SL280DFV SERIES UNITS

SL280DFV series units are 80% efficiency gas furnaces used for downflow applications only, manufactured with Lennox Duralok™ heat exchangers formed of aluminized steel. Units are available in heating capacities of 66,000 to 110,000 Btuh and cooling applications up to 5 tons. Refer to Engineering Handbook for proper sizing.

Units are factory equipped for use with natural gas. Kits are available for conversion to LPG operation. SL280DFV model units are equipped with the SureLight® two-stage variable speed integrated control. All units use a redundant gas valve to assure safety shut-off as required by CSA

All specifications in this manual are subject to change. Procedures outlined in this manual are presented as a recommendation only and do not supersede or replace local or state codes. In the absence of local or state codes, the guidelines and procedures outlined in this manual (except where noted) are recommendations only and do not constitute code.

TABLE OF CONTENTS

Specifications . . . . . Page 2
Parts Identification . . . . . Page 3
I Unit Components . . . . . Page 4
II Installation . . . . . Page 21
III Start Up . . . . . Page 21
IV Heating System Service Checks . . . . . Page 22
V Typical Operating Characteristics . . . . . Page 24
VI Maintenance . . . . . Page 24
VII Wiring and Sequence of Operation . . . . . Page 28
VIII Field Wiring and Jumper Settings . . . . . Page 31
IX SureLight Integrated Control TroubleshootingPage 33

⚠WARNING

Improper installation, adjustment, alteration, service or maintenance can cause property damage, personal injury or loss of life. Installation and service must be performed by a licensed professional installer (or equivalent), service agency or the gas supplier.

⚠WARNING

Electric shock hazard. Can cause injury or death. Before attempting to perform any service or maintenance, turn the electrical power to unit OFF at disconnect switch(es). Unit may have multiple power supplies.

⚠ WARNING

Sharp edges.
Be careful when servicing unit to avoid sharp edges which may result in personal injury.

SPECIFICATIONS

		Model No.	SL280DF070V36A	SL280DF090V48B	SL280DF090V60C	SL280DF110V60C
Gas Heating Performance		[1] AFUE	80%	80%	80%	80%
	High Fire	Input - Btuh	66,000	88,000	88,000	110,000
		Output - Btuh	52,000	69,000	70,000	87,000
		Temperature rise range - °F	35-65	35-65	35-65	35-65
		Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0	3.5 / 10.0
	Low Fire	Input - Btuh	43,000	57,000	57,000	72,000
		Output - Btuh	35,000	46,000	46,000	59,000
		Temperature rise range - °F	25-55	25-55	25-55	25-55
		Gas Manifold Pressure (in. w.g.) Nat. Gas / LPG/Propane	1.7 / 4.9	1.7 / 4.9	1.7 / 4.9	1.7 / 4.9
High static - in. w.g.		Heating	0.8	0.8	0.8	0.8
		Cooling	1.0	1.0	1.0	1.0
Connections in.		Flue connection - in. round	4	4	4	4
		Gas pipe size IPS	1/2	1/2	1/2	1/2
Indoor Blower		Wheel nominal diameter x width - in.	10 x 8	11 x 9	11 x 10	11 x 10
		Motor output - hp	1/2	1	1	1
		Tons of add-on cooling	2 - 3	3 - 4	3.5 - 5	3.5 - 5
		Air Volume Range - cfm	589 - 1514	830 - 1996	899 - 2273	882 - 2120
Electrical Data		Voltage	120 volts - 60 hertz - 1 phase			
		Blower motor full load amps	7.7	12.8	12.8	12.8
		Maximum overcurrent protection	15	20	20	20
Shipping Data		lbs. - 1 package	130	153	164	173

NOTE - Filters and provisions for mounting are not furnished and must be field provided.

[1] Annual Fuel Utilization Efficiency based on DOE test procedures and according to FTC labeling regulations. Isolated combustion system rating for non-weatherized furnaces.

OPTIONAL ACCESSORIES - MUST BE ORDERED EXTRA

	"A" Width Models	"B" Width Models	"C" Width Models
CABINET ACCESSORIES			
Downflow Combustible Flooring Base	**11M59**	**11M60**	**11M61**
CONTROLS			
ComfortSense® 7000 Thermostat	**Y0349**	**Y0349**	**Y0349**
Remote Outdoor Sensor (for dual fuel and Humiidtrol®)	**X2658**	**X2658**	**X2658**
DOWNFLOW FILTER KITS			
Downflow Filter Kit	**51W06**	**51W07**	**51W08**
No. and Size of filter - in.	(1) 20 x 16 x 1	(2) 20 x 20 x 1	(2) 20 x 20 x 1
NIGHT SERVICE KITS			
Night Service Kit	**51W04**	**51W04**	**51W04**
Safety Night Service Kit	**51W05**	**51W05**	**51W05**

GAS HEAT ACCESSORIES

Models	Natural Gas to LPG/Propane Kit	LPG/Propane to Natural Gas Kit
all	**51W02**	**69W79**

PARTS IDENTIFICATION

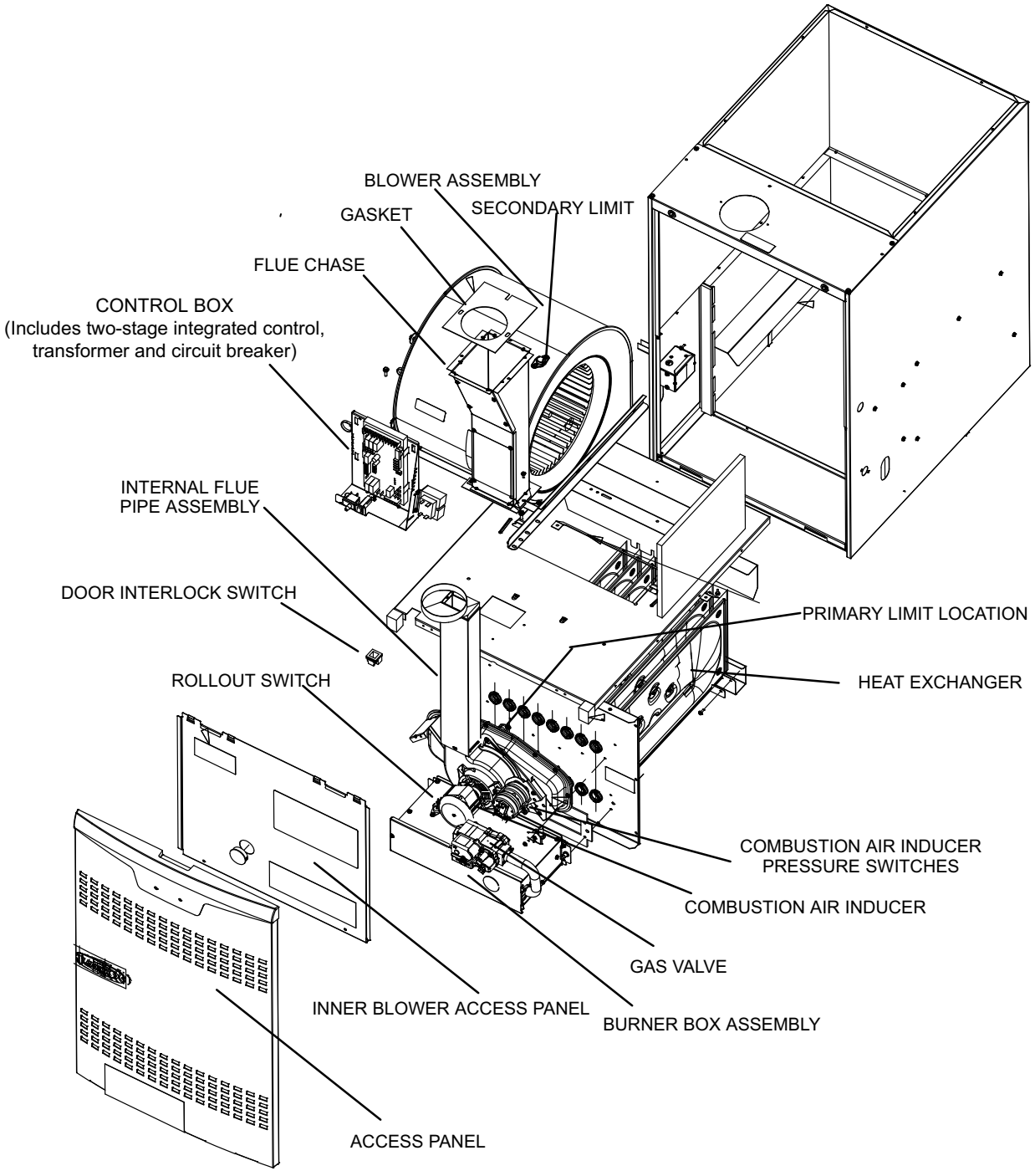


FIGURE 1

I-UNIT COMPONENTS

Unit components are shown in figure 1. The gas valve, combustion air inducer and burners can be accessed by removing the access panel. Electrical components are in the control box (figure 2) found in the blower section.

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.

1. Control Transformer (T1)

A transformer located in the control box provides power to the low voltage section of the unit. Transformers on all models are rated 40VA with a 120V primary and a 24V secondary.

2. Door Interlock Switch (S51)

An interlock switch rated 14A at 125VAC is wired in series with line voltage. When the indoor blower access panel is removed the unit will shut down.

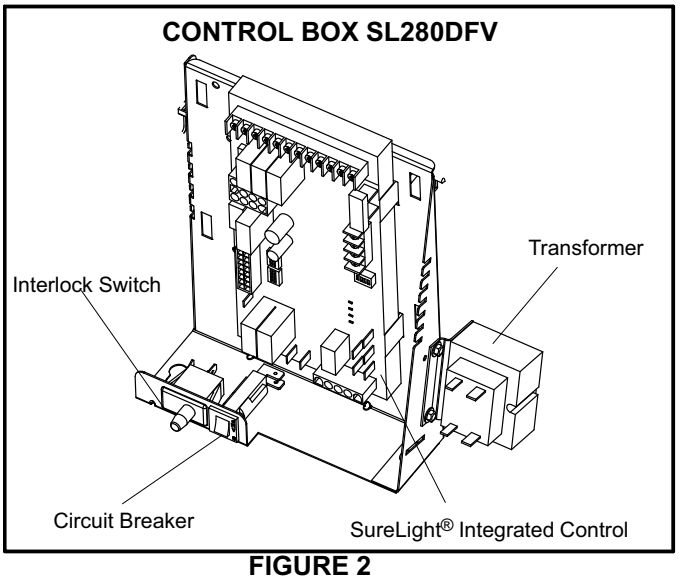


FIGURE 2

3. Circuit Breaker (CB8)

A 24V circuit breaker is also located in the control box. The switch provides overcurrent protection to the transformer (T1). The breaker is rated 3A at 32V. If the current exceeds this limit the breaker will trip and all unit operation will shutdown. The breaker can be manually reset by pressing the button on the face. See figure 3.

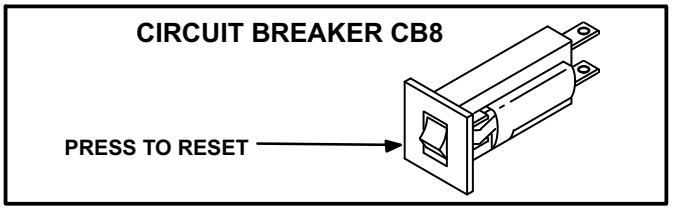


FIGURE 3

⚠ WARNING

Shock hazard.
Disconnect power before servicing. Integrated control is not field repairable.

If control is inoperable, simply replace entire control.
Can cause injury or death. Unsafe operation will result if repair is attempted.

4. SureLight Integrated Control (A92)

Units are equipped with the SureLight two-stage, variable speed integrated SureLight® control. The system consists of a ignition / blower control (figures 4 and 5) with control pin designations in tables 1, 2 and 3 and ignitor (figure 12). The control and ignitor work in combination to ensure furnace ignition and ignitor durability.

Four LED's indicate single or two-stage thermostat operation.

- SPEED LED (green) - Indicates circulating blower speed. The LED is lit during normal operation and is off during a dehumidification demand. In Harmony III™ zoning applications, the the brightness of the LED indicates the requested blower speed.
- CFM LED (green) - indicates blower cfm
- STATUS LED (red) - Flashes diagnostic codes
- E-COM LED (green) Indicates that the control is receiving and processing commands and inputs

This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. THE DIP switch is factory-positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the DIP switch must be repositioned.

NOTE - *DIP switches are coated with a protective film that must be removed in order to adjust DIP switches.*

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

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

The board also has two 120 volt accessory terminals rated at (1) one amp each. In addition there is a 24 volt accessory terminal located on TB1.

Electronic Ignition

At the beginning of the heat cycle the SureLight® control monitors the first stage and second stage combustion air inducer prove switch. The control will not begin the heating cycle if the first stage prove switch is closed (by-passed). Likewise the control will not begin the second stage heating cycle if the second stage prove switch is closed, and will remain in first stage heat. However, if the second stage prove switch closes during the first stage heat pre-purge, the control will allow second stage heat. Once the first stage prove switch is determined to be open, the combustion air inducer is energized on low (first stage) heat speed. When the differential in the prove switch is great enough, the prove switch closes and a 15-second pre-purge begins.

NOTE - *During abnormal conditions such as low supply voltage or low outdoor temperatures and the low fire pressure switch does not close, the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 20 seconds of high fire operation the unit will switch to low fire*

TABLE 1

SureLight Control 5 Pin Terminal Designation	
PIN #	**Function**
1	Ignitor
2	Combustion Air Inducer High Speed
3	Combustion Air Inducer Low Speed
4	Combustion Air Inducer Neutral
5	Ignitor Neutral

TABLE 2

SureLight Control 12Pin Terminal Designation	
PIN #	**Function**
1	Gas Valve High Fire
2	Second Stage Prove Switch
3	Rollout In
4	Ground
5	24V Hot
6	Primary Limit In
7	Gas Valve Low Stage
8	Gas Valve Common
9	24V Neutral
10	Ground
11	Rollout Switch Out
12	1st Stage Prove Switch

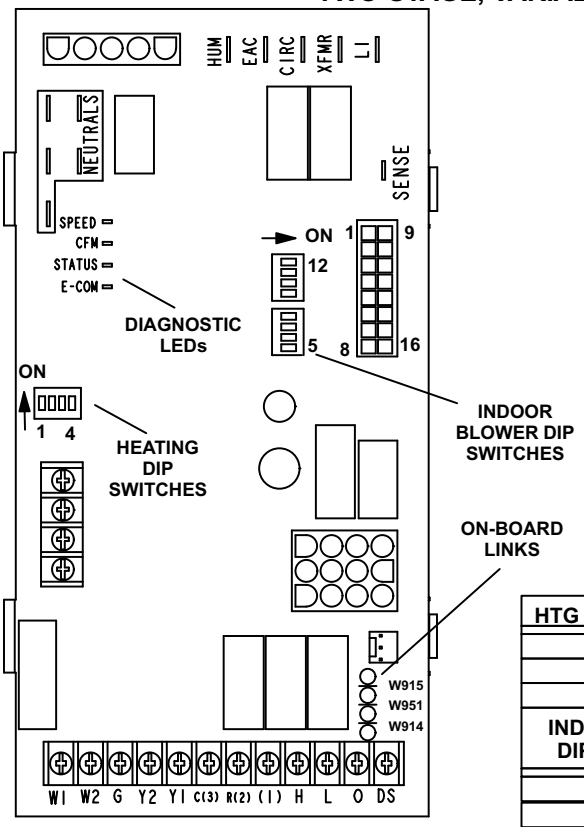
After the 15-second pre-purge period, the SureLight ignitor warms up for 20 seconds after which the gas valve opens for a 4-second trial for ignition. The ignitor energizes during the trial until flame is sensed. If ignition is not proved during the 4-second period, the control will try four more times with an inter purge and warm-up time between trials of 35 seconds. After a total of five trials for ignition (including the initial trial), the control goes into Watchguard-Flame Failure mode. After a 60-minute reset period, the control will begin the ignition sequence again.

Two Stage Operation / Thermostat Selection DIP Switch

The control can be utilized in two modes: SINGLE-STAGE thermostat or TWO-STAGE thermostat. The thermostat selection is made using a DIP switch (figure 5) and must be positioned for the particular application. DIP switch 1, labeled T"STAT HEAT STAGE is factory-set in the OFF position for use with a two-stage thermostat. Move the DIP switch to ON for use with a single stage thermostat.

While in the single-stage thermostat mode (*single* DIP switch setting), the burners will always fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. After a factory default 10 minute recognition period, the unit will switch to second stage heat. While in the two-stage thermostat mode (*two* DIP switch setting) the burners will fire on first-stage heat. The combustion air inducer will operate on low speed and indoor blower will operate on low heat speed. The unit will switch to second-stage heat on call from the indoor thermostat. If there is a simultaneous call for first and second stage heat, the unit will fire an first stage heat and switch to second stage heat after 30 seconds of operation. See Sequence of Operation flow charts in the back of this manual for more detail.

TWO-STAGE, VARIABLE SPEED INTEGRATED CONTROL



1/4" QUICK CONNECT TERMINALS

HUM = 120 VAC OUTPUT TO HUMIDIFIER
XMFR = 120 VAC OUTPUT TO TRANSFORMER
LI = 120 VAC INPUT TO CONTROL
CIRC = 120 VAC OUTPUT TO CIRCULATING BLOWER
EAC = 120 VAC OUTPUT TO ELECTRONIC AIR CLEANER
NEUTRALS= 120 VAC NEUTRAL

THERMOSTAT CONNECTIONS (TB1)

DS= DEHUMIDIFICATION SIGNAL
W2= HEAT DEMAND FROM 2ND STAGE T'STAT
W1= HEAT DEMAND FROM 1ST STAGE T'STAT
R= CLASS 2 VOLTAGE TO THERMOSTAT
G= MANUAL FAN FROM T'STAT
C= THERMOSTAT SIGNAL GROUND CONNECTED TO TRANSFORMER GROUND (TR) & CHASIS GROUND (GRD)
Y1= THERMOSTAT 1st STAGE COOL SIGNAL
Y2= THERMOSTAT 2nd STAGE COOL SIGNAL
O= THERMOSTAT SIGNAL TO HEAT PUMP REVERSING VALVE
H= 24V HUMIDIFIER OUTPUT
L= LENNOX SYSTEM OPERATION MONITOR
1= FUTURE USE

DIP SWITCH FUNCTIONS

HTG DIP SWITCH(ES)	FUNCTION
1	T'stat Heat Stages (single or two-stage)
2	Second Stage ON Delay (single-stage t'stat)
3 and 4	Heating Fan OFF Delay
INDOOR BLOWER DIP SWITCH(ES)	**FUNCTION**
5 and 6	Cooling Mode Blower Speed
7 and 8	Blower Speed Adjustment
9 and 10	Cooling Mode Blower Ramping Profile
11 and 12	Heating Mode Blower Speed

FIGURE 4

TABLE 3

SureLight Board 16 Pin Blower Control Terminals	
PIN #	**Function**
1	Ground
2	Low Heat Speed
3	Ground
4	"DELAY" DIP Switch Selection
5	"COOL" DIP Switch Selection
6	"Y1" Signal
7	"ADJUST" DIP Switch Selection
8	Ground
9	"0" From Thermostat
10	"DS" Output Signal
11	"HEAT" DIP Switch Selection
12	24 VAC
13	HIGH HEAT Speed
14	"Y2" Signal
15	"G"
16	CFM LED

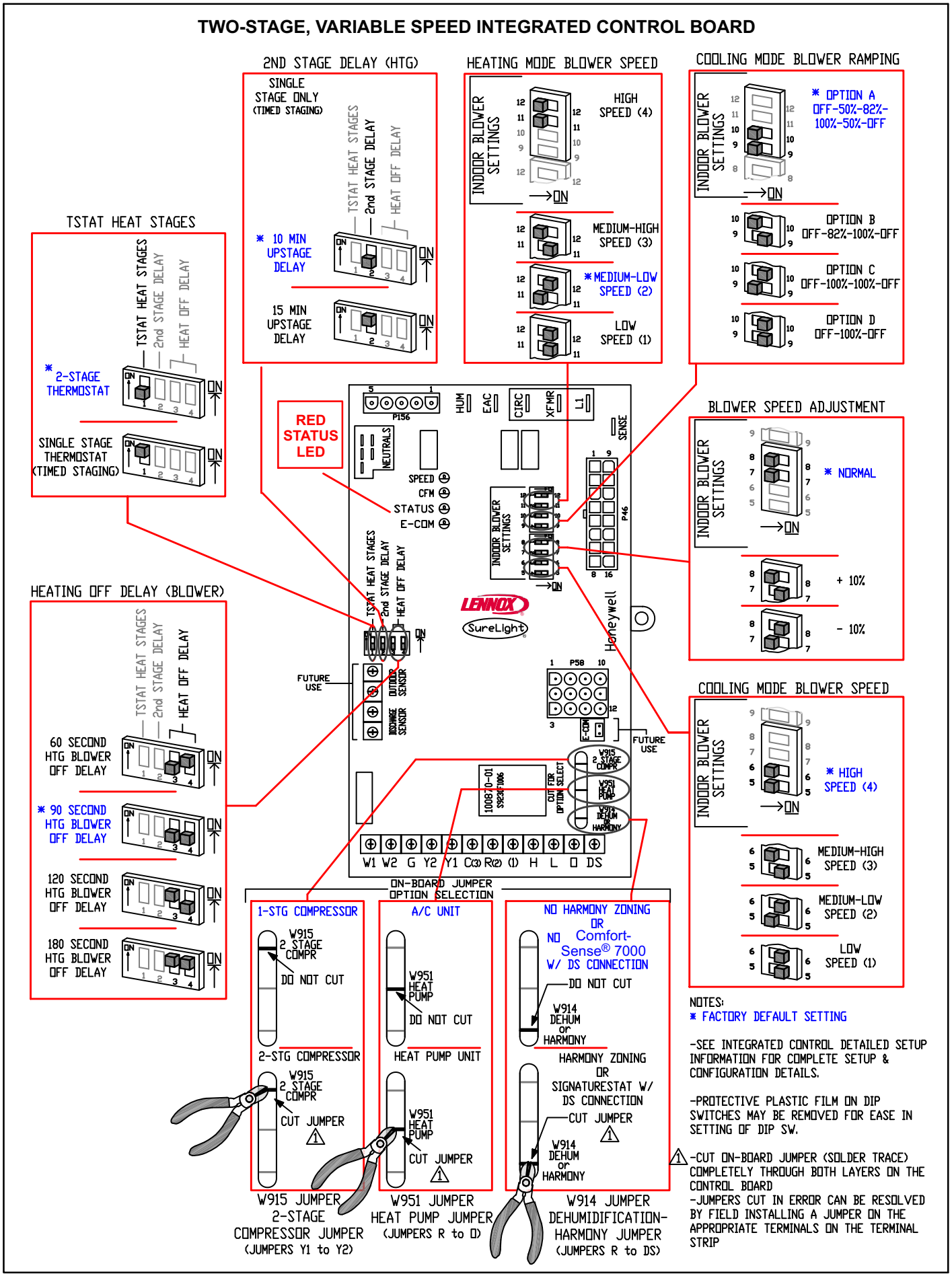

TWO-STAGE, VARIABLE SPEED INTEGRATED CONTROL BOARD
2ND STAGE DELAY (HTG)
SINGLE STAGE ONLY (TIMED STAGING)
TSTAT HEAT STAGES
2nd STAGE DELAY
HEAT OFF DELAY
* 10 MIN UPSTAGE DELAY
15 MIN UPSTAGE DELAY
HEATING MODE BLOWER SPEED
INDOOR BLOWER SETTINGS
HIGH SPEED (4)
MEDIUM-HIGH SPEED (3)
*MEDIUM-LOW SPEED (2)
LOW SPEED (1)
COOLING MODE BLOWER RAMPING
* OPTION A OFF-50%-82%-100%-50%-OFF
OPTION B OFF-82%-100%-OFF
OPTION C OFF-100%-100%-OFF
OPTION D OFF-100%-OFF
TSTAT HEAT STAGES
* 2-STAGE THERMOSTAT
SINGLE STAGE THERMOSTAT (TIMED STAGING)
RED STATUS LED
P156
HUM
EAC
CIRC
XFMR
L1
NEUTRALS
SENSE
P46
SPEED
CFM
STATUS
E-COM
LENNOX
SureLight
Honeywell
FUTURE USE
OUTDOOR SENSOR
DISCHARGE SENSOR
P58
E-COM
W915 2 STAGE COMPR
W951 HEAT PUMP
W914 DEHUM OR HARMONY
CUT FOR OPTION SELECT
W1 W2 G Y2 Y1 C(3) R(2) (1) H L O DS
BLOWER SPEED ADJUSTMENT
* NORMAL
+ 10%
- 10%
COOLING MODE BLOWER SPEED
* HIGH SPEED (4)
MEDIUM-HIGH SPEED (3)
MEDIUM-LOW SPEED (2)
LOW SPEED (1)
HEATING OFF DELAY (BLOWER)
60 SECOND HTG BLOWER OFF DELAY
* 90 SECOND HTG BLOWER OFF DELAY
120 SECOND HTG BLOWER OFF DELAY
180 SECOND HTG BLOWER OFF DELAY
ON-BOARD JUMPER OPTION SELECTION
1-STG COMPRESSOR
DO NOT CUT
2-STG COMPRESSOR
CUT JUMPER
A/C UNIT
HEAT PUMP UNIT
NO HARMONY ZONING OR NO Comfort-Sense® 7000 W/ DS CONNECTION
HARMONY ZONING OR SIGNATURESTAT W/ DS CONNECTION
W915 JUMPER 2-STAGE COMPRESSOR JUMPER (JUMPERS Y1 to Y2)
W951 JUMPER HEAT PUMP JUMPER (JUMPERS R to O)
W914 JUMPER DEHUMIDIFICATION-HARMONY JUMPER (JUMPERS R to DS)
NOTES:
* FACTORY DEFAULT SETTING
-SEE INTEGRATED CONTROL DETAILED SETUP INFORMATION FOR COMPLETE SETUP & CONFIGURATION DETAILS.
-PROTECTIVE PLASTIC FILM ON DIP SWITCHES MAY BE REMOVED FOR EASE IN SETTING OF DIP SW.
1 -CUT ON-BOARD JUMPER (SOLDER TRACE) COMPLETELY THROUGH BOTH LAYERS ON THE CONTROL BOARD
-JUMPERS CUT IN ERROR CAN BE RESOLVED BY FIELD INSTALLING A JUMPER ON THE APPROPRIATE TERMINALS ON THE TERMINAL STRIP

FIGURE 5

TABLE 4

The SureLight® integrated control features a red LED light, for furnace status and troubleshooting. The LED flashes in "X" + "Y" codes. For example using table 4 under "PRESSURE SWITCH CODES", if the red LED flashes 2 times, then off for 2 seconds then flashes 3 times, the low pressure switch is failed open. Two green LEDs show indoor blower status and CFM. See Page 10 for more detail.

FLASH CODE (X + Y) LED	STATUS / DIAGNOSTIC DESCRIPTION
FLASH CODE DESCRIPTIONS	
Pulse	A 1/4 second flash ON / four seconds of off time.
Heartbeat	1/2 second bright / 1/2 second dim cycles.
X + Y	LED flashes X times at 1/2 second / two seconds off / flashes Y times at 1/2 second / four seconds off - repeats.
Pulse	Control powered (standby) Also signaled during cooling and continuous fan.
Heartbeat	Call for heat - normal operation
FLAME CODES	
1 + 2	Low flame signal -- Check flame sensor.
1 + 3	Flame sensed out of sequence -- flame still present. Flame sensed without gas valve energized.
PRESSURE SWITCH CODES	
2 + 3	Low fire pressure switch sensed open. 80% - check blocked exhasut (90% check inlet/exhaust or condensate line. condensate line)
2 + 4	Low fire pressure switch sensed closed prior to activation of combustion air inducer.
2 + 5	High fire pressure switch sensed open. 80% - check blocked exhaust (90% check inlet/exhaust or condensate line)
2 + 6	High fire pressure switch sensed closed prior to activation of combustion air inducer.
2 + 7	Low fire pressure switch opened during ignition trial or heating demand.
LIMIT CODE	
3 + 1	Primary / Secondary limit switch open.
WATCHGUARD CODES	
4 + 1	Watchguard -- Burner failed to light, exceeded maximum retries. (auto retry after 60 min)
4 + 2	Watchguard -- Low pressure switch opened 5 times in one heating cycle. (auto retry after 60 min.)
4 + 3	Watchguard -- Lost flame sense 5 times in one heating cycle. (auto retry after 60 min)
4 + 5	Watchguard -- Limit open longer than 3 minutes. (auto retry aftrer 60 min.)
4 + 6	Watchguard -- Flame sensed out of sequence; flame not present. (auto retry after 60 min.)
4 + 7	Watchguard -- Ignitor circuit fault -- failed ignitor or wiring. If ignitor and wiring are okay, replace control. (auto retry after 60 min)
4 + 8	Watchguard -- Line voltage below 90 volts
HARD LOCKOUT CODE	
5 + 1	Rollout circuit open -- Reset rollout switch, check wiring and recycle power to furnace.
OTHER CODES	
5 + 2	Control failed self check, internal error (control will restart if error recovers).
5 + 3	No Earth ground (control will restart if error recovers).
5 + 4	Reversed line voltage polarity (control will restart if the error recovers).
5 + 5	Low 24V (control will restart if voltage rises to normal)

Error Code Storage

The ignition control stores the last ten error codes in memory. The codes are retained in case of power loss.

Error Code Review

1 - Short R (2) to (1). Within 1/2 second, the STATUS LED will stay lit continuously to indicate that the short was sensed.

2 - Continue to hold the short between R (2) to (1). After 5 seconds, STATUS LED will go from being continuously lit to off. This indicates that error code review is pending.

3 - Remove R (2) to (1) short within ten seconds of STATUS LED turning off. This activates error code review.

4 - Last ten error codes will be flashed on the STATUS LED.

5 - After final error code is indicated, STATUS LED will flash to indicate normal operation.

Clearing Error Codes

1 - Short R (2) to (1). Within 1/2 second, the STATUS LED will stay lit continuously to indicate that the short was sensed.

2 - Continue to hold the short between R (2) to (1). After 5 seconds, STATUS LED will go from being continuously lit to off.

3 - Continue to hold the short between R (2) to (1) beyond ten seconds after STATUS LED has turned off. STATUS LED will turn on, indicating that error codes have been cleared.

4 - Remove R (2) to (1) short. STATUS LED will flash to indicate normal operation.

DIP Switch Settings

Heating Operation DIP Switch Settings

Switch 1 -- Thermostat Selection -- This unit may be used with either a single-stage or two-stage thermostat. The thermostat selection is made using a DIP switch which must be properly positioned for the particular application. THE DIP switch is factory-positioned for use with a two-stage thermostat. If a single-stage thermostat is to be used, the DIP switch must be repositioned.

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

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

Switch 2 -- 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 OFF position, which provides a 10-minute delay before second-stage heat is initiated. If the switch is toggled to the ON 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.

Switches 3 and 4 -- 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 3 and 4 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.Table 5 provides the blower off timings that will result from different switch settings.

TABLE 5
Blower Off Delay Switch Settings

Blower Off Delay (Seconds)	Switch 3	Switch 4
60	Off	On
90	Off	Off
120	On	Off
180	On	On

Indoor Blower Operation DIP Switch Settings

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. Switches 5 and 6 set the blower cfm for second-stage cool. The integrated control automatically ramps down to 70% of the second-stage cfm for first-stage cfm. The table below provides the cooling mode blower speeds that will result from different switch settings. Refer to blower tables on page 11 for corresponding cfm values.

TABLE 6
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 blower tables on page 11 for corresponding cfm values.

TABLE 7
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. Table 8 provides the cooling mode blower speed ramping options that will result from different switch settings. The cooling mode blower speed ramping options are detailed on the next page.

NOTE - The off portion of the selected ramp profile also applies during heat pump operation in dual fuel applications.

TABLE 8
Cooling Mode Blower Speed Ramping

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

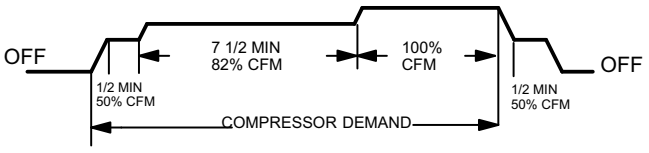
Switches 11 and 12 -- Heating Mode Blower Speed -- Switches 11 and 12 are used to select heating mode blower motor speed. The unit is shipped from the factory with the DIP switches positioned for medium low (2) speed indoor blower motor operation during the heating mode. The table below provides the heating mode blower speeds that will result from different switch settings. Switches 11 and 12 set the blower cfm for high-fire. The integrated control automatically ramps down to 91% of the high fire cfm for low-fire cfm. Refer to blower tables on page 11 for corresponding cfm values.

TABLE 9
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

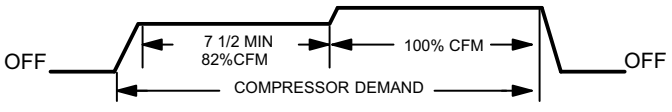
Ramping Option A (Factory Selection)

- Motor runs at 50% for 30 seconds.
- 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 30 seconds then ramps down to stop.



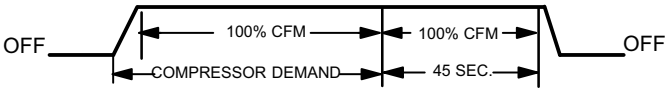
Ramping Option B

- Motor 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 stop.



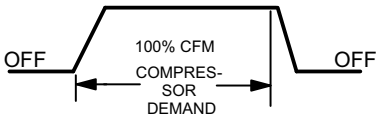
Ramping Option C

- Motor runs at 100% until demand is satisfied.
- Once demand is met, motor runs at 100% for 45 seconds then ramps down to stop.



Ramping Option D

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



On-Board Link W914 DEHUM OR HARMONY (DS to R)
On-board link W914 is a clippable connection which connects terminals DS and R on the integrated control board. W914 must be cut when the furnace is installed with either the Harmony III zone control board or a thermostat which features humidity control. If the link is left intact the PWM signal from the HARMONY III control will be blocked and also lead to control damage. Refer to table 10 for operation sequence in applications including SL280DFV, a thermostat which features humidity control and a single-speed outdoor unit. Table 11 gives the operation sequence in applications with a two-speed outdoor unit.

On-Board Link W951 HEAT PUMP (R to O)
On-board link W951 is a clippable connection which connects terminals R and O on the integrated control board. W951 must be cut when the furnace is installed in applications which include a heat pump unit and a thermostat which features dual fuel use. If the link is left intact, terminal "O" will remain energized eliminating the HEAT MODE in the heat pump.

On-Board Link W915 2 STAGE COMPR (Y1 to Y2)
On-board link W915 is a clippable connection which connects terminals Y1 and Y2 on the integrated control board. W915 must be cut if two-stage cooling will be used. If the link is not cut the outdoor unit will operate in second-stage cooling only.

Status LEDs (SPEED, CFM, E-COM)
The green SPEED LED indicates circulating blower speed in response to the DS signal. The LED is lit during normal blower operation and is off during a dehumidification demand. In Harmony III applications, the brightness of the LED indicates the requested blower speed.

The green CFM LED indicates the blower air flow. Count the number of blinks between the two-second pauses to determine the CFM. Each blink represents approximately 100 CFM.

The green E-COM LED indicates that the control is receiving and processing of commands and inputs. The LED may flash rapidly or may display a single flash, depending upon the activity.

SL280DF070V36A BLOWER PERFORMANCE (less filter)
0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

"ADJUST" Switch Positions	Speed Switch Positions							
	Second Stage "HEAT" Speed - cfm				Second Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1007	1036	1192	1241	1015	1100	1240	1425
[1] NORM	915	942	1084	1128	920	1010	1115	1300
—	824	848	976	1015	800	900	1020	1165
"ADJUST" Switch Positions	First Stage "HEAT" Speed - cfm				First Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	891	944	1109	1130	665	755	870	1010
[1] NORM	810	858	1008	1027	615	680	775	920
—	729	772	907	924	535	615	690	810

SL280DF090V48B BLOWER PERFORMANCE (less filter)
0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

"ADJUST" Switch Positions	Speed Switch Positions							
	Second Stage "HEAT" Speed - cfm				Second Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1384	1440	1724	1925	930	1285	1525	1745
[1] NORM	1258	1309	1567	1750	855	1160	1410	1605
—	1132	1178	1410	1575	790	1085	1245	1445
"ADJUST" Switch Positions	First Stage "HEAT" Speed - cfm				First Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1251	1324	1593	1767	740	930	1090	1200
[1] NORM	1137	1204	1448	1606	710	880	1000	1135
—	1023	1084	1303	1445	665	845	930	1025

SL280DF090V60C BLOWER PERFORMANCE (less filter)
0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

"ADJUST" Switch Positions	Speed Switch Positions							
	Second Stage "HEAT" Speed - cfm				Second Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1329	1440	1579	1745	1580	1770	2000	2270
[1] NORM	1208	1309	1435	1586	1420	1605	1840	2045
—	1087	1178	1292	1427	1305	1390	1640	1875
"ADJUST" Switch Positions	First Stage "HEAT" Speed - cfm				First Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1218	1367	1471	1598	1110	1260	1410	1600
[1] NORM	1107	1243	1337	1453	1020	1110	1305	1440
—	996	1119	1203	1308	925	1010	1130	1290

SL280DF110V60C BLOWER PERFORMANCE (less filter)
0 through 0.8 in. w.g. (Heating) and 0 through 1.0 in. w.g. (Cooling) External Static Pressure Range

"ADJUST" Switch Positions	Speed Switch Positions							
	Second Stage "HEAT" Speed - cfm				Second Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1497	1607	1901	2041	1500	1755	1910	2120
[1] NORM	1361	1461	1728	1855	1360	1585	1765	1955
—	1225	1315	1555	1670	1225	1400	1595	1760
"ADJUST" Switch Positions	First Stage "HEAT" Speed - cfm				First Stage "COOL" Speed - cfm			
	1	[1] 2	3	4	1	2	3	[1] 4
+	1381	1460	1737	1905	1055	1230	1365	1525
[1] NORM	1255	1327	1579	1732	975	1115	1250	1400
—	1130	1194	1421	1559	895	1005	1130	1245

[1] Factory default jumper setting.

NOTES - The effect of static pressure is included in air volumes shown.

First stage HEAT is approximately **91%** of the same second stage HEAT speed position.

First stage COOL (two-stage air conditioning units only) is approximately **70%** of the same second stage COOL speed position.

Continuous Fan Only speed is approximately **38%** of the same second stage COOL speed position - minimum 500 cfm.

Lennox Harmony III™ Zoning System - Minimum blower speed is 426 cfm.

TABLE 10
SL280DFV, ComfortSense® and SINGLE STAGE OUTDOOR UNIT

OPERATING SEQUENCE		SYSTEM DEMAND							SYSTEM RESPONSE		
System Condition	Step	Thermostat Demand					Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		Y1	O	G	W1		Status	D			
NO CALL FOR DEHUMIDIFICATION											
Normal Operation	1	On	On	On			Acceptable	24 VAC	High	100%	Compressor and indoor blower follow thermostat demand
BASIC MODE (only active on a Y1 thermostat demand)											
Normal Operation	1	On	On	On			Acceptable	24 VAC	High	100%	ComfortSense® 7000 thermostat energizes Y1 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On			Demand	0 VAC	High	60%, 65%, 70%*	
PRECISION MODE (operates independent of a Y1 thermostat demand)											
Normal Operation	1	On	On	On			Acceptable	24 VAC	High	100%	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On			Demand	0 VAC	High	60%, 65%, 70%*	
Dehumidification call ONLY	1	On	On	On			Demand	0 VAC	High	60%, 65%, 70%*	ComfortSense® 7000 thermostat will try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint**
	Jumpers at indoor unit with a single stage outdoor unit With Condensing unit - Cut W914 (R to DS) on SureLight® board With Heat Pump - Cut W914 (R to DS) & W951 (R to O) on SureLight® board										

ComfortSense® 7000 thermostat to use for this application - Y2081 4 heat / 2 cool

**Dehumidification blower speed is 70% of COOL speed for all units .*

***In Precision mode, ComfortSense® 7000 thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.*

TABLE 11
SL280DFV, ComfortSense® 7000 thermostat and TWO STAGE OUTDOOR UNIT

OPERATING SEQUENCE		SYSTEM DEMAND								SYSTEM RESPONSE		
System Condition	Step	Thermostat Demand						Relative Humidity		Compressor	Blower CFM (COOL)	Comments
		Y1	Y2	O	G	W1	W2	Status	D			
NO CALL FOR DEHUMIDIFICATION												
Normal Operation - Y1	1	On		On	On			Acceptable	24 VAC	Low	60%, 65% 70%*	Compressor and indoor blower follow thermostat demand
Normal Operation - Y2	2	On	On	On	On			Acceptable	24 VAC	High	100%	
ROOM THERMOSTAT CALLS FOR FIRST STAGE COOLING												
BASIC MODE (only active on a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	60%, 65% 70%*	ComfortSense® 7000 thermostat energizes Y2 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	60%, 65% 70%**	
PRECISION MODE (operates independent of a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	60% 65% 70%*	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On	On			Demand	0 VAC	High	60% 65% 70%**	
Dehumidification call ONLY	1	On	On	On	On			Demand	0 VAC	High	60% 65% 70%**	ComfortSense® 7000 thermostat will try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint***
ROOM THERMOSTAT CALLS FOR FIRST AND SECOND STAGE COOLING												
BASIC MODE (only active on a Y1 thermostat demand)												
Normal Operation	1	On	On	On	On			Acceptable	24 VAC	High	100%	ComfortSense® 7000 thermostat energizes Y2 and de-energizes D on a call for de-humidification
Dehumidification Call	2	On	On	On	On			Demand	0 VAC	High	60% 65% 70%**	
PRECISION MODE (operates independent of a Y1 thermostat demand)												
Normal Operation	1	On		On	On			Acceptable	24 VAC	Low	60% 65% 70%*	Dehumidification mode begins when humidity is greater than set point
Dehumidification call	2	On	On	On	On			Demand	0 VAC	High	60% 65% 70%**	
Dehumidification call ONLY	1	On	On	On	On			Demand	0 VAC	High	60% 65% 70%**	ComfortSense® 7000 thermostat will try to maintain room humidity setpoint by allowing the room space to maintain a cooler room thermostat setpoint***
	Jumpers at indoor unit with a two stage outdoor unit Cut factory jumper from Y1 to Y2 or cut W915 (Y1 to Y2) With Condensing unit - Cut W914 (R to DS) on SureLight® board With Heat Pump - Cut W914 (R to DS) & W951 (R to O) on SureLight® control											

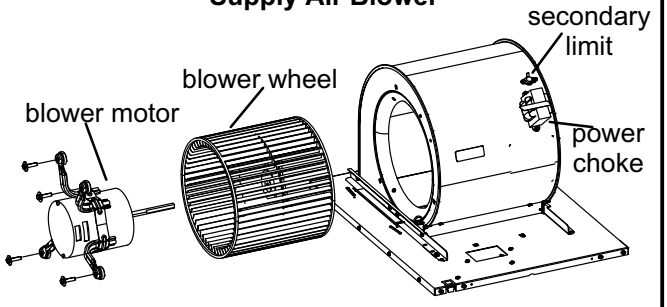
ComfortSense® 7000 thermostat to use for this application - Y2081 4 heat / 2 cool

**Normal operation first stage cooling blower speed is 70% COOL speed.*

***Dehumidification blower speed is, reduced to 70% of COOL.*

****In Precision mode, ComfortSense® 7000 thermostat will maintain room temperature up to 2 °F (1.2°C) cooler than room setting.*

5. Blower Motor



To Remove Blower From Unit:
1. Disconnect Power, 2. Remove internal flue pipe and chase 3. Remove Control Box 4. Remove Bolts. 5. Unplug Motor Wires From Control Board. Then Slide Out Front of Unit.

FIGURE 6

Blower Motor (B3)

SL280DFV units use 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 (figure 7). Because this motor has a permanent magnet rotor it does not need brushes like conventional D.C. motors. Internal components are shown in figure 8. The stator windings are split into three poles which are electrically connected to the controller. This arrangement allows motor windings to turn on and off in sequence by the controller.

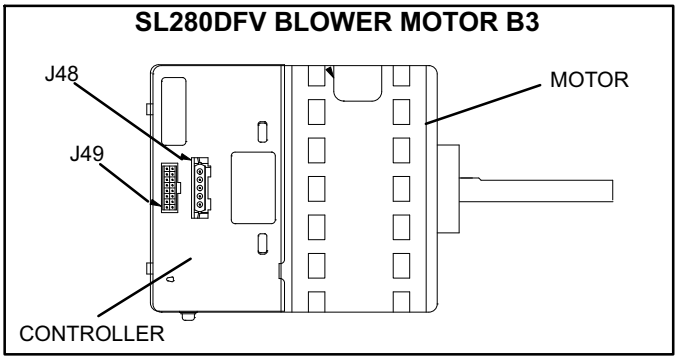


FIGURE 7

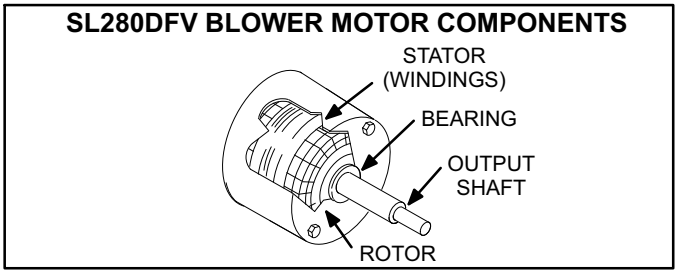


FIGURE 8

A solid-state controller is permanently attached to the motor. 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 sense 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.

All SL280DFV blower motors use single phase power. An external run capacitor is not used. The motor uses permanently lubricated ball-type bearings.

Internal Operation

Each time the controller switches a stator winding 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 11), 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 motor controller is driven by the Two-stage Variable Speed Integrated control. The control receives its demand (PWM signal or fixed 24 VAC or VDC signal) from optional controls such as the Harmony III zoning system, 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 as shown in Blower Ratings Tables. The cfm remains relatively stable over a broad range of static pressure. Since the blower constantly adjusts rpm to maintain a specified cfm, motor rpm is not rated. Hence, the terms “cool speed”, “heat speed ” or “speed tap” in this manual, on the unit wiring diagram and on blower B3, 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 B3, 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.

Motor Start-Up

When B3 begins start-up, the motor gently vibrates 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.

⚠ 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.

External Operation (Speed Tap Priority)

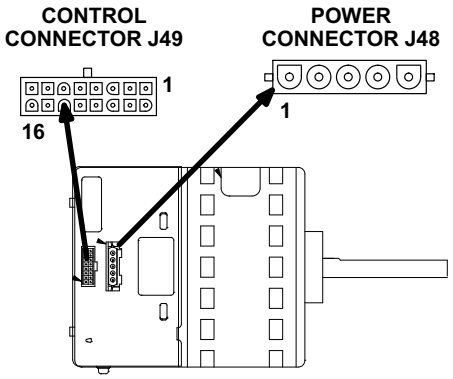
Figure 9 show the two quick-connect jacks (J48 and J49) which connect the motor to the SL280DFV. Jack J48 is the power plug and jack J49 connects the unit controls to the motor.

Jack J48 is the power plug. Line voltage must be applied to J48 pins 4 and 5 in order for the motor to operate. When using 120VAC pins 1 and 2 must be jumpered.
Jack J49 connects the unit controls to the motor. 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.

Troubleshooting

See figure 10 for troubleshooting using 24 volts. Another option is to use the TECMate PRO. The TECMate PRO isolates the motor from the integrated control. Follow the instructions provided with the kit.

BLOWER B3 HARNESS CONNECTORS



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 9

Precautions

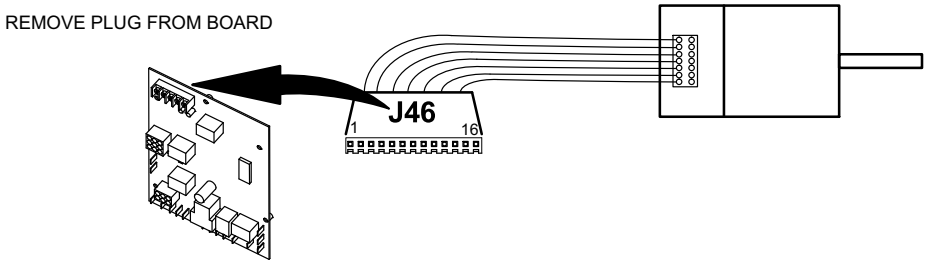
If the SL280DFV or its electronically controlled blower motor is improperly or inadequately grounded, it may cause television interference (commonly known as RFI or radio frequency interference).

This interference is caused by internal switching frequencies of the motor controller. 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.

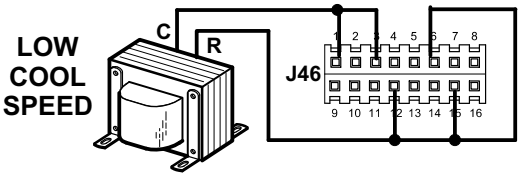
TV interference may be stopped by making sure the motor is solidly grounded to the cabinet (metal to metal) and by making sure the cabinet is solidly grounded. If TV interference persists, make sure the television (and all affected RF appliances) are moved away from the SL280DFV. Also make sure affected appliances are connected to a separate electrical circuit.

TWO STAGE VARIABLE SPEED CONTROL

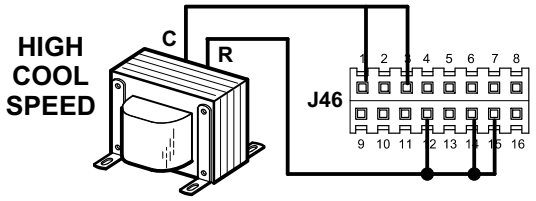
120V to the motor must not be interrupted. All connections for check out will be from 24VAC to plug J46, after disconnecting from blower control board.



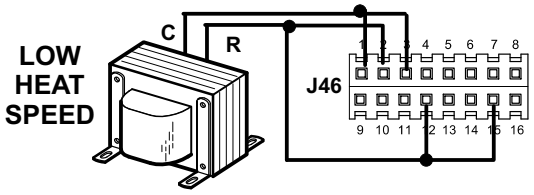
If transformer T1 is used, double check all wiring connections before placing unit back in operation.



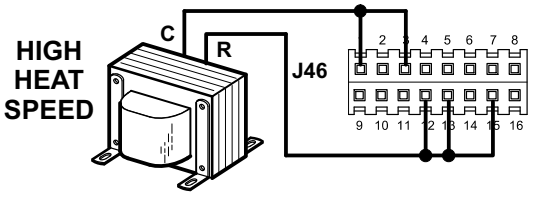
1 Disconnect power to unit.
2 Disconnect plug J46 from P46 located on the blower control board.
3 Connect voltage source as shown above.
4 Turn on power to unit. Blower should operate at low cool speed.



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.



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.



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 10

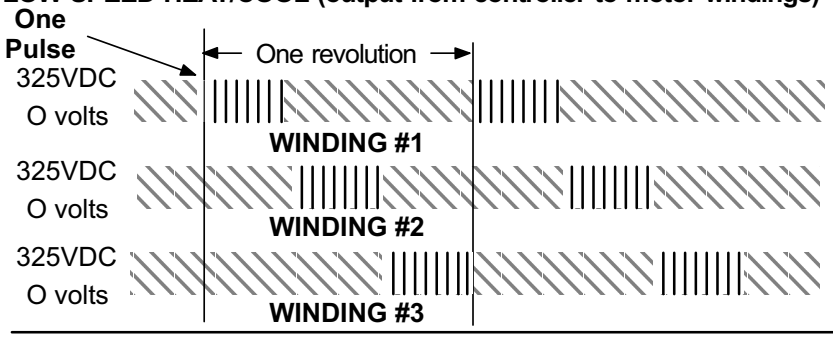
MOTOR SPEED CONTROL WITH D.C. PULSE-WIDTH MODULATION

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

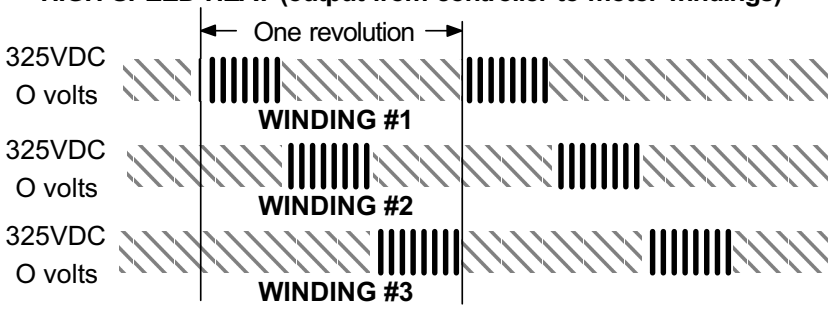
OUTPUT FROM CONTROLLER TO MOTOR WINDINGS	
WINDINGS TURNED OFF	**WINDINGS TURNED ON**
	ON PULSE **OFF PULSE**

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)

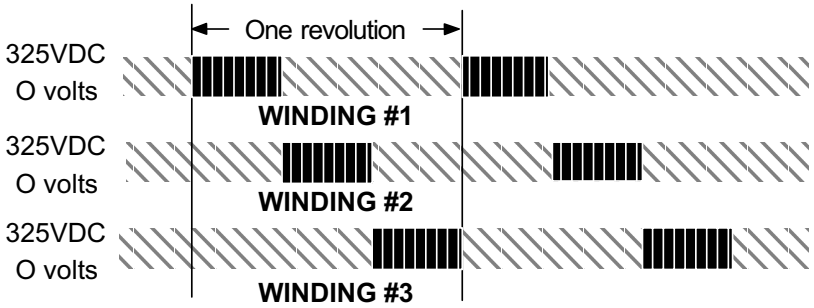


FIGURE 11

6. Ignitor

The SureLight® ignitor is made of durable silicon nitride. Ignitor longevity is enhanced by controlling voltage to the ignitor. The integrated control provides a regulated 95 volts to the ignitor for a consistent ignition and long ignitor life. Due to this feature of the control, voltage measured with a digital meter will be slightly lower. To measure correct voltage use a true RMS meter or ignitor can be ohmed. Ohm value should be 25 to 47. See figure 12 for ignitor location.

NOTE - *The SL280DFV furnace contains electronic components that are polarity sensitive. Make sure that the furnace is wired correctly and is properly grounded.*

7. Flame Sensor

A flame sensor is located on the left side of the burner support. See figure 12. The sensor is tip protrudes into the flame envelope of the left-most burner. The sensor can be removed for service without removing any part of the burners. During operation, flame is sensed by current passed through the flame and sensing electrode. The SureLight control allows the gas valve to remain open as long as flame signal is sensed.

8. Gas Valve

All units use a two-stage gas valve manufactured by Honeywell (figure 14). The valve is internally redundant to assure safety shut-off. If the gas valve must be replaced, the same type valve must be used.

24VAC terminals and gas control knob are located on the valve. All terminals on the gas valve are connected to wires from the electronic ignition control. 24V applied to the terminals energizes the valve.

Inlet and outlet pressure taps are located on the valve. A regulator adjustment screw is located on the valve.

LPG change over kits are available from Lennox.

9. Flame Rollout Switches (S47)

Flame rollout switch is a high temperature limit located on top of the burner box. See figure 12. The limit is a N.C. SPST manual-reset limit connected in series with the secondary limit S21. When S47 senses rollout, the circuit breaks and the ignition control immediately stops ignition and closes the gas valve. Rollout can be caused by a blocked heat exchanger, flue or lack of combustion air. The switch is factory set to trip (open) at 210°F and cannot be adjusted. The switch can be manually reset. To manually reset a tripped switch, push the reset button located on the control.

10. Burners

All units use inshot burners. Burners are factory set and require no adjustment. Always operate the unit with the burner box front panel in place. Each burner uses an orifice (see table 16 for orifice size) that is precisely matched to the burner input. Burners can be removed as a one piece assembly for service. If burner assembly has been removed, it is critical to align center of each burner to the center of the clamshell when re-installing. See more detail in Section VI- MAINTENANCE sub-section E- Heat Exchanger and Burners.

11. Primary Limit Control (S10)

The primary limit (S10) is located in the heating vestibule panel. When excess heat is sensed in the heat exchanger, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch must reset within three minutes or the SureLight control will go into Watch guard for one hour. The switch is factory set and cannot be adjusted. The switch may have a different set point for each unit model number. If limit switch must be replaced, see Lennox Repair Parts Handbook for correct replacement.

12. Secondary Limit Controls (S21)

The secondary limit (S21) is located in the blower compartment on the front side of the blower housing. When excess heat is sensed in the blower compartment, the limit will open. If the limit is open, the furnace control energizes the supply air blower and closes the gas valve. The limit automatically resets when unit temperature returns to normal. The switch must reset within three minutes or the SureLight control will go into Watch guard for one hour. The switch is factory set and cannot be adjusted.

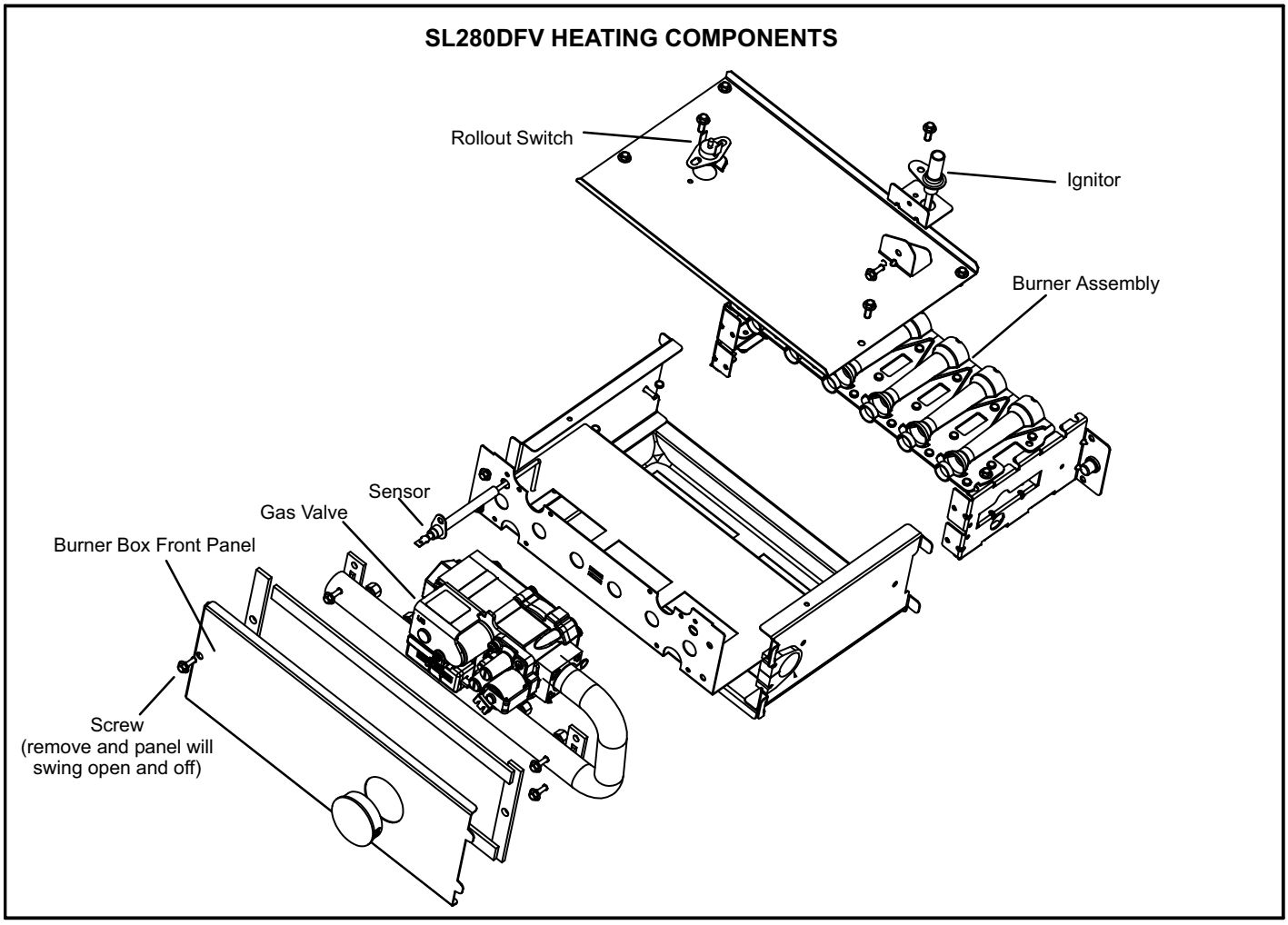


FIGURE 12

13. Combustion Air Inducer (B6)

All units use a two-stage combustion air inducer to move air through the burners and heat exchanger during heating operation. The blower uses a 120VAC motor. The motor operates during all heating operation and is controlled by furnace / blower control A92. The inducer also operates for 15 seconds before burner ignition (pre-purge) and for 5 seconds after the gas valve closes (post-purge). The inducer operates on low speed during first-stage heat, then switches to high speed for second stage heat.

NOTE - *Each furnace model uses a unique CAI. Refer to Lennox Repair Parts listing for correct inducer for replacement.*

A pressure switch connected to the combustion air inducer orifice plate is used to prove inducer operation. The combustion air inducer orifice will be different for each model. See table 12 for orifice sizes. The switch monitors air pressure in the inducer housing. During normal operation, the pressure in the housing is negative. If pressure becomes less negative (signifying an obstruction) the proving switch opens. When the proving switch opens, the furnace control (A92) immediately closes the gas valve to prevent burner operation.

TABLE 12

SL280DFV Unit	C.A.I. Orifice Size
-070	1.375
-090	1.625
-110	1.844

14. Combustion Air Inducer Pressure Switch (S18)

S18 is a dual combustion air pressure switch (first and second stage) located on the combustion air inducer orifice bracket. The switch is connected to the combustion air inducer housing by means of a flexible silicone hose. It monitors negative air pressure in the combustion air inducer housing.

The switches are a single-pole single-throw proving switch electrically connected to the furnace control. The purpose of the switch is to prevent burner operation if the combustion air inducer is not operating or if the flue becomes obstructed.

On heat demand (first or second stage) the switch senses that the combustion air inducer is operating. It closes a circuit to the furnace control when pressure inside the combustion air inducer decreases to a certain set point.

Set points vary depending on unit size. See table 13. The pressure sensed by the switch is negative relative to atmospheric pressure. If the flue becomes obstructed during operation, the switch senses a loss of negative pressure (pressure becomes more equal with atmospheric pressure) and opens the circuit to the furnace control and gas valve. A bleed port on the switch allows relatively dry air in the vestibule to purge switch tubing, to prevent condensate build up.

NOTE - *The switch is factory set and is not field adjustable. It is a safety shut-down control in the furnace and must not be by-passed for any reason. If switch is closed or by-passed, the control will not initiate ignition at start up.*

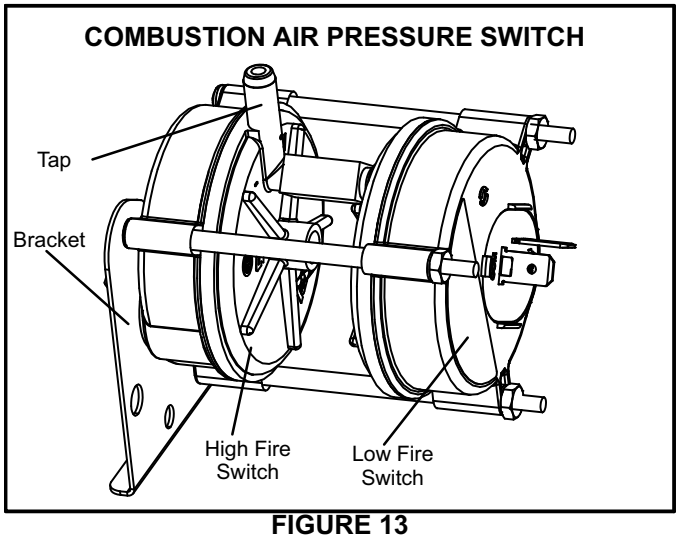


FIGURE 13

TABLE 13

SL280DFV Unit	Set Point High Heat	Set Point Low Heat
-070	0.55	0.20
-090	0.55	0.20
-110	0.25	0.60

II-PLACEMENT AND INSTALLATION

Make sure unit is installed in accordance with installation instructions and applicable codes.

III-START-UP

A-Preliminary and Seasonal Checks

1 - Inspect electrical wiring, both field and factory installed for loose connections. Tighten as required.

2 - Check voltage at disconnect switch. Voltage must be within range listed on the nameplate. If not, consult the power company and have voltage condition corrected before starting unit.

B-Heating Start-Up

⚠ WARNING

Shock and burn hazard.

SL280DFV units are equipped with a hot surface ignition system. Do not attempt to light manually.

1 - **STOP**! Read the safety information at the beginning of this section.

2 - Set the thermostat to the lowest setting.

3 - Turn off all electrical power to the unit.

4 - This furnace is equipped with an ignition device which automatically lights the burners. Do **not** try to light the burners by hand.

5 - Remove the upper access panel.

6 - Turn switch on gas valve clockwise to **OFF**. Do not force. See figure 14.

7 - Wait five minutes to clear out any gas. If you then smell gas, STOP! Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions. If you do not smell gas go to next step.

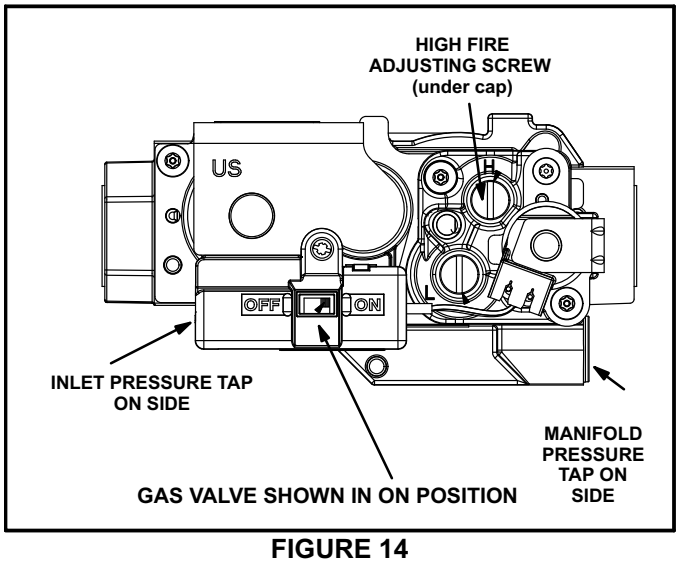


FIGURE 14

8 - Turn switch on gas valve counterclockwise to **ON**. Do not force. See figure 14.

9 - Replace the upper access panel.

10- Turn on all electrical power to to the unit.

11- Set the thermostat to desired setting.

NOTE - When unit is initially started, steps 1 through 11 may need to be repeated to purge air from gas line.

Turning Off Gas To Unit

1 - Set thermostat to lowest setting.

2 - Turn off all electrical power to unit if service is to be performed.

3 - Remove access panel.

4 - Turn switch on gas valve clockwise to **OFF**. Do not force.

5 - Replace access panel.

Failure To Operate

If the unit fails to operate, check the following:

1 - Is the thermostat calling for heat?

2 - Are access panels securely in place?

3 - Is the main disconnect switch closed?

4 - Is there a blown fuse or tripped circuit breaker?

5 - Is the filter dirty or plugged? Dirty or plugged filters will cause the limit control to shut the unit off.

6 - Is gas turned on at the meter?

7 - Is the manual main shut-off valve open?

8 - Is the internal manual shut-off valve open?

9 - Is the unit ignition system in lock out? If the unit locks out again, call the service technician to inspect the unit for blockages.

10 -Is pressure switch closed? Obstructed flue will cause unit to shut off at pressure switch. Check flue and outlet for blockages.

11 -Are flame rollout switches tripped? If flame rollout switches are tripped, call the service technician for inspection.

C-Safety or Emergency Shutdown

Turn off unit power. Close manual and main gas valves.

D-Extended Period Shutdown

Turn off thermostat or set to "UNOCCUPIED" mode. Close all gas valves (both internal and external to unit) to guarantee no gas leak into combustion chamber. Turn off power to unit. All access panels and covers must be in place and secured.

IV-HEATING SYSTEM SERVICE CHECKS

A-CSA Certification

All units are CSA design certified without modifications. Refer to the SL280DFV Installation Instruction.

B-Gas Piping

⚠ CAUTION

If a flexible gas connector is required or allowed by the authority that has jurisdiction, black iron pipe shall be installed at the gas valve and extend outside the furnace cabinet. The flexible connector can then be added between the black iron pipe and the gas supply line.

⚠ WARNING

Do not exceed 600 in-lbs (50 ft-lbs) torque when attaching the gas piping to the gas valve.

Gas supply piping should not allow more than 0.5"W.C. drop in pressure between gas meter and unit. Supply gas pipe must not be smaller than unit gas connection.

Compounds used on gas piping threaded joints should be resistant to action of liquefied petroleum gases.

C-Testing Gas Piping

⚠ IMPORTANT

In case emergency shutdown is required, turn off the main shut-off valve and disconnect the main power to unit. These controls should be properly labeled by the installer.

When pressure testing gas lines, the gas valve must be disconnected and isolated. Gas valves can be damaged if subjected to more than 0.5 psig (14" W.C.). See figure 15. If the pressure is equal to or less than 0.5psig (14"W.C.), use the manual shut-off valve before pressure testing to isolate furnace from gas supply.

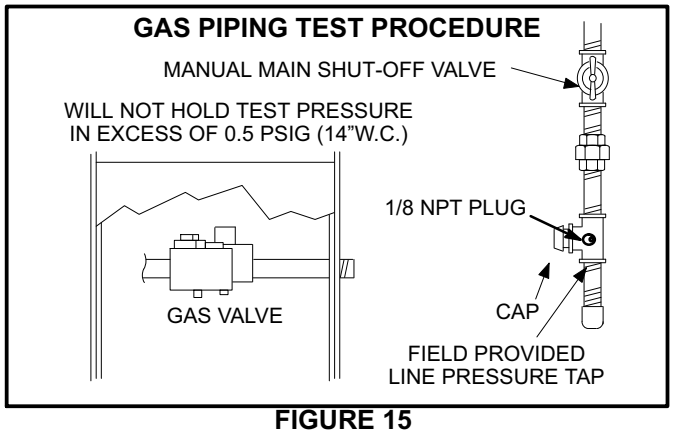


FIGURE 15

When checking piping connections for gas leaks, use preferred means. Kitchen detergents can cause harmful corrosion on various metals used in gas piping. Use of a specialty Gas Leak Detector is strongly recommended. It is available through Lennox under part number 31B2001. See Corp. 8411-L10, for further details.

Do not use matches, candles, flame or any other source of ignition to check for gas leaks.

D-Testing Gas Supply Pressure

When testing supply gas pressure, connect test gauge to inlet pressure tap (field provided). See figure 15. Check gas line pressure with unit firing at maximum rate. Low pressure may result in erratic operation or underfire. High pressure can result in permanent damage to gas valve or overfire. See table 16 for operating pressure at unit gas connection (line).

On multiple unit installations, each unit should be checked separately, with and without units operating. Supply pressure must fall within range listed in table 16.

E-Check Manifold Pressure

After line pressure has been checked and adjusted, check manifold pressure. Move pressure gauge to outlet pressure tap located on unit gas valve (GV1). Checks of manifold pressure are made as verification of proper regulator adjustment. Manifold pressure can be measured at any time the gas valve is open and is supplying gas to the unit. See table 16 for normal operating manifold pressure.

⚠ IMPORTANT

For safety, connect a shut-off valve between the manometer and the gas tap to permit shut off of gas pressure to the manometer.

The gas valve is factory set and should not require adjustment. All gas valves are factory regulated.

Manifold Adjustment Procedure:

1 - Connect test gauge to manifold pressure tap (figure 14) on gas valve.
2 - Ignite unit on high fire and let run for 5 minutes to allow for steady state conditions.
3 - After allowing unit to stabilize for 5 minutes, record manifold pressure and compare to value given in table 16.
4 - If necessary, make adjustments. Figure 14 shows location of high fire adjustment screw.
5 - If an adjustment is made on high fire, re-check manifold pressure on low fire. *Do not adjust low fire manifold pressure.* If low fire manifold pressure is more than 1/2" above or below value specified in table 16, replace valve.

⚠ IMPORTANT

For safety, shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.

F- Proper Gas Flow (Approximate)

Furnace should operate at least 5 minutes before checking gas flow. Determine time in seconds for **two** revolutions of gas through the meter. (Two revolutions assures a more accurate time.) **Divide by two** and compare to time in table 14 below. If manifold pressure matches table 16 and rate is incorrect, check gas orifices for proper size and restriction.

NOTE- To obtain accurate reading, shut off all other gas appliances connected to meter.

TABLE 14

GAS METER CLOCKING CHART				
SL280DF Unit	Seconds for One Revolution			
	Natural		LP	
	1 cu ft Dial	2 cu ft Dial	1 cu ft Dial	2 cu ft DIAL
-045	80	160	200	400
-70	55	110	136	272
-90	41	82	102	204
-110	33	66	82	164
-135	27	54	68	136
Natural-1000 btu/cu ft LP-2500 btu/cu ft				

⚠ IMPORTANT

For safety, shut unit off and remove manometer as soon as an accurate reading has been obtained. Take care to replace pressure tap plug.

G- Proper Combustion

Furnace should operate minimum 15 minutes with correct manifold pressure and gas flow rate before checking combustion. See sections E- and F-. Take combustion sample beyond the flue outlet and compare to the table below. The maximum carbon monoxide reading should not exceed 50 ppm.

TABLE 15

Firing Rate	CO_2% For Nat	CO_2% For L.P.
High Fire	6.0 - 7.4	6.9 - 8.4
Low Fire	4.8 - 6.0	5.7 - 7.0
The carbon monoxide reading should not exceed 50 ppm.		

H-High Altitude

The manifold pressure, gas orifice and pressure switch may require adjustment or replacment to ensure proper operation at higher altitudes. See table 16 for manifold pressures and table 17 for pressure switch and gas conversion kits.

Table 16
Manifold Pressure Settings

Unit Input	Gas	Orifice Size 0 - 7500 ft.[1]	Orifice Size 7501 - 10,000 ft.	Manifold Pressure in. w.g. 0-4500 ft.		Manifold Pressure in. w.g. 4501-7500 ft.		Manifold Pressure in.wg. 7501-10,000 ft.[2]		Supply Line Pressure in. w.g.	
				Low Fire	High Fire	Low Fire	High Fire	Low Fire	High Fire	Min	Max
070	Natural	.063	.055	1.7	3.5	1.6	3.4	1.7	3.5	4.5	13.0
	LP/propane[3]	.039	.037	4.9	10.0	4.9	10.0	4.9	10.0	11.0	13.0
090	Natural	.063	.055	1.7	3.5	1.5	3.0	1.7	3.5	4.5	13.0
	LP/propane[3]	.039	.037	4.9	10.0	4.9	10.0	4.9	10.0	11.0	13.0
110	Natural	.063	.055	1.7	3.5	1.5	3.2	1.7	3.5	4.5	13.0
	LP/propane[3]	.039	.037	4.9	10.0	4.9	10.0	4.9	10.0	11.0	13.0

[1] This is the only permissible derate for these units.

[2] Natural gas high altitude orifice kit required.

[3] A natural to L.P. propane gas changeover kit is necessary to convert this unit. Refer to the changeover kit installation instruction for the conversion procedure.

NOTE - Units may be installed at altitudes up to 4500 ft. above sea level without modifications.

TABLE 17
High Altitude Pressure Switch and Gas Conversion Kits

Unit Input	High Altitude Pressure Switch Kit			High Altitude Natural Gas Orifice Kit	Natural Gas to LP/ Propane Kit		LP/Propane to Natural Gas Kit
	0 - 4500 ft.	4501 - 7500 ft	7501 - 10,000 ft.	7501 - 10,000 ft.	0 - 7500 ft.	7501 - 10,000 ft.	0 - 7500 ft.
070	No Change	No Change	73W36	73W37	51W02	73W38	69W79
090	No Change	No Change	73W36	73W37	51W02	73W38	69W79
110	No Change	No Change	73W35	73W37	51W02	73W38	69W79

I-Flame Signal

A microamp DC meter is needed to check the flame signal on the ignition control.

Flame (microamp) signal is an electrical current which passes from the furnace control through the sensor during unit operation. Current passes from the sensor through the flame to ground to complete a safety circuit.

To Measure Flame Signal - Ignition Control:

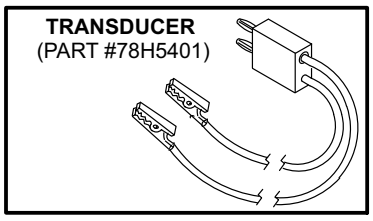


FIGURE 16

if meter used will not read a low micro amp signal. A transducer (Part #78H5401 available from Lennox Repair Parts) is required to measure flame signal See figure 16. The transducer converts microamps to volts on a 1:1 conversion. See table 18 for flame signal. A digital readout meter must be used. The transducer plugs into most meters. See figure 18 for proper use of transducer.

1 - Set the volt meter to the DC voltage scale. Insert transducer into the VDC and common inputs. Observe correct polarities. Failure to do so results in negative (-) values.

2 - Turn off supply voltage to control.

3 - Disconnect ignition control flame sensor wire from the flame sensor.

4 - Connect (-) lead of the transducer to flame sensor.

5 - Connect (+) lead of transducer to the ignition control sensor wire.

6 - Turn supply voltage on and close thermostat contacts to cycle system.

7 - When main burners are in operation for two minutes, take reading. Remember 1 DC volt = 1 DC microamp.

TABLE 18

Normal Flame Signal	$\geq$ 1.50 Microamps
Low Flame Signal	$\leq$ 1.40 Microamps
Drop Out Signal	= 0.20 Microamps

V-TYPICAL OPERATING CHARACTERISTICS

A-Blower Operation and Adjustment

When the thermostat is set to “FAN ON,” the indoor blower will run continuously at approximately 38% of the second-stage cooling speed when there is no cooling or heating demand.

When the SL280DFV is running on high fire or low fire (low fire is 91% of high fire), the indoor blower will run on the heating speed designated by the positions of DIP switches 11 and 12.

When the SL280DFV is running on second-stage cool or first-stage cool (second-stage cool is 70% of first-stage cool), the indoor blower will run on the cooling speed designated by the positions of DIP switches 5 and 6.

B-Temperature Rise

Temperature rise for SL280DFV units depend on unit input, blower speed, blower horsepower and static pressure as marked on the unit rating plate. The blower speed must be set for unit operation within the range of “TEMP. RISE °F” listed on the unit rating plate for high fire and low fire.

To Measure Temperature Rise:

1 - Place plenum thermometers in the supply and return air plenums. Locate supply air thermometer in the first horizontal run of the plenum where it will not pick up radiant heat from the heat exchanger.

2 - Set thermostat to highest setting. Confirm unit is on high fire by checking rate.

3 - After plenum thermometers have reached their highest and steadiest readings, subtract the two readings. The difference should be in the range listed on the unit rating plate. If the temperature is too low, decrease blower speed.

4 - Repeat on low fire. *Do not adjust low fire manifold pressure.*

C-External Static Pressure

1 - Tap locations shown in figure 17.

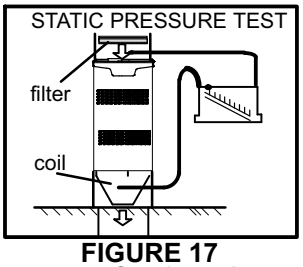


FIGURE 17

2 - Punch a 1/4” diameter hole in supply and return air plenums. Insert manometer hose flush with inside edge of hole or insulation. Seal around the hose with permagum. Connect the zero end of the manometer to the discharge (supply) side of the system. On ducted systems, connect the other end of manometer to the return duct as above. Open all return air registers and check for clean filter.

3 - With only the blower motor running and the evaporator coil dry, observe the manometer reading. Adjust blower motor speed to deliver the air desired according to the job requirements. For heating speed external static pressure drop must not be more than 0.8” W.C. For cooling speed external static pressure drop must not be more than 1.0” W.C.

4 - Seal the hole when the check is complete.

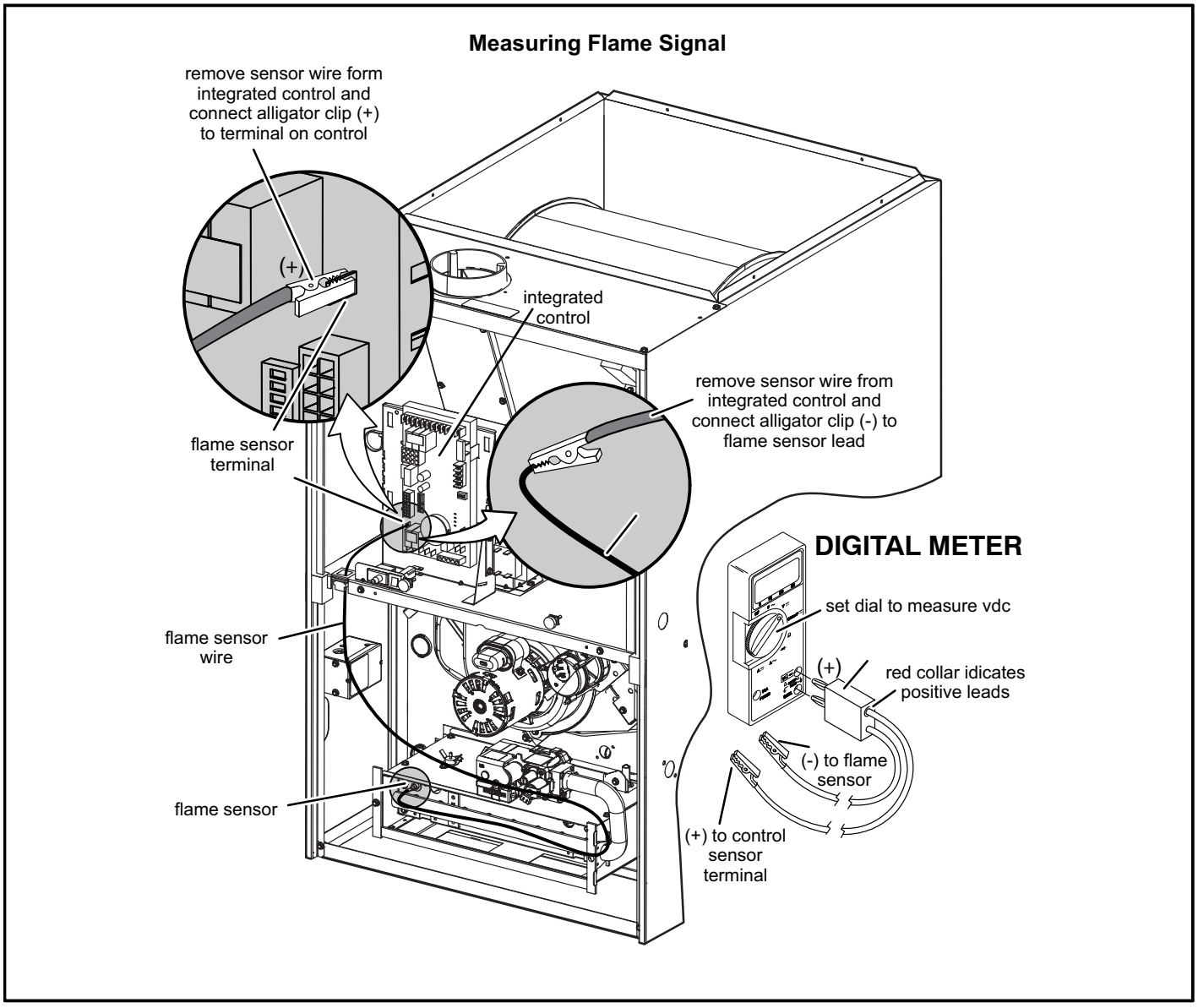


FIGURE 18

VI-MAINTENANCE

⚠WARNING

Disconnect power before servicing unit.

⚠CAUTION

Label all wires prior to disconnection when servicing controls. Wiring errors can cause improper and dangerous operation. Verify proper operation after servicing.

At the beginning of each heating season, a qualified technician should check the system as follows:

A-Blower

Check the blower wheel for debris and clean if necessary. The blower motors are prelubricated for extended bearing life. No further lubrication is needed.

⚠WARNING

The inner blower access panel and vent pipe must be securely in place when the blower and burners are operating. Gas fumes, which could contain carbon monoxide, can be drawn into living space resulting in personal injury or death.

B-Filters

All filters are installed external to the unit. Filters should be inspected monthly. Clean or replace the filters when necessary to ensure that the furnace operates properly. Replacement filters must be rated for high velocity airflow.

C-Flue and Chimney

Check the flue pipe, chimney and all connections for tightness and to make sure there is no blockage.

A “Disconnected Vent” warning sticker should be attached to a visible area of the plenum near the vent pipe. If the sticker is not legible or missing, order kit 66W04 for replacement stickers.

D-Electrical

1 - Check all wiring for loose connections.

2 - Check for the correct voltage at the furnace (furnace operating). Correct voltage is 120VAC ± 10%

3 - Check amp-draw on the blower motor with inner blower access panel in place
Unit Nameplate_____Actual_____

E-Heat Exchanger and Burners

Cleaning the Heat Exchanger and Burners

NOTE - Use papers or protective covering in front of the furnace during cleaning.

1 - Turn off both electrical and gas power supplies to furnace.

2 - Remove flue pipe, top cap, flue chase and internal flue pipe assembly from the unit.

3 - Label the wires from gas valve, rollout switches, primary limit switch and make-up box then disconnect them.

4 - Remove the screws that secure the combustion air inducer/pressure switch assembly to the collector box. Carefully remove the combustion air inducer to avoid damaging blower gasket. If gasket is damaged, it must be replaced to prevent leakage.

5 - Remove the collector box located behind the combustion air inducer. Be careful with the collector box gasket. If the gasket is damaged, it must be replaced to prevent leakage.

6 - Disconnect gas supply piping. Remove the screw securing the burner box cover and remove cover. Remove the four screws securing the burner manifold assembly to the vestibule panel and remove the assembly from the unit.

7 - Remove screws securing burner box and remove burner box.

8 - Remove screws from both sides, top and bottom of vestibule panel.

9 - Remove heat exchanger. It may be necessary to spread cabinet side to allow more room. If so, remove five screws from the left side or right side of cabinet. See figure 20.

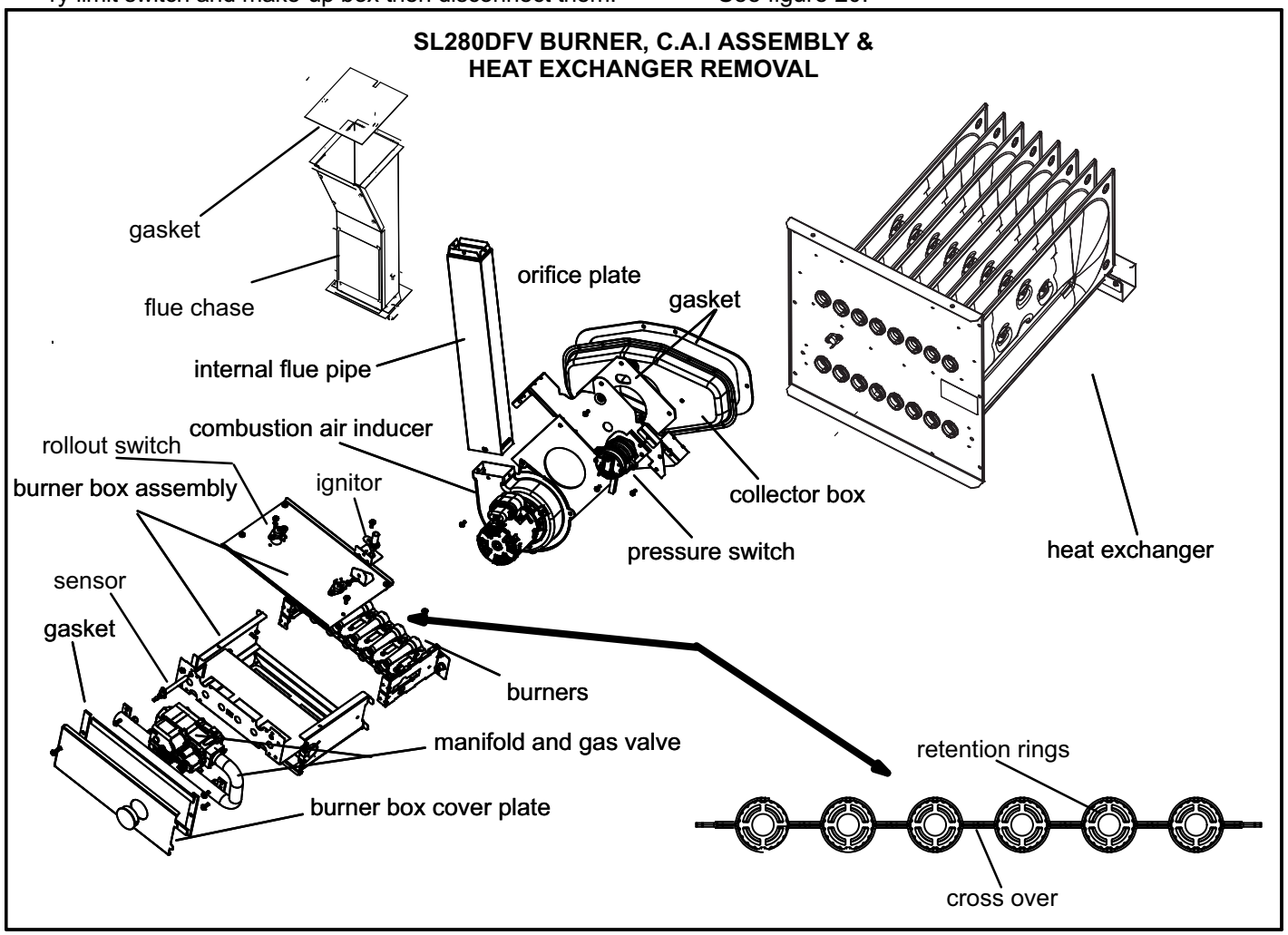


FIGURE 19

10- Back wash using steam. Begin from the burner opening on each clam. Steam must not exceed 275°F.

11- To clean burners, run a vacuum cleaner with a soft brush attachment over the face of burners. Visually inspect inside the burners and crossovers for any blockage caused by foreign matter. Remove any blockage. Figure 19 shows burner detail.

12- To clean the combustion air inducer visually inspect and using a wire brush clean where necessary. Use compressed air to clean off debris and any rust.

13- Reinstall heat exchanger in vestibule. (Replace the five screws in the cabinet from step 10 if removed).

14- Reinstall collector box, combustion air assembly, internal flue pipe and flue chase. **Seal with high temperature RTV**. Reinstall all screws to the collector box and combustion air inducer. Failure to replace all screws may cause leaks. Inspect gaskets for any damage and replace if necessary.

15- Reinstall burner box, manifold assembly and burner box cover.

16- Reconnect all wires.

17- Reconnect top cap and vent pipe to combustion air inducer outlet.

18- Reconnect gas supply piping.

19- Turn on power and gas supply to unit.

20- Set thermostat and check for proper operation.

21- Check all piping connections, factory and field, for gas leaks. Use a leak detecting solution or other preferred means.

⚠ CAUTION

Some soaps used for leak detection are corrosive to certain metals. Carefully rinse piping thoroughly after leak test has been completed. Do not use matches, candles, flame or other sources of ignition to check for gas leaks.

22- If a leak is detected, shut gas and electricity off and repair leak.

23- Repeat steps 21 and 23 until no leaks are detected.

24- Replace access panel.

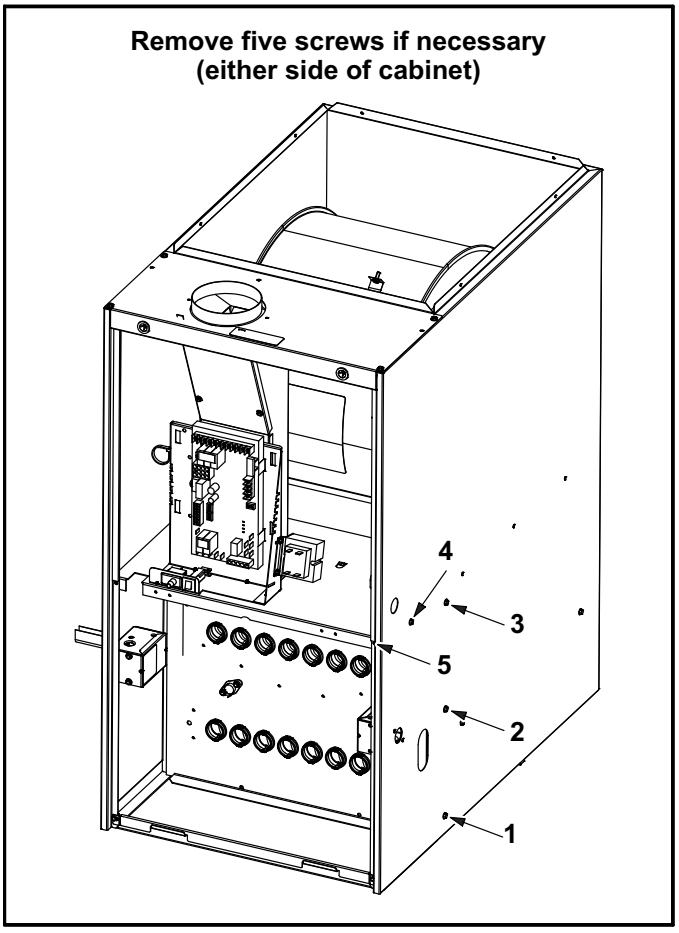
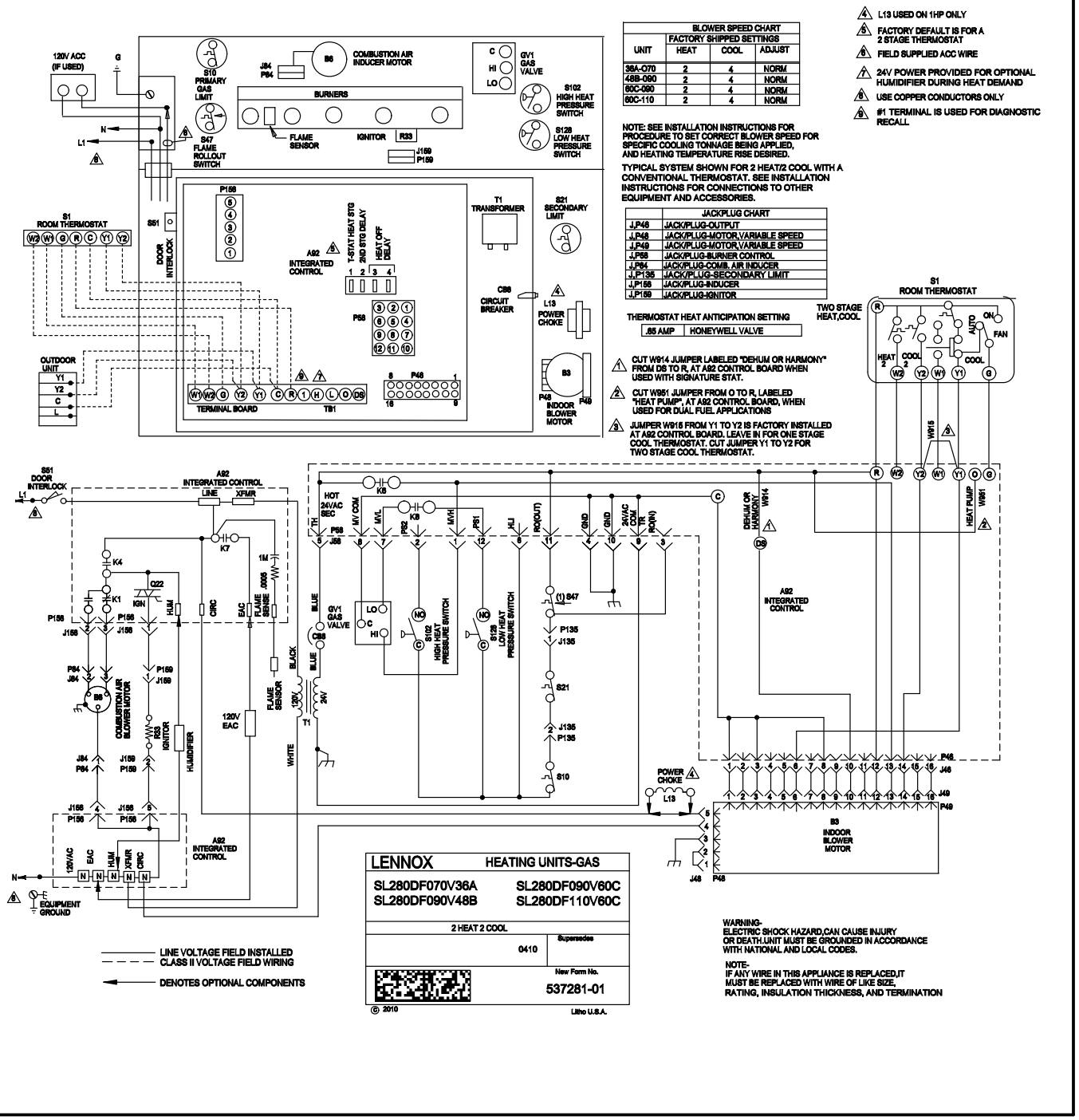


FIGURE 20

VII- Wiring and Sequence of Operation

SL280DFV Schematic Wiring Diagram



A-Sequence of Operation

Sequence depends on type thermostat used. SL280DFV units are applicable for single stage or two stage thermostats. Both type thermostats are described below. Thermostat DIP switch selection dictates which mode unit will operate in. See flow chart for more sequence detail.

SureLight Control Self Check

When there is a call for heat, the SureLight integrated control runs a self check. The control checks for S10 primary limit, S21 secondary limit (s) and S47 rollout switch normally closed contacts. The control also checks for S102 high heat and S128 low heat prove switch normally open contacts. Once self check is complete and all safety switches are operational, heat call can continue.

Two-Stage Thermostat, Two Stage Heat. DIP Switch set at *"TWO". See figure 21.*

1- SureLight control energizes combustion air inducer B6 on low heat speed. Combustion air inducer runs until S128 low heat prove switch contacts close (switch must close within 2 1/2 minutes or control goes into Watchguard Pressure Switch mode. High heat prove switch S102 may also close). A 15 second pre-purge follows once S128 closes.
NOTE - If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 20 seconds of high fire operation the unit will switch to low fire.

2- SureLight control begins 20 second ignitor warm up period.

3- Gas valve opens on first stage for a 4 second trial for ignition. Ignitor stays energized during the trial or until flame sensed.

4- Flame is sensed, gas valve remains on first stage heat, ignitor de-energizes.

5- After 45 second delay, indoor blower B3 is energized on low heat speed.
The furnace will stay in this mode until first stage demand is satisfied OR a second stage heat demand is initiated.

6- Second stage heat demand initiated. A 30 second second stage recognition period begins.

7- The combustion air inducer ramps up to high heat speed.

8- S102 high heat prove switch closes and the gas valve energizes second stage heat.

9- B3 indoor blower ramps up to high heat speed.

Single-Stage Thermostat, Two Stage Heat. DIP Switch set at "*SINGLE*" See figure 22

1- SureLight control energizes combustion air inducer B6 on low heat speed. Combustion air inducer runs until S128 low heat prove switch contacts close (switch must close within 2 1/2 minutes or control goes into Watchguard Pressure Switch mode. High heat prove switch S102 may also close). A 15 second pre-purge follows once S128 closes.
NOTE - If the low fire pressure switch does not close the combustion air inducer will switch to high fire. After a 15 second pre-purge the high fire pressure switch will close and the unit will begin operation on high fire. After 20 seconds of high fire operation the unit will switch to low fire.

2- SureLight control begins 20 second ignitor warm up period.

3- Gas valve opens on first stage for a 4 second trial for ignition. Ignitor stays energized during the trial or until flame sensed.

4- Flame is sensed, gas valve remains on first stage heat, ignitor de-energizes.

5- After 45 second delay, indoor blower B3 is energized on low heat speed.

6- A 10 minute (factory set) or 15 minute (field set) second stage heat delay period begins.

7- After the delay the combustion air inducer ramps up to high heat speed.

8- S102 high heat prove switch closes and the gas valve energizes second stage heat.

9- B3 indoor blower ramps up to high heat speed.

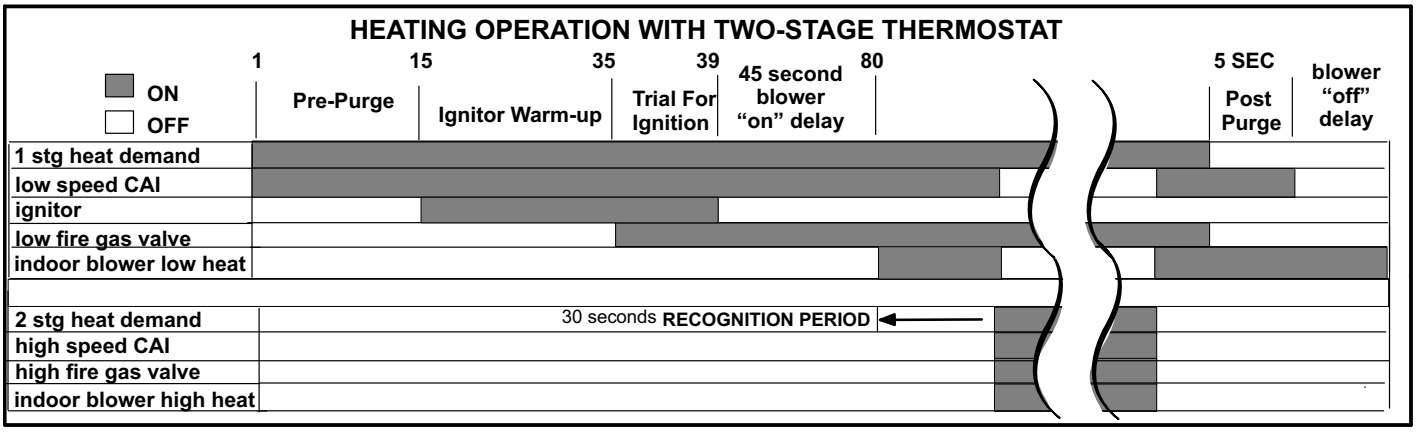


FIGURE 21

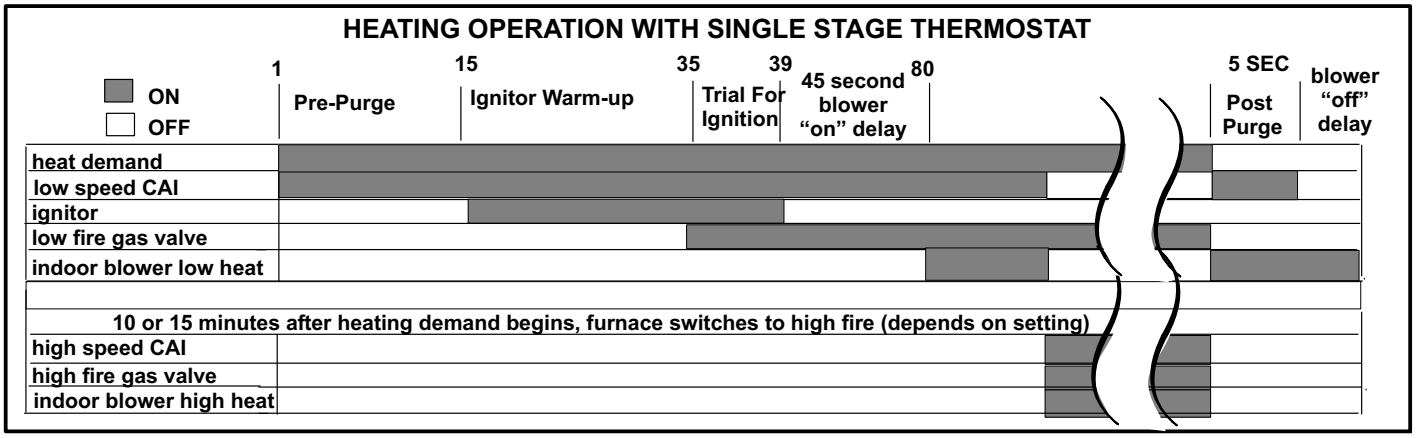
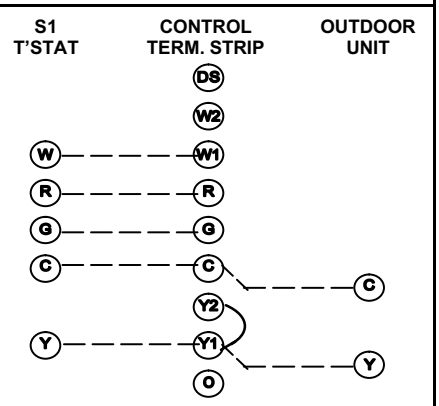
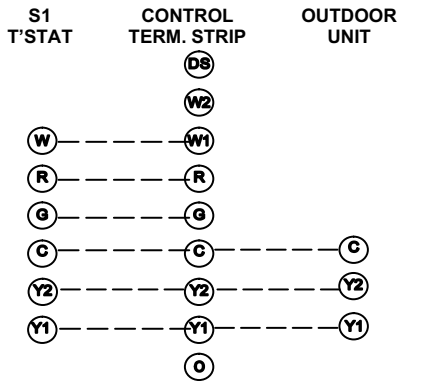
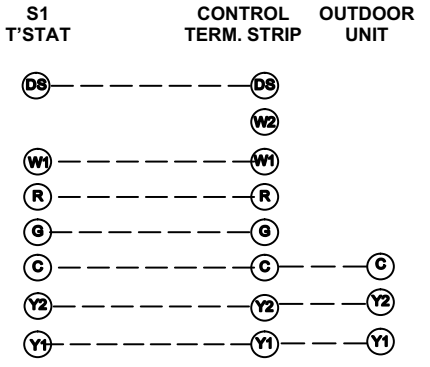
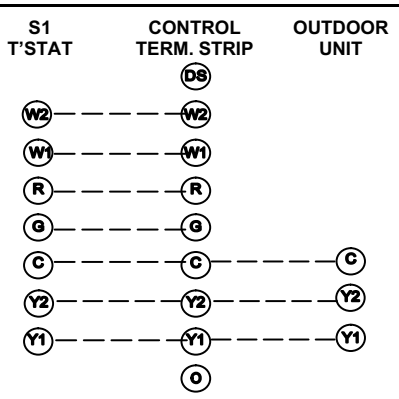
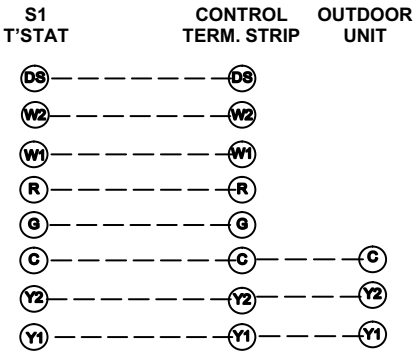
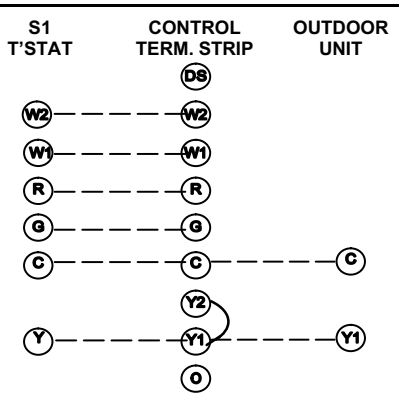


FIGURE 22

VIII- Field Wiring & Jumper Settings

Thermostat	DIP Switch Settings and On-Board Links (See figure 4)				Wiring Connections
	DIP Switch 1	W915 Two-Stage Cooling	W914 Dehu-midification or Harmony III	W951 Heat Pumps	
1Heat / 1 Cool *NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-10 minutes. ON-15 minutes.*	ON	Intact	Intact	Intact	
1 Heat / 2 Cool *NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-10 minutes. ON-15 minutes.*	ON	Cut	Intact	Intact	
1 Heat / 2 Cool with t'stat with humidity control *NOTE - Use DIP switch 2 to set second-stage heat ON delay. OFF-10 minutes. ON-15 minutes.*	ON	Cut	Cut	Intact	

Thermostat	DIP Switch Settings and On-Board Links (See figure 4)				Wiring Connections
	DIP Switch 1	W915 Two-Stage Cooling	W914 Dehu-midification or Harmony III	W951 Heat Pumps	
2 Heat / 2 Cool	OFF	Cut	Intact	Intact	
2 Heat / 2 Cool with t'stat with humidity control	OFF	Cut	Cut	Intact	
2 Heat / 1 Cool	OFF	Intact	Intact	Intact	

IX- Troubleshooting

Two Stage Variable Speed Control Board

UPON INITIAL POWER UP, REMOVE ALL THERMOSTAT DEMANDS TO THE UNIT

PROBLEM: 1 UNIT FAILS TO OPERATE IN THE COOLING, HEATING, OR CONTINUOUS FAN MODE		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action / Comments**
1.1 - Diagnostic lights fail to light up. LED OFF	**1.1.1** Main voltage 120V not supplied to unit.	**ACTION 1 -** Check 120V main voltage. Determine cause of main power failure.
	1.1.2 Miswiring of furnace or improper connections.	**ACTION 1 -** Check for correct wiring of 120V to power make up box and transformer. **ACTION 2** - Check 24V wiring to control board.
	1.1.3 Circuit breaker tripped or fails to close.	**ACTION 1 -** Replace circuit breaker if it is reset but does not have continuity. **ACTION 2 -** If circuit breaker still trips, check for short.
	1.1.4 Door interlock switch failure.	**ACTION 1 -** Check that door switch is activated when door is closed. **ACTION 2 -** Check wire connections to switch, replace loose connectors. **ACTION 3 -** Check continuity of switch in closed position. Replace if defective.
	1.1.5 Transformer Failure.	**ACTION 1 -** Check that transformer output is 24V. Replace if defective.
	1.1.6 Failed control board.	**ACTION 1 -** If all the above items have been checked, replace board.
1.2 Diagnostic light flashes the reverse polarity code. LED 5 + 4	**1.2.1** 120V main power polarity reversed.	**ACTION 1 -** Check the 120V has line and neutral correctly input into control. **ACTION 2 -** Reverse the line and neutral at the 120V field connection.
1.3 - Diagnostic light flash the improper main ground. LED 5 + 3	**1.3.1** Improper ground to the unit.	**ACTION 1 -** Check that the unit is properly ground. **ACTION 2 -** Install a proper main ground to the unit
1.4 - Diagnostic light flashes ignitor circuit fault. LED 4 + 7	**1.4.1** Open ignitor circuit.	**ACTION 1 -** Check for correct wiring and loose connections in the ignitor circuit. Check mult-plug connections for correct installation.
	1.4.2 Broken or failed ignitor.	**ACTION 1 -** Unplug ignitor and read resistance across ignitor. If resistance does not read between 25 and 47 ohms, replace the ignitor.
1.5 - Diagnostic light flashes low line voltage LED 4 + 8	**1.5.1** Line voltage is below 90V.	**ACTION 1 -** Check that the line voltage is above 90V. Determine cause of voltage drop and supply correct voltage to the control.

PROBLEM 2: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR BLOWER DOES NOT ENERGIZE		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action / Comments**
2.1 Unit operates with a cooling or continuous fan demand. Combustion air inducer will not start with a Heating demand. Diagnostic lights flash the limit failure mode. LED 3 + 1	**2.1.1** Primary Limit or secondary limit (if equipped) open.	**ACTION 1 -** Check continuity across switch(es). Switches reset automatically upon cool down. **ACTION 2 -** Check for restrictions on blower inlet air (including filter) and outlet air. Determine cause for limit activation before placing unit back in operation.
	2.1.2 Miswiring of furnace or improper connections at limit switch(es).	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
2.2 Unit operates with a cooling and continuous fan demand. Combustion air inducer will not start with a Heating demand. Diagnostic lights flash the pressure switch failure code. LED 2 +4	**2.2.1** Miswiring of furnace or improper connections to combustion air inducer.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	2.2.2 Prove switch stuck closed.	**ACTION 1 -** Check that the prove switch is open without the combustion air inducer operating. Replace if defective.
2.3 Unit operates with a cooling or continuous fan demand. Combustion air inducer will not start with a Heating demand. Diagnostic lights flash the open rollout failure mode. LED 5 + 1	**2.3.1** Rollout Switch Open.	**ACTION 1 -** Check continuity across rollout switches. Rollout switches must be manually reset. **ACTION 2 -** Look for restrictions in vent pipe or combustion air inlet or heat exchanger. Determine cause before placing unit in operation.
PROBLEM 3: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR INDUCER DOES NOT ENERGIZE		
Condition	**Possible Cause**	**Corrective Action/Comments**
3.3 Unit operates with a cooling and continuous fan demand. Combustion air inducer will not start with a Heating demand. Diagnostic lights flash the pressure switch failure code 2.5 minutes after heating demand. LED 2 + 3	**3.3.1** Miswiring of furnace or improper connections to combustion air inducer.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	3.3.2 Combustion air inducer failure.	**ACTION 1 -** If there is 120V to combustion air inducer and it does not operate, replace combustion air inducer.

PROBLEM 4: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR INDUCER ENERGIZES, IGNITOR IS NOT ENERGIZED.		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
4.1 **-** Unit operates with a cooling and continuous fan demand. **-** Combustion air inducer energizes with a heating demand. - Diagnostic lights flash the pressure switch failure code 2.5 minutes after heating demand. LED 2 + 3	**4.1.1** Prove switch does not close due to obstruction in vent pipe.	**ACTION 1 -** Check for restricted vent. Remove all blockage. **ACTION 2:** Check for proper vent sizing. See installation instructions.
	4.1.2 Prove switch does not close due to incorrect routing of the prove switch line.	**ACTION 1 -** Check that the prove switch line is correctly routed. Correctly route prove switch line.
	4.1.3 Prove switch does not close due to obstructions in the prove switch line.	**ACTION 1 -** Remove any obstructions from the the prove switch line and/or taps.
	4.1.4 Prove switch line damaged	**ACTION 1 -** Check prove switch line for leaks. Replace broken line if required.
	4.1.5 Condensate in prove switch line.	**ACTION 1 -** Check prove switch line for condensate. Remove condensate from line.
	4.1.6 Prove switch does not close due to a low differential pressure across the prove switch.	**ACTION 1 -** Check the differential pressure across the prove switch. This pressure should exceed the set point listed on the switch. **ACTION 2 -** Check for restricted inlet vent. Remove all blockage. **ACTION 3 -** Check for proper vent sizing and run length. See installation instructions.
	4.1.7 Wrong prove switch installed in the unit, or prove switch is out of calibration.	**ACTION 1 -** Check that the correct prove switch is installed in the unit. Replace prove switch if necessary.
	4.1.8 Miswiring of furnace or improper connections at prove switch.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	4.1.9 Prove switch failure.	**ACTION 1 -** If all the above modes of failure have been checked, the prove switch may have failed. Replace prove switch and determine if unit will operate.

PROBLEM 5: UNIT FIRES ON LOW FIRE, FAILS TO GO TO HIGH FIRE OPERATION		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
5.1 **-** Unit light s normally during low fire **-** Call for high fire inducer switches to high fire for 10 seconds then back to low fire. - Diagnostic lights flash the high pressure switch failure to close. LED 2 + 5	**5.1.1** Prove switch does not close due to obstruction in vent pipe.	**ACTION 1 -** Check for restricted vent. Remove all blockage. **ACTION 2:** Check for proper vent sizing. See installation instructions.
	5.1.2 Prove switch does not close due to incorrect routing of the prove switch line.	**ACTION 1 -** Check that the prove switch line is correctly routed. Correctly route prove switch line.
	5.1.3 Prove switch does not close due to obstructions in the prove switch line.	**ACTION 1 -** Remove any obstructions from the the prove switch line and/or taps.
	5.1.4 Prove switch line damaged	**ACTION 1 -** Check prove switch line for leaks. Replace broken line if required.
	5.1.5 Condensate in prove switch line.	**ACTION 1 -** Check prove switch line for condensate. Remove condensate from line.
	5.1.6 Prove switch does not close due to a low differential prove across the prove switch.	**ACTION 1 -** Check the differential pressure across the prove switch. This pressure should exceed the set point listed on the switch. **ACTION 2 -** Check for restricted inlet vent. Remove all blockage. **ACTION 3 -** Check for proper vent sizing and run length. See installation instructions.
	5.1.7 Wrong prove switch installed in the unit, or prove switch is out of calibration.	**ACTION 1 -** Check that the correct prove switch is installed in the unit. Replace prove switch if necessary.
	5.1.8 Miswiring of furnace or improper connections at prove switch.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	5.1.9 Prove switch failure.	**ACTION 1 -** If all the above modes of failure have been checked, the prove switch may have failed. Replace prove switch and determine if unit will operate.

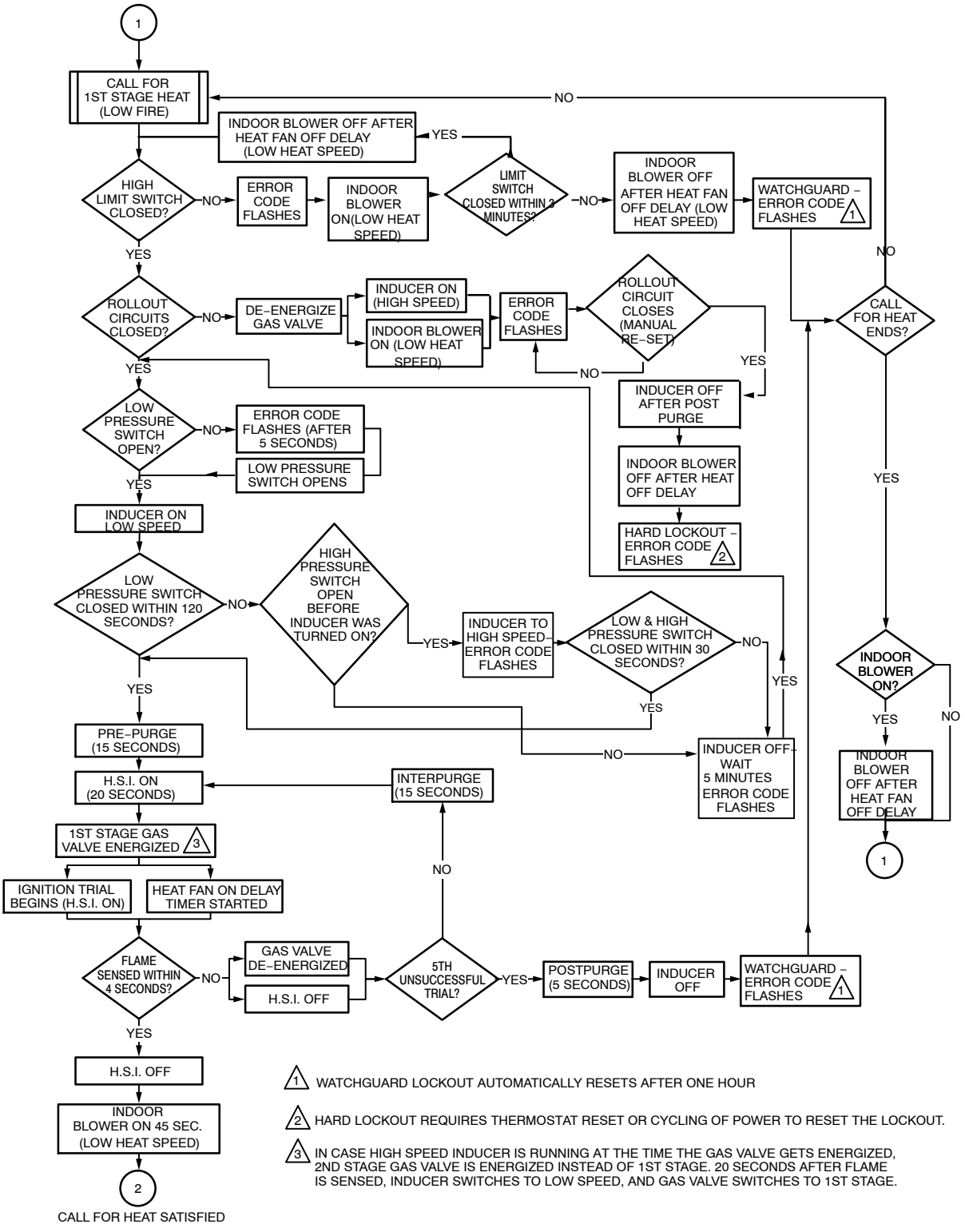
PROBLEM 6: UNIT FAILS TO FIRE IN THE HEATING MODE, COMBUSTION AIR BLOWER ENERGIZES, IGNITOR IS ENERGIZED.		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
6.1 Unit operates with a cooling and continuous fan demand. Combustion air inducer energizes with Heating demand. Ignitor is energized but unit fails to light. LED 4 + 1	**6.1.1** Check that gas is being supplied to the unit.	**ACTION 1 -** Check line pressure at the gas valve. Pressure should not exceed 13" WC for both natural and propane. Line pressure should read a minimum 4.5" WC for natural and 8.0"WC for propane.
	6.1.2 Miswiring of gas valve or loose connections at multi-pin control amp plugs or valve.	**ACTION 1 -** Check for correct wiring and loose connections. Correct wiring and/or replace any loose connections.
	6.1.3 Defective gas valve or ignition control.	**ACTION 1 -** Check that 24V is supplied to the gas valve approximately 35 seconds after heat demand is initiated. **ACTION 2 -** Replace the valve if 24V is supplied but valve does not open. **ACTION 3 -** Replace the control board if 24V is not supplied to valve.
PROBLEM 7: BURNERS LIGHT WITH A HEATING DEMAND BUT UNIT SHUTS DOWN PREMATURELY		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
7.1 Burners fire with a heating demand. Burners light but unit shuts off prior to satisfying T-stat demand. Diagnostic lights flash the prove switch code. LED 2 + 7	**7.1.1** Low pressure differential at the prove switch.	**ACTION 1 -** Check for restricted exhaust vent. Remove all blockage. **ACTION 2:** Check for proper vent sizing. See installation instructions.
7.2 Combustion air inducer energizes with a heating demand. Burners light but fail to stay lit. After 5 tries the control diagnostics flash the watchguard burners failed to ignite code. LED 4 + 3	**7.2.1** Sensor or sense wire is improperly installed.	**ACTION 1 -** Check that sensor is properly located and that the sense wire is properly attached to both the sensor and the control.
	7.2.2 Sensor or sense wire is broken.	**ACTION 1 -** Check for a broken sensor. **ACTION 2 -** Test continuity across the sense wire. If wire or sensor are damaged replace the component.
	7.2.3 Sensor or sensor wire is grounded to the unit.	**ACTION 1 -** Check for resistance between the sensor rod and the unit ground. **ACTION 2 -** Check for resistance between the sensor wire and the unit ground. **ACTION 3 -** Correct any shorts found in circuit.
	7.2.4 Control does not sense flame.	**ACTION 1 -** Check the microamp signal from the burner flame. If the microamp signal is below normal microamps, check the sense rod for proper location or contamination. **ACTION 2 -** Replace, clean, or relocate flame sense rod. If rod is to be cleaned, use steel wool or replace sensor. DO NOT CLEAN ROD WITH SAND PAPER. SAND PAPER WILL CONTRIBUTE TO THE CONTAMINATION PROBLEM. **NOTE:** Do not attempt to bend sense rod. **ACTION 3 -** Check that there is proper ground to burner box. Repair as necessary.

PROBLEM 7: BURNERS LIGHT WITH HEATING DEMAND BUT UNIT SHUTS DOWN PREMATURELY (CONT.)		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
7.3 Combustion air inducer energizes with a heating demand. Burners light. Roll-out switch trips during the heating demand. Diagnostic lights flash roll-out switch failure. LED 5 + 1	**7.3.1** Unit is firing above 100% of the nameplate input.	**ACTION 1 -** Check that the manifold pressure matches value listed on nameplate. See installation instructions for proper procedure. **ACTION 2 -** Verify that the installed orifice size match the size listed on the nameplate or installation instructions. **ACTION 3 -** Check the input rate to verify rate matches value listed on nameplate.
	7.3.2 Gas orifices leak at the manifold connection.	**ACTION 1 -** Tighten orifice until leak is sealed. **NOTE:** Be careful not to strip orifice threads. **ACTION 2 -** Check for gas leakage at the threaded orifice connection. Use approved method for leak detection (see unit instructions).
	7.3.3 Insufficient flow through the heat exchanger caused by a sooted or restricted heat exchanger.	**ACTION 1** - Check for sooting deposits or other restrictions in the heat exchanger assembly. Clean assembly as outlined in instruction manual. **ACTION 2** - Check for proper combustion. See IV-Heating System Service Checks section G-.
	7.3.4 Burners are not properly located in the burner box.	**ACTION 1 -** Check that the burners are firing into the center of the heat exchanger openings. Correct the location of the burners if necessary.
	7.3.5 Poor Venting	**ACTION 1** -Check vent pipe and remove any obstructions **ACTION 2 -** Check for correct exhaust vent installation. See instructions
	7.3.6 Improper burner cross-overs	**ACTION 1 -** Remove burner and inspect the cross-overs for burrs, or any restriction or if crossover is warped. Remove restriction or replace burners.
7.4 Combustion air inducer energizes with a heating demand. Burners light roughly and the unit fails to stay lit. Diagnostic lights flash watchguard flame failure. LED 4 + 3	**7.4.1** Poor Venting	**ACTION 1** -Check vent pipe and remove any obstructions **ACTION 2 -** Check for correct exhaust vent installation. See instructions
	7.4.2 Improper burner cross-overs	**ACTION 1 -** Remove burner and inspect the cross-overs for burrs, or any restriction or if crossover is warped. Remove restriction or replace burners.
	7.4.3 Burrs in gas orifices	**ACTION 1 -** Remove gas orifices and inspect. Remove any burrs that are present or replace orifice.

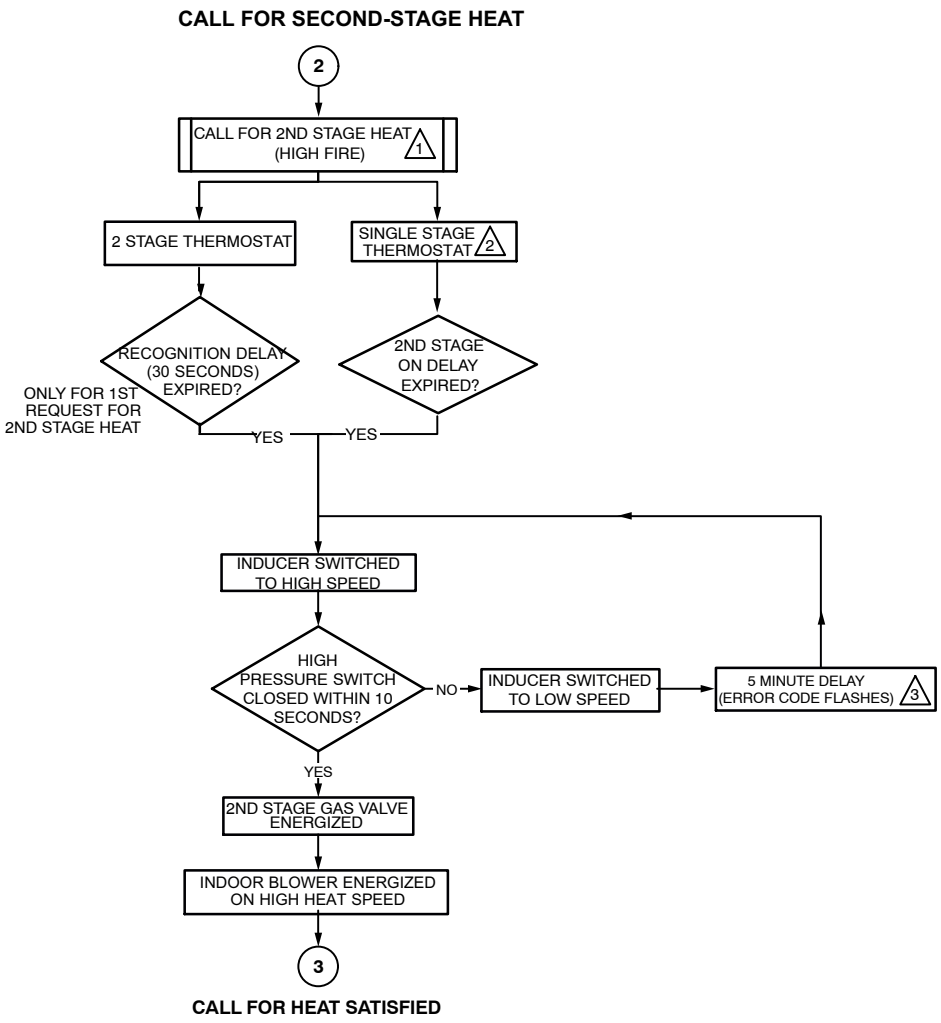
PROBLEM 7: BURNERS LIGHT WITH HEATING DEMAND BUT UNIT SHUTS DOWN PREMATURELY (CONT.)		
Flash Code LED X + Y	**Possible Cause**	**Corrective Action/Comments**
7.5 Combustion air inducer energizes with a heating demand. - Burners light. Diagnostic lights flash watch guard flame failure. NOTE" Unit might go into 60 minute Watchguard mode depending on intermittent nature of sensor signal. LED 4 + 3	**7.5.1** Loose sensor wire connection causes intermittent loss of flame signal.	**ACTION 1 -** Check that the sensor is properly located. **ACTION 2 -** Check that the sense wire is properly attached to both the sensor and the control. Pay extra attention to the pin connectors.
	7.5.2 Poor ground to burner box	**ACTION 1 -** Check for proper ground and repair as necessary.
PROBLEM 8: CONTROL SIGNALS LOW FLAME SENSE DURING HEATING MODE		
Condition	**Possible Cause**	**Corrective Action/Comments**
8.0 Unit operates correctly but the diagnostic lights flash low flame sense code. LED 1 + 2	**8.1.1** Sense rod is improperly located on the burner.	**ACTION 1 -** Check the sense rod for proper location on the burner. Properly locate the sense rod or replace if rod cannot be located correctly.
	8.1.2 Sense rod is contaminated.	**ACTION 1 -** Check sense rod for contamination or coated surface. Clean the sense rod with steel wool or replace sensor. DO NOT USE SAND PAPER TO CLEAN ROD. SAND PAPER WILL CONTRIBUTE TO THE CONTAMINATION PROBLEM.
PROBLEM 9: INDOOR BLOWER FAILS TO OPERATE IN COOLING, HEATING, OR CONTINUOUS FAN MODE		
Condition	**Possible Cause**	**Corrective Action/Comments**
9.0 - Indoor blower fails to operate in continuous fan, cooling, or heating mode.	**9.1.1** Miswiring of furnace or improper connections at control or indoor blower motor.	**ACTION 1-** Correct wiring and/or replace any loose connections. Check for correct wiring and loose connections.
	9.1.2 120V is not being supplied to the indoor air blower or blower motor failure.	**ACTION 1 - PSC MOTORS** Check for 120V at the various calls for indoor blower by energizing "Y", "G", and "W" individually on the low voltage terminal strip. Note that when "W' is energized, the blower is delayed 45 seconds. If there is 120V to each motor tap but the blower does not operate, replace the motor. **ACTION 1 - VARIABLE SPEED MOTORS for operation of the VSM see Page 14**
	9.1.3 Defective control board	**ACTION 1 - PSC MOTORS** If there is not 120V when "Y", "G", or "W" is energized, replace the control.

Troubleshooting: Heating Sequence of Operation

CALL FOR FIRST-STAGE HEAT



Troubleshooting: Heating Sequence of Operation (Continued)

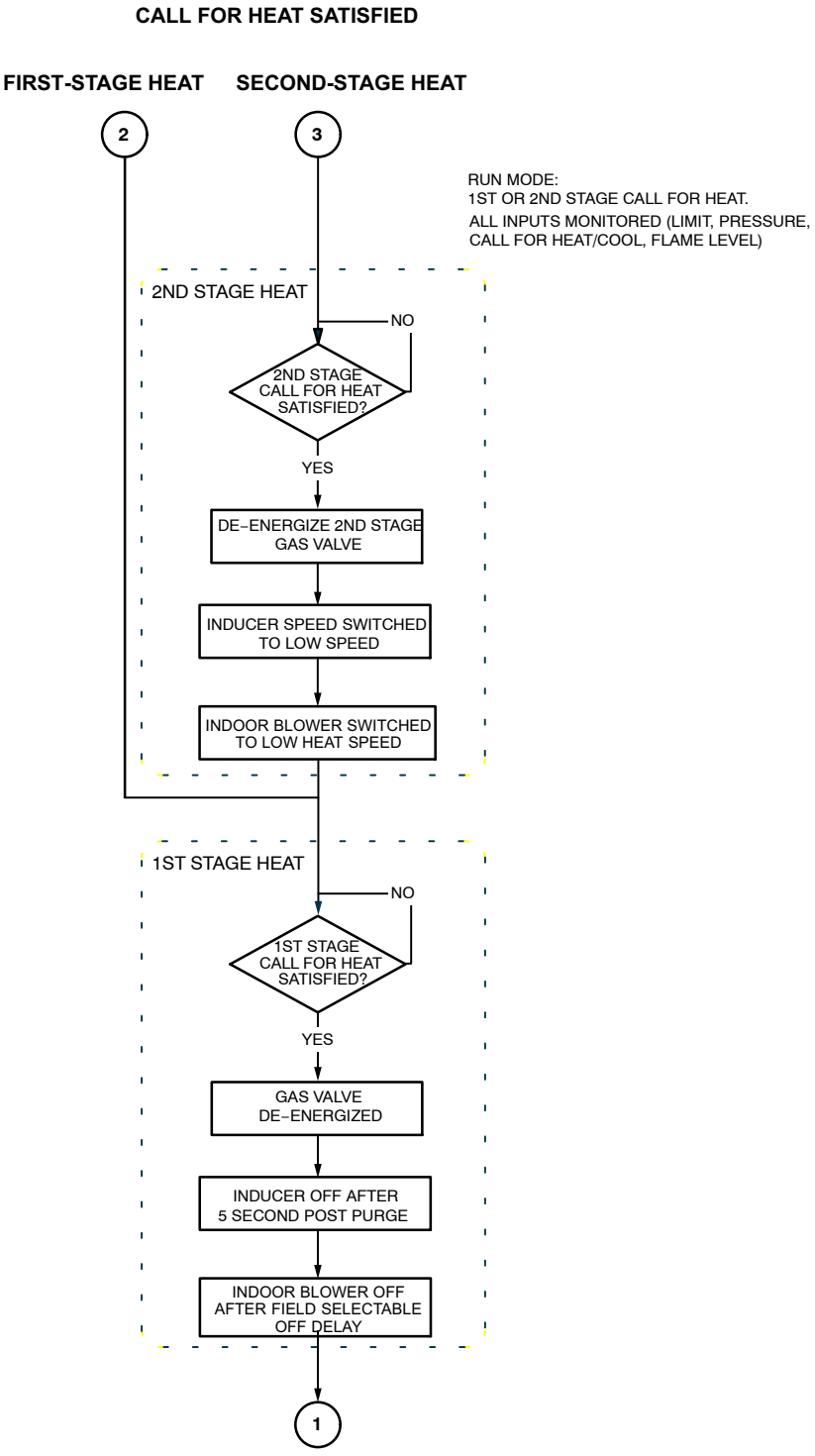


1 SYSTEM WILL ALWAYS LIGHT ON LOW FIIRE, EVEN IF 2ND STAGE HEAT IS IN PLACE.

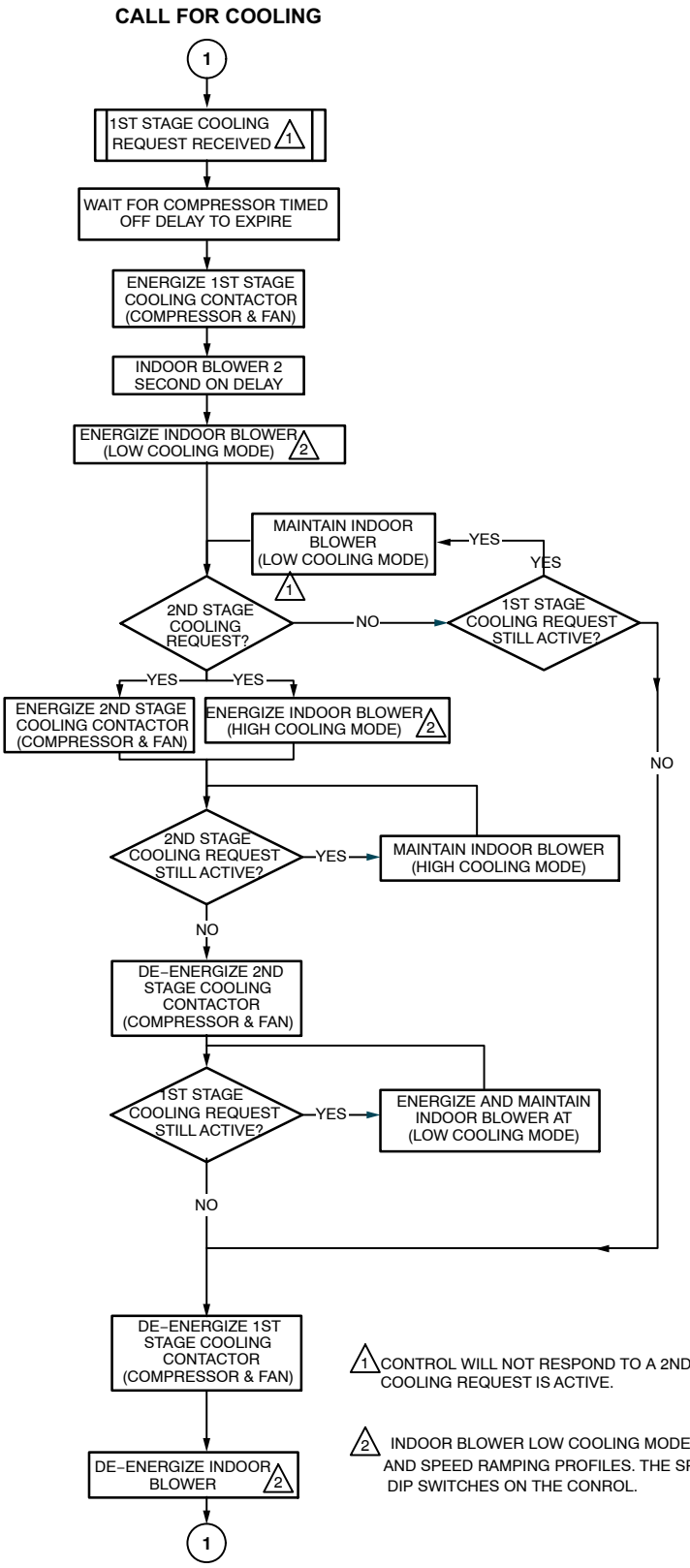
2 WHEN USED WITH A SINGLE STAGE THERMOSTAT, SET SW1 TO THE ON POSITION IN DIP SWITCH S1.

3 IF THE HIGH FIRE PRESSURE SWITCH DOES NOT CLOSE WITHIN 5 ATTEMPTS, THE SYSTEM WILL OPERATE AT LOW FIRE FOR THE REMAINDER OF THE CALL FOR HEAT REQUEST.

Troubleshooting: Heating Sequence of Operation (Continued)



Troubleshooting: Cooling Sequence of Operation (Continued)



Troubleshooting: Continuous Fan Sequence of Operation