

# INSTALLATION INSTRUCTIONS

## FOSSIL FUEL KIT AXWR01DFB1

FOR USE WITH  
Heat Pump Outdoor Sections

**These instructions must be read and understood completely before attempting installation.**

### SYSTEM MATCH INFORMATION

The Fossil Fuel Kit may only be used with Manufacturers Series, heat pump outdoor sections and the listed coil matches at the rated or above airflow.

### OPERATION

The purpose of the fossil fuel kit is to perform the following switching functions.

The indoor thermostat calls for first stage heat through the "Y" circuit.

If the outdoor ambient is above the outdoor thermostat's set point the "Y" circuit will go to the heat pump for "Heat Pump" operation.

If the outdoor ambient is below the outdoor thermostat's set point the "Y" circuit will go to a built in relay that makes a standard "R" and "W" circuit for the fossil fuel furnace for "Furnace" operation

Should the Heat Pump go into defrost, the furnace will be energized through the "D" terminal on the control board and the furnace will operate during the defrost cycle.

The end result is that the heat pump or furnace is being controlled by the "first stage" of the indoor thermostat circuit and therefore, no pronounced "controlled" temperature differences should be experienced.

The indoor thermostat calls for "second stage heat through the "W" circuit.

This "W" circuit goes to a built in relay that disconnects the

"Y" circuit to the heat pump, shutting it down, and making the standard "R" to "W" circuit for the fossil fuel furnace for "Furnace" operation, independent of the outdoor temperature.

Emergency Heat will perform the same operational function except the indoor thermostat's second stage "W" circuit moves to the first stage thermostat bulb.

### Components

**Outdoor Temperature Sensor:** Based on temperature setting, triggers control circuit to a built in relay that commands either the gas furnace or the heat pump to operate on first stage indoor thermostat keyed to outdoor ambient.

**NOTE:** When sensor is shipped with a plug, remove the plug by carefully cutting the wires closest to the plug.

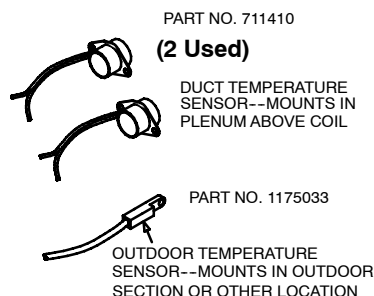
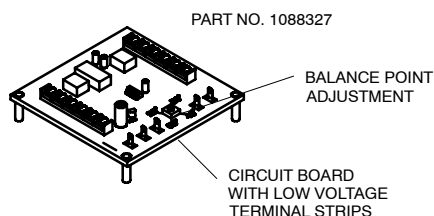
**Duct Temperature Sensors:** Prevents heat pump operation until the furnace cools down after run cycle.

**Circuit Board:** Acts as a switching control and terminal connections.

Coil matches and airflow are listed in the Split System Summary. Coil static drops versus CFM is listed in the coil manual.

**NOTE: Check the furnace airflow capabilities to be sure it can supply adequate airflow for the system. See checks and adjustments Page 5.**

### FOSSIL FUEL KIT



## MOUNTING CONTROLS AND ELECTRICAL WIRING

### WARNING

#### ELECTRICAL SHOCK HAZARD.

Failure to follow this warning could result in property damage, personal injury and/or death.

Turn OFF electric power at fuse box or service panel before making any electrical connections.

### WARNING

#### DEATH, PERSONAL INJURY, AND/OR PROPERTY DAMAGE HAZARD.

Failure to carefully read and follow this warning could result in equipment malfunction, property damage, personal injury and/or death.

Installation or repairs made by unqualified persons could result in equipment malfunction, property damage, personal injury and/or death. Installation MUST conform with local building codes or, in the absence of local codes, with the National Fuel Gas Code, NFPA NO. 54 / ANSI Z223.1, current edition, or with the National Standards CAN/CGA B149.1; CAN/CGA B149.2; and CSA C.22.1 - Canadian Electrical Code Part 1, depending on jurisdiction.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

1. The low voltage connections in the furnace that cause it to come on. These connections will normally be shown on the furnace wiring diagram as thermostat connections "R" and "W".
  - a. Actual connections points for gas furnaces will normally be at a terminal board marked "R" and "W".
2. Locate the existing thermostat (if installed) and determine number of wires from it to the furnace. Normally there will only be 2 or 3 wires.
  - a. This system must use a heat pump thermostat and it requires 6 wires from it to the control box.
  - b. Additional wires may be added or the old wire can be used to pull new wire through. If wire is replaced leave approximately 6 feet of it connected to the furnace for use from the new control box.

## MOUNTING CONTROLS

Figure1

Outdoor Temp. Sensor Location in Outdoor Unit Typical Mounting



Outdoor Sensor Location in low-volt area.

### 1. OUTDOOR TEMPERATURE SENSOR LOCATION/MOUNTING

The sensor can be mounted inside the control box of the outdoor heat pump section or it can be mounted in any suitable outdoor location.

Consider location of indoor and outdoor units relative to each other and necessary low voltage wiring between them when determining location for the sensor.

If sensor is mounted inside the control box a total of 7 wires will be required from the outdoor section to the control box.

If sensor is mounted remote it will require 2 wires from it to the control box and 5 wires from control box to the outdoor unit.

- A. Mount sensor in low voltage wiring area as shown in **Fig. 1**. Use long screw supplied with sensor to mount. Be sure that when drilling hole and placing screw that it does not interfere with the wires or capacitor or tubing inside the unit.
- B. Remote Mounting Of Sensor
  - a. Select a suitable location where sensor will not be exposed to direct sunlight or prevailing winter winds. Avoid mounting on a surface which can absorb a lot of heat or cold such as a brick or masonry wall.

### 2. CONTROL BOARD

Mount control board inside furnace cabinet near furnace controls if there is a suitable area. If not, then mount on an adjacent wall (post, etc.) within 4 feet of the furnace discharge plenum so the duct sensor can be connected without having to splice the wiring. **DO NOT** mount control board to the furnace plenum or duct.

Figure 2.

Mounting Controls

To Control Board

Control Board,  
Mounts inside furnace  
or suitable area.

To Control Board

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### 3. DUCT SENSORS

Mount the bracket for duct sensors on "A" coil as shown in Figure 2. This location will also work for counter flow applications. For horizontal coils locate the bracket approximately 6" downstream of the coil.

Mount the two sensors as illustrated. Limit #2 facing the airstream and Limit #1 facing away.

Drill a 7/8" hole in the duct and install bushing, supplied, and route wires from sensors through the bushing to the control box.

During defrost, since limit 2 is facing the airstream, the furnace will shutdown until the temperature allows the sensor to close. At this point the furnace will reignite. If the temperature continues to rise, limit 1 will trip and the compressor will shutdown to protect it.

## WIRING CONNECTIONS

### LOW VOLTAGE

Use minimum 18 gauge thermostat wire

#### 1. DUCT SENSOR

Route wires from duct sensor to control board, Fig 2.

- a. Connect spade terminals to terminals on the circuit board marked "limits".

#### 2. OUTDOOR HEAT PUMP SECTION

Route 5 wire (remote mounted sensor) or 7 wire (sensor mounted in unit) thermostat cable from out door section to control box.

- a. Run cable into control box through finger bushing and complete connections at terminal strip marked "Outdoor", Fig. 2.
- b. Complete connections at outdoor unit, inside junction box, with "Red, Blue, Orange, White, and Yellow" wires as shown on Wiring Diagrams.
- c. Complete connections to Outdoor Temperature Sensor (if installed in unit) with wire nuts.

### 3. OUTDOOR TEMPERATURE SENSOR (REMOTE MOUNTED)

Route 2 wire thermostat cable from control box to sensor. Complete connections at "T" and "T" in control box and at sensor using wire nuts.

#### CAUTION

**Connecting 24 volts to either of the "T" terminals on the circuit board will result in instant failure of the "IC" chip on the control board and require replacement of the the entire board.**

- a. Connections at sensor should be taped over or sealed using silicone sealant and secured in a location (such as up under the window sill) to provide some protection from moisture.

#### 4. INDOOR THERMOSTAT

Install according to instructions provided. Make sure the unit is level.

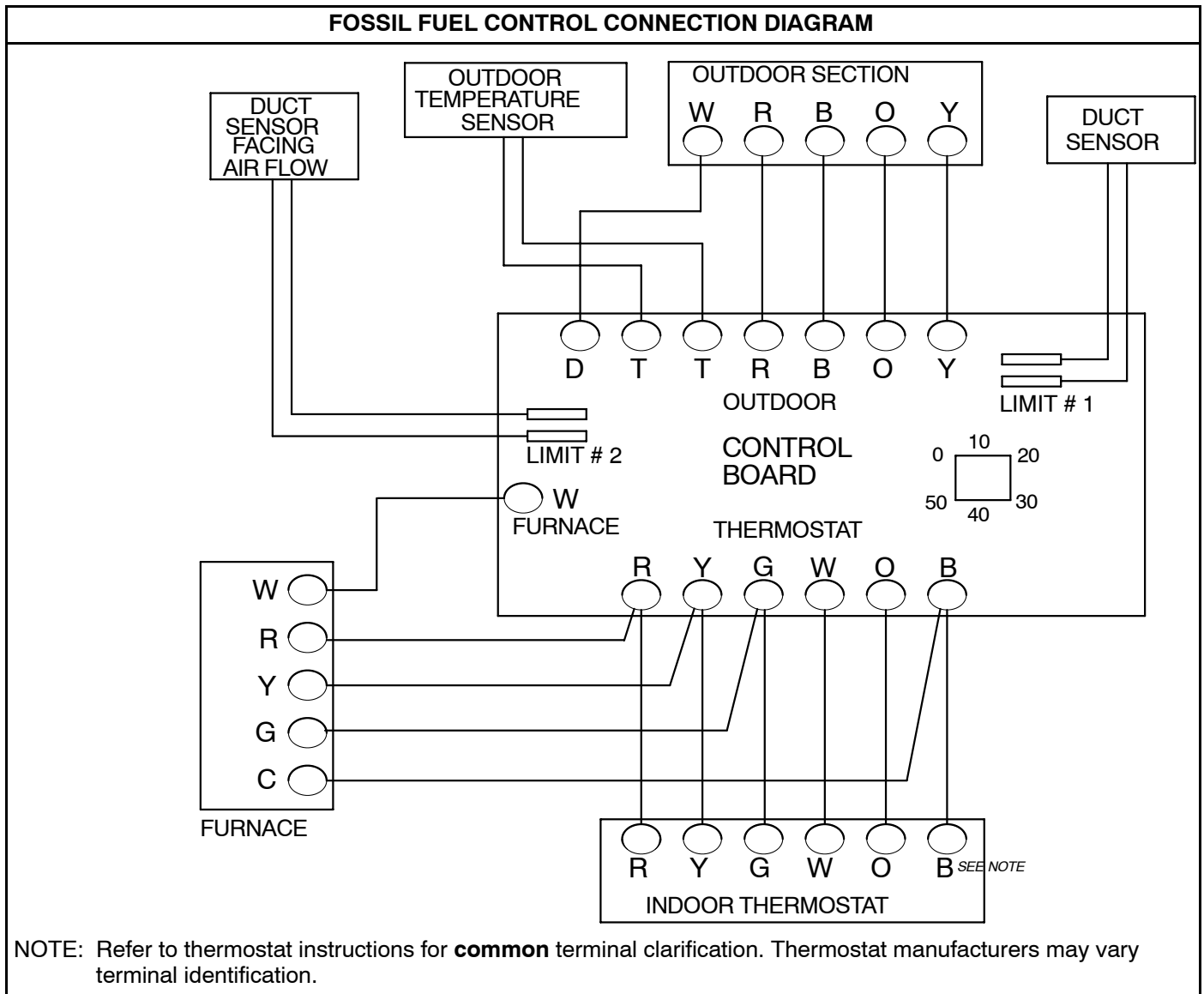
- a. Route 7 wire thermostat cable or add wires to existing cable for connections between thermostat and control box.
- b. Complete connections as shown on wiring diagram except when a White Rodgers 1F92 thermostat is used.
- c. The connections for a 1F92 are the same except it requires a jumper between "Y I" and "W I" on the thermostat and between "E I" and "W2" on the thermostat.

**NOTE Some thermostats may have one or both of these jumpers already installed.**

#### 5. FURNACE CONTROLS

Refer to furnace wiring diagram for thermostat connections reference Step 4 under Mounting Controls and Electrical Wiring.

- a. Connect furnace "R" and "W" terminal on control board to appropriate furnace controls as shown on wiring diagram.



## CHECKS AND ADJUSTMENTS

Refer to installation instructions for the furnace, heat pump coil and outdoor heat pump section for checks and adjustments and perform in conjunction with the following.

### WARNING

**ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD.**

Failure to follow this warning could result in equipment malfunction, property damage, personal injury and/or death.

Perform checks and adjustments by referring to furnace and heat pump instructions.

## AIRFLOW - ACROSS COIL

1. Refer to the coil instructions for static pressure drop across coil for the CFM of air required and check according to instructions.
2. If the airflow is inadequate change the furnace blower motor to a higher speed tap or adjust belt drive pulley.
3. If the airflow is too high change to a lower speed tap or adjust belt drive pulley.

**NOTE** Speed tap may be the one shown on furnace wiring diagram as the heating speed tap. Some furnaces have a blower relay and may show separate speed taps for heating and cooling but separate speeds cannot be used with this system. The furnace blower will run on the same speed for all functions.

## AIRFLOW - FURNACE TEMPERATURE RISE

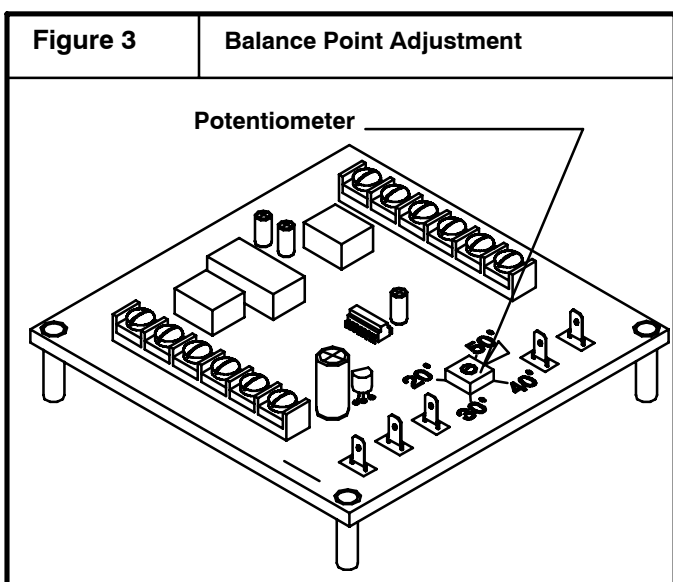
1. Following the furnace manufacturer's instructions measure the temperature rise across the heat exchanger.

2. Compare with the temperature rise specifications given on the furnace rating plate. A temperature rise within the range given on the rating plate is satisfactory.
3. If temperature rise is too high adjust blower drive or change to a higher speed tap, even if it was changed because of too much air flow across the coil, Reference Step 3, Airflow Across Coil.

### BALANCE POINT ADJUSTMENT

The balance point can be adjusted from 0°F to 50°F at the potentiometer on the electronic board inside the control box, Fig 3.

1. To adjust use a small screwdriver to turn the center adjustment to align with temperature of balance point of the structure
  - a. If balance point is unknown, but experience indicates that equipment is properly sized, set balance point on 35° F.



### COOLING CHECKOUT

Perform checkout according to instructions in outdoor section manual.

### HEATING CHECKOUT

If outdoor temperature is not above balance point setting the outdoor temperature sensor will have to be warmed in order to do a complete check. Sensor can be warmed by holding your hand around it, immersing in warm water or using a heat lamp, etc.

1. Turn thermostat heat-cool switch to OFF. Turn thermostat fan switch to ON.
2. Turn on all power except 230 volt line to outdoor section.
3. Turn fan switch on thermostat to ON. Blower should run. Reset to AUTO; blower should turn off

4. Set thermostat below room temperature. Turn selector switch to HEAT. Move thermostat just above room temperature, not more than 2°F. Blower should run and a click should be heard in the outdoor section (contactor closing)
5. Set system switch to OFF. Turn the thermostat below room temperature. Turn on the 230 volt power to the outdoor unit. Nothing apparent will be happening, but the crankcase heater is now energized. If the outdoor temperature is below 75°F allow the unit to stay in this mode at least 6 hours. This is needed to vaporize any refrigerant that may be in the compressor oil.
6. Set the thermostat just above room temperature, max..2°F. Move system switch to HEAT. Count to 5 (about 5 sec.). Turn the electric power off. (This is to be done at outdoor unit disconnect switch) Check that there is no clattering or unusual noises. The outdoor fan blade should have started turning and a humming noise should have been heard from the compressor. The indoor fan should continue to run.

**NOTE: Wait 2 minutes. Repeat the procedure. Check the same things again in case you missed one on the first power application. Wait 2 minutes this time to assure refrigerant pressures in the system are equalized. Turn the electric power on and allow the system to run for a few minutes.**

7. With the heat pump running, disconnect one of the Outdoor Temperature Sensor wires at "T" in the control box, Fig 2.
  - a. The heat pump should shut off and the furnace will come on.
  - b. Reconnect wire at "T" and furnace will shut off. Heat pump should not come back on immediately, but should come on within 1 to 5 minutes.
8. With the heat pump running move temperature setting of thermostat up a few more degrees.
  - a. Heat pump will shut off and furnace will come on.
  - b. Move temperature setting back down so it is just above room temperature max. 20F. Furnace will shut off and heat pump will come on in a few minutes.
9. With the heat pump running switch thermostat selector switch to "Emergency Heat".
  - a. Heat pump will shut off and furnace will come on .
  - b. Move selector switch back to "Heat" position. Furnace will shut off and heat pump will come on after a few minutes.
10. With the heat pump running, chill the Outdoor Temperature Sensor so it's below the balance point setting. Sensor can be immersed in a mixture of water, ice and salt to chill if outdoor temperature is above balance point.
  - a. Heat pump will shut off and furnace will come on.

11. Allow the Outdoor Temperature Sensor to stabilize at the outdoor temperature.
  - a. System will run in the heat pump mode if temperature is above balance point
  - b. System will switch to furnace if temperature is below balance point.

### SYSTEM OPERATION

The indoor thermostat operates like any standard heat/cool or cool only thermostat in the cooling mode. When switched over to "HEAT" the thermostat has two stages. The first stage will control the heat pump or furnace depending on outdoor temperature and balance point setting in control box. The second stage will only control the furnace and it will cause the furnace to come on if the heat pump cannot maintain the desired indoor temperature or if the thermostat is set to auxiliary heat mode.

If the balance point is set on too low of a temperature the heat pump will not be able to maintain the desired indoor temperature. When the temperature drops 4°F below desired setting, the heat pump will shut off and the furnace will come on from the second stage of the thermostat. As soon as the temperature rises 2°F the first stage of the thermostat will shut the furnace off and the heat pump will come back on. The system will continue to cycle between the heat pump and furnace unless the balance point temperature is correctly set.

A one time cycle from heat pump to furnace to heat pump will also occur anytime the desired temperature setting on the thermostat is moved upward (higher temperature) more than 2° F.

**NOTE: If voltage from power grid is less than 108v, you may experience problems in operation. If this happens you will need to install a 75 VA Class II transformer (ICP kit # AXWR020TA1).**

### COOLING OPERATION

1. Set system select switch to "COOL".
2. Position temperature setting lever to desired temperature.
  - a. System will come on and cycle on and off to maintain desired temperature.
3. If continuous air circulation is desired position Fan Switch from "AUTO" to "ON".

### HEATING OPERATION

1. Set system select switch to "HEAT".

2. Position temperature setting lever to desired temperature.
  - a. Heat pump or furnace will come on and cycle to maintain desired temperature.
  - b. If the heat pump is running and you wish to raise the temperature (without having the furnace come on) move the temperature lever upward in small increments (2°F) every 15 to 30 minutes.
  - c. If continuous air circulation is desired position Fan Switch from "AUTO" to "ON"

### CONSTANT CYCLING/HEAT PUMP FURNACE

Inadequate heating from the heat pump or a balance point that is not properly set will cause cycling between the furnace and heat pump.

1. Position select switch to "EMER HEAT" and set desired temperature.
  - a. The furnace only will operate to maintain desired temperature.
2. Contact a qualified service agency to have the heat pump checked.
  - a. If heat pump is OK set the balance point temperature (inside control box) about 2-5°F higher.

### TROUBLE SHOOTING

The following diagnostic flow charts cover complete trouble shooting of all the fossil fuel control components plus the indoor thermostat circuit and part of the furnace blower circuit.

The charts do not cover the furnace or heat pump, but they will indicate if the problem is in that area.

## WARNING

The charts and other checks are intended for use by a qualified service technician who is familiar with the safety procedures required in installation checks and repair and who is equipped with the proper tools and testing instruments.

Many of the checks must be done while either the furnace or heat pump is running and there is both line voltage (115V) and low voltage (24V) circuit in the control box. Checks or repairs not done properly may result in injury from electrical shock which can be serious or even fatal.

If you install or perform checks or service on equipment, you must assume responsibility for any bodily injury or property damage which may result to you or others. We will not be responsible for any injury or property damage arising from improper installation, service, and/or service procedures.

## CHECKING OUTDOOR TEMPERATURE SENSOR AND BALANCE POINT CIRCUIT OF BOARD

The switching from the heat pump cycle to the furnace at the proper balance point temperature is controlled by resistance values between the sensor and board.

### TEMPERATURE SENSOR CHECK

Correct resistance through the Temperature Sensor can be checked using an Ohmmeter. However, the sensor must be disconnected and must be at a given temperature. Use following chart, Fig. 4 and check against at least two different temperatures. Temperature of sensor can be controlled by chilling the Outdoor Temperature Sensor in a brine solution of ice, water and salt or warming in warm water.

Figure 4.		Resistance Values/Versus Approximate Temperature	
Resistance In Ohms	Approx. Temp °F	Resistance In Ohms	Approx. Temp °F
20K	50	35K	30
23K	45	40K	25
26K	40	46K	20
30K	35		

### CIRCUIT BOARD CHECK

The switching functions at a specific temperature can only be checked by placing a known resistance across terminals "T" and "T" on the board. Resistance can be a variable resistor (range of 20 to 50K ohms) or the Outdoor Temperature Sensor at a specific temperature. Make sure sensor has been checked against values in chart.

1. Make sure furnace circuit is on so power is supplied to board.
2. Immerse Outdoor Temperature Sensor in water between 20° and 50° F, at a known temperature.
3. Adjust the potentiometer on the board, Fig 3, to the same temperature as the water the sensor is in.
4. A click should be heard from the relays on the board and the heating mode should change from heat pump to furnace or furnace to heat pump.

**NOTE: When switching from furnace to heat pump allow several minutes for heat pump to come on as limit will be open. Board should be checked at several different temperatures to confirm proper operations. If a variable resistor is used, set resistor to correspond to values shown in Fig. 4. Disconnect Outdoor Temperature Sensor and connect resistor across "T" and "T".**

### FAILED CIRCUIT BOARD

#### (EMERGENCY HEAT OPERATION)

1. Disconnect thermostat wires at terminal board connections "R", "W" and "B". Tape wire that connects to "B".
2. Disconnect the two wires going to furnace for "R" and "W" that are connected to the two black wires from the control board with wire nuts.
3. Connect the two wires from the furnace directly to the "R" and "W" wires from the thermostat.
4. Switch thermostat to "Emergency Heat" position and set temperature lever above room temperature.

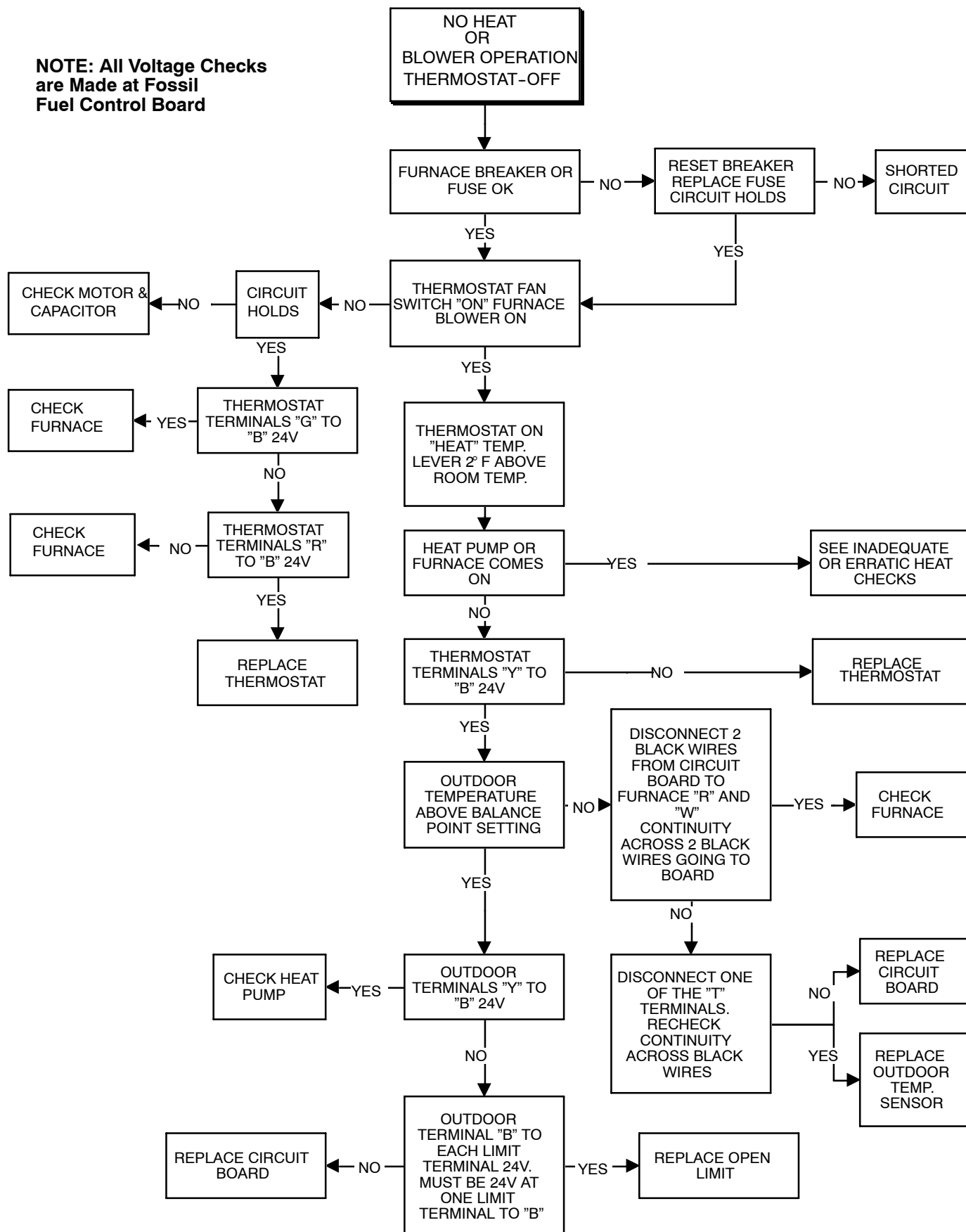
Furnace will cycle to maintain temperature. Explain operation to homeowner and that heat pump will not operate for either heating or cooling.

### OPERATION SEQUENCE

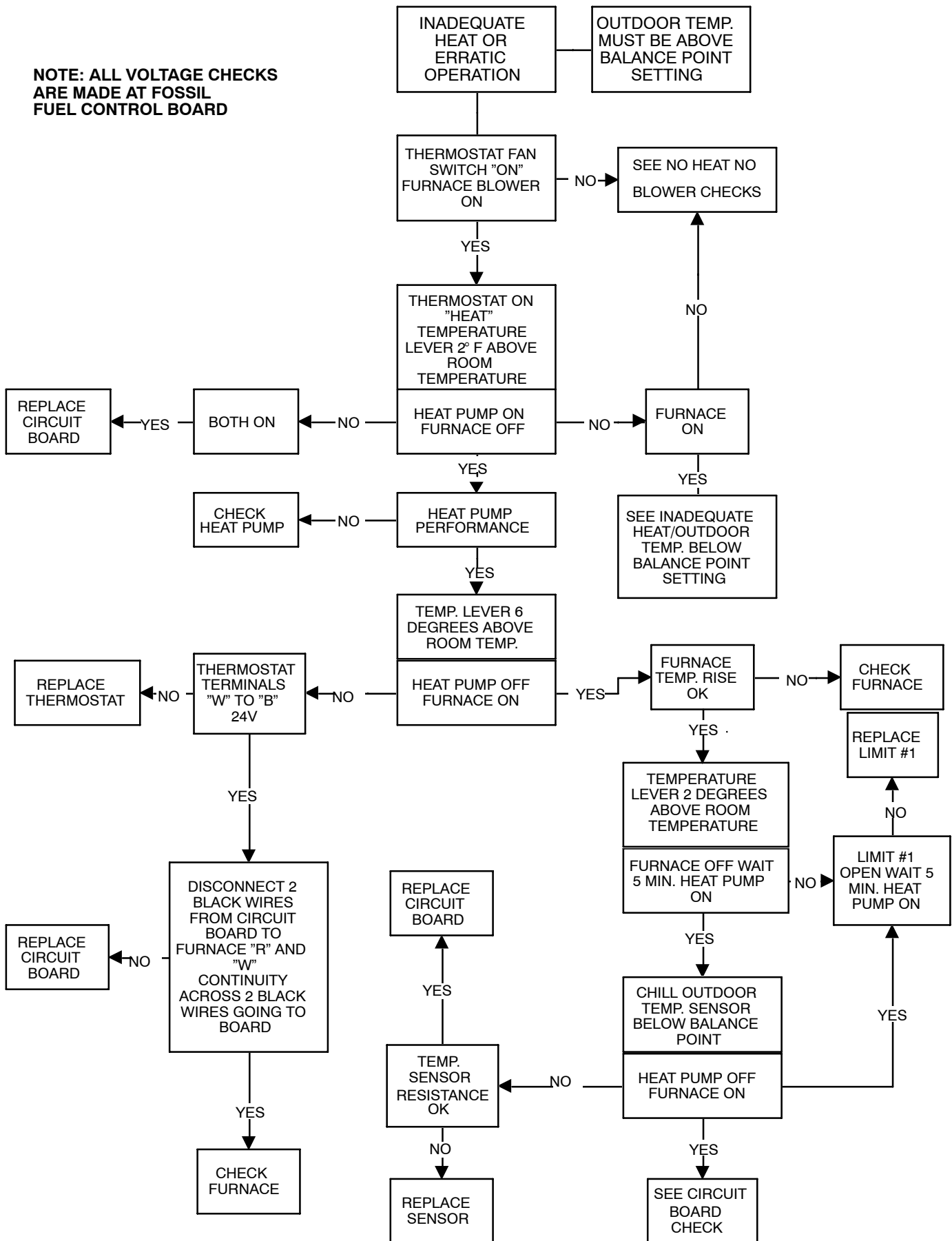
Conditions	Outdoor Unit (Check Cond Fan)	Indoor Blower (Check Blower)	Furnace Operating (C and W on Furnace)	Furnace				Condensor			
				W	R	Y	G	W	R	Y	O
Cooling - OD temp above BP (Balance Point)	on	on	off	X	X	X		X	X	X	
Limit one trips cooling OD above BP	on	on	off	X	X	X		X	X	X	
Limit two trips cooling OD above BP	on	on	off	X	X	X		X	X	X	
Cooling - OD temp below BP	off	on	off	X	X	X		X			X
Limit one trips cooling OD below BP	off	on	off	X	X	X		X			X
Limit two trips cooling OD below BP	off	on	off	X	X	X		X			X
Heating - OD temp above BP	on	on	off	X	X	X		X	X	X	
Limit one trips heating OD above BP	off	on	off	X	X	X		X			
Limit two trips heating OD above BP	on	on	off	X	X	X		X	X		
Heating - OD temp below BP	off	on	on	X	X	X	X	X			
Limit one trips heating OD below BP	off	on	on	X	X	X	X	X			
Limit two trips heating OD below BP	off	on	on	X	X	X	X	X			
Defrost - OD temp above BP	on (no fan)	on	on	X	X	X	X	X	X	X	
Limit one trips defrost OD above BP	off	on	off	X	X	X		X			
Limit two trips defrost OD above BP	on (no fan)	on	off	X	X	X	X	X	X	X	
Emergency Heat - OD temp above BP	off	on	on	X	X		X	X			
Limit one trips emergency heat OD temp above BP	off	on	on	X	X		X	X			
Limit two trips emergency heat OD temp above BP	off	on	on	X	X		X	X			
Emergency Heat - OD temp below BP	off	on	on	X	X	X	X	X			
Limit one trips emergency heat OD temp below BP	off	on	on	X	X	X	X	X			
Limit two trips emergency heat OD temp below BP	off	on	on	X	X	X	X	X			



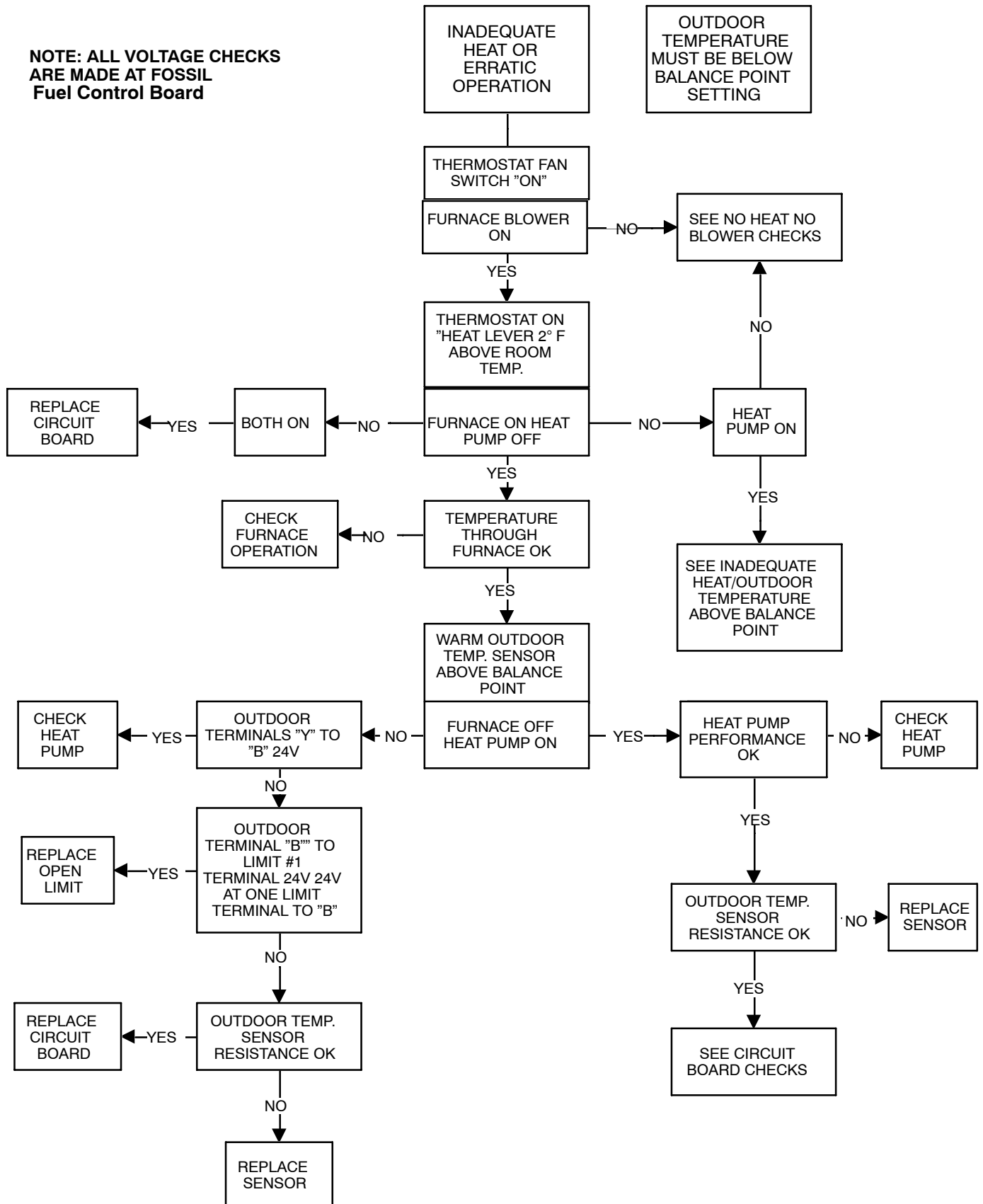
**NOTE: All Voltage Checks  
are Made at Fossil  
Fuel Control Board**



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