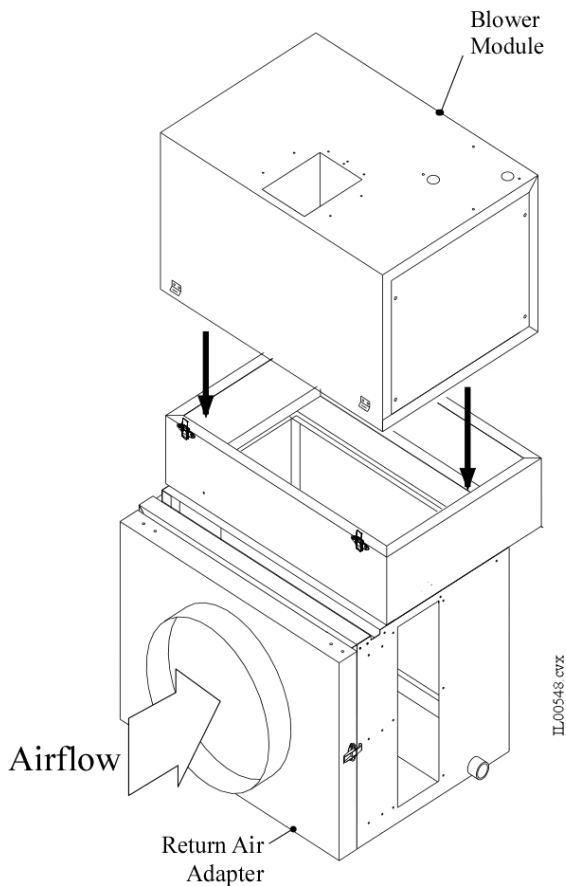


Figure 11. Heating-Only Vertical Modular System

Control Box Assembly.

The control box is shipped with the blower module. It can be installed on either the discharge side of the blower cabinet, on top, or on the bottom of the blower cabinet, depending on what is most convenient.

To install, first remove the two knockouts on the side or top of the cabinet, where it will be installed. Mount the control box using four (4) sheet metal screws as shown in Figure 12. Connect the wiring as required in the wiring section and Bulletin 30-039 for the SCB control box and Bulletin 30-037 for the ST control box.

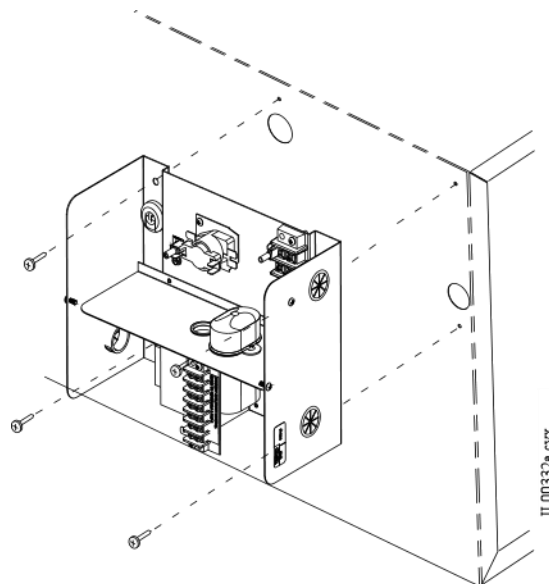


Figure 12. Control Box Mounting

Secondary Drain Pan Installation. Where an overflow of condensate could cause water damage, a secondary drain pan **MUST BE INSTALLED**. Place the drain pan on the mounting base, platform or angle iron support frame. Be sure to allow enough room for the drain line and connection (refer to Table 3). The assembled unit should be placed over the secondary drain pan supported by rails with rubber pads for isolation to raise the unit above the 1.5-inch (38mm) sides of the secondary drain pan.

Table 2 shows the secondary drain pans to be used for horizontally mounted modules. For vertical up-flow arrangements that use the cooling module, the 2-module drain pans can be used where space permits and the return air is entering from the side. These pans would be over-sized compared to the footprint of the cooling module. If a smaller drain pan is necessary, it should be fabricated to be at least 1-1/2-inch (12.7 mm) larger on each side of the bottom module.

For vertical down flow (counter flow) arrangements it is difficult to provide a secondary drain pan because of the blower discharge at the bottom. The secondary drain pan must be fabricated with an opening for the blower discharge and plenum adapter and still provide a sealed drain pan.

Table 2. Secondary Drain Pan Dimensions, in (mm)

| Unit Size | 2 Modules | | 3 Modules | |
|-----------|--------------|---------------------------|-----------|---------------------------|
| | Part No. UPC | Dimensions inches (mm) | Part No. | Dimensions inches (mm) |
| 1218 | 94 | 24† x 42 (610 x 1067) | | |
| 2430 | 20B | 29† x 31.25 (737 x 800) | UPC 20C | 29† x 43.75 (737 x 1060) |
| 3036 | 27B | 34† x 31.5 (864 x 800) | UPC-27C | 34† x 43.75 (864 x 1111) |
| 3642 | 24B | 42† x 31.5 (1067 x 800) | UPC 24C | 42† x 43.75 (1067 x 1111) |
| 4860 | 24C | 42† x 43.75 (1067 x 1111) | UPC-24D | 42† x 54 (1067 x 1372) |

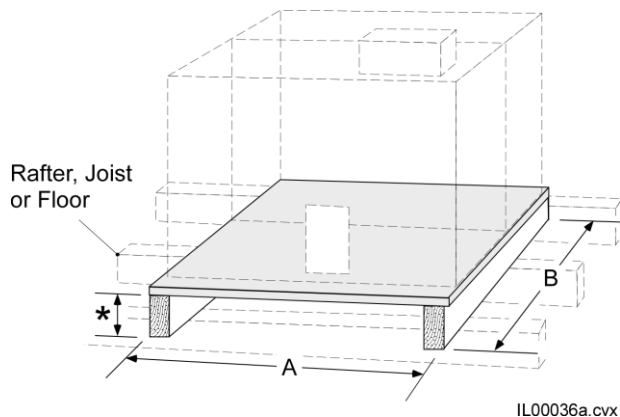
† NOTE — The drain fitting extends 7/8 inch (22 mm) beyond this dimension.

Like the modules, all the secondary drain pans except *UPC-24D* will fit through the return air opening. For these drain pans it will be necessary to fold the pans in order to pass through the return opening. If you are unable to use the *UPC-24D* because of space limitations, use the *UPC-24C* under the cooling and heating modules. In this case the blower module will extend beyond the secondary drain pan and should be supported with blocks or an angle iron frame.

MOUNTING

The modules come factory-ready for horizontal airflow applications and may be modified for vertical airflow arrangements (see Fig. 1) with the addition of the vertical heat module (with or without the heating coil) and the vertical spacer module.

Horizontal Platform Mounting. Mount the unit horizontally when vertical height is limited such as in an attic or crawl space. It is easiest to mount the unit on a platform but care must be taken to assure proper drain line pitch.



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All Dimensions in inches (mm)

| Dim | Model | 2430 | 3036 | 3642 | 4860 |
|-----|-----------|----------|---------|----------|------|
| A | | 27(690) | 32(810) | 40(1000) | |
| B | 2 Modules | 30(760) | | 42(1070) | |
| | 3 Modules | 42(1070) | | 50(1270) | |

Figure 13. Typical Platform Installation

The platform height must allow for proper pitch of the condensate drain lines — at least ¼ inch drop per lineal foot (20 mm per meter). The platform can be built from a sheet of ½ inch (13 mm) plywood and stud frame. Table 3 lists the maximum horizontal drain line run for various framing materials and still provide adequate drainage.

Table 3. Horizontal Distance of Drain Piping for Different Framing Materials

| Frame Lumber: | 2 x 4 | 2 x 6 | 2 x 8 | 2 x 10 |
|------------------------------|--------|--------|---------|---------|
| Max. Horizontal Run, ft. (m) | 18 (5) | 26 (8) | 34 (10) | 42 (13) |

The platform size must allow for the number of modules being used. For dimensions for minimum platform size see Figure 13.

Place secondary drain pan on platform and unit on top of isolation pads inside of secondary drain pan. Be sure that the unit is raised above the height of the drain pan side to allow duct connections.

Horizontal Suspended Mounting. The modules can also be suspended from the ceiling or rafters. A typical suspension method is shown in Fig. 14. Screw four (4) “J” hooks into rafters. Suspend four (4) chains from “J” hooks and attach eyebolts to chains. Secure angle iron to eyebolts and place secondary drain pan on top. Put isolation pads in drain pan, making sure unit sits above sides of drain pan.

CAUTION
Do not hang unit from top of unit cabinet as this could distort unit.

As an alternative, rest the unit on the angle iron supports and hang the secondary drain pan from the same supports. As stated above, install “J” hooks, chains, and angle iron. Secure angle iron to eyebolts and put isolation padding on angle iron.

Adjust the length of the eyebolts and chains so there is slight pitch towards the drain end.

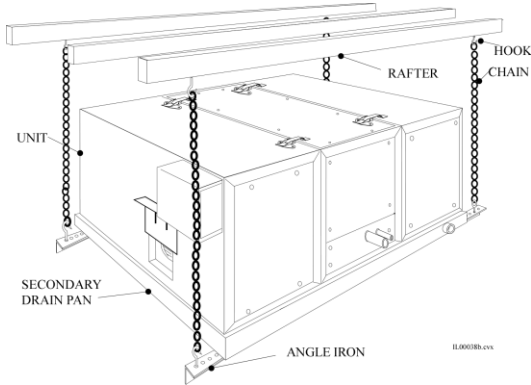


Figure 14. Typical Suspended Mounting

Vertical Mounting. Because the units are top heavy, it is not recommended to suspend a vertical unit. It should be mounted on either a platform or a floor. Unico makes a module specifically for vertical installations (refer to previous section). If only a blower and heating module are being installed, fabricate a return plenum for the unit to sit upon.

Although the modules may be assembled without a spacer module, this can severely restrict the airflow; especially if the blower needs to achieve its maximum airflow. Therefore, always use the spacer module for any vertical configuration.

DUCT CONNECTIONS

Supply Plenum (main duct). The main duct (or plenum) can be round, square or rectangular, provided it meets the pressure drop requirements of the application. Adapters are available for the standard sizes for both round and square ducts.

| | | Model, UPC-61- | | | |
|-------------------------|---|----------------|------------|------------|-------------|
| | | 2430 | 3036 | 3642 | 4860 |
| Dimension, inch (mm) | A | 6 (152) | 7.16 (182) | 7.16 (182) | 10.13 (257) |
| | B | 6.38 (162) | | | |
| | D | 7 (178) | 9 (229) | 9 (229) | 10 (254) |
| | L | 12 (305) | 18 (457) | | |

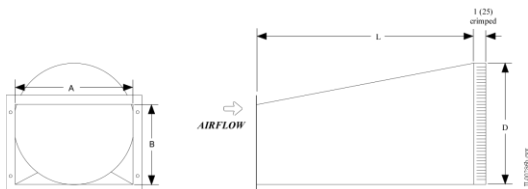


Figure 15. Round Supply Plenum Adapter Dimensions

| Part No. | A, inch (mm) |
|-------------|--------------|
| UPC-62-2430 | 8.50 (216) |
| UPC-62-3036 | 10.50 (267) |
| UPC-62-3642 | 10.50 (267) |
| UPC-62-4860 | 11.50 (292) |

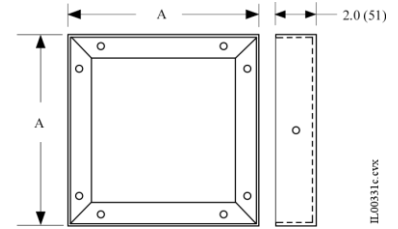


Figure 16. Square Supply Plenum Adapters

To attach the plenum adapter, first install the restrictor plate (for ST only). Then install the adapter with eight (8) sheet metal screws as shown in Fig. 17. Sheet metal screws for installing both are provided with the blower.

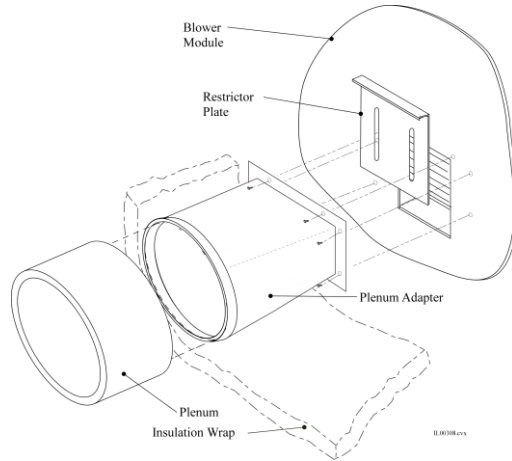


Figure 17. Supply Plenum Adapter Installation

Restrictor Plate (ST). The single speed (non-ECM) blower includes a restrictor plate to fine-tune the airflow. The purpose of the restrictor plate is to eliminate objectionable outlet noise because the blower is delivering more air than required. In some cases where the maximum airflow is required, the restrictor may be omitted.

The restrictor plate is used to set the system airflow. The full open position corresponds to the highest airflow the installed duct system will allow (figure 18). Set the restrictor plate to the full open position and measure the system airflow. The required system airflow is 200-250 CFM per nominal ton (27-34 L/s per nominal kW). Measure the motor amperage and use this to ensure the 200-250 CFM per nominal ton (27-34 L/s per nominal kW) has been achieved. If elevated sound levels are noticed at the outlets with more than 250 CFM per nominal ton (34 L/s per nominal kW), the airflow may be reduced with the restrictor plate. Always measure the system airflow by the motor amperage (see Table 4). Refer to the airflow-amperage charts provided with the blower.

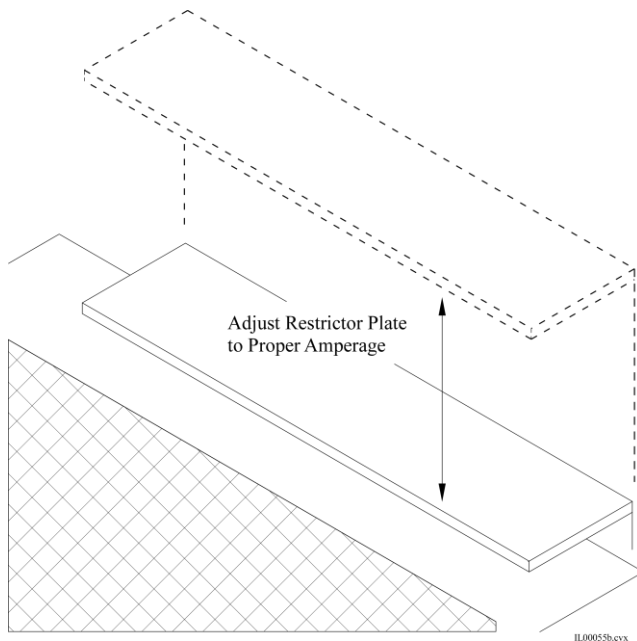


Figure 18. Restrictor Setting

Note: Do not use restrictor plate to adjust plenum static pressure. Adjust the restrictor to the proper amperage. This will assure proper airflow.

Table 4. Approximate Amperages at Given Airflows (for single speed blowers only)

| Unit Size | Airflow, CFM (L/s) | MxxxxB Amps @230V †* |
|--------------|--------------------|----------------------|
| 4860 | 1250 (590) | 4.1 |
| | 1000 (470) | 3.5 |
| | 800 (380) | 3.1 |
| 3036 3642 | 1000 (470) | 3.9 |
| | 900 (420) | 3.6 |
| | 800 (380) | 3.2 |
| | 700 (330) | 3.0 |
| 2430 | 600 (280) | 2.8 |
| | 500 (240) | 2.2 |
| | 400 (190) | 1.8 |

* multiply by 1.1 if 208V

† for more exact airflow use the chart included with the blower or see Bulletin 20-040.

Attach main duct. Attach the plenum to the adapter by inserting it over the supply adapter. If using sheet metal duct, use three (3) or four (4) equally spaced sheet metal screws or nails to secure the duct to the supply adapter. Then tape around the seam with UL 181A aluminum tape. Then wrap the outside of the plenum adapter with the supplied blanket insulation and secure the insulation seams with UL 181A tape.

Return Air Duct. Unico supplies a return duct system but any return duct system is acceptable provided the pressure loss does not exceed 0.15 inches of water (37 Pa), including filters. The return duct should have at least one 90° bend between the unit and filter box to reduce sound transmission directly from the unit.

The Unico Return Duct system has a single return that includes the return air box with filter, the return duct, and the return air adapter (refer to Fig. 3). Multiple returns or extra-long returns are possible so long as the maximum pressure loss is not exceeded. For vertical installations or tight spaces it may be necessary to fabricate a return duct system from duct board or lined metal.

The typical return duct is 10-foot (3 m) in length so it may have to be cut to avoid bunching if the distance to the unit is significantly less than 100-inches. The minimum length should be 7-feet (2 m). When given a choice, the shorter distances should be avoided as this may increase sound transmission from the unit.

Cut an opening for the return box as specified in Table 1. For the 2430, 3036 and 3642 if the joists or studs are on 16-inch (410mm) centers, there is no need to build a frame to hold the return air box. Otherwise, it will be necessary to construct a frame around the opening. For the 4860 return, it will almost always be necessary to cut and header at least one joist.

Center the return air box so the filter frame flange covers all the gaps and make sure the flange is flush against the wall or ceiling. Install the return air box against the frame using nails or screws.

Screw holes are provided in the return air box. Use the holes nearest the corners. The other holes are for mounting the filter grille. See Fig. 19.

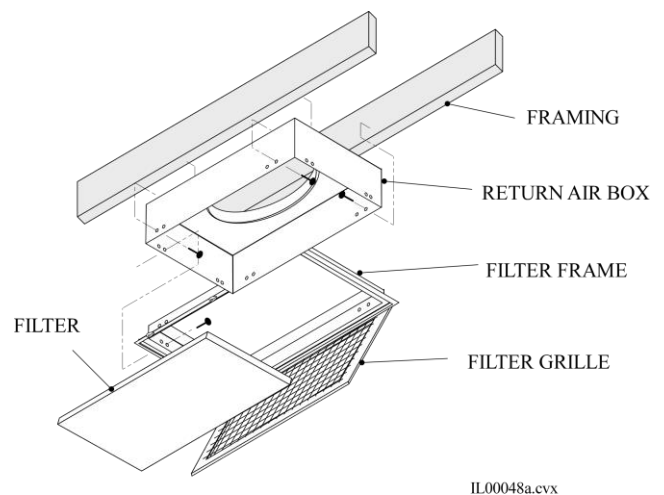


Figure 19. Return Air Box and Filter

Install filter frame into the return air box using four nails or screws. Use the holes furthest from the corners. Insert filter and hold in place by rotating metal clips. Close grille and secure with clips.

Refer to Table 5 for correct Return Duct Adapter selection. Attach the proper return duct adapter to either the Heating or Cooling Module. Then attach the return duct to the adapter and to the return air box using the Q-bands and Q-clips.

The return air adapter ships with an insulation blanket that must be wrapped around the adapter. Tape the seams with UL 181A aluminum tape.

Table 5. Return Duct Adapter

| Unit Size | Blower Module + | |
|-----------|-----------------|---------------------------------|
| | Cooling Module | Heating Module + Cooling Module |
| 4860 | UPC-59-4860 | UPC-104-4860 |
| 3642 | UPC-59-3642 | UPC-104-3642 |
| 3036 | UPC-59-3036 | UPC-104-3036 |
| 2430 | UPC-59-2430 | UPC-104-2430 |

Multiple Returns. If more than one return is desired, Unico has designed a return plenum (MR) module. The MR module is available in three sizes: 2430, 3036, and 3642/4860, and it includes a central filter. The MR module is easily fitted to the air handling unit and multiple return openings may be cut in the top back or sides of the box. Refer to *Bulletin 20-20.6, Return Plenum Module*, for additional information.

PIPING

All piping must be in accordance with all local codes and ordinances.

Condensate Lines. The primary drain pan condensate connection is a 3/4-inch (19mm) female pipe thread fitting, and the secondary drain pan connection is a 3/4-inch (19mm) PVC socket fitting.

- Elevate the unit so the condensate lines are pitched at least 1/4-inch per lineal foot (20 mm per meter).
- Trap the condensate line near the unit using U-trap A00924-G05 as shown in Figure 20.
- If located in a high humidity area, above 50°F (10°C) dew point, insulate the condensate line to prevent water condensation on the outside of the pipe.
- In cold climates, protect the trap from freezing in the winter.
- Do not trap the secondary drain line and do not terminate connect to the primary drain line.

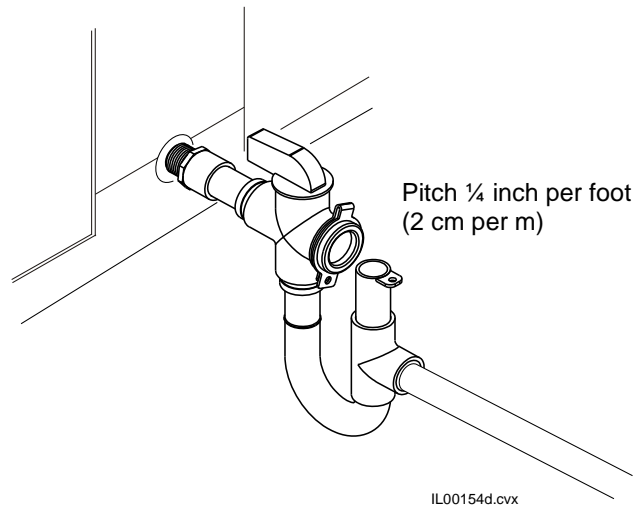


Figure 20. Typical Condensate Trap

The standard trap that ships with the cooling coil includes a float switch to shut off the system if the drain is plugged up.

Run secondary drain line so that any drainage will be immediately known without causing damage to property. A typical location is to terminate the secondary drain line above a windowsill so that the drainage splashes on the window. This will serve as an indicator that there is a problem with the primary drain. In cases where a secondary drain line cannot be run, add a float switch or a micro switch with a paper fuse.

Refrigerant Connections. All refrigerant coils have two refrigerant lines: a liquid line (small tube) and a vapor line (large tube). The connections are either sweat or flare as listed in table 6, depending on what type of outdoor unit the cooling module is matched to.

Table 6. Refrigerant Line and Connection Size

| Outdoor unit | Liquid line | Vapor line |
|--------------|------------------|------------------|
| Standard | 3/8 (9.5 mm) | 7/8 (22 mm) |
| 1 or 2-stage | ODF sweat | ODF sweat |
| “iSeries” | 1/4 Flare (2430) | 1/2 Flare (2430) |
| Var.-stage | 3/8 Flare (3036) | 5/8 Flare (3036) |

Refer to the condensing unit manufacturer’s instruction for proper line sizing information based on distance from condenser.

For 1 and 2-stage outdoor units (non-iSERIES), install a liquid line filter drier as close to the coil module as possible to protect the evaporator from foreign object debris. For attic installations or when using long line sets, an optional moisture indicating sight glass should also be installed between the filter-drier and expansion valve, near the indoor unit.

Use the following steps when connecting the refrigerant lines:

STEP 1. RELEASE THE NITROGEN HOLDING CHARGE.

All refrigerant coils are shipped from our factory pressurized with nitrogen. They do not contain any refrigerant.

WARNING
To prevent injury to eyes, face away from the Schrader valve when releasing nitrogen gas.

The refrigerant coils are equipped with a Schrader valve port to relieve the pressure and for factory testing purposes. It can also be used to check for leaks prior to installation. Unscrew the Schrader cap and press the depressor.

Note: If there is no nitrogen pressure present, the coil may have developed a leak during shipment and should be returned to the point of purchase for exchange.

If pressure is present, then go ahead and finish releasing the pressure in the coil by continuing to press on the depressor.

WARNING
To prevent injury, remove all pressure from coil before removing connection end caps.

STEP 2. REMOVE THE CAPS.

When all the pressure is removed the suction line connections end off if the coil has brazed caps (Figure 21), or use two wrenches to remove the flare caps if flare caps are present.



Figure 21. Cut end of connection as shown.

CAUTION

When brazing, purge with nitrogen gas to prevent the formation of oxides.

Use two wrenches to remove the nut from distributor (figure 22) to install the TXV or, if an iSeries, to connect the liquid line. This can be done prior to connecting the modules together as shown. If modules are connected already, then remove the two side access panels to reach the nut.



Figure 22. Remove Nut

STEP 3. INSTALL THE TXV (SKIP IF ISERIES).

Expansion Valve Installation (not for iSeries). All refrigerant coils, *except for the iSeries cooling coil*, require a thermostatic expansion valve (TXV). For coils requiring a TXV, an R-410A valve is shipped loose with the cooling module and must be installed prior to charging. The iSeries expansion valve is in the outdoor unit already installed so the liquid line should be installed directly to the distributor prior to charging.

CAUTION

iSeries ONLY: To prevent equipment damage, DO NOT install an expansion valve inside the indoor unit. It is located in the outdoor unit.

Always use new Teflon seals (part no. A00809-001) when connecting the threaded fittings. Table 7 below lists the compatible valves for each coil.

Table 7. Expansion Valve model numbers

| Coil Model | Nominal Condenser Size | Valve Part Number | | Nom. Valve Size |
|------------------|---------------------------------|-------------------|------------|-----------------|
| | | R-22 | R-410a | |
| 2430-B 2430-E | 1.5 to 2.5-ton (5.2 to 9 kW) | A00805-002 | A00808-013 | 2 |
| 3036-B 3036-E | 2.5 to 3-ton (9 to 10 kW) | A00805-004 | A00808-014 | 3 |
| 3642-B 3642-E | 3 to 4 ton (10 to 14 kW) | A00805-004 | A00808-014 | 3 |
| 4860-B 4860-E | 4 to 5 ton (14 to 17 kW) | A00805-005 | A00808-015 | 4 |

* Refer to AHRI directory to heat pump coil compatibility.

1. Install the white Teflon o-ring in both connections of the TXV (figure 23). Attach and tighten lower connecting nut to the distributor as shown in Figure 23. On iSERIES, connect liquid line directly to the distributor (Figure 26).

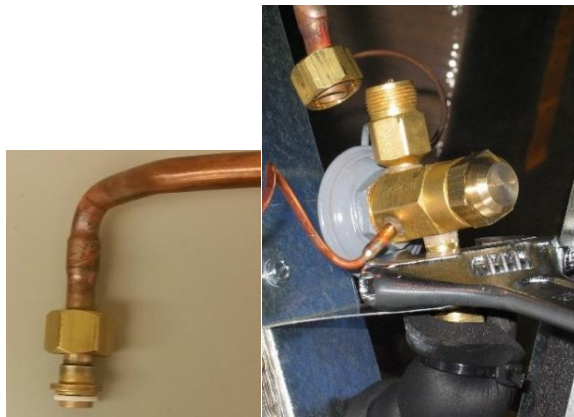


Figure 23. Install White Teflon O-ring in both connections (not on iSeries). Attach and tighten lower connecting nut

2. Connect the outlet to the 3/8" (9.5 mm) OD copper refrigerant fitting. Make sure the threaded fitting is tight (Figure 24).



Figure 24. Attach and tighten upper connecting nut (B/E coils)

3. Route both the external equalizer pressure tube and the thermostatic bulb tube (figure 25). Then tighten the external equalizer line to the flare connection (figure 26).



Figure 25. External equalizer line and thermostatic bulb line location routing

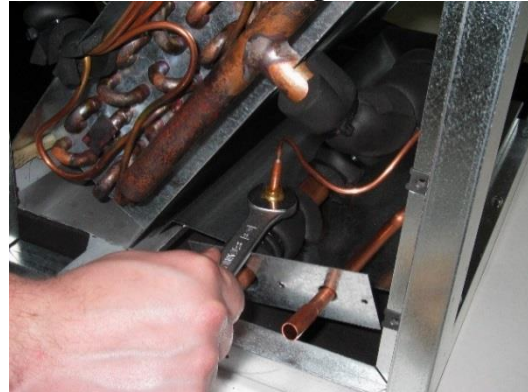


Figure 26. Tighten Pressure Tube Nut

4. Locate the bulb on a horizontal straight section of the suction line (Figure 27). Attach the bulb to the tubing with clamp provided and wrap with two pieces of cork tape (Figure 28). For satisfactory expansion valve control, good thermal contact between the bulb and the suction line is essential.



Figure 27. Thermal Measuring Bulb Placed on Copper Tube.

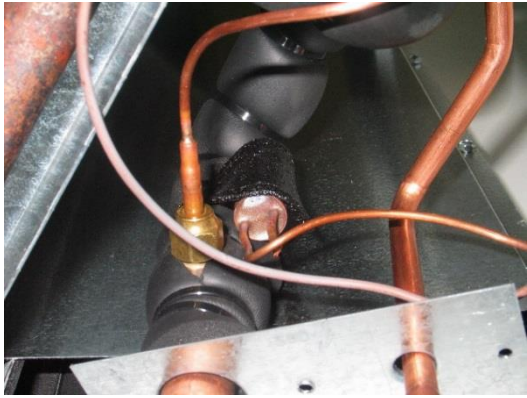
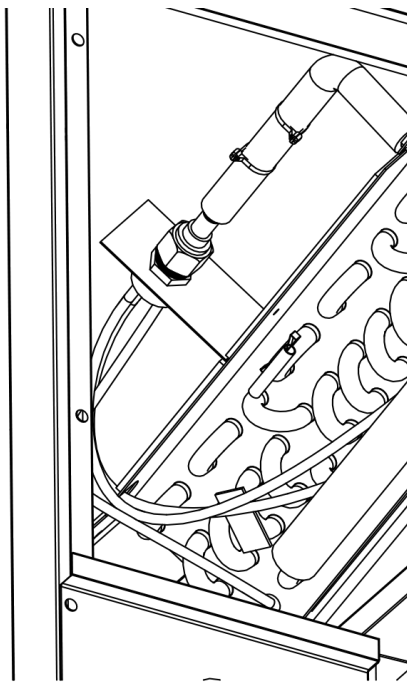


Figure 28. Bulb Secure Clamp and Cork Tape

- After all lines have been connected, pressure check the connections by charging the system with 150 psig of dry nitrogen and check for leaks at all connections.

STEP 4 CONNECT SMALL TUBE (ISERIES ONLY)

For the iSeries coil, connect the small tube directory to the distributor, where the TXV would normally be located (figure 29).



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Figure 29. Attach and tighten connection nut straight to distributor (Iseries coils only)

STEP 5. CONNECT THE LINE SET.

Braze the line sets to the copper stubs or connect to the flare. If brazing, use a nitrogen purge and protect the expansion valve by wrapping it with a wet cloth. For threaded flare fittings, use 1 or 2 drops of refrigerant oil on the flare (not on the threads) and tighten per the torque specified in the iSeries manual.

Water Coil Connections. If you are installing the hot water coil, remove the side coil access panel and cut away the insulation. Slide the coil into the cabinet and secure with brackets supplied with the hot water coil. Install the access panel after the coil is in place.

All water connections are 7/8-inch (22mm) sweat OD connections. Sweat the water connections, then fill the system. Bleed the air from the coil by backing off the screw inside the bleed valve for venting (Fig. 30).

If unit is in an unconditioned space below freezing, care must be taken not to freeze the water in the coil. The best method is to use a glycol-water antifreeze solution with a freezing point below the coldest temperature expected.

After venting the chilled water coil, replace the access panel and seal around the connections with the rubber gasket provided.

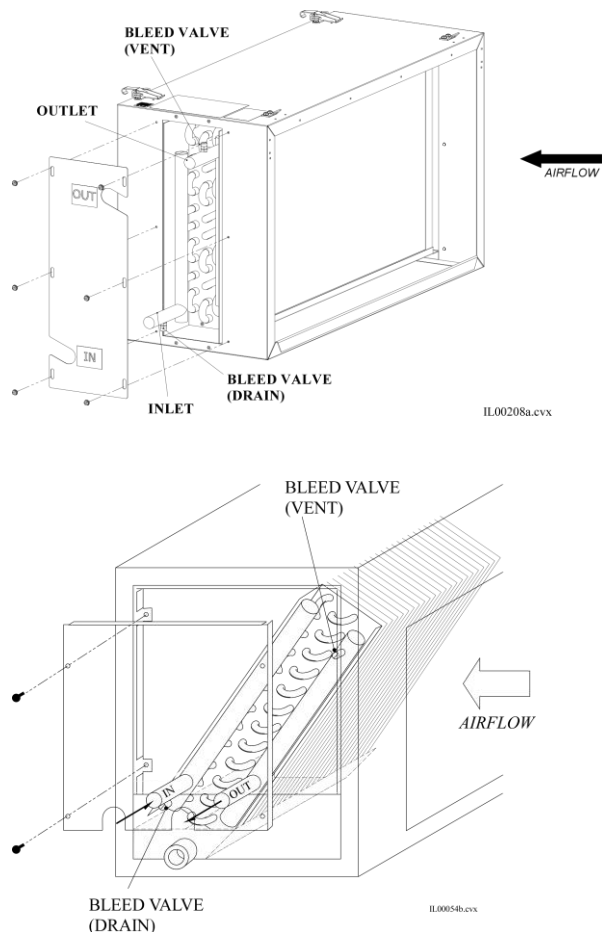


Figure 30. Water Coil Connections

Coil Cleaning. The coil should be sprayed with liquid detergent, or any commercially available evaporator cleaner solution, thoroughly and rinsed thoroughly before installation to assure proper drainage of condensate from the coil. This will eliminate moisture carry-over and assure maximum coil performance. As an alternate to cleaning, allow approximately 50 hours of break-in time to achieve the same results.

WIRING

WARNING!

**DISCONNECT ELECTRICAL SUPPLY
BEFORE WIRING UNIT TO PREVENT
INJURY OR DEATH FROM ELECTRICAL
SHOCK.**

All electrical wiring must comply with local codes and ordinances. Blower module controls and components are bonded for grounding to meet safety standards UL Standard 1995 and CAN/CSA-C22.2 No. 236 and are listed by ETL. All 50 Hz units are CE marked and conform to the Low Voltage 73/23/EEC and EMC 89/336/EEC Directives.

The control wiring, sequence of operation, and troubleshooting are included in a separate bulletin for each control box.

Table 8. Control Box Manuals

| Blower Model | Control Box Manual |
|--------------|--------------------|
| M-----ST2 | Bulletin 30-037 |
| M-----EC- | Bulletin 30-032 |

CHECKING AIR FLOW**CAUTION**

Do not operate blower with free discharge or low static pressures (below 1-inch w.c. (250 Pa)) to prevent motor from overloading.

After the system is installed and before charging system, check for proper airflow. Record the position of the restrictor plate, the plenum static pressure, and the motor amperage (standard units only). With this information, the amount of airflow can be determined.

As a recommended further check on airflow, use a velometer to measure the airflow from each outlet. The most convenient instrument to use is a hand held vane type velocity meter that fits directly over the outlet. The Turbo-Meter (Davis Instruments Catalog No. DS105I07) or equivalent meter will give a direct LED readout on the Knots (FPM x 100) setting, when multiplied by 2 gives the CFM of the outlet within an accuracy of 10%. (Multiply 'knots' by 0.94 to obtain L/s.) Refer to Technote 113 for more information.

By measuring and totaling the airflow of all outlets, the total airflow of the system can be closely approximated and provide a crosscheck for the airflow determined from the motor amperage using the airflow-amperage table that is shipped with the Blower module. Use Table 9 to correct the airflow.

Note: These tables are for the specific motor installed in each blower module. Be sure the table used applies to the correct model number that is shown on the table.

Check Static Pressure Airflow should be verified using the amps listed on the yellow label on the ST2 blower and from the control board for the EC blower. If the air flow is low, it is because of a restriction. Check static pressure to find the restriction and correct.

Measure the external static pressure (see the following section) in the supply plenum at least two feet (610 mm) from the unit and verify that it is within the allowable range.

It is not necessary to measure the return duct static pressure unless it was field fabricated. The maximum return static pressure (including filters) should be 0.15 inches of water (37 Pa). If it is greater than 0.15 inches of water column, subtract the extra return system pressure drop from the supply plenum static pressure to get the total static pressure drop.

For example: If the supply static pressure is measured to be 1.6 inches w.c. and the return system pressure drop is 0.25 inches w.c, the total static pressure drop as shown on the blower curve is: $1.6 - 0.10 = 1.50$. In this case the static pressure is too high.

If the restrictor plate (standard units only) is not positioned according to Table 4, the static pressure reading is not an effective indicator of airflow although it should still be recorded. In this case, measuring motor amperage is the only reliable indicator.

Check Outlet Airflow. Measure and record the air flow from each outlet with a TurboMeter (refer to *Tech Note 113, How to Measure Outlet Airflow*, for more information). Place the TurboMeter against each outlet, centered as best possible and record the "knots". Multiply the knots by 2 to obtain CFM, then sum all the outlets. The sum is the total airflow; this can be compared to the outlet indicated by the amperage. A significant difference could indicate duct leakage.

Table 9. Airflow Troubleshooting Chart

| Problem | Probable Cause | Remedy |
|---------------------------|--|---|
| Low Static, Low Amperage | Restrictor set too low. Blocked filters, restriction in return duct. Low Voltage. Blower Wheel not aligned properly. Dirty blower wheel. | Open restrictor to table 4 setting. Clear restriction. Check with local utility. Center wheel inside of inlet ring. Position on shaft for 1/8 inch (3 mm) clearance from inlet ring. Clean wheel. |
| Low static, high amperage | Large number of outlets. Restrictor setting to high. | Close restrictor to proper amperage, or Add balancing orifices to outlets. Close restrictor to obtain proper amperage. |
| High Static, Low Amperage | Restrictive duct system. | Add outlets, add splitter vane in tee, reduce the number of tees and elbows in plenum, increase plenum size to 9" equivalent, or Open restrictor to proper amperage. |

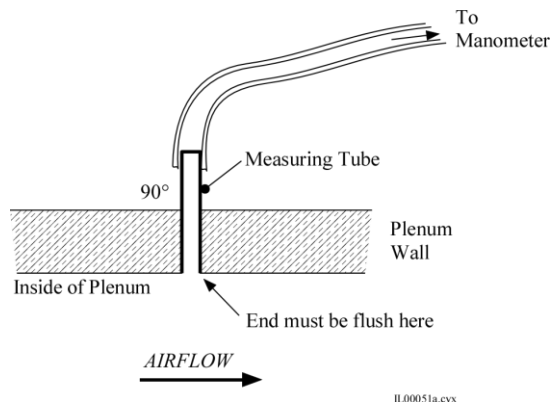
How to Measure Static Pressure. Measure the supply plenum static pressure at least 18-inches (457mm) from the unit, but before any tee or elbow. A distance of between 2 and 3-feet (0.6 to 0.9m) is best. Use an inclined manometer capable of reading at least 2.5 inches of water column (622 Pa), such as Dwyer Instrument's model 109 manometer. Be sure to zero the scale and level the manometer.

A magnehelic gauge that measures up to at least 2.5 inches of water may also be used.

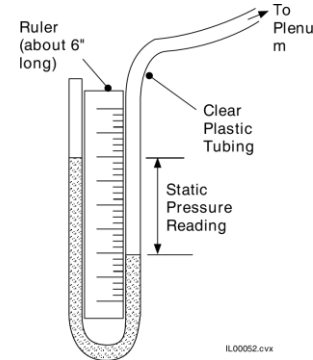
Use a metal tube, typically ¼-inch (6mm) diameter, to measure the static pressure. Determine where you want it and cut or punch a small hole in the duct. Make the hole the same size as the metal tube to prevent leakage. Insert the metal tube 1-inch (25mm) so that the tip of the tube is flush to inside wall of the duct and perpendicular to the air stream as shown in Fig. 40.

Attach the metal tube to the manometer using a rubber hose (usually supplied with the manometer). Record the pressure.

Note: If the tube is not perpendicular to the air stream, the reading will be in error. You will get a higher reading if the tube is angled toward the air stream.

**Figure 31. Measuring Plenum Static Pressure**

In the absence of a manometer you can build a simple but less accurate manometer in one of two ways. One way is to use a short piece of ruler or yardstick and clear plastic tubing as shown in Fig. 41.

**Figure 32. U-Tube Manometer**

CHARGING THE SYSTEM

DO NOT VENT REFRIGERANT TO THE ATMOSPHERE!! It is a violation of federal law and in some cases local ordinances also. Always use a refrigerant recovery or recycling device.

If charging a heat pump, refer to *Bulletin 30-024, Instructions for "M" Series Modular Heat Pump Systems*. The following procedure is only valid for charging the system during the cooling mode.

To check for proper charge record the refrigerant pressures and temperatures. Check the refrigerant charge by measuring the amount of sub-cooling (or 'approach' temperature for some condensing units). If the outdoor manufacturer does not have sub-cooling or "approach" temperature charts, then be sure that the sub-cooling is at least between 3 and 8 °F (2 to 5°C). For long refrigerant lines or when the evaporator is above the condenser, the sub-cooling should be close to 8°F; otherwise, aim for the low end of the range.

After the refrigerant lines and evaporator have been carefully leak tested and evacuated, release the R410A operating charge in the condensing unit. The system is now ready for refrigerant charge adjustment. If the coil is equipped with a threaded TXV, always verify that the threads are tight and do not leak.

Start up the system and check line voltage to assure it is within acceptable limits for the system as dictated by the condensing unit manufacturer. Run the system for 20 to 30 minutes to get reasonably stabilized conditions. Do not attempt to adjust charge with outdoor temperature below 75°F (24°C). An outdoor temperature of 75 to 85°F (24 to 29°C) is preferred.

If the system charge must be checked when the outdoor temperature is below 80°F (26.7°C), block the condenser coil until the head pressure is approximately equal to what its charging chart specifies for an 85°F (29°C) day.

For heat pumps always check the charge in cooling mode. If this is not possible because of low outdoor temperatures, charge the system in the heating mode, but return later when the weather is warmer before the system is switched to cooling.

Sub-cooling Method. Many condensing unit manufacturers publish the amount of sub-cooling that the condenser will produce. Follow their instructions to charge the unit. Typical sub-cooling values will be between 3 and 8°F (2 to 5°C). The unit should ALWAYS have some amount of sub-cooling. To be sure there is enough sub-cooling, especially if the unit is in a hot attic, check the liquid line sight glass near the evaporator for bubbles or measure the refrigerant liquid line pressure and temperature AT THE EVAPORATOR.

To measure sub-cooling use the following procedure:

1. Measure and record the liquid line pressure using an accurate refrigerant gauge. Record the corresponding saturation temperature for this pressure (see Table 10).
2. Measure and record the liquid line temperature using an accurate metal or glass thermometer, or thermocouple. Tape or strap the sensor firmly against the surface of the liquid line and cover with insulation.
3. Determine the sub-cooling with the following equation:

$$\begin{array}{r} \textit{Saturated Temperature} \\ - \textit{Liquid Line Temperature} \\ = \textit{Subcooling} \end{array}$$

If the sub-cooling temperature at the condenser is low, the system is undercharged and refrigerant must be added.

CAUTION
TO PREVENT DAMAGE TO THE COMPRESSOR, DO NOT ADD LIQUID CHARGE INTO SUCTION PORT.

If it is high, the system is overcharged and some refrigerant must be removed and collected in an empty refrigerant container. **DO NOT RELEASE REFRIGERANT INTO THE ATMOSPHERE.**

In some cases, such as in a hot attic, the liquid line will pick up heat and lose its sub-cooling. This will be apparent if the sub-cooling at the evaporator is low. In these cases, the liquid line should be insulated or strapped to the suction line and both insulated. The same problem can occur for long refrigerant lines; in this case, increase the size of the liquid line to reduce the pressure drop.

CAUTION
TO MAINTAIN PROPER HEAT PUMP OPERATION, DO NOT STRAP THE LIQUID AND SUCTION LINES TOGETHER FOR HEAT PUMP SYSTEMS.

Superheat Method Do not charge the system based on superheat. Superheat measurements should only be used to verify that the expansion valve is working properly. If it is more than expected please refer to the *Technote* on troubleshooting expansion valves.

The superheat should be between 8 to 12°F (4 to 7°C) at the indoor coil. In some cases, particularly for the larger capacity match-ups (i.e. 3 ton and 5 ton), a superheat of 15 to 18°F (8 to 10°C) is satisfactory. It is not uncommon to measure a superheat above 20 to 25°F (11 to 14°C) at the condensing unit.

Be aware that the superheat value is also dependent on the outdoor air temperature. At lower air temperatures the superheat will be higher than at higher air temperatures. If the condenser ambient temperature is between 75 and 85°F (24 to 29°C), superheat should be approximately 10 to 12°F (5 to 7°C). If the outdoor temperature is between 85 and 105°F (29 to 40°C), superheat should be approximately 8 to 10°F (4 to 5°C).

To measure the superheat, use the following:

1. Measure and record the suction pressure at the evaporator outlet using an accurate refrigerant gauge. If this is not possible, measure the pressure at the service port on the suction valve fitting at the condensing unit and add the estimated pressure loss in the suction line between the condensing unit and evaporator. Record the corresponding saturation temperature for this pressure (see Table 10).
2. Measure the suction line temperature at the evaporator outlet using an accurate metal or glass thermometer, or thermocouple. Insert the thermometer under the insulation on the suction line and tape firmly against the surface of the suction tube.
3. Determine the superheat with the following equation:

$$\frac{\text{Suction Line Temperature} - \text{Saturated Temperature}}{\text{Superheat}}$$

Charging by Gauge Pressures It is not possible to charge the system by gauge pressures. Gauge pressure should only be used to verify the system is working properly.

The Unico System will show a lower suction pressure during the cooling mode than a conventional system. Generally, it will be 10 to 15 psi (70 to 100 kPa) less. For example, a normal suction pressure for the Unico System will be about 114 psig (786 kPa) with an 85 to 95°F (29 to 35°C) outdoor temperature. Expect lower pressures when the outdoor temperatures are lower.

The head pressures should be similar to a conventional system when in the cooling mode.

Table 10. R410A Saturation Pressure - Temperature

| °F | psig | °C | kPa (gauge) |
|-----|------|-----|-------------|
| 0 | 48.4 | -18 | 334 |
| 2 | 51.1 | -17 | 352 |
| 4 | 53.8 | -16 | 371 |
| 6 | 56.6 | -14 | 390 |
| 8 | 59.4 | -13 | 410 |
| 10 | 62.4 | -12 | 430 |
| 12 | 65.4 | -11 | 451 |
| 14 | 68.6 | -10 | 473 |
| 16 | 71.8 | -9 | 495 |
| 18 | 75.1 | -8 | 518 |
| 20 | 78.5 | -7 | 541 |
| 22 | 82.1 | -6 | 566 |
| 24 | 85.7 | -4 | 591 |
| 26 | 89.4 | -3 | 616 |
| 28 | 93.2 | -2 | 643 |
| 30 | 97.2 | -1 | 670 |
| 32 | 101 | 0 | 696 |
| 34 | 105 | 1 | 724 |
| 36 | 110 | 2 | 758 |
| 38 | 114 | 3 | 786 |
| 40 | 119 | 4 | 820 |
| 42 | 123 | 6 | 848 |
| 44 | 128 | 7 | 883 |
| 46 | 133 | 8 | 917 |
| 48 | 138 | 9 | 951 |
| 50 | 143 | 10 | 986 |
| 55 | 156 | 13 | 1076 |
| 60 | 170 | 16 | 1172 |
| . | . | . | . |
| . | . | . | . |
| . | . | . | . |
| 90 | 274 | 32 | 1889 |
| 95 | 295 | 35 | 2034 |
| 100 | 317 | 38 | 2186 |
| 105 | 341 | 41 | 2351 |
| 110 | 365 | 43 | 2517 |
| 115 | 391 | 46 | 2696 |
| 120 | 418 | 49 | 2882 |
| 125 | 447 | 52 | 3082 |
| 130 | 477 | 54 | 3289 |

Using a Low Ambient Control Kit.

Since the Unico System operates at colder coil temperatures (in cooling mode), an anti-frost switch is installed on the coil to prevent coil freeze-up. In certain instances, such as when the outdoor ambient temperature is low, the condensing unit will cycle on the anti-frost switch. This may reduce the cooling capacity at a time when the cooling load is still fairly high. To provide better control and comfort, install a *low ambient control* on the condensing unit. Typically, a low ambient control is necessary when operating the unit at outdoor temperatures below 80°F (26.6 °C), especially for a 5-ton nominal capacity system.

These controls come in different configurations such as the Hoffman Controls Corp. series 800AA-head pressure control. This control modulates the outdoor fan to maintain a minimum liquid line temperature. Other controls may cycle the fan on/off. In either case check with the condensing unit manufacturer to determine what controls are compatible with the condensing unit.

MAINTENANCE

When service is required to the motor or the wheel, the entire assembly may be removed as a unit (see figure 42). The blower assembly unit is accessible from the piping side of the unit. It is not necessary to disconnect any module or ducting.

To remove the motor and blower wheel assembly, loosen the six (6) screws fastening the motorized blower assembly to the blower housing. Twist the motorized blower assembly counter-clockwise (CCW) and pull the assembly away from the blower housing.

CAUTION

TO PREVENT DAMAGE TO THE WHEEL BALANCE, DO NOT GRAB THE ASSEMBLY BY THE WHEEL OR SET THE ASSEMBLY DOWN SUCH THAT THE WHEEL IS SUPPORTING THE ASSEMBLY. ALWAYS SET THE ASSEMBLY DOWN WITH THE WHEEL ON TOP.

Once the assembly is removed, the proper service may be performed. If the wheel is to be changed, it may simply be removed from the motor shaft by loosening the motor set screw and pulling the blower wheel off the motor shaft. If the motor is to be changed, first the blower wheel must be removed as mentioned above, and then the screws fastening the motor to the inlet ring must be removed.

To re-install the motorized blower assembly back into the blower housing, follow the steps mentioned above in reverse order. connection side of the unit. It is not necessary to access both sides of

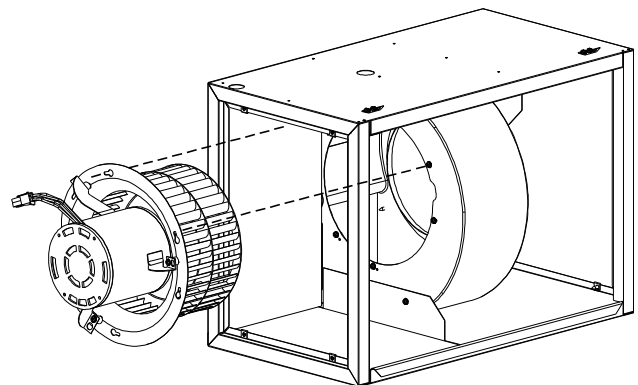
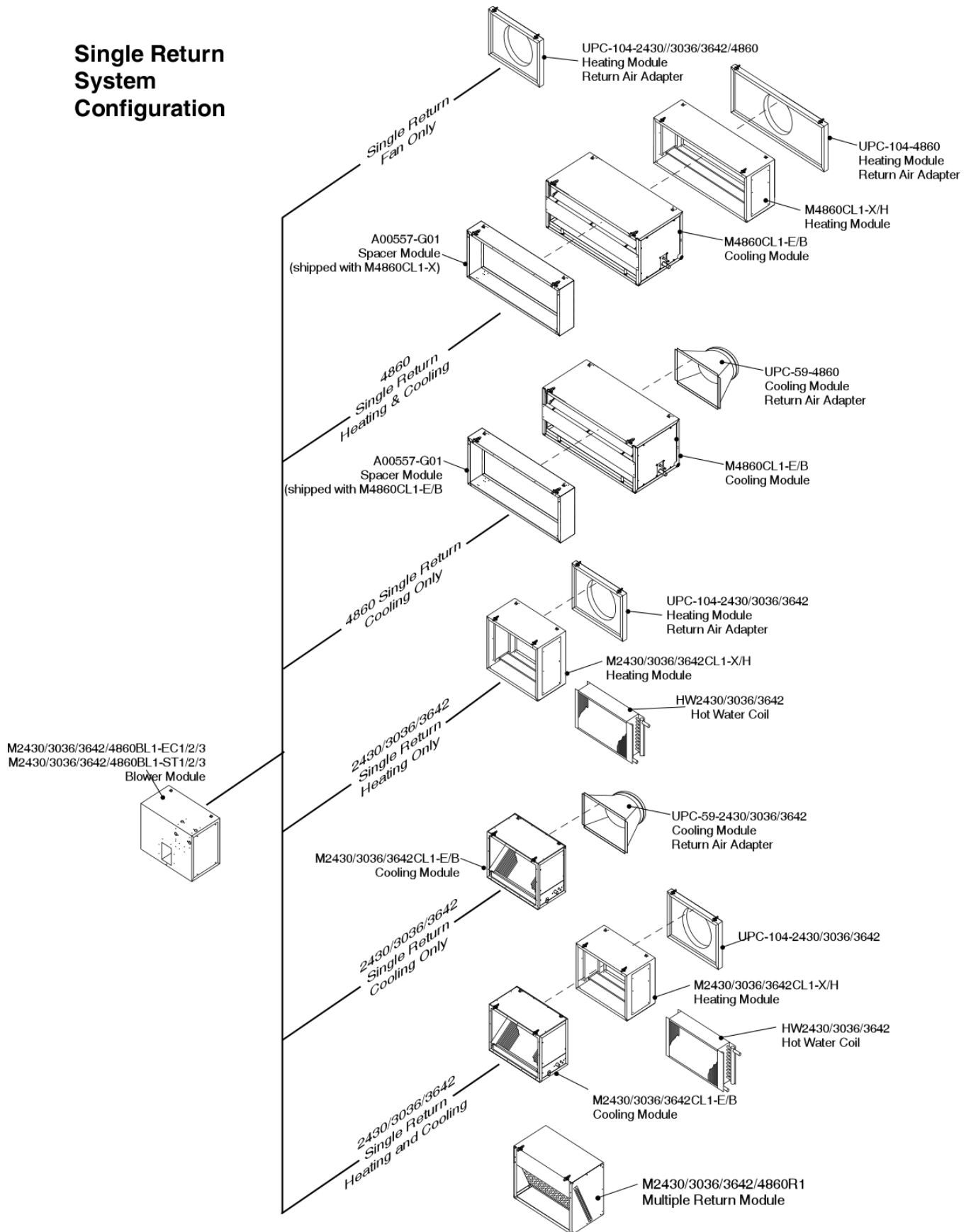


Figure 33. Removal of the Motorized Blower Assembly

Single Return System Configuration

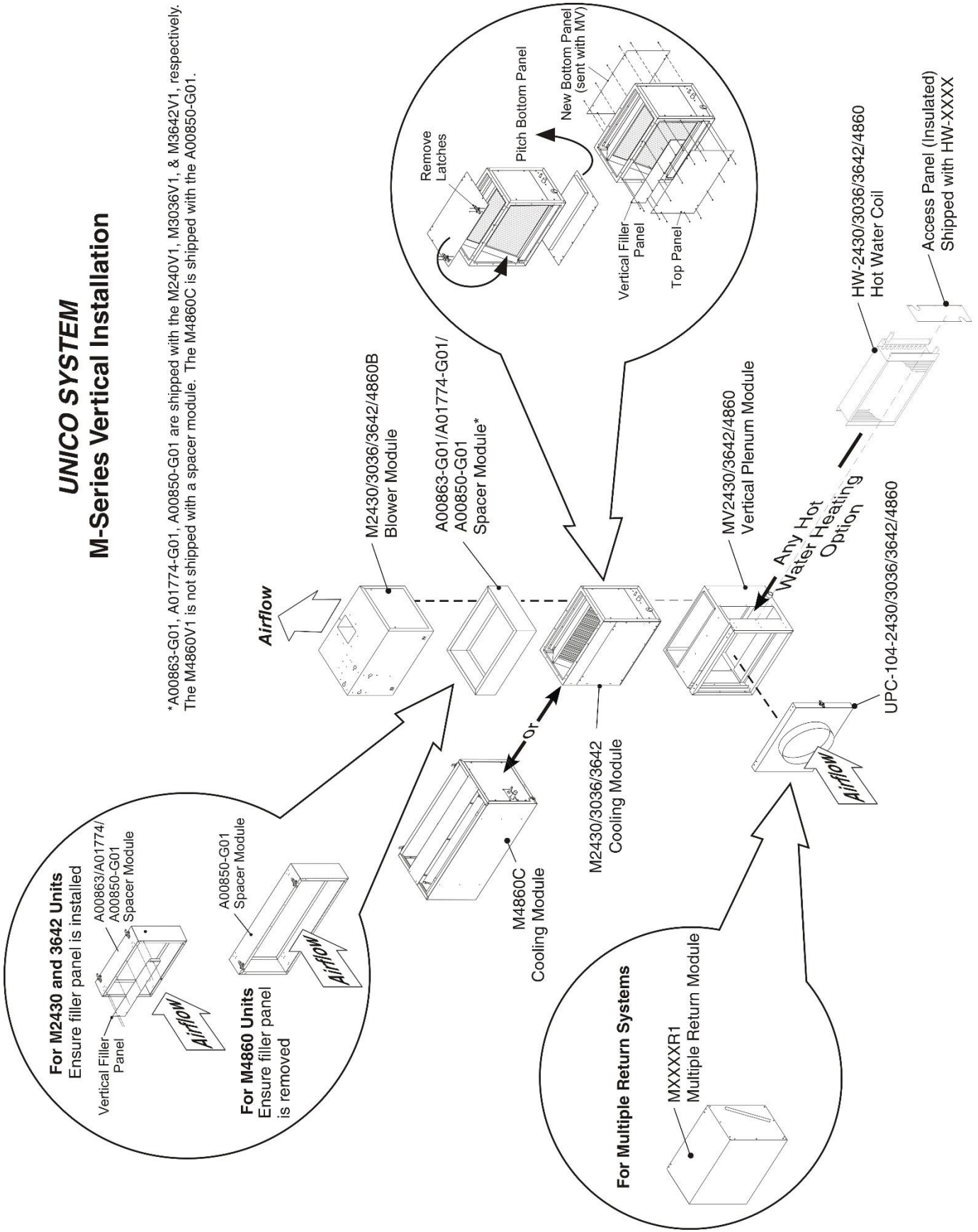


If using multiple returns replace single return adapter with the correct MXXXXR1 module, where xxxx stands for unit size.

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UNICO SYSTEM M-Series Vertical Installation

*A00863-G01, A01774-G01, A00850-G01 are shipped with the M240V1, M3036V1, & M3642V1, respectively. The M4860V1 is not shipped with a spacer module. The M4860C is shipped with the A00850-G01.



For M2430 and 3642 Units
Ensure filler panel is installed

Vertical Filler Panel
A00863/A01774/
A00850-G01
Spacer Module

For M4860 Units
Ensure filler panel is removed

A00850-G01
Spacer Module

M2430/3036/3642/4860B
Blower Module

A00863-G01/A01774-G01/
A00850-G01
Spacer Module*

M4860C
Cooling Module

M2430/3036/3642
Cooling Module

For Multiple Return Systems
MXXXXR1
Multiple Return Module

MV2430/3642/4860
Vertical Plenum Module

Any Hot
Water Heating
Option

HW-2430/3036/3642/4860
Hot Water Coil

UPC-104-2430/3036/3642/4860

Access Panel (Insulated)
Shipped with HW-XXXX