

# **combo-pac**<sup>®</sup> *by Ecologix*

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Combination Heating Equipment, Water Heaters, Air Handlers

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## Installation Instructions

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**combo-pac**<sup>®</sup>  
hot water air handler

**ECOLOGIX HEATING TECHNOLOGIES INC.**

3-101 Hollinger Cres.  
Kitchener, Ont. N2K 2Y8  
Ph: 519-744-8343  
Fx: 519-744-6743  
E-mail: [info@ecologix.ca](mailto:info@ecologix.ca)  
Web: [www.ecologix.ca](http://www.ecologix.ca)

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## INTRODUCTION

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The **combo-pac**® line of air handlers are specifically designed for use in residential combination space and water heating systems (Combo Systems). Combo heating systems use the home's water heater to provide both the space heating and domestic hot water, eliminating the need for a furnace.

Combo heating systems are ideally suited for single family homes, townhouses and apartments where the cost of a furnace does not make sense or space requirements are limited. They are also great for additions, renovation and finished basements as a replacement for, or in addition to the existing heating system. Our air handlers are the smallest units available in their capacity range.

The **combo-pac**® line of air handlers are designed to take the guess work out of system sizing and installation. Matched specifically to common water heater sizes, our air handlers can be quickly sized using the quick sizing information in our ***Equipment Sizing Manual***. For applications requiring special consideration, our detailed sizing method

gives you the ability to size the air handler to ANY operating condition. Call (519)744-8343 for answers to any questions related to sizing, installation or trouble-shooting for any of our air handlers or water heaters. We will even do the sizing for you. Just call us with the information and we can fax back the proper selection for any application.

We provide you with the quietest operating air handler available. By using large capacity, high output heating coils, our product delivers more heating per volume of air than any of our competitors, which means warmer delivered air temperatures. Our blower fans are also the widest available in their size range, which translates into slower fan speeds to deliver the same amount of air. All these features add up to warmer, more comfortable air, super quiet operation, and a satisfied customer.

Water heaters can be purchased from a supplier, rented from your Gas Utility, or purchased from ***Ecologix*** as part of a complete heating package.

# PRODUCT DESCRIPTION

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## ***cabinet***

All cabinet panels have a tough, durable low maintenance high gloss finish.

Cabinet dimensions are designed to provide maximum installation flexibility. Refer to installation requirements for more details.

## ***heating coils***

All heating coils are potable water grade copper suitable for use in plumbing systems. No lead solder is used in any component construction. All coils and internal piping conform to ASTM B68 or ASTM B88 standards.

High density aluminum fins provide maximum heat transfer for small coil surface. Lower air flow and higher fin density equals warmer, more comfortable air with much less fan noise than other air handlers.

## ***fan***

All fans are wide body dynamically balanced for extra quiet operation.

Three speed motors allow for separate speeds for heating, cooling, and continuous run, providing the installer or home owner maximum choice of options.

Multi-directional sleeve bearing motors allow mounting in any direction for maximum installation flexibility.

## ***circulating pump***

The circulating pump is matched for maximum performance for combo use. Air handlers can come with external, field installed pumps, for flexibility and service, or with internally mounted pumps for ease of installation.

## ***check valve***

Check valves serve two purposes:

- protect against back-flow of water to avoid short circuiting around the water heater during domestic water use.
- protect against thermal siphoning.

Thermal siphoning is flow of water through the space heating circuit while the circulating pump is not operating due to hot water rising by natural convection. This phenomenon is of little consequence during winter months, but during the summer this will cause overheating, interfere with air conditioning and waste energy.

All **combo-pac®** air handlers come supplied with spring loaded, vertical lift check valves. These check-valves have been tested and proven to resist thermal siphoning for installations where the air handler elevation does not exceed the distance above the water heater shown in table I.

**Table I      Check Valves**

<b>valve size</b>	<b>Maximum elevation</b>
1/2"(12mm)	25 feet(8 metres)
3/4"(20mm)	50 feet(15 metres)

## ***water heater***

Any properly sized gas or oil fired water heater will work in a combo heating system. Make sure the water heater being used is approved for combo applications. (Most manufacturer's heaters are approved.) Warranties are not affected by using a water heater in combo applications.

## ***boiler***

All **combo-pac**® air handlers are compatible for use with boilers or instantaneous water heaters. Contact your **combo-pac**® representative for sizing and installation details.

## **ACCESSORIES**

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### ***positive shut off motorized valve***

For installations where the air handler is located at an elevation above the water heater exceeding table I, or where local by-laws or gas utility rental rules require positive shut off of the space heating loop, a motorized valve can be put into the circuit. This valve can be purchased as part of the air handler, or can be purchased separately for field installation.

### ***freeze protection switch***

The freeze protection switch is a low cost method to protect the **combo-pac**® fan-coil from freezing, when installed in semi-heated locations such as attics and crawl-spaces. The clip-on thermostatic switch mounts to the heating coil and connects to the pump relay in the electrical box of the air handler. Refer to instructions provided with the kit for installation.

### ***flow control valve***

An adjustable flow control valve is required to optimize system performance and ensure that the output from the water heater is stable. Any throttling type

valve may be used, but for convenience, Ecologix can include a valve with each air handler for field installation.

Combo heating systems function poorly if the temperature drop through the air handler's coil is not maintained between 20-30F(11-17C). The only way to adjust the water temperature drop through the coil to match the rated output conditions of the coil is to adjust the flow of water.

The performance relationship between the air handler and the water heater is ignored by most manufacturers. The **combo-pac**® system has been specifically designed to optimize the output of the water heater to which the air handler is attached.

- If the temperature drop is less than 20F(11C), the system has an excessive flow rate. This will cause turbulent mixing within the water heater storage tank, reducing the domestic water capacity, and creating large fluctuations in delivered water temperature.
- If the temperature drop across the heating circuit is greater than 30-40F (17-22C) there is inadequate flow. This will cause poor heating performance of the air handler.

### ***special order air handlers***

Air handlers can be ordered with any of the above accessories factory installed

for ease of installation. Contact your **combo-pac®** representative for information on pricing and delivery.

## **EQUIPMENT SELECTION AND SIZING**

Proper sizing of system components is crucial for proper operation of the system. Ecologix has a detailed sizing manual. Copies of our sizing instructions can be requested for free. Phone, fax, or write us at the address shown on the front cover of this manual.

Our sizing manual includes water heater sizing as well as air handler sizing

There are two air handler sizing methods available:

**The Quick Sizing Method** is a simple one table sizing method that is good for most applications. A graph format of the quick sizing method is also available, providing one step sizing.

**The Detailed Sizing Method** is a rigorous method of sizing that takes into account all possible operating parameters. This method is excellent for engineers or experienced designers that have special applications with non-standard operating conditions.

There are a number of publicly recognized sizing guides which are commonly used for sizing combo heating systems. We can help you size your heating system to conform to any requirements or sizing methods you need. We have tables for the following Guides:

- Union/Centra Combo sizing Guide for rental water heater applications,
- Consumers Gas Sizing Guide for rental water heater applications,

- B.C. Gas Combo Sizing Guide for combo systems in British Columbia,
- Unified Canadian Combo Sizing Guide, now required by some municipalities for permit applications, and
- Ecologix recommended sizing method, for most applications where a rental water heater is not used.

For sizing or trouble-shooting, give us a call and let us do the work for you. If you know the heat loss and cooling loads we can make the selection for you and send you the information by fax. This can be extremely handy when applying for a heating permit.

If you need heat loss and cooling load calculations, we can include that service as part of the purchase of the air handler. Call us for details.

# INSTALLATION

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The installer must adhere strictly to all local and national code requirements pertaining to the installation of this equipment.

Detailed instructions are shipped with all accessory items and should also be followed in detail.

## ***air handler mounting***

The **combo-pac**® air handler can be installed in any direction. Its compact dimensions even allow for installation between joists. Some precautions must be observed for some of the possible mounting positions.

For installations where the access door faces up or down, select an air handler with an external pump to avoid the pump being mounted with its shaft vertical. The pump shaft must be mounted horizontally to avoid damage during operation.

For installations where the access door is facing up or down, remove the fan and motor assembly. Loosen the band holding the fan motor in place. Rotate the motor to ensure the oil port on the motor faces above the horizontal when installed, then tighten the holding band. Note: no field adjustment is required for upflow, downflow, horizontal left or right configurations.

The air handler can be hung by securing straps through any of the existing screw holes in the cabinet. When the existing screw is too short for securing a mounting strap, a longer screw can be used, provided care is taken not to damage any internal components. When fastening straps using screws other than those supplied with the

cabinet, special care should be taken in the vicinity of the coil to avoid tube puncture.

The cabinet is designed so that the return air can be located on either side of the cabinet, through the bottom of the cabinet, or from the back. Slots are provided to indicate the outline of the opening required to be cut. Position the filter rack so that the filter is readily accessible.

Install the air handler with the door firmly screwed in place to make sure the cabinet is hung without racking.

Provide at least 2 feet (0.75 metres) of clearance in front of the access panel of the air handler for servicing. Opening a closet door or similar removable panel is an acceptable means of providing the required clearance. Zero clearance is acceptable on all other faces.

## ***domestic water piping***

Install a 1/2" (12mm) sediment faucet for use as a drain/purge valve. The drain valve must be located on the return line downstream of the pump and check valve and upstream of the isolation valve (if isolation valve is present). With this arrangement, any air trapped in the system can easily be flushed out following the instructions in the *Start-up & Troubleshooting* sections.

Install a throttling valve in the heating loop. The isolation valves installed in the system shall not be used as a throttling valve.

Isolation valves are recommended, but not required. Installing isolation valves facilitates easy servicing and ensures positive purging of the system during start-up.

Any pipe and fittings approved for domestic or potable hot water can be used in a combo system. This includes PEX (cross linked polyethylene) pipe and fittings. All solder joints in copper pipe must be lead free solder. The temperature and pressure supplied to the **combo-pac**® air handler must not exceed 180°F (82°C) and 150 psig (1 Mpa)

Maximum pipe lengths for all **combo-pac**® air handlers should be as shown in Table V below. Pipe lengths indicated are actual lengths. Allowance has been made for a reasonable number of valves and fittings.

**Table V      maximum pipe lengths**

Pipe size	maximum length
1/2" (12mm)	25 feet (9 metres)
3/4" (20mm)	125' (45 metres)

When both top and side connections are provided on the water heater, the side connections should be used for the space heating loop and top connections for cold supply and hot water to the fixtures.

When the space heating loop connections are made to the domestic water connections (instead of the water heater):

- the heating loop connections should be positioned horizontally in a vertical section of the domestic water line for both inlet and outlet. Refer to the piping schematic for details.

- connect the heating loop to the domestic water connections as close to the water heater as possible.

Avoid sections of pipe in the heating loop that can trap air where possible. It is usually impossible to install a system without having at least one part of the system or heating coil able to trap air. This will not be a problem if the connection to the domestic water lines is made properly, and the system is properly purged on set-up:

- The circulating pump is capable of removing small amounts of entrained air from the heating loop.
- Following the flushing procedures in the *Start-up* section will ensure that there is no air in the system after initial set-up.
- Proper connections between the domestic water lines and the heating loop will ensure that any air that collects in the water tank, does not make its way into the heating loop.

Air bleed valves at high points of the heating system are not required and NOT recommended.

***anti-scald valve***

Anti-scald valves are not required for normal operation, but may be used for installations where the home owner wishes a lower domestic water temperature than 140F (60C). It is not recommended that anti-scald valves be installed unless required. If an anti-scald device is to be installed, it must comply with ASSE standards no. 1016 and 1017. Refer to *Accessories*.

### **water heater**

Follow the water heater manufacturer’s instructions for installation and start-up of the water heater. Make sure the water heater is turned off during air handler installation and service. Ensure the water heater has been refilled, and all air is purged from the system before turning on the water heater.

### **duct work**

To minimize fan noise in the living space, it is recommended that the first

three feet of supply and return air duct be lined with acoustic insulation.

Return and supply air duct work should be the same size as the air handler openings up to the first branch, fitting or transition.

**Warning!** special care should be taken in the vicinity of the coil to avoid tube puncture. Screw into opening flange instead of top of cabinet when fastening the supply air duct.

## **ELECTRICAL**

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**Warning!** - Make sure unit is properly grounded. Locate air handler on a separate electric circuit or, if a power vented water heater is used, use the same circuit as the water heater.

Hint: For installations with a power vented water heater, order the air handler complete with cord set, and plug the air handler into the same outlet as the water heater. This simplifies installation and improves serviceability. It also removes the need for an electrical permit to install the air handler in retrofit applications.

All air handlers operate on 120v/1ph/60hz line voltage. All control circuits are 24 volt AC.

### **thermostat**

The **combo-pac**® air handlers are compatible with any standard heat/cool, heat pump, “electric heat”, “gas heat”, set-back or electronic thermostat.

Thermostat wire	Air handler wire
R – 24VAC	Blue
W – Heating	White

Y – Cooling	Yellow
G – Continuous Fan	Brown

Note: Wire colours may vary from what is shown in the table. Always verify the wires based upon the relay labels on the control panel.

Thermostat Heat Anticipator Setting	<b>0.04 amps</b>
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Thermostats without cooling: do not connect the yellow wire at the air handler.

Thermostats without continuous run switch: do not connect the brown wire at the air handler.

### Air conditioning contactor:

Connect to the yellow thermostat wire and the ground screw on the terminal strip.

### **electrical information**

Air handler wiring diagrams are located on the inside of the access panel for easy reference during installation and servicing.

A wiring schematic and ladder diagram are included in this manual for reference by designers.

Connect the power supply to the three labeled wires:

- Black – line voltage
- White – neutral
- Green – ground

Note: The wire colours shown in this manual may vary from colours found in the air handler! Please refer to diagrams on the inside of the access panel during installation.

Nameplate data is located on the side of the unit.

For other electrical details and schematics, please contact **combo-pac®** representative.

### ***connection locations***

A terminal strip inside the electrical box is provided for the following electrical connections:

- motor speed settings
- circulation pump

### ***changing motor speed settings***

**combo-pac®** air handlers are equipped with either three or four speed motors.

Factory settings are:

Cooling speed = high

Heating speed = low

Continuous run = low

Motor speeds for cooling, heating or continuous run are all field selectable, in any combination.

Changes to motor speeds are made at the terminal strip in the electric module.

**Warning!** Do not move motor wires to change speed selections. Only move the orange wires from the relays. All connections are clearly marked. It is acceptable to put two or more fan relay connections under one terminal lug. (The unit comes factory set with both the continuous run and heating speed relay connections under the motor low speed terminal lug.) Do not use jumpers between terminal lugs! Connecting two or more motor taps together will result in immediate motor failure and possible fire hazard.

## **START-UP PROCEDURES**

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**Do not start the air handler or water heater until ALL air has been purged!**

1. Fill the water heater with water, but do not start it.
2. Purge all air for the domestic water lines by opening faucets at the remote parts of the plumbing system.
3. Purge all air from the space heating loop by closing the isolation valve on

the return leg of the loop and open the drain to purge air. Open the return leg isolation valve and then close the drain valve. If no isolation valves are installed, open drain fully to purge air and let run for at least 30 seconds.

4. On Grundfos pumps, vent the air from the pump chamber by loosening the large screw plug on the front of the

- pump motor until water appears. Hold a rag underneath to catch drops.
5. Start the water heater according to the manufacturer's instructions. Set the desired water temperature (140F/60C) and wait for the tank to shut off.
  6. Turn on the power to the air handler and set the room thermostat for heat to energize the fan and pump. If a gurgling sound is present, it should subside within one minute. If noise is still present after one minute, repeat step 3 to purge air as necessary.
  7. Check pipes for heating to make sure there is flow and feel the pump motor to see if it is running hot.
  8. With the air handler running, adjust the water flow through the circulation loop to obtain 20-30F (11-17C)

temperature drop through the air handler with an entering water temperature between 135-140F (57-60C).

HINT: The temperature drop across the air handler can easily be measured with a probe type pocket thermometer. Just rap a rag or piece of insulation around the inlet and outlet to the air handler and insert the thermometer probe between the insulation and the pipe to take the reading. Wait at least two minutes to take each reading. Make sure to take both readings one immediately after the other. At high flow rates the temperature in the tank may drift, causing error in the calculated temperature difference, if reading are taken more than 4 minutes apart.

## **SEQUENCE OF OPERATION**

Refer to Ladder Diagram and Wiring Schematic for relay locations.

Note: **combo-pac**® air handlers are equipped with 3 speed fan motors (high, medium, low). Speeds for heating, cooling and continuous run are all field selectable. Refer to *Electrical* section for description.

### Heating Cycle

1. thermostat calls for heat, connection is made between the R and W thermostat wires.
2. heating relay 2R is energized; 2R1 closes providing power to the heating speed motor tap; 2R2 opens, interrupting power to continuous run motor tap.  
pump relay 1R is energized; 1R1 closes.

3. When room temperature is satisfied, thermostat breaks connection between wires R and W.
4. relays 2R and 1R are de-energized; pump stops, fan shuts off (or switches to continuous run speed when continuous run employed)

### Cooling Cycle

1. thermostat calls for cooling, connection is made between R and Y thermostat wires.
2. cooling relay 3R and cooling contactor circuit are energized.
3. 3R2 opens interrupting power to the continuous run motor tap; 3R1 closes providing power to cooling speed motor tap and the outdoor air conditioning unit.
4. when the thermostat is satisfied, the connection between R and Y is broken at the thermostat.

5. cooling relay 3R and compressor contactor are de-energized.
6. fan shuts off (or switches to continuous run speed when continuous run employed)

#### Continuous Run Cycle

1. connection is made between R and G thermostat wire.
2. continuous run relay 4R is energized; 4R1 closes, fan operates on continuous run speed. (factory set to low)

## **SERVICE AND MAINTENANCE**

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### ***filter***

The **combo-pac**® air handler is provided with a reusable washable filter media. This filter should be inspected monthly and removed and vacuumed or rinsed as required. Use water only to clean the filter. The filter is designed to last for many years, but replacements can be purchased from any hardware store and cut to fit the filter rack. Pre-cut replacement filters are available from Ecologix.

### ***duct cleaning***

If proper filter maintenance is adhered to, duct cleaning will not be required for the life of the equipment.

### ***coils***

air conditioning and heating coils should not require cleaning if the filter maintenance schedule is adhered to. If a filter is damaged or collapses from plugging, the coils may get fouled by dust. If this happens, replace the filter and carefully vacuum the heating coil. The fan may need to be removed to gain access to the face of the heating coil.

### ***air conditioning coil***

At the start of each cooling season, check the drain connection to the cooling coil to ensure it is free of debris. An easy way to do this is to blow into the tube to see if there is any obstruction. If a plugged air conditioning coil is suspected, call a service technician for testing and cleaning

### ***fan and motor***

oil the fan motor bearings every twelve months. (two oil ports total; only one drop of oil in each port) check fan for dust once a year. If dirty, vacuum or wash to remove dust. Keeping the fan blades clean will reduce noise and improve the capacity and efficiency of the heating system. Take care to avoid wetting the motor! Remove the motor if required.

### ***pump***

The circulating pump is water lubricated and should require no regular maintenance. If the pump fails to start at the beginning of the heating season, follow the instructions in the *Trouble Shooting* section of this manual below.

# TROUBLESHOOTING

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**First**, verify that the power is on (at switch and panel), the isolation valves to the air handler are fully open and the water heater is operating properly (hot water at the faucets).

## ***pump does not run***

In areas where hard water is present the pump may “stick” and fail to run after long idle periods. Often this can be freed by closing the isolation valve on the return leg and opening the drain port so full city water pressure flows through the pump. For Grundfos pumps, remove the screw-on cover from the face of the pump, and rotate the shaft one turn with a slotted screw driver (Protect the air handler from drips!). If either method fails to free the pump, removal for cleaning or replacement is necessary.

## ***pump is noisy at start-up***

Air is present in heating loop. If sound has not diminished within 1 minute, purge air in accordance with the *Start-Up* procedures. Check to make sure branch connections for heating loop are horizontal.

## ***water heater T&P is weeping***

A check valve or back-flow preventor has been installed in the system. Some form of pressure relief may be required.

Options are:

- install expansion tank
- install pressure relief valve; locate outlet over laundry tub or floor drain.
- install combination toilet tank/pressure relief valve

## ***insufficient or no heat***

- Plugged air filter or coil. Refer to *Maintenance* section for filter care and coil cleaning
- Air in heating loop; purge system
- Inlet and outlet connections to air handler backwards; reverse connections
- Restricted or improperly installed supply tube in water heater; check and replace
- Water heater thermostat set too low or not calibrated properly; check water temperature at a faucet. If the temperature has been set low because of homeowner preference, an anti-scald valve may be needed to provide the homeowner with the means of turning the domestic hot water down without affecting the heating output.
- Restriction in heating loop; remove restriction, check valve stuck or closed valve.

## ***cold water at hot faucet***

The most probable cause is reverse flow through the heating loop from a stuck check valve; repair or replace valve.

## ***fan runs for cooling but not heating***

Thermostat may be connected improperly. Refer to *Electrical* section for proper installation.

## ***heating during off cycle***

probable cause is thermal siphoning. See check valve description for details; repair or replace check valve.

## AIR HANDLER PARTS LIST

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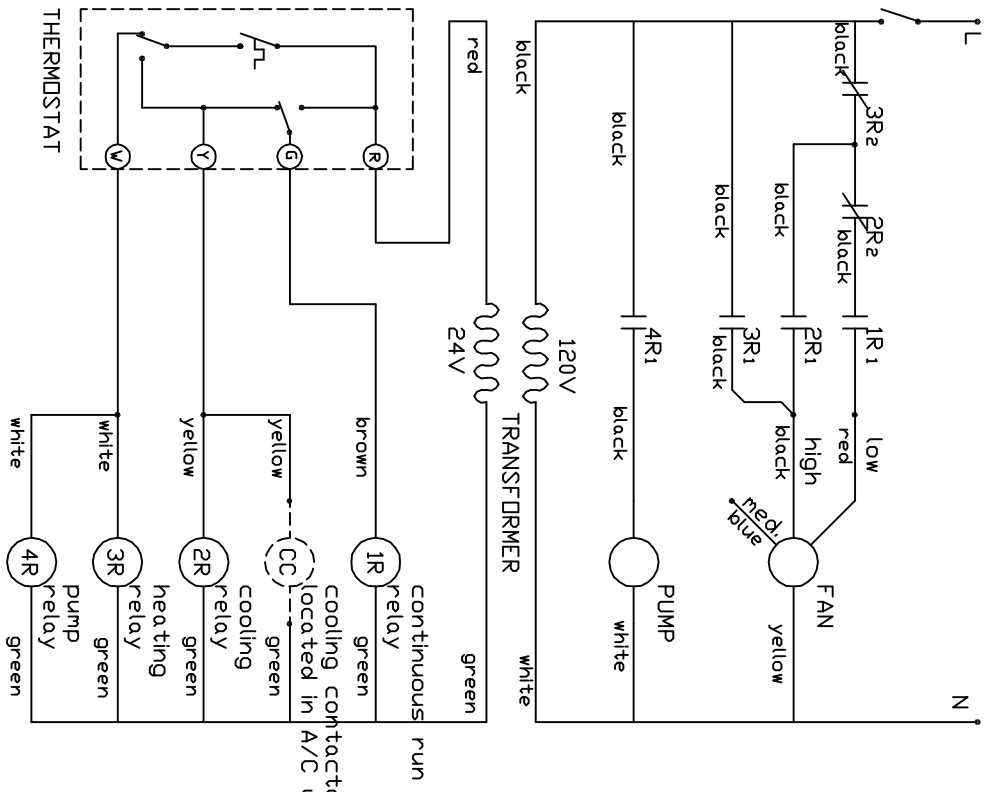
Part No.	Description
P001	A2 Hot Water Coil -- 12"x16"
P003	A3 Hot Water Coil -- 12"x16"
P112	A4 Hot Water Coil -- 12"x16"
P118	C3 Hot Water Coil -- 18"x20"
P158	Pump -- 3/4" sweat
P162	Check Valve - 3/4" sweat
P009	Terminal Strip
P010	Relay -- SPDT
P020	Transformer 24VAC, 20 VA
P022	Fuse (transformer primary) 2A, 250V
P024	Fuse block
P026	Door interlock switch
P030	Capacitor Strap
P032	Capacitor Boot
P034	Capacitor 5 MFD
P045	1/4 hp Motor c/w bracket for -05 series
P046	1/3 hp Motor c/w bracket for -06 series
P047	1/2 hp Motor c/w bracket for -07 series
P057	Blower 10x7 DD c/w mounting bracket
P058	Blower 10x8 DD c/w mounting bracket
P190	External pump module pump - and check valve

**TYPICAL PLUMBING CONNECTIONS**

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# Combo—pac™ AH—38

## Ladder Diagram and Wiring Schematic



- NOTES
- 1) DOTTED LINES INDICATE FIELD WIRING
  - 2) SUPPLY: 120V/1PH/60HZ

