ECM MOTOR INFORMATION

The ECM (Brushless permanent magnet) motor used on the blower in this product is programmed to operate over a wide range of external static pressures (0.0" - 1.0" W.C.) with essentially constant air flow (CFM). Motor efficiency on ECM type motors is higher than that of P.S.C. type motors normally used on this type product. See air flow performance data tables.

The ECM motor is programmed to provide a "soft" start and stop. On a call for heat or cool, the motor will gradually ramp up to the field selected blower speed. This eliminates the sudden rush of air and noise normally associated with a P.S.C. type motor. Once the thermostat and blower delay are satisfied, the motor will gradually ramp down as well.

IMPORTANT: Units equipped with ECM motors cannot be used in by-pass zoning applications.

IMPORTANT: The A.C. power plug to the blower motor has locking tabs. It has been shown that by applying excessive force to the A.C. cable half of the connector it is possible to force the connector in backwards. It will not seat and "click" properly but will make connection. If A.C. power is applied with the connector reversed the motor will be immediately destroyed. Do not force power plug into motor connector backwards.

NOTE: Because of the harmonic content of the A.C. Line current to the ECM motor a conventional ammeter will not read correct motor amps. Only a true RMS meter will give accurate AMP readings.

IMPORTANT: The flexibility of ECM motors and the fact that this flexibility is contained in programmed memory, not hardware, emphasizes the need for exact motor numbers for replacement motors. Because they all look the same, ECM MOTORS FROM DIFFERENT PRODUCTS OR DIFFERENT MODELS OF THE SAME PRODUCT MUST NOT BE INTERCHANGED.

IMPORTANT: If a ECM motor is replaced, for proper motor cooling, it is important that the motor be mounted as the original, as far into the blower wheel as practical.

IMPORTANT: The ECM motor is controlled directly from the room thermostat (no blower relay). In cooling or heat pump heating, the motor is controlled from the thermostat "Y" terminal. When the "Y" or "R" thermostat circuit is opened a 60 second delay will occur before the blower motor will cycle off. In heating with electric heat or aux. electric heat with heat pump the motor is controlled from either the "W1", "W2" or "E" terminals from the thermostat. When the "W1" to "R" thermostat circuit is opened, a 2.5-minute delay will occur before the blower will cycle off. When the "G" to "R" thermostat circuit is opened for low speed blower, there is no "off" delay. For high-speed blower there is a 60-second delay. All thermostat sub-base combinations as recommended and provided through the Parts Department have been tested and are compatible with the ECM motor used in this equipment. Some thermostats may not be compatible with the ECM motor provided in this unit. With thermostat in off state, the voltage on control lines "G", "Y", W or W2 with respect to 24 vac common should be less than half of the actual measured value of the 24 vac supply. If the measured voltage is too high, thermostat is incompatible with the ECM motor and will cause the motor to run when it should be off.

IMPORTANT: "RXMD-CO2" accessory blower time delay. Blower time delay is programmed into the ECM motor as standard. Do not use "RXMD-C02" blower timer delay on air handlers using ECM motors.

TROUBLESHOOTING ECM MOTOR

MOTOR RUNS WHEN IT SHOULD BE OFF

- See above thermostat compatibility with ECM note normal 60 second cooling and 2.5 minute heating delays described above.

MOTOR DOES NOT RUN

- Verify that blower wheel is free and properly tightened on the shaft. Verify line voltage on power connector at motor.
- Be sure all connectors are properly seated. Do not force the power connector. It should snap easily when correctly positioned.
- Put thermostat in continuous fan mode. If motor does not run, verify 24 vac on the "G" to common lines at motor connector.

MOTOR OPERATION IS INTERMITTENT

- Check motor to be sure no water is dripping on or running into it. Verify motor mounting orientation. The wire connectors on motor shell should point straight to the front of the unit. Verify proper drip loops in motor connector cables - If water is found correct source problem.
- Verify all connectors are firmly seated. Gently pull motor connector wires (both ends of cables) individually to be sure they are properly crimped into housings.

MOTOR HESITATES WHEN STARTING

- This is normal operation while the motor is verifying proper rotation direction.

ECM MOTOR INTERFACE CONTROL AND SETTINGS

The (-)BHK series air handlers have ECM blower motors, which deliver a constant level of airflow over a wide range of external static pressures (up to 1.0" W.C.). The interface control board provides the required communications between the thermostat and the ECM blower motor.

There is a bank of 6 dip switches on the interface board that define the operation of the ECM motor. Switch functions are:

Switch	Function
1	Nominal Airflow
2 & 3	Latent/Sensible Airflow Adjustments
4	Continuous Airflow
5 & 6	On-Demand Dehumidification

Refer to Figure 9 for switch identification and factory default settings.

IMPORTANT: Disconnect power to air handler when changing dip switch positions. Even if blower is not operating, the motor will not recognize changes in dip switch positions until unit power is removed and then restored.

NOMINAL AIRFLOW ADJUSTMENT

The blower motor is programmed to provide cooling airflows of 1½ to 5 tons at 400cfm/ton, depending on air handler size. Air handlers are shipped from the factory set for maximum cooling airflow. Switch 1 is used to adjust airflow for the particular system in use.

CABINET WIDTH	SWITCH 1 POSITION	TONNAGE	CFM
-17	ON	1.5	600
	OFF	2	800
-21	ON	2.5	1000
	OFF	3	1200
-24	ON	3.5	1400
	OFF	4	1600
-25	ON	---	1800
	OFF	5	2000

Refer to Figure 9 for switch position to achieve the desired airflow.

COOLING AIRFLOW ADJUSTMENTS

Cooling airflow may be adjusted +10% or -10% from nominal airflow using switches 2 & 3.

SWITCH 2 POSITION	SWITCH 3 POSITION	COOLING AIRFLOW ADJUSTMENT
OFF	OFF	NONE
ON	OFF	10%
OFF	ON	-10%
ONE	ON	NONE

Refer to Figure 9 for switch positions to achieve the desired adjustments in airflow.

NOTE: Heating airflow is not affected by switch 2 & 3 positions.

NOTE: If the nominal airflow is adjusted +/-10% with switches 2 & 3, the continuous fan speed is adjusted by the same amount. Example: If the nominal airflow is increased by 10%, the continuous fan airflow is increased 10%.

CONTINUOUS FAN ADJUSTMENTS

Continuous fan may be set to low or high airflow with switch 4. Low airflow is 50% of nominal airflow. High airflow is equivalent to 100% nominal airflow.

SWITCH 4 POSITION	CONTINIOUS FAN AIRFLOW
OFF	50% NOMINAL
ON	100% NOMINAL

Refer to Figure 9 for switch 4 settings.

NOTE: Only use switch 4 if no nominal airflow adjustments are needed.

IMPORTANT: If switch 4 is set to the "ON" position, nominal airflow adjustments and On Demand Dehumidification adjustments will not function regardless of their dip switch settings.

COOLING MODE DEHUMIDIFICATION

The first optional 24-volt AC-only input to the interface control board is the "On Demand Dehumidification", ODD, terminal input. The "ODD" terminal input allows the user to have automatic dehumidification in the cooling mode that is controlled by the user's humidistat setting. When the humidity exceeds the humidistat setting, the airflow will be decreased by 15%. This results in higher latent capacity and increases the level of comfort.

An Explanation of On Demand Dehumidification Terminal Use

The interface control board "ODD" terminal input is designed to be used with a traditional humidistat. For proper operation, the humidistat must conform to these conditions:

INDOOR AMBIENT CONDITION	INPUT TO "ODD" TERMINAL (FROM HUMIDISTAT)
HIGH HUMIDITY	NONE
LOW HUMIDITY	24V AC

IMPORTANT: Dehumidistats are not compatible with the interface control board. Typical dehumidistats apply a 24V signal when humidity is high and are incompatible with the interface control board.

ON DEMAND DEHUMIDIFICATION AIRFLOW ADJUSTMENT

On Demand Dehumidification cooling airflow may be reduced by 15% of nominal airflow using switches 5 & 6. Airflow adjustment available are defined in the following table:

SELECTION	SWITCH 5 POSITION	SWITCH 6 POSITION	COOLING AIRFLOW ADJUSTMENT
A	OFF	OFF	15% LESS COOLING AIRFLOW
B	ON	OFF	NONE (FACTORY SETTING)
C	OFF	ON	ON DEMAND (WHEN USED WITH HUMIDISTAT)
D	ON	ON	NONE

- Selection A gives a 15% reduction in nominal airflow WITHOUT the use of a humidistat. Nominal cooling airflow is reduced 15% whenever the unit is in cooling mode.

  Example: On a 2.5-ton system, selection A reduces nominal airflow from 1000cfm to 850cfm whenever the system is in cooling.

- Selection B is the factory setting and does not affect nominal airflow.
- Selection C allows On Demand Dehumidification when using a humidistat. Nominal airflow is reduced by 15% when the humidistat senses high humidity in the conditioned space.

  Example: On a 2.5-ton system, selection C reduces nominal airflow from 1000 cfm to 850 cfm when the system is in cooling and the humidistat is calling for On Demand Dehumidification.

- Selection D does not affect nominal airflow.

SWITCH 2 POSITION	SWITCH 3 POSITION	EFFECT OF SWITCHES 2 & 3 ON NOMINAL AIRFLOW	SWITCH 5 POSITION	SWITCH 6 POSITION	EFFECT OF SWITCHES 5 & 6 ON NOMINAL AIRFLOW	RESULT: ACTUAL REDUCTION IN NOMINAL AIRFLOW
ON	OFF	+10%	OFF	OFF	-15%	-7%
OFF	ON	-10%	OFF	OFF	-15%	-15%
ON	OFF	+10%	OFF	ON	-15%*	-7%
OFF	ON	-10%	OFF	ON	-15%*	-15%

*15% reduction in airflow when ODD is used with a humidstat. Note the total reduction in nominal airflow is limited to 15%.

On Demand Dehumidification switch settings (5 & 6) do interact with cooling airflow adjustment switch settings (2 & 3). Combining airflow adjustments between these two features may produce unexpected results. The following table defines these interactions:

CONTROLLING HUMIDITY WITH A TWO-STAGE COOLING THERMOSTAT

It is possible to control humidity with a 2-stage cooling thermostat. Set dip switch 5 “OFF” and switch 6 “ON” (position “C” as defined in Figure 9).

This feature will allow the blower speed to be reduced by 15% for the first stage of cooling. Once the thermostat requires more cooling capacity the second stage will be activated and the blower will then go to 100% cooling speed. Once second stage drops out the blower speed will be reduced again. To set this feature, set the dip switches for humidistat control (selection “C” as defined in Figure 9). A humidistat can also work in parallel with this new feature. Refer to Figures 10 through 15 for typical wiring schematic using this feature. The ODD wiring is shown as the dashed line in the figure.

NOTE: Do not use humidistat and a two-stage cooling system together using the above wiring scheme for dehumidification.

NOTE: The On Demand Dehumidification feature is ONLY available in the cooling mode.

CONTROL BOARD SETTINGS IN THE HEATING MODE

The second optional 24-volt AC only input to the interface control board is the “B” terminal input. The “B” terminal input is provided for heat pump applications and allows a heat pump thermostat to tell a heat pump to switch its reversing valve to heat mode. Refer to Figure 8 for the interface control board low voltage connections.

When “B” receives a 24-volt signal, all airflow adjustment switches (2, 3, & 4) and cooling “On Demand Humidification” switches (5 & 6) are bypassed. Nominal airflow as defined with switch 1 is maintained throughout the heat mode. This allows the user to define cooling airflow independently of heating airflow and prevents adverse humidity and heat rise effects.

NOTE: The “B” terminal must be used on heat pumps with auxiliary resistance heat or heat pumps with auxiliary gas heat.

NOTE: The “B” terminal is not used in resistance heat-only systems.

TYPICAL SYSTEM CONTROL WIRING

The (-)BHK series of air handlers can be used in cooling-only systems or in heat pump applications. The following diagrams illustrate typical system control wiring:

Cooling-only Systems:
Figure 10: Single-stage cooling-only system with electric heat using a single-stage cooling thermostat

Figure 11: Single-stage cooling-only system with electric heat and a humidistat used for On Demand Dehumidification using a single-stage cooling thermostat

Figure 12: Single-stage cooling-only system with electric heat and a two-stage cooling thermostat used for On Demand Dehumidification

Heat Pump Systems:
Figure 13: Single-stage heat pump with electric heat

Figure 14: Single-stage heat pump with electric heat and a humidistat used for On Demand Dehumidification

Figure 15: Single-stage heat pump with electric heat and a two-stage cooling thermostat used for On Demand Dehumidification

FIGURE 8
IFC BOARD

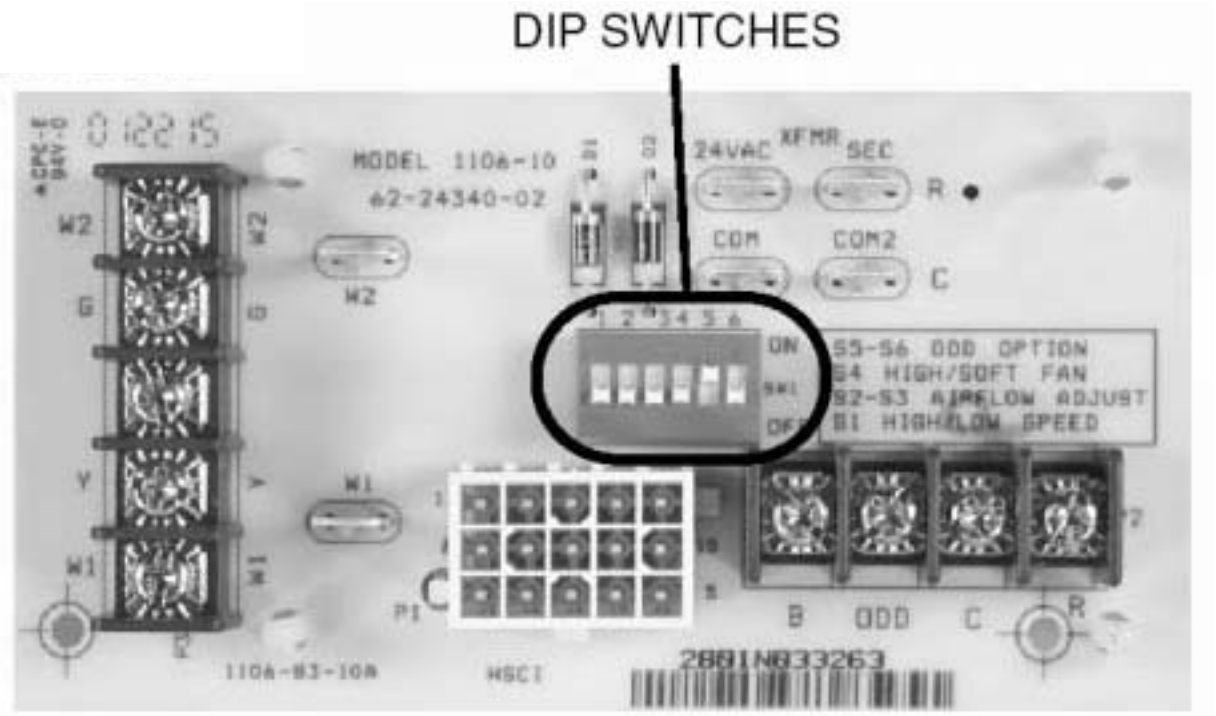

FIGURE 9
AIRFLOW SETTINGS

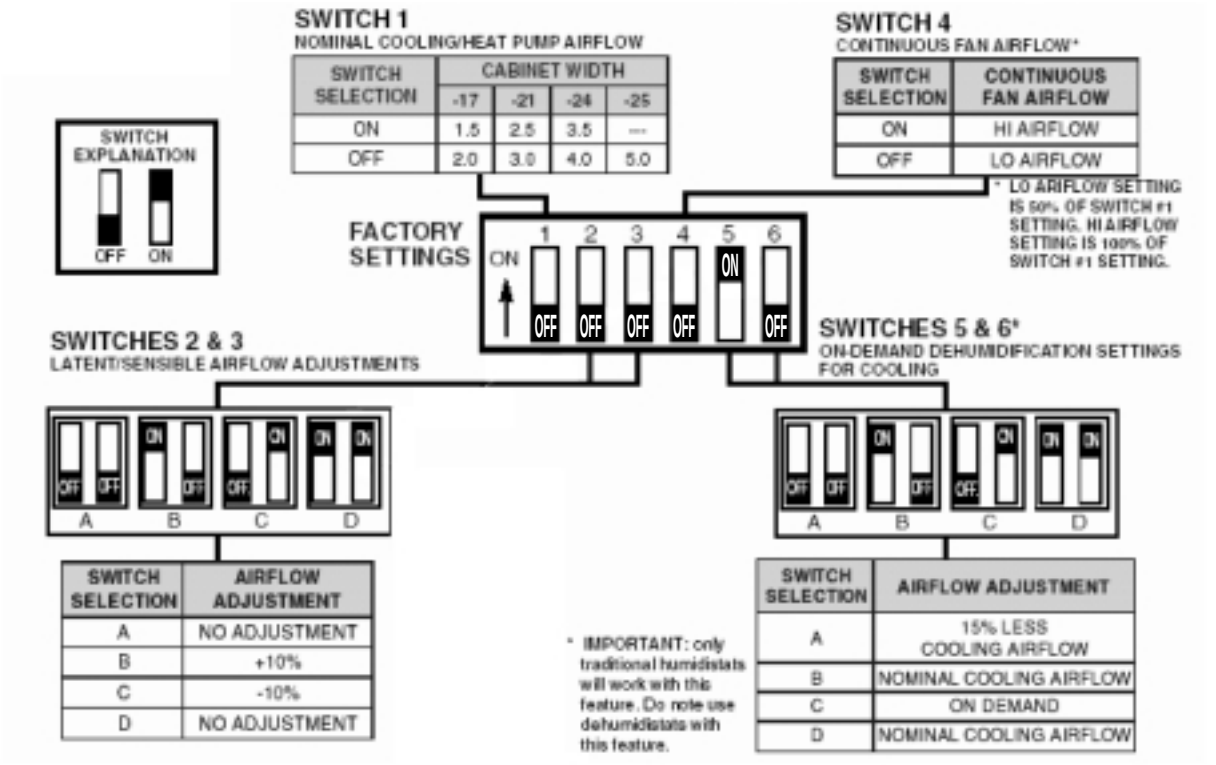

FIGURE 10
TYPICAL THERMOSTAT WIRING – STRAIGHT COOLING WITH ELECTRIC HEAT

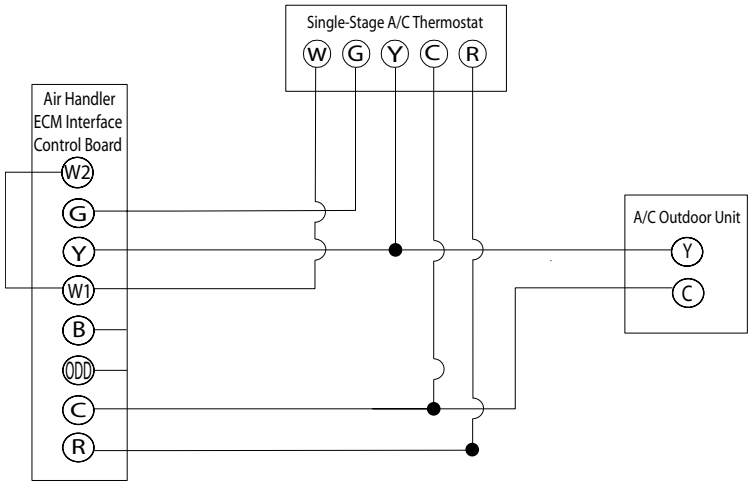

FIGURE 11
STRAIGHT COOLING WITH ELECTRIC HEAT AND USING A HUMIDISTAT FOR DEHUMIDIFICATION

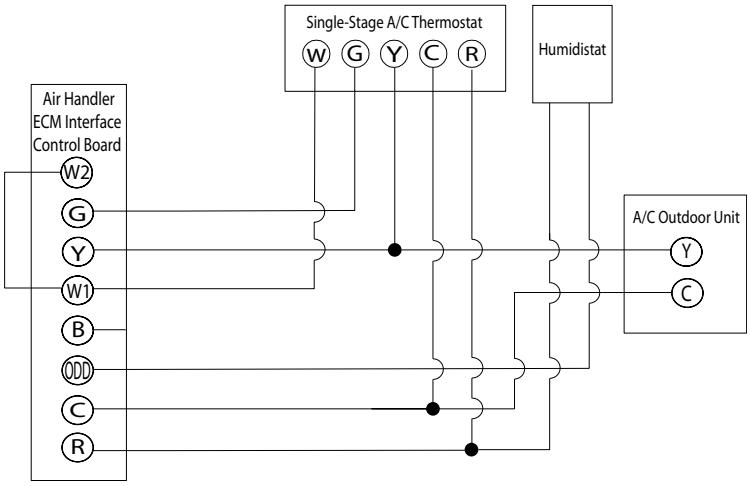

FIGURE 12
STRAIGHT COOLING WITH ELECTRIC HEAT USING A TWO-STAGE COOLING THERMOSTAT FOR DEHUMIDIFICATION

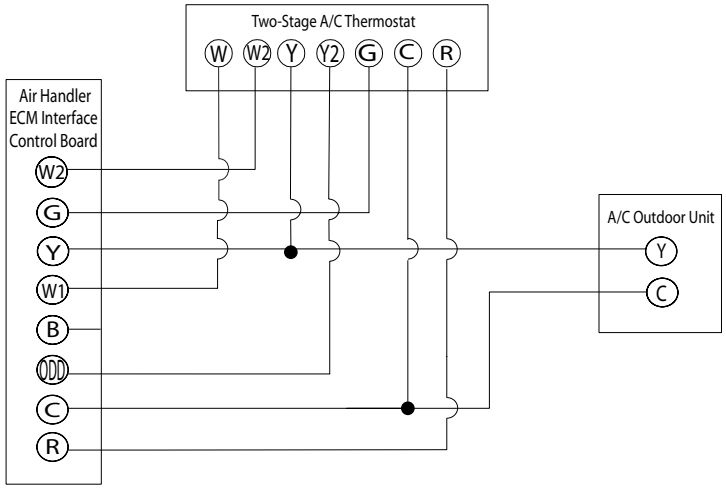

FIGURE 13
HEAT PUMP WITH ELECTRIC HEAT

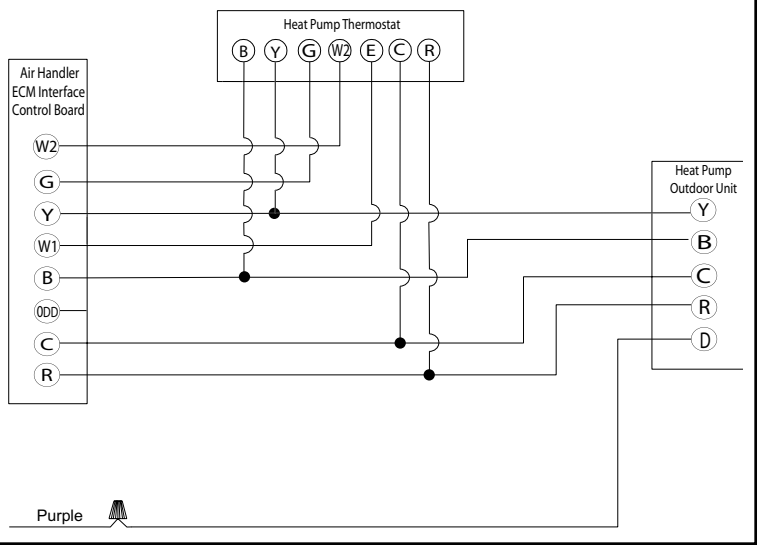

FIGURE 14
HEAT PUMP WITH ELECTRIC HEAT AND USING A HUMIDISTAT FOR DEHUMIDIFICATION

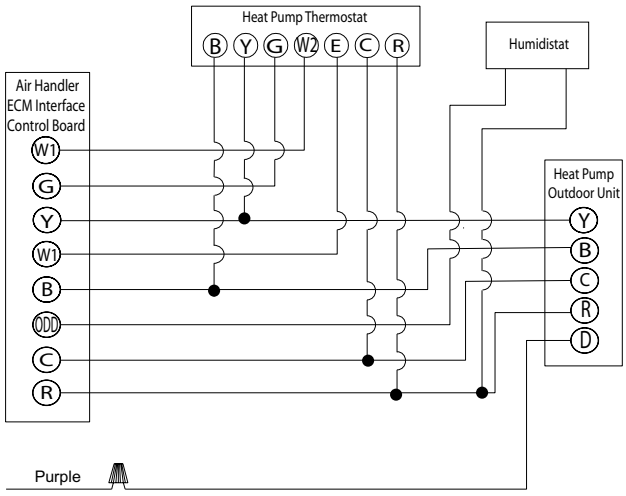

FIGURE 15
HEAT PUMP WITH ELECTRIC HEAT USING A TWO-STAGE THERMOSTAT FOR DEHUMIDIFICATION