GENERAL

Equipment required:

Digital Volt/Ohm Meter

Explanation:

All electrical components within the heater may be tested to determine if voltage is being supplied to, or sent through the component. Familiarizing yourself on how to check voltage is critical since it will help you determine if a component is working properly, plus, it will shorten the amount of time used should troubleshooting equipment problems occur.

Attention

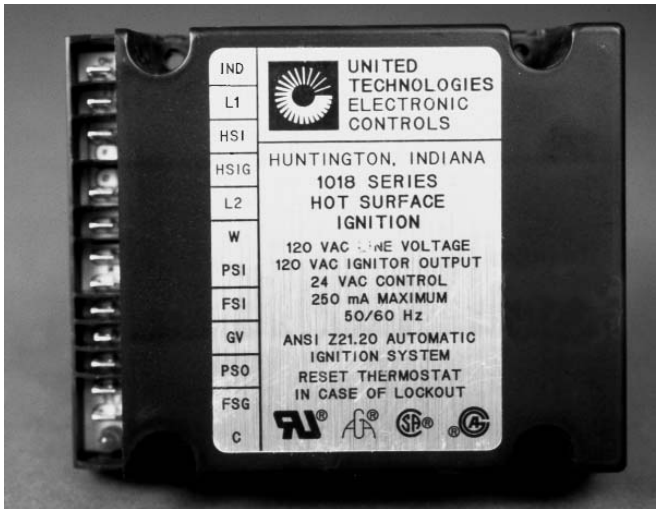
The ignition control module will not operate without 24 V.A.C. supplied from the transformer.

Before we look at basic procedures in checking voltages at individual parts, it is good to know which components within the control system work on a particular voltage. Since the ignition control module sends and receives voltages throughout the heater we will review the terminal designation on both past and present designs of control modules. Refer to the following illustrations for comparison of ignition controls and positioning of designators, which in turn will identify the voltage that each individual component receives.

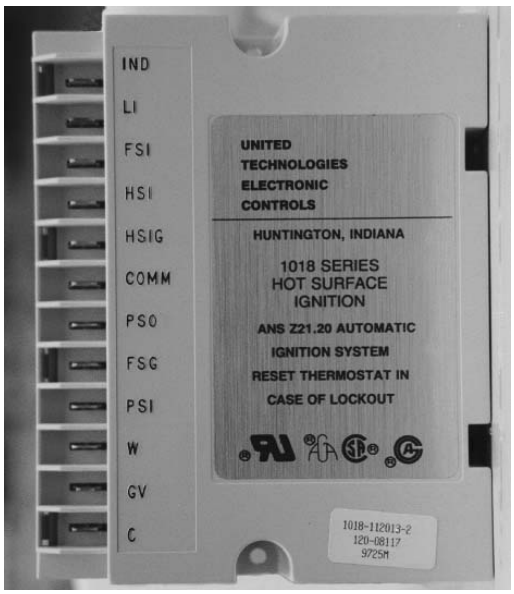
Self-Diagnostic Control Module Terminal Designators and Voltages (Part #120-09298 and 120-08117)

IND	120 V.A.C. from module to motor
L1	120 V.A.C. power supply voltage to module
HSI	120 V.A.C. from module to igniter
HSIG	Neutral return for igniter
L2	Neutral of igniter (part #120-09298)
COMM	Neutral of igniter (part #120-08117)
W	24 V.A.C. to module from transformer
PSI	24 V.A.C. from module to air proving switch
FSI	100 V.A.C. from module to flame sensor (black module) 24 V.A.C. from module to flame sensor (white module)
GV	24 V.A.C. from module to high limit and then to gas control valve
PSO	24 V.A.C. from air proving switch back to module
FSG	Flame sensor ground
C	Control module ground

Part #120-09298



Part #120-08117



Voltage Checks

Control Module Terminal Designators and Voltages (Part #120-08027)

IGN	120 V.A.C. from module to igniter
L	120 V.A.C. power supply to module
GND	Control module ground
FP	24 V.A.C. from module to flame sensor
TH	24 V.A.C. from transformer through air proving switch, to high limit switch, and finally to control module
TR	Neutral return for transformer
MV	Neutral return for control valve
MV	24 V.A.C. to gas control valve

ATTENTION

The control module has three diagnostic light patterns:

- -- No Light: Normal operation.
- -- Steady On Light: Fault is internal to module. Replace module.
- -- Flashing Light: Problem is within other heater components or wiring. Refer to wiring diagram for Model 284/285 heaters within Section 7 for assistance in determining failure.

Control Module
Part #120-08027

Equipment required:

Digital Volt/Ohm Meter

Procedure

Testing for voltage at any of the components is a relatively easy procedure. The following illustrates how to check voltage at some of the components used in the heater.

Be aware on the heater's electrical control system that black and red color coded wires will carry high voltage (either 120 V.A.C. or 220 V.A.C.). All other wires will carry low voltage (24 V.A.C.). Use extreme care to prevent electrical shock.

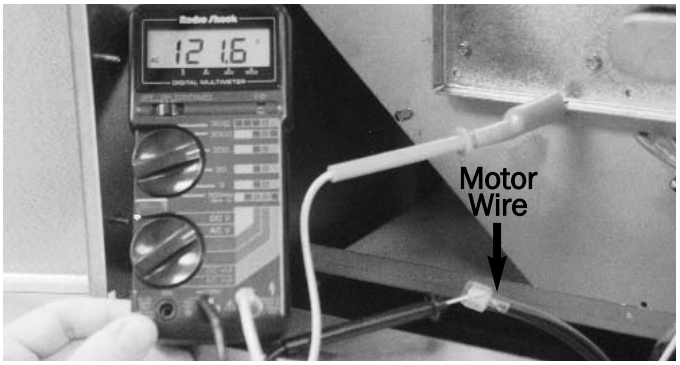
⚠ Warning
Electrical Shock Hazard

- Troubleshooting may require the heater to be connected to its electrical supply.
- Do not directly touch exposed terminal connections when checking voltage. Use only the insulated probes of the voltage tester.
- Failure to follow this warning may result in electrical shock leading to personal injury.

First, set the function selector switch of the tester to "AC" (alternating current). Check for voltage at either the ignition module or the individual component. To test, place one of your tester probes at the "hot" power supply terminal of the component being tested and the other probe to a grounded portion of the heater's cabinet. (Normally, a sheet metal screw on the cabinet will serve this purpose.) Or, place your probes across the terminals of component being tested. The following are some examples showing both procedures:

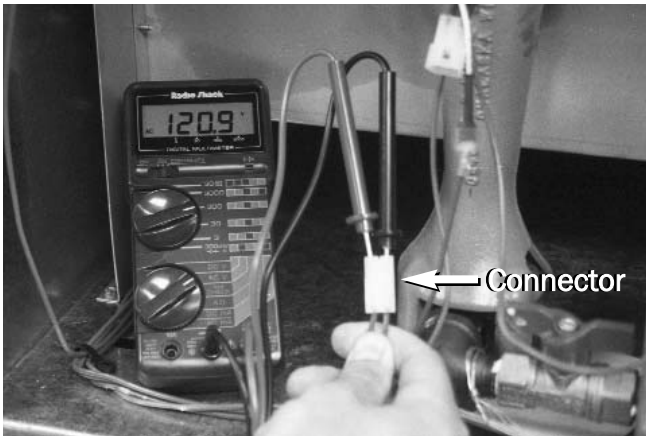
Checking for voltage supply to motor from module.

Apply a tester probe to the end of the black motor wire and the other probe to ground. When the module is energized, you will see approximately 120 volts readout on the meter display. This verifies the module is supplying voltage and the wiring between the module and the motor is in good condition.



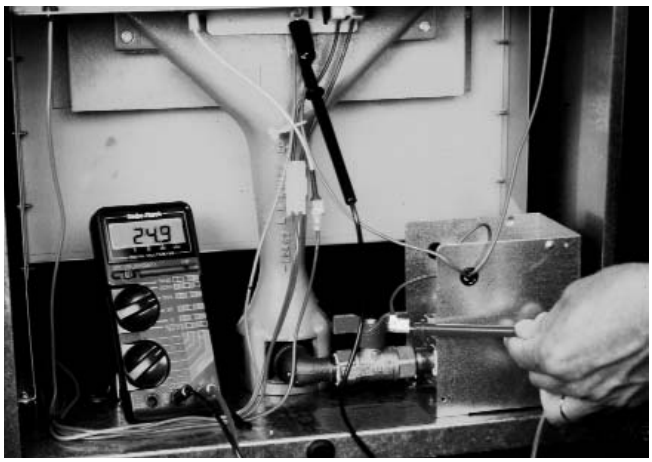
Checking for voltage supply to igniter from module.

Apply the probes to the female terminals in the plastic connector at the end of the red igniter wires. The board will send voltage to the igniter once the motor stops after prepurge. Voltage (120 V.A.C. approximately) will appear for 17 seconds, thereby proving both control module and igniter wires are working properly.



Checking for voltage supply to gas control valve from the high-limit switch.

Apply one probe to female terminal at end of brown gas control valve wire and the other to ground. You will see 24 volts appear, proving both the module, high-limit switch, and their respective wires are in order.



Continuity Checks

Equipment required:

Digital Volt/Ohm Meter

Explanation:

In a continuity test, you simply want to determine whether or not an electrical pathway exists through a component. For these tests, it is important that the probes of the multimeter make good contact with the part being tested. They should touch bare metal or wire, not insulation, paint, or dirt. Alligator clips make firmer contact than needle probes, use them where possible.

The components which exhibit good continuity within the electrical circuit also provide a resistance to the flow of electricity. The resistance is measured in ohms and will be displayed on the meter. You do not need to remove the components to check for continuity. Also, manipulate wires to see if they are loose to help uncover poor connections or other electrical interruptions. The following illustrates how to check for continuity for some of the components used in the heater.

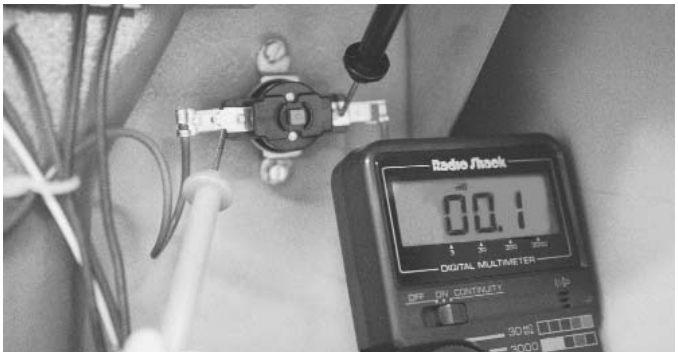
Attention

Make sure that the heater is disconnected from its electrical source before conducting this procedure. Failure to do so will result in damage to your meter.

Procedure

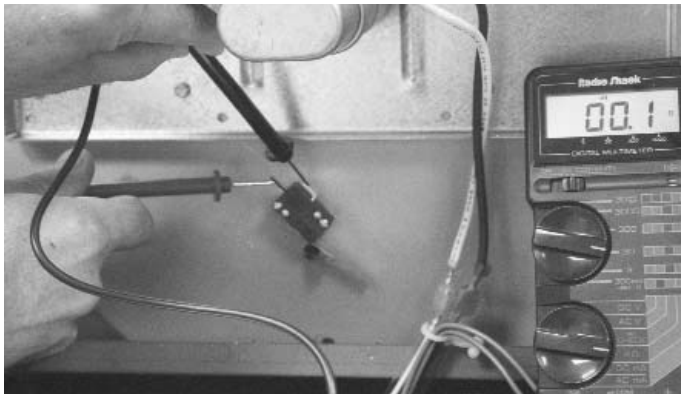
First, set your meter to the continuity scale (if provided) or the ohm(s) scale. Place the tester probes on the terminals of the component being tested. If your meter has an audible continuity feature you will hear a "ringing" sound in addition to seeing a read out in ohms. Examples of checking for continuity on several components are shown.

High Limit Switch



Typically, components which show an open circuit and are not in proper working order will exhibit an "overload" readout on the display of the multimeter. These components should be replaced. However, some components such as an air proving switch have a set of normally open contacts. To verify proper operation, the switch arm needs to be pushed so the contacts are engaged. At this point an ohm reading should appear.

Air-Proving Switch



Some components, such as an igniter, have a much larger amount of resistance to the flow of electricity. The ohm read out will be much greater on the igniter than on some other components such as an air-proving switch or high-limit switch. Continuity through the igniter indicates that it is good.

Hot Surface Igniter

To check for proper thermostat operation, connect the testing probe to the end of the thermostat cord set leads that normally connect to the heater. When the thermostat contacts are open, the meter will show an open circuit. When the thermostat is adjusted to call for heat, the contacts should close and you will see an ohm readout

appear on the tester indicating that there is a completely closed electrical circuit through the cordset and thermostat.

Thermostat

Attention

- Many thermostats can be wired to open or close on an increase in temperature.
- Make sure the thermostat is wired properly so the contacts close when the thermostat is set to a point above room temperature and open when the temperature is achieved. This will allow the heater to cycle accordingly.
- Refer to the heater wiring diagram or the wiring diagram applied to the inside of the thermostat cover for proper hook-up.

Flame Sensor Tests

Equipment Required:

Volt / Ohm Meter with a DC Scale

Signal Transducer:

Part Number 120-08507

EXPLANATION:

The flame sensor is responsible for monitoring burner flame presence. It is used in conjunction with the ignition module.

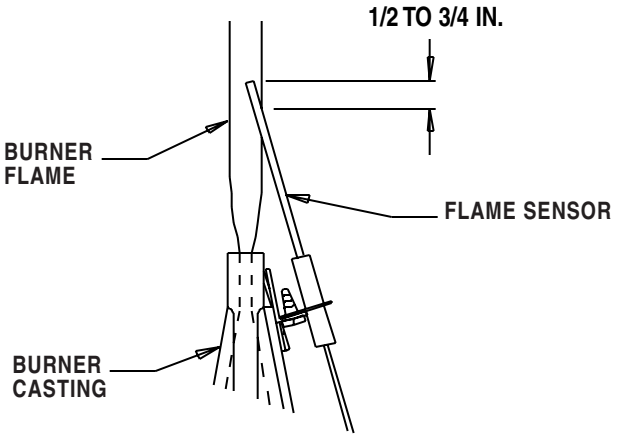
Here is how it works. Flame sensing is the ability of a flame to conduct current when current is supplied to the flame sensor (from the module) and the flame sensor is immersed in the burner flame. The alternating current received at the flame sensor passes through the flame to the nearest grounded surface, which is at the burner. At this point the alternating current has been rectified or converted to direct current. A green wire connected at the burner receives this direct current and returns it back to the ignition module thereby proving the presence of flame. The system control allows the burner to operate as long as it receives this signal from the flame sensor.

Checking for Flame Sense:

With heater on check to make sure the black control module (part number 120-09298) is sending approximately 100 V.A.C. from terminal "FSI" through the flame sensor wire to the flame sensor. (For units with the white control module, part number 120-08117, the flame sensor receives approximately 24 V.A.C. from terminal FSI.) This can be accomplished by disconnecting the flame sensor from its power supply wire (from module) and performing the following:

- Shut the heater off.
- Set your multimeter to A.C. Connect one probe to the exposed terminal at the end of the wire from terminal FSI and the other probe to ground (sheet metal screw or cabinet).
- Turn the heater on. As soon as there is a call for heat, the control module will start sending approximately 100 V.A.C. (or 24 V.A.C.) to the sensor depending on control module. If you do not see this voltage appear, shut the heater off and check the wire for continuity. If the wire is good, the control module is defective and must be replaced. However, if the control module is sending necessary voltage to the sensor, then reconnect the sensor to its wire and recycle the heater. If flame sense failure occurs, then proceed to check these problem areas:

A. Extremely low gas pressure
B. Dirty flame sensor element. (Rub sensor element briskly with steel wool or emery cloth.)
C. Cracked insulator base on sensor
D. Poor electrical connection
E. Flame sensor tip touching metal
F. Flame sensor tip not in burner flame. (See below for proper positioning.)



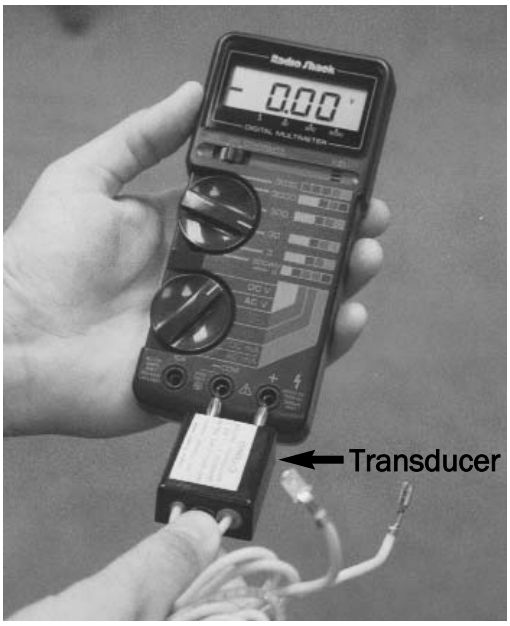
Any of the preceding conditions allow flame current to be "blocked" with subsequent extinguishing of the burner flame. Therefore, make sure these conditions do not exist before replacing the sensor.

If these areas have been checked, one final procedure is to check for proper flame sense current. This procedure requires the use of a signal transducer used in conjunction with a digital meter.

Signal Transducer:

The signal transducer allows current measurements to be read from the D.C. voltage scale using the conversion 1 D.C. volt equals 1 D.C. microamp. The tester allows flame sense current measurements down to .01 MA (microamp).

The transducer is designed to plug directly into a meter as shown. If your meter does not have a connector jack, simply apply the meter probes directly to the transducer's pins. Observe proper polarity. Failure to do so results in negative values being read.

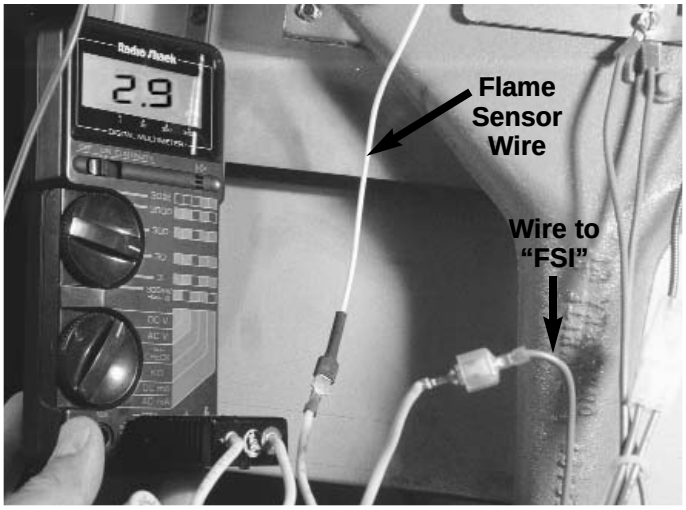


Testing Procedures:

Conduct this test with both access doors closed. Failure to follow this instruction will create disruption of proper sensing, with possible extinguishing of burner flame.

A. Initial Preparation

1. Disconnect the heater from its electrical supply.
2. Set function selector switch on meter to D.C. voltage position.



B. Test Kit Installation

1. Disconnect flame sensor wire from terminal FSI on the ignition control module.
2. Connect the male terminal from the transducer to the female terminal of the flame sensor wire. Connect the female terminal of the transducer to the male terminal at terminal FSI on the control module.
3. Reconnect heater to electrical supply.

C. Flame Sensor Check

1. Start the heater and allow the ignition sequence to proceed until flame is firmly established. Crack open the burner access door slightly to allow just enough of a view. Make sure the flame sensor tip is at midpoint in the burner flame and is not touching any metal on the heater.
2. Note the reading on the meter. A slight fluctuation is normal. Readings will be anywhere from .50 MA (minimum) to 4.5 MA (maximum).
3. If the reading drops below .50 MA, the ignition module will eventually allow burner flame to be extinguished.
   - Shut off gas supply and disconnect heater from its electrical supply.
   - Allow heater to COOL.
   - Replace the flame sensor and retest.

Component Testing

High Limit Switch Tests

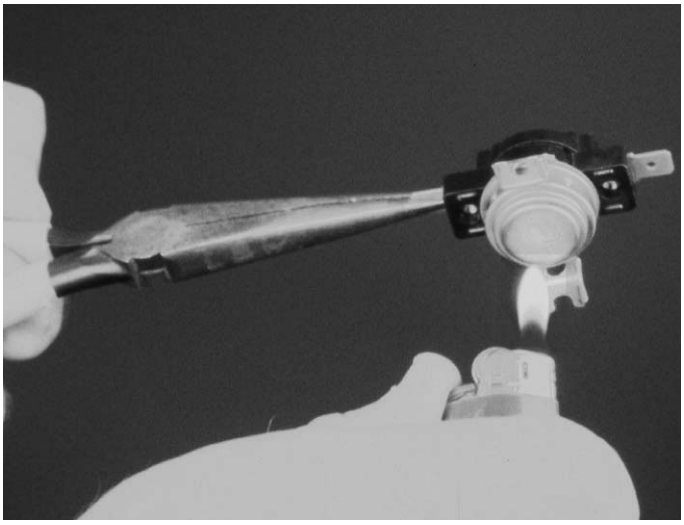
Method of Test:

Disconnect the heater from its electrical supply before conducting this test.

Remove the switch from its location. Hold the switch by one of its legs with a pliers and apply a small flame only to the sensing portion on the back side of the switch. Be careful not to melt the plastic housing of the switch when conducting this test. Within 1 minute, you should hear a "pop" coming from the switch which indicates the electrical contacts have opened.

Let the switch cool down for about 10 - 20 seconds before firmly pressing the reset button on the switch. Check for continuity across the terminals of the switch to make sure the contacts are closed.

Reinstall the switch into the heater and reconnect heater to its electrical supply.



ATTENTION

Model AB200 heaters incorporate a high limit switch with a sensing capillary. To test this switch, run a small flame back and forth along a 6 inch section of the capillary. Within 1 minute the electrical contacts of the switch should open. You may leave the switch in its mounted position to perform the test.

Electrical Connection and Ladder Diagram

The wiring diagrams on the following pages are provided to give the qualified service person information on the interconnection and sequence of operation of the electrical components of various models of L. B. White hot-surface ignition heaters.

On more current models, typical location is the interior of the fan and motor access panel. Earlier models will have the diagram on the burner end panel, or within the "Master Control" panel.

Although the wiring diagrams appear to be the same, be aware there are differences in the color coding of the component interconnecting wiring. Also, the ignition control module of specific models may have different wiring designators.

CAUTION

Refer to the heater's electrical connection diagram when servicing to avoid wiring errors and heater malfunction. Check for proper operation after servicing.

To be sure of what diagram to use, always obtain the heater's model number and design sequence. This information is identified on the heater's dataplate. For earlier design heaters, the design sequence will be shown as the 6th digit of the model number. For heaters manufactured more recently, the dataplate will identify a configuration number. The design sequence is the first digit of the configuration number. Match this information to the models and designs given at the top of each of the following pages within this section.

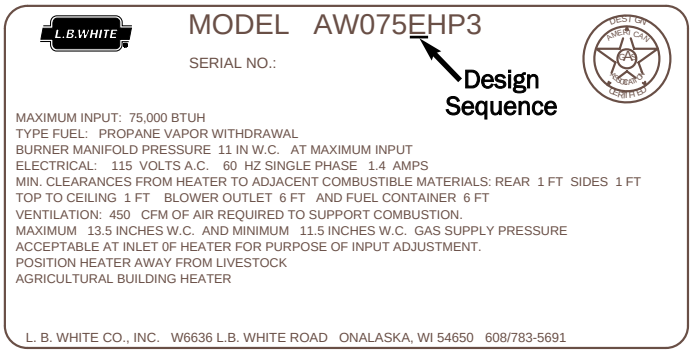
The part number of the wiring diagram varies with model number and design sequence. Contact L.B. White Co., Inc.

ATTENTION

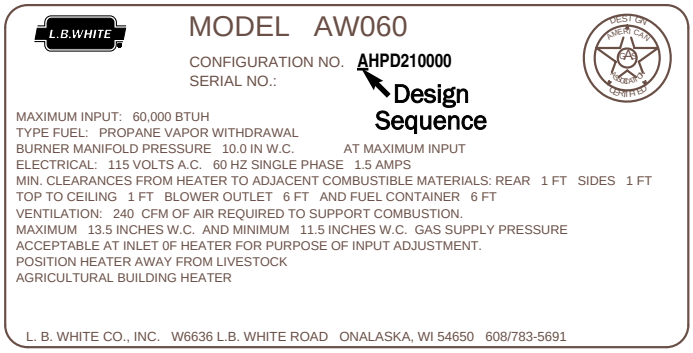
If any of the original wire as supplied with the heater must be replaced, it must be replaced with wiring material having a temperature rating of at least 302° F. (150° C.)

Dataplate Comparison

Without Configuration Number



With Configuration Number

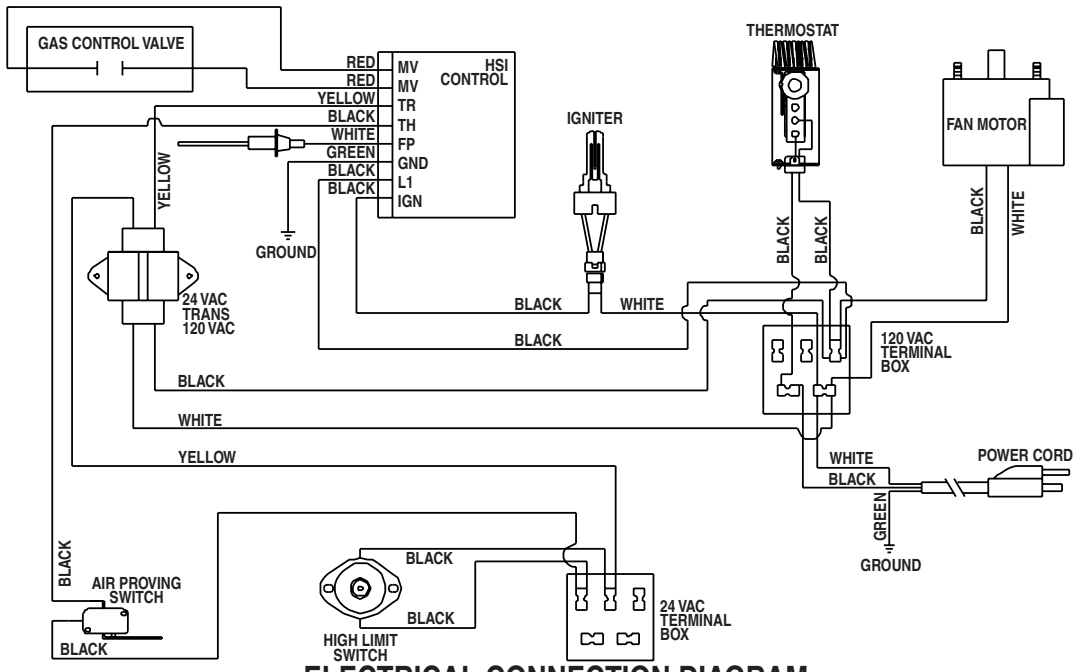


Electrical Connection and Ladder Diagram

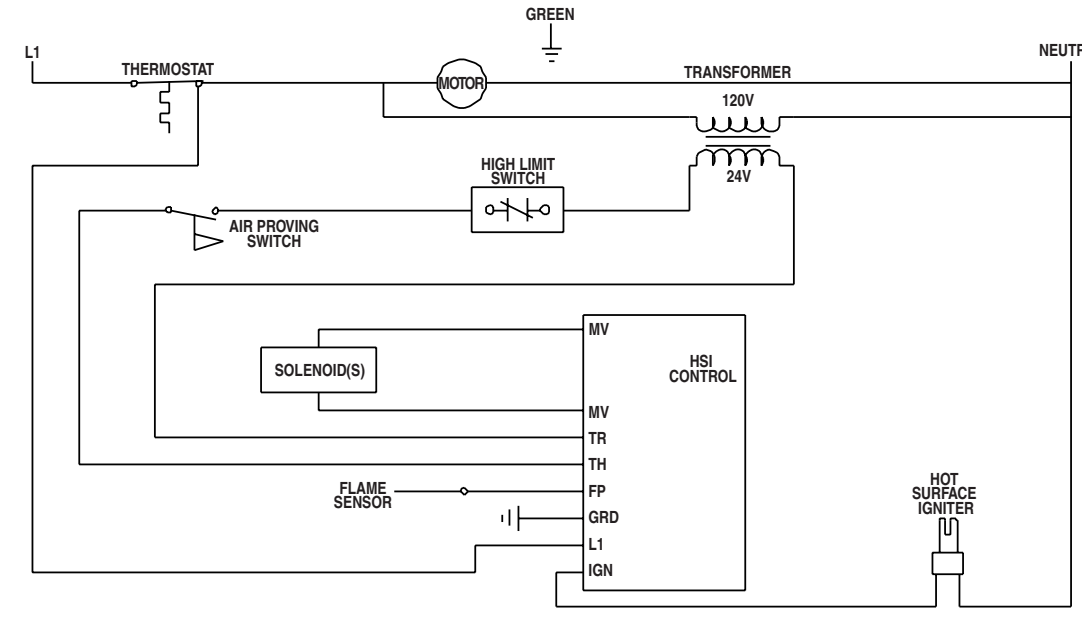
Wiring Diagrams

Used on:	Model	Design Sequence
	284	A
	285	A

WARNING: THIS HEATER MAY START AT ANY TIME



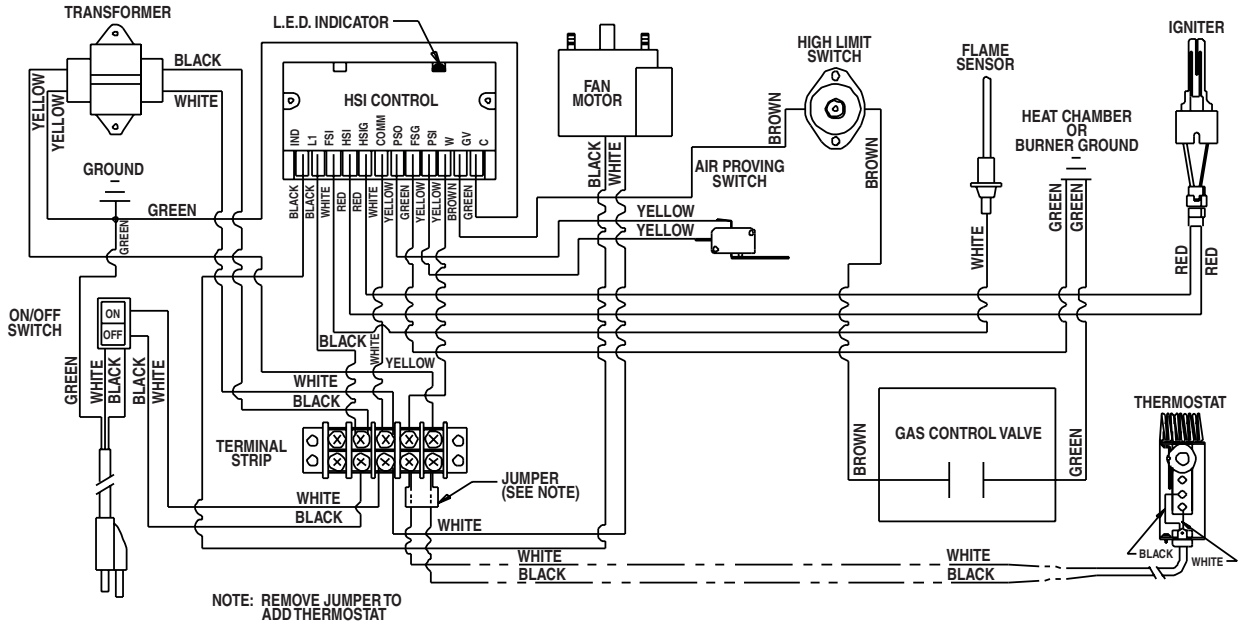
ELECTRICAL CONNECTION DIAGRAM



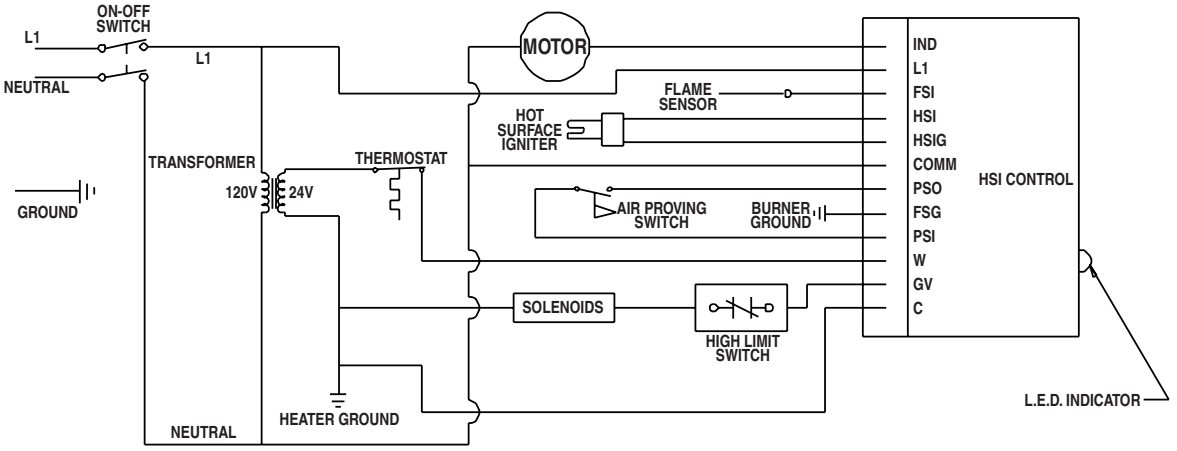
ELECTRICAL LADDER DIAGRAM

Used on:	Model	Design Sequence
	AW075	B, C and D
	AB200	B
	AW215	B
	AW230	C and D

WARNING: THIS HEATER MAY START AT ANY TIME



ELECTRICAL CONNECTION DIAGRAM



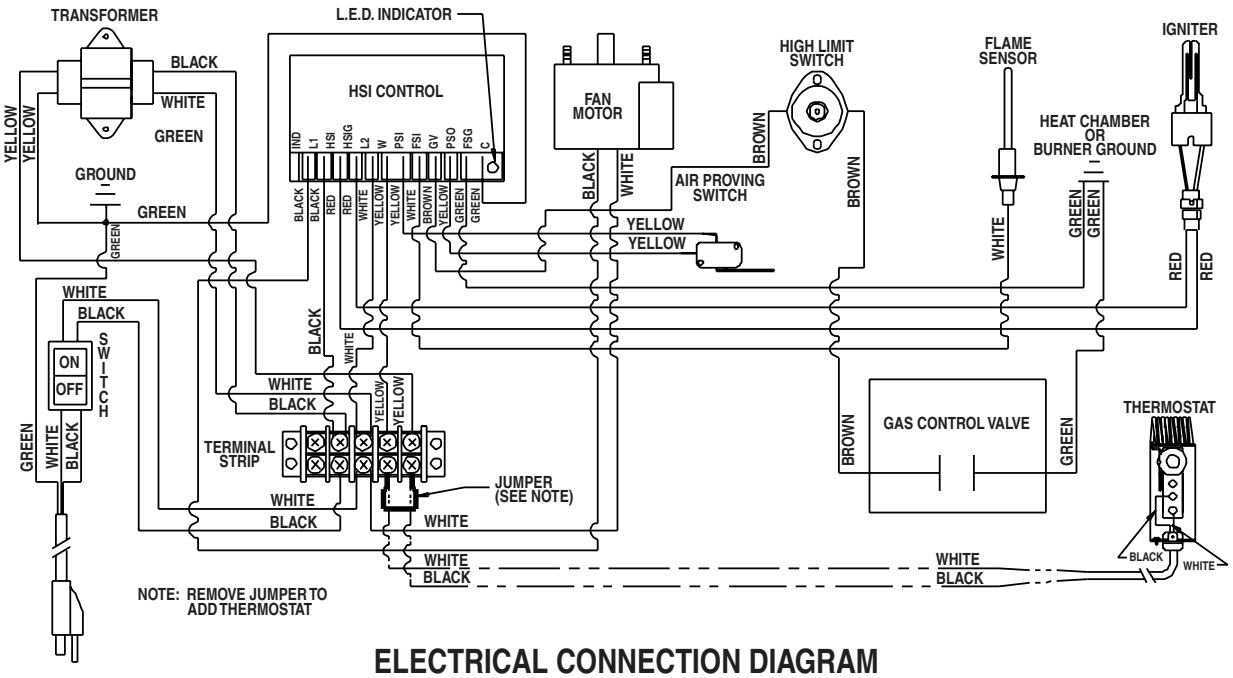
ELECTRICAL LADDER DIAGRAM

Electrical Connection and Ladder Diagram

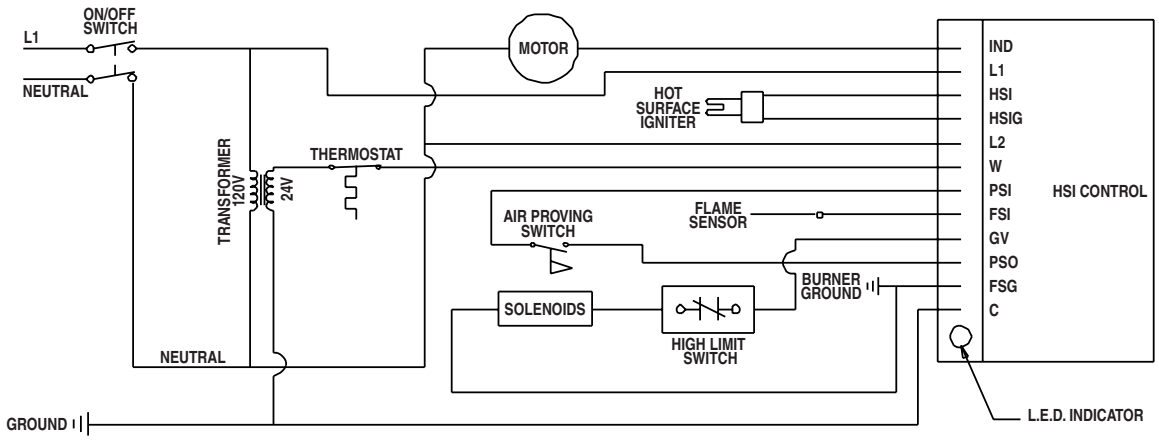
Wiring Diagrams

Used on:	Model	Design Sequence
	AW075	E
	AB200	C
	AW215	C
	AW230	E and F

WARNING: THIS HEATER MAY START AT ANY TIME

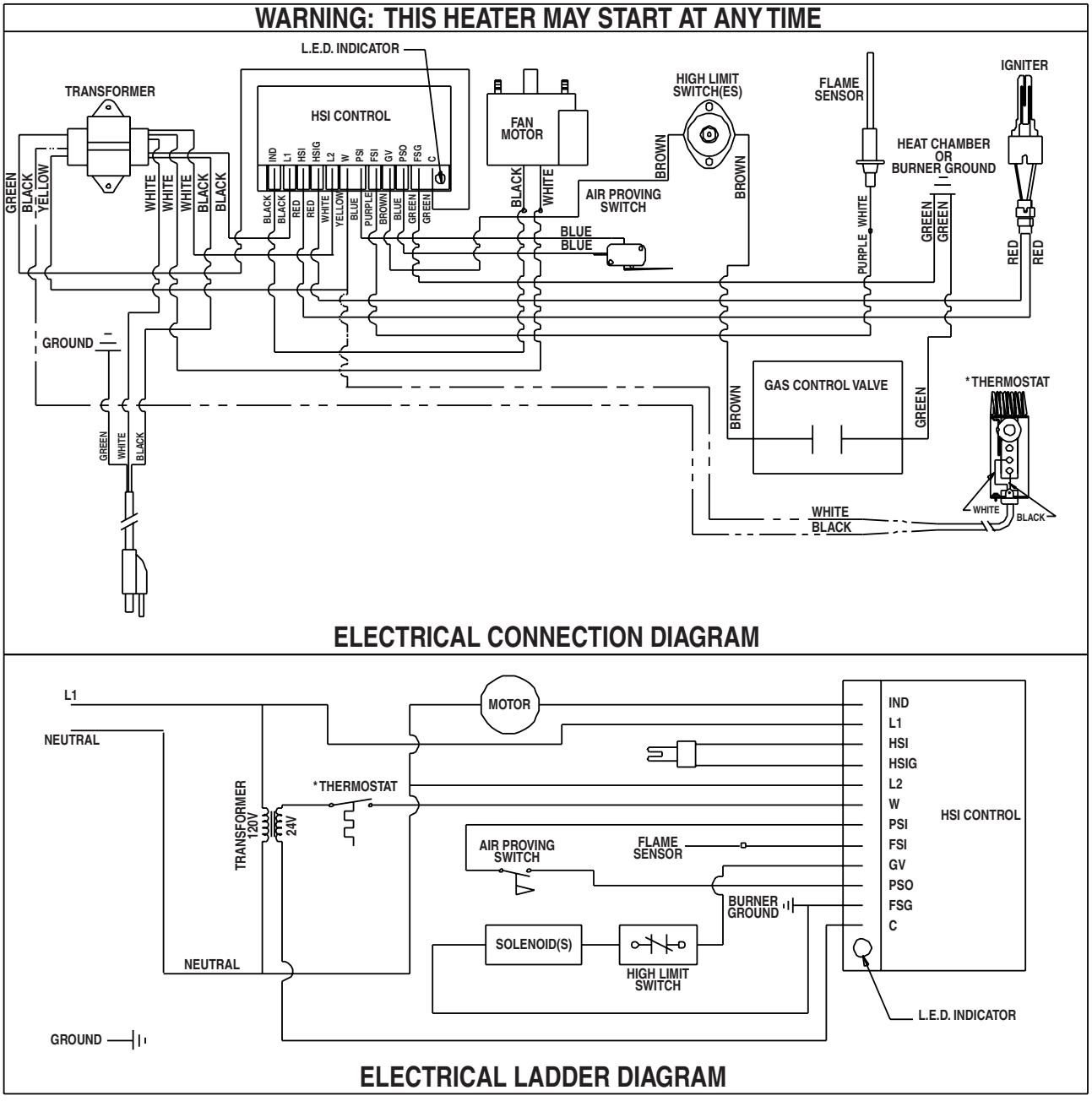


ELECTRICAL CONNECTION DIAGRAM



ELECTRICAL LADDER DIAGRAM

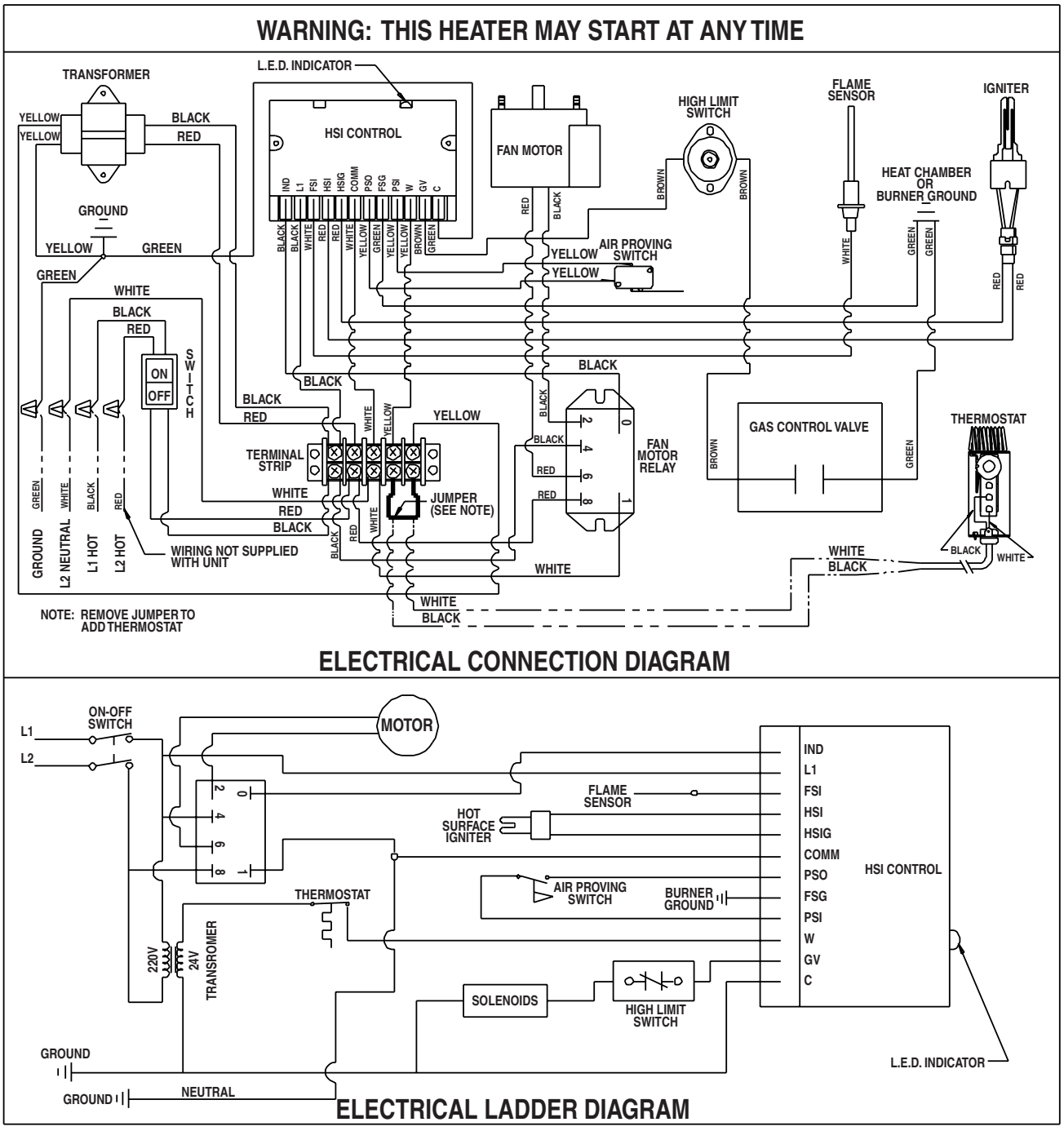
Used on:	Model	Design Sequence
	AW060	A
	AW100	A
	AW250	A



Electrical Connection and Ladder Diagram

Wiring Diagrams

Used on:	Model	Design Sequence
	AW325	A



Used on:

Model	Design Sequence
AW325	B