

iSERIES

The Unico System[®]

ISERIES VERTICAL AHU INSTALLATION MANUAL

BULLETIN 30-131.001

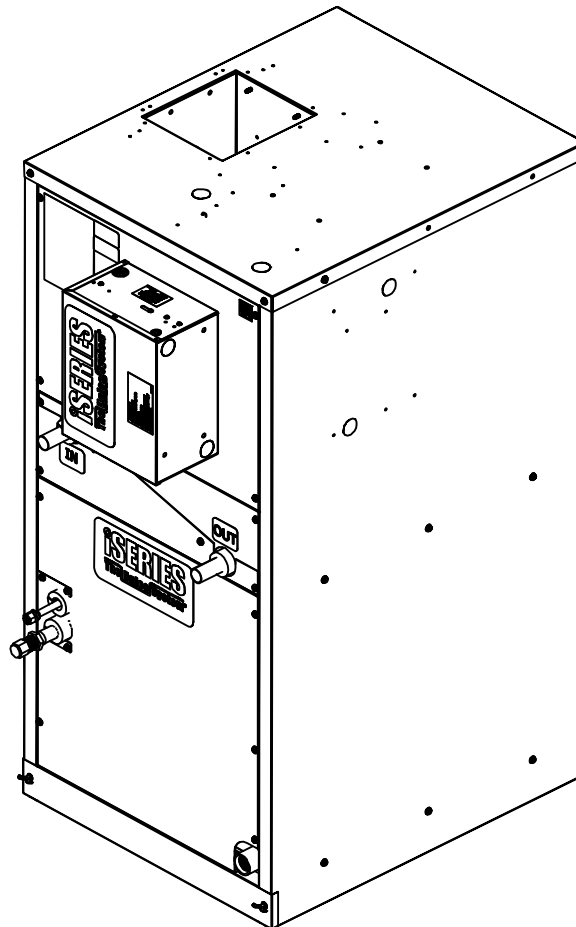


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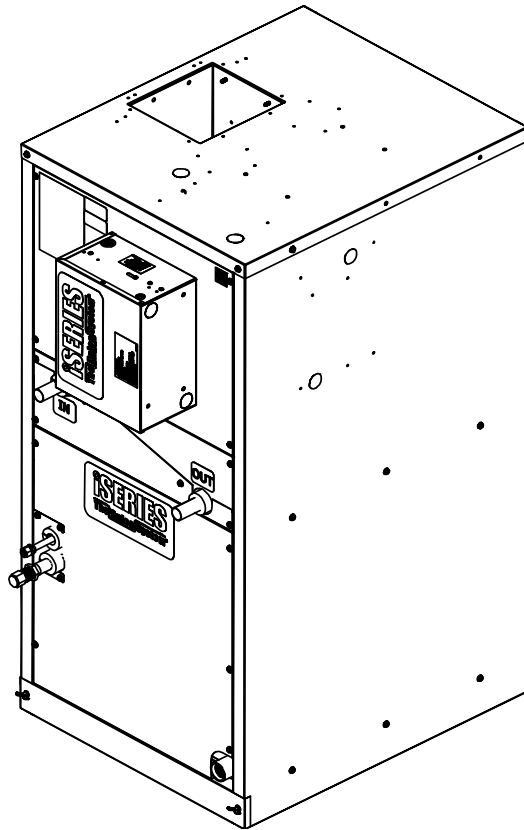
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Certified to UL Standard 1995
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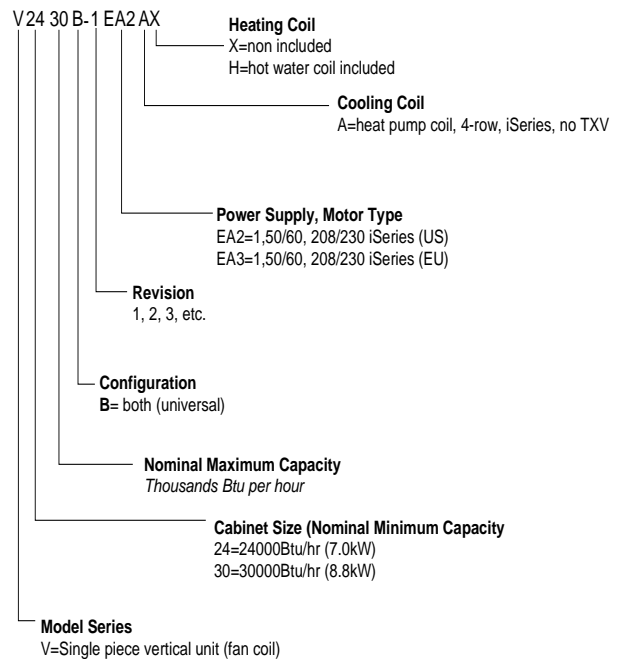


Unico products comply with the European regulations that guarantee product safety.

Installation Specifications



Model Number Key



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.

Scope. These instructions apply to the Unico V2430 and V3036 iSERIES Vertical Air Handler Unit. The Unico iSERIES vertical air handler unit (V-AHU) is a single packaged unit. The cooling and heating coils are contained within the same cabinet. The unit is mounted in a vertical-upflow configuration. The coils can be combined as a heating-only, cooling-only, or heating and cooling fan coil unit (see Figure 1).

The iSERIES vertical unit is available in two sizes: 2430 and 3036. The heating only system includes the blower/motor and a hot water coil. The cooling only system includes the blower/motor and a cooling coil. For the heating and cooling system both coils are provided. The cooling coil is a heat pump coil (A-Style).

All insulated *Unico System* Vertical air handlers feature closed-cell insulation for improved sound attenuation. There is no exposed insulation.

The Unico System is a complete indoor comfort system that includes an indoor fan coil unit and small duct system. The fan coil unit 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 two-inch diameter ducts as a stream of air that entrains and mixes with the room air. This process of aspiration produces a more even temperature distribution in the room than a conventional system.

Installation instructions for the air distribution system are covered in other bulletins. Before beginning any installation, a detailed system layout must be done in accordance with *Bulletin 40-40 System Sizing and Layout bulletin*.

SUFFICIENT BUILDING INSULATION IS ESSENTIAL FOR THE MOST ECONOMICAL OPERATION

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 Fire Protection Association and Underwriters Laboratories applicable standards and 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.
- Condensate piping should be installed in accordance with governing code.
- Always install a secondary drain pan when an overflow of condensate could cause damage.

Options. An electric duct heater is another option that is available to add additional features or to simplify installation. Please refer to the latest Unico Catalog for information on this and other options.

Temperature Limitations

The fan coil unit will operate properly under normal air conditioning and heating temperature conditions. However, there is a possibility that ice could form inside the unit under unusual conditions.

For refrigerant systems, the anti-frost switch provides some protection against frosting. It is not complete protection however. To prevent coil frosting, avoid low return air temperature below 65°F, low airflow below 200 CFM/nominal ton, low outdoor temperatures below 65°F, and especially all of these together.

Special care must be made when using water coils. The hot water coil is affected by the refrigerant coil so it is very important to verify that the air temperature leaving the refrigerant coil is always greater than 32°F. If not, or if unsure, install an averaging air temperature thermostat on the front of the hot water coil to automatically shut down the system should the air entering the hot water coil fall below 35°F. The same must be done if bringing in fresh outside air that could be below freezing.

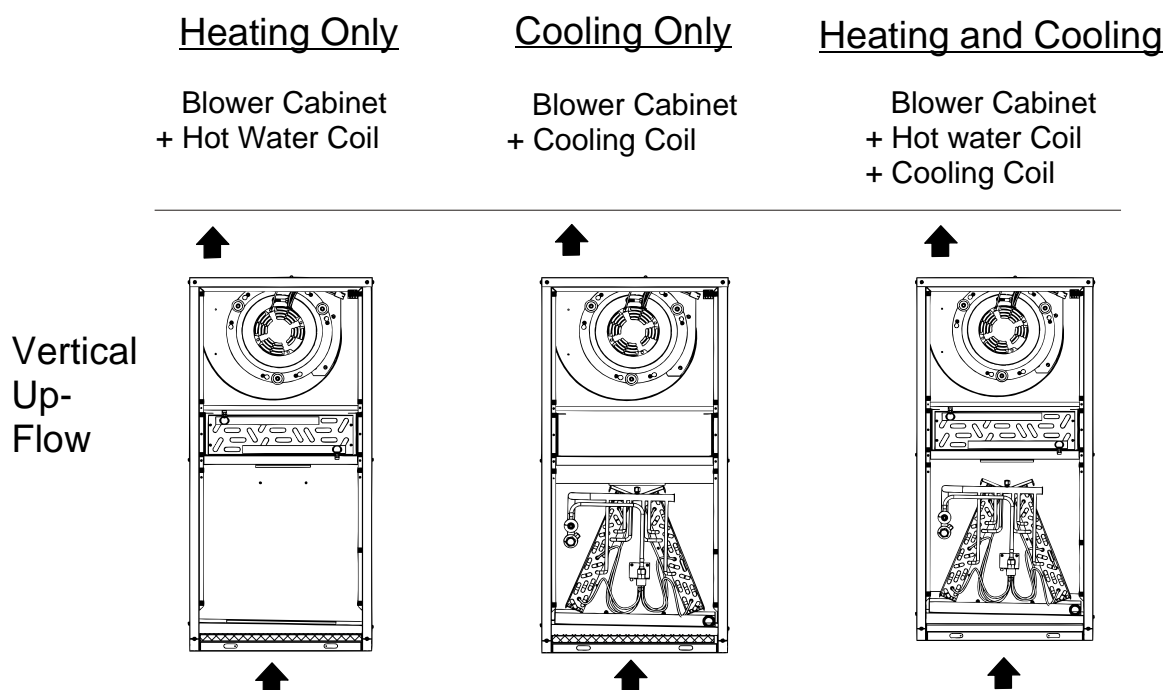
Unpacking

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

Lift up carton over the unit to reveal the unit. 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 a damaged condition. Remove the control box from its carton sent inside the Vertical AHU carton. There is no expansion valve shipped with iSERIES units.

MOUNTING

There is no assembly or mounting required. The unit comes factory ready for vertical airflow applications (see Figure 1).



IL00535b.cvx

Figure 1 Unit Arrangement

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 40-30, Component Layout*). The fully insulated cabinet allows installation with zero clearance to the top, bottom, or sides of the unit. However, clearance must be provided for servicing. All components are accessible from the front. Provide a minimum of 26 inches (660 mm) in the front. Servicing of the blower/motor assembly and coils can be performed by removing the access panels located in the front.

Each unit is designed to fit into a closet, basement or utility room (see Figure 2). The maximum width that is on the V3036 is 20" and the maximum height is 42" which will easily fit into the average size closet.

The airflow enters the bottom of the unit so either set the unit on the floor with a cutout to allow air from underneath, or set the unit on a plenum base (not provided by Unico).

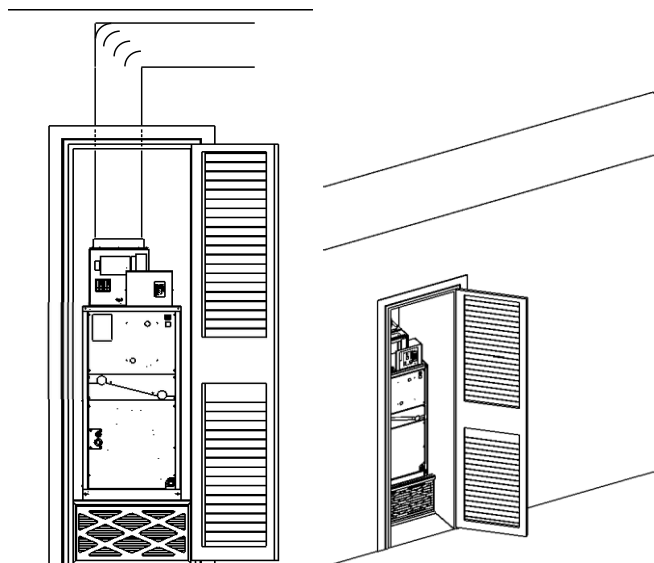


Figure 2 Typical closet installation with 'Wild' return

Secondary Drain Pan

Where an overflow of condensate could cause water damage, a secondary drain pan **MUST BE INSTALLED**. Place the drain pan under the entire unit, including any plenum base that may be installed. Be sure to allow enough room for the drain line and connection (refer to Table 1). The unit should be placed over the secondary drain pan. Use rubber pads for

Table 1 Secondary Drain Pan (field supplied)

Unit Size	Part No.	Dimensions inches (mm)
V2430	N/A	22 x 22 (560 x 560)
V3036	N/A	22 x 26 (560 x 660)

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

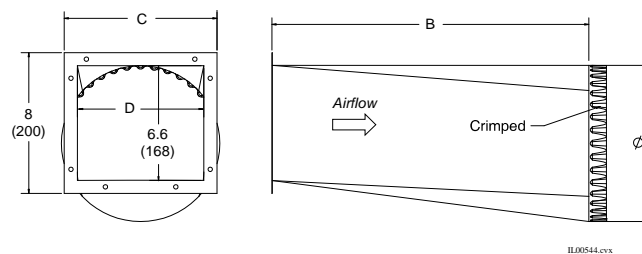
isolation to raise the unit high enough in the secondary drain pan for the drain line to clear the side.

DUCT CONNECTION

Supply Plenum

The unit must have a plenum attached to the blower discharge. The plenum can be most any type of duct, provided it is the correct size and is insulated. The EC motor is variable speed so no restrictor plate is required. The supply duct attaches to the air handler with a supply adapter (sold separately). There are two adapters: one for square plenum and one for round. These are listed in the table below. The electric furnace, if used, includes its own supply adapter. Refer to the electric furnace installation manual for more information.

The adapter for round supply duct is a crimped metal duct transition as shown in Figure 3.



Model	Part No.	A	B	C	D
V2430	UPC-61-2430	7 (178)	12 (300)	7.5 (190)	6.0 (152)
V3036	UPC-61-3036	9 (228)	18 (450)	8.5 (215)	7.2 (183)

Figure 3 Supply plenum adapter, round metal duct

The square adapter is typically used with fiberglass ductboard but can be used with any square duct. The standard square adapter is designed for 1-inch (25 mm) thick ductboard. Use the R6 adapter if using 1.5 inch (38 mm) thick ductboard. The ductboard plenum should be made to fit snugly inside the adapter. See Figure 4 for standard sizes for the square adapter.

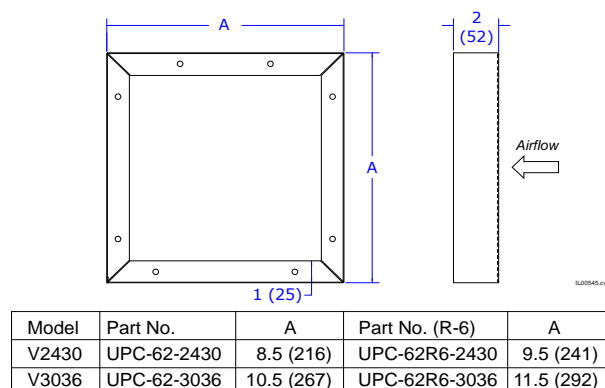


Figure 4 Supply plenum adapter, square duct

To attach the plenum adapter to the unit, align the holes on the adapter with the holes located around the supply outlet on the unit. Mount the adapter with eight (8) sheet metal screws.

For metal duct, attach the plenum to the adapter by inserting it over the collar. Use three (3) or four (4) equally spaced sheet metal screws to secure the duct to the collar and then tape around the seam with UL 181A aluminum tape. Then wrap the 1-in fiberglass blanket duct insulation around the adapter and seal with UL 181A aluminum tape.

Other size plenum may be used provided it is similar in cross-sectional area. Refer to the design manual for alternate sizes.

Return Duct

The Unico return air system typically has a single return that includes the return air box with filter, the acoustical flex return duct, and the return air adapter. Multiple returns or extra-long returns are possible so long as the maximum pressure loss is not exceeded. The return system is designed for a maximum static pressure drop of 0.15 inches of water (37 Pa) including the filter. The return duct should have at least one 90 degree bend between the unit and filter box to reduce sound transmission directly from the unit.

The return air must always enter the unit from the bottom. Set the unit on a field fabricated duct (figure 5) or use a field supplied plenum base. If using a duct, be sure that the inside of the duct is insulated with acoustical insulation (typically duct liner). The minimum height of the plenum duct is shown in figure 5.

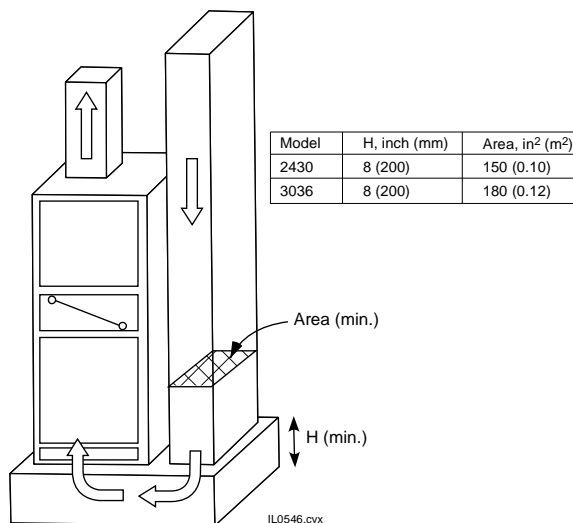


Figure 5 Minimum duct return

Although Unico only supplies a single return system, the return system can be redesigned for multiple returns. The return duct system is not high velocity. Therefore, the return system static pressure should not exceed 0.15 inches of water column. Generally, this means sizing the duct for a pressure loss of 0.05 inches of water column at the required airflow and sizing the filter for a pressure drop of 0.10 inches of water column at the required airflow.

It should also have some form of sound attenuation. Sound attenuation can be accomplished with fabricated duct board, lined sheet metal, or acoustical flex. For best attenuation, always have at least one 90 degree bend to eliminate direct line-of-site from the unit to the return opening.

AIR FILTRATION

The unit includes a 1 inch (25 mm) thick pleated filter (Table 2). You can remove this filter (Figure 6) and replace it with a 2" filter or install another filter elsewhere in the system. See figure 7 and table 3 for a plenum base concept and filter size.

Table 2 Unit Filter Size, 1 inch (25 mm)

Model	Filter Part No.	Dimensions, inch (mm)
2430	A00558-005	18 x 18 (457 x 457)
3036	A00558-008	18 x 22 (457 x 559)

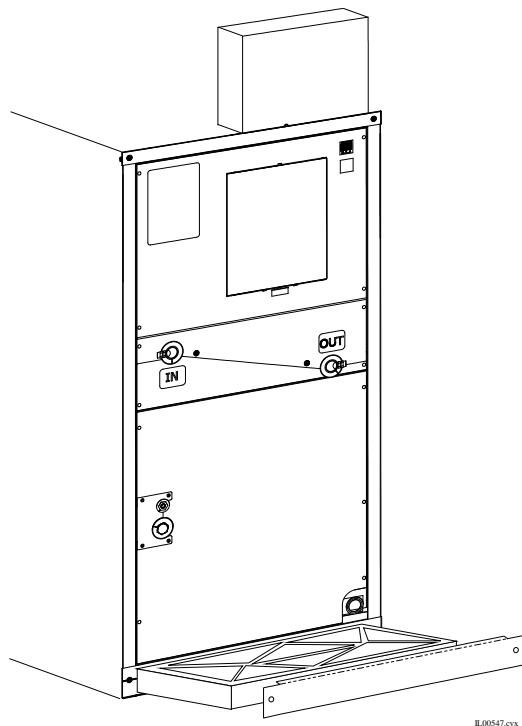


Figure 6 Air Filter Removal

PIPING

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

Condensate Lines

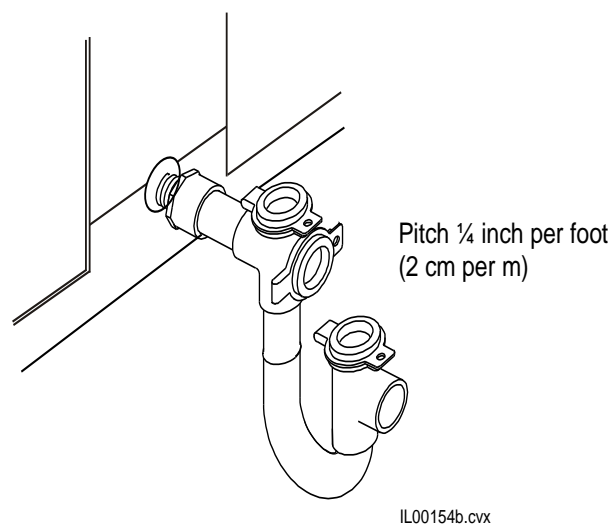


Figure 7 Typical Condensate Trap

The primary drain pan condensate connection is a 3/4 inch (19 mm) female pipe thread 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 as shown in Figure 8.

Sent with the Vertical AHU is the Unico Condensate U-Trap which features a clear trap that is easy to visually inspect for clogs. The U-Trap is designed for the *Unico System* with a 2.5 inch (64mm) deep trap to handle the higher static pressures. The U-Traps also feature easy to remove clean-out caps and incorporate tees to accommodate any piping arrangement (Part No. A00924-G05).

Refrigerant Connections

CAUTION: WHEN BRAZING, PURGE WITH NITROGEN GAS TO PREVENT THE FORMATION OF OXIDES.

The refrigerant lines are copper flare connections. The sizes are shown in Table 4. Refer to the condensing unit manufacturer's instruction for proper line sizing information based on distance from condenser. An iSERIES coil does not require a TX Valve. The liquid line connects directly to the distributor as shown in Figure 9.

Table 3 Liquid and Suction line size

Model Size	Liquid line	Vapor line
2430	1/4 Flare	1/2 Flare
3036	3/8 Flare	5/8 Flare

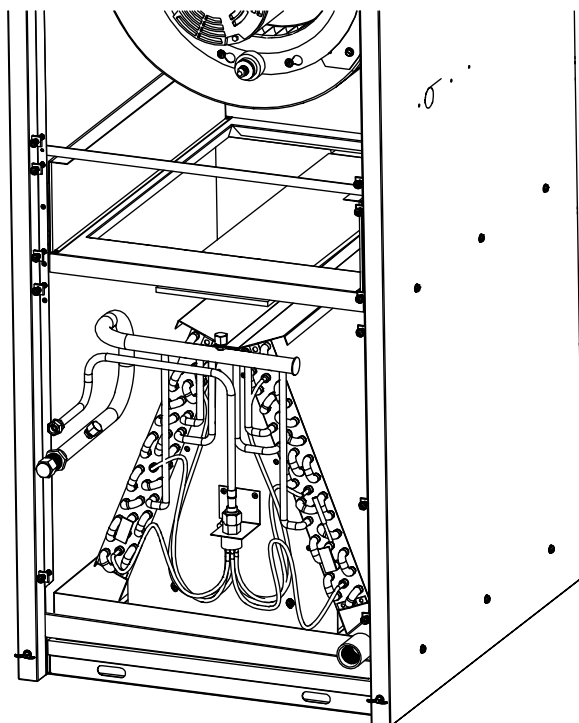


Figure 8 Liquid and Suction line piping.

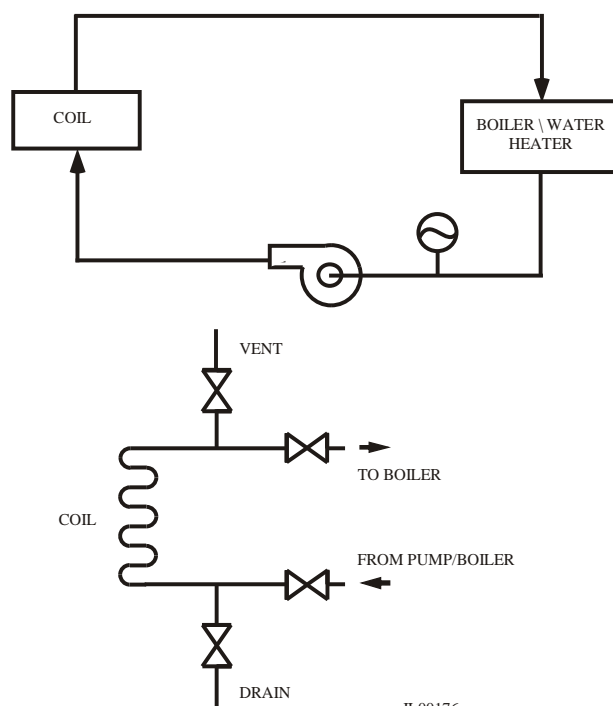


Figure 9 Water Piping Schematic

Water Connections

If you are installing the hot water coil, remove the side coil access panel. Slide the coil into the cabinet if not already installed at the factory and reinstall the door panel. After removing plugs in the inlet and outlet holes, caulk around connections to prevent leakage.

Pump and pipe sizing should be based on proper flow rate. Refer to Bulletin 30-121 for water coil capacities based on flow rate.

Sweat the water connections, then fill the system. Install a vent valve at the highest point and a drain valve at the lowest point of the water system (refer to Fig. 10). Fill and bleed the air from the system.

If unit is in an unconditioned space care must be taken to prevent the water from freezing. Use a glycol-water antifreeze solution with a freezing point below the coldest temperature expected.

As an alternate to an anti-freeze solution, the water can be continuously circulated to prevent freezing. If the coil will not be used for an extended period of time during cold temperatures, drain the system then flush with a glycol solution.

V-AHU INSTALLATION & CONTROL BOX WIRING.

WARNING!

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

The information below is a short guide to setting up your iSeries system. Refer to the *iSeries Installation Checklist* and *Bulletin 30-121* for more details. Disconnect power from the indoor unit before modifying any switch settings.

All electrical wiring must comply with all local codes and ordinances. Make electrical connection in accordance with the wiring diagram shown in Fig. 11. Refer to separate control box manual for additional wiring instructions.

1. **Connect liquid line.** SDHV units matched to iSeries outdoor units do not require a TXV at the indoor unit. Be sure to connect the liquid line to the distributor inside the cabinet of the cooling module (see figure 11).
2. **Connect Sensors.** Connect the Indoor Coil Temperature (ICT) and Return Air Temperature (RAT) sensors. The sensors are mounted to the coil at the factory and their wires must be routed into the control box. The plugs on the control board are labelled J15 (ICT 1) and J14 (RAT). Refer to the wiring schematic and board layout for location of connections.
3. **Connect the thermostat.** The SDHV fan coil unit is compatible with either an infrared (IR) remote thermostat (Available from Unico) or with a standard 24VAC thermostat (field supplied). Instructions for installation depend on which thermostat is being used.

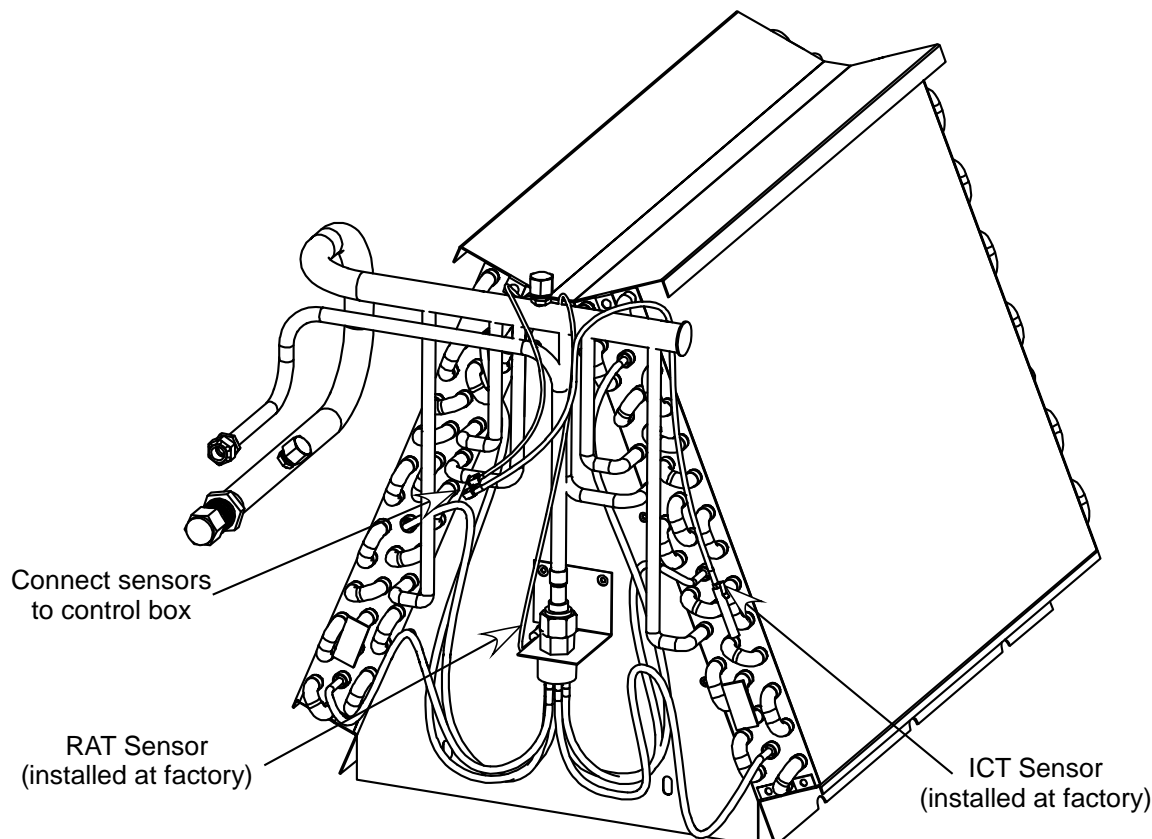


Figure 10 A01862-K01 iSERIES sensor kit

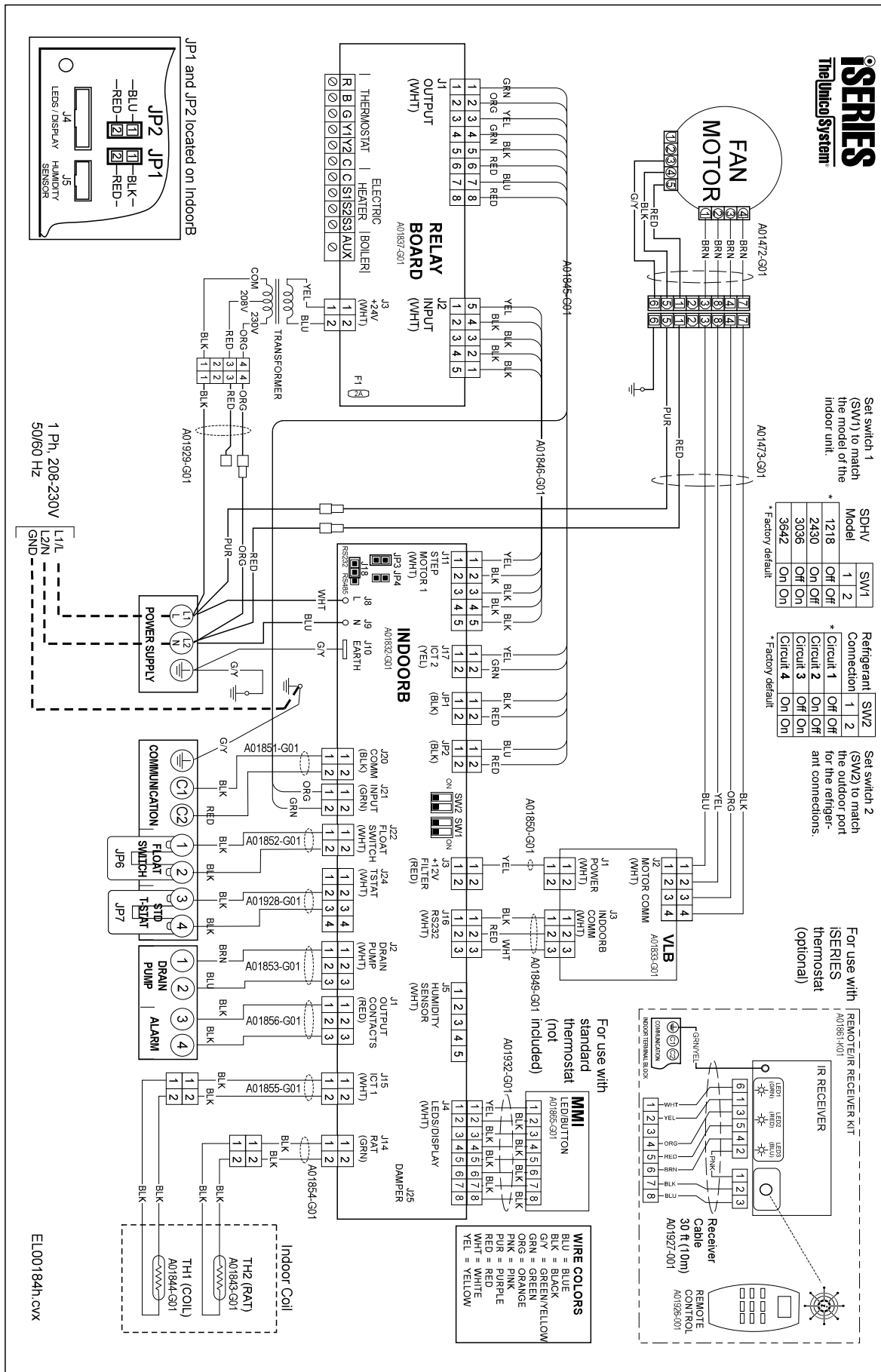


Figure 11 iSERIES Wiring Schematic

SEQUENCE OF OPERATION

The sequence of operation depends on the options installed and type of control thermostat used. Most thermostats have a fan AUTO-ON switch. When the fan switch is set to ON, the “G” input is closed and the blower relay is energized. The indoor blower starts after about a 30 second delay. The following paragraphs describe the sequence of operation when the fan is set to AUTO. If the fan switch is set to ON, the sequence is the same except the “G” circuit is always closed and the indoor fan is always operating, except in multisplit systems where one or more units is actively heating. In this case, fan-only operation is forbidden.

Cooling Cycle. When the thermostat calls for cooling, the “G” and “Y1” or G, Y1, and Y2 inputs are shorted at the iSeries control box Thermostat Board. The blower will ramp up after approximately 30 seconds. This signal is transmitted over serial communication to the outdoor unit (ODU), and the ODU begins its startup sequence. This sequence homes all of the EEVs, initiates a check of all systems sensors, and tests the compressor for proper current draw. This startup sequence lasts approximately 3 minutes. Once the startup check is complete, the compressor starts and ramps up to a fixed speed. If the outdoor coil temperature sensor (OCT) meets minimum temperature requirements, then the outdoor fan will also start. In cooler weather, the outdoor fan may not run. After running for approximately 2-3 minutes, the compressor will begin to modulate its speed. It will ramp up and down to meet the load. The position of the EEVs are also modulated as the system continues to operate in cooling. When the thermostat call is satisfied, the outdoor unit will pump down the indoor unit so that all refrigerant is returned to the ODU. The blower will continue to run for 60 seconds and then shut off.

All iSeries units are heat pumps so you must use a heat pump thermostat. Be sure to connect the B terminal. In cooling mode, any call for cooling will only energize the G and Y1 (low stage), or Y1 and Y2 (high stage). The B terminal is only energized in heating mode and the system does not use the O terminal.

Heating Cycle (Heat Pump). Setting the thermostat to HEATING will short the “B” input on the iSeries control box Thermostat Board. B alone will not engage heating. B+Y1 or B+Y2 (Y1 optional) is required to initiate a thermostat call.

When the thermostat calls for heating, the B, G, Y1 or B, G, Y1, and Y2 inputs are shorted at the iSeries control box Thermostat Board. This signal is transmitted over serial communication to the outdoor unit (ODU), and the ODU begins its startup sequence.

This sequence homes all of the EEVs, initiates a check of all systems sensors, and tests the compressor for proper current draw. This startup sequence lasts approximately 3 minutes. Once the startup check is complete, the compressor starts and ramps up to a fixed speed. If the outdoor coil temperature sensor (OCT) meets minimum temperature requirements, then the outdoor fan will also start. In cooler weather, the outdoor fan may not run. After running for approximately 2-3 minutes, the compressor will begin to modulate its speed. It will ramp up and down to meet the load. The position of the EEVs are also modulated as the system continues to operate in heating. The indoor blower will only start once the indoor coil has warmed up. This is normal and is a feature of the “cold blow prevention” algorithm. The blower will start at a low speed and will ramp up to its full airflow over a period of a few minutes while continuously checking the indoor coil temperature sensor (ICT). The ICT sensor must be 20°F above the return air temperature in order for the indoor blower to turn on and for the blower to remain at full airflow. This algorithm will also reduce blower speed if the indoor coil temperature drops below the 20°F threshold. If the system is not able to maintain the 20°F differential by ramping down the airflow, then the blower will turn off until the coil temperature increases.

In heating mode, hot gas flows to all indoor units. In multisplit systems, this means that Fan only operation is not allowed on units not calling for heating. Fan-only could cause overheating of the rooms and is thus prevented from occurring.

When the thermostat call is satisfied, the outdoor unit will pump down the indoor unit so that all refrigerant is returned to the ODU. The blower will continue to run for 60 seconds and then shut off.

Heating Cycle (Electric Heat). If the B+G+Y1 call does not satisfy the thermostat, the second stage thermostat calls for more heat (B+G+Y1+Y2). If this does not satisfy the call, and if the call has been present for at least 20 minutes, then the S1 relay on the thermostat board will close (24VAC). After 40 minutes of continuous call, S2 will also close. After 60 minutes of total call, S3 will also close. 20 minutes is the default Supplemental Heat Startup Delay (The time between the start of a heating call, and when S1 engages). 20 minutes is also the default Supplemental Heat Interval Delay (the time between S1 activating and S2 activating, and similarly between S2 and S3). These times are adjustable between 0 minutes and over 8 hours (See “Special Functions Menu” in Bulletin 30-121). Electric heat will not engage if there is insufficient airflow. This is to protect the heating elements from burning out. If the airflow in a system is less than the programmed Y2 airflow, no electric

heat relays will engage. In some systems where there is a restriction (e.g. insufficient number of outlets), Y2 airflow may not be achieved. In this case, electric heat will not engage, and the airflow restriction must be corrected before heat can be delivered.

Heating Cycle (Hydronic Heat). iSERIES systems allow for a hydronic coil to be installed downstream of the refrigerant coil to function as a supplement to the heating provided by the heat pump, or as the sole source of heat. If the intent is to use the hydronic coil to supplement the heat pump, use the control sequence described above in “Electric Heat”, and wire the boiler valve or pump as shown in the installation diagrams of Bulletin 30-121.

If the user wishes to stop heat pump operation at a certain outdoor temperature (the Auxiliary Heat Changeover Temperature (AHCT)), then a jumper must be installed at the indoor control box. See Bulletin 30-121 for installation instructions. Heating operation will occur as stated in the preceding two sections until the outdoor air temperature sensor (OAT) reaches the AHCT. At this point, the compressor will turn off and the AUX relay will close (24VAC). The system will continue to use the AUX relay on a call for heat until the OAT reaches 5°F above the AHCT. Additionally, compressor operation will be prevented, even if the OAT rises above the 5°F deadband if the Minimum Auxiliary Heat Enable Time (MAHET) has not elapsed. This feature prevents rapid cycling between compressor and boiler operation.

In both supplemental and auxiliary modes of operation, if a heating call is received and the OAT is within 18F of the AHCT setpoint, then the outdoor fan will run for 90s to verify the OAT reading. If the OAT sensor reads below the AHCT, then the system will engage the AUX relay and keep the compressor stopped.

Both the Minimum Auxiliary Heat Enable Time (MAHET) and the Auxiliary Heat Changeover Temperature (AHCT) are adjustable. See Bulletin 30-121 Special Functions Menu for details.

CHECKING AIRFLOW

CAUTION. DO NOT OPERATE BLOWER WITH FREE DISCHARGE OR LOW STATIC PRESSURES (BELOW 1 INCH WC (250 Pa)) TO PREVENT MOTOR FROM OVERLOADING.

After the system is installed and before charging system, check for proper airflow. To do this, count the blinks from LED 2 (Blue) on the Control Board, each blink is 100 CFM. A maximum of 40CFM per outlet is recommended for 2" supply outlets, or 50CFM for 2.5" round outlets. Less airflow per outlet will deliver

a quieter system. See Bulletin 20-054 for more information on airflow design.

As a recommended further check on airflow, use the Turbo-Meter (Davis Instruments Catalog No. DS105107) to measure the CFM from each outlet. This hand held vane type velocity meter that fits over the outlet is the most convenient instrument to use. The Turbo-Meter will give a direct LED readout on the KNOTS (FPM x 100) setting, when multiplied by a simple factor gives the CFM of the outlet within an accuracy of 10%. Refer to Technote 113 for more information on use of the Turbo-Meter.

By measuring and totaling the CFM of all outlets and comparing the total to the Control Board readout, one can determine whether there is gross leakage in the duct system. If the values are more than 20% or 150 CFM apart, inspect the duct system for leaks and repair. Refer to Bulletin 30-121 for checking airflow for iSERIES.

Static Pressure. Measuring static pressure is optional and should be used to help diagnose low airflow problems by locating any restrictions in the duct system. Measure the external static pressure (see figure 13) in the supply plenum at least two feet (0.6 m) 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 column (37 Pa). If it is greater than 0.15 inches of water column, add the return system pressure drop to 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 is: $1.6 + 0.25 = 1.85$. In this case the static pressure is too high.

How to Measure Static Pressure. Measure the supply plenum static pressure at least 24 inches (610 mm) from the unit, but before any tee or elbow. A distance of between 2 and 3 feet (0.6 to 0.9 m) 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 1/4-inch (6 mm) 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 one-inch (25 mm) 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. 13.

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.

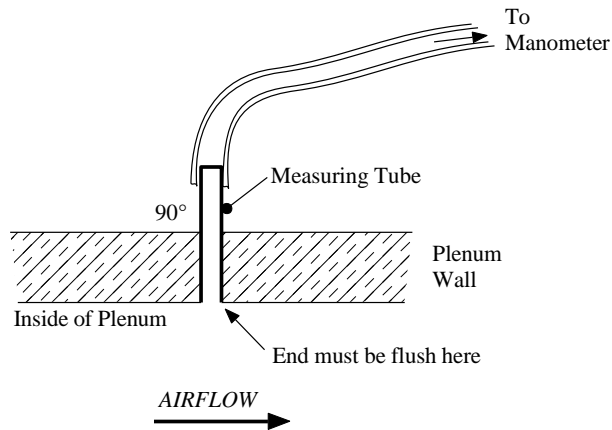


Figure 12 Measuring Plenum Static Pressure

CHARGING AN iSERIES SYSTEM

The only proper way to charge an iSERIES system is by weight. Refer to Bulletin 30-121 for the factory charge, charge adjustment tables, and other refrigerant installation guidelines.