LENNOX®
Service Literature

UNIT INFORMATION

ICM1 / ICM2
Corp. 0125-L11
Revised 10-2003

Variable Speed Motors

I - Introduction

This manual is meant to be a helpful guide in servicing Lennox residential split system products equipped with a variable speed motor. See figure 1. “V” series units feature an electronically controlled motor manufactured by General Electric. Lennox currently uses the ICM2 with past products using the ICM1. Variable speed motors consist of a control module (controller) and motor. “V” motors can be used in all applications: downflow, upflow and horizontal. The variable speed motor is controlled by an integrated blower control (BDC, BDC2, BDC3, VSP1, VSP2, VSP3 and the Two-Stage Variable Speed SureLight). Products currently equipped with a variable speed motor and control are: CB21/CB21H, CB21V/CBH21V, CB31MV, G25MV, G21V/GSR21V, G32V, GHR32V, G60UHV and G60DFV. CFM tables can be found in the furnace Installation Instructions or the Unit Information (service manual), can be ordered if needed. See table 1 for equipment matchups and literature.

ELECTROSTATIC DISCHARGE (ESD)
Precautions and Procedures

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions during furnace installation and service to protect the furnace’s electronic controls. Precautions will help to avoid control exposure to electrostatic discharge by putting the furnace, the control and the technician at the same electrostatic potential. Neutralize electrostatic charge by touching hand and all tools on an unpainted unit surface, such as the gas valve or blower deck, before performing any service procedure.

⚠ CAUTION

The IMC1 / ICM2 may be energized during some service procedures. Care must be taken not to wear loose clothing and to keep hands away from wheel.

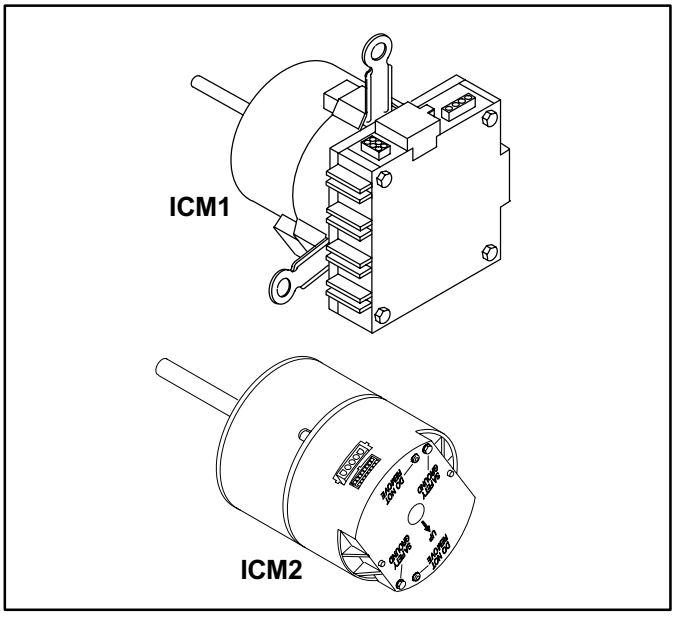

FIGURE 1

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II - Equipment Matchups

TABLE 1

MODEL	MOTOR	BLOWER CONTROL BOARD	UNIT INFORMATION
CB21 / CB21H	ICM1	BDC	Corp. 9020-L8
CB21V / CB21HV	ICM2	BDC2	Corp. 9433-L11
CB31MV	ICM2	BDC3	Corp. 9618-L9
CBX32MV	ICM2	BDC3	Corp. 0206-L3
G25MV	ICM2	VSP2-1	Corp 9505-L2
G21V -1 to -3 GSR21V -1 to -9	ICM1	VSP1	Corp. 9815-L9
G21V -4 to -8 GSR21V -10 to -15	ICM2	VSP2-1	Corp. 9815-L9
G32V-1 / -3	ICM2	VSP2-1	Corp. 9816-L10
G32V-4	ICM2	VSP3-1	Corp. 9816-L10
G32V-5	ICM2	Two Stage Variable Speed SureLight	Corp 9816-L10
GHR32V-1 / -3	ICM2	VSP2-1	Corp 0001-L2
GHR32V-4	ICM2	VSP3-1	Corp 0001-L2
GHR32V-5	ICM2	Two Stage Variable Speed SureLight	Corp 0001-L2
G60UHV	ICM2	Two Stage Variable Speed SureLight	Corp. 0124-L11
G60DFV	ICM2	Two Stage Variable Speed SureLight	Corp. 0211-L3
G61MPV	ICM2	Two Stage Variable Speed SureLight	Corp. 0310-L7

III - Motor

The ICM2 and ICM1 motor is a three-phase, electronically controlled d.c. brushless motor (controller converts single phase a.c. to three phase d.c.), with a permanent-magnet-type rotor . Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors. The motors consist of a control module and motor (figure 2). The ICM2 control module can be replaced separately from the motor if necessary. However, if the motor fails the motor/module assembly must be replaced. Internal components are shown in figure3. The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to be turned on and off in sequence by the controller.

The controller is primarily an a.c. to d.c. converter. Converted d.c. power is used to drive the motor. The controller contains a microprocessor which monitors varying conditions inside the motor (such as motor workload).

The controller uses sensing devices to know what position the rotor is in at any given time. By sensing the position of the rotor and then switching the motor windings on and off in sequence, the rotor shaft turns the blower.

Internal Operation

Each time the controller switches a stator winding (figure3) on and off, it is called a “pulse.” The length of time each pulse stays on is called the “pulse width.” By varying the pulse width (figure 4), the controller varies motor speed (called “pulse-width modulation”). This allows for precise control of motor speed and allows the motor to compensate for varying load conditions as sensed by the controller. In this case, the controller monitors the static workload on the motor and varies motor rpm in order to maintain constant airflow (cfm).

The ICM1 motor is equipped with 11 incremental taps which are driven by the integral controller. The controller is capable of controlling three of the 11 taps.

The VSP2 and VSP3 control board gives the ICM2 several options for cfm for heat or cool call. Figure 18 for example shows four pin selections for High/Cool speed and four pin selections for Heat speed. In addition there is four pin selections for Low speed which can be used for either Heat or Cool.

The motor controller is driven by a blower control board. The blower control board receives its demand (PWM signal or fixed 24 VAC or VDC signal) from optional controls such as the Harmony zone control system, Efficiency Plus Humidity Control (CCB1) or a conventional thermostat.

Motor rpm is continually adjusted internally to maintain constant static pressure against the blower wheel. The controller monitors the static work load on the motor and motor amp-draw to determine the amount of rpm adjustment. Blower rpm may be adjusted any amount in order to maintain a constant cfm. The amount of adjustment is determined by the incremental taps which are used and the amount of motor loading sensed internally. Since the blower constantly adjusts rpm to maintain a specified cfm, motor rpm is not rated. Hence, the terms “blower speed” and “speed tap” in this manual refer to blower cfm regardless of motor rpm.

When Harmony is used, speed taps are overridden and a PWM signal generated by the Harmony controller continuously varies motor speed based upon zone demands.

Initial Power Up

When line voltage is applied to the motor, there will be a large inrush of power lasting less than 1/4 second. This inrush charges a bank of DC filter capacitors inside the controller. If the disconnect switch is bounced when the disconnect is closed, the disconnect contacts may become welded. Try not to bounce the disconnect switch when applying power to the unit.

The DC filter capacitors inside the controller are connected electrically to the speed tap wires. The capacitors take approximately 5 minutes to discharge when the disconnect is opened. For this reason it is necessary to wait at least 5 minutes after turning off power to the unit before attempting to change speed taps.

⚠ DANGER

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to adjust motor speed tap settings. Failure to wait may cause personal injury or death.

Motor Start-Up

At start-up, the motor gently rocks back and forth for a moment. This is normal. During this time the electronic controller is determining the exact position of the rotor. Once the motor begins turning, the controller slowly eases the motor up to speed (this is called “soft-start”). The motor may take as long as 10-15 seconds to reach full speed. If the motor does not reach 200rpm within 13 seconds, the motor shuts down. Then the motor will immediately attempt a restart. The shutdown feature provides protection in case of a frozen bearing or blocked blower wheel. The motor may attempt to start eight times. If the motor does not start after the eighth try, the controller locks out. Reset controller by momentarily turning off power to unit.

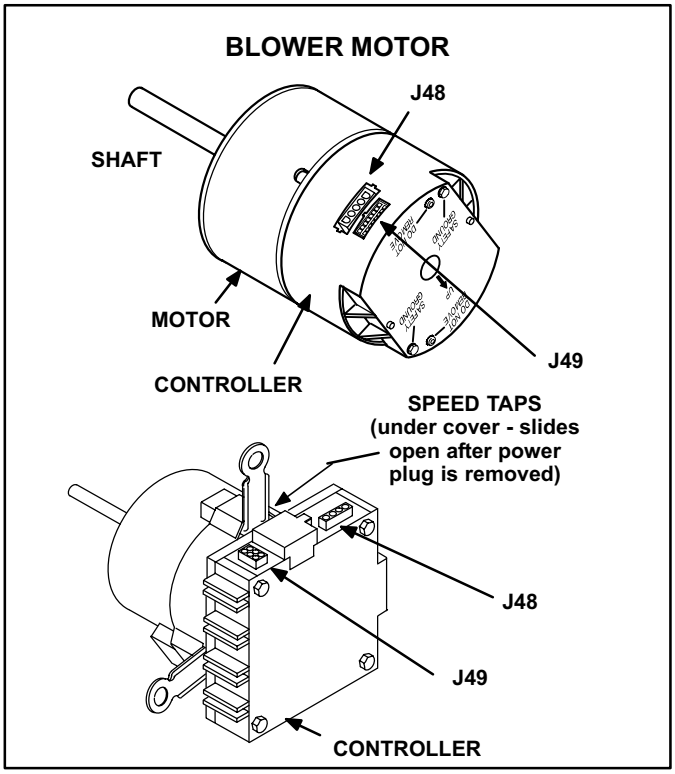


FIGURE2

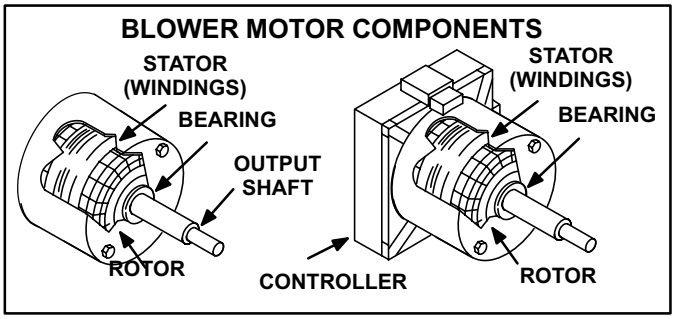


FIGURE 3

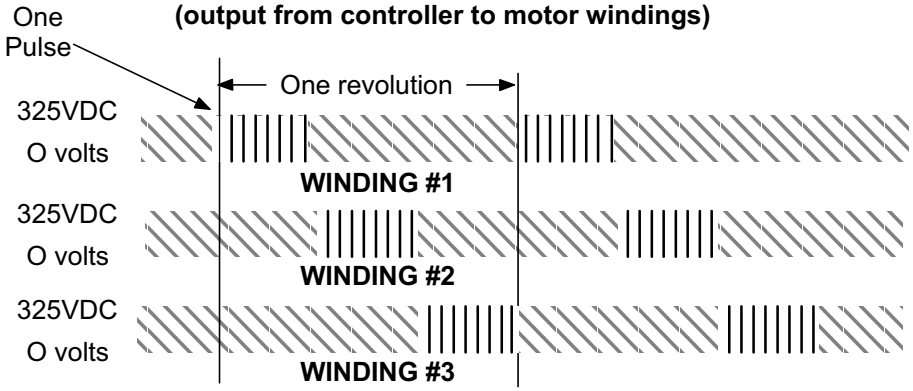
MOTOR SPEED CONTROL WITH D.C. PULSE-WIDTH MODULATION

Motor speed is determined by the size of the electrical pulse sent to the motor windings. The longer the pulse, the faster the motor.

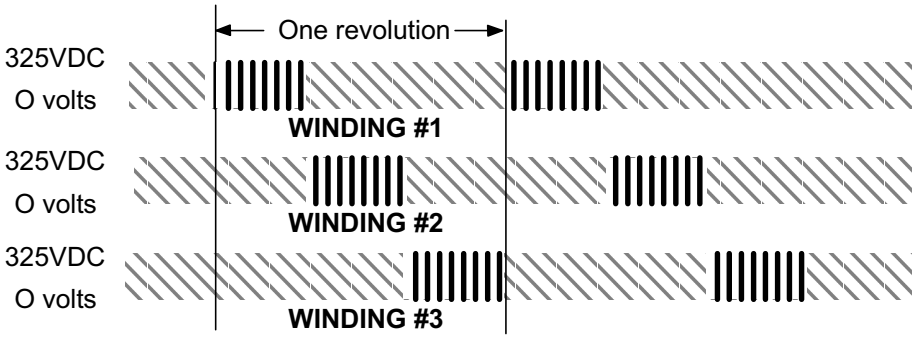
OUTPUT FROM CONTROLLER TO MOTOR WINDINGS	
WINDINGS TURNED OFF	**WINDINGS TURNED ON**
	ON PULSE **OFF PULSE**

The frequency of the pulses to the windings is 20KHz.
DO NOT ATTEMPT TO MEASURE THESE VOLTAGES.

LOW SPEED HEAT/COOL
(output from controller to motor windings)



HIGH SPEED HEAT
(output from controller to motor windings)



HIGH SPEED COOL
(output from controller to motor windings)

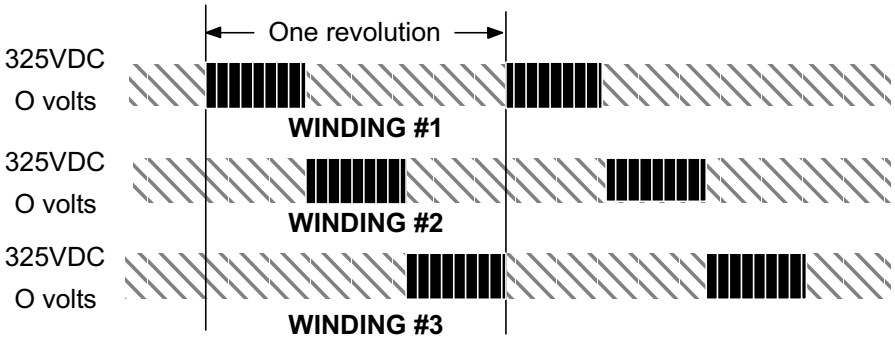


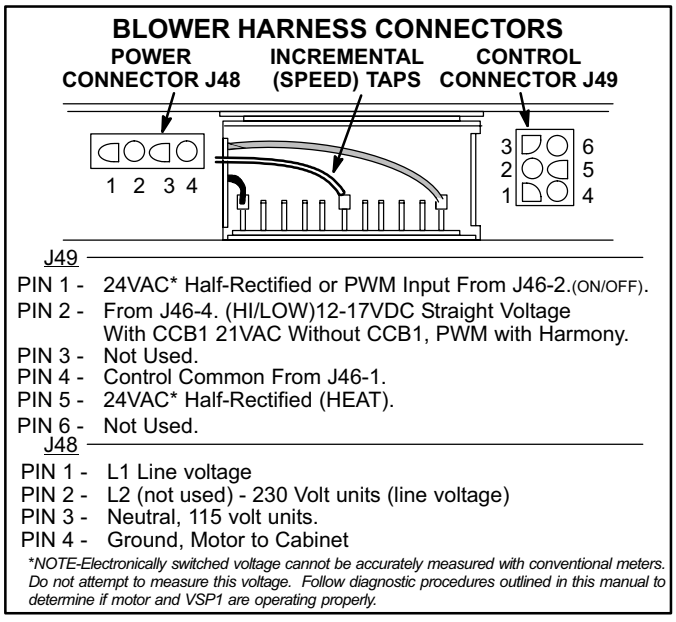
FIGURE 4

A - External Operation ICM1

Figure 5 shows the two quick-connect jacks (J48 and J49) which connect the motor to the unit. Jack J48 is the power plug and jack J49 connects the unit controls to the motor. The power plug must be removed to gain access to the incremental (speed) taps.

Line voltage must be applied to J48 pin 1 in order for the motor to operate. When control voltage is applied to J49 pin 1 (low speed cooling), the motor is energized on the low speed heat/cool tap.

When voltage is applied to J49 pin 2 in addition to pin1 (high speed cooling), the blower is energized on the high speed cooling tap. When voltage is applied to J49 pin 5 (heating demand), the blower is energized on the low speed heat/cool tap. The motor assigns priority to J49 pin 5 so that if a call for cooling and a call for heating are concurrent, heating call overrides and the blower operates on high speed heating tap.



J49

PIN 1 - 24VAC* Half-Rectified or PWM Input From J46-2.(ON/OFF).
PIN 2 - From J46-4. (HI/LOW)12-17VDC Straight Voltage With CCB1 21VAC Without CCB1, PWM with Harmony.
PIN 3 - Not Used.
PIN 4 - Control Common From J46-1.
PIN 5 - 24VAC* Half-Rectified (HEAT).
PIN 6 - Not Used.

J48

PIN 1 - L1 Line voltage
PIN 2 - L2 (not used) - 230 Volt units (line voltage)
PIN 3 - Neutral, 115 volt units.
PIN 4 - Ground, Motor to Cabinet

**NOTE-Electronically switched voltage cannot be accurately measured with conventional meters. Do not attempt to measure this voltage. Follow diagnostic procedures outlined in this manual to determine if motor and VSP1 are operating properly.*

FIGURE 5

⚠ DANGER

Disconnect power from unit and wait at least five minutes to allow capacitors to discharge before attempting to adjust motor speed tap settings. Failure to wait may cause personal injury or death.

Blower Speed Taps

Use the following procedure to change blower speed selection for high, low or heat speed selection:

1 - Disconnect line voltage from unit.
2 - Wait 5 minutes.
3 - Disconnect AC power plug P48 from motor/controller. See figure 5.
4 - Slide tap cover toward AC power plug. See figure 6.
5 - Remove the appropriate speed connector and place it on the proper tap. See figure7.
6 - When all connections are made to proper taps, close tap cover and reconnect AC power plug to motor/controller and reconnect line voltage to unit.

If any of the tap wires are left disconnected, the motor reverts to default speed taps. If the black or red wires are left off, the motor defaults to tap 11. If the white wire is left off, the motor defaults to tap 5.

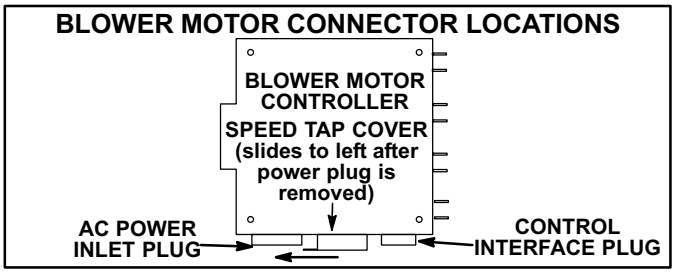
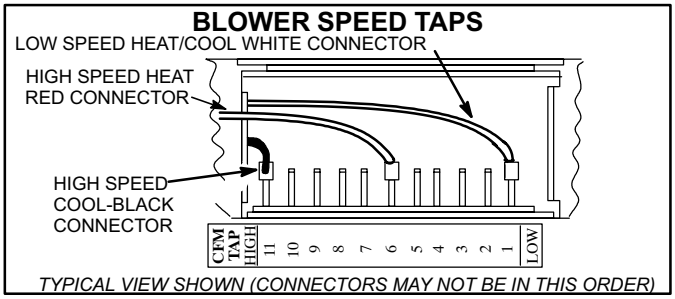


FIGURE 6



TYPICAL VIEW SHOWN (CONNECTORS MAY NOT BE IN THIS ORDER)

FIGURE 7

B - External Operation ICM2

Figure 8 shows the two quick-connect jacks (J48 and J49) which connect the motor to the unit. Jack J48 is the power plug and jack J49 connects the unit controls to the motor. Line voltage must be applied to J48 pin 5 in order for the motor to operate. When using 120VAC pins 1 and 2 must be jumpered. When control voltage is applied to J49 pin 3 and 15 (single stage heating and cooling), the motor is energized on the low speed heat/cool tap.

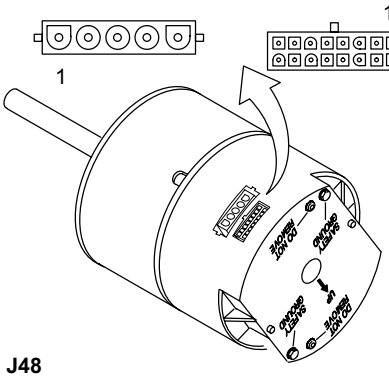
When voltage is applied to J49 pin 2 in addition to pin 3 and 15 (second stage heating), the blower is energized on the high speed heating tap. When voltage is applied to J49 pin 10 in addition to pin 3 and 15 (second stage cooling), the blower is energized on the high speed cooling tap. The motor assigns priority to J49 pin 2 so that if a call for cooling and a call for heating are concurrent, heating call overrides and the blower operates on high speed heating tap.

ICM2 with VSP3 or TwoStage Variable Speed Control

The ICM2 operates slightly different than stated above when matched with the VSP3 or the Two-Stage Variable Speed control board. When control voltage is applied to J49 pin 3 and 15, the motor is energized on continuous fan. When voltage is applied to J49 pin 2 in addition to pin 3 and 15 (first stage heating), the blower is energized on the low speed heating tap. When voltage is applied to J49 pin 13 in addition to pin 3 and 15 (second stage heating), the blower is energized on the high speed heating tap. The motor assigns priority to J49 pin 2 so that if a call for cooling and a call for heating are concurrent, heating call overrides and the blower operates on high speed heating tap.

BLOWER HARNESS CONNECTORS

POWER CONNECTOR J48 | **CONTROL CONNECTOR J49**



J49
PIN 1 - C1
PIN 2 - W / W1
PIN 3 - C2
PIN 4 - Delay
PIN 5 - Cool
PIN 6 - Y1
PIN 7 - Adjust
PIN 8 - 0ut
PIN 9 - 0
PIN 10 - BK / PWM
PIN 11 - Heat
PIN 12 - R
PIN 13 - EM / W2
PIN 14 - Y / Y2
PIN 15 - G
PIN 16 - Out +

J48
PIN 1 - Jumper PIN 1 to PIN2 for 120VAC line input only.
PIN 2 - Jumper PIN 1 to PIN2 for 120VAC line input only.
PIN 3 - Ground
PIN 4 - AC Line
PIN 5 - AC Line

FIGURE 8

Precautions ICM1 and ICM2

If the unit equipped with an electronically controlled blower motor is improperly or inadequately grounded, it may cause television interference (commonly known as RFI or radio frequency interference).

This interference is caused by internal switching frequencies of the motor controller (see figure 9). TV interference may show up as small specks or lines which randomly appear on the TV screen accompanied by pops or clicks in the sound. Before attempting any service, make sure the indoor unit is causing the interference. To check, disconnect power to indoor unit then check TV for continued signs of interference.

TV interference may be stopped by making sure the motor is solidly grounded to the cabinet (metal to metal) and by making sure the cabinet is solidly grounded. If TV interference persists, make sure the television (and all affected RF appliances) are moved away from the unit. Also make sure affected appliances are connected to a separate electrical circuit.

Coil Choke L13

A coil choke is used on some ICM2 motors. The choke is located on the blower housing and is used to supress transient current spikes.

ICM SWITCHING FREQUENCY

The electrical pulses to the windings cycle on and off at a rate of 20,000 cycles per second (20Khz, this is called the switching frequency). The effective d.c. voltage can be varied by changing the pulse width. The switching frequency is necessary in order to vary the speed of the motor. If the motor is not securely grounded to the cabinet and if the cabinet is not securely grounded, the switching frequency may cause television interference.

OUTPUT FROM CONTROLLER TO MOTOR WINDINGS

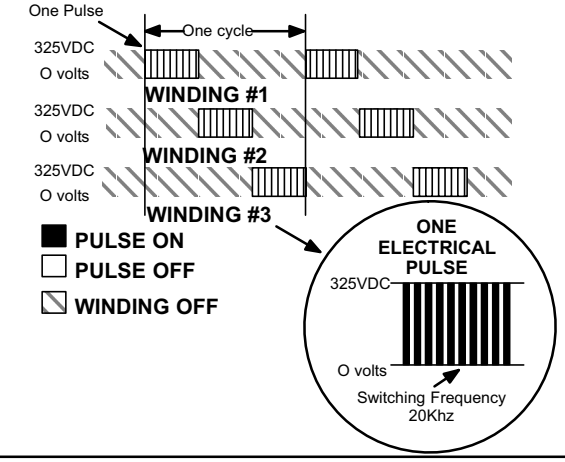


FIGURE 9

IV - Blower Motor Control

A - BDC Blower Control

Blower drive control A15, located in the unit control box, provides an interface between the analog 24VAC indoor thermostat signal and the direct current digital signal to the blower motor. The control is responsible for energizing the blower motor in response to thermostat demand and for converting thermostat demand from 24VAC to 24VAC half-wave rectified (half-rectified, see figure 19). The ECM motor controller (inside the blower motor) is responsible for selecting the blower speed.

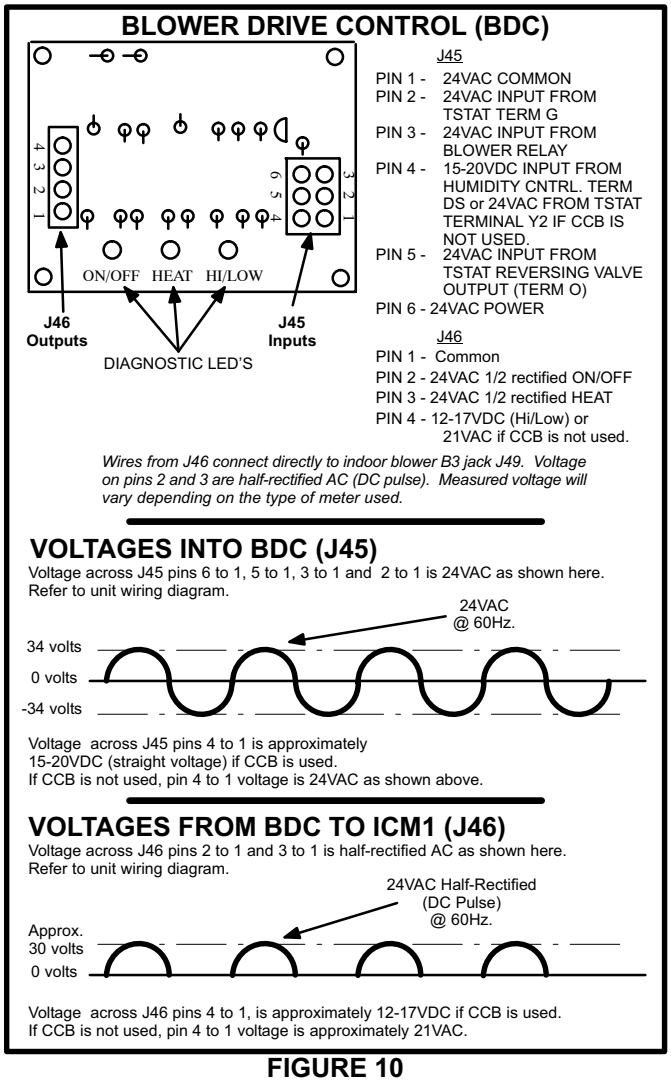


FIGURE 10

Diagnostic LED Lights: Cooling Mode

Three diagnostic LED lights are provided on the control for troubleshooting. The three lights (figure 11) are "ON/OFF," "HI/LOW" and "HEAT." In cooling mode, the ON/OFF LED indicates the blower is operating on low speed. It is lit when 24VAC thermostat demand is supplied to the control (jack-plug JP45 pin 2). The ON/OFF LED and HI/LOW LED both light to indicate the blower is operating on high speed (15-20VDC from CCB1 terminal DS or 24VAC from Y2 if CCB1 is not used). During dehumidification mode, the CCB1 turns off the DS output and the blower operates on low speed.

Diagnostic LED Lights: Heating Mode

The heat light is energized when 24VAC is supplied to the unit, however, when a cooling demand is present, the light is not energized.

During heating mode, the HEAT light is energized at all times (with or without thermostat demand). The HEAT light is tied electrically to J45 pin 5. Pin 5 receives 24VAC power from the indoor thermostat reversing valve output. When the reversing valve output is off (indicating that the unit is in heating mode), the BDC HEAT light is on.

The ON/OFF and HEAT lights are both energized when the blower is operating on heating speed. During heating operation, the blower operates on HEATING speed regardless of compressor speed or electric heat operation. 2nd stage thermostat demand energizes electric heat but does not change blower speed (or BDC lights). If outdoor temperature drops enough to close the speed control thermostat in the outdoor unit, the compressor goes to high speed but the indoor blower speed does not change (nor do the BDC lights).

The ON/OFF LED may be delayed by the action of thermal heat relays in the ECB21. For example, when the unit is in EM HEAT mode, the ON/OFF light energizes after the thermal heat relay closes and de-energizes after the thermal heat relay opens.

If the unit is switched from a heating demand to a 2nd stage cooling demand, all three lights may be energized for a short time. During this period, the blower operates on heating speed. When the thermal heat relay cools and opens, the HEAT light de-energizes and the blower switches to high speed.

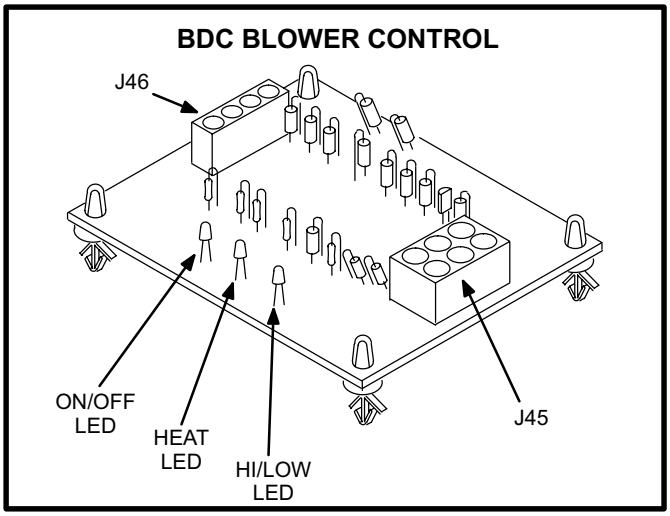


FIGURE 11

B - BDC2 Blower Control

Units equipped with a variable speed motor are capable of maintaining a specified CFM throughout the external static range. A particular CFM can be obtained by positioning four jumpers (Low, High, Heat, and Adjust) on the BDC-2 control board. The Low, High, and Heat jumpers are labeled 1, 2, 3, and 4. This indicates the selected air volume (CFM). The adjust jumper is labeled Test, -, +, and Norm. The - and + pin settings are used to add or subtract a percentage of the CFM selected. The Test jumper is used to operate the motor in the test mode.

Figure 12 shows the BDC-2 control board jumper settings.

Diagnostic LEDs located on the BDC-2 control board are provided to aid in identifying the unit's mode of operation. Certain scenarios will arise depending on the jumper positions. Read through the diagnostic and jumper settings sections before adjusting blower speed. Refer to figure 12 for identification.

Diagnostic LEDs

A - DS3 "ON/OFF"

ON/OFF-DS3 indicates there is a demand for the blower motor to run. When the **ON/OFF** LED-DS3 is lit, a demand is being sent to the motor.

If **ON/OFF** LED-DS3 is on and both **HIGH/LOW** LED-DS1 & **HEAT** LED-DS2 are off, the motor will operate in low speed.

B - DS2 "HEAT"

If **HEAT** LED-DS2 is on, the blower is running in the heat speed according to the "HEAT" jumper setting. If

the **HEAT** LED-DS2 is on at the same time as the **HIGH/LOW** LED-DS1, the blower is running in heat speed according to the "HEAT" jumper setting.

C - DS1 "HI/LOW"

HIGH/LOW LED-DS1 indicates whether the blower is operating in high or low speed. When the light is off, the blower is running in low or heat speed according to the "LOW" or "HEAT" jumper setting. When **HIGH/LOW** LED-DS1 is on and the **HEAT** LED-DS2 is off, the blower is operating in high speed according to the "HIGH" jumper setting.

D - DS4 "CFM"

CFM LED-DS4 indicates the CFM the unit is operating according to the jumper settings. The light flashes once for approximately every 100 CFM. For example, if the unit is operating at 1000 CFM, **CFM** LED-DS4 will flash 10 times. If the CFM is 1150, **CFM** LED-DS4 will flash 11 full times plus one fast or half flash.

At times the light may appear to flicker or glow. This takes place when the control is communicating with the motor between cycles. This is normal operation.

The appropriate speed according to application and CFM need is selected by moving jumper pins.

Jumper Settings

⚠ IMPORTANT

Before changing jumper setting, make sure the motor has completely stopped. Any jumper setting change will not take place while the motor is running.

Jumper settings are factory set. To change jumper positions, gently pull the jumper off the pins and place it on the desired set of pins. The following section outlines the different jumper selections available and conditions associated with each one. Use table 2 as an **example only** for CFM per jumper setting. See CFM tables in units Installation Instructions or Unit Information if needed. Refer to figure 12 for identification.

After the CFM for each application has been determined, the jumper settings must be adjusted to reflect the that value. Use the tables in Installation Instructions to determine which row of CFM volumes most closely matches the desired CFM. Once a specific row has been chosen (+, NORMAL, or -), CFM volumes from other rows cannot be used. Below are the descriptions of each of the jumper selections.

A-"ADJUST"

The **ADJUST** pins allow the motor to run at normal speed, approximately 10% higher, or approximately 10% lower than normal speed.

The TEST pin is available to bypass the BDC-2 control and run the motor at approximately 70% to test that the motor is operational. This is beneficial primarily in troubleshooting. G must be energized for motor to run.

B-"HEAT"

The **HEAT** jumper is used to set the blower speed to obtain the required CFM for HEAT SPEED.

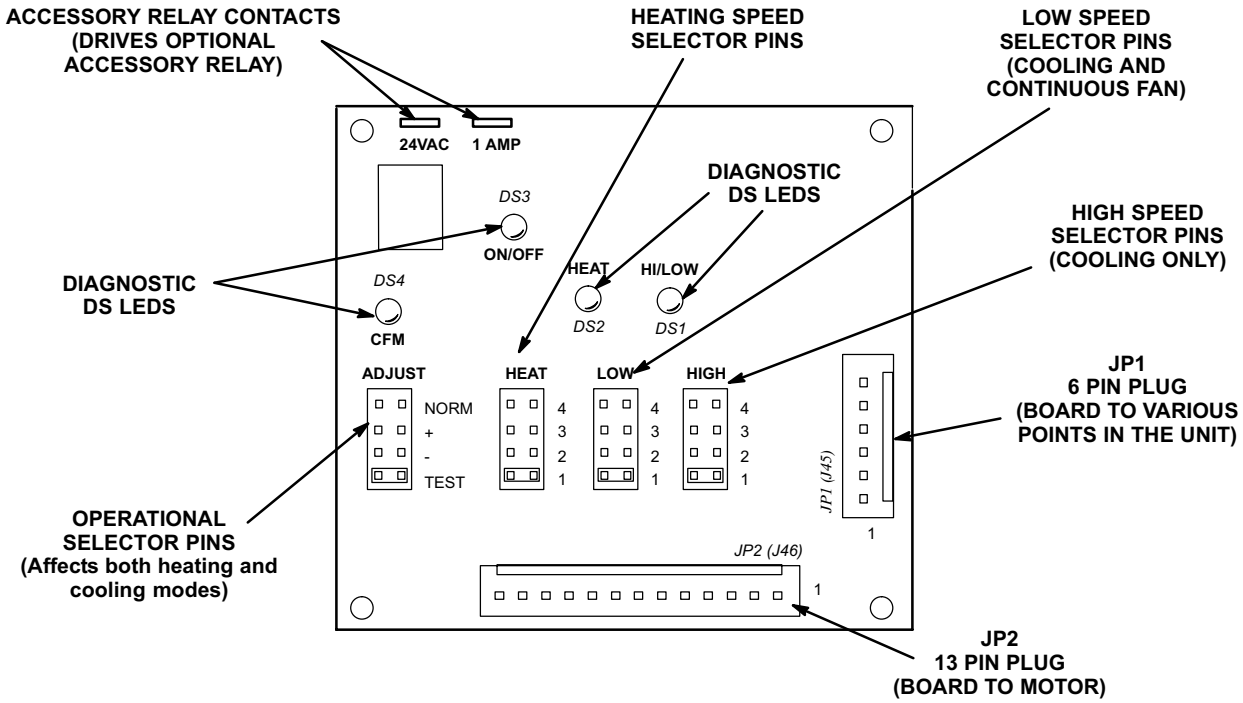
C-"HIGH"

The **HIGH** jumper is used to determine the CFM during cooling speed. These jumper selections are activated when G and DS terminals are energized.

D-"LOW"

The **LOW** jumper is used to determine CFM during low speed cooling. These jumper selections are activated only when G is energized.

BDC-2 VARIABLE SPEED CONTROL BOARD SELECTIONS



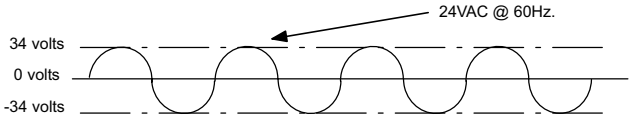
PIN DESIGNATIONS

J45
PIN 1 - C - 24 VAC common.
PIN 2 - G - Input signal from thermostat's fan signal.
PIN 3 - HEAT BLOWER RELAY - Input signal
PIN 4 - DS - Input signal for the blower speed regulation.
PIN 5 - 0 - Input signal from the reversing valve
PIN 6 - R - 24 VAC power to the thermostat.

J46
PIN 1 - Heat - Heat speed input signal to the ICM2 motor.
PIN 2 - C - 24 VAC common.
PIN 3 - C - 24 VAC common.
PIN 4 - High Tap - High Speed programming input.
PIN 5 - Low Tap - Low speed programming input.
PIN 6 - On / Off - On / off output signal to the ICM2 motor.
PIN 7 - Adjust Tap - ICM2 mode selection.
PIN 8 - Hi / Low - Speed regulate input signal to the ICM2 motor.
PIN 9 - Hi / Low - Speed regulate input signal to the ICM2 motor.
PIN 10 - Ref. V - ICM2 reference voltage.
PIN 11 - Heat Tap - Heating blower speed programming.
PIN 12 - C - 24 VAC common.
PIN 13 - cfm - Motor speed diagnostic signal.

VOLTAGES INTO BDC-2

Voltage across J45 pins 6 to 1 is 24VAC constant as shown here.
Pin 1 to all other pins will be either 24VAC or 0VAC (off).



If Harmony is used pin 4 will be DC.

VOLTAGES FROM BDC-2 TO ELECTRONICALLY CONTROLLED BLOWER MOTOR

The output voltages from BDC-2 to ICM2+ are not always 24AC. In harmany applications high/low (pin 9) is DC. Other outputs could be half-rectified.

FIGURE 12

TABLE 2
Example Only

ADJUST JUMPER SETTING	LOW SPEED				HIGH (COOL) SPEED				HEAT SPEED			
	BDC-2 JUMPER POSITION				BDC-2 JUMPER POSITION				BDC-2 JUMPER POSITION			
	1	2	3	4	1	2	3	4	1	2	3	4
+	850	950	1060	1150	1150	1250	1490	1600	1230	1340	1480	1600
NORM	750	850	950	1025	1025	1125	1325	1425	1125	1225	1325	1425
-	650	730	830	900	900	1000	1190	1260	980	1080	1190	1260

C - BDC3 Blower Control

Units equipped with a variable speed motor are capable of maintaining a specified CFM throughout the external static range. The BDC3 variable speed control board,controls the blower speed and provides diagnostic LEDs. CFM can be obtained by positioning jumpers **(COOL, HEAT** and **ADJUST)** on the BDC3 board. The jumpers are labeled 1, 2, 3 and 4. Each enables a different air volume. Diagnostic LEDs are provided as an aid in identifying the unit's mode of operation. The LEDs are labeled **RUN** and **CFM**. See figure 13.

BLOWER SPEED ADJUSTMENTS

Diagnostic LEDs

"RUN"

RUN indicates there is a demand for the blower motor to run.

"CFM"

CFM LED indicates the CFM the unit is operating according to the jumper settings. The light flashes once for approximately every 100 CFM. For example, if the unit is operating at 1000 CFM, **CFM** LED will flash 10 times. If the CFM is 1150, **CFM** LED will flash 11 full times plus one fast or half flash.

At times the light may appear to flicker or glow. This takes place when the control is communicating with the motor between cycles. This is normal operation.

The appropriate speed according to application and CFM need is selected by moving jumper pins.

Jumper Settings

⚠ IMPORTANT

Before changing jumper setting, make sure the motor has completely stopped. Any jumper setting change will not take place while the motor is running.

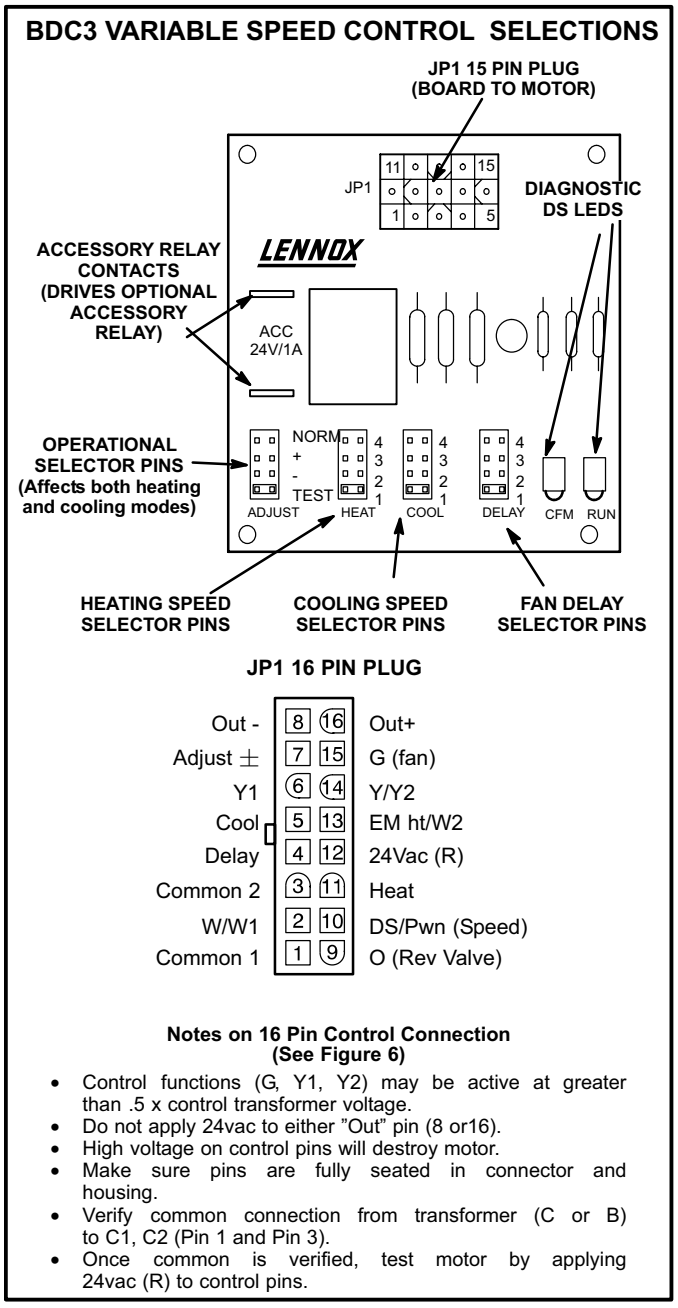
Jumper settings are factory set. To change jumper positions, gently pull the jumper off the pins and place it on the desired set of pins. The following section outlines the different jumper selections available and conditions associated with each one. Use table 3 as an **example only** for CFM per jumper setting. See CFM tables in units Installation Instructions or Unit Information if needed. Refer to figure 13 for identification.

After the CFM for each application has been determined, the jumper settings must be adjusted to maintain the CFM required. Following are the descriptions of each of the jumper selections.

"ADJUST"

The **ADJUST** pins allow the motor to run at normal speed, approximately 10% higher, or approximately 10% lower than normal speed.

The TEST pin is available to bypass the BDC3 control and run the motor at approximately 70% to test that the motor is operational. This is beneficial primarily in troubleshooting. G must be energized for motor to run.



Notes on 16 Pin Control Connection (See Figure 6)

- Control functions (G, Y1, Y2) may be active at greater than .5 x control transformer voltage.
- Do not apply 24vac to either "Out" pin (8 or16).
- High voltage on control pins will destroy motor.
- Make sure pins are fully seated in connector and housing.
- Verify common connection from transformer (C or B) to C1, C2 (Pin 1 and Pin 3).
- Once common is verified, test motor by applying 24vac (R) to control pins.

FIGURE 13

"COOL"

The **COOL** jumper is used to determine the CFM during either 1) cooling or 2) heat pump operation without a call for electric heat. These jumper selections are activated for cooling when Y2 and DS terminals in the CB31MV are energized and for heating when Y2 is energized.

For applications with Harmony II® zone control, the blower CFM volume is determined by the Harmony II control center. This speed is not adjustable.

With the thermostat set for "Continuous Fan" and without a call for heating or cooling, the CB31MV will provided 50% of the **COOL** CFM selected.

*NOTE: For two speed heat pumps, blower will operate at 60% or 65% of **COOL** selection. For single speed heat pumps blower will operate at 100% of **COOL** selection until supplemental electric heat is demanded. At that time, the blower will operate at the **HEAT** speed selected. This arrangement provides for warmer supply air during heat pump operation only.*

"HEAT"

The **HEAT** jumper is used to determine CFM during a W1 demand for electric heat operation. These jumper selections are activated when W1 is energized with or without a Y1 demand for heat pump compressor.

"DELAY"

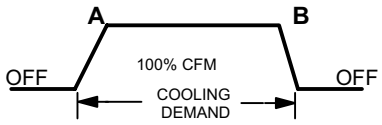
The **DELAY** jumper is used to set the specific motor fan mode of operation during cooling. Depending on the application, one of four fan options may be chosen by moving the jumper pins to the appropriate set of pins. Options 1, 2, 3, or 4 will have an increased dehumidification effect on the system. Option 1 will have the least effect and option 4 will have the greatest effect.

NOTE - For HARMONY II and/or CCB1 applications, the delay jumper must be set to position 1.

DELAY OPTIONS

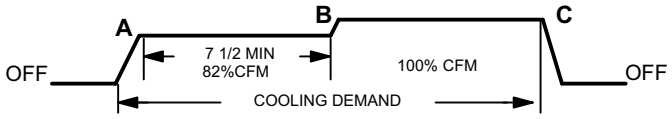
#1 PIN JUMPERED

A-Motor runs at 100% until demand is satisfied.
B- Once demand is met, motor ramps down to off.



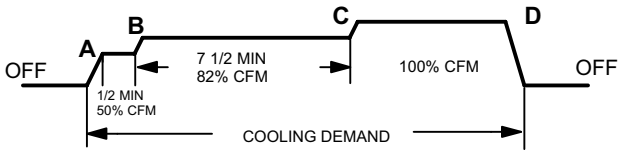
#2 PIN JUMPERED

A-Motor runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes,
B-motor runs at 100% until demand is satisfied.
C- Once demand is met, motor ramps down to off.



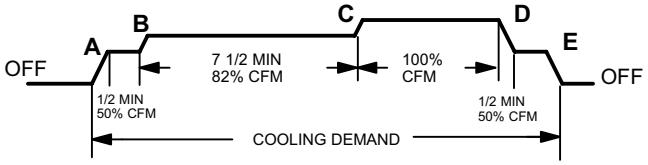
#3 PIN JUMPERED

A-Motor runs at 50% for 1/2 minute. **B-**Motor then runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes. **C-**Motor runs at 100% until demand is satisfied. **D-** Once demand is met, motor ramps down to off.



#4 PIN JUMPERED

A-Motor runs at 50% for 1/2 minute. **B-**Motor then runs at 82% for approximately 7-1/2 minutes. If demand has not been satisfied after 7-1/2 minutes. **C-**Motor runs at 100% until demand is satisfied. **D-** Once demand is met, motor runs at 50% for 1/2 minute then **E**- Motor ramps down to off.



ICM2 CHECK

Kit #70J11 can be used to check the ICM2. The kit is available at the Lennox parts center. If not using the kit, follow the procedure below. These settings and jumper placements will bypass the BDC3 control board and confirm correct ICM2 operation.

60/65% of Cool speed

- Disconnect power to the unit.
- Change delay pin setting on the BDC3 board to #1
- Remove wires from terminal strips in control box.
- Install jumpers between ”R” and ”Y1” and ”R and ”G”
- Turn on power to unit. Blower should operate on 60/65% of cool speed.
- When check is complete disconnect power and replace delay setting to original position.

Cool speed

- Disconnect power to unit.
- Change delay pin setting on the BDC3 board to #1
- Remove wires from terminal strips in control box.
- Install jumpers between ”R” and ”Y1”, ”R” and ”Y2”,”R” and ”DS”and ”R” and ”G”.
- Turn on power to unit. Blower should operate on cool speed.
- When check is complete disconnect power and replace delay setting to original position.

Heat Speed

- Disconnect power to the unit.
- Change delay pin setting on the BDC3 board to #1
- Remove wires from terminal strips in control box.
- Install jumper between ”R” and ”W1”.
- Turn on power to unit. Blower should operate on heat speed.
- When check is complete disconnect power and replace delay setting to original position.

TABLE 3
Example Only

“ADJUST” Jumper Setting	BDC3 Jumper Speed Positions															
	“HEAT” Speed								“COOL” Speed*							
	1		2		3		4		1		2		3		4	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
+	1230	580	1335	630	1445	680	1545	730	1090	515	1225	580	1380	650	1545	730
NORM	1120	530	1215	575	1315	620	1400	660	975	460	1125	530	1275	600	1400	660
—	1010	475	1200	565	1185	560	1265	595	900	425	1000	470	1135	535	1265	595

D - VSP1 Blower Control

The VSP1, a printed circuit board located in the control box, serves four primary functions:

1- Controls blower timings during heating to accommodate the required initial heat-up and cool-down times of the heat exchanger.
2- Senses limit trip condition and turns on the blower.
3- Controls the accessory relay.
4- Interfaces the 24VAC thermostat with the blower.

When operating in heating mode, VSP1 controls the blower and monitors limit and gas valve operation. The VSP1 controls the “fan-on” and “fan-off” timings. Fan-on timings are pre-set and non adjustable. Fan-off timings are adjustable. Fan-on timing is the amount of time the unit operates before the blower is started. This period allows for heat exchanger warm-up. The fan-on timing is pre-set at 45 seconds and is not adjustable.

Fan-Off timings (time that blower operates after heating demand has been satisfied) are determined by the arrangement of a jumper on the VSP1 board. To adjust fan-off timings, gently disconnect jumper and reposition it across pins corresponding with new timing (see figure 15). The fan-off timing is factory set at 270 seconds.

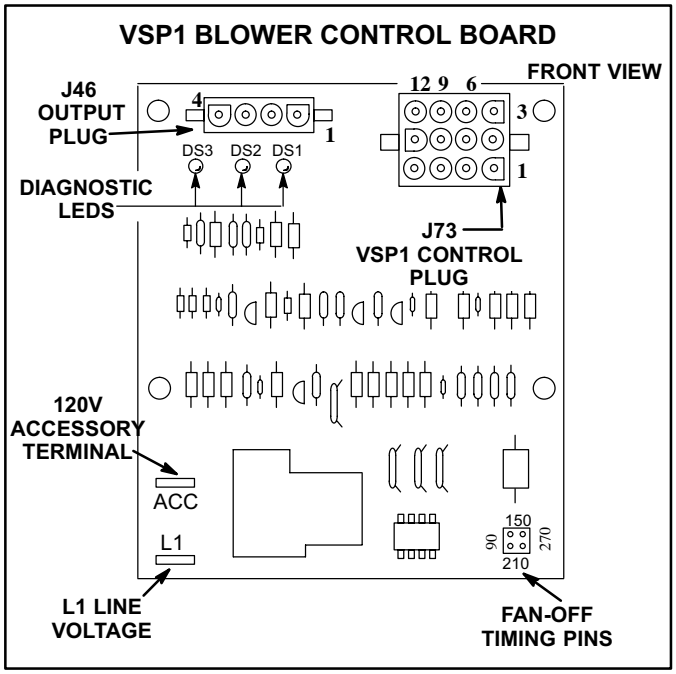


FIGURE 14

⚠ IMPORTANT

If fan-off time is too low, residual heat in heat exchanger may cause primary limit S10 to trip resulting in frequent cycling of blower. If this occurs, adjust blower to longer time setting.

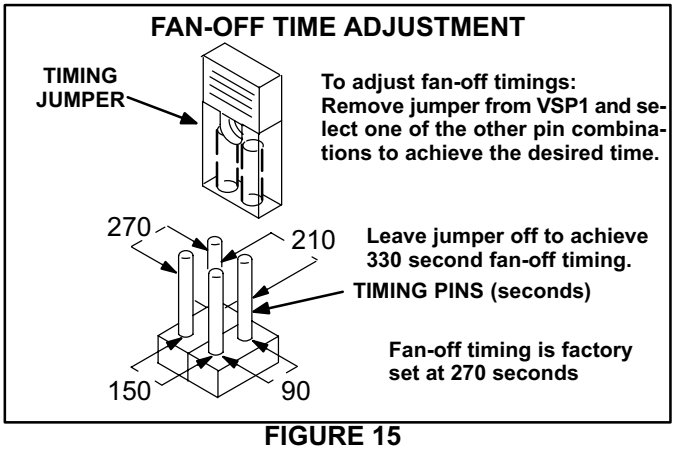


FIGURE 15

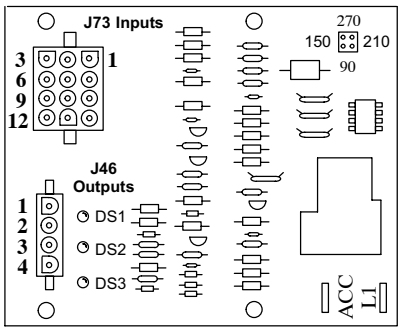
⚠ DANGER

Shock Hazard. VSP1 fan control is connected to line voltage. Disconnect power to unit before changing pin timings. Can cause personal injury or control damage.

The VSP1 includes a 120 VAC accessory terminal. The terminal is wired directly to terminal block TB2 and powers the accessory connection on the terminal block. The terminal is energized when the blower is running. It can be used for any desired accessory equipment such as an electronic air cleaner or humidifier.

VSP1 provides an interface between the 24VAC indoor thermostat signal and the direct current digital signal to the blower motor. The control is responsible for energizing the blower motor in response to thermostat demand and for converting thermostat demand from 24VAC to 24VAC half rectified (DC pulse) see figure 16. The motor controller (inside the blower motor) is responsible for regulating blower speed to maintain the desired CFM.

VSP1 BLOWER CONTROL BOARD



J73

PIN 1 - 24VAC COMMON
PIN 2 - 24VAC INPUT FROM TSTAT TERM G
PIN 3 - 24VAC POWER TO TSTAT
PIN 4 - 12-17VDC INPUT FROM HUMIDITY CNTRL. TERM DS or 24VAC FROM TSTAT TERMINAL Y2 IF CCB OR HARMONY IS NOT USED. PWM SIGNAL FROM HARMONY.
PIN 5 - OUTPUT SIGNAL CONFIRMING HEATING BLOWER SIGNAL
PIN 6 - 24VAC INPUT FROM TSTAT TERM W2
PIN 7 - 24VAC INPUT SIGNAL FROM EXTERNAL LIMIT
PIN 8 - 24VAC POWER FOR VSP1
PIN 9 - 24VAC INPUT FROM GAS VALVE
PIN 10 - 24VAC OUTPUT FROM VSP1 TO IGNITION CONTROL A3
PIN 11 - 24VAC INPUT FROM FAN LIMIT CONTROL
PIN 12 - 24VAC INPUT FROM FAN LIMIT CONTROL

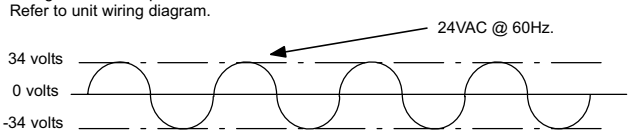
J46

PIN 1 - Common
PIN 2 - 24VAC 1/2 rectified ON/OFF
PIN 3 - 24VAC 1/2 rectified HEAT
PIN 4 - 12-17VDC (Hi/Low) if CCB1 is used, 21VAC if CCB or Harmony is not used. PWM signal if Harmony is used.

Wires from J46 connect directly to indoor blower B3 jack J49. Voltage on pins 2 and 3 are half-rectified AC (DC pulse). Measured voltage will vary depending on the type of meter used.

VOLTAGES INTO VSP1

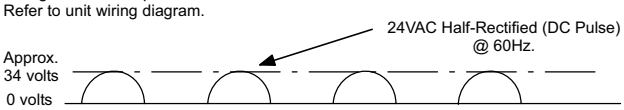
Voltage across J73 pins 8 to 1 and 3 to 1 is 24VAC as shown here.
Refer to unit wiring diagram.



Voltage across J73 pins 4 to 1 is approximately 12-17VDC (straight voltage) if CCB is used. A PWM signal if Harmony is used. If CCB or Harmony is not used, pin 4 to 1 voltage is 21VAC.

VOLTAGES FROM VSP1 TO ELECTRONICALLY CONTROLLED BLOWER MOTOR

Voltage across J46 pins 2 to 1 and 3 to 1 is half-rectified AC as shown here.
Refer to unit wiring diagram.



Voltage across J46 pins 4 to 1, is approximately 12-17VDC if CCB is used. If CCB or Harmony is not used, pin 4 to 1 voltage is approximately 21VAC. A PWM signal if Harmony is used.

FIGURE 16

⚠ IMPORTANT

24 VAC half wave rectified (DC pulse), when measured with a meter, may appear as a lower or higher voltage depending on the make of the meter. Rather than attempting to measure the output voltage of the blower control, see TROUBLESHOOTING FLOW CHART in the TROUBLESHOOTING section of this manual.

Diagnostic LED Lights

Three diagnostic LED lights are provided on the control for troubleshooting. The three lights DS1, DS2 and DS3 (figure 17) are “on/off,” “hi speed heat” and “high speed cool.” In the heating and cooling mode, the on/off LED (DS1) is lit indicating the blower is operating on low speed heat/cool tap. It is lit whenever a 24VAC thermostat demand is supplied to the control (jackplug JP73 pin 2). When the “hi speed heat”(DS2) and the on/off (DS1) LED are both lit the blower is operating on high speed heating tap (12-17VDC from CCB1 terminal DS or 24VAC from Y2 if CCB1 is not used). During dehumidification mode, the CCB1 turns off the DS output and the blower operates on low speed heat/cool tap. When the “high speed cool” (DS3) and the “on/off” (DS1) LED are both lit the blower is operating on high speed cool tap.

If the unit is switched from a heating demand to a 2nd stage cooling demand, all three lights (DS1, DS2 and DS3) may be energized for a short time. During this period, blower operates on high speed heating tap.

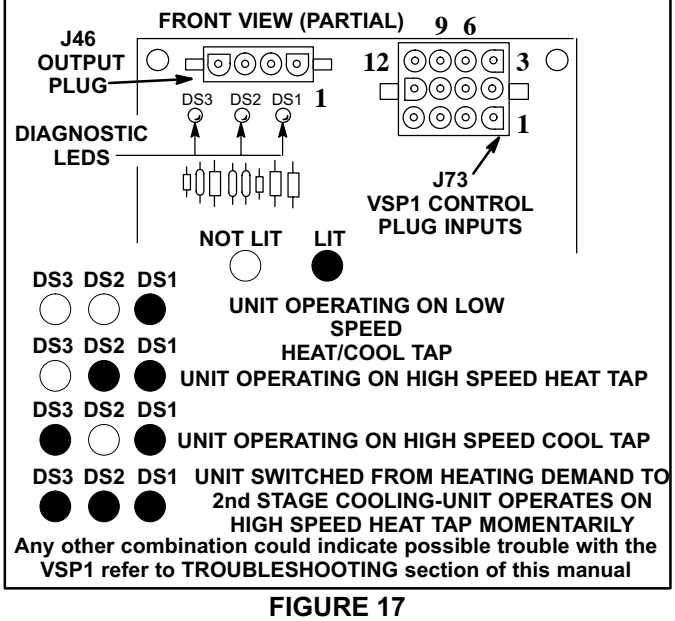


FIGURE 17

E - VSP2-1 Blower Control

⚠ IMPORTANT

If fan-off time is too low, residual heat in heat exchanger may cause primary limit S10 to trip resulting in frequent cycling of blower. If this occurs, adjust blower to longer time setting.

Units equipped with a variable speed motor are capable of maintaining a specified CFM throughout the external static range. The VSP2-1 variable speed control board, controls the blower speed and provides diagnostic LEDs. The control has both a non-adjustable, factory preset “ON” fan timing delay and an adjustable “OFF” fan timing delay (see figure 20).

The VSP2-1 also senses limit trip condition and turns on the blower. When excess heat is sensed in the heat exchanger, the limit switch will open and interrupt the current to the gas valve, while at the same time the VSP2-1 energizes the blower on heating speed. The limit automatically resets when the unit temperature returns to normal and the blower is de - energized.

Diagnostic LEDs located on the VSP2-1 control board are provided to aid in identifying the unit’s mode of operation. Certain scenarios will arise depending on the jumper positions.

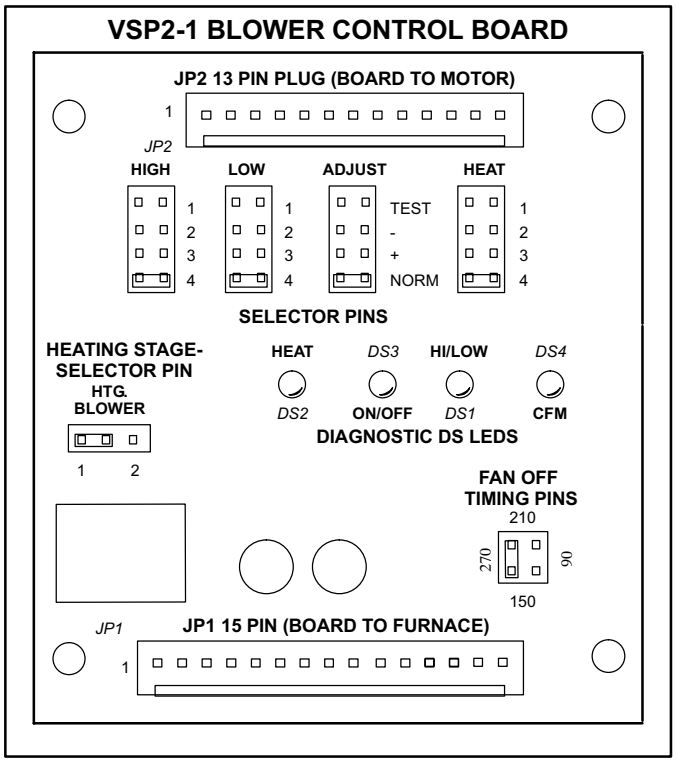
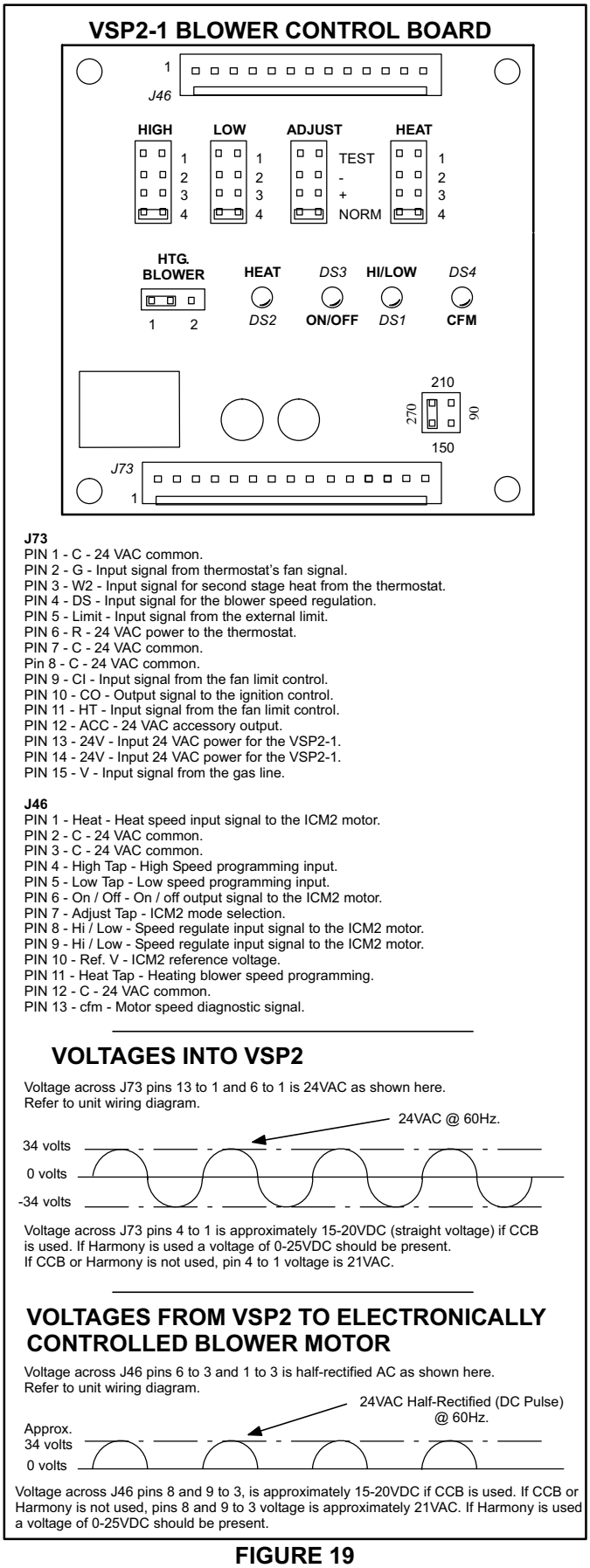


FIGURE 18



J73
PIN 1 - C - 24 VAC common.
PIN 2 - G - Input signal from thermostat’s fan signal.
PIN 3 - W2 - Input signal for second stage heat from the thermostat.
PIN 4 - DS - Input signal for the blower speed regulation.
PIN 5 - Limit - Input signal from the external limit.
PIN 6 - R - 24 VAC power to the thermostat.
PIN 7 - C - 24 VAC common.
Pin 8 - C - 24 VAC common.
PIN 9 - CI - Input signal from the fan limit control.
PIN 10 - CO - Output signal to the ignition control.
PIN 11 - HT - Input signal from the fan limit control.
PIN 12 - ACC - 24 VAC accessory output.
PIN 13 - 24V - Input 24 VAC power for the VSP2-1.
PIN 14 - 24V - Input 24 VAC power for the VSP2-1.
PIN 15 - V - Input signal from the gas line.

J46
PIN 1 - Heat - Heat speed input signal to the ICM2 motor.
PIN 2 - C - 24 VAC common.
PIN 3 - C - 24 VAC common.
PIN 4 - High Tap - High Speed programming input.
PIN 5 - Low Tap - Low speed programming input.
PIN 6 - On / Off - On / off output signal to the ICM2 motor.
PIN 7 - Adjust Tap - ICM2 mode selection.
PIN 8 - Hi / Low - Speed regulate input signal to the ICM2 motor.
PIN 9 - Hi / Low - Speed regulate input signal to the ICM2 motor.
PIN 10 - Ref. V - ICM2 reference voltage.
PIN 11 - Heat Tap - Heating blower speed programming.
PIN 12 - C - 24 VAC common.
PIN 13 - cfm - Motor speed diagnostic signal.

VOLTAGES INTO VSP2

Voltage across J73 pins 13 to 1 and 6 to 1 is 24VAC as shown here.
Refer to unit wiring diagram.

Voltage across J73 pins 4 to 1 is approximately 15-20VDC (straight voltage) if CCB is used. If Harmony is used a voltage of 0-25VDC should be present.
If CCB or Harmony is not used, pin 4 to 1 voltage is 21VAC.

VOLTAGES FROM VSP2 TO ELECTRONICALLY CONTROLLED BLOWER MOTOR

Voltage across J46 pins 6 to 3 and 1 to 3 is half-rectified AC as shown here.
Refer to unit wiring diagram.

Voltage across J46 pins 8 and 9 to 3, is approximately 15-20VDC if CCB is used. If CCB or Harmony is not used, pins 8 and 9 to 3 voltage is approximately 21VAC. If Harmony is used a voltage of 0-25VDC should be present.

FIGURE 19

Diagnostic LED Lights

DS3 "ON/OFF"

ON/OFF-DS3 indicates there is a demand for the blower motor to run. When the **ON/OFF** LED-DS3 is lit, a demand is being sent to the motor. In heating mode only, there is a 45 second fan "ON" delay in energizing **ON/OFF** LED-DS3. The light will not go off until adjustable fan "OFF" delay has expired.

If **ON/OFF** LED-DS3 is on and both **HIGH/LOW** LED-DS1 & **HEAT** LED-DS2 are off, the motor will operate in low speed.

DS2 "HEAT"

If **HEAT** LED-DS2 is on, the blower is running in the heat speed according to the "HEAT" jumper setting. In heating mode only, there is a 45 second delay in energizing **HEAT** LED-DS2. Light will not go off until adjustable fan "OFF" delay has expired.

DS1 "HI/LOW"

HIGH/LOW LED-DS1 indicates whether the blower is operating in high or low speed. When the light is off, the blower is running in low speed according to the "LOW" jumper setting. When **HIGH/LOW** LED-DS1 is on, the blower is operating in high speed according to the "HIGH" jumper setting.

DS4 "CFM"

CFM LED-DS4 indicates the CFM the unit is operating, according to the jumper settings. The light flashes once for approximately every 100 CFM. For example, if the unit is operating at 1000 CFM, **CFM** LED-DS4 will flash 10 times. If the CFM is 2050, **CFM** LED-DS4 will flash 20 full times plus one fast or half flash.

At times the light may appear to flicker or glow. This takes place when the control is communicating with the motor between cycles. This is normal operation.

The appropriate speed according to application and CFM need is selected by moving jumper pins.

NOTE-On Harmony II zoning applications in the heating mode, the highest speed obtainable is the same as the highest cooling speed selection. Also, the heating speed (heat jumper position) is only used when the primary limit has been tripped. In non-zoning applications, refer to the section on the VSP2-1 control.

Jumper Settings

⚠ IMPORTANT

Before changing jumper setting, make sure the motor has completely stopped. Any jumper setting change will not take place while the motor is running.

Jumper positions are factory set. To change jumper positions, gently pull the jumper off the pins and place it on the desired set of pins. The following section outlines the different jumper selections available and conditions associated with each one. Use table 4 as an **example only** for CFM per jumper setting. See CFM tables in units Installation Instructions or Unit Information if needed. Refer to figure 18 for identification.

a-"ADJUST"

The **ADJUST** pins allow the motor to run at normal speed, approximately 10% higher, or approximately 10% lower than normal speed.

The TEST pin is available to bypass the VSP2-1 control and run the motor at approximately 70% to test that the motor is operational. This is beneficial primarily in troubleshooting. G must be energized for motor to run.

b-"HEATING BLOWER"

Place the **HEATING BLOWER** jumper across the first and second pins for single-stage heating operation (position #1). For two-stage operation, place the jumper across the second and third pins (position #2).

The position of the jumper determines which set of speed jumpers is activated. When the **HEATING BLOWER** jumper is across the first and second pins, the **HEAT** jumper selections are activated when W1 is energized.

If the jumper is across the second and third pins, the **LOW** jumper selections are activated when W1 is energized. **HEAT** jumper selections are activated when W2 is energized.

NOTE-In Harmony II zoning applications, HEATING BLOWER jumper must be in position #2.

c-"HEAT"

The **HEAT** jumper is used to set the blower speed to obtain the required CFM for HEAT SPEED.

If a lower heating speed is required, the **LOW** jumper may be used to set the heating speed. This is done by first placing the **LOW** jumper in the desired CFM position and then placing the **HTG. BLOWER** jumper across the second and third pins (regardless of the actual stage). Doing so will activate the low speed jumper setting when W1 is energized.

d-"HIGH"

The **HIGH** jumper is used to determine the CFM during cooling speed. These jumper selections are activated when G and DS terminals are energized.

e-"LOW"

The **LOW** jumper is used to determine CFM during low speed cooling. These jumper selections are activated when G is energized. The **LOW** jumper may also be used for low speed heating.

f-FAN "OFF"

Fan "OFF" timings (time that the blower operates after the heat demand has been satisfied) are determined by the arrangement of a jumper on the VSP2-1 board. See figure20. To adjust fan "OFF" timings, gently disconnect the jumper and reposition it across pins corresponding with the new timing. Fan "OFF" time is factory set at 270 seconds. Fan "ON" time is factory set at 45 seconds and is not adjustable.

⚠ WARNING

Make sure to disconnect power before changing fan "OFF" timings.

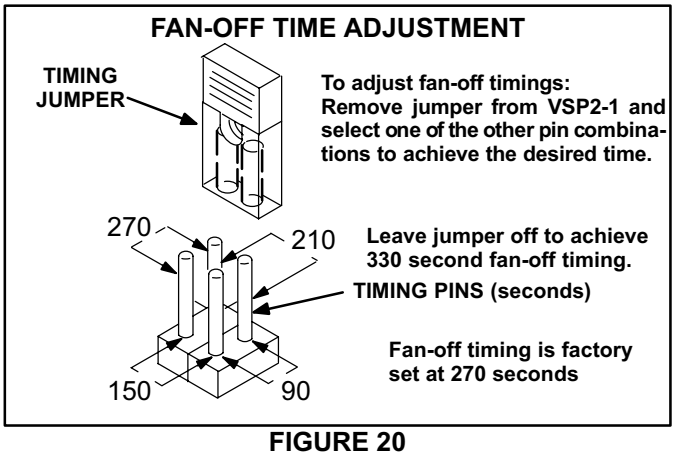


FIGURE 20

NOTE—If fan "OFF" time is too low, residual heat in heat exchanger may cause primary limit S10 to trip resulting in frequent cycling of blower. If this occurs, adjust blower to longer time setting.

Table 5 outlines the operation of the variable speed motor in relation to specific modes of operation. Some information has been repeated from the previous section to provide an example. Refer to each diagnostic LED or jumper settings section for more information.

TABLE 4
Example Only

ADJUST JUMPER SETTING	LOW SPEED				HIGH (COOL) SPEED				HEAT SPEED			
	VSP2-1 JUMPER POSITION				VSP2-1 JUMPER POSITION				VSP2-1 JUMPER POSITION			
	1	2	3	4	1	2	3	4	1	2	3	4
+	540	700	830	1000	1150	1260	1400	1410	1150	1250	1350	1420
NORM	490	630	740	880	1040	1140	1240	1265	1030	1140	1220	1300
-	440	560	670	800	940	1030	1140	1160	920	1020	1100	1190

TABLE 5
VSP2-1 OPERATION

HEATING MODE		COOLING MODE	
UNITS WITH SINGLE-STAGE HEATING	**UNITS WITH TWO-STAGE HEATING**	**UNITS WITH SINGLE-SPEED COMPRESSOR**	**UNITS WITH TWO-SPEED COMPRESSOR**
NON-ZONED APPLICATIONS Using a single-stage thermostat with "one-stage" heating, the **HEAT** LED-DS2 is lit when the thermostat calls for heat. The **ON/OFF** LED-DS3 is lit after 110 seconds (65 seconds pre-purge and 45 seconds fan "ON" time) from the time a call for heat is made. This indicates the blower is operating in heating speed. Using a single-stage thermostat with "W2 TIMED," and W1 calling, the ON/OFF LED-DS3 is lit to indicate the blower is operating on low speed. When the HEAT LED-DS2 is lit, the blower is operating in heating speed, and second-stage (W2) heating is calling.	**NON-ZONED APPLICATIONS** Using a two-stage thermostat with first-stage (W1) calling, the **ON/OFF** LED-DS3 is lit to indicate the blower is operating in low speed. When the **ON/OFF** LED-DS3 and **HEAT** LED-DS2 are lit, the blower is operating in heating speed and second-stage (W2) heating is calling. **HEAT** LED-DS2 is lit with a call for heat from the thermostat. **ON/OFF** LED-DS3 is lit after 110 seconds from the time a call for heat is made.	**NON-ZONED APPLICATIONS** The terminals DS and Y must be jumpered together. With a call for cooling, terminals G, Y and DS on the unit control board are energized from the thermostat. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating on high speed. *NOTE—Y and DS are factory jumpered for single-stage cooling, non-zoned.* *NOTE—For low speed during single-stage cooling remove jumper from Y and Ds.*	**NON-ZONED APPLICATIONS** The **ON/OFF** LED-DS3 is lit to indicate the blower is operating in first stage cooling. This LED is energized on when a 24VAC thermostat demand is supplied to the control (terminal "G" on the control board terminal strip). In second stage, the **ON/OFF** LED-DS3 and **HI/LOW** LED-DS1 are lit to indicate the blower is operating on high speed (24VAC is supplied to the unit terminal strip Y2 from Y2 on the thermostat). *NOTE— Jumper must be moved from Y1 to Y2 In two-speed, non-zoned applications.*
HARMONY ZONED APPLICATIONS The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating. *NOTE-In Harmony II zoning applications, HTG. BLOWER jumper must be in position #2.*	**HARMONY ZONED APPLICATIONS** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating. *NOTE-In Harmony II zoning applications, HTG. BLOWER jumper must be in position #2.*	**HARMONY ZONED APPLICATIONS** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating.	**HARMONY ZONED APPLICATIONS** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating.

NOTE: For zone applications with Harmony, remove the wire from the pin #3 of the J73 terminal on the VSP control board, insulate the end, and secure it to prevent from shorting.

F - VSP3-1 Blower Control Board (A24)

Units equipped with a variable speed motor are capable of maintaining a specified CFM throughout the external static range. The VSP3-1 variable speed control board,controls the blower speed and provides diagnostic LEDs. The control has both a non-adjustable, factory preset “ON” fan timing delay and an adjustable “OFF” fan timing delay (see figure 23).

The VSP3-1 also senses limit trip condition and turns on the blower. When excess heat is sensed in the heat exchanger, the limit switch will open and interrupt the current to the gas valve, while at the same time the VSP3-1 energizes the blower on heating speed. The limit automatically resets when the unit temperature returns to normal and the blower is de-energized.

Diagnostic LEDs located on the VSP3-1 control board are provided to aid in identifying the unit’s mode of operation. Certain scenarios will arise depending on the jumper positions. Refer to figure 21 for identification.

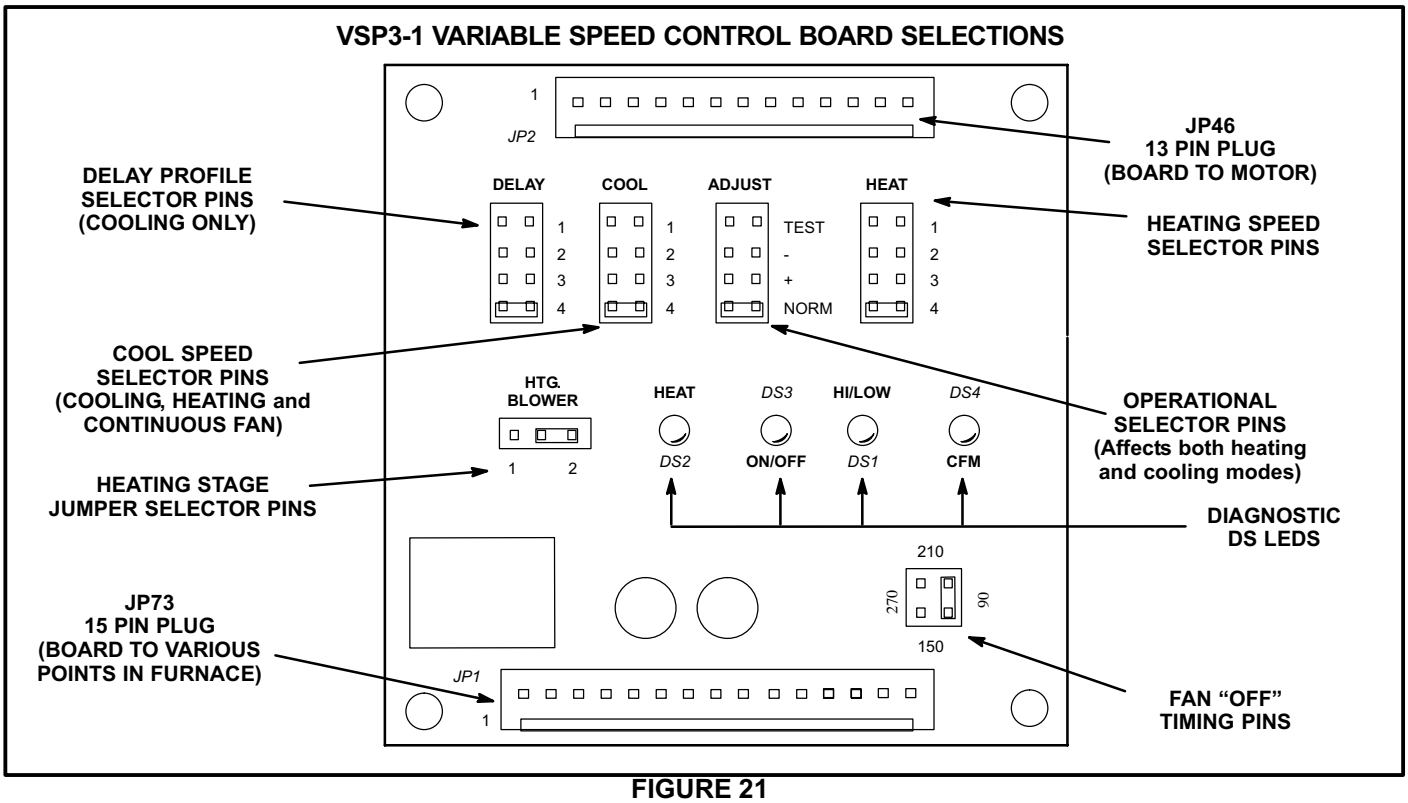
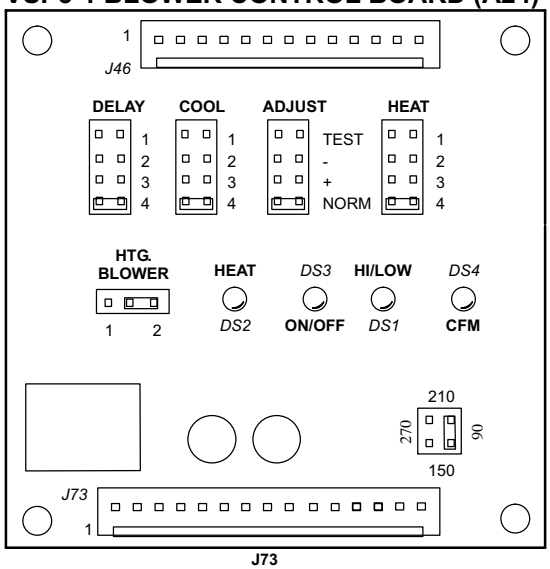


FIGURE 21

VSP3-1 BLOWER CONTROL BOARD (A24)

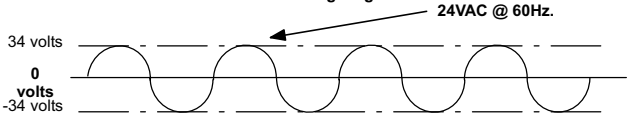


J73
PIN 1 - C - 24 VAC common.
PIN 2 - G - Input signal from thermostat's fan signal.
PIN 3 - W2 - Input signal for second stage heat from the thermostat.
PIN 4 - DS - Input signal for the blower speed regulation.
PIN 5 - Limit - Input signal from the external limit.
PIN 6 - R - 24 VAC power to the thermostat.
PIN 7 - C - 24 VAC common.
Pin 8 - C - 24 VAC common.
PIN 9 - CI - Input signal from the fan limit control.
PIN 10 - CO - Output signal to the burner control.
PIN 11 - HT - Input signal from the fan limit control.
PIN 12 - ACC - 24 VAC accessory output.
PIN 13 - 24V - Input 24 VAC power for the VSP2-1.
PIN 14 - 24V - Input 24 VAC power for the VSP2-1.
PIN 15 - V - Input signal from the gas line.

J46
PIN 1 - Not Used.
PIN 2 - C - 24 VAC common.
PIN 3 - C - 24 VAC common.
PIN 4 - Delay Tap - Delay profile programming input.
PIN 5 - Cooling blower speed programming input.
PIN 6 - On / Off - On / off output signal to the ICM2 motor.
PIN 7 - Adjust Tap - ICM2 mode selection.
PIN 8 - NOT USED
PIN 9 - Hi / Low - Speed regulate input signal to the ICM2 motor with CCB1 and HARMONY only
PIN 10 - Ref. V - ICM2 reference voltage.
PIN 11 - Heat Tap - Heating blower speed programming.
PIN 12 - C - 24 VAC common.
PIN 13 - cfm - Motor speed diagnostic signal.

VOLTAGES INTO VSP3-1

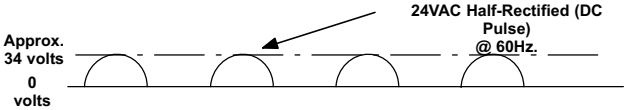
Voltage across J73 pins 13 to 1 and 6 to 1 is 24VAC as shown here. Refer to unit wiring diagram.



Voltage across J73 pins 4 to 1 is approximately 15-20VDC (straight voltage) if CCB is used. If Harmony is used a voltage of 0-25VDC should be present. If CCB or Harmony is not used, pin 4 to 1 voltage is 21VAC.

VOLTAGES FROM VSP3-1 TO ELECTRONICALLY CONTROLLED BLOWER MOTOR

Voltage across J46 pins 6 to 3 and 1 to 3 is half-rectified AC as shown here. Refer to unit wiring diagram.



Voltage across J46 pin 9 to 3 is approximately 15-20VDC if CCB is used. If CCB or Harmony is not used, pin 9 to 3 voltage is approximately 21VAC. If Harmony is used a voltage of 0-25VDC should be present.

FIGURE 22

⚠ IMPORTANT

24 VAC half wave rectified (DC pulse), when measured with a meter, may appear as a lower or higher voltage depending on the make of the meter. Rather than attempting to measure the output voltage of A24, see VSP3 BLOWER CONTROL BOARD TROUBLESHOOTING FLOW CHART in the TROUBLESHOOTING section of this manual.

Diagnostic LED Lights

DS3 ON/OFF

ON/OFF-DS3 indicates there is a demand for the blower motor to run. When the **ON/OFF** LED-DS3 is lit, a demand is being sent to the motor. In heating mode only, there is a 45-second fan "ON" delay in energizing **ON/OFF** LED-DS3. Light will not go off until adjustable fan "OFF" delay has expired.

If **ON/OFF** LED-DS3 is on and both **HIGH/LOW** LED-DS1 & **HEAT** LED-DS2 are off, the motor will operate in low speed (heating).

DS2 HEAT

If **HEAT** LED-DS2 is on, the blower is running in second-stage heat speed according to the "HEAT" jumper setting. In heating mode only, there is a 45 second delay in energizing **HEAT** LED-DS2. Light will not go off until adjustable fan "OFF" delay has expired.

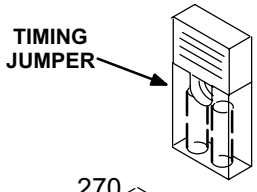
DS1 HI/LOW

HIGH/LOW LED-DS1 indicates the blower is operating in the cooling mode.

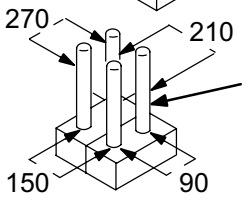
DS4 CFM

CFM LED-DS4 indicates the CFM the blower is providing, according to the jumper settings.

FAN-OFF TIME ADJUSTMENT



To adjust fan-off timings: Remove jumper from VSP3-1 and select one of the other pin combinations to achieve the desired time.



Leave jumper off to achieve 330 second fan-off timing.

TIMING PINS (seconds)

Fan-off timing is factory set at 270 seconds

FIGURE 23

Jumper Settings

⚠ IMPORTANT

Before changing jumper setting, make sure the motor has completely stopped. Any jumper setting change will not take place while the motor is running.

To change jumper positions, gently pull the jumper off the pins and place it on the desired set of pins. The following section outlines the different jumper selections available and conditions associated with each one. Use table 6 as an **example only** for CFM per jumper setting. See CFM tables in units Installation Instructions or Unit Information manual if needed. Refer to figure 21 for identification.

ADJUST

The **ADJUST** pins allow the motor to run at normal speed or approximately 15% lower than normal speed.

The TEST pin is available to bypass the VSP3-1 control and run the motor at approximately 70% to test that the motor is operational. This is beneficial primarily in troubleshooting. G must be energized for motor to run.

HTG. BLOWER

Place the **HTG. BLOWER** jumper across the second and third pins (position #2).

NOTE - In Harmony II zoning applications, HTG. BLOWER jumper must be in position #2.

HEAT

The **HEAT** jumper is used to set the blower speed to obtain the required CFM as outlined in HEAT SPEED section of the blower performance tables. The **HEAT** jumper selections are activated with a call for first-stage heating (W1) and second-stage heating (W2).

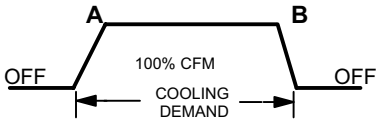
DELAY

The **DELAY** jumper is used to set the specific motor fan mode of operation during cooling. Depending on the application, one of four fan options may be chosen by moving the jumper to the appropriate set of pins.

Options 1, 2, 3, or 4 will have an increased dehumidification effect on the system. Option 1 will have the least effect and option 4 will have the greatest effect.

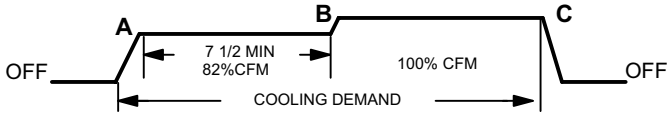
#1 PIN JUMPERED

- **A -** Motor runs at 100% until demand is satisfied.
- **B -** Once demand is met, motor ramps down to off.



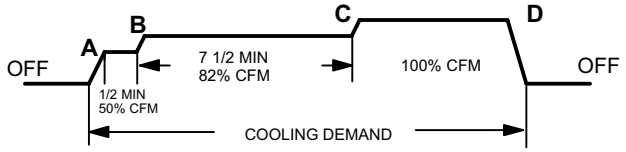
#2 PIN JUMPERED

- **A -** Motor runs at 82% for approximately 7-1/2 minutes.
- **B -** If demand has not been satisfied after 7-1/2 minutes, the motor runs at 100% until demand is satisfied.
- **C -** Once demand is met, motor ramps down to off.



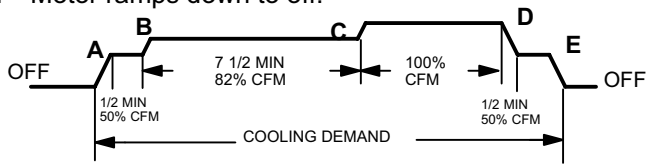
#3 PIN JUMPERED

- **A -** Motor runs at 50% for 1/2 minute.
- **B -** Motor then runs at 82% for approximately 7-1/2 minutes.
- **C -** If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- **D -** Once demand is met, motor ramps down to off.



#4 PIN JUMPERED

- **A -** Motor runs at 50% for 1/2 minute.
- **B -** Motor then runs at 82% for approximately 7-1/2 minutes.
- **C -** If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- **D -** Once demand is met, motor runs at 50% for 1/2 minute.
- **E -** Motor ramps down to off.



COOL

The cool jumper is used to set the blower speed to obtain the required CFM as outlined in the blower performance tables.

VSP Operation

Table 7 outlines the operation of the variable speed motor in relation to specific modes of operation. Some information has been repeated from the previous section to provide an example. Refer to each diagnostic LED or jumper settings section for more information.

TABLE 6
Example Only

"ADJUST" Jumper Positions	VSP Jumper Speed Positions															
	"HEAT"															
	Low Speed								High Speed							
	1		2		3		4		1		2		3		4	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
"**NORM**" (Normal)	875	415	940	445	985	465	1060	500	1090	515	1175	555	1285	605	1330	630
[1] "**—**" (Minus) 15%	750	355	795	375	850	400	915	430	940	445	995	470	1095	515	1180	555
"ADJUST" Jumper Positions	"COOL"															
	Low Speed								High Speed							
	1		2		3		4		1		2		3		4	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
"**NORM**" (Normal)	875	415	940	445	985	465	1060	500	1070	505	1130	535	1270	600	1290	610
[1] "**—**" (Minus) 15%	750	355	795	375	850	400	915	430	900	425	940	445	1055	500	1120	530

TABLE 7
VSP3-1

Heating Mode		Cooling Mode	
Units With Single-Stage Heating	**Units With Two-Stage Heating**	**Units With Single-speed Compressor**	**Units With Two-speed Compressor**
Non-Zoned Applications Using a single-stage thermostat with "one-stage" heating, the **HEAT** LED-DS2 is lit when the thermostat calls for heat. The **ON/OFF** LED-DS3 is lit after 110 seconds (65 seconds prepurge and 45 seconds fan "ON" time) from the time a call for heat is made. This indicates the blower is operating in high speed heat. Using a single-stage thermostat with "W2 TIMED" and W1 calling, the ON/OFF LED-DS3 is lit to indicate the blower is operating on low speed heat. When HEAT LED-DS2 is lit, the blower is operating in high speed heat and second-stage (W2) is calling.	**Non-Zoned Applications** Using a two-stage thermostat with first-stage (W1) calling, the **ON/OFF** LED-DS3 is lit to indicate the blower is operating in low speed heat. When the **ON/OFF** LED-DS3 and **HEAT** LED-DS2 are lit, the blower is operating in high speed heat and second-stage (W2) is calling. **HEAT** LED-DS2 is lit with a call for heat from the thermostat. **ON/OFF** LED-DS3 is after 110 seconds from the time a call for heat is made.	**Non-Zoned Applications** Y1-DS and Y1-Y2 must be jumpered together. With a call for cooling, G, Y1, Y2 and DS on the unit control board are energized from the thermostat. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate a call for cooling. *Note - Y1 to DS and Y1 to Y2 are factory jumpered for single-stage cooling, non-zoned applications.*	**Non-Zoned Applications** Y1-DS must be jumpered together. With a call for single-stage cooling, G, Y1, and DS on the unit control board are energized from the Thermostat. With a call for second-stage cooling, G, Y1, Y2, and DS on the unit control board are energized from the thermostat. In both cases, **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate a call for cooling. *Note - Jumper Y1-Y2 must be removed for units with two-speed compressor.*
Harmony Zoned Applications The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating. *Note - In Harmony II zoning applications, HTG BLOWER jumper must be in position #2.*	**Harmony Zoned Application** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating. *Note - In Harmony II zoning applications, HTG BLOWER jumper must be in position #2.*	**Harmony Zoned Application** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating.	**Harmony Zoned Application** The blower speed is controlled by the PWM (pulse width modulation) signal sent from the control center of the zoning system to the terminal strip's DS terminal. **HI/LOW** LED-DS1 and **ON/OFF** LED-DS3 are lit to indicate the blower is operating.

NOTE - For zone applications with Harmony, remove the wire from pin #2 and pin #13 of the J49 terminal at the motor and the wire from pin #3 of the J73 terminal on the VSP control board, insulate the ends and secure to prevent shorting.

G - Two-Stage Variable Speed SureLight

This control manages ignition timing, heating mode fan off delays and indoor blower speeds based on selections made using the control dip switches and jumpers. The control includes an internal watchguard feature which automatically resets the ignition control when it has been locked out because the burner has failed to light. After one hour of continuous thermostat demand for heat, the watchguard will break and remake thermostat demand to the furnace and automatically reset the control to relight the furnace.

Thermostat Selection Jumper (E20)

This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection jumper, located just below dip switches 1 through 3, must be properly positioned for the particular application. The jumper is factory positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the jumper must be repositioned.

a - *Select "*TWO" for two-stage heating operation controlled by a two-stage heating thermostat (factory setting);

b - *Select "SINGLE*" for two-stage heating operation controlled by a single-stage heating thermostat. This setting provides a timed delay before second-stage heat is initiated.

Dip Switch Settings

Switches 1 and 2 -- Blower Off Delay -- The blower-on delay of 45 seconds is not adjustable. The blower-off delay (time that the blower operates after the heating demand has been satisfied) can be adjusted by moving switches 1 and 2 on the integrated control board. The unit is shipped from the factory with a blower-off delay of 90 seconds. The blower off delay affects comfort and is adjustable to satisfy individual applications. Adjust the blower off delay to achieve a supply air temperature between 90° and 110°F at the exact moment that the blower is de-energized. Longer off delay settings provide lower supply air temperatures; shorter settings provide higher supply air temperatures.The table below provides the blower off timings that will result from different switch settings.

TABLE 8
Blower Off Delay Switch Settings

Blower Off Delay (Seconds)	Switch 1	Switch 2
60	Off	Off
90	Off	On
120	On	Off
180	On	On

Switch 3 -- Second Stage Delay (Used with Single-Stage Thermostat Only) -- This switch is used to determine the second stage on delay when a single-stage thermostat is being used. The switch is factory-set in the ON position, which provides a 10-minute delay before second-stage heat is initiated. If the switch is toggled to the OFF position, it will provide a 15-minute delay before second-stage heat is initiated. This switch is only activated when the thermostat selector jumper is positioned for SINGLE-stage thermostat use.

Switch 4 -- Not used

Switches 5 and 6 -- Cooling Mode Blower Speed -- Switches 5 and 6 are used to select cooling blower motor speed. The unit is shipped from the factory with the dip switches positioned for high speed (4) indoor blower motor operation during the cooling mode. The table below provides the cooling mode blower speeds that will result from different switch settings. Refer to table 13 (example only) for corresponding cfm values.

TABLE 9
Cooling Mode Blower Speeds

Speed	Switch 5	Switch 6
1 - Low	On	On
2 - Medium Low	Off	On
3 - Medium High	On	Off
4 - High (Factory)	Off	Off

Switches 7 and 8 -- Blower Speed Adjustment -- Switches 7 and 8 are used to select blower speed adjustment settings. The unit is shipped from the factory with the dip switches positioned for NORMAL (no) adjustment. The dip switches may be positioned to adjust the blower speed by +10% or -10% to better suit the application. The table below provides blower speed adjustments that will result from different switch settings. Refer to table 13 (example only) for corresponding cfm values.

TABLE 10
Blower Speed Adjustment

Adjustment	Switch 7	Switch 8
+10% (approx.)	On	Off
NORMAL (Factory)	Off	Off
-10% (approx.)	Off	On

Switches 9 and 10 -- Cooling Mode Blower Speed Ramping -- Switches 9 and 10 are used to select cooling mode blower speed ramping options. Blower speed ramping may be used to enhance dehumidification performance. The switches are factory set at option A which has the greatest effect on blower motor performance. The table below provides the cooling mode blower speed ramping options that will result from different switch settings. The cooling mode blower speed ramping options are detailed below.

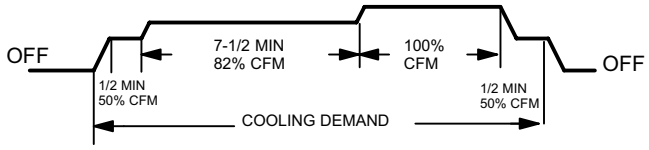
TABLE 11
Cooling Mode Blower Speed Ramping

Ramping Option	Switch 9	Switch 10
A (Factory)	Off	Off
B	On	Off
C	Off	On
D*	On	On

**Only option for CCB1*

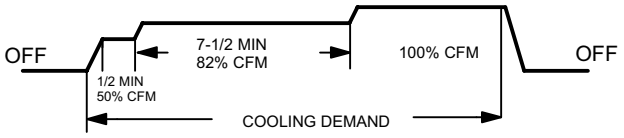
Ramping Option A (Factory Selection)

- Motor runs at 50% for 1/2 minute.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 50% for 1/2 minute.
- Motor ramps down to off.



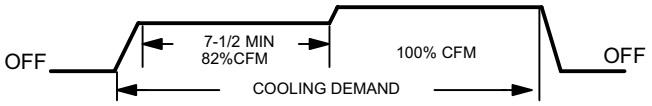
Ramping Option B

- Motor runs at 50% for 1/2 minute.
- Motor then runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to off.



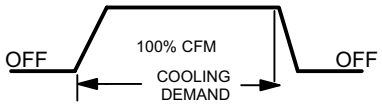
Ramping Option C

- Motor runs at 82% for approximately 7-1/2 minutes.
- If demand has not been satisfied after 7-1/2 minutes, the motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to off.



Ramping Option D

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor ramps down to off.



Switches 11 and 12 -- Heating Mode Blower Speed -- Switches 11 and 12 are used to select heating mode blower motor speed. The unit is shipped from the factory with the dip switches positioned for medium low (2) speed indoor blower motor operation during the heating mode. The table below provides the heating mode blower speeds that will result from different switch settings. Refer to table 13 (example only) for corresponding cfm values.

TABLE 12
Heating Mode Blower Speeds

Speed	Switch 11	Switch 12
1 - Low	On	On
2 - Medium Low (Factory)	Off	On
3 - Medium High	On	Off
4 - High	Off	Off

On-Board Jumper W914

On-board jumper W914, which connects terminals DS and R on the integrated control board, must be cut when the furnace is installed with either the Harmony II zone control board or the CCB1 EfficiencyPlus humidity control.

On-Board Jumper W951

On-board jumper W951, which connects terminals R and O on the integrated control board, must be cut when the furnace is installed in applications which include a heat pump unit and the FM21 FuelMaster control board.

Factory-Installed Jumper Y1 to Y2

A factory-installed jumper from Y1 to Y2 terminals on the integrated control board terminal strip must be removed if two-stage cooling will be used.

Diagnostic LEDs (DS1 and DS2)

Two diagnostic LEDs are located on the two-stage, variable speed integrated control just to the left of the first bank of dip switches. These lights' flashes correspond with diagnostic codes detailed in the units Installation Instructions or Unit Information.

Status LEDs (HEAT, HI/LO, ON/OFF and CFM)

The integrated control includes four LEDs which indicate operating status. The green ON/OFF LED is lit any time the blower is operating. The green CFM LED indicates the blower motor speed. Count the number of blinks between the two-second pauses to determine the CFM. Each blink represents approximately 100 CFM. The yellow HI/LO LED is lit when the W914 (DS to R) jumper **has not** been clipped for CCB1 or Harmony operation. The yellow HEAT LED is lit when the indoor blower is operating at the HEATING speed.

TABLE 13

"ADJUST" Switch Positions	2nd Stage "HEAT" Speed								2nd Stage "COOL" Speed							
	1		2		3		4		1		2		3		4	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
"+" (Plus)	910	430	1055	495	1305	615	1350	635	1045	495	1230	580	1315	620	1420	670
"NORM" (Normal)	830	390	940	445	1165	550	1215	575	945	445	1100	520	1190	560	1300	615
"—" (Minus)	745	350	845	400	1030	485	1070	505	850	400	975	460	1035	485	1130	535
"ADJUST" Switch Positions	**1st Stage "HEAT" Speed**								**1st Stage "COOL" Speed**							
	1		2		3		4		1		2		3		4	
	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s	cfm	L/s
"+" (Plus)	840	395	965	455	1195	565	1235	585	700	330	765	360	820	385	885	420
"NORM" (Normal)	765	360	865	410	1055	495	1105	520	660	310	715	335	750	355	800	380
"—" (Minus)	700	330	785	370	955	450	985	465	595	280	665	315	695	330	730	345

V - Troubleshooting

A - ICM1 Does Not Run

If the motor does not run the problem could be with the electronically controlled blower motor or the VSP1. Check all connectors and wire terminations for good contact. Figure 24 shows the electronically controlled blower motor and VSP1 checkout procedure. The checkout procedure may be used to determine if either of these components must be replaced. The procedure bypasses the VSP1. If the electronically controlled blower motor does not operate properly it must be replaced. If the electronically controlled blower appears to be operating properly, replace the VSP1. For a detailed trouble shooting chart see VSP1 Blower Control Board Troubleshooting Flow Chart.

B - ICM2 Does Not Run

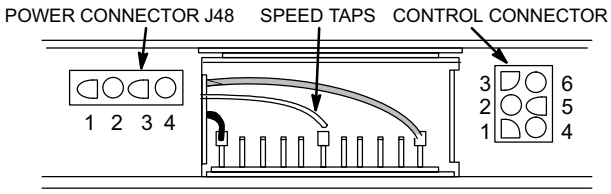
To check-out the ICM2 motor and the VSP blower control board, begin with the ICM blower. Refer to figures 25, 26 and 27 and follow the check-out procedure as outlined. If the blower fails any of these tests, do not attempt to repair the ICM2 blower. There are no field serviceable parts in this component. Replace the motor and repeat the check-out procedure. To verify proper operation of the blower control board check the board as outlined in the troubleshooting flowcharts.

If a power interrupt occurs during a demand cycle and the heat exchanger is still hot, the blower may begin cycling on and off with the gas valve when power is restored. This condition may continue until the demand is satisfied. It is recommended that the lower setting of the modulation control (marked FAN OFF) be reduced by 10°F to 20°F if this problem should occur. This condition will not occur in zoned applications.

C - ICM2 Control Module Replacment

The ICM2 consists of a control module and motor. Both are manufatcured by General Electric (GE). The motor and module should be considered two seperate peices of equipment, assembled to make one piece of equipment. If after following the troubleshooting procedures outlined in section V - and it is determined the problem exist with the control module alone, then replace the module ONLY. The ICM1 module cannot be replaced. The ICM1 must be replace with the later GE ICM2. All replacement control modules look alike; however, each module is factory programmed to be used for a specific motor. It is very important to make sure that you are using the correct replacement module. **USE OF THE WRONG MODULE MAY RESULT IN UNEXPECTED UNIT OPERATION**. Call Lennox Repair Parts, Dallas.

ICM1 CHECK OUT



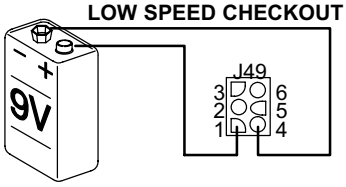
WARNING-DISCONNECT P49 FROM J49 BEFORE BEGINNING THIS CHECKOUT. FAILURE TO DISCONNECT P49 WILL DAMAGE VSP1.

NOTE-Any A.C. voltage source less than 30 volts or any D.C. voltage source less than 20 volts may be used to check out the motor. An ordinary 9 volt battery is recommended. Unit transformer T1 secondary may be used in lieu of a battery. A 9 volt battery will last for about one day of normal operation. If transformer T1 is used, double check all wiring connections before placing unit back in operation.

CHECKOUT PROCEDURE:

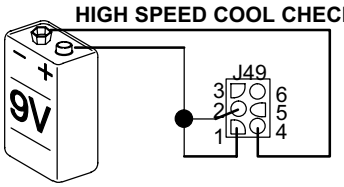
1- Disconnect power to unit.
2- Disconnect P49 from J49.
3- Connect voltage source as shown below.
4- Turn on power to unit. Blower should operate on low speed heat/cool tap.

LOW SPEED CHECKOUT



5- Disconnect power to unit.
6- Connect voltage source as shown below.
7- Turn on power to unit. Blower should operate on high speed cool tap.

HIGH SPEED COOL CHECKOUT



8- Disconnect power to unit.
9- Connect voltage source as shown below.
10-Turn on power to unit. Blower should operate at high speed heat tap.

HIGH SPEED HEATING CHECKOUT

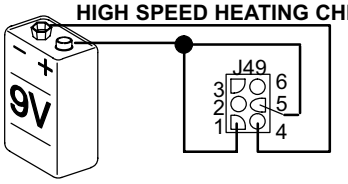
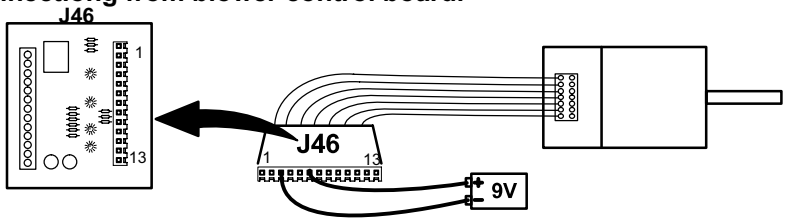


FIGURE 24

ICM2 WITH VSP2 OR BDC-2

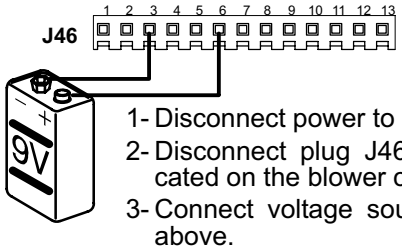
120V to the motor must not be interupted. All connections for check out will be from the voltage source below (battery or 24V) to plug J46, after disconnectiong from blower control board.



CHECK-OUT PROCEDURE USING BATTERY

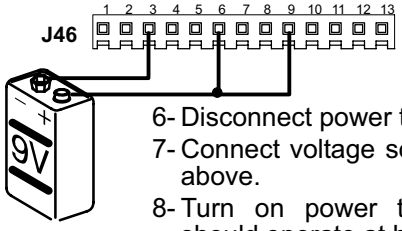
An ordinary 9 volt battery with maximum DC 20volts is recommended. A 9 volt battery will last for about one day of normal operation.

LOW SPEED CHECK-OUT



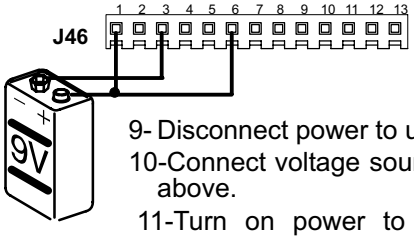
1- Disconnect power to unit.
2- Disconnect plug J46 from P46 located on the blower control board.
3- Connect voltage source as shown above.
4- Turn on power to unit. Blower should operate at low speed.

HIGH SPEED CHECK-OUT



6- Disconnect power to unit.
7- Connect voltage source as shown above.
8- Turn on power to unit. Blower should operate at high speed.

HEATING SPEED CHECK-OUT

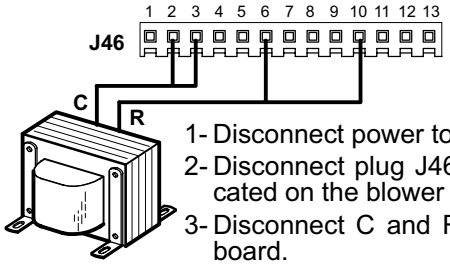


9- Disconnect power to unit.
10-Connect voltage source as shown above.
11-Turn on power to unit. Blower should operate at heating speed.

CHECK-OUT PROCEDURE USING 24V SOURCE

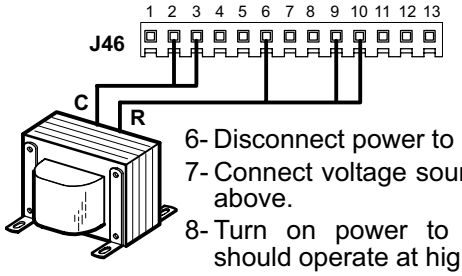
Unit transformer T1 with a maximum AC 30 volts may be used in lieu of a battery. If transformer T1 is used, double check all wiring connections before placing unit back in operation.

LOW SPEED CHECK-OUT



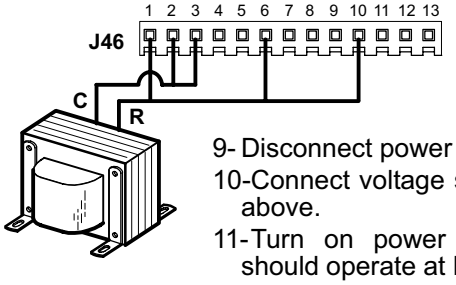
1- Disconnect power to unit.
2- Disconnect plug J46 from P46 located on the blower control board.
3- Disconnect C and R from control board.
4- Connect voltage source as shown above.
5- Turn on power to unit. Blower should operate at low speed.

HIGH SPEED CHECK-OUT



6- Disconnect power to unit.
7- Connect voltage source as shown above.
8- Turn on power to unit. Blower should operate at high speed.

HEATING SPEED CHECK-OUT



9- Disconnect power to unit.
10-Connect voltage source as shown above.
11-Turn on power to unit. Blower should operate at heating speed.

A kit is available from the Lennox parts center to use in testing the variable speed motor. The kit 70J11 includes a test plug harness to facilitate ICM2 check-out. **Follow testing procedures outlined in the instructions provided with the kit. The testing procedures are different than those listed above.**

FIGURE 25

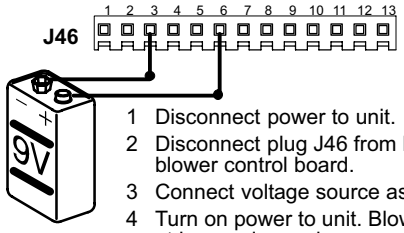
ICM-2 WITH VSP3 CHECK-OUT

120V to the motor must not be interupted. All connections for check out will be from the voltage source below (battery or 24V) to plug J46, after disconnectiong from blower control board.

CHECK-OUT PROCEDURE USING BATTERY

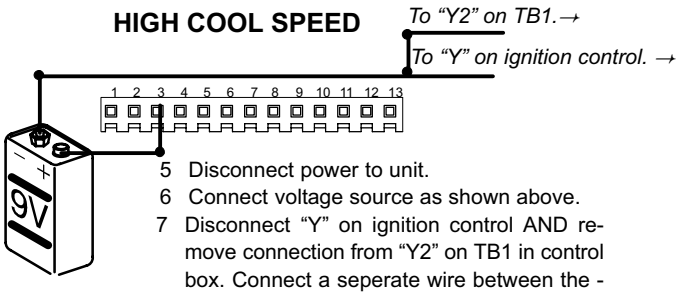
An ordinary 9 volt battery with maximum DC 20volts is recommended. A 9 volt battery will last for about one day of normal operation.

LOW COOL SPEED



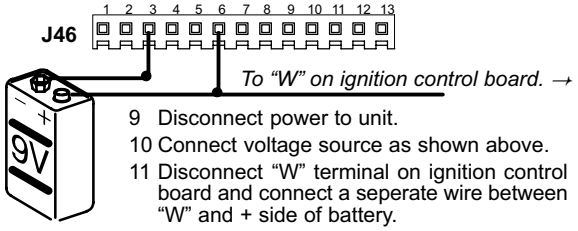
1 Disconnect power to unit.
2 Disconnect plug J46 from P46 located on the blower control board.
3 Connect voltage source as shown above.
4 Turn on power to unit. Blower should operate at low cool speed.

HIGH COOL SPEED



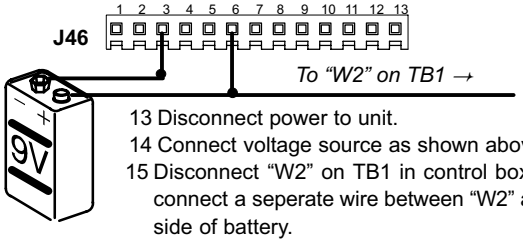
5 Disconnect power to unit.
6 Connect voltage source as shown above.
7 Disconnect "Y" on ignition control AND remove connection from "Y2" on TB1 in control box. Connect a seperate wire between the - side of the battery and BOTH "Y" on the ignition control and Y2" on TB1.
8 Turn on power to unit. Blower should operate at high cool speed.

LOW HEAT SPEED



9 Disconnect power to unit.
10 Connect voltage source as shown above.
11 Disconnect "W" terminal on ignition control board and connect a seperate wire between "W" and + side of battery.
12 Turn on power to unit. Blower should operate at low heat speed.

HIGH HEAT SPEED

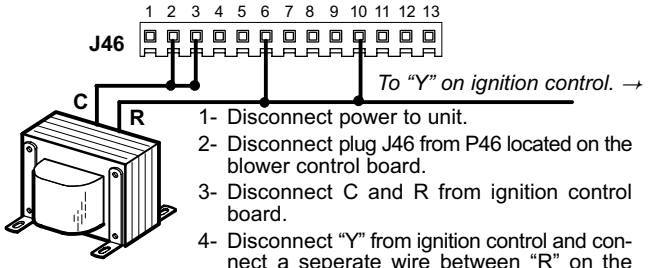


13 Disconnect power to unit.
14 Connect voltage source as shown above.
15 Disconnect "W2" on TB1 in control box and connect a seperate wire between "W2" and + side of battery.
16 Turn on power to unit. Blower should operate at high heat speed.

CHECK-OUT PROCEDURE USING 24V SOURCE

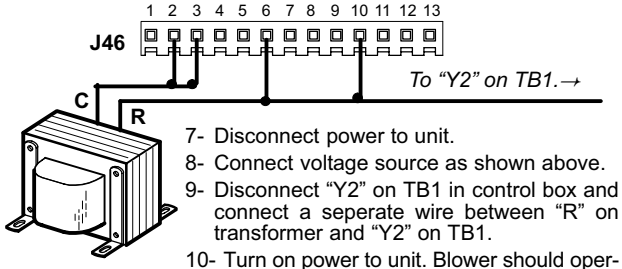
Unit transformer T1 with a maximum AC 30 volts may be used in lieu of a battery. If transformer T1 is used, double check all wiring connections before placing unit back in operation.

LOW COOL SPEED



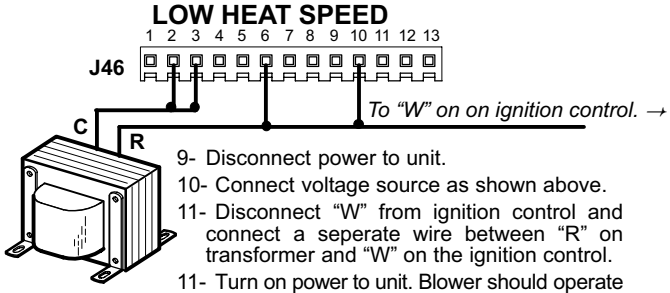
1- Disconnect power to unit.
2- Disconnect plug J46 from P46 located on the blower control board.
3- Disconnect C and R from ignition control board.
4- Disconnect "Y" from ignition control and connect a seperate wire between "R" on the transfomer and "Y" on the ignition control.
5- Connect voltage source as shown above.
6- Turn on power to unit. Blower should operate at low cool speed.

HIGH COOL SPEED



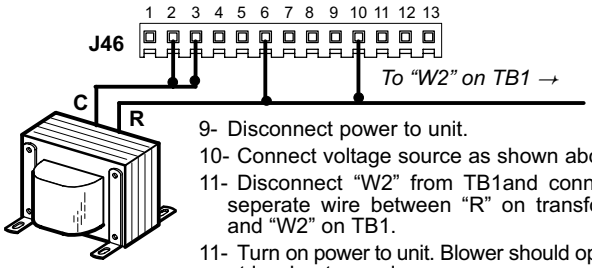
7- Disconnect power to unit.
8- Connect voltage source as shown above.
9- Disconnect "Y2" on TB1 in control box and connect a seperate wire between "R" on transformer and "Y2" on TB1.
10- Turn on power to unit. Blower should operate at high cool speed.

LOW HEAT SPEED



9- Disconnect power to unit.
10- Connect voltage source as shown above.
11- Disconnect "W" from ignition control and connect a seperate wire between "R" on transformer and "W" on the ignition control.
11- Turn on power to unit. Blower should operate at low heat speed.

HIGH HEAT SPEED

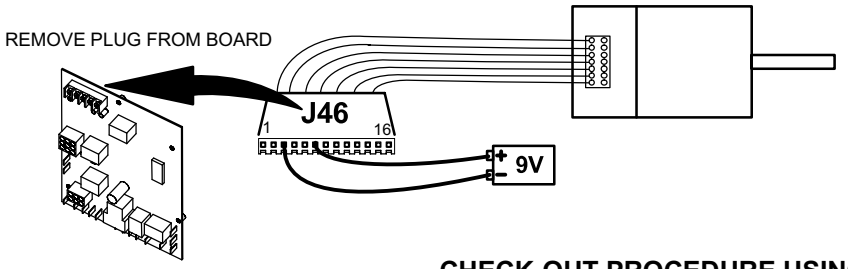


9- Disconnect power to unit.
10- Connect voltage source as shown above.
11- Disconnect "W2" from TB1and connect a seperate wire between "R" on transformer and "W2" on TB1.
11- Turn on power to unit. Blower should operate at low heat speed.

FIGURE 26

ICM-2 WITH TWO STAGE VARIABLE SPEED SURELIGHT

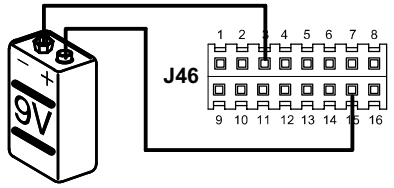
120V to the motor must not be interrupted. All connections for check out will be from the voltage source below (battery or 24V) to plug J46, after disconnecting from blower control board.



CHECK-OUT PROCEDURE USING BATTERY

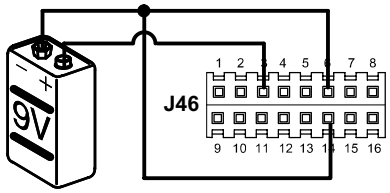
An ordinary 9 volt battery with maximum DC 20volts is recommended. A 9 volt battery will last for about one day of normal operation.

LOW COOL SPEED



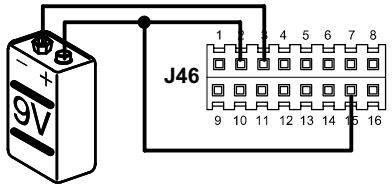
1 Disconnect power to unit.
2 Disconnect plug J46 from P46 located on the blower control board.
3 Connect voltage source as shown above.
4 Turn on power to unit. Blower should operate at low cool speed.

HIGH COOL SPEED



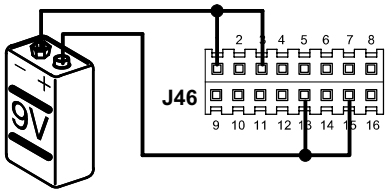
5 Disconnect power to unit.
6 Connect voltage source as shown above.
7 Turn on power to unit. Blower should operate at high cool speed.

LOW HEAT SPEED



8 Disconnect power to unit.
9 Connect voltage source as shown above.
10 Turn on power to unit. Blower should operate at low heat speed.

HIGH HEAT SPEED

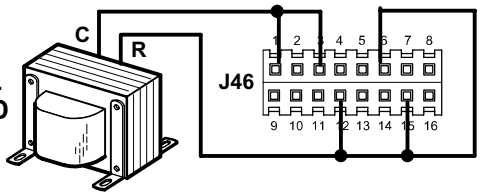


11 Disconnect power to unit.
12 Connect voltage source as shown above.
13 Turn on power to unit. Blower should operate at high heat speed.

CHECK-OUT PROCEDURE USING 24V SOURCE

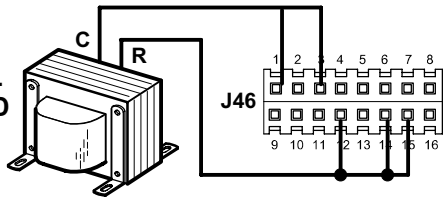
Unit transformer T1 with a maximum AC 30 volts may be used in lieu of a battery. If transformer T1 is used, double check all wiring connections before placing unit back in operation.

LOW COOL SPEED



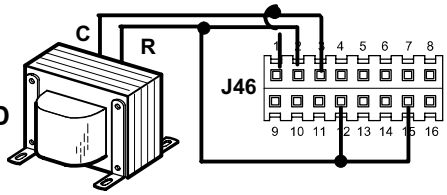
1 Disconnect power to unit.
2 Disconnect plug J46 from P46 located on the blower control board.
3 Connect voltage source as shown above.
4 Turn on power to unit. Blower should operate at low cool speed.

HIGH COOL SPEED



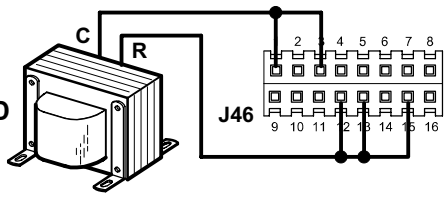
5 Disconnect power to unit.
6 Connect voltage source as shown above.
7 Turn on power to unit. Blower should operate at high cool speed.

LOW HEAT SPEED



8 Disconnect power to unit.
9 Connect voltage source as shown above.
10 Turn on power to unit. Blower should operate at low heat speed.

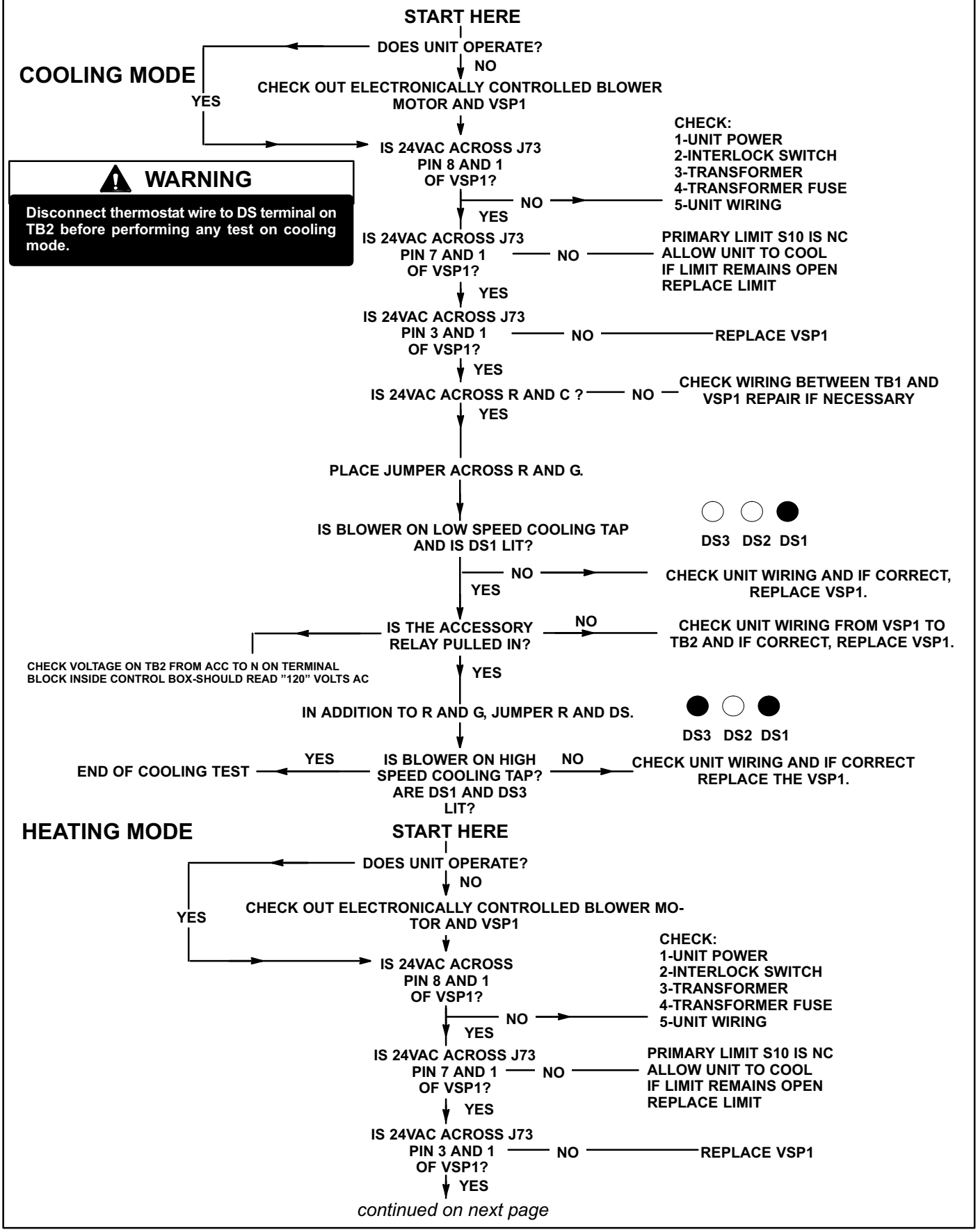
HIGH HEAT SPEED



11 Disconnect power to unit.
12 Connect voltage source as shown above.
13 Turn on power to unit. Blower should operate at high heat speed.

FIGURE 27

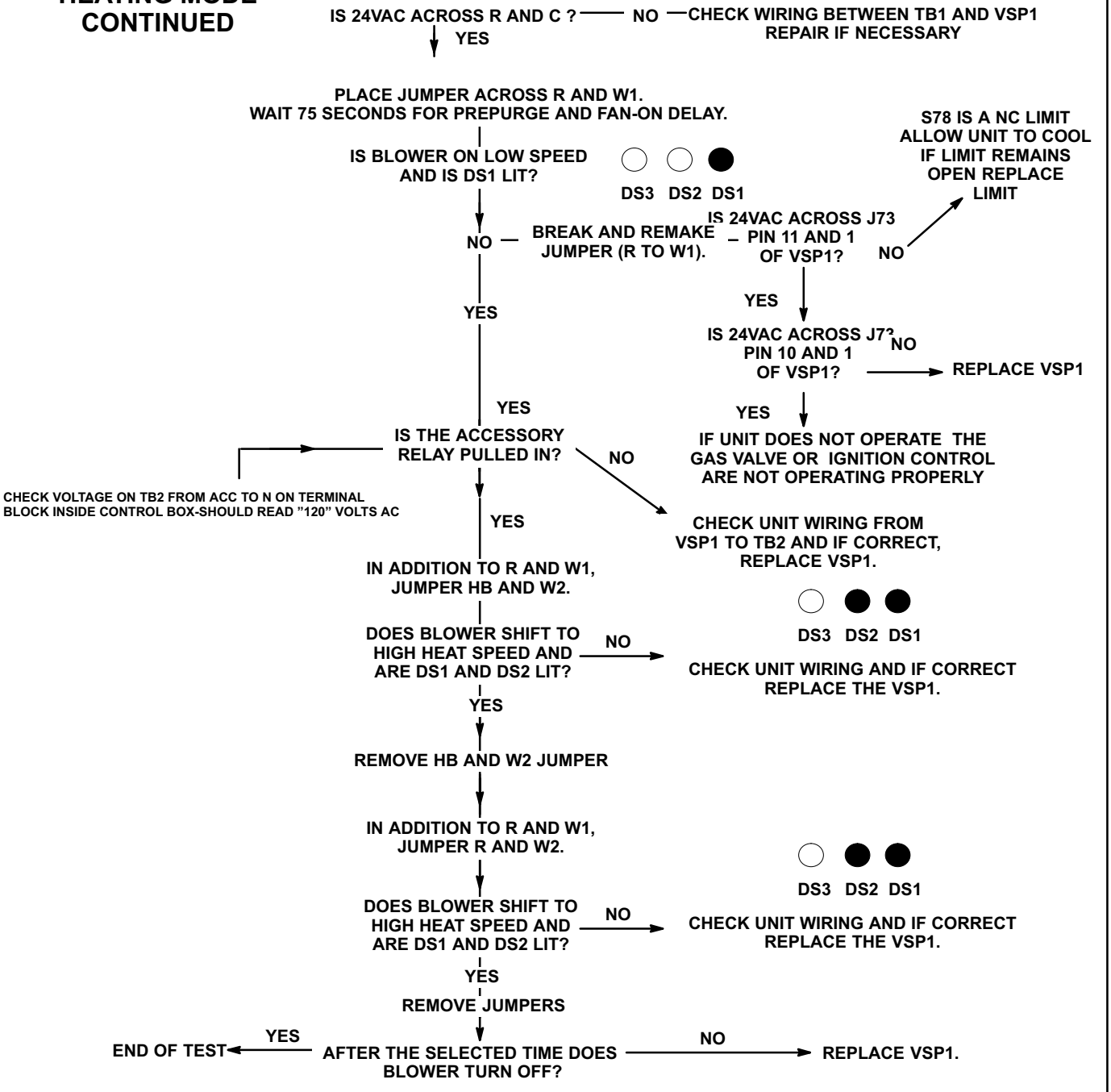
VSP1 TROUBLESHOOTING



continued on next page

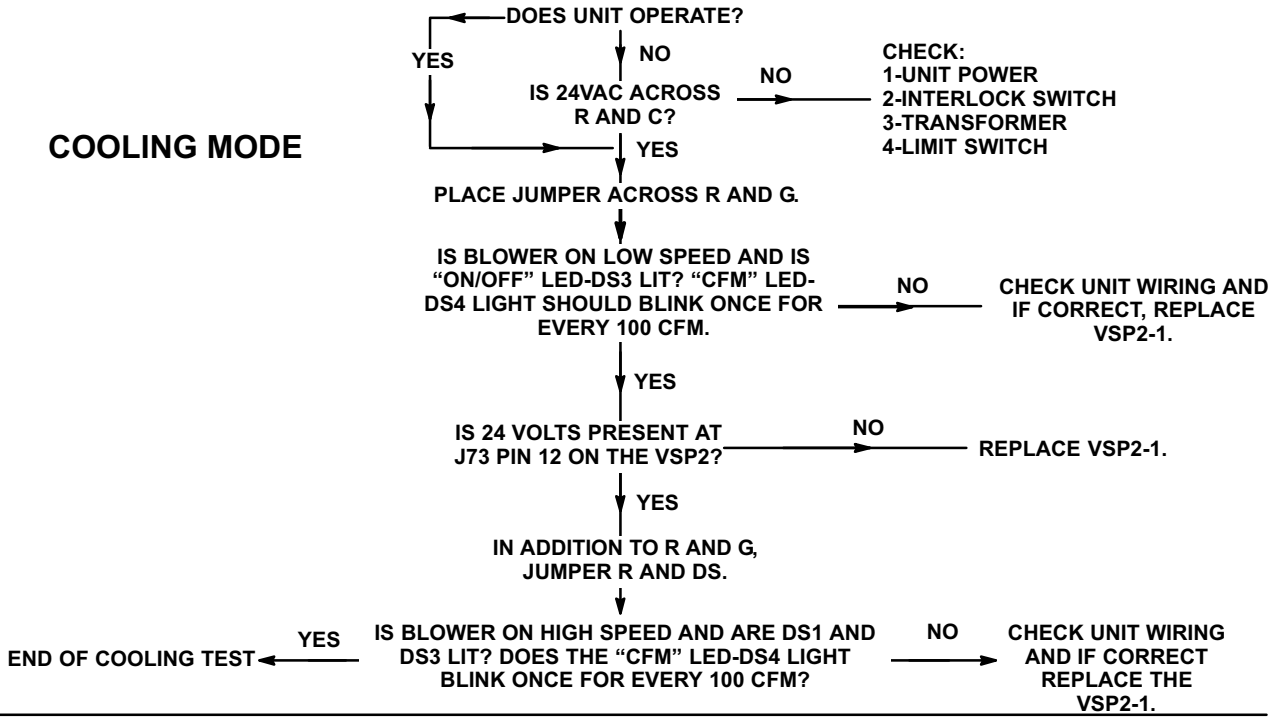
VSP1 TROUBLESHOOTING
(CONT.)

HEATING MODE CONTINUED

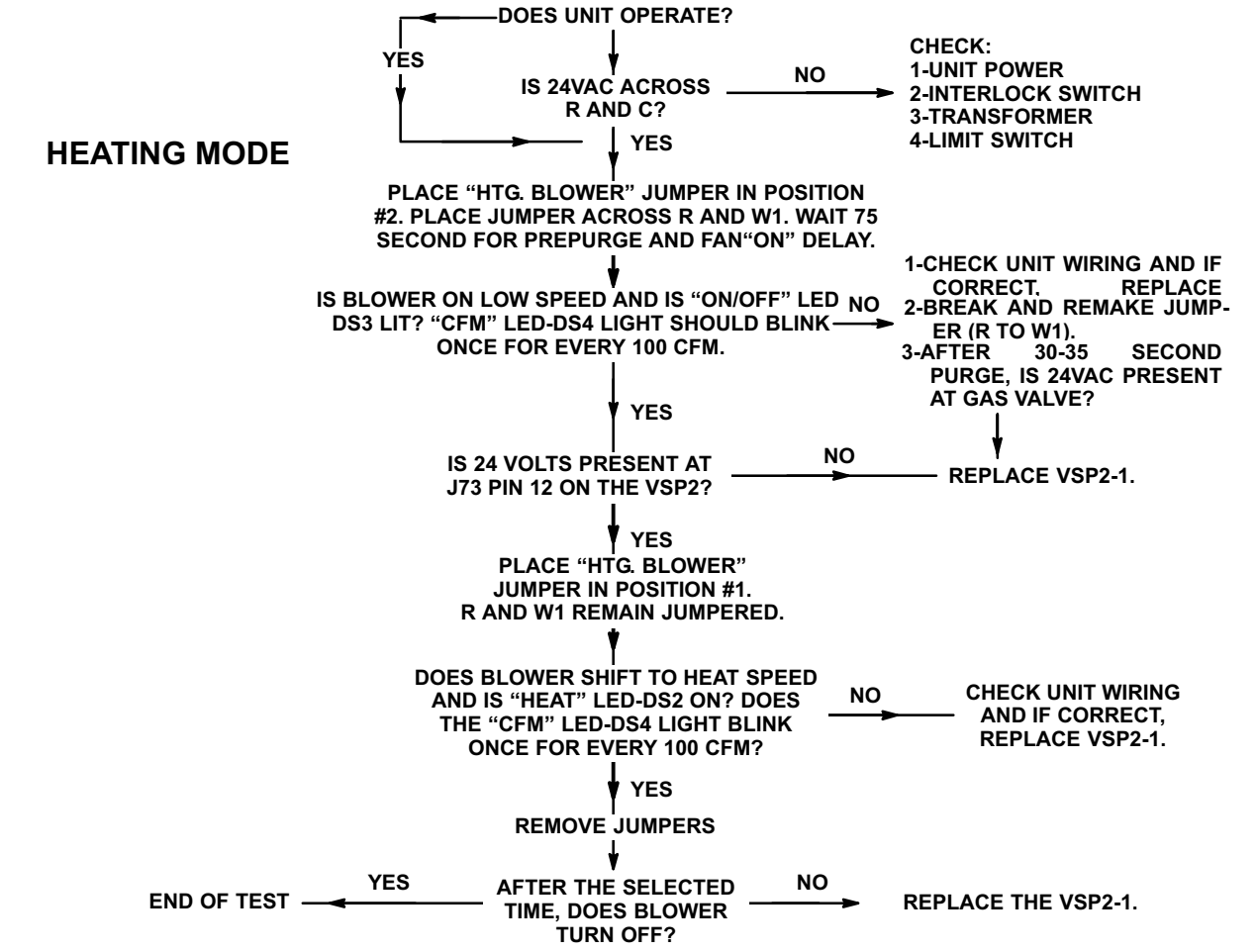


VSP2-1 TROUBLESHOOTING

COOLING MODE

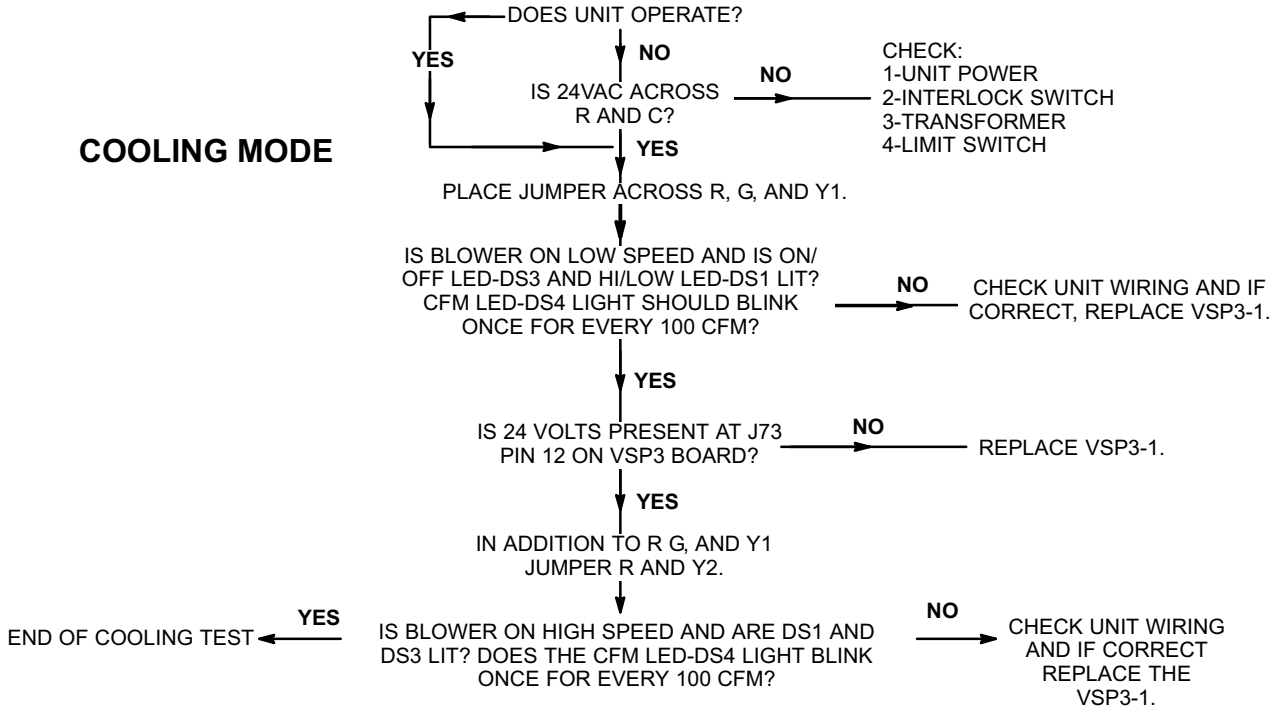


HEATING MODE



VSP3-1 TROUBLESHOOTING

COOLING MODE



HEATING MODE