

Safety & Installation Instructions

Model 6504

CONTROLS:

- Up to four zones
- Separate two-stage heating and two-stage cooling equipment
- Two stage heat pumps with one stage of auxiliary heat
- Energy Recovery Ventilators or Model 6506 Ventilation Damper
- Electronic Air Cleaners
- 2-wire or 3-wire dampers

INTEGRATES WITH:

- Aprilaire Automatic Humidifier Control (AHC) to enhance humidity control
- Aprilaire Model 8570 Thermostat

REQUIRES:

- Two 24-volt transformers: one for control panel and thermostats, and one for dampers
- One Aprilaire Model 8570 Thermostat per zone
- Standard thermostat wire

OPTIONAL:

- Plenum Temperature Sensor (Aprilaire Model 8052)
- Model 56 Aprilaire Automatic Humidifier Control
- Outdoor Temperature Sensor (Aprilaire Model 8052 – not needed if installed with an AHC)

TABLE OF CONTENTS

WARNINGS AND CAUTIONS	3	START UP AND TEST	17
CONTROL PANEL SPECIFICATIONS	3	SEQUENCE OF OPERATION	22
CONTROL PANEL LAYOUT	4	Automatic Changeover	22
RUN WIRE FOR THE SYSTEM	5	Initial Power Up or Reset	22
MOUNT THE CONTROL PANEL	6	Damper Outputs	22
SET THE CONTROL CONFIGURATION		Heating Equipment Outputs – Configured for	
SWITCHES/JUMPER	7	HEAT/COOL Operation	23
WIRE THE SYSTEM	8	Heating Equipment Outputs – Configured for	
Select and Wire the Transformers to the Control Panel	8	HEAT PUMP Operation	24
Install the Model 8570 Thermostats and Wire to the		Emergency Heat Equipment Outputs – Applies Only	
Control Panel	9	When Configured for HEAT PUMP Operation	25
Wire the HVAC Equipment to the Control Panel	10	Cooling Equipment Outputs	25
Wire the Zone Dampers to the Control Panel	12	EAC Output	26
Wire a Plenum Sensor to the		ERV/Vent Output	26
Control Panel – OPTIONAL	12	AHC Operation	27
Wire an Outdoor Sensor to the			
Control Panel – OPTIONAL	13		
Wire an Aprilaire Automatic Humidifier Control (AHC)			
to the Control Panel – OPTIONAL	14		
Wire an EAC, ERV or Ventilation Damper to the			
Control Panel – OPTIONAL	15		

WARNINGS AND CAUTIONS

WARNING

1. 120 Volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Leave power disconnected until installation is complete.
2. Sharp edges may cause serious injury from cuts. Use care when making duct openings and handling ductwork.
3. The Aprilaire Zoned Comfort Control System is designed for indoor use only. Do not expose any component of the zone control system to moisture. Do not mount any Aprilaire Zoned Comfort Control equipment where it may be accessible to children.

CAUTION

1. Turn off the HVAC system power before removing or installing any wires into the terminals of any component on the system. Wiring with a live circuit can lead to electrical shorts that can damage components.
2. Installation must be done in accordance with all applicable codes.
3. Installer should touch a grounded metal object before handling the Aprilaire control panel to avoid potential loss of internal computer programs due to static discharge.
4. A zoned comfort control system may not control temperature properly unless the heating and cooling system is properly sized and balanced.
5. Insufficient air flow or excessive temperatures through the heating and cooling system could result in equipment damage. Refer to the manufacturer's recommendations for minimum safe airflow and temperature requirements.
6. Excessive pressure across a bypass evaporative type humidifier may cause high air velocity in the humidifier, resulting in water being blown into the ductwork. Refer to the Design Guide form 5001 for humidifier installation considerations.
7. Install an outdoor thermostat to prevent non-seasonal equipment starts.
8. Do not mount the control panel on any part of the heating/cooling equipment or ductwork.
9. Do not install control panel where temperatures exceed 140°F (60°C) or are below 32°F (0°C).
10. Improper system installation could cause water damage from frozen pipes. Check system operation after installation.

SPECIFICATIONS

ELECTRICAL

Control Panel Input Voltage	20-30 VAC
Power Requirement (control panel & thermostats only)	40 VA
Max. current through EAC terminals	1 amp @ 24 VAC
Max. current through ERV/Vent terminals	1 amp @ 24 VAC
Max. current through equipment control terminals	1 amp each or 3 amp total @ 24 VAC
Damper Voltage	18-30 VAC
Damper Fuse	3 amp, fast acting
Outdoor Temperature Sensor	RPC Model 8052
Plenum Temperature Sensor	RPC Model 8052

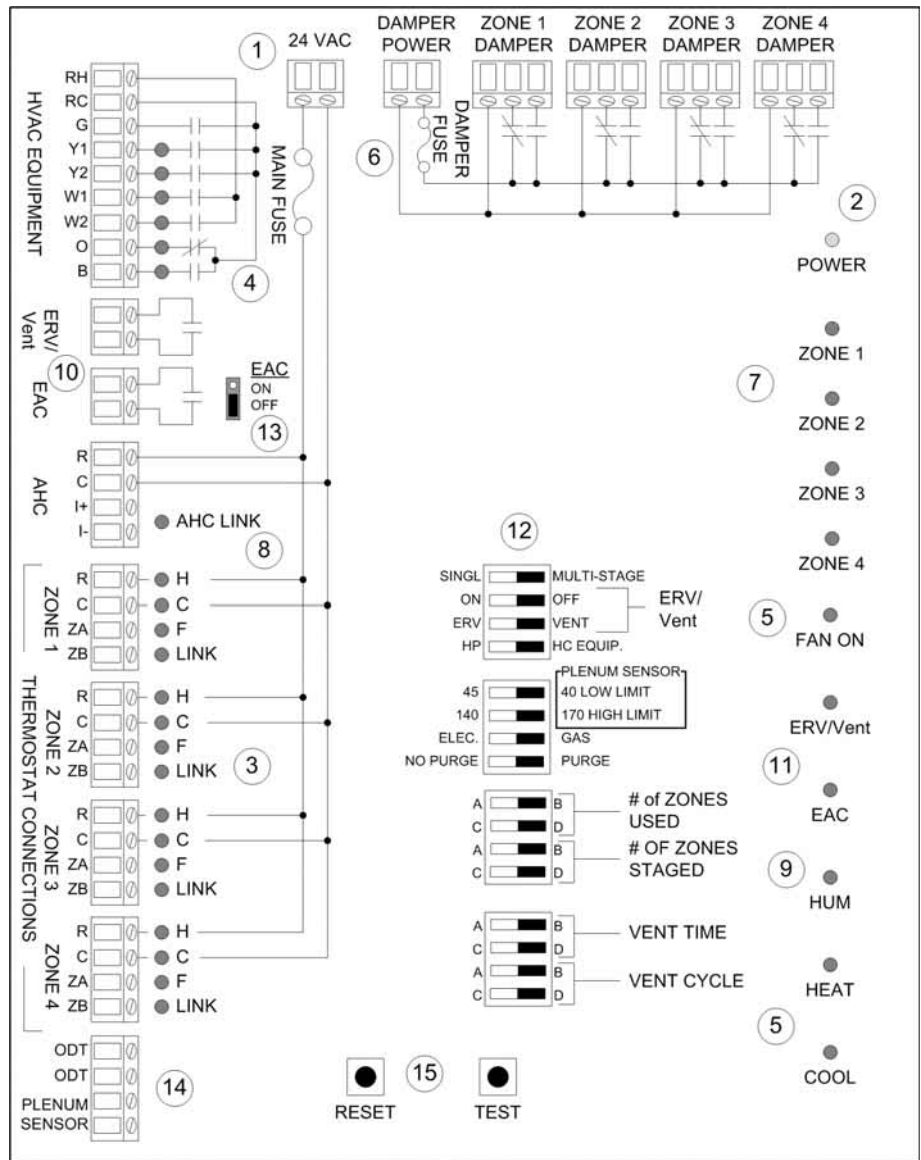
ENVIRONMENTAL

Operating Temperature	32°F (0°C) to 140°F (60°C)
Operating Humidity	up to 90% non-condensing
Shipping Temperature	-40°F (-40°C) to 180°F (82°F)

CONTROL PANEL LAYOUT (See Figure 1)

- (1) 24 VAC power input serves thermostat and AHC connection.
- (2) POWER LED light blinks at once per second with power applied unless put in Test Mode when it blinks twice per second.
- (3) Four sets of thermostat inputs. H (eat) LED lights when the thermostat calls for heating, C (ool) LED lights when calling for cooling, F (an) LED lights when calling for continuous fan and the LINK LED is lit continuously when a thermostat is connected.
- (4) LEDs for all HVAC Equipment outputs.
- (5) Visible (with the cover on) LEDs to indicate when the system is Heating, Cooling or operating the Fan.
- (6) Separate power input for 2 or 3-wire dampers.
- (7) ZONE LEDs light when the Normally Open (NO) contact is closed.
- (8) Automatic Humidifier Control connection; LINK LED lights when the AHC is communicating to the control panel.
- (9) HUM LED lights when the Humidifier valve is on.
- (10) Outputs for ERV/Ventilation and Electronic Air Cleaner (EAC) control.
- (11) LED indicates when ERV/Vent or EAC relay is closed.
- (12) Dip switch settings to configure HVAC outputs, activate/deactivate ERV/Vent outputs and set period and frequency for ventilation control.
- (13) Jumper to turn on/off EAC control.
- (14) Inputs for an outdoor temperature sensor and plenum temperature sensor.
- (15) Test button runs automatic test sequence. Reset button momentarily breaks power to control panel microcontroller.

FIGURE 1



RUN WIRE FOR THE SYSTEM (See Figure 2)

TABLE 1 – WIRES REQUIRED FOR VARIOUS HVAC EQUIPMENT TYPES

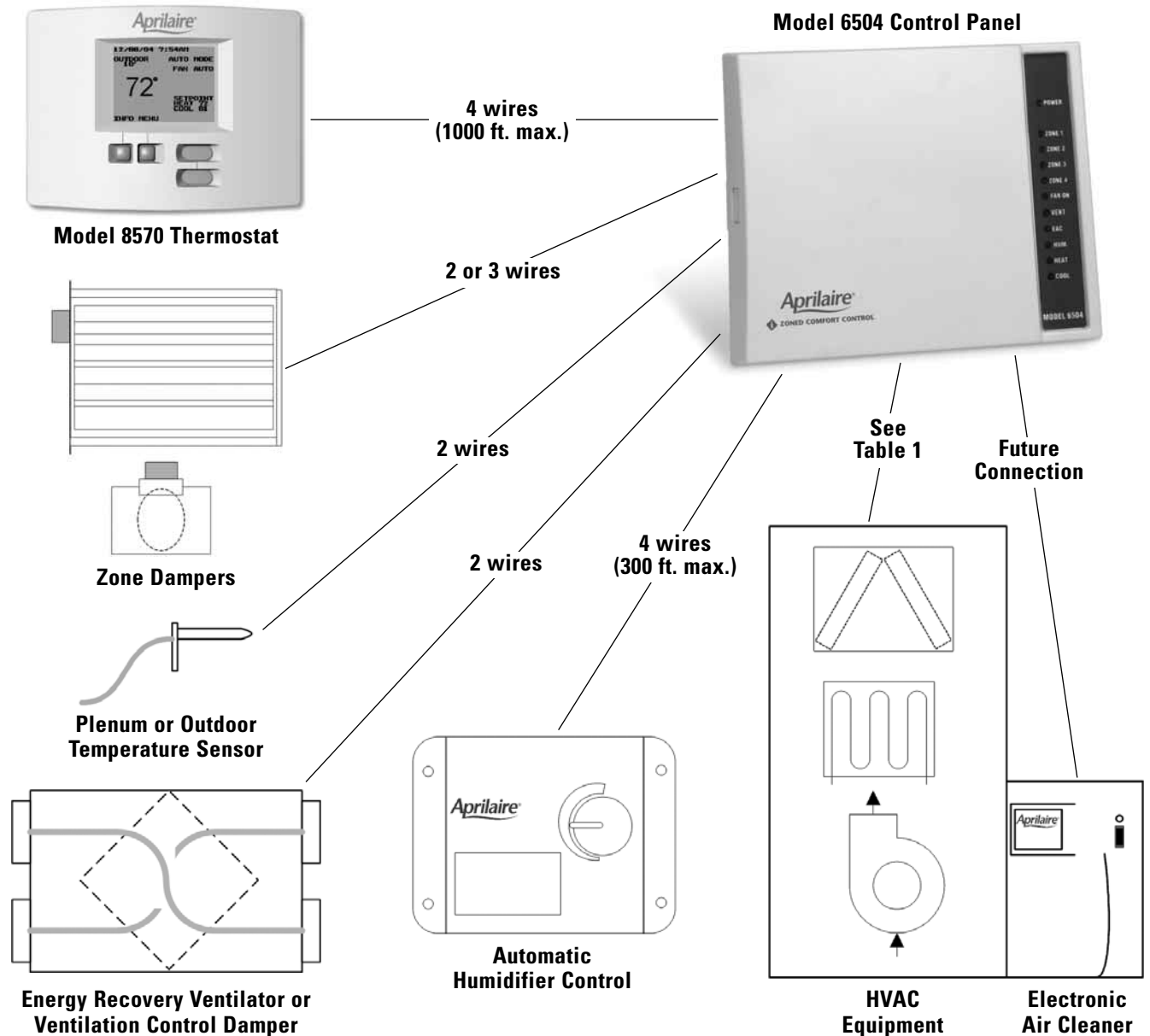
System Type	Single-Stage Furnace & A/C	Two-Stage Furnace & A/C	Boiler w/AC (2-xformer)	Radiant 1st Stage Heat, Furnace 2nd Stage Heat & A/C	Single-Stage Heat Pump	Two-Stage Heat Pump
Wires	4	6	5	5	5	7

WIRE TYPE: Standard 18-24 gauge stranded or solid thermostat wire can be used for all wire runs.

IMPORTANT

Avoid running thermostat, AHC and sensor wires along side line voltage wires to prevent electrical noise on the Intelligent Zoned Comfort Control system.

FIGURE 2



MOUNT THE CONTROL PANEL (See Figure 3)

- Do not mount directly on foundation walls or on the HVAC equipment or ductwork. These locations can cause moisture to condense on the control panel.
- Mount indoors, in a location where the temperature will not exceed 140°F (60°C) or drop below 32°F (0°C).

1. Press in the cover latch on the left side of the enclosure and pull open the cover.
2. There are six (6) keyholes on the base of the enclosure. Use the four that are visible with the circuit board in place.
3. Use #8 screws (field supplied) to mount the base.

If space limits the use of the outside keyholes, the circuit board must be removed from the base to use the two center keyholes.

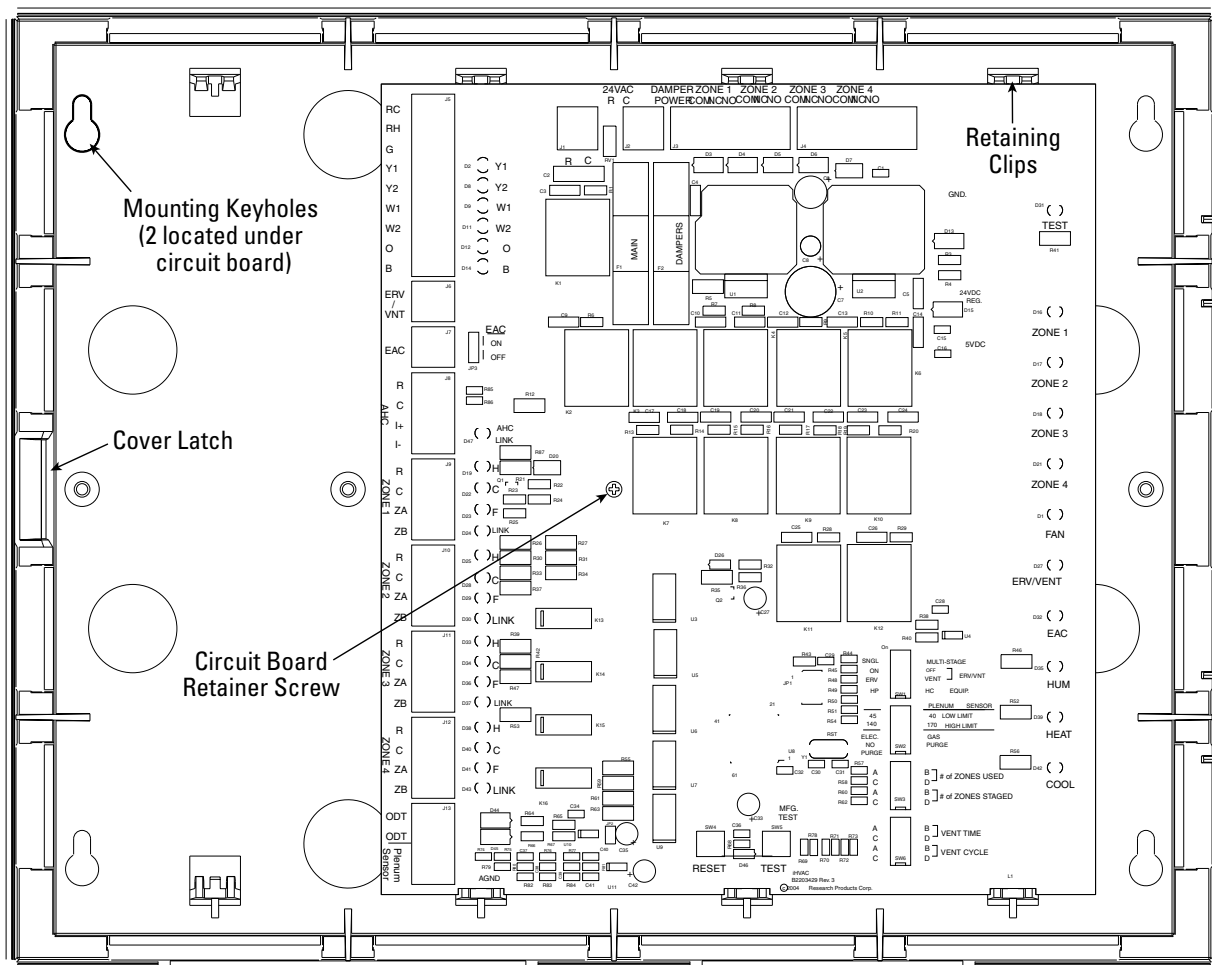
- a. Carefully remove the screw securing the circuit board to the base.
- b. Flex back the retaining clips holding the top of the circuit board to release.

CAUTION

Electrostatic discharge can damage the control. Touch a grounded metal object before touching the circuit board, and then only touch the circuit board on the edges when handling.

- c. Re-install the circuit board after mounting the base.

FIGURE 3



SET THE CONTROL CONFIGURATION SWITCHES/JUMPER (See Figure 4)



EAC ON or EAC OFF – In the future, the Aprilaire Model 5000 will be capable of wiring directly to the 6504. Alternative wiring options do currently exist – contact the factory and request Diagram 30-293. Set the jumper to the top two pins if EAC control is desired.

SINGL(E) OR MULTI-STAGE – Set to SINGL if the heating and cooling equipment or heat pump is single stage.

ERV/VNT: ON/OFF – If you want the control panel to control an energy recovery ventilator or a ventilation damper, turn this switch on.

ERV/VNT: ERV/Vent – To control an ERV, set the switch to ERV. To control a ventilation damper, set to Vent (ERV/VNT ON/OFF switch must be set to ON for this switch to have any function).

HC EQUIP or HP (Heat Pump) – If controlling a heat pump, set to HP. If controlling separate source heating and cooling equipment, such as a furnace and air condition or roof top unit, set to HC EQUIP.

Plenum Sensor: 40° or 45° Low Limit – Set the temperature at which the cooling outputs will be turned off to prevent coil freezing. (Requires an Aprilaire Model 8052 Plenum Sensor.)

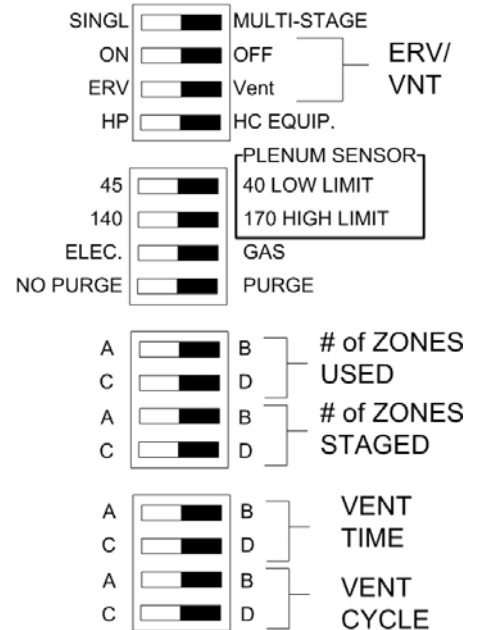
Plenum Sensor: 140° or 170° High Limit – Set the temperature at which the heating outputs will be turned off to prevent overheating. (Requires an Aprilaire Model 8052 Plenum Sensor.)

ELEC or GAS – Set to ELEC if the G terminal is to be energized with W1/W2 heating outputs.

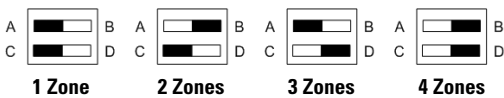
NO PURGE or PURGE – Set to NO PURGE if the HVAC equipment has a built in purge, where the blower continues to operate, after a cooling call for a specific amount of time. Set to PURGE to allow the control panel to control this purge cycle.

of ZONES USED – Set the number of zones that will be wired to the control panel.

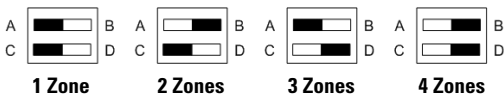
FIGURE 4



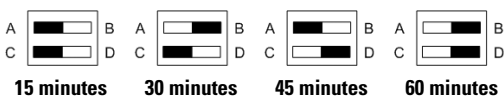
IMPORTANT: This must be set properly for the system to operate.



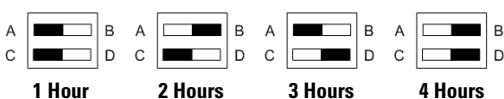
of ZONES STAGED – Set to something other than 1 if it is desired to allow staging (and subsequently increased airflow) only when 2, 3 or 4 zones are calling, and at least one of those zones are calling for second stage heating or cooling.



VENT TIME – Sets the amount of time that the ERV will operate or the Ventilation Damper will be open during the Vent Cycle.



VENT CYCLE – Sets the period over which the amount of ventilation run time will be summed. For example, if the Vent Time is set for 30 minutes and the Vent Cycle is set for 1 hour, the ERV or Ventilation Damper will be operated for 30 minutes per hour.



WIRE THE SYSTEM

SELECT AND WIRE THE TRANSFORMERS TO THE CONTROL PANEL

WARNING

120-volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Leave power disconnected until installation is complete.

- Two separate 24-volt transformers will be required for the system. The HVAC equipment transformer can not be used for power. Transformer #1 is used to power the control panel, thermostats and humidifier. Transformer #2 is used to power the zone dampers and Ventilation Damper.

Component	Component VA Required
Control Panel and up to Four Thermostats	40 VA
AHC and Humidifier	10 VA
Zone Damper	10 VA each
Ventilation Damper (Aprilaire Model 6506)	10 VA

- Size Transformer #1.

- If an Aprilaire Automatic Humidifier control (AHC) **will be part** of the system, install a 50 VA transformer.
- If an AHC **will not be part** of the system, install a 40 VA transformer.

- Install Transformer #1 (see **Diagram 1**). The load side (24-volt side) of Transformer #1 is wired to the 24 VAC terminals of the control panel.

- Size Transformer #2.

- Add all the zone dampers that are in the system.
- Subtract the number of dampers in the zone with the least number of dampers.
- This is the most number of dampers that **could be** energized at one time. Multiply this number by 10.

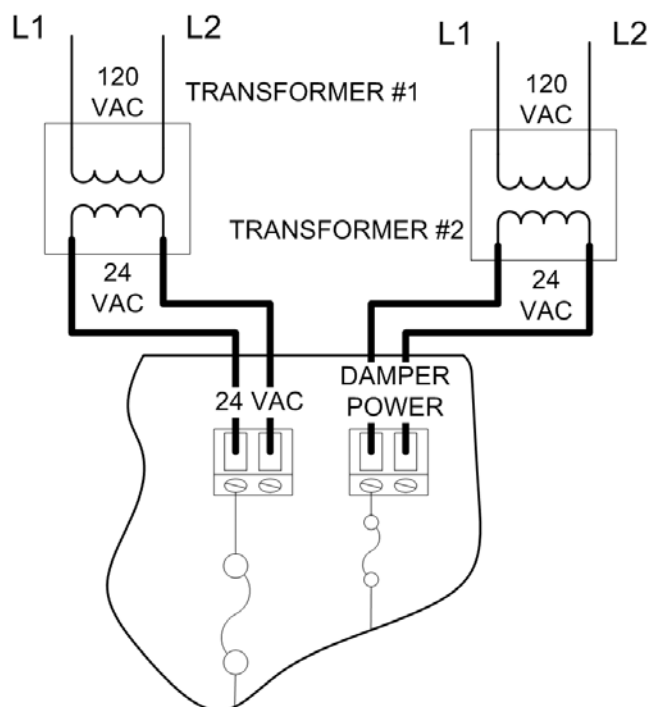
Example: If you have a 4-zone system, and there are two dampers per zone in all but one zone that has only one damper (7 total dampers in the system), then the total number of dampers that could be energized at one time is: **7 - 1 = 6 dampers**.

- Add 10 VA if a Ventilation Damper will be powered from this transformer. In the example above you would need 70 VA to power the zone dampers (60 VA) and the Ventilation Damper (10 VA), so use a 75 VA transformer.

- Install Transformer #2 (see **Diagram 1**). The load side (24-volt side) of Transformer #2 is wired to the DAMPER POWER terminals of the control panel.

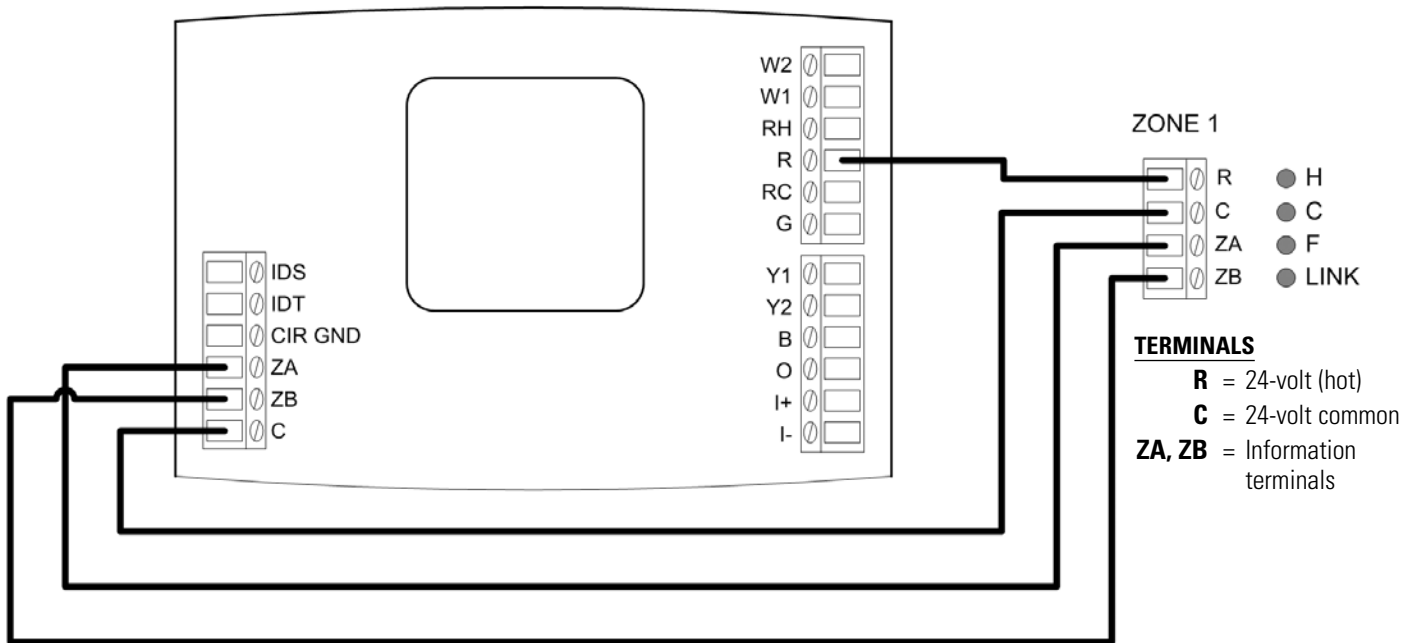
- If multiple transformers are required for damper power, refer to the "Wire the Zone Dampers to the Control Panel" section on page 12.

DIAGRAM 1



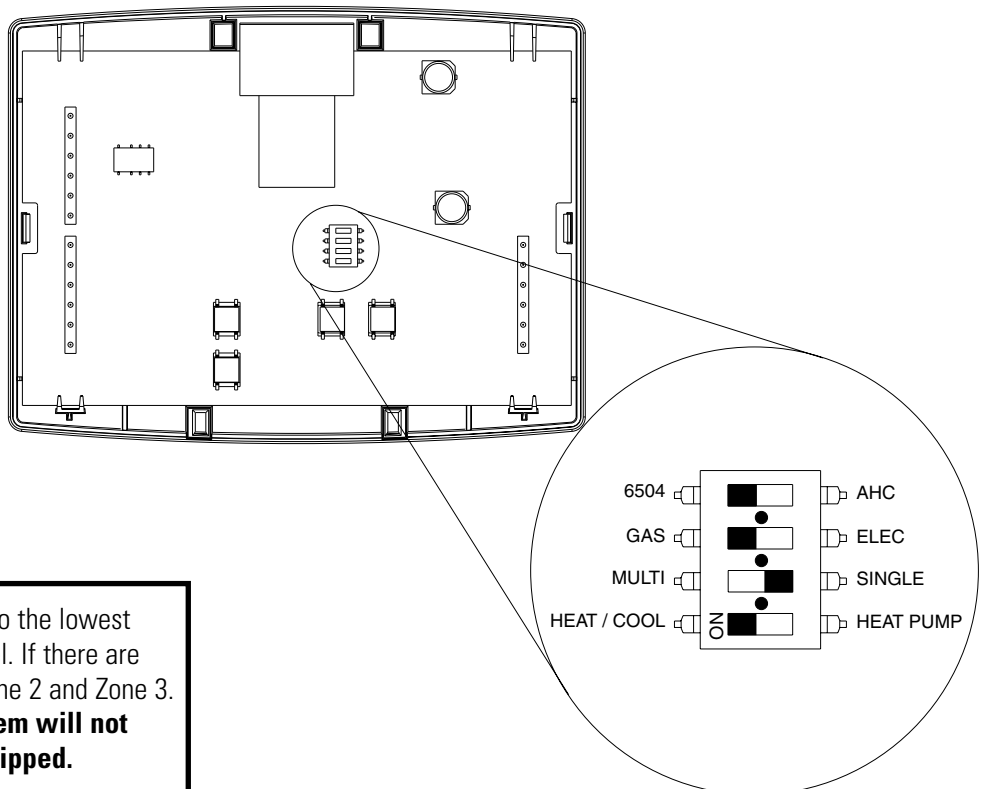
INSTALL THE MODEL 8570 THERMOSTATS AND WIRE TO THE CONTROL PANEL

DIAGRAM 2 – MODEL 8570 THERMOSTAT (shown with enclosure face removed)



1. Run wire between the thermostat and control panel. Use standard 4-conductor, 18-24 gauge thermostat cable. The maximum wire length is 1000 feet. **Do not run wire along side line voltage (110-volt) wire.**
2. Install the thermostat base according to the instructions supplied with the thermostat. Make the wire entry hole in the wall as small as possible to prevent drafts into or out from the inside of the wall.
3. Install the wires in the thermostat terminals as shown in **Diagram 2**. Use the same wire colors for the terminals at each of the thermostats for consistency – this will help to ensure a successful start up.
4. Set the 6504/AHC dip switch (see **Figure 5**) located on the thermostat circuit board to the 6504 position, and set the other dip switches to match what was set on the control panel dip switches.
5. Install the wires in the control panel terminals as shown in **Diagram 2**.

FIGURE 5



IMPORTANT NOTE: Always wire to the lowest numbered zones on the control panel. If there are only three zones, wire to Zone 1, Zone 2 and Zone 3. **DO NOT SKIP A ZONE – the system will not operate correctly if zones are skipped.**

WIRE THE HVAC EQUIPMENT TO THE CONTROL PANEL

WARNING

120-volts may cause serious injury from electrical shock. Sudden operation may cause serious injury from moving parts. Turn off power to HVAC System and leave power disconnected until installation is complete.

1. Disconnect power to the HVAC system.
2. Run wire between the HVAC equipment and the control panel. Use the appropriate number of conductors for your application. Standard 18-24 gauge thermostat cable can be used.
3. Set the HVAC equipment configuration switches to match your application (see "Set the Control Configuration Switches/Jumper" on page 7).
4. Use the diagram that is appropriate for your application to terminate the wires to the HVAC equipment and the HVAC EQUIPMENT terminals of the control panel. (Refer to **Diagrams 3-8.**)

DIAGRAM 3 – Single-Stage Furnace and A/C

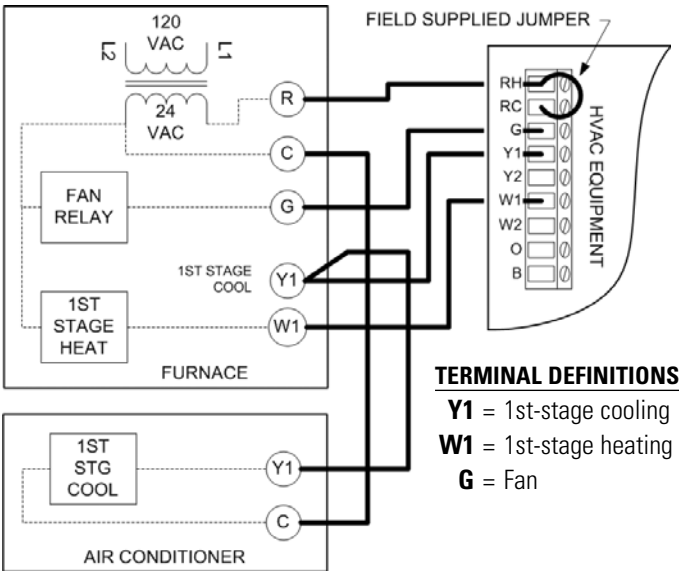


DIAGRAM 4 – Two-Stage Furnace and A/C

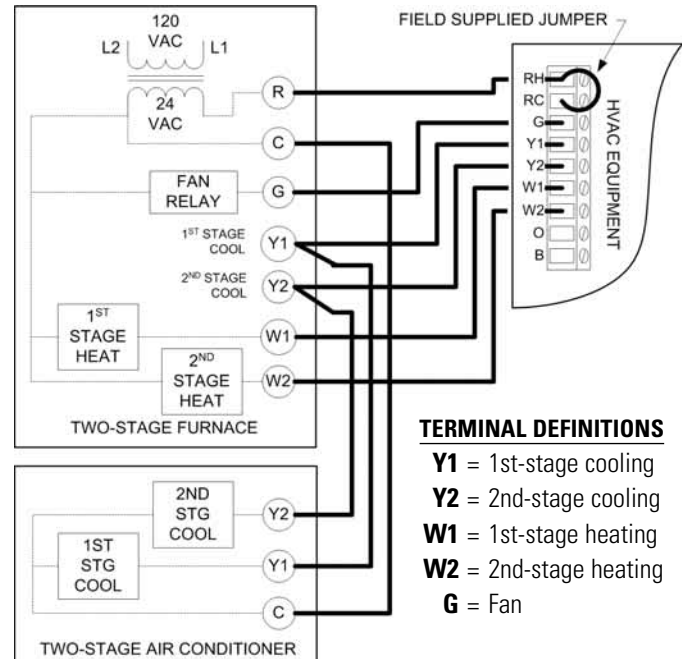


DIAGRAM 5 – Boiler and A/C

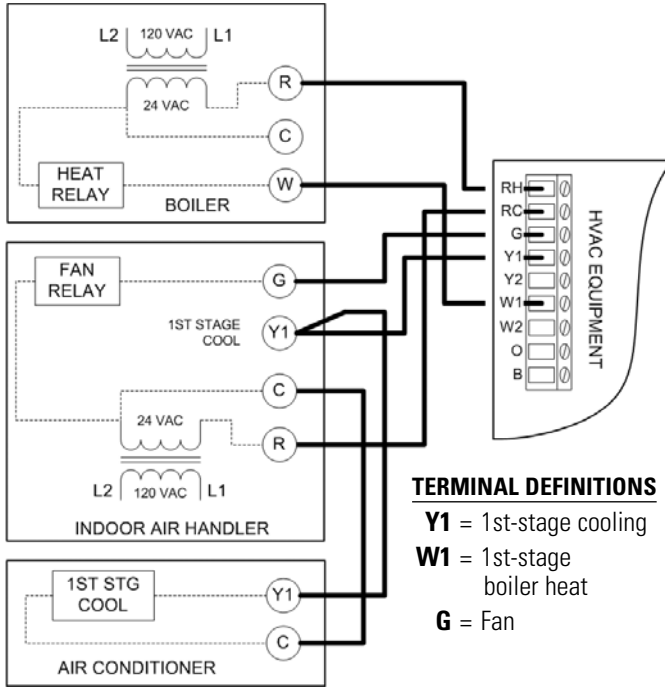


DIAGRAM 6 – Radiant Floor First-Stage Heat, Furnace 2nd-Stage Heat and A/C

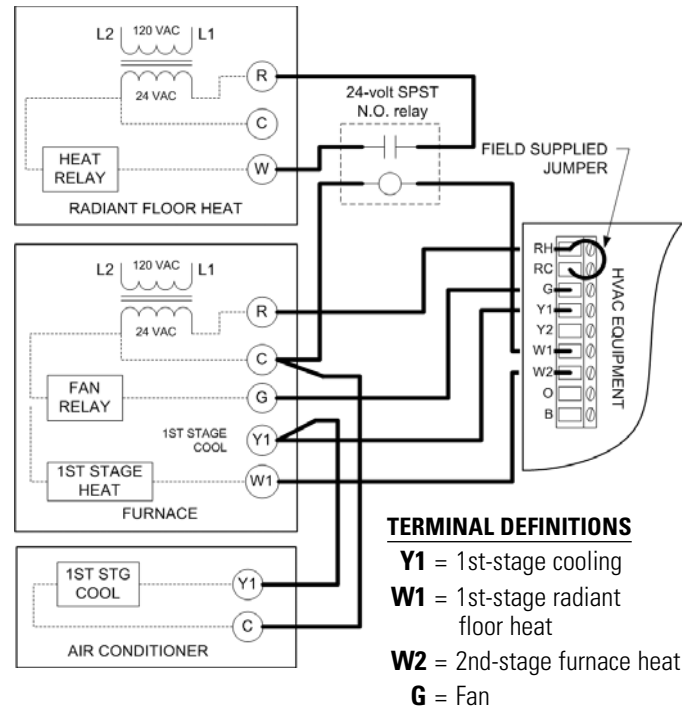


DIAGRAM 7 – Single-Stage Heat Pump

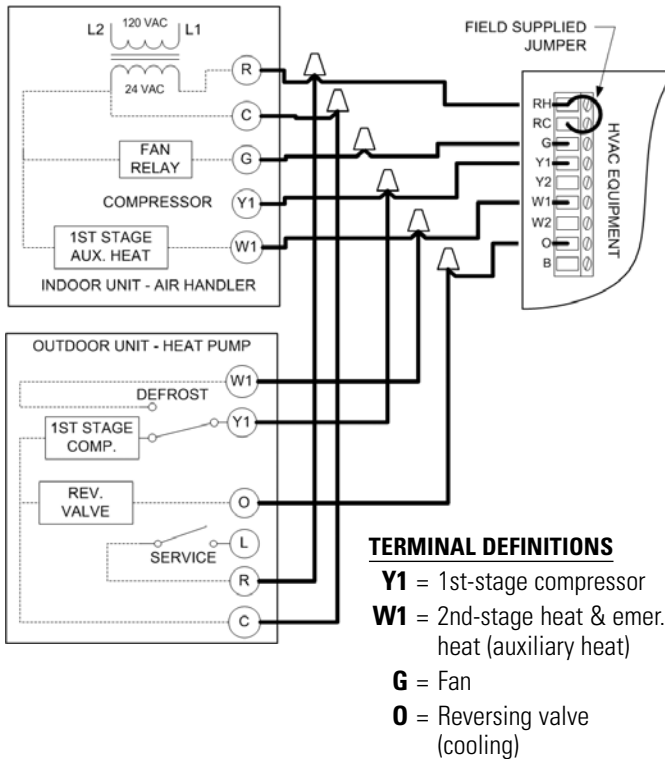
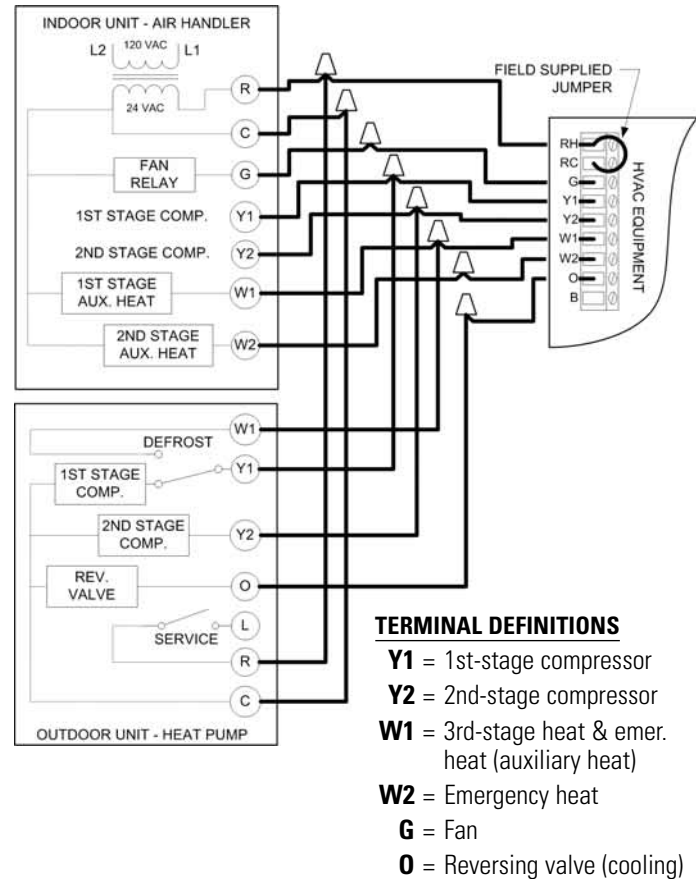


DIAGRAM 8 – Two-Stage Heat Pump



WIRE THE ZONE DAMPERS TO THE CONTROL PANEL

1. Run 2-wire thermostat cable to normally open or normally closed dampers. Run 3-wire cable for power open/power close dampers. Multiple dampers for the same zone can be daisy chained together.

2. Wire the dampers to the Zone Damper output terminals on the control panel (See **Diagram 9**):

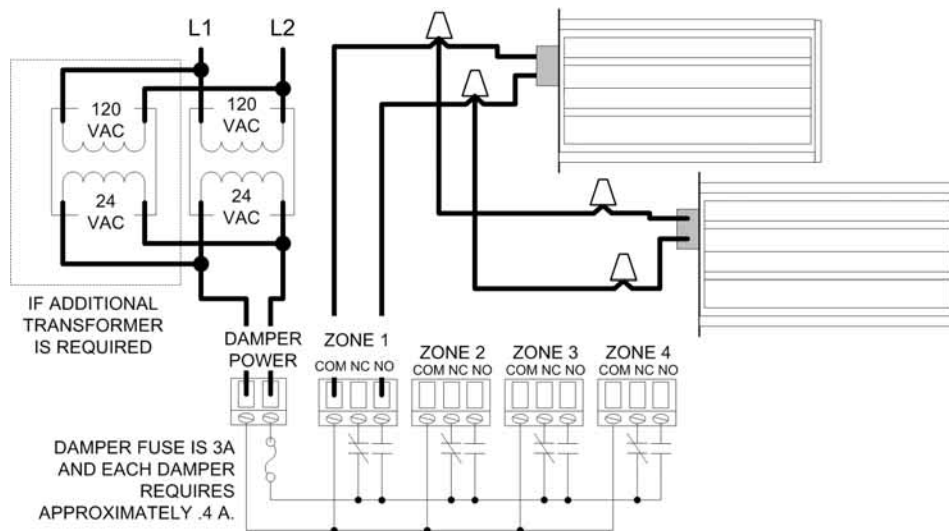
NC – This terminal remains energized when that zone thermostat is calling for heating/cooling/fan or when no zone is calling. This terminal is used to power a damper open.

NO – This terminal energizes in a non-calling zone when another zone thermostat makes a call for heating/cooling/fan. This terminal is used to power a damper closed.

COM – This terminal provides a common connection for the NC and NO terminals.

3. If multiple transformers will be required, wire them in parallel as shown. Before wiring the transformers together, **ensure that they are connected in phase** by observing polarity marks or terminal orientation on each transformer.

DIAGRAM 9



WIRE A PLENUM SENSOR TO THE CONTROL PANEL – OPTIONAL

IMPORTANT

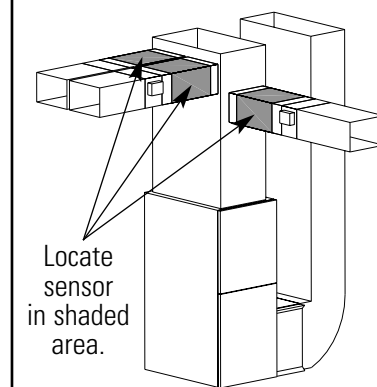
Do not mount the sensor in direct line-of-sight of the heat exchanger, cooling coils or UV lights as this may cause the sensor to report false temperature readings.

1. Locate the Aprilaire Model 8052 sensor in the supply trunk, after the heat exchanger and cooling coils and before the zone dampers (see the shaded areas of **Figure 6**).
2. Mount the sensor according to the installation instructions provided with the sensor.
3. Before wiring to the control panel, measure the resistance across the sensor. The resistance corresponds (approximately) to the sensed temperature according to the following table:

Temperature (°F)	30	40	50	60	70	80	90	100
Resistance (kΩ)	34.6	26.1	19.9	15.3	11.9	9.4	7.4	5.9

4. Wire the sensor to the control panel PLENUM SENSOR terminals. **THIS MUST BE DONE BEFORE POWER IS APPLIED TO THE CONTROL PANEL** or the sensor will not be recognized by the control panel.

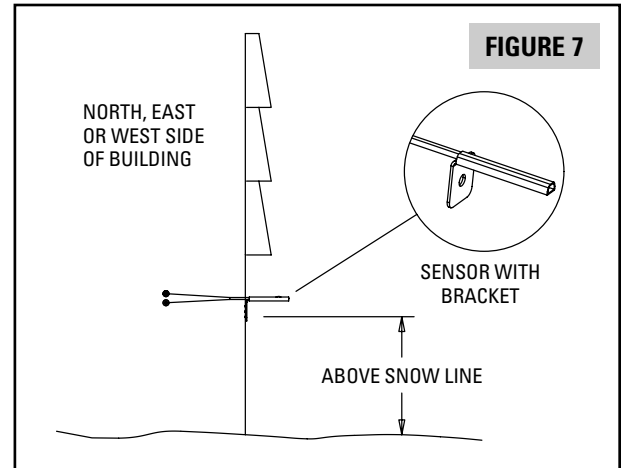
FIGURE 6 – Furnace Setup



WIRE AN OUTDOOR SENSOR TO THE CONTROL PANEL – OPTIONAL

NOTE: If an outdoor sensor is wired to the control panel, it will override the temperature provided by the AHC, if an AHC will be part of the installation. Outdoor temperature is transmitted to all the connected thermostats to be shown on the display, is used for ventilation control and is used for balance point control on heat pump applications.

1. Mount the Aprilaire Model 8052 sensor (see **Figure 7**).
 - Locate on the North, side of the building if possible. East and West are acceptable locations as long as the sensor will not be exposed to direct sunlight.
 - Mount above anticipated snow line.
 - Mount at least 3 ft. away from exhaust vents and condensing units.
 - Maximum wire length from sensor to thermostat is 300 feet.
 - Under a soffit or under a wall overhang are recommended areas for mounting the sensor.



2. Run a 2-wire cable from the sensor to the control panel.
3. Take a resistance measurement before connecting to the ODT terminals of the control panel to verify the sensor is properly installed. Measure the resistance at the control panel to account for wire splices. The resistance will depend on the outdoor temperature:

Temperature (°F)	0	10	20	30	40	50	60	70	80	90	100
Resistance (kΩ)	85.4	62.6	46.3	34.6	26.1	19.9	15.3	11.9	9.4	7.4	5.9

4. Wire the sensor to the ODT terminals of the control panel.

WIRE AN APRILAIRE AUTOMATIC HUMIDIFIER CONTROL (AHC) TO THE CONTROL PANEL – OPTIONAL

The AHC must be the type that has the “CHANGE WATER PANEL” LED on the front and has the front access door for wiring (knob does not need to be removed to access the wiring terminals).

Information is shared between the AHC and the control panel. The AHC provides indoor humidity, outdoor temperature and humidifier valve status (on/off) to the control panel. The control panel tells the AHC when the heat is on or when continuous fan is on, eliminating the need for a Model 50 relay or use of equipment humidifier (HUM) terminals. The control panel also supplies power to the AHC. The control panel will distribute outdoor temperature to be displayed on the thermostats and will use outdoor temperature for ventilation control and high and low balance point control in heat pump applications.

NOTE: If an AHC is installed, do not wire an outdoor temperature sensor to the ODT terminals of the control panel.

1. Install the Automatic Humidifier Control and its outdoor temperature sensor:

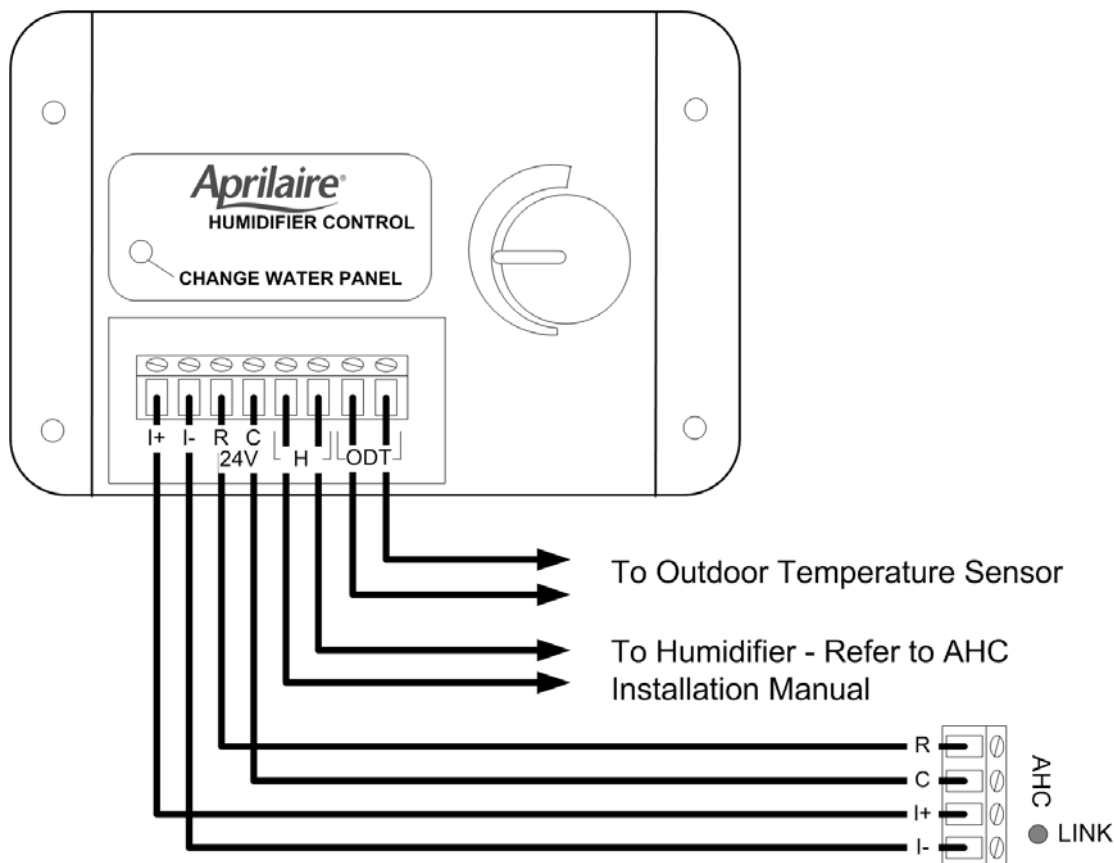
- Follow the directions provided with the AHC except **do not mount the AHC temperature sensor in a fresh air intake**. To ensure accurate measurement, the temperature sensor must be mounted outside.
- Maximum wire length from AHC to the control panel is 300 feet.
- Power the AHC through the 6504 Control Panel as shown. **DO NOT power the AHC through furnace accessory terminals.**
- DO NOT operate the AHC in Manual Mode – this will result in the outdoor temperature shown on the thermostats to always be 20°F.

2. Run a 4-wire cable from the AHC to the control panel – maximum wire length is 300 feet.

3. Wire the AHC to the control panel – see **Diagram 10**. Use wire color as a means to ensure the terminals are connected correctly.

4. After completing the Model 6504 installation, you will need to verify proper operation of the AHC – see AHC installation instructions for details on how this is done.

DIAGRAM 10



WIRE AN EAC, ERV OR VENTILATION DAMPER TO THE CONTROL PANEL – OPTIONAL

To control an electronic air cleaner (EAC), ventilation damper or an energy recovery ventilator (ERV), 24-volt control will be required. The EAC relay closes whenever the HVAC equipment is operating (heating, cooling or continuous fan – see sequence of operation for details). The ERV/VNT relay closes in accordance with the amount of time set on the VENT TIME and VENT CYCLE dip switches – see sequence of operation for details.

EAC OR ERV INSTALLATIONS – REQUIRES 24-VOLT CONTROL

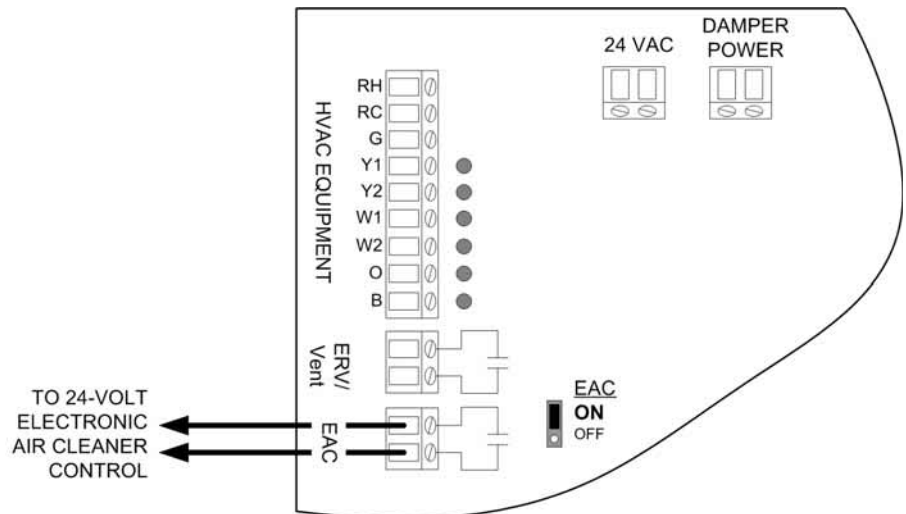
1. Mount the EAC or ERV in accordance with the installation instructions provided with the unit.
2. Run a 2-wire cable from the 24-volt control of the device to the control panel.
3. Connect the wires to the 24-volt control of the device.
4. **For EAC control** – connect the other end of the wires to the **EAC terminals** on the control panel (see **Diagram 11**).

- Set the EAC ON/OFF jumper to the ON position as shown in **Diagram 11**.

5. **For ERV control** – connect the other end of the wires to the **ERV/Vent terminals** on the control panel (see **Diagram 12**).

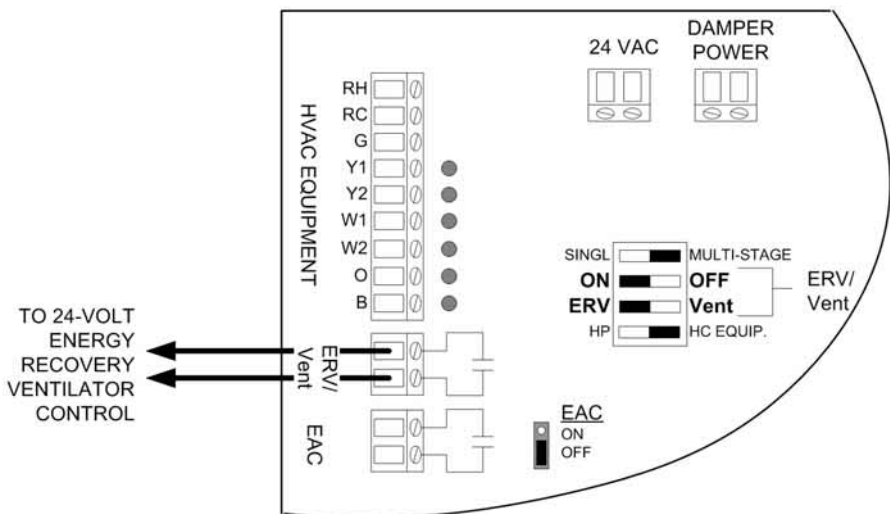
- Set the ERV/Vent switches as shown in **Diagram 12**.

DIAGRAM 11



Contact the factory and request diagram 30-293 to control an Aprilaire Model 5000 Electronic Air Cleaner.

DIAGRAM 12



Contact the factory and request diagram 30-293 to control an Aprilaire Model 8100 Energy Recovery Ventilator.

MODEL 6506 VENTILATION CONTROL DAMPER INSTALLATIONS

Control of a ventilation damper requires a 24-volt power source, which can be taken from the zone damper power input terminals. It also requires an AHC or an outdoor temperature sensor – see sequence of operation for details.

1. Install the Aprilaire Model 6506 Ventilation Damper, into a fresh air intake duct in accordance with the instructions provided with the damper.
2. Run a 2-wire cable from the ventilation damper to the control panel.
3. Wire the ventilation damper according to **Diagram 13**. Set the ERV/Vent switches as shown in **Diagram 13**.
4. Set the Ventilation Time and Ventilation Cycle dip switches to meet ventilation needs.

DIAGRAM 13

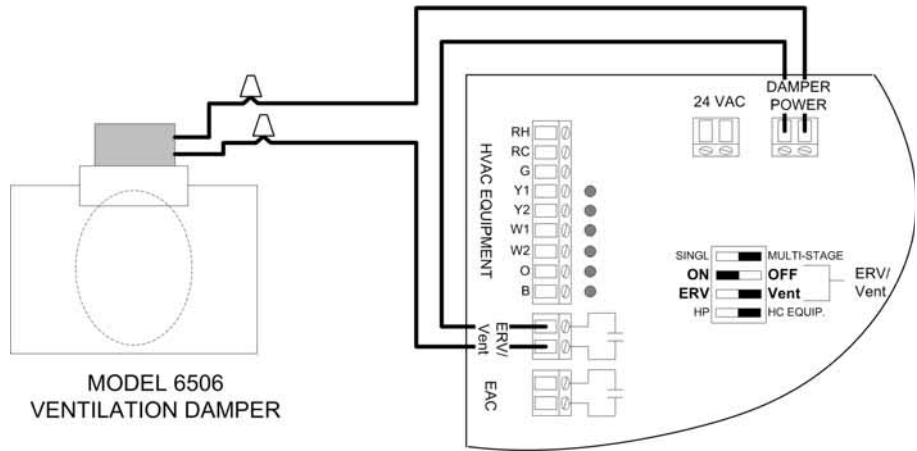


TABLE 2 – RECOMMENDED SETTINGS FOR VENTILATION CONTROL
Ventilation Time Setting (minutes/hour)

House Size (square feet)	Bedrooms			
	2	3	4	5
1000-1500	15	30	30	30
1501-2000	30	30	30	30
2001-2500	30	30	30	30
2501-3000	30	30	30	45
3001-3500	30	30	45	45

As an example, for a 2,500 square foot home with 3 bedrooms set the Vent Time switches for 30 minutes and the Vent Cycle switches for a one-hour cycle.

NOTES:

Based on ASHRAE 62.2 ventilation requirement.

Based on fresh air duct of 20' long flex duct, 0.08 in. w.c. static pressure at fresh air duct. A longer fresh air intake duct or lower return static will increase the Ventilation Time required. Additionally, local codes may affect the settings.

Based on the default setting of one hour Cycle Time. Use Cycle Time settings of 2, 3 or 4 hours where longer run times or less frequent operation is preferred. Adjust Ventilation Time accordingly. (In the above example set the Ventilation Time to 50 minutes and the Cycle Time to 2 hours.)

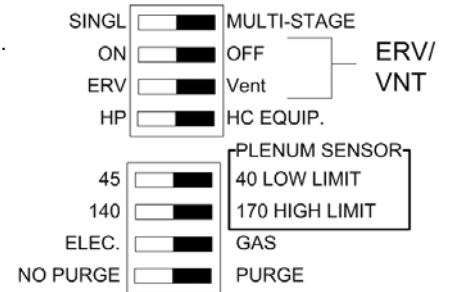
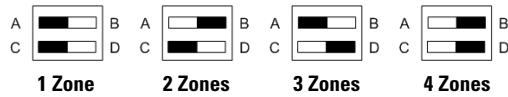
START UP AND TEST

1. Before applying power to the control panel or the HVAC equipment, perform the following inspections:

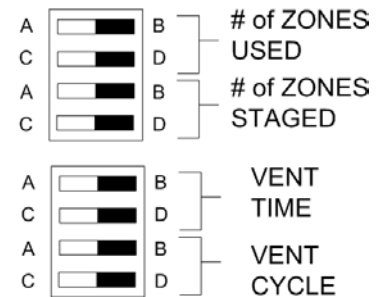
- Make sure that the “# of ZONES USED” dip switches are set correctly for your installation and that the thermostat inputs for the lowest numbered zones are used. For example if there are two zones in your system, set the “Number of Zones” dip switches for 2 zones, then wire to the Zone 1 and Zone 2 thermostat inputs.



of ZONES USED



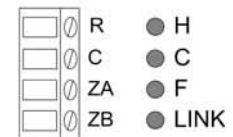
- Verify that the 6504/AHC dip switch is set to 6504 on all thermostats.
- Verify that the following dip switches are set correctly and are the same on the control panel and the thermostats:
 - Heat/Cool or Heat Pump
 - Single or Multi-Stage
 - Electric or Gas
- Use wire colors to verify wiring to each thermostat terminal in each zone.



2. Power up the control panel transformer – do not power the HVAC Equipment.

- Powering the control panel will initiate an addressing sequence that will cause the LEDs at each zone to blink in sequence – this is normal. After power up, or whenever the RESET button is pressed, the control panel goes through the addressing sequence. The sequence takes approximately 5 seconds to complete.

ZONE 1



3. Verify that the “LINK” LED at each set of wired thermostat inputs is lit continuously.

If one or more of the “LINK” LEDs is not lit, is blinking or if all LEDs are blinking then return to step 1. If all are on, then continue with step 4.

TROUBLESHOOTING GUIDE

SYMPTOM	CAUSE
Not all of the zones were included in the addressing sequence	# of ZONES USED dip switch is not set correctly – change setting and press the RESET button.
All of the LEDs in a zone are blinking	Corrupt response or no response from a thermostat. Make sure the smallest numbered zones are used, verify that wiring is correct, and that the thermostat 6504/AHC dip switches are set to 6504. Press the RESET button.
The LINK LED is blinking	Heat/Cool or Heat Pump dip switch on this thermostat does not match what was set on the control panel. Set the thermostat or the control panel dip switch to the correct setting, then press the RESET button.
The LINK LED in a zone is not lit	# of ZONES USED dip switches not set correctly – change setting and press the RESET button.

4. Power up the damper transformer.

5. Auto Test

Auto Test allows you to turn on/off all of the outputs without having to go to the thermostats to make calls for heating, cooling or fan. **Auto Test will turn on and off all of the outputs** that have been configured to be available. If, for example, the EAC and ERV/Vent outputs are not turned on by their respective dip switch, or an AHC has not been installed, then these steps are skipped in the Auto Test sequence. Similarly, if the dip switches have been set for single stage operation, then second stage outputs will not be turned on.

BEFORE STARTING AUTO TEST, DETERMINE IF THE HVAC EQUIPMENT POWER IS TO BE TURNED ON AND CLOSE FURNACE/AIR HANDLER ACCESS DOORS. As stated, the outputs will turn on/off, so, for example, if you do not want to have the compressor turn on with the control panel outputs, do not turn on the power to the condensing unit. Each step will last for one minute, or until the next press of the TEST button.

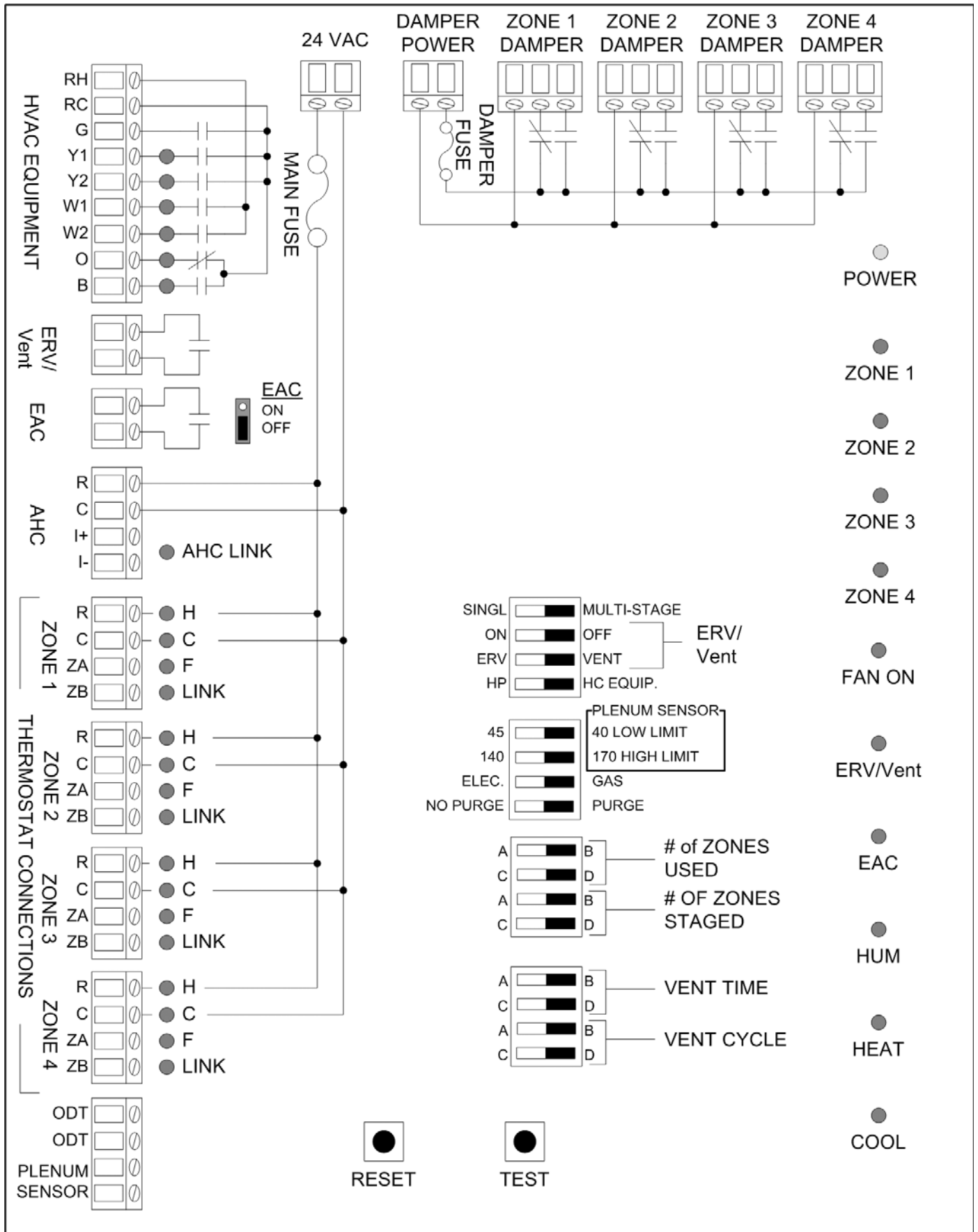
To Auto Test, repeatedly press the TEST button on the control panel to cycle through the steps shown in **Table 3**. You have one minute to check that the outputs are functioning before Auto Test times out. If it times out before desired, simply repeat the Auto Test. Press the TEST button to cycle to the next step. After the final step, all thermostat LEDs will blink to indicate that Auto Test has been completed, after which the panel will reset.

Auto Test is only available the first four minutes after power up or after pressing the RESET button on the control panel.

TABLE 3 – AUTO TEST SEQUENCE

Step	Output Relays Closed (see Figure 8)	LEDs ON (see Figure 8)			Step skipped if...
		Thermostat	Equipment	Side Panel	
1	B	none	B	none	
2	EAC	none	B	EAC	EAC ON/OFF pin jumper in OFF position
3	ERV/Vent	none	B	ERV/Vent	ERV/Vent ON/OFF dip switch set to OFF
4	B	none	B	HUM	AHC has not been installed
5	B, W1	Zone 1-4 "H"	B, W1	HEAT	
6	B, W1, W2	Zone 1-4 "H"	B, W1, W2	HEAT	SINGL/MULTI-STAGE dip switch set to SINGL
7	B	none	B	none	
8	G	Zone 1-4 "F"	B	FAN ON	
9	B	none	B	none	
10	O, Y1	Zone 1-4 "C"	O, Y1	FAN ON, COOL	
11	O, Y1, Y2	Zone 1-4 "C"	O, Y1, Y2	FAN ON, COOL	SINGL/MULTI-STAGE dip switch set to SINGL
12	B	none	B	none	
13	ZONE 1 NO (damper)	none	B	ZONE 1	
14	ZONE 1,2 NO (dampers)	none	B	ZONE 1 & ZONE 2	# of ZONES USED set to 1
15	ZONE 1-3 NO (dampers)	none	B	ZONE 1 – ZONE 3	# of ZONES USED set to 1 or 2
16	ZONE 1-4 NO (dampers)	none	B	ZONE 1 – ZONE 4	# of ZONES USED set to 1, 2 or 3
17	B	none	B	none	

FIGURE 8 – Control Panel Layout



TROUBLESHOOTING GUIDE

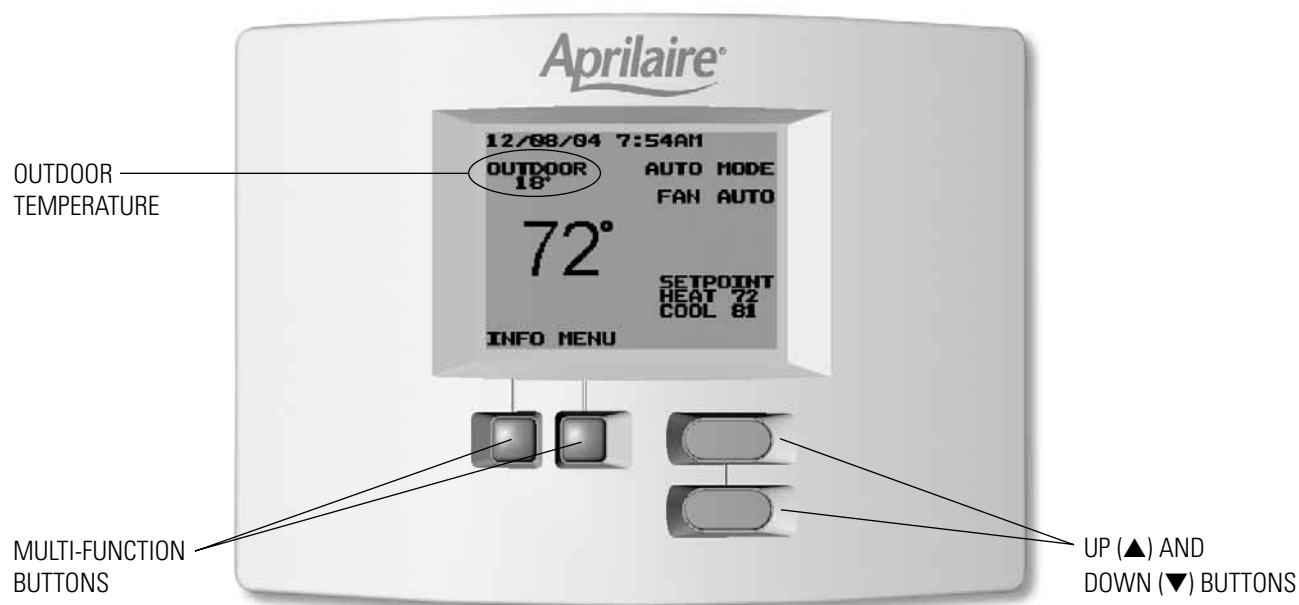
SYMPTOM	CAUSE
Auto Test did not start	No power – apply power to control panel. Auto Test is only available the first four minutes after power up – press the RESET button and try Auto Test again.
EAC or ERV/Vent output and LED did not activate	Outputs not configured to be on – use jumper/dip switches to turn EAC ON or ERV/VENT ON.
AHC LED did not light or HUM LED did not light	No AHC detected: <ul style="list-style-type: none"> • Apply power to AHC or ensure power supplied to AHC is continuous. • Verify wiring is correct.
W2 or Y2 outputs did not energize	Configured for single-stage operation – change SINGLE/MULTI dip switch position.
Not all of the damper outputs were energized	Not configured for correct number of zones – see NO. OF ZONES dip switch.

6. Reapply power to the HVAC equipment if not already done prior to Auto Test (step 5).

7. Verify that the AHC or outdoor temperature sensor has been installed correctly.

- The thermostat display will be similar to **Figure 9**. The time and date, mode of operation, temperature settings and fan status may be different.
- To check the AHC or outdoor temperature sensor, at one of the thermostats, look for the outdoor temperature on the display.

FIGURE 9



8. Press the MENU button on the thermostat to access the Main Menu of the thermostat. Use the ▲ and ▼ buttons to scroll, and the Multi-Function buttons to select items or go back within a menu – see the thermostat Owners Manual for additional information on how to navigate within the thermostat menus.
9. To verify that all thermostats have been addressed, scroll to the VIEW OTHER THERMOSTATS menu and press SELECT.
10. This will show a list of thermostats labeled Thermostat 1, Thermostat 2, etc. There should be as many thermostats listed as there are thermostats in your system.
11. **To verify fan operation**, select the FAN menu then select FAN ON. Go to the control panel and verify that the FAN LED for this thermostat is lit. Allow the fan to run for at least 40 seconds, and then return the thermostat to AUTOMATIC FAN.
12. **To verify heating operation**, go to the Main Menu, and select MODE, then select HEAT. Press the ▲ or ▼ button to change the Heat setting to 5° above the room temperature and then press SAVE to enter this heat setting.

NOTE: The control panel will not make heating or cooling calls until four (4) minutes after system power up.
13. When “HEAT MODE” turns to “HEATING” on the thermostat display and begins to flash, heat will be initiated. Go to the control panel and verify that the “H” LED is lit for the zone you are operating, and that the appropriate outputs have been energized.
14. If set for multi-stage equipment, wait 2 minutes for second stage heating (4 minutes for second stage compressor on heat pump applications) to be initiated, and then verify that the appropriate outputs have been energized.
15. If you are operating a multi-stage heat pump, wait an additional two (2) minutes for auxiliary heat to be energized.
16. Go to the Main Menu, and select MODE, and then select OFF to turn off the heating outputs.
17. **To verify cooling operation**, go to the Main Menu, and select MODE, then select COOL. Press the ▲ or ▼ button to change the Cool setting to 5° below the room temperature and then press SAVE to enter this cool setting.
 - Four (4) minutes must elapse following a mode change before a cooling call can be initiated.
18. When “COOL MODE” turns to “COOLING” and begins to flash, cooling will be initiated. Go to the control panel and verify that the “C” LED is lit for the zone you are operating, and that the appropriate outputs have been energized.
19. Wait 4 minutes for second stage cooling to be initiated (if set for Multi-Stage operation), then verify that the appropriate outputs have been energized.
20. Go to the Main Menu, and select MODE, then select OFF to turn off the cooling outputs.
21. **HEAT PUMPS ONLY – To verify emergency heat operation**, go to the Main Menu, and select MODE, then select EMERGENCY HEAT. Press the ▲ or ▼ button to change the Heat setting to 5° above the room temperature and then press SAVE to enter this heat setting.
22. When “E-HEAT MODE” turns to “HEATING” on the thermostat display and begins to flash, heat will be initiated. Go to the control panel and verify that the “H” LED is lit for the zone you are operating, and that the appropriate outputs have been energized.
23. Return the thermostat to the OFF mode.
24. Repeat steps 11 through 23 for all remaining thermostats if desired.
25. **To verify EAC operation**, make a heat, cool or fan call. Go to the control panel and verify that the EAC LED is lit and that the EAC is energized. For gas heating, the EAC output is delayed for 30 seconds after the start of a heat call.
26. **To verify ERV/Vent operation**, make a heat, cool or fan call.
 - **For ERV operation**, there is no outdoor temperature or indoor humidity restriction. The ERV/Vent LED should be lit and the output energized.
 - If the control panel has been configured for **Vent operation**, the outdoor temperature must be between 20°F and 100°F for the Vent output to energize. Additionally, the indoor RH must be less than 55% – refer to the sequence of operation for ERV/Ventilation Control.

SEQUENCE OF OPERATION

AUTOMATIC CHANGEOVER

The Model 6504 is a heat call priority system with automatic mode changeover after 20 minutes of operation. If two calls for opposing mode exist while the system is idle, the Heat call will be satisfied first. The heating equipment will not stop operating until all heat calls have been satisfied and the minimum-on time lapses or if the equipment has been on for 20 minutes **while** a cooling call exists. After the heating equipment has stopped, calls for cooling can be satisfied. Similarly, once the cooling equipment comes on it will not stop operating until all cool calls have been satisfied and the minimum-on time lapses or if the equipment has been on for 20 minutes **while** a heat call exists.

INITIAL POWER UP OR RESET

No HVAC equipment calls other than continuous fan will be accepted until a time delay of 4 minutes has elapsed. The reversing valve output will default to the heat mode (B terminal energized). This applies whenever power is restored to the panel or when the RESET button is pressed.

DAMPER OUTPUTS

The Normally Open (NO) output will be energized and the Normally Closed (NC) output will be de-energized for any zone not calling for heating or cooling while an equipment output is energized and during the damper purge time delay. During equipment operation or during the damper purge time delay, should all zones stop calling for heating or cooling, the damper terminals will remain in the position they were in before all zones stopped calling.

DAMPER PURGE TIME DELAY

When the **PURGE/NO PURGE Selector** is set to **NO PURGE**, the damper purge time delay is 3.5 minutes and begins when the equipment output(s) turn off. When the **PURGE/NO PURGE Selector** is set to **PURGE**, the damper purge time delay is one (1) minute.

HEATING EQUIPMENT OUTPUTS – CONFIGURED FOR HEAT/COOL OPERATION

There is a two minute minimum-on and minimum-off time for heating outputs.

On first stage heat, the W1 and B terminals are energized. If the ELEC/GAS switch is set to the ELEC position, the G terminal is also energized. The B terminal remains energized until the first cooling call.

When the control panel has been configured to operate multi-stage equipment, the W2 output is energized if a thermostat calls for second stage heat, unless the "Number of Zones to Stage" dip switches are set for anything other than one zone. If set for more than one zone, the set number of zones must be calling with at least one of the zones calling for second stage heat for the W2 output to energize.

FAN PURGE DELAY TIME

After the W1 (and W2) terminal turns off, the G terminal, if the ELEC/GAS switch is in the ELEC position, will remain on for one (1) minute if the **PURGE or NO PURGE Selector** switch is set to PURGE. The G terminal will immediately turn off, if on, when the switch is set to NO PURGE.

If the ELEC/GAS switch is set in the GAS position, the G terminal does not turn on during purge regardless of the position of the PURGE or NO PURGE switch.

HIGH TEMPERATURE LIMIT

If the Plenum Temperature Sensor (PTS) senses temperatures at/above the value set on the **Heat Output High Temperature Limit Selector** switch the W1 and W2 terminals will turn off. The G terminal turns on or remains on until the plenum temperature falls 10°F below the setting. During this equipment cool down, the dampers will be positioned according to which zone is calling for heat.

The heating equipment outputs will turn on again, if a heat call still exists after the plenum temperature falls 10°F below the setting. If a heating call no longer exists, the G terminal will de-energize and the dampers will return to their normal position. All equipment minimum-on times and minimum-off times will be observed.

HEATING EQUIPMENT OUTPUTS – CONFIGURED FOR HEAT PUMP OPERATION

There is a four minute minimum-on and minimum-off time for compressor operation, and a two minute minimum-on and off time for fossil fuel auxiliary heat operation. There is no minimum-on or off time for electric auxiliary heat.

On first stage heat, the Y1, B and G terminals are energized. If the control panel has been configured to operate single stage equipment, the W1 output (auxiliary heat) will be energized when any zone calls for second stage heat. The “Number of Zones to Stage” switch has no effect on auxiliary heat. If the ELEC/GAS switch is in the GAS position, the Y1 and G outputs will turn off before the W1 output turns on. The B terminal remains energized until the first cooling call.

When the control panel has been configured to operate multi-stage equipment, the Y2 output is energized if a thermostat calls for second stage heat, unless the “Number of Zones to Stage” dip switches are set for anything other than one zone. If set for more than one zone, the set number of zones must be calling with at least one of the zones calling for second stage heat for the Y2 output to energize. If any zone calls for third stage heat, the W1 output will turn on. If the ELEC/GAS switch is in the GAS position, the Y1, Y2 and G outputs will turn off before the W1 output turns on.

FAN PURGE DELAY TIME

After the Y1, Y2 and/or W1 terminals turn off, the G terminal, if the ELEC/GAS switch is in the ELEC position, will remain on for one (1) minute if the **PURGE or NO PURGE Selector** switch is set to **PURGE**. The G terminal will immediately turn off, if on, when the switch is set to NO PURGE.

HIGH TEMPERATURE LIMIT

If the Plenum Temperature Sensor (PTS) senses temperatures at/above the value set on the **Heat Output High Temperature Limit Selector** switch the Y1, Y2 and W1 terminals will turn off. The G terminal turns on or remains on until the plenum temperature falls 10°F below the setting. During this equipment cool down, the dampers will be positioned according to which zone is calling for heat.

The heating equipment outputs will turn on again, if a heat call still exists after the plenum temperature falls 10°F below the setting. If a heating call no longer exists, the G terminal will de-energize and the dampers will return to their normal position. All equipment minimum-on times and minimum-off times will be observed.

HIGH AND LOW BALANCE POINT RESTRICTIONS

High and low balance point restrictions are handled by the thermostat. If the outdoor temperature rises above the high balance point set at the thermostat, it will not call for the stage of heat that would bring on the auxiliary heat output (i.e. second stage heat if configured to operate single stage equipment or third stage heat if configured to operate multi-stage equipment). If the outdoor temperature falls below the low balance point, the thermostats will change from heat calls to emergency heat calls. This will turn off the compressor outputs and turn on only the auxiliary heat outputs (W1 and W2). All minimum-on and off times will be observed during balance point restrictions.

EMERGENCY HEAT EQUIPMENT OUTPUTS – APPLIES ONLY WHEN CONFIGURED FOR HEAT PUMP OPERATION

There is a two minute minimum-on and off time for fossil fuel auxiliary heat operation. There is no minimum-on or off time for electric auxiliary heat.

Should any zone call for emergency heat during a heat call, the compressor outputs will turn off (after the four minute minimum-on time for compressor), and all calls for heat will be satisfied with emergency heat output until there are no emergency heat calls. On a call for emergency heat, the W1, W2 and B terminals are energized. If the ELEC/GAS switch is in the ELEC position, the G terminal is also energized. The B terminal remains energized until a first cooling call is made.

FAN PURGE DELAY TIME

After the W1 and W2 terminals turn off, the G terminal, if the ELEC/GAS switch is in the ELEC position, will remain on for one (1) minute if the **PURGE or NO PURGE Selector** switch is set to **PURGE**. The G terminal will immediately turn off, if on, when the switch is set to NO PURGE.

With the ELEC/GAS switch in the GAS position, the G terminal is not turned on during purge regardless of the position of the PURGE/NO PURGE switch.

HIGH TEMPERATURE LIMIT

If the Plenum Temperature Sensor (PTS) senses temperatures at/above the value set on the **Heat Output High Temperature Limit Selector** switch the W1 and W2 terminals will turn off. The G terminal turns on or remains on until the plenum temperature falls 10°F below the setting. During this equipment cool down, the dampers will be positioned according to which zone is calling for heat.

The emergency heat equipment outputs will turn on again, if an emergency heat call still exists after the plenum temperature falls 10°F below the setting. If an emergency heat call no longer exists, the G terminal will de-energize and the dampers will return to their normal position. All equipment minimum-on times and minimum-off times will be observed.

HIGH AND LOW BALANCE POINT RESTRICTIONS

Emergency heat operation is not affected by high balance points.

COOLING EQUIPMENT OUTPUTS

There is a four minute minimum-on and minimum-off time for compressor (cooling) outputs.

On first stage cooling, the Y1, G and O terminals are energized. The O terminal remains energized until the first heat call.

When the control panel has been configured to operate multi-stage equipment, the Y2 output is energized if a thermostat calls for second stage cooling, unless the "Number of Zones to Stage" dip switches are set for anything other than one zone. If set for more than one zone, the set number of zones must be calling with at least one of the zones calling for second stage cooling for the Y2 output to energize.

FAN PURGE DELAY TIME

After the Y1 (and Y2) terminal turns off, the G terminal will remain on for one (1) minute if the **PURGE or NO PURGE Selector** switch is set to **PURGE**. The G terminal will immediately turns off when the switch is set to NO PURGE.

LOW TEMPERATURE LIMIT

If the Plenum Temperature Sensor (PTS) senses temperatures at/below the value set on the **Cool Output Low Temperature Limit Selector** switch the Y1 and Y2 terminals will turn off after the minimum-on time has elapsed. The G terminal remains on until the plenum temperature rises 10°F above the setting. During this equipment warm up, the dampers will be positioned according to which zone is calling for cooling.

The cooling equipment outputs will turn on again, if a cool call still exists after the plenum temperature rises 10°F above the setting. If a cooling call no longer exists, the G terminal will de-energize and the dampers will return to their normal position. All equipment minimum-on times and minimum-off times will be observed.

EAC OUTPUT

The EAC output will energize on a call for cooling, heating or continuous fan, unless the EAC ON/EAC OFF jumper has been set for EAC OFF, in which case the EAC output does not energize. There is a thirty second delay in the turning on and off of the EAC output with a heat call when the ELEC/GAS switch is in the GAS position. This allows time for the heat exchanger warm up and cool down at the beginning and end of a heat call.

ERV/VENT OUTPUT

Operation of the output will depend on whether it has been configured as an ERV output or a Vent output by the ERV/VENT selector switch.

ERV OPERATION

If the ventilation need has not been met, the ERV/Vent terminals are energized whenever the W1, G or Y1 equipment outputs are energized.

Equipment run time is measured by the amount of time any of the three, equipment control outputs (W1, G or Y1) are energized. The controller adds the amount of equipment run time during the period of time defined by the **VENT CYCLE** switches. The first cycle starts at system power up or when the RESET button is pressed. At the end of the Vent Cycle, the equipment run time is reset to zero and the controller again starts adding equipment run time. The equipment run time is compared to the target defined by the **VENT TIME** switches. As long as the sum time is less than the target, the ERV/Vent terminals will be energized whenever the W1, G or Y1 equipment terminals are energized.

If, near the end of a cycle, the HVAC system has not operated for the amount of time set on the Vent Time switches, then the iHVAC panel will energize the ERV/Vent terminals without the HVAC system blower operating. This way, fresh air will be introduced for no less than the amount of time set by the Vent Time during a Vent Cycle. The ERV/Vent terminals will remain energized for no less than two minutes. Once the terminals are de-energized, they will remain de-energized for no less than 1 minute.

Example: If the Vent Cycle is set to 1 hour and the Vent Time to 20 minutes, this means that there will be no less than 20 minutes of fresh air ventilation for any given hour. If, during the one hour cycle time, the HVAC equipment operates for a total 15 minutes of run time, then the last 5 minutes of that hour will have the ERV/Vent terminals energized alone.

VENT OPERATION

Operation with the ERV/VENT switch set to VENT is identical to ERV operation except that the system blower is to run when the Vent terminals are energized. If the HVAC system has not operated for the minimum amount of time defined by the Vent Time inputs, then the control panel will operate the HVAC system blower and complete the circuit between the ERV/Vent terminals (see example above). This operation is referred to as **Unsolicited Blower Control** as the HVAC system blower is turned on without control input by a thermostat.

Additionally, because there is no energy exchange between indoor and outdoor air, there are temperature and humidity limits for operation.

When the outdoor temperature exceeds 100°F or drops below 0°F, there will not be ventilation. Additionally, if the indoor relative humidity is greater than 55% when the outdoor temperature is 50° or higher, there will be no ventilation. Finally, if the outdoor temperature is below 20° then there will only be ventilation when the heating equipment is operating.

AHC OPERATION

When the control panel has detected that an AHC has been connected, the AHC LINK LED near the AHC input terminals, will blink five times then be lit continuously.

The control panel does not control the Aprilaire Humidifier; this is left to the Automatic Humidifier Control. Setting the desired humidity level and sensing the actual humidity level is also performed at the AHC. The control panel does, however, send the AHC an enable signal whenever the heat or continuous fan is operating. This enable signal, along with the humidity setting and the sensed humidity level, is used by the AHC to determine if the humidifier will be turned on. Should the AHC sense that the humidity is lower than required, and receive the enable signal from control panel; the AHC will turn on the humidifier. The AHC transmits a status signal to the control panel when the humidifier is turned on or off, which is used to turn the HUM LED on and off.

The control panel will extend blower operation at the end of a heat call or continuous fan call if the AHC is still operating the humidifier. By extending blower operation the humidifier is better able to meet humidification requirements. Blower extension will last no less than 5 minutes and no more than 15 minutes after the end of a heat or continuous fan call. This feature can be disabled through the thermostat – refer to the thermostat Owners Manual for details.

