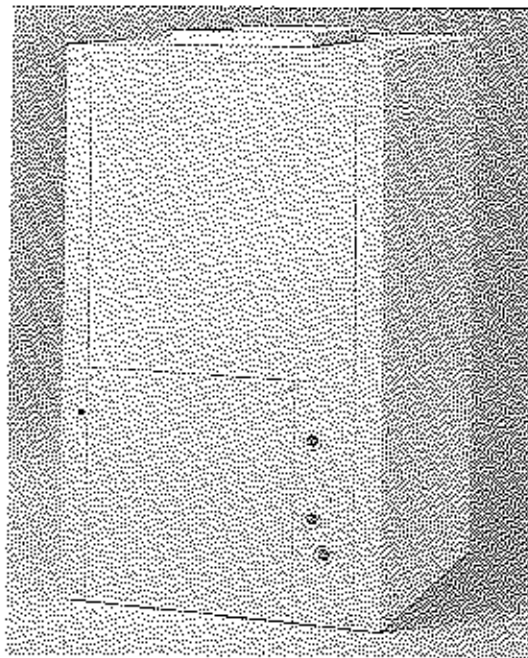
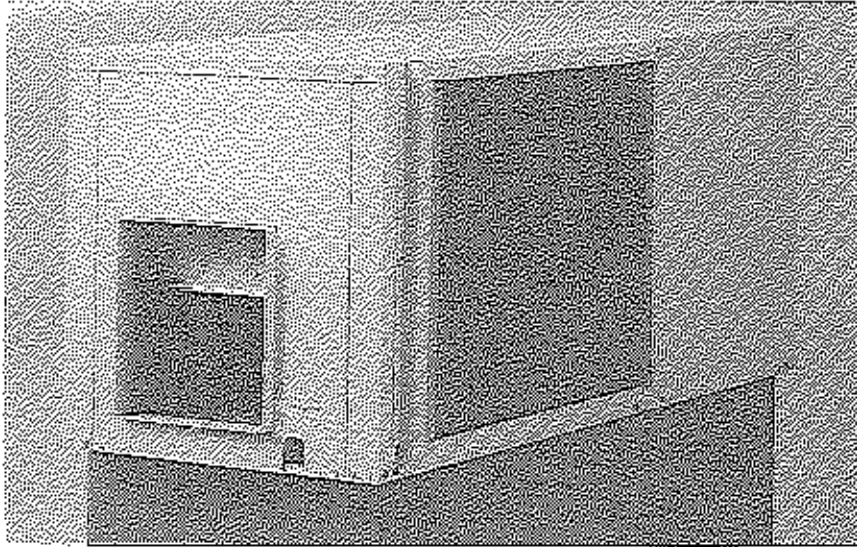


# INSTALLATION OPERATION MAINTENANCE



## WATER SOURCE HEAT PUMPS: HORIZONTAL & VERTICAL UNITS

Continuing engineering research results in steady improvements. Therefore, these ratings and specifications are subject to change without notice.

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**ClimateMaster**

Revised 2/91

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# Installation

## Location and Access Horizontal Units

Because Horizontal units are designed for installation above a false ceiling or ceiling plenum, access becomes an extremely important consideration. Be sure that the site chosen for unit installation provides enough clearance to allow easy maintenance or servicing of the unit without necessitating its removal from the ceiling.

A number of guidelines to consider when installing a Horizontal unit are listed below; refer to Figure 1 for an illustration of a typical Horizontal installation.

1. Provide a hinged access door (in concealed-spline or plaster ceilings), or removable tiles (in T-bar or lay-in ceilings).

The access opening must be large enough to accommodate the service technician as he services the unit (including compressor removal and replacement), and to permit removal of the unit. Refer to Table 1 for overall dimensions of the unit.

2. Provide easy access to hanger brackets, water valves and fittings, and screwdriver clearance to access panels, the discharge collar, and all electrical connections.
3. If a return duct is used, be sure to provide a duct slot for filter replacement.
4. To allow removal of the unit do not run obstructions (e.g., piping, electrical cable, etc.) under the unit.
5. Minimize obstructions in the conditioned space beneath the unit whenever possible. A manual, portable jack can then be used to lift and support the weight of the unit during installation or servicing. See Figure 2.

**Table 1  
Horizontal Unit Dimensions**

Unit Size	Dimensions (L x W x H)
006, 009, 012	20" x 34" x 11 1/8"
015, 019	20" x 43" x 17"
024, 030	20" x 43" x 19"
036, 042	20" x 47" x 21"
048, 060	36 1/4" x 36 1/4" x 21 5/8"
096, 120	72 1/4" x 36 1/4" x 21"

Dimensions in inches

1. Dimensions shown above do not include duct collar or hanger brackets.
2. Dimension "L" is measured across the front of the unit (i.e., water connection side).

## Initial Inspection

Be sure to inspect the carton or crating housing each Horizontal and Vertical unit as it is received at the job site and before signing the freight bill. Verify that all items have been received and that there is no visible damage; note any shortages or damage on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damage not discovered until after unloading must be reported to the carrier within 15 days of its receipt.

Unit wiring diagrams and installation/operation/maintenance instructions are provided with each unit. Before unit start-up, be sure to read these manuals to become familiar with the unit and its operation.

Notice that an installation checklist is provided at the end of this manual; it should be completed after all the installation procedures described have been accomplished. A periodic maintenance checklist is provided in the "Maintenance" section to outline recommended maintenance schedules. Do not substitute these checklists for the detailed information found in the appropriate sections of this manual.

In addition, a start-up/inspection log has also been included at the end of this manual to encourage thorough unit checkout at initial start-up.

## Storage

If the equipment is not needed for immediate installation upon its arrival at the job site, it should be left in its shipping carton and stored in a clean, dry area of the building, or in a warehouse. Units must be stored in an upright position at all times. If carton stacking is necessary, stack units as follows: Horizontal units, maximum 4 high; Vertical units up to and including model 060, 3 high; Vertical units 080 to and including 120, 2 high. Do not remove any equipment from its shipping package until it is needed for installation.

## Unit Protection

Once the Horizontal or Vertical units are properly positioned on the job site, they must be covered with either a shipping carton, vinyl film, or an equivalent protective covering; open ends of pipes stored on the job site must be capped. This precaution is especially important in areas where painting, plastering, or spraying of fireproof material and the like is not yet complete. Foreign material that is allowed to accumulate within the units can prevent proper start-up and necessitate costly clean-up operations.

Before installing any of the system components, be sure to examine each pipe, fitting, and valve, remove any dirt found on these components.

Do NOT use these units as a source of heat during construction of the building since the units' filters will quickly fill with construction dirt and debris. (Operating a unit with a clogged filter impairs or prevents unit operation, and—as stated earlier—necessitates costly unit clean-up.) It is strongly recommended that an alternative means of providing temporary heat be used.

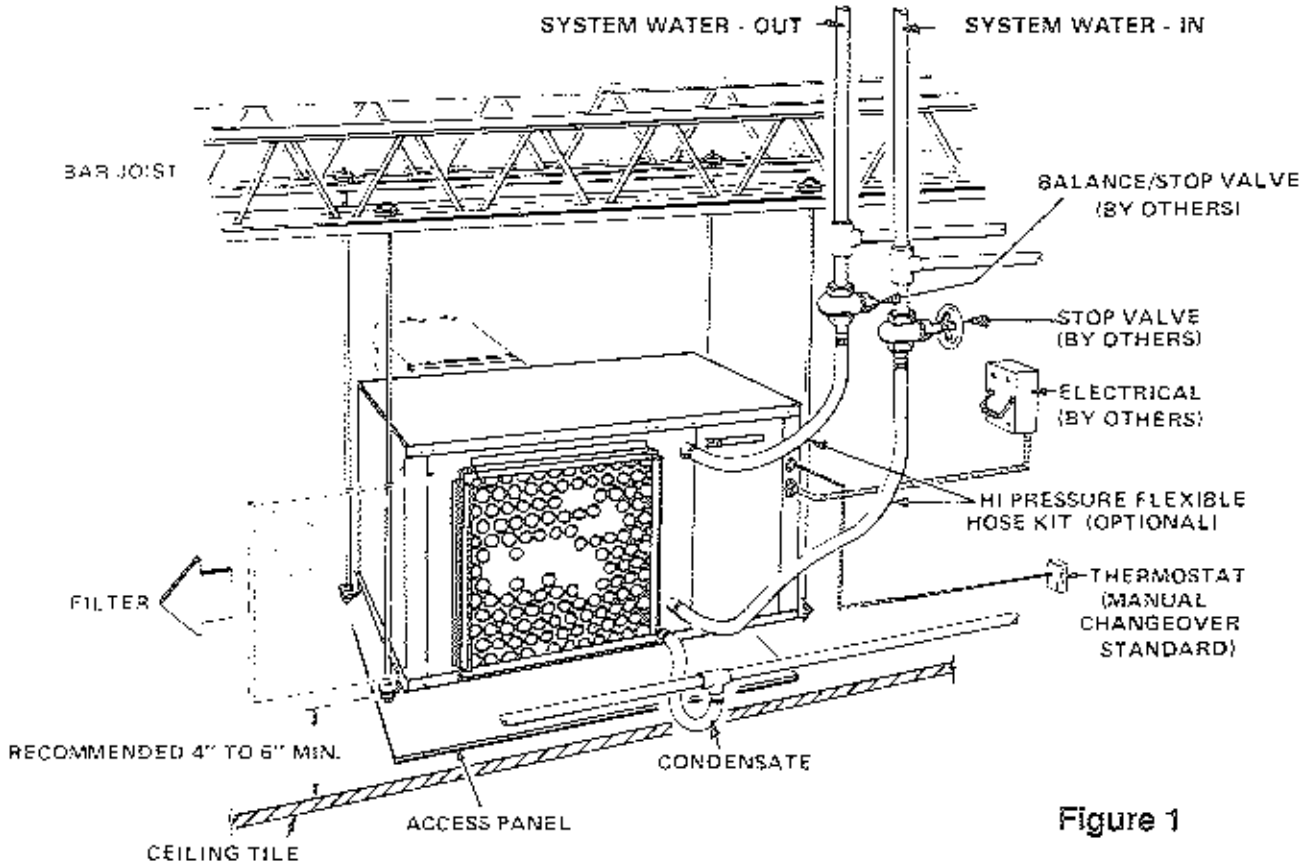
## Preinstallation

To prepare a Horizontal or Vertical unit for installation, be sure to complete the inspections and instructions listed below:

1. Compare the electrical data on the unit nameplate with ordering and shipping information to verify that the correct unit has been shipped.
2. Do not remove the cardboard carton until the unit is ready for installation.
3. Verify that the refrigerant tubing is free of kinks or dents, and that it does not touch other unit components.
4. Inspect all electrical connections; connections should be clean and tight at the terminals.

The compressors of all Horizontal and Vertical units are internally spring-mounted. Those equipped with external spring Vibration Isolators must have bolts loosened and shipping clamps removed.

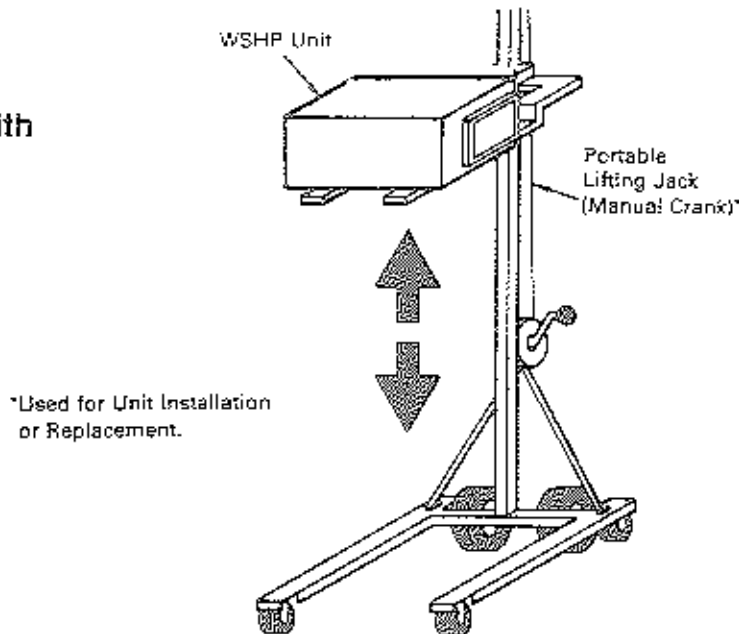
**Access Guidelines  
(Typical Installation Shown)  
Horizontal - Size 006 thru 030**



**Figure 1**

**Note:** Provide adequate service clearance on access panel side of unit; minimum recommended clearance is 18 inches.  
\*Optional is a flow meter which is not shown in the above installation.

**Figure 2  
Lifting Unit with  
Portable Jack**



## Vertical Heat Pump Units

While Vertical units are typically installed in a floor-level closet or a small mechanical room, the unit access guidelines for these units are very similar to those described for Horizontal units. Table 2 provides the overall dimensions of the various sizes of Vertical units. Refer to Figure 3 for a schematic of a typical Vertical installation.

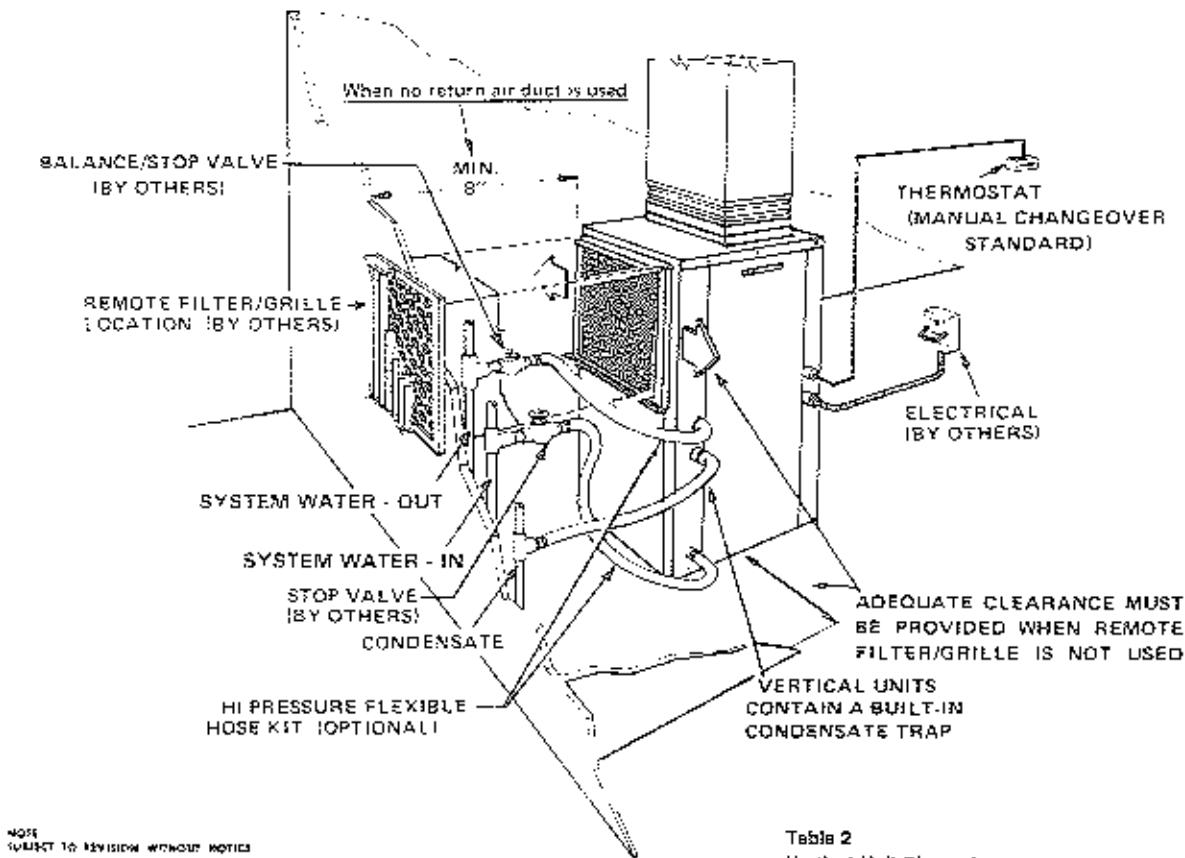


Figure 3

Table 2  
Vertical Unit Dimensions

Unit Size	Dimensions (L x W x H)
009, 012	19 1/8" x 19 1/8" x 24 1/8"
015, 019	21 1/8" x 21 1/8" x 37 3/8"
024, 030	23" x 23" x 37 3/8"
036, 042	25 1/4" x 25 1/4" x 42"
048, 060	28 1/8" x 28 1/8" x 43 3/16"
080, 100, 118, 120	29" x 41" x 70 3/4"

Notes: Dimensions do not include duct collar.  
Dimensions in inches.

Use these guidelines to determine proper Unit placement:

1. Provide adequate clearance for filter replacement and drain pan cleaning. Do not allow piping, conduit, etc. to block filter access.
2. Provide sufficient access to allow maintenance and servicing of the fan and fan motor, compressor and coils (Removal of the entire unit from the closet to accomplish this should not be necessary).
3. Provide an unobstructed path to enable removal of the unit from the closet or mechanical room.
4. Provide ready access to water valves and fittings, and screwdriver access to unit side panels, discharge collar, and all electrical connections.

**Condensate Drain 2nd Trap**

A drain line must be connected to each heat pump and pitched to allow condensate to flow away from the machine. A trap, illustrated in Figure 4 below, must be installed in the condensate line for vertical and horizontal units to insure free flow of condensate. Figure 5 also shows the addition of vertical air vent tubes which are sometimes required at frequent enough intervals to avoid air pockets so that condensate can flow freely through long, nearly horizontal drain lines.

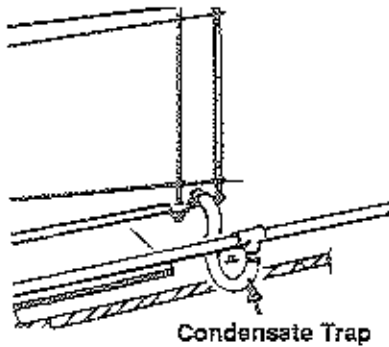


Figure 4 - Condensate trap.

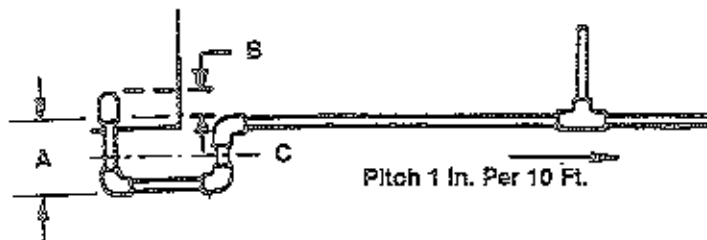


Figure 5 - Condensate drain line for horizontal heat pumps.

**DIMENSIONS**

HORIZONTAL UNIT SIZE	A	B
006	3/4"	3/4"
009	3/4"	3/4"
012	3/4"	3/4"
015	1"	1"
019	1"	1"
024	1"	1"
030	1"	1"
036	1"	1 1/4"
042	1"	1 1/4"
048	1"	1 3/4"
060	1"	1 3/4"
096	1"	2"
120	1"	2"

Minimum Dimension

**DIMENSIONS**

VERTICAL UNIT SIZE	A	B
009	1"	2"
012	1"	2"
015	1"	2 1/4"
019	1"	2 1/4"
024	1"	2 1/4"
030	1"	2 1/4"
036	1"	2 1/2"
042	1"	2 1/2"
048	1"	2 1/2"
060	1"	2 1/2"

Minimum Dimension

## Hanging or Mounting

While horizontal heat pumps may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling or within a soffit using field-supplied, threaded rods to support their weight.

A mounting kit—which includes four mounting brackets and vibration isolators—is shipped inside the blower compartment of the unit. Attach the brackets and isolators to the bottom corners of the unit. Then use four field-supplied threaded rods to suspend the unit.

Be sure to follow the clearance guidelines described under "Location and Access". Remember that the unit must not be mounted flush with the floor slab above, but should hang clear and be supported only by the mounting bracket assemblies.

Unit installation within the plenum should provide adequate clearance for filter removal in any one of the four directions possible. On those applications with a return air plenum, a slot for filter removal (i.e., toward the front) must be provided.

Vertical heat pump units are usually installed on the floor or on shelves. To properly isolate the unit, be sure to place a piece of rubber or neoprene under the unit; the pad should extend beyond the edges of the unit, and should be 3/8 to 1/2-inch thick. See Figure 6.

## Sound Attenuation Horizontal Units

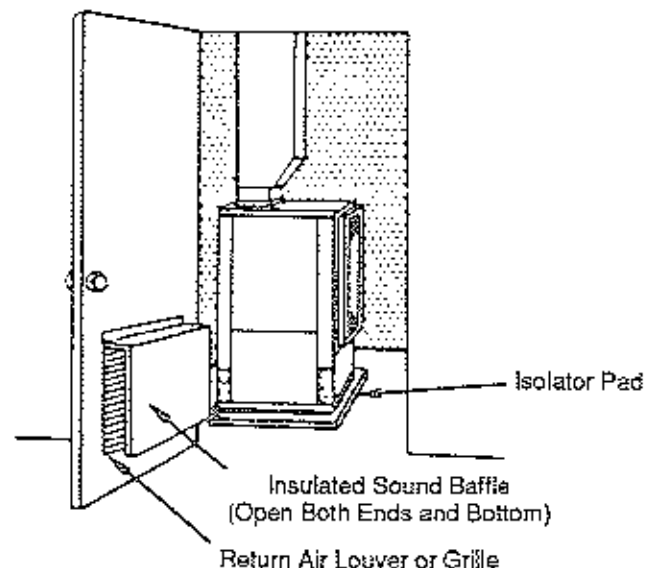
Correct placement of the Horizontal unit can play an important part in minimizing sound problems. Since ductwork is normally applied to these units, this enables the unit to be placed so that the principal sound emission is outside the occupied space in sound-critical applications. A fire damper may be required by the local code if a fire wall is penetrated.

## Vertical Units

Because Vertical units are usually in small mechanical rooms or closets (see Figure 6), the location of the unit often serves as the primary means of sound attenuation. Additional measures for reducing sound transmission include the following:

1. Use a sound baffle, as shown in Figure 6, to attenuate line-of-sight sound radiated through the return air grilles.
2. Mount the unit on a rubber or cork isomode pad to minimize vibration transmission to the building structure (The entire base of the unit—not just the corners—should rest on the pad to ensure adequate isolation).

**Figure 6**  
**Vertical Sound Attenuation**



## Supply and Return Piping

Besides complying with any applicable codes, system piping should also include the following features:

1. a drain valve at the base of each supply and return riser to enable system flushing at start-up and during routine servicing;
2. shut-off/balancing valves and unions at each unit to permit unit removal for servicing; and,
3. strainers at the inlet of each system circulating pump.  
(Shut-off/balancing valves, flow indicators, and drain tees in the supply runout and return at each floor facilitate loop balancing and servicing.)

Insulation is not required on the loop water piping except on those sections that run through unheated areas or outside the building. This is because the loop temperature is normally between 60 and 90 F; therefore, the piping will neither sweat nor suffer heat loss.

## Condensate Piping

In most system applications, Horizontal and Vertical units are positioned directly above each other on successive floors, and the condensate risers are located next to the units. A flexible, nonpressure-rated plastic hose is typically used to connect the unit condensate drain connection to the condensate riser (This condensate hose must be field supplied and installed). To ensure an unobstructed flow of condensate from the unit to the riser, this hose must be carefully arranged to avoid kinks.

Though the horizontal run of the condensate hose is usually too short to pose any drainage problems, it is important to remember that horizontal runs of condensate line are typically pitched at least one inch for every 10 feet of run in the direction of flow. Low points and unpitched piping cannot be allowed, since dirt will collect in these areas and cause stoppage and overflow.

To ensure proper condensate flow from Horizontal or Vertical units, the contractor must install a condensate trap at each unit, with the top of the trap positioned below the unit condensate drain connection.

## Installation of Supply and Return Hoses

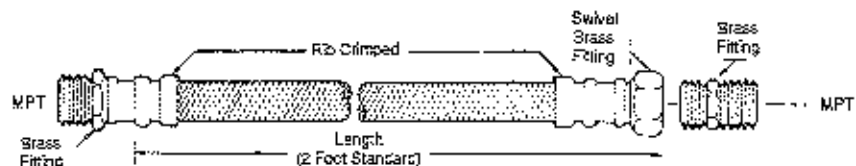
Optional pressure-rated hose assemblies designed specifically for use with Horizontal and Vertical units may be ordered though hoses of a similar type can also be obtained from alternate suppliers in the field. In either case, these hoses will provide long life and trouble-free service if they are properly selected, installed and maintained.

Supply and return hoses are fitted with swivel-joint fittings at one end to prevent the hose from twisting; male adapters are provided to secure the hose assemblies to the unit and risers. Refer to Figure 7 for an illustration of the hoses, and to Table 3 for a listing of the hose kits available. Figure 1 illustrates the supply, return and condensate hoses assembled to a Horizontal unit.

**CAUTION:** Extremely corrosive system water may require use of special corrosion-resistant fittings and hoses. When this condition is encountered, water treatment is required.

Hose assemblies must be installed properly and checked regularly. Improper installation of hose assemblies may cause failure or reduce service life. Because water leaks can cause severe damage to carpeting, furniture, etc., it is extremely important that the installation guidelines provided below be strictly followed to ensure that water leaks do not occur.

**Figure 7**  
**Supply/Return Hose Kit**





**Table 3**  
**Supply and Return Hose**  
**Specifications**

Hose Size	Outside Diameter	Min. Bend Radius	Galvanized Braid			Stainless Steel Braid*		
			Part Number	Operating Pressure (PSI)	Bursting Pressure (PSI)	Part Number	Operating Pressure (PSI)	Bursting Pressure (PSI)
1/2"	23/32"	2 7/8"	AK5042	300	1200	AK5032	375	1500
3/4"	1 1/8"	4 1/2"	AK7542	225	900	AK7532	300	1200
1"	1 3/8"	5 1/2"	AK1042	175	700	AK1042	225	900
1 1/4"	1 11/16"	6 3/4"	AK1212	150	600	AK1222	200	800

\*Optional - on order only.

Revised

To properly select and install the hose assemblies:

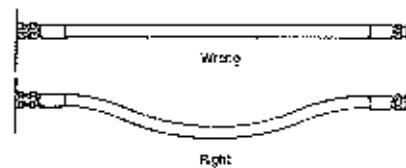
1. Select the proper hose length to allow the slack required between connection points. Since the hose may change in length from +2 to -4 percent under the surge of high pressure, it is necessary to provide sufficient slack for expansion and contraction. See Figure 8.
2. Hoses must also be selected to the proper length to ensure that the minimum bend radius is not exceeded. Exceeding the minimum bend radius can cause the hose to collapse, thus reducing the water flow rate, and/or damaging the hose wall construction. A minimum bend radius specification of four inches means that the shortest distance between sections of bent hose cannot be less than eight inches.

Use the following minimum bend radii when selecting metal hoses:

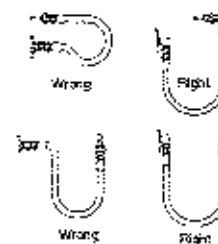
- 1/2-Inch Hose = 2-7/8-Inch Minimum Bend Radius
- 3/4-Inch Hose = 4-1/2-Inch Minimum Bend Radius
- 1-Inch Hose = 5-1/2-Inch Minimum Bend Radius
- 1 1/4 Inch Hose = 6-3/4-Inch Minimum Bend Radius

Where the radius falls below the required minimum, an angle adapter should be used, as shown in Figure 9, to avoid sharp bends in the hose.

**Figure 8**  
**Slack Allowance for Hose**  
**Installation**



**Figure 9**  
**Use of Angle Adapter to**  
**Achieve Proper Bend Radius**



**Note:** Bend radius specifications are for hose assemblies stored at temperatures above 40 F (4 C). If hoses have been stored at temperatures below 40 F, the hose will be stiffer than normal. Under these conditions, increase the minimum specified bend radius by 50 percent, and use extreme care to avoid bending the hose.

3. Pipe joint compound is not necessary where Teflon thread tape has been preapplied to hose assemblies, or when flared-end connections are used. In those instances where pipe joint compound is preferred in lieu of tape, use only a small amount on the male pipe threads of the fitting adapters. Be sure to prevent any sealant from reaching the flared surfaces of the joint.
4. Where brass fittings are used, the maximum torque—without damage to the fitting—is 30 foot-pounds. If a torque wrench is not available, use "finger-tight" plus one quarter turn. Tighten steel fittings as necessary.
5. Do not twist hose to avoid damage to the hose wall or rubber compound.
6. Hose connections are completed with the incorporation of combination shut-off/balancing valves at each unit supply and return riser to simplify removal of the unit, as well as proper water flow adjustment.

**Electrical Wiring**

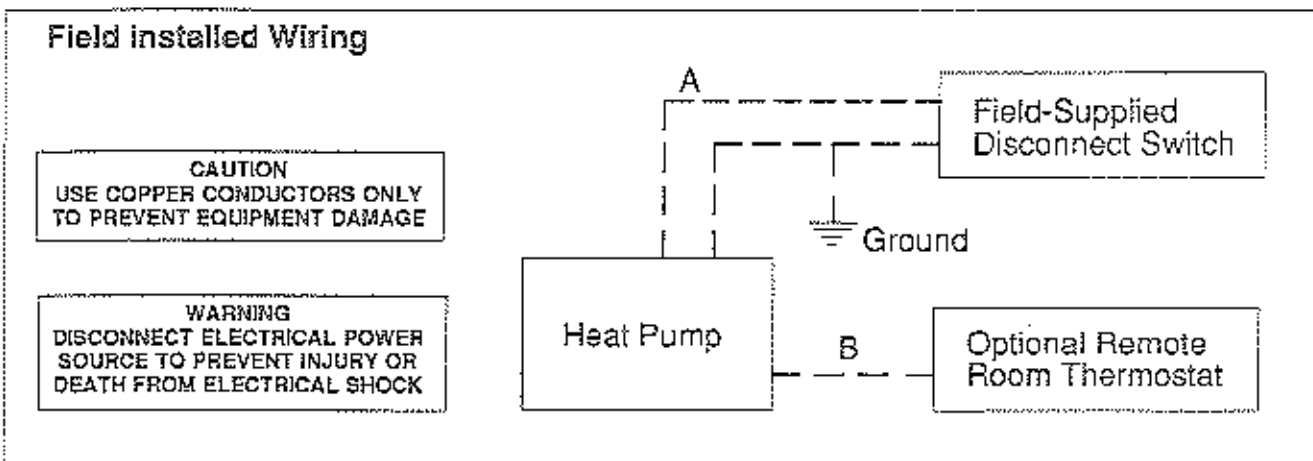
**WARNING: TO AVOID POSSIBLE INJURY OR DEATH DUE TO ELECTRICAL SHOCK, OPEN SUPPLY POWER DISCONNECT SWITCH AND SECURE IT IN THAT POSITION.**

**CAUTION:** Use only copper conductors for field-installed electrical wiring. Unit terminals are not designed to accept other types of conductors.

All field-installed wiring—including the electrical ground—must comply with the National Electrical Code, as well as applicable local codes. In addition, all field wiring must conform to the Class II temperature limitations described in the NEC. Refer to Figure 10 for a schematic of the field connections which must be made by the installing (or electrical) contractor.

To ensure proper electrical hookup, be sure to consult the unit wiring diagram pasted on the inside surface of the electrical access panel. Notice that the 24-volt transformer connection must be modified if the unit nameplate voltage is 208-230 volts, and the actual supply power is 230 volts.

**Note:** To minimize vibration and sound transmission to the structure, all final unit electrical connections should be made with a length of flexible, rather than rigid, conduit.



**Figure 10**

A = Two power wires on single-phase units; three power wires on three-phase units.  
 B = 1 H/1 C manual changeover or auto changeover — 4 wires.

For multiple compressor units and/or other thermostats, see Unit Wiring Diagram  
**Note:** All customer-supplied wiring to be copper only, and must conform to NEC and local electrical codes. Wiring shown with dashed lines must be field-supplied and field-installed.

## Notes:

1. Voltage utilization range complies with ARI Standard 110.
2. When using 100 percent outside air as a source of ventilation, a 40 F DB minimum and a 78 F WB are acceptable, but the cabinet may sweat during hot weather.
3. Determination of operating limits is dependent primarily upon 3 factors: (1) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any one of these factors is at a minimum or maximum level, the other two factors should be at normal levels to ensure proper unit operation.
4. Extreme variations in temperature and humidity, and corrosive water or air will adversely affect unit performance, reliability and service life.

## Unit Start-Up

Use the procedure outlined below to initiate proper unit start-up:

1. Adjust all valves to the full open position, and turn on the line power to all heat pump units.

**WARNING: HIGH VOLTAGE IS PRESENT IN SOME AREAS OF THE ELECTRICAL PANELS WITH THE DISCONNECT SWITCH (ES) CLOSED. BE SURE TO EXERCISE CAUTION WHEN WORKING WITH ENERGIZED EQUIPMENT.**

2. **Operate each unit first in the cooling cycle.** Room temperature should be in the normal range (i.e., approximately 61 to 67 F, wet bulb). Loop water temperature entering the heat pump should normally be at least 60°F, but not in excess of 95°F.

**Note:** Three factors determine the operating limits of a unit—(1) return air temperature, (2) water temperature, and (3) ambient temperature. Whenever any one of these factors is at a minimum or maximum level, the other two factors must be at normal levels to ensure proper unit operation.

- a. **For heat pumps equipped with an optional, accessory MCO thermostat,** adjust the thermostat temperature indicator to the lowest setting, and the selector switch to COOL. At this time, both the fan and compressor should run.

**For heat pumps equipped with an optional, accessory ACO thermostat,** set the thermostat temperature indicators to the far left position, and the selector switch to AUTO. At this time both the fan and the compressor should run.

- b. Check for cool air delivery at the registers or unit grille a few minutes after the units have begun to operate. List the serial number of any machines that do not function at this time.
  - c. Check the elevation and cleanliness of the condensate lines; any dripping could be a sign of a blocked line.
3. **Operate each heat pump in the heating cycle immediately after checking cooling cycle operation.**

**Note:** Horizontal and Vertical heat pumps are designed to start heating at a minimum return air temperature of 50 F with a normal water flow rate and ambient temperature.

- a. **If the unit is equipped with an optional, accessory MCO thermostat,** adjust the thermostat temperature indicator to the highest setting and set the selector switch to HEAT; both the fan and the compressor should run.

**If the unit is equipped with an optional, accessory ACO thermostat,** set the thermostat temperature indicator levers to the far right position with the selector switch still set on AUTO; both the fan and compressor should run.

- b. Once the unit has begun to run, check for warm air delivery at the registers or unit grille. Again the installing contractor must list the serial number of any machines that do not function.

4. If the unit fails to operate, conduct the following checks:
- Check the voltage and current; it should be in accordance with the electrical specifications described on the unit nameplate.
  - Look for wiring errors; check for loose terminal screws where wire connections have been made on both the line and low-voltage terminal boards.
  - Check for dirty filters; a clogged filter will cause the unit's safety cutouts to stop unit operation.
  - Verify that the supply and return piping is properly connected to the inlet and outlet connections on the unit.
  - If the fan fails to operate, check to see that the fan wheel turns freely and that it is secured to the shaft. Also, determine whether the fan operates during both the heating and cooling modes.
  - If the checks described above fail to reveal the problem and the unit still will not operate, be sure to contact a trained service technician to ensure proper diagnosis and repair of the equipment.

## Maintenance

### Maintenance Procedures

Perform the maintenance procedures outlined below at the intervals indicated.

**WARNING: BEFORE SERVICING UNIT, OPEN UNIT DISCONNECT SWITCH TO PREVENT INJURY OR DEATH DUE TO ELECTRICAL SHOCK OR CONTACT WITH MOVING PARTS.**

- [ ] **Inspect filters every three months.**

A regular maintenance schedule is recommended, and the frequency of filter changeouts depends upon the type of occupancy (e.g., hotel, office, school).

**CAUTION:** To avoid fouled machinery and extensive unit clean-up, do not operate units without filters in place or use as a temporary heat source during construction.

To remove the filter from a Horizontal or Vertical unit, simply slide the filter out of its frame. When installing a new filter, be sure to use the slide-in rails to guide the filter into the proper position. Verify that the airflow arrow found on the top of each filter points toward the unit.

- [ ] **Check condensate drain pans for algae growth at three-month intervals.**

When algae growth is apparent, consult a water treatment specialist for proper chemical treatment. Typically, the application of an algicide every three months will eliminate algae problems in most locations.

- [ ] **Visually inspect the unit at least once each year.**

When inspecting each Horizontal and Vertical unit, give special attention to the hose assemblies; note any signs of deterioration or cracking, and repair any leaks immediately.

- [ ] **Conduct an amperage check annually on the compressor and fan motor.**

Amperage draw on this equipment should not exceed normal full load or rated load amps by more than 10 percent of the values noted on the unit nameplate. Record the values obtained in this check in a log book so that a deteriorating condition in a fan motor or compressor can be detected prior to component failure.

- [ ] **Clean the refrigerant coil at least once each year (or more frequently if the unit is located in a "dirty" environment) to help maintain proper unit operating efficiency.**

Revised