COLMAC
WATERHEAT

Installation Manual

Heat Pump Water Heaters

1. INSTALLATION

1.1. Inspection

1.1.1. Upon receipt of equipment, inspect for shortages and damage. Any shortage or damage found should be noted on delivery receipt; this action notifies the carrier a claim is intended to be filed. If any shortage or damage is discovered after unpacking the unit, call the delivering carrier for a concealed damage or shortage inspection. The inspector will need related paperwork, delivery receipt, and any information indicating their liability for the damage.

1.1.2. Also check the electrical characteristics on nameplate of unit to be certain unit is compatible with the power supply.

1.1.3. Remove all **red** shipping brackets and bracing applied to unit. Any red shipping brackets, wood bracing or blue or pink packaging foam need to be removed prior to machine start up. See Figure 1 below.

Figure 1 - Example of Red Shipping Bracket

1.2. Mounting

1.2.1. Rigging: Units are crated and shipped in an upright position. After uncrating, use of nylon slings is recommended for lifting the unit.

1.2.2. Compressor: The hermetic compressor in the heat pump is mounted on four rubber mounts for vibration isolation. No adjustments to the four (4) bolts in the compressor mounting feet are necessary. Remove any shipping shims if present. In the case of scroll compressors (by Copeland), vibration isolation is by springs which require adjustment at the time of installation.

1.2.3. Mounting: Anchor the machine in compliance to local machine mounting codes and seismic restrictions. Failure to restrain the machine may lead to movement due to vibration, which may result in machine damage. Machines must be oriented and handled in the vertical upright position.

1.2.4. Curb Mount: When mounting the heat pump on a curb or on structural beams, isolate the unit from the building with cork type pads or vibration isolation springs. Optional Spring Isolation Kits are available for all air and water source heat pumps.

1.2.5. Machine frame: Machines are not designed to support any additional loads, other than the machine structure. If units are to be suspended or stacked, a separate frame work should be considered.

1.2.6. Location: Position the heat pump so the unit can be easily serviced through access panels. Minimum distance from the unit to any wall is 24 inches (610 mm) for this reason. On air source heat pumps, the air inlet (evaporator coil) and outlet (fan discharge) must be unrestricted. Units with horizontal discharge fan arrangement should be mounted with a minimum of 4 feet (1219 mm) from the fan outlet to closest wall. Units with vertical air discharge can be located no closer than the 24 inches (610 mm) minimum mentioned above. ***Reference the installation drawing associated to the model to be installed for specific clearances***. Consideration of surrounding equipment should be accounted for in the event of water leaks.

1.3. Electrical

1.3.1. Supply: Supply wiring is single point in the unit control panel. Fused disconnect, if required, is supplied by others. Refer to the wiring diagram attached to the unit. Supply wire sizing and routing shall be considered and supplied by others, consistent with the load requirements and components of the equipment supplied by Colmac.

1.3.2. Control: Control wiring is single point in the unit control panel. The basic heat pump control circuit will require a normally open contact closure from the aquastat for the heat pump run signal. Heat pumps which utilize the remote heat rejection option will require additional control wiring from the room thermostat. Refer to the wiring diagram attached to the unit.

1.3.3. Wire Size: Incoming line conductors must be sized according to national and local codes for the voltage, and amperage shown on the unit nameplate. Heat pump control leads (aquastat and room thermostat) must be a minimum of 14 AWG. Use only copper conductors for all field wiring.

1.3.4. Source Water Circulating Pump: Source water circulating pump is to be appropriately sized for the source water system and is to be provided by others. A contact set will be provided in the water source heat pump (HPW) control circuit for starting and stopping the source water pump. Pump power circuitry hardware, circuit protection and contactors by others.

1.3.5. Consistent power quality electrical supplies shall be provided for all operating conditions. Considerations of the equipment requiring operation in poor power quality environments may result in additional cost to the equipment in supplemental parts and labor, and shall be assumed by the equipment owner. Warranty conditions shall be invalidated in poor power quality conditions.

1.3.6. The quality of electrical power may be described as a set of values of parameters, such as:

1.3.6..1. Continuity of service
1.3.6..2. Variation in voltage magnitude
1.3.6..3. Transient voltages and currents
1.3.6..4. Harmonic content in the waveforms for AC power

6.3.7. Examples of possible variations:

Variations in the peak or RMS, when the RMS voltage exceeds the nominal voltage by 10 to 80% for 0.5 cycles to 1 minute, the event is called a "swell."

Sag: the RMS voltage is below the nominal voltage by 10 to 90% for 0.5 cycles to 1 minute.

Random or repetitive variations in the RMS voltage between 90 and 110% of nominal can produce a phenomenon known as "flicker."

Abrupt, very brief increases in voltage called "spikes," "impulses," or "surges," generally caused by large inductive loads being turned off, or by severely by lightning impacting voltage supplies.

"Under voltage" occurs when the nominal voltage drops below 90% for more than 1 minute.

"Overvoltage" occurs when the nominal voltage rises above 110% for more than 1 minute.

Variations in the source frequency.

Variations in the wave shape – usually described as harmonics.

Each of these power quality problems has a different cause. Some problems are a result of the shared infrastructure.

Electrical supply quality should be provided within standard NFPA 79 as listed below:

- (NFPA 79 : 4.3.2.1) Voltage. The electrical equipment shall be designed to operate correctly where the steady-state supply voltage is from 90% to 110% of the nominal voltage.
- (NFPA 79 : 4.3.2.5) Voltage Impulses. The electrical equipment shall be designed to operate correctly where the supply voltage impulses do not exceed 1.5 milliseconds in duration with a rise/ fall time between 500 nanoseconds and 500 microseconds. A peak supply voltage impulse shall not exceed more than 200% of the rated supply voltage (RMS value).

- (NFPA 79 : 4.3.2.6) Voltage Interruption. The electrical equipment shall be designed to operate correctly where the supply voltage is interrupted at zero voltage for not more than 3 milliseconds at any random time in the supply cycle. The time interval between successive voltage interruptions shall be more than 1 second.
- (NFPA 79 : 4.3.2.7) Voltage Dips. The electrical equipment shall be designed to operate correctly where the supply voltage dips do not exceed 20% of the peak voltage of the supply for more than one cycle. The time interval between successive dips shall be more than 1 second.

6.3.8. Electrical supply design reviews by certified professionals are recommended for local conditions in consideration of the operation of the heat pump and its components.

1.4. Water Piping

1.4.1. General: For proper heat pump operation it is important to plumb the water piping and storage tanks as indicated in the appropriate piping diagrams. **Refer to Colmac Engineering Bulletin 940126-0003**.

1.4.2. All piping diagrams show non-vented pressurized systems. Vented non-pressurized systems are not recommended.

1.4.3. System piping should be plumbed and storage tanks installed in accordance with all local and national codes that apply.

1.4.4. A Pressure Temperate (P-T) type relief valve is required on all non-vented pressurized tank, as shown in the piping diagrams.

1.4.5. Insulation: It is highly recommended all hot water piping and storage tanks be insulated for energy efficiency.

Outdoor applications: Fiberglass with aluminum sheathing is preferred for piping and tanks (also sprayed foam for tanks).

Indoor applications: Fiberglass with paper sheathing is preferred for piping and tanks (also sprayed foam for tanks). Closed cell foam is acceptable for piping and tanks where permitted.

1.4.6. Pipe Sizing: System piping shall be sized for the minimum allowable water flow rate required for the heat pump.

1.4.7. Existing Water Storage Tanks: The use of existing resistance heat water tanks is permitted when the tank volume is suitable for the job application.

⚠ CAUTION

1.4.8. The use of existing gas water heaters and boiler as storage tanks is not recommended due to high standby losses.

⚠ CAUTION

1.4.9. Using the existing water tanks without proper cleaning can result in fouling of the internal water piping and may cause damage to the system water pump. The use of existing water storage tanks is permitted only if measures are taken to remove all accumulated scale deposits in the tank.

1.4.10. Strainers should be added to all water inlet lines to filter out sediment and particulates before they reach the Heat Pump (strainer on potable water inlet of HPA and strainers on both potable water inlet and source water inlet on HPW).

1.5. Booster Pump

1.5.1. In piping systems where the heat pump is located far away from the storage tanks (greater than the maximum allowable external water pressure drop), it will be necessary to install a booster pump to maintain the minimum required flow rate. See the pump manufacturers design data for the required flow rate and pressure.

1.6. Net Positive Suction Head (NPSH)

1.6.1. This term is defined as the water pressure required at the inlet of the pump to cause water to flow (and prevent cavitation). NPSH can be calculated as follows:

1.6.2. NPSH = Barometric Pressure + Static Pressure on Pump Suction - Friction losses in Suction Piping - Vapor Pressure of Water

1.6.3. Normally with non-vented, pressurized hot water systems, NPSH is high enough to prevent cavitation. Vented, non-pressurized systems are not recommended unless special care is taken to prevent cavitation of the water circulating pump. Cavitation can lead to pump failure not covered by warranty.

1.7. Condensate Drain

1.7.1. During normal operation of air source heat pumps, the air drawn into the heat pump is dehumidified producing condensate on the surface of the evaporator coil. This condensate is collected in the coil drain pan and must be piped away to a suitable drain system. There is a drain connection provided on all air source heat pumps for draining the condensate from the unit. This connection is located on the underside of the heat pump base. Pipe the condensate drain with a "P" trap to prevent drain system air from being drawn back into the unit.

1.8. Aquastat

1.8.1. General: Heat pump water heaters are controlled by a remote aquastat, which senses storage tank temperature and turns the heat pump on and off to maintain a preset temperature. Typical aquastat installations include the aquastat control unit, a sensing bulb, and a bulb well. The aquastat control will be installed and wired by the job contractor.

1.8.2. Sensing Bulb: The use of a sensing bulb well with thermal mastic is highly recommended for installing the aquastat sensing bulb. This will result in greater accuracy and much faster response times than surface mounted sensing bulbs. The location of the sensing bulb on the tank will depend on tank orientation and piping arrangement. Refer to the piping diagrams.

1.8.3. Wiring: The aquastat will provide the heat pump run signal through a set of normally open contacts on the aquastats output relay. As hot water is used the storage tank temperature will fall. When the water temperature reaches the aquastat set point (minus differential) the normally open contacts will close to start the heat pump. Refer to the appropriate wiring diagram included with the heat pump.

CAUTION

1.8.4. **Normally open contacts on aquastat must be non - powered**. Damage will result to the heat pump control circuits if voltage is applied to the control terminals.

1.8.5. Aquastat Settings: The aquastat has two adjustments, Set point and Differential, which must be set properly by the installer for the water heating system to operate correctly.

1.8.6. The Set point is the temperature at which the aquastat contacts open and stop the heat pump.

1.8.7. The Differential is the temperature difference between the Set point and the temperature at which the aquastat contacts close and the heat pump starts.

1.8.8. For example, an aquastat with 140°F (60°C) Set point and 10°F (5.6°C) Differential settings would start the heat pump when tank temperature falls to 140° - 10° = 130°F (54.4°C), and stop the heat pump when tank temperature is brought up to 140°F (60°C).

1.8.9. **It is critical to set the Differential large enough so that the heat pump runs for at least 10 minutes once it starts.** This allows oil to circulate properly, compressor windings to cool, Expansion Valve to modulate, etc. The minimum Differential setting to produce 10 minutes of running time is a function of heat pump heating capacity and storage tank volume.

1.8.10. On larger systems where multiple heat pumps are piped in parallel to a common storage tank, an aquastat having more than one stage can be used to sequentially add or shed units to adjust total system heating capacity to the load. For multistage systems, use the following rules for setting aquastat set point and differential for each stage:

Rule 1: Make set point for all stages the same. For example, if desired tank temperature is 140°F (60°C) and the system has 3 stages, then make the aquastat set point 140°F (60°C) for stages 1, 2, and 3.

Rule 2: Give each stage equal heating capacity. For example, in a system having 4 x HPA/HPW, either a 2 stage aquastat with 2 x HPA/HPW on each stage or a 4 stage aquastat with 1 x HPA/HPW on each stage could be used.

1.8.11. Colmac HPAPro Software calculates minimum aquastat differential for any combination of heat pump capacity and tank volume.