

# 2 STAGE CONDENSING & NON-CONDENSING GAS FURNACES



# Service Manual



**NTVM**

**NTPM**

**NTP6**

**VNK**

**TNK**

**TNE**

**This manual supports two stage gas furnaces manufactured after 1998**

**Manufactured by:**



**Part Number  
441 081002 00**

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## INTRODUCTION

This service manual is designed to be used in conjunction with the installation manual and/or technical support manual provided with each two stage furnace.

These furnaces represent the very latest in high efficiency two stage gas furnace technology. Consequently, they incorporate the use of certain controls that contain highly sophisticated electronic components which are **not user serviceable**. Therefore, it is essential that only competent, qualified, service personnel attempt to install, service, or maintain this product.

This service manual was written to assist the professional HVAC service technician to quickly and accurately diagnose and repair any malfunctions of this product.

This service manual covers several different models in two (2) families of product; Variable Speed (D.C.–Blower Motor) models in the Condensing furnace family, and 2 speed (P.S.C.–Blower Motor) models in both the Condensing and Non–Condensing furnace

families. The overall operation of all of these models and families is essentially the same, with the exception of the Blower Motor, and/or certain control functions which may be unique to a particular model and/or family.

This manual, therefore, will deal with all subjects in a general nature (I.E. all text will pertain to all models) unless that subject is unique to a particular model or family, in which case it will be so indicated.

Throughout the manual references may be made to “VARIABLE SPEED MODELS” as well as “TWO SPEED MODELS”. GENERALLY, the distinction between these two groups is based on a difference in the type of Blower Motor used. These may not be the only differences, however, and the differences may vary from model to model within a particular family or series.

It will be necessary then for you to accurately identify the unit you are servicing, so you may be certain of a proper diagnosis and repair. (See Unit Identification, Page 2)

## WARNING

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

**Installation or repairs made by unqualified persons can result in hazards subjecting the unqualified person making such repairs to the risk of injury or electrical shock which can be serious, or even fatal not only to them, but also to persons being served by the equipment.**

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

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## UNIT IDENTIFICATION

The unit's rating plate contains important information for the service technician. It also lists the complete Model, Manufacturing, and Serial numbers.

marketing revision of "A") as well as accurate service information.

These complete numbers are required to obtain correct replacement parts (for example, in certain model families of our product line a unit having a MARKETING REVISION of "C" is likely to be equipped with a *Different* ignition system than a unit having a

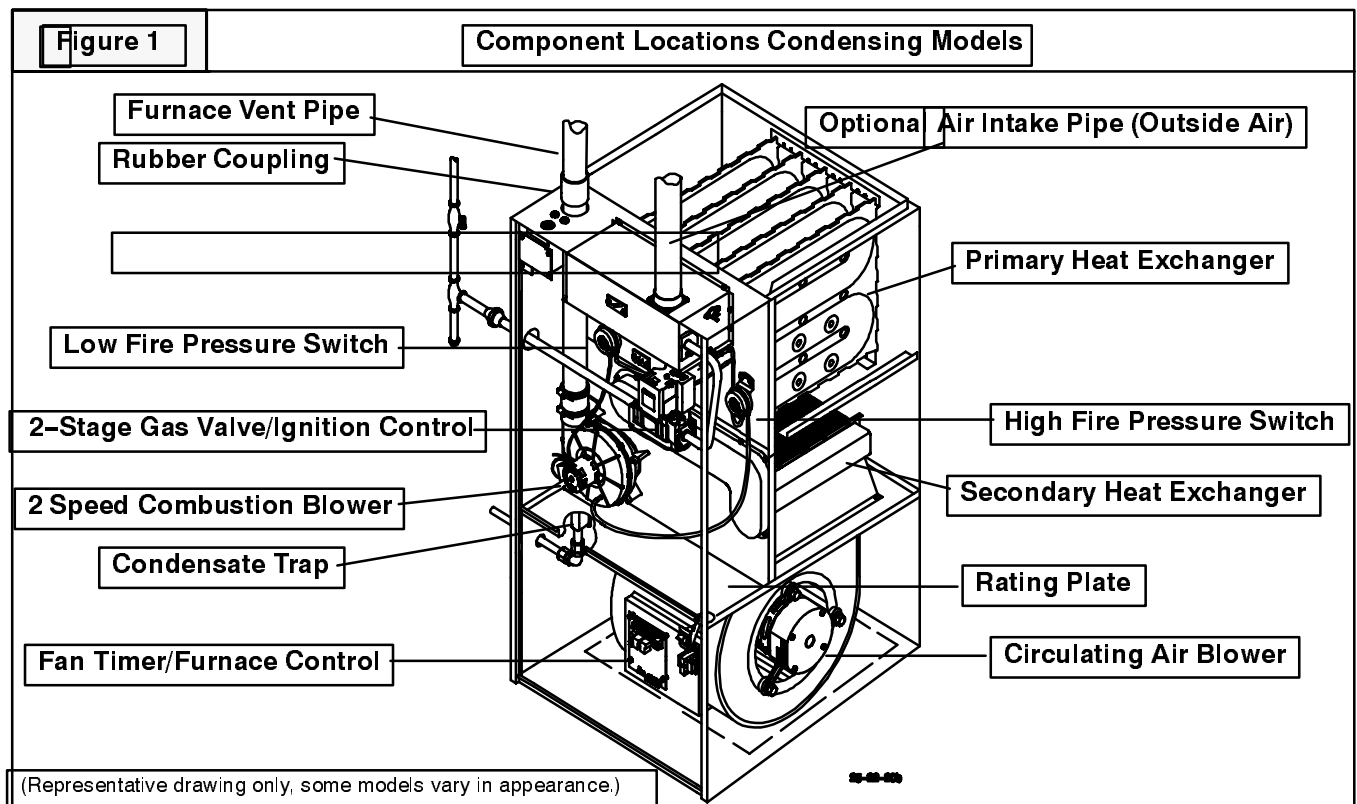
Before attempting any adjustments, or replacing any components, be certain to check the unit's rating plate (located on the left or right inside side panel) to obtain these complete numbers. The illustrations below will help you know more about the unit you are servicing.

### Model Numbers Beginning With "N"

<b>MODEL NUMBER</b>	N	T	V	M	075	G	F	A
<b>MARKETING REVISION</b>								
<b>PRODUCT FAMILY</b>								
<b>PRODUCT GROUP</b>								
U = Upflow		T = Upflow/Horizontal						
H = Horizontal		C = Downflow/ Horizontal						
D = Downflow		L = Lowboy						
F = Floor Furnace		M = Multiposition						
<b>FUEL</b>								
P = 2-Stage Gas								
V = 2-Stage Gas Variable Speed								
<b>SERIES</b>								
6 = 6000								
M = Multivent								
<b>NOMINAL AIR FLOW (Tons)</b>								
A = Heat Only				G = 3.5				
B = 1				H = 4				
C = 1.5				J = 4.5				
D = 2				K = 5				
E = 2.5				L = 5.5 - 7.0				
F = 3				M = 7.5 - 10.0				
<b>NOMINAL INPUT MBTUH</b>								

### Model Numbers Beginning With "T" or "V"

<b>MODEL NUMBER</b>	T	N	K	050	B	12	A
<b>MARKETING REVISION</b>							
<b>FUEL</b>							
T = 2-Stage Gas							
V = 2-Stage Gas Variable							
<b>PRODUCT GROUP</b>							
U = Upflow		N = Upflow/Horizontal					
D = Downflow		C = Downflow/Horizontal					
H = Horizontal							
<b>SERIES</b>							
<b>NOMINAL AIR FLOW (CFM)</b>							
8 = 800		16 = 1600					
12 = 1200		18 = 1800					
14 = 1400		20 = 2000					
<b>FURNACE WIDTH</b>							
B = 15 1/2		J = 22 3/4					
F = 19 1/8		N = 26 3/8					
<b>NOMINAL INPUT MBTUH</b>							



## FURNACE THEORY OF OPERATION

The high efficiencies and low profile of this furnace have been obtained using design techniques not typical of traditional furnace designs. A brief description of these new design techniques and the purpose they serve follows.

1. Obtaining the high efficiency (A.F.U.E.) ratings of these models required a large **surface area** heat exchanger. Since a relatively low furnace height and overall size was desirable, a heat exchanger design was required that could achieve the desired efficiency, and yet minimize its physical size.

The design required to achieve these results is the "SERPENTINE" design, wherein the flue gasses must follow a serpent shaped passage through the heat exchanger, rather than simply rise to the top of the heat exchanger via convection.

This "Serpentine" path is resistive to normal convective flow, and requires that a partial vacuum be created at the outlet of the heat exchanger to maintain the flow of flue products through the heat exchanger.

2. The serpentine heat exchanger design does not lend itself well to the ribbon type, or slotted port type burner found in more traditional design furnaces for the following reasons:

- A. The secondary combustion air flows at right angles to the burner flame, making it likely to "pull" the flame off a ribbon or slotted port type burner.
- B. The flame "height" of a ribbon or slotted port type burner would make it difficult (if not impossible) to prevent impingement of the flame on the heat exchanger surfaces while maintaining the low profile heat exchanger.

For these reasons, an "INSHOT" type burner is used in this series. The inshot burner (also called a "jet" burner) fires a flame straight out its end. This burner is designed to fire into a tube style heat exchanger, making it an ideal application in the tube-like passages of the serpentine heat exchanger.

3. On Condensing Models (Only) to extract the maximum amount of heat possible from the flue gasses, a secondary heat exchanger (condenser) is connected to the outlet of the primary heat exchanger. This condenser removes additional heat from the flue gasses, causing their temperature to drop below dew point. This results in the forming of condensation (water) which then must be routed to a drain.

4. On Condensing Models (Only) the placement of the secondary heat exchanger at the outlet of the primary heat exchanger creates additional resistance to the flow of the flue gasses.
5. To overcome the resistance to convective flow of the Primary heat exchanger and on Condensing Models (Only) Secondary heat exchanger requires the use of a two (2) Speed Induced Draft Combustion Blower Assembly.
6. On Condensing Models the Combustion Blower Assembly is mounted on the outlet side of the **Secondary** heat exchanger. On Non-Condensing Models, the Combustion Blower Assembly is mounted on the outlet side of the **Primary** heat exchanger. This blower creates a partial vacuum (negative pressure) within the heat exchanger(s) drawing the flue products out of the furnace.
7. High Fire and Low Fire Pressure switches (Air Proving Switches) are used as safety devices that prevent the ignition system from firing the furnace until it senses that a proper draft has been established through the furnace.

## HIGH ALTITUDE OPERATION

These furnaces are designed to operate in the majority of the country without any modifications. At altitudes over 2,000 Ft. above sea level, however, certain measures need to be taken to insure continued, safe, reliable operation. For example, units must be de-rated for altitude (by adjusting manifold pressure and/or changing orifice size) based upon the type of fuel (I.E. Natural Gas or L.P. gas), Btu content of the gas, and installed altitude.

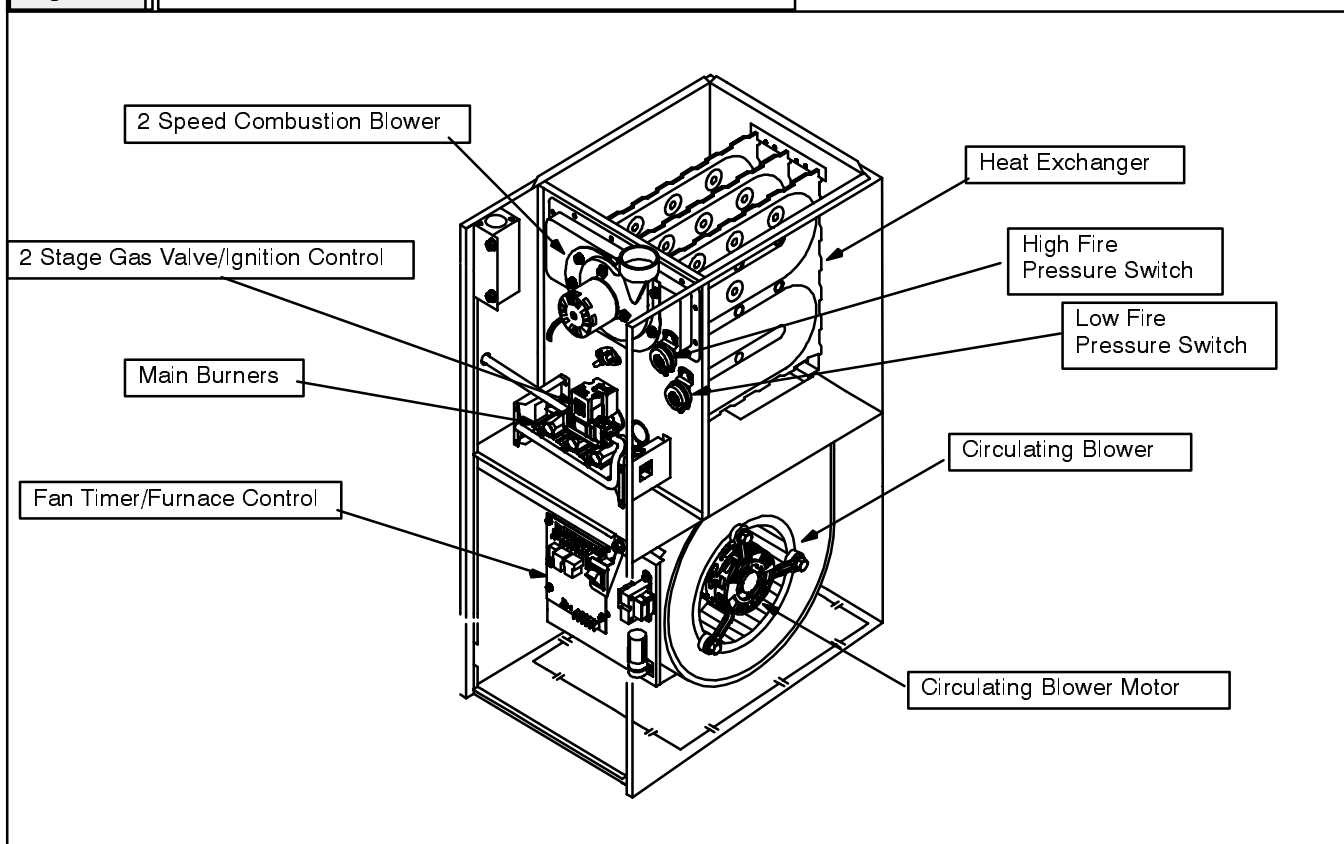
pressure switch installed to insure proper operation at altitudes above 4,000 Ft. above sea level.

Non-Condensing Models **MUST** have a high altitude air inlet restrictor installed to insure proper operation at altitudes above 4,000 Ft. above sea level.

When servicing a unit installed at altitudes above 2,000 Ft., insure that it has been properly modified to operate at that altitude. See the sections on Gas pressure (Page 9), and pressure switches (Page 18) to obtain specific information for your particular installation altitude.

Condensing Models **MUST** have a high altitude

**Figure 2** Component Locations Non-Condensing models



## SEQUENCE OF OPERATION

### HEATING

#### Call for 1st Stage Heating (W1 Request) From Thermostat

1. 24 VAC signal from W1 of thermostat applied to W1 terminal of Honeywell ST9162A control.
2. Inducer motor turns on at high speed.
3. The high fire solenoid energizes.
4. Following a 3 second prepurge delay, the pilot valve opens and the ignitor begins to warm up.
5. After the pilot lights, the main valve opens and burners light (burners now at high fire rate).
6. Timed from the opening of the main valve, the control will wait for the selected Heat Fan On Delay time before de-energizing the high fire solenoid, switching the inducer to low speed, and switching the fan to Low Heat speed.
7. The furnace remains at Low fire until thermostat is satisfied, or it receives a call for 2nd Stage Heat (W2).

#### Call for 2nd Stage Heating (W1 & W2 Request) From Thermostat

24 VAC signals from W1 & W2 of thermostat applied to W1 and W2 terminals of Honeywell ST9162A control.

- Same light-off routine as described for 1st stage operation except that at the end of the selected Heat Fan On Delay (See step 6.), the high fire solenoid remains energized the inducer remains on high speed, and the High Heat fan speed remains energized until call for 2nd Stage Heat (W2) is satisfied.

**NOTE:** The Honeywell ST9162A control responds without delay to the presence or loss of W2 (with W1 constant). W1 & W2 (2nd Stage Heat) results in High fire, High speed inducer, and High Heat fan speed. W1 only (1st Stage Heat) results in Low fire, Low speed inducer, and Low Heat fan speed.

#### Thermostat Satisfied (W Request from thermostat ends)

1. 24 VAC signal from W1 or W1 & W2 of thermostat signal removed from W1 or W1 & W2 terminal of Honeywell ST9162A control.
2. The gas valve de-energizes and the main burners go out.
3. The inducer runs at its present speed for a 5 second

postpurge period.

4. The fan switches to (or stays at) Low Heat speed.
5. Timed from the gas valve de-energizing, the Low Heat fan speed de-energizes after the selected Heat Fan OFF Delay time expires.

**NOTE:** If a new Heating request arrives while the control is waiting in the Heat Fan Off Delay time, the fan speed switches to High Heat until the Heat Fan Off Delay expires or the Heat Fan On Delay expires for the new Heating request.

#### Heating Request with Failure to establish flame (I.E. Gas Supply Line Shut Off, etc.)

- 24 VAC signals from W1 **OR** W1 & W2 of thermostat applied to W1 **OR** W1 & W2 terminals of Honeywell ST9162A control.
- Inducer motor turns on at high speed.
- The high fire solenoid energizes.
- Following a 3 second prepurge delay, the pilot valve opens and the ignitor begins to warm up.
- The ignitor glows red-hot for 30 seconds, then turns off.
- The igniter stays off for 25 seconds, then begins to warm-up again.
- The igniter glows red-hot for 30 seconds, then turns off.
- The pilot valve closes 3 seconds after the igniter de-energizes.
- The inducer de-energizes 5 seconds after the pilot valve closes.
- The Smart Valve proceeds to soft lockout and flashes error code 6.
- The control exits soft lockout after 5 minutes and begins another ignition sequence.

#### Gas Valve Diagnostic (Error) Codes

Bright/Dim	= Normal Operation
2 Flashes	= Low Pressure Switch Stuck Closed
3 Flashes	= Low Pressure Switch Stuck Open, Aux. Limit Switch Open or Manual ON/OFF Switch in OFF Position.
4 Flashes	= Limit Switch Open
5 Flashes	= Flame Sensed Out of Sequence
6 Flashes	= Control in Soft Lockout (Automatic Restart or Retry Delay)
8 Flashes	= High Pressure Switch Stuck Closed
9 Flashes	= High Pressure Switch Stuck Open



### Call for Cooling (Y & G Request) from Thermostat

- 24 VAC signals from Y & G terminals of thermostat applied to Y & G terminals of Honeywell ST9162A control.
- Contactor circuit to condensing unit energized.
- Cooling Blower motor speed energized after 5 second Cool Fan On Delay time.

### Thermostat Satisfied (Y & G request from thermostat ends)

- 24 VAC signals from Y & G terminals of thermostat removed from Honeywell ST9162A control.
- Contactor circuit to condensing unit de-energized.
  - Cooling Blower motor speed de-energized after 60 second Cool Fan Off Delay time.

### Call for Cooling (Y & G Request) from Thermostat with Call for Dehumidification (Y2 request) from Humidistat or Outdoor Thermostat.

- 24 VAC signals applied to Y, Y2 & G terminals of ST9162A control.
- Contactor circuit to condensing unit energized.

- Blower motor energized at a 20% reduction in Cooling speed after 5 second Cool Fan On Delay time.

### Circulating Fan (G) Request:

- 24 VAC signal applied to G terminal of ST9162 control.
- Low Heating speed energized without delay.

G signal removed from ST9162.

- Low Heating speed de-energized without delay.

NOTE1) Furnaces with DC blower motors run a low circulating fan speed in response to G request.

NOTE2) Furnaces with PSC blower motors de-energize the Low Heat fan speed during the heat exchanger warm-up period on a call for Heating that occur during a G request.

NOTE3) Heating or Cooling requests received during a Fan request cause the fan speed to change to the appropriate heat or cool speed after the selected Fan On Delay time expires. The fan returns to circulating speed after the selected Fan Off Delay time expires following loss of the Heating or Cooling request.

## ELECTRICAL SUPPLY

### WARNING

Electrical shock hazard.

Turn OFF electric power at fuse box or service panel before making any electrical connections and ensure a proper ground connection is made before connecting line voltage.

Failure to do so can result in property damage, personal injury and/or death.

### SUPPLY CIRCUIT

The furnace cannot be expected to operate correctly unless it is properly connected (wired) to an adequately sized (15 amp) single branch circuit.

### SUPPLY VOLTAGE

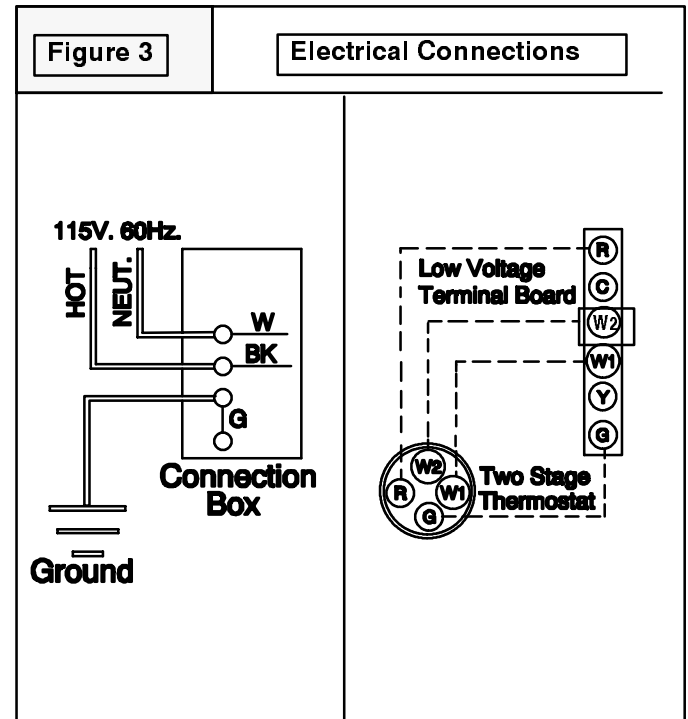
Supply voltage to the furnace should be a nominal 115 volts. It MUST be between 97 volts and 132 volts. Supply voltage to the furnace should be checked WITH THE FURNACE IN OPERATION. Voltage readings outside the specified range can be expected to cause operating problems. Their cause MUST be investigated and corrected.

### ELECTRICAL GROUND

Grounding of the electrical supply to ALL FURNACES IS REQUIRED for safety reasons. The HONEYWELL controls used in these models are GROUND SENSITIVE, and consequently MUST be grounded to operate properly.

### POLARITY

CORRECT POLARITY of the line voltage supply to all furnaces is also REQUIRED for safety reasons. The HONEYWELL controls used in these models are POLARITY SENSITIVE, and consequently MUST have proper line voltage polarity to operate properly.



### CHECKING GROUNDING AND POLARITY

Grounding may be verified as follows:

1. Turn the power supply "OFF"
2. Using an **Ohmmeter** check for continuity between the Neutral (white) wire and Ground wire of the supply circuit.
3. With the Ohmmeter set on the R x1 scale, the reading should be **zero Ohms**.
4. A zero Ohm reading indicates that the neutral is grounded back to the main panel.
5. An alternate check would be to check for continuity from the Neutral to a cold water pipe, (Pipe must be metal, and must have a continuous, uninterrupted connection to ground) or to a driven ground rod.
6. Any **readings other than zero Ohms** would indicate a poor ground, or no ground.

Polarity may be verified as follows:

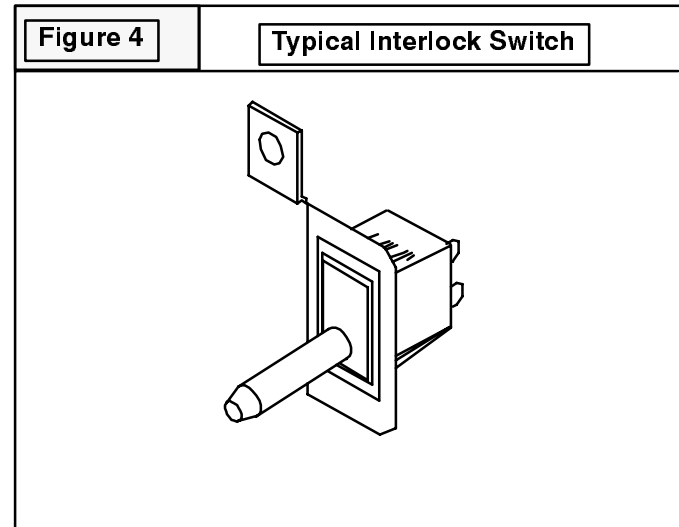
1. Turn power supply "ON"
2. Using a **Voltmeter** check for voltage between the **Hot** (Black) and **Neutral** (White) wire of supply circuit.
3. Reading should be **Line** (Supply) **Voltage**.
4. Check for Voltage between the **Neutral** (White) wire and **Ground** wire of the supply circuit.

5. Reading should be **zero Volts**. (if line voltage is read, polarity is reversed)
6. A zero Volt reading indicates there is no voltage potential on Neutral wire.
7. Double check by checking for voltage between the **Hot (Black) wire** and **Ground** wire of the supply circuit.
8. Reading should be **Line (supply) Voltage**. (if zero volts is read, there is no ground, or polarity is reversed.)

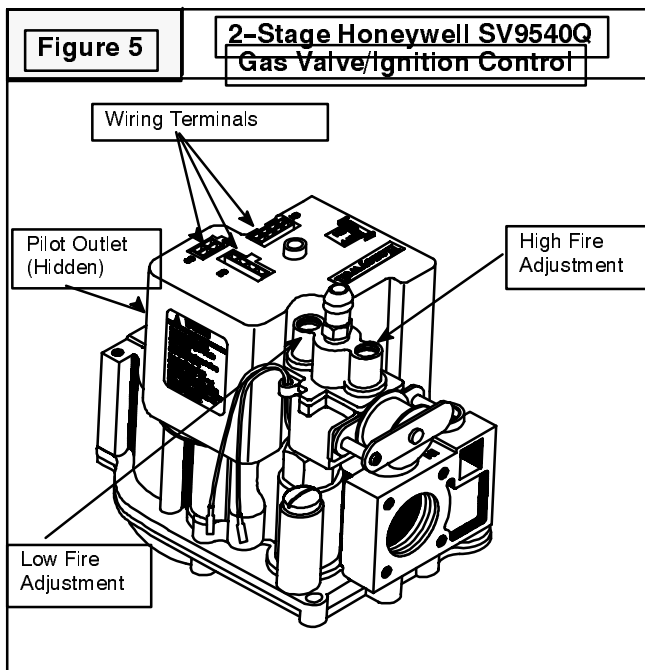
## INTERLOCK SWITCH

The blower compartment door of all models is equipped with an interlock switch. This switch is "Normally Open" (closes when the door is on the furnace) and interrupts furnace operation when the door is open. This interlock switch is a safety device, and **SHOULD NEVER BE BY-PASSED**.

Since this is a single pole switch, (breaking only one side of the line) proper line voltage polarity is essential to insure that furnace components are not "HOT" when switch is open. (See Checking Grounding and Polarity)



## GAS SUPPLY



An adequately sized gas supply to the furnace is required for proper operation. Gas piping which is undersized will not provide sufficient capacity for proper operation. Piping should be sized in accordance with accepted industry standards.

### NATURAL GAS

Inlet (Supply) pressure to the furnace should be checked (at the gas valve) with **ALL OTHER GAS FIRED APPLIANCES OPERATING**. Inlet (Supply) pressure to the furnace under these conditions **MUST** be a minimum of 4.5 in. W.C. If the inlet pressure is less, it may be an indication of undersized piping or regulator problems.

### L.P. GAS

Inlet (Supply) pressure to the furnace should be checked in the same manner as for Natural gas, however, with L.P. Gas, the inlet pressure **MUST** be a minimum of 11 in. W.C. If this cannot be obtained, problems are indicated in either the regulator or pipe sizing.

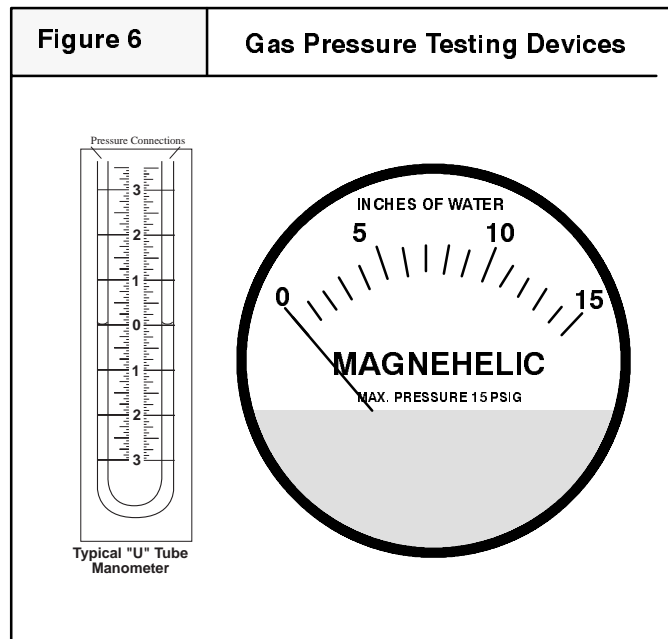
Table 1		Gas Pressures Below 2000 Ft.			
Gas Type	Supply Pressure			Manifold Pressure	
	Recom- mended	Max.	Min.	Hi Fire	Lo Fire
Natural	7" (1.7 kPa)	14" (3.5 kPa)	4.5" (1.1 kPa)	3.5" (0.9 kPa)	1.7" (0.5 kPa)
LP	11" (2.7 kPa)	14" (3.5 kPa)	11" (2.7 kPa)	10" (2.5 kPa)	4.9" (1.3 kPa)

**Important Notes**

- With Propane gas, the rated input is obtained when the BTU content is 2,500 BTU per cubic foot and manifold pressure set at 10 inches W.C.
- If Propane gas has a different BTU content, orifices **MUST** be changed by licensed Propane installer.
- Measured input can **NOT** exceed rated input.
- Combustion Air Box Cover (Condensing Models) **MUST** be removed when adjusting manifold pressure.
- Any major change in gas flow requires changing burner orifice size.

## CHECKING INPUT (FIRING) RATES

Once it has been determined that the gas supply (inlet) pressure is correct to the furnace, it is necessary to check **BOTH** the HIGH and LOW input (firing) rates. This can be done in two (2) ways. First (the preferred method) by checking and adjusting (as necessary) the manifold (Outlet) pressures. The second way is to "Clock" the gas meter.



## WARNING

Fire or explosion hazard.

Turn OFF gas at shut off before connecting U-tube manometer.

Failure to turn OFF gas at shut off before connecting U-tube manometer can result in personal injury and/or death.

## CHECKING MANIFOLD PRESSURE

**Note:** ALL Condensing models that have been installed as a direct-vent furnace (i.e. with combustion air piped directly to the furnace from outside the structure) **Must** have the combustion box cover **OFF** (removed) to accurately adjust manifold pressure.

1. Connect a U-tube manometer or Magnehelic gauge (0–15 in. W.C. range) to the pressure tap on the manifold.

## HIGH FIRE ADJUSTMENT

2. Turn gas "ON", fire the furnace on HIGH Fire by using a jumper wire on the **R** to **W1** & **W2** thermostat connections of the fan timer.
3. Remove HIGH fire adjustment cover (plastic cap) on valve, and turn HIGH fire adjustment screw clockwise (IN) to INCREASE pressure and counterclockwise (OUT) to DECREASE pressure.
4. At altitudes **BELOW 2,000 Ft.** set High Fire manifold pressure to 3.5 in. W.C. for Natural Gas, and to 10 in. W.C. for L.P. Gas. (See **Special High Altitude Instructions** for units installed **Above 2,000 Ft.**)

## LOW FIRE ADJUSTMENT

5. Turn gas "ON", fire the furnace on LOW Fire by using a jumper wire on the **R** to **W1** thermostat connections of the fan timer.
6. Remove LOW fire adjustment cover (plastic cap) on valve, and turn LOW fire adjustment screw clockwise (IN) to INCREASE pressure, and counterclockwise (OUT) to DECREASE pressure.
7. At altitudes **BELOW 2,000 Ft.** set LOW Fire manifold pressure to 1.7 in. W.C. for Natural Gas, and to 4.9 in. W.C. for L.P. Gas. (See **Special High Altitude Instructions** for units installed **Above 2,000 Ft.**)

**SPECIAL HIGH ALTITUDE INSTRUCTIONS**

1. For **Condensing Models** operating on **Natural Gas ABOVE 2,000 Ft.**, set manifold pressure according to **Table 2**.
2. For **Condensing Models** operating on **L.P. Gas ABOVE 2,000 Ft.**, insure that orifice size has been changed (per National Fuel Gas Code – Appendix “F”) if gas supply has not already been de-rated for altitude by the gas supplier. Then, adjust High Fire and Low Fire manifold pressure to 10 in. W.C. and 4.9 in. W.C. respectively.
3. For **Non-Condensing Models** operating on **Natural Gas ABOVE 2,000 Ft.**, set manifold pressure according to **Table 3**.
4. For **Non-Condensing models** operating on **L.P. Gas ABOVE 2,000 Ft.**, set manifold pressure according to **Table 4**.
5. For **ALL Models** ABOVE 8,000 Ft, contact the factory for SPECIFIC de-rating information.

**HIGH ALTITUDE APPLICATIONS – HIGH FIRE MANIFOLD PRESSURE & ORIFICE SIZES**

SHADED AREA REQUIRES ORIFICE CHANGE. NO SHADING INDICATES MANIFOLD PRESSURE CHANGE ONLY.

Table 2		Natural Gas – CONDENSING MODELS ONLY													
		Elevation Above Sea Level													
Heat Value Btu/Cu.Ft.	0–1999		2000–2999		3000–3999		4000–4999		5000–5999		6000–6999		7000–7999		
	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	High	Low	
800	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.2	1.7	2.9	1.7	
850	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.2	1.7	2.9	1.7	2.6	1.7	
900	3.5	1.7	3.5	1.7	3.4	1.7	3.1	1.7	2.8	1.7	2.5	1.7	2.3	1.7	
950	3.5	1.7	3.3	1.7	3.1	1.7	2.8	1.7	2.5	1.6	2.3	1.6	3.5	1.5	
1000	3.5	1.7	3.0	1.7	2.8	1.6	2.5	1.5	2.3	1.5	3.5	1.4	3.1	1.4	
1050	3.2	1.6	2.7	1.5	2.5	1.5	2.3	1.4	3.5	1.3	3.2	1.3	2.8	1.2	
1100	2.9	1.4	2.5	1.4	2.3	1.3	3.5	1.3	3.2	1.2	2.9	1.2	2.6	1.1	
Orifice Size	#42		#42		#42		#45		#45		#45		#45		

Table 3		Natural Gas – NON-CONDENSING MODELS ONLY													
		MEAN ELEVATION FEET ABOVE SEA LEVEL													
HEATING VALUE BTU/CU. FT.	0 to 1999 (" wc)		2000 to 2999 (" wc)		3000 to 3999 (" wc)		4000 to 4999 (" wc)		5000 to 5999 (" wc)		6000 to 6999 (" wc)		7000 to 8000 (" wc)		
	Hi	Lo	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	
800	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.2	1.6	2.9	1.4	
850	3.5	1.7	3.5	1.7	3.5	1.7	3.5	1.7	3.2	1.5	2.9	1.4	2.6	1.3	
900	3.5	1.7	3.5	1.7	3.4	1.7	3.1	1.5	2.8	1.4	2.5	1.2	2.3	1.1	
950	3.5	1.7	3.3	1.6	3.1	1.5	2.8	1.4	2.5	1.2	2.3	1.1	3.5	1.7	
1000	3.5	1.7	3.0	1.5	2.8	1.4	2.5	1.2	2.3	1.1	3.5	1.7	3.1	1.5	
1050	3.2	1.6	2.7	1.3	2.5	1.2	2.3	1.1	3.5	1.7	3.2	1.5	2.8	1.4	
1100	2.9	1.4	2.5	1.2	2.3	1.1	3.5	1.7	3.2	1.6	2.9	1.4	2.6	1.3	
Orifice Size	#42		#42		#42		#45		#45		#45		#45		

Table 4		L.P. Gas – NON-CONDENSING MODELS ONLY													
		MEAN ELEVATION FEET ABOVE SEA LEVEL													
HEATING VALUE BTU/CU. FT.	0 to 1999 (" wc)		2000 to 2999 (" wc)		3000 to 3999 (" wc)		4000 to 4999 (" wc)		5000 to 5999 (" wc)		6000 to 6999 (" wc)		7000 to 8000 (" wc)		
	Hi	Lo	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	Lo	Hi	
2500	10.0	4.9	10.0	4.9	9.4	4.6	10.0	4.9	9.8	4.8	8.8	4.3	7.9	3.9	
Orifice Size	#54		#54		#54		#55		#55		#55		#55		

NOTE: NATURAL GAS DATA BASED ON 0.60 SPECIFIC GRAVITY. PROPANE DATA BASED ON 1.53 SPECIFIC GRAVITY. FOR FUELS WITH DIFFERENT SPECIFIC GRAVITY CONSULT THE LATEST EDITION OF THE NATIONAL FUEL GAS CODE ANSI Z223.1 and CAN B149.

### "CLOCKING" GAS METER (NATURAL GAS)

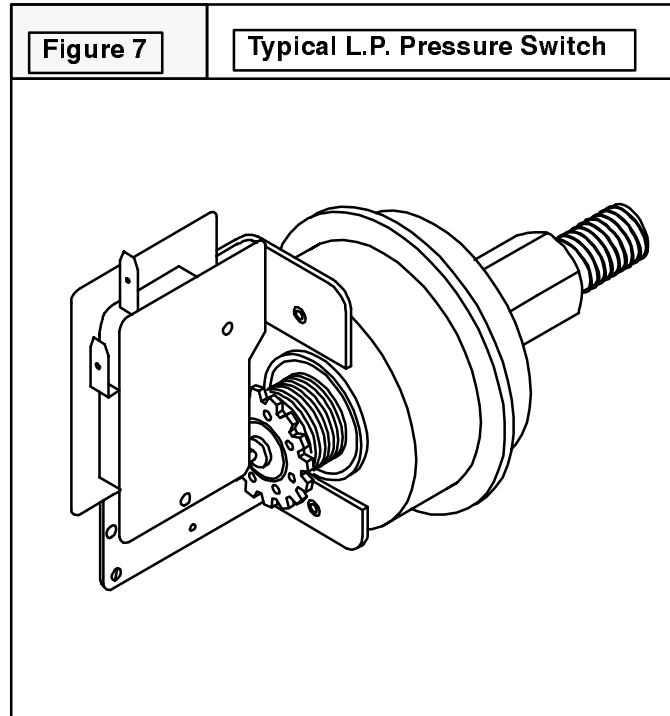
**Note:** ALL *Condensing models* that have been installed as a direct-vent furnace (i.e. with combustion air piped directly to the furnace from outside the structure) **Must** have the combustion box cover **ON** (installed) to accurately calculate input rate by "clocking" the gas meter .

1. Check with gas supplier to obtain ACTUAL BTU content of gas.
2. Turn "OFF" gas supply to ALL other gas appliances.
3. Operate furnace on HIGH fire, and time how many seconds it takes the smallest (normally 1 cfh) dial on the gas meter to make one complete revolution.

4. Calculate HIGH fire input rate by using ACTUAL BTU content of gas in formula shown in example.
5. Operate furnace on LOW fire, and time how many seconds it takes the smallest (normally 1 cfh) dial on the gas meter to make one complete revolution.
6. Calculate LOW fire input rate by using ACTUAL BTU content of gas in formula shown in example.

Example			
Natural Gas BTU Content	No. of Seconds Per Hour	Time Per Cubic Foot in Seconds	BTU Per Hour
1,000	3,600	48	75,000
$1,000 \times 3,600 \div 48 = 75,000 \text{ BTUH}$			

## L.P. PRESSURE SWITCH



Models equipped for or converted to operate on L.P. Gas will normally be equipped with an L.P. Pressure Switch. If so equipped, the switch will be located in the gas supply line ( in a "Tee" fitting), just ahead of the gas valve.

The purpose of this switch is to prevent furnace operation under low line (Supply) pressure conditions. Operating under low line pressure conditions, can create problems such as incomplete combustion, flashback, sooting, etc.

The switch is a "Normally Open" pressure operated switch that is wired in series with the furnace (vent) pressure switch. The L.P. Pressure Switch closes when line (Supply) pressure is 8.0" W.C. or higher. The L.P. Pressure Switch Opens if line pressure falls below 6.0"  $\pm$  0.6" W.C. interrupting power to the gas valve.

On ALL models, it is located (electrically) between the Auxiliary Limit Switch and the furnace Low Fire pressure switch.

## MAIN BURNERS

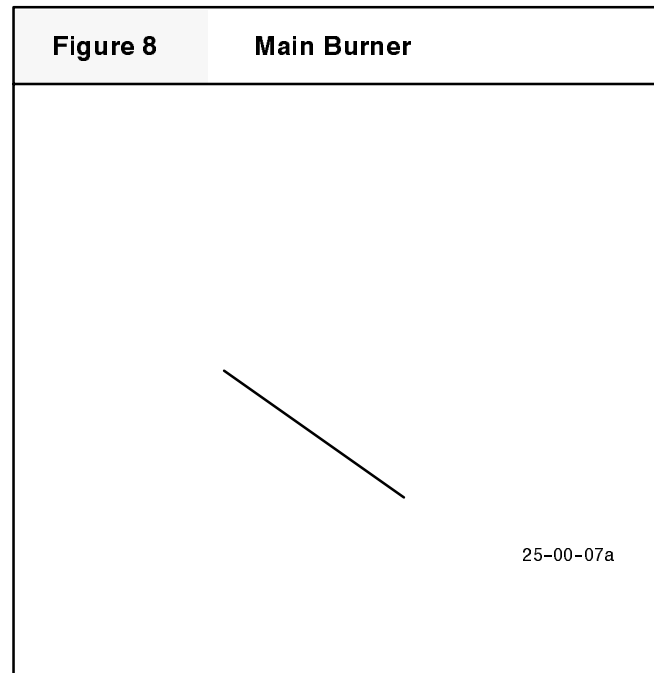
Burners used in this series of furnace are of the "INSHOT" type. Their operation can be compared to that of a torch in that they produce a hard, sharp, somewhat noisy flame. Noise should not be an issue, however, because of the closed burner box used on Condensing Models, and the burner enclosure used on Non-Condensing models.

In order to insure that the burners are operating properly, and at their design noise level, proper adjustment of the gas (manifold) pressure is essential. See page 9 for further information on manifold pressure adjustment.

The burners used in this series ARE NOT EQUIPPED WITH AIR SHUTTERS, as none are required. Proper operation (flame characteristics) is obtained by insuring that the orifice size, and manifold pressure are correct for the fuel being used and the altitude of the installation.

Figure 8

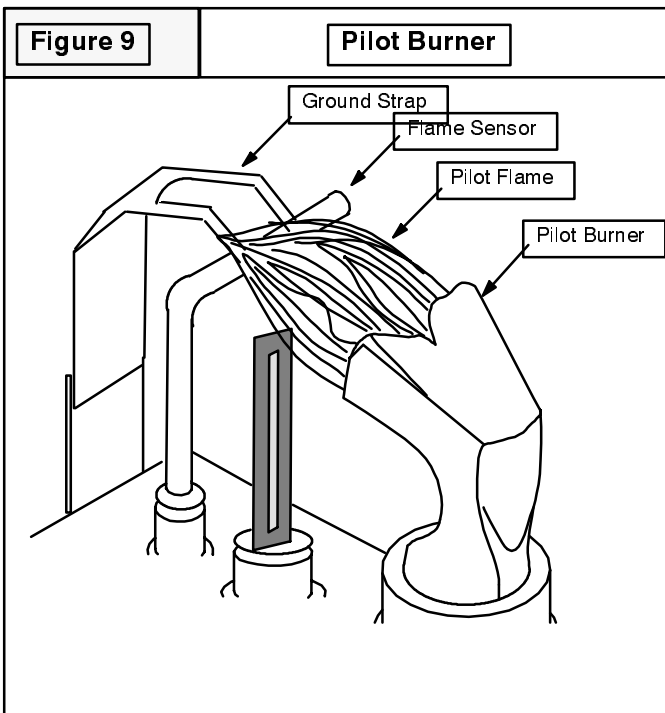
Main Burner



## PILOT BURNER

Figure 9

Pilot Burner

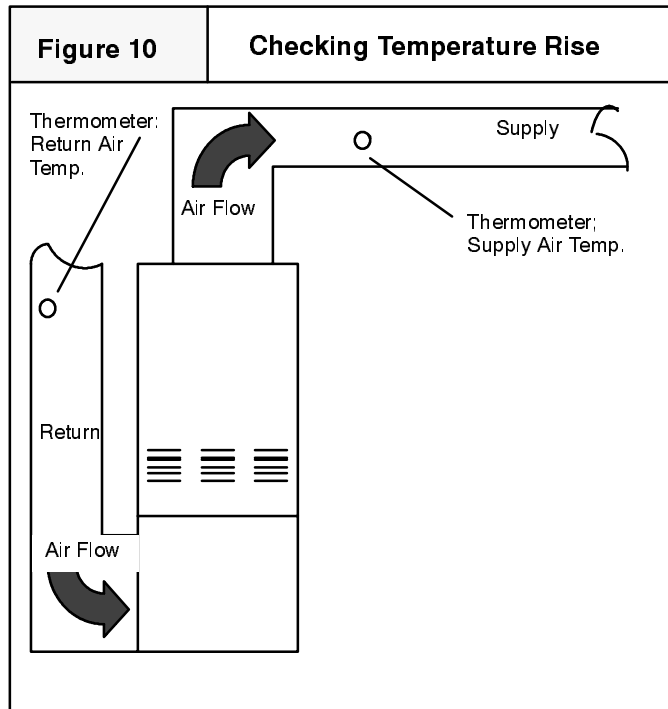


The same Pilot Burner is used on both Condensing and Non-Condensing models. The size of the Pilot Orifice, however, will depend upon the fuel being used. An .018" orifice is used for operation on Natural Gas, whereas an .011" orifice is used for operation on L.P. Gas. The Ignitor/Flame sensor assembly is replaceable independently of the pilot burner assembly.

Proper adjustment of the pilot flame is essential to proper flame sensing, and consequently to proper operation of the equipment. Improper adjustment of the pilot flame can lead to pilot lighting, and/or flame sensing problems. A pilot flame that is adjusted too low may not light consistently, and/or envelop the sensor sufficiently to maintain operation. A pilot flame that is adjusted too high may become very unstable causing it to be blown out, and/or may cause premature carbon build-up on the flame sensor.

The pilot flame must be adjusted so that it envelops BOTH the Flame Sensor, AND the Ground Strap of the pilot burner assembly. When adjusted properly, the pilot flame should envelop approximately 3/8" to 1/2" of the flame sensor.

## CHECKING TEMPERATURE RISE



The Two Stage furnace is designed to operate within a certain specified range of temperature rise.

Operating the furnace outside the specified range may result in lower efficiency and/or comfort levels, as well as premature combustion component failures.

Simply stated, the temperature rise through the furnace is the difference in temperature between the return air, and the supply air.

**NOTE: BEFORE CHECKING TEMPERATURE RISE BE CERTAIN THAT MANIFOLD PRESSURE IS PROPERLY ADJUSTED FOR BOTH HIGH AND LOW FIRE OPERATION.**

Temperature Rise can be checked by placing a thermometer in the return air duct as close to the furnace as possible. Place a second thermometer in the supply duct at least two (2) feet away from the furnace. (This will prevent any false readings caused by radiation from the furnace heat exchanger) Make sure that the **FILTER IS CLEAN** and that **ALL REGISTERS AND/OR DAMPERS ARE OPEN**.

### ALLOWABLE TEMPERATURE RISE VARIABLE SPEED CONDENSING MODELS

Model	Range
50 Mbtu, 75 Mbtu, & 100 Mbtu	40°F - 70°F
125 Mbtu	45°F - 75°F

Operate the furnace for 15 minutes before taking temperature readings. Subtract the return air temperature from the supply air temperature. The result is the temperature rise. Compare with the allowable rise listed for the Firing rate and model (size) you are checking.

### ALLOWABLE TEMPERATURE RISE 2 SPEED CONDENSING MODELS

Model	Fire	Range
50 Mbtu, 75 Mbtu, & 100 Mbtu	HI	40°F - 70°F
	LOW	30°F - 60°F
125 Mbtu	HI	45°F - 75°F
	LOW	30°F - 60°F

### ALLOWABLE TEMPERATURE RISE NON-CONDENSING MODELS

Model	Range
50 Mbtu & 75 Mbtu	35°F - 65°F
100 Mbtu	45°F - 75°F
125 Mbtu	40°F - 70°F

If the rise is not within the specified range, it will be necessary to change the heating blower speed. **If the rise is too high**, it will be necessary to **increase the blower speed**. **If the rise is too low**, it will be necessary to **reduce the blower speed**.

#### Example:

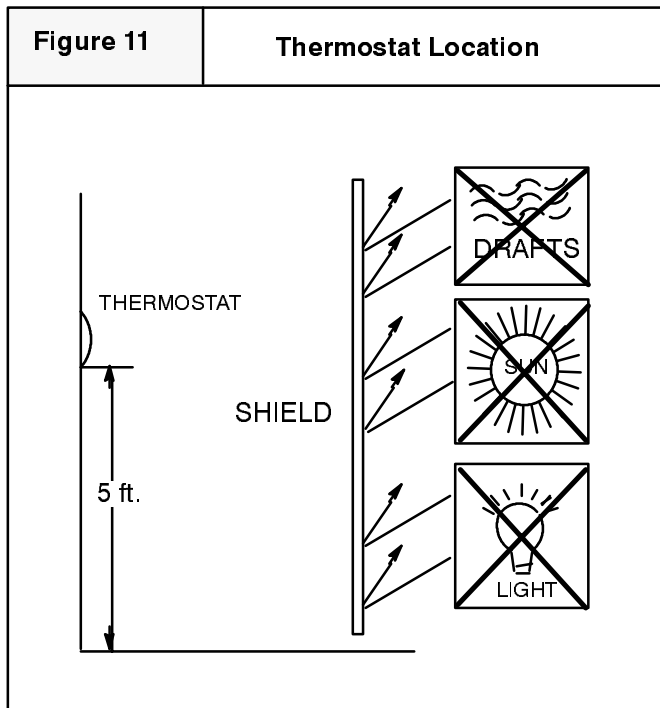
Supply Temp.      170 degrees  
Return Temp.      70 degrees  
Temperature Rise 100 degrees = Too High

**Solution: Increase Blower Speed**



## ROOM THERMOSTATS

Room thermostats are available from several different manufacturers in a wide variety of styles. They range from the very simple and inexpensive Bi-metallic type to the complex and costly electronic set-back type. In all cases, no matter how simple or complex, they are simply a switch (or series of switches) designed to turn equipment (or components) "ON" or "OFF" at the desired conditions.



An improperly operating, or poorly located room thermostat can be the source of perceived equipment problems. A careful check of the thermostat and wiring must be made then to insure that it is not the source of problems.

### LOCATION

The thermostat should not be mounted where it may be affected by drafts, discharge air from registers (hot or cold), or heat radiated from the sun or appliances.

The thermostat should be located about 5 Ft. above the floor in an area of average temperature, with good air circulation. Normally, an area in close proximity to the return air grille is the best choice.

Mercury bulb type thermostats **MUST** be level to control temperature accurately to the desired set-point. Electronic digital type thermostats **SHOULD** be level for aesthetics.

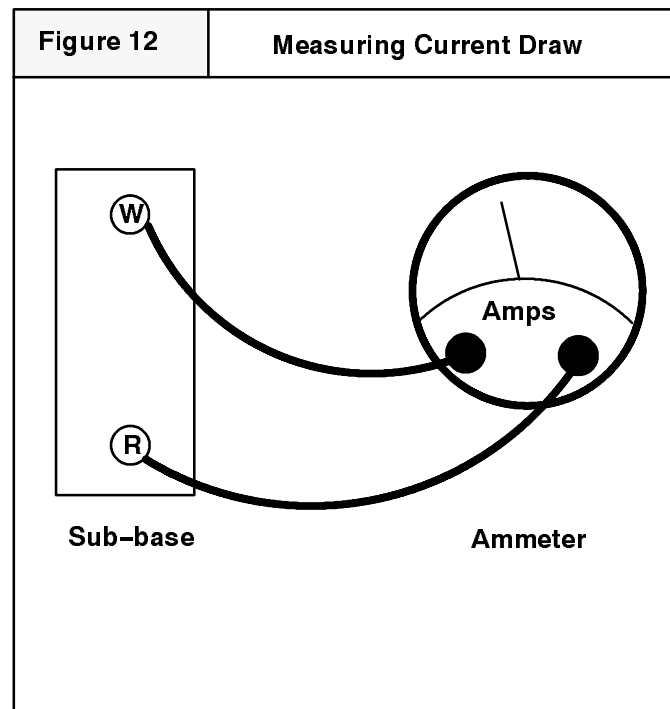
## HEAT ANTICIPATORS

Heat anticipators are small resistance heaters built into most electro-mechanical thermostats. Their purpose is to prevent wide swings in room temperature during furnace operation.

In order to accomplish this, the heat output from the anticipator must be the same regardless of the current flowing through it. Consequently, most thermostats have an adjustment to compensate for varying current draw in the thermostat circuit.

The proper setting of heat anticipators then is important to insure proper temperature control and customer satisfaction.

The best method to obtain the required setting for the heat anticipator, is to measure the actual current draw in the control circuit ("W") using a low range (0-2.0 Amps) Ammeter. (See Figure 12) After measuring the current draw, simply set the heat anticipator to match that value.



If a low range ammeter is not available, a "Clamp-on" type ammeter may be used as follows:

1. Wrap EXACTLY ten (10) turns of wire around the jaws of a clamp-on type ammeter.
2. Connect one end of the wire to the "W" terminal of the thermostat sub-base, and the other to the "R" terminal.

3. Turn power on, and wait approximately 1 minute, then read meter.
4. Divide meter reading by 10 to obtain correct anticipator setting.

**NOTE:** For 2 Stage heating thermostats the above procedure **MUST** be performed twice. Once for first stage (W1), and once for second stage (W2), if both stages have adjustable heat anticipators.

If an ammeter is not available, a setting of 0.10 amps may be used. This is an APPROXIMATE setting. It

should, however, provide satisfactory operation in most cases.

Electronic thermostats do not use a resistance type anticipator. These thermostats use a microprocessor (computer) that determines a cycle rate based on a program loaded into it at the factory.

These cycle rates are normally field adjustable for different types of equipment. The method of adjustment, however, varies from one thermostat manufacturer to another. Check with the thermostat manufacturer to find out the proper way of adjusting the cycle rate.

## CONTROL WIRING

Control wiring is an important part of the total equipment installation, since it provides the vital communications link between the thermostat, and the equipment. It is often overlooked as the source of equipment malfunctions. Control wiring that is either too long, undersized, or improperly connected (be it simply loose, or on the wrong terminal) can in fact be the source of many equipment problems.

ALWAYS check to make sure that the control wiring is connected to the proper terminal(s) of the equipment and thermostat you are using. Remember, also, that thermostat terminals are not always identified alike by different thermostat manufacturers. Connections **MUST** be clean and tight to insure trouble-free operation.

The controls of this series of 2-Stage furnaces are designed to provide 2-Stage operation using a Two (2) Stage Thermostat, **ONLY** as follows:

The **R**, **W1**, & **W2** wires from the room thermostat connect to the **R**, **W1**, & **W2** terminals of the Fan Timer/Furnace Control. With a call for 1st stage heat (R & W1), the furnace will (after its initial start-up on High) operate on LOW fire until the call for Heat ends, or there is a call for 2nd stage (W2) operation. With a call for 2nd stage heat (R, W1 & W2), the furnace will operate on HIGH fire until the call for 2nd stage ends, (at which time it will return to LOW fire operation) or until the call for Heat ends.

The **ELECTRONIC CONTROLS** used on this series **RESPOND DIFFERENTLY** to certain control wiring practices which have been generally accepted in the HVAC industry for many years.

For Example: For years, installers have run a wire from the "Y" terminal of the room thermostat and connected it directly to the contactor coil of a condensing unit. (not making any connection to the furnace with this wire) Then, run the low voltage "Common" wire from the condensing unit back to the "C" terminal of the furnace.

With the **HONEYWELL ST9162A** electronic Fan Timer/Furnace Control used in the models of this series, however, the "Y" terminal of the furnace does in fact serve a particular purpose. Failure to connect it will result in certain improper operation as follows:

The **COOLING** fan speed is energized via the "Y" terminal. **Failure to connect** the thermostat "Y" terminal to the "Y" terminal on the control will result in the **failure to energize** the **COOLING speed** on a call for cooling from the thermostat. (Depending upon the model, either the **LOW HEATING** speed or the **CIRCULATING** speed will be energized instead via the "G" terminal)

For more detailed information about this control, see the section on the ST9162A control beginning on page 23 of this manual.

## LIMIT SWITCHES

Three (3) different kinds of limit switches are used on this series of furnace. They are the main limit, roll out limit, and auxiliary limit switches.

**NOTE:** All **limit switches** are **safety devices** and other than for testing purposes, **should never be jumped out!** Limit switches are “normally closed” electrical switches, designed to open when their predetermined “limit setting” has been reached.

It should also be remembered, that when a limit switch opens, it more than likely is not due to a bad switch! The cause of the opening limit must be found and corrected, before the furnace can resume proper operation.

### WARNING

**Fire hazard.**

**Limit controls are factory preset and MUST NOT be adjusted. Use ONLY manufacturer's authorized replacement parts.**

**Failure to do so can result in personal injury and/or death.**

The specific functions of the Three (3) limit switches used in this series of furnaces are as follows:

### MAIN LIMIT SWITCH

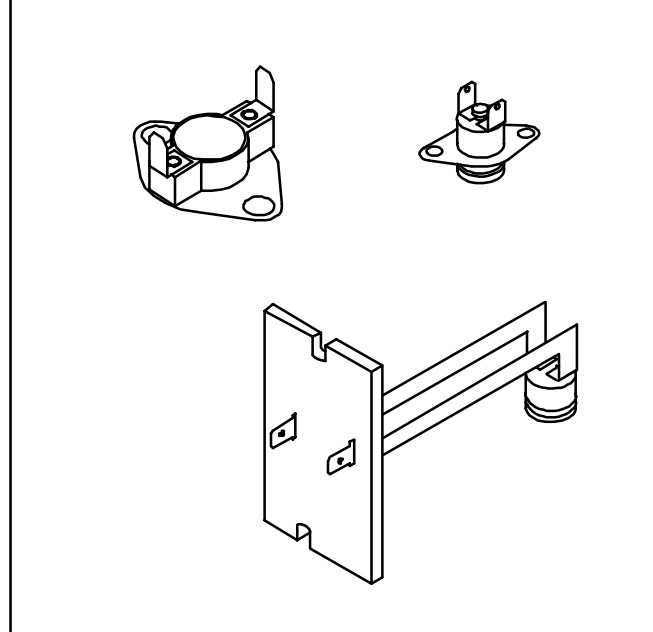
A “Normally Closed” switch located on the front partition of the furnace. It monitors supply air temperature, and interrupts furnace (burner) operation when a supply air temperature is sensed which would result in the furnace exceeding Maximum allowable outlet air temperature. While the main limit is open, the combustion blower, and the circulating blower will be energized continuously. This control is an “Automatic” reset control, which will reset itself when the temperature sensed drops to a safe level.

If furnace (burner) cycles on this limit switch, (I.E. switch opens and closes during furnace operation) it is more than likely due to a high temperature rise through the furnace. (See checking temperature rise on page 13 of this manual)

High temperature rise can be caused by either OVER FIRING (high manifold pressure, incorrect orifices, etc.) or LOW AIR FLOW (dirty filter, blower speed too low, excessive static in duct system, etc.)

Figure 13

Typical Limit Switches



To verify this, the cut-out (opening) point of the switch should be checked (using a thermocouple type thermometer connected to the face of the switch) as follows:

1. Operate furnace for several minutes.
2. Block return air grille(s) to furnace.
3. Observe temperature at which switch opens (burner operation ceases).
4. Remove blockage from return grille(s).
5. Observe temperature at which switch closes (burner operation resumes).
6. Compare readings with the limit setting listed in the appropriate chart for the model you are servicing.

### MAIN LIMIT SWITCHES - CONDENSING MODELS

MODEL	OPEN	CLOSE	PART #
50 Mbtu	160°F ± 5°	140° ± 7°	1010647
75 Mbtu	190°F ± 5°	170° ± 7°	34332903
100 Mbtu (Variable Speed)	180°F ± 5°	160° ± 7°	1320547
100 Mbtu (2 Speed)	170°F ± 5°	150° ± 7°	1010652
125 Mbtu	180°F ± 5°	160° ± 7°	1320547

If switch is opening within the specified range, then it is simply doing its job, and the cause of the over-temperature must be determined and corrected.

If, however, the switch is found to be opening prematurely, then it should be replaced. When replacing ANY limit switch, use ONLY a switch of EXACTLY the same temperature setting. Use of a different temperature limit switch can create a dangerous situation. Some of the main limit switches used in this series are SIMILAR IN APPEARANCE. DIFFERENT TEMPERATURE SETTINGS, HOWEVER, ARE USED for different models. Be certain you have the correct control for the model you are servicing.

### MAIN LIMIT SWITCHES - NON-CONDENSING MODELS

MODEL	OPEN	CLOSE	PART #
50 Mbtu	260°F ± 6°	240° ± 7°	1320366
75 Mbtu	300°F ± 5°	280° ± 8°	34333002
100 Mbtu (3 Ton)	270°F ± 6°	250° ± 8°	1320365
100 Mbtu (5 Ton)	180°F ± 5°	160° ± 6°	1008417
125 Mbtu	150°F ± 5°	130° ± 5°	1320362

### AUXILIARY LIMIT SWITCH

All models are equipped with an additional (AUXILIARY) limit switch mounted on the blower housing. Its purpose is to monitor return air temperature, and interrupt burner operation when a temperature is sensed which could result in the filter surface(s) exceeding allowable temperatures.

#### AUXILIARY LIMIT SWITCHES - ALL MODELS

MODEL	OPEN	CLOSE	PART #
ALL	130°F ± 5°	110°F ± 8°	1000735

This switch is wired in series with the LOW pressure switch. While the auxiliary limit switch remains open the combustion blower, and/or circulating blower will be disabled (de-energized) and the gas valve will display (Flash) an error code 3. The auxiliary limit switch is an "Automatic" reset control which will reset itself when the temperature drops to a safe level.

### ROLL OUT LIMIT SWITCH

A "Normally Closed" switch (wired in series with the Main Limit switch) mounted on the burner box or burner enclosure.

The roll out switch monitors the temperature inside the burner box, and interrupts furnace (burner) operation when its temperature indicates flame roll out has occurred.

This switch is of the manual reset type, and must be "Manually Reset" (by pressing the red button located on the switch) once it opens. While the roll out switch is open the combustion blower and/or circulating blower will be energized continuously.

If the roll out switch has opened, the cause must be determined. Some possible reasons for flame roll out include a restricted primary or secondary heat exchanger or over fired furnace.

### ▲ CAUTION

**NEVER use an automatic reset roll out switch to replace a manual reset type roll out switch.**

**Doing so may cause potentially unsafe and/or intermittent operation.**

Different temperature (OPENING) settings are used depending upon the particular model and/or family. When replacing this switch, be absolutely certain the correct switch is used. See the chart for the model you are servicing, to obtain its specific Roll-Out limit switch setting.

#### ROLL OUT SWITCHES - NON-CONDENSING MODELS

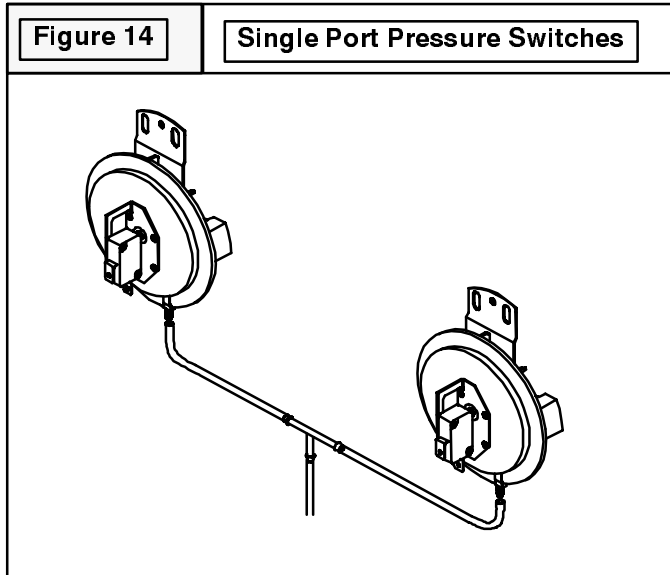
MODEL	OPEN	CLOSE	PART #
ALL	300°F ± 10°	MANUAL	1005549

#### ROLL OUT SWITCHES - CONDENSING MODELS

MODEL	OPEN	CLOSE	PART #
50 Mbtu	250°F ± 10°	MANUAL	1005549
75 Mbtu, 100 Mbtu, 125 Mbtu	200°F ± 10°	MANUAL	1005549

# PRESSURE SWITCHES

Air proving switches (pressure switches) are used on all models to insure that a draft has been established through the heat exchanger(s) before allowing burner operation.



**Non-Condensing Models** use two (2) single tap (port) switches that are connected in tandem to the combustion blower. They sense the negative pressure created by the combustion blower which indicates that sufficient draft is present inside of the flue.

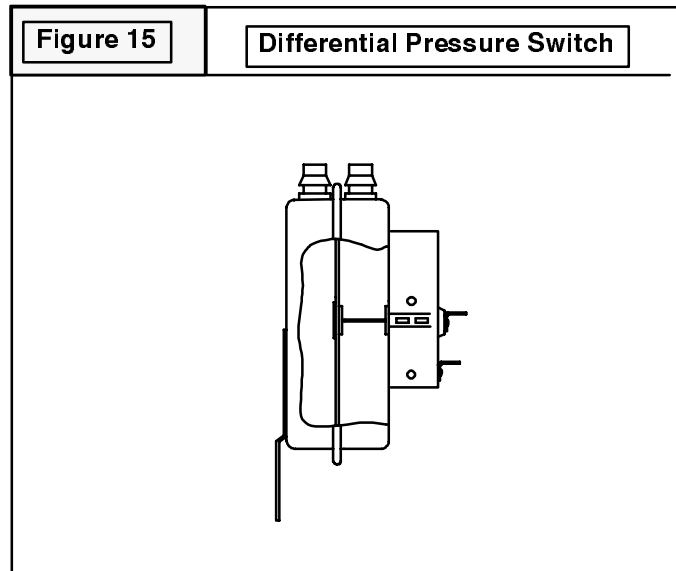
All Non-Condensing models use the same (setting) HIGH pressure switches, and the same (setting) LOW pressure switches. High altitude *switches* are not required on these models, as high altitude conversion is accomplished via changing the inlet air restrictor (see Figure 19).

### NON-CONDENSING MODELS HIGH & LOW PRESSURE SWITCHES

SWITCH	MAX. CLOSE	OPEN	PART #
HIGH	-.95" W.C.	-.80 ± 0.08" W.C.	1010945
LOW	-.53" W.C.	-.35 ± 0.05" W.C.	1010739

**Condensing Models** use two (2) dual tap (port) "Differential" type switches. The HIGH pressure switch senses the differential in negative pressure between that created by (at) the combustion blower, and that which is present inside the burner box of the furnace. The LOW pressure switch senses the differential in negative pressure between the burner box of the furnace and the transition assembly. In horizontal

applications, the LOW pressure switch also serves as a blocked condensate drain safety switch.



All condensing models use the same (setting) HIGH pressure switch, each model, however, uses a different (setting) LOW pressure switch. High altitude *switches* (when required) are also different for each model.

### CONDENSING MODELS STANDARD HIGH PRESSURE SWITCHES

MODEL	MAX. CLOSE	OPEN	PART #
ALL	-1.62" W.C.	-1.38 ± 0.12" W.C.	1010895

### CONDENSING MODELS STANDARD LOW PRESSURE SWITCHES

MODEL	MAX. CLOSE	OPEN	PART #
50 Mbtu	-1.08" W.C.	-.90 ± 0.08" W.C.	1011778
75 Mbtu	-.65" W.C.	-.50 ± 0.05" W.C.	1011776
100 Mbtu	-.86" W.C.	-.70 ± 0.06" W.C.	1011777
125 Mbtu (Variable Speed)	-1.08" W.C.	-.90 ± 0.08" W.C.	1011778
125 Mbtu (2 - Speed)	-1.40" W.C.	-1.20 ± 0.10" W.C.	1011779

To insure continued SAFE, RELIABLE, operation. NEVER SUBSTITUTE a pressure switch with one that is similar in appearance. ONLY FACTORY PROVIDED or AUTHORIZED SUBSTITUTES ARE ACCEPTABLE.

All Condensing models installed at altitudes of 4,000 Ft. above sea level or higher require replacing the standard pressure switch with a high altitude pressure switch. The different pressure switch settings allow continued SAFE, RELIABLE, high altitude operation.

### CONDENSING MODELS

#### HIGH ALTITUDE HIGH PRESSURE SWITCHES

MODEL	MAX. CLOSE	OPEN	PART #
ALL	-1.40" W.C.	-1.18" ± 0.12" W.C.	1008817

### CONDENSING MODELS

#### HIGH ALTITUDE LOW PRESSURE SWITCHES

MODEL	MAX. CLOSE	OPEN	PART #
50 Mbtu	-.86" W.C.	-.70 ± 0.06" W.C.	1011777
75 Mbtu	-.52" W.C.	-.37 ± 0.05" W.C.	1010943
100 Mbtu	-.65" W.C.	-.50 ± 0.05" W.C.	1011776
125 Mbtu (Variable Speed)	-.86" W.C.	-.70 ± 0.06" W.C.	1011777
125 Mbtu (2 - Speed)	-1.08" W.C.	-.90 ± 0.08" W.C.	1011778

Under normal operating conditions, sufficient negative pressure will be created to close the pressure switch,

and keep it closed to keep furnace operating. Under abnormal conditions, however, such as a restricted vent pipe, or a leak in one of the heat exchangers, sufficient negative pressure will not be created. This will result in the switch failing to close or failing to remain closed during furnace operation.

When servicing a unit whose pressure switch will not close, or remain closed during operation, the operating pressures of that furnace should be checked and compared to approximate operating pressures listed in Table 5 and the switch setting(s) listed above for the model family you are servicing.

It is important to remember, that greater negative pressures are created by the furnace when "Cold" (I.E. upon initial start-up) than when "Hot" (I.E. after furnace has been in operation for a few minutes). Because of this, furnace pressures should ONLY be checked when "Hot" to insure accurate readings.

Table 5 lists approximate operating pressures for Direct Vent (I.E. Two Pipe) installations of condensing models in this series. They were obtained in a test lab, under controlled conditions using two (2) specific vent lengths. They are included in this manual to provide you with a "Barometer" to gauge your pressures against. The pressures you obtain in the field will differ slightly from these figures based upon vent length, gas pressure, operating temperature, etc.

Major discrepancies in pressures, will normally cause problems with pressure switch operation. These Major discrepancies should be investigated as follows:

## CONDENSING MODELS

Table 5		APPROXIMATE OPERATING PRESSURES (INCHES OF W.C.)					
Model	Vent Length	@Blower	@Transition	@Burner Box		Differential	
		(High Fire)	(Low Fire)	Hi	Lo	Hi	Lo
50 Mbtu	Short - (5 Ft. No Elbows)	-2.30	-1.56	-.10	-.04	-2.20	-1.52
	Long - (40 Ft. + 5 90° Elbows)	-2.20	-1.52	-.20	-.14	-2.00	-1.38
75 Mbtu	Short - (5 Ft. No Elbows)	-2.30	-.98	-.10	-.08	-2.20	-.90
	Long - (40 Ft. + 5 90° Elbows)	-2.05	-.95	-.15	-.15	-1.90	-.80
100 Mbtu	Short - (5 Ft. No Elbows)	-2.40	-1.36	-.10	-.06	-2.30	-1.30
	Long - (40 Ft. + 5 90° Elbows)	-1.98	-1.22	-.20	-.18	-1.78	-1.22
125 Mbtu	Short - (5 Ft. No Elbows)	-2.40	-1.76	-.10	-.08	-2.23	-1.68
	Long - (40 Ft. + 5 90° Elbows)	-2.16	-1.64	-.20	-.12	-1.78	-1.52

## CONDENSING MODELS

### Lower (Lesser) Negative Pressures

**Lower than normal** negative pressures measured at the **Combustion Blower** may be caused by:

1. Restriction on the **Outlet** side of the combustion blower. (I.E. Blocked Flue, Vent Too long, etc.)
2. Leak (lack of restriction) on the **Inlet** side of the combustion blower. (I.E. Transition Assembly, Primary or Secondary heat exchanger)

**Lower than normal** negative pressures measured at the **Transition Assembly** may be caused by:

1. Restriction on the **Outlet** side of the Transition Assembly. (I.E. Blocked Flue, Vent Too long, air inlet orifice too small, etc.)
2. Leak (lack of restriction) on the **Inlet** side of the Transition Assembly. (I.E. Primary or Secondary heat exchanger)

**Lower than normal** negative pressures measured at the **Burner Box** may be caused by:

1. Combustion air inlet (Burner) box not properly sealed to front partition.
2. Combustion air inlet pipe not installed, too short, or diameter of pipe too large.

### Higher (Greater) Negative Pressures

**Higher than normal** negative pressures measured at the **combustion blower** may be caused by:

1. Restriction on the **Inlet** side of the combustion blower. (I.E. Plugged Heat Exchanger, air inlet orifice too small)

**Higher than normal** negative pressures measured at the **Transition Assembly** may be caused by:

1. Restriction on the **Inlet** side of the transition Assembly (I.E. Plugged Heat Exchanger)

**Higher than normal** negative pressures measured at the **burner box** may be caused by:

1. Restricted combustion air inlet pipe (I.E. blocked, too long, diameter of pipe too small).

## VENT/COMBUSTION AIR PIPING

Vent and combustion air piping are an extremely important part of the total furnace installation. Improperly installed or inadequately sized vent and/or combustion air piping can be the source of many perceived furnace problems.

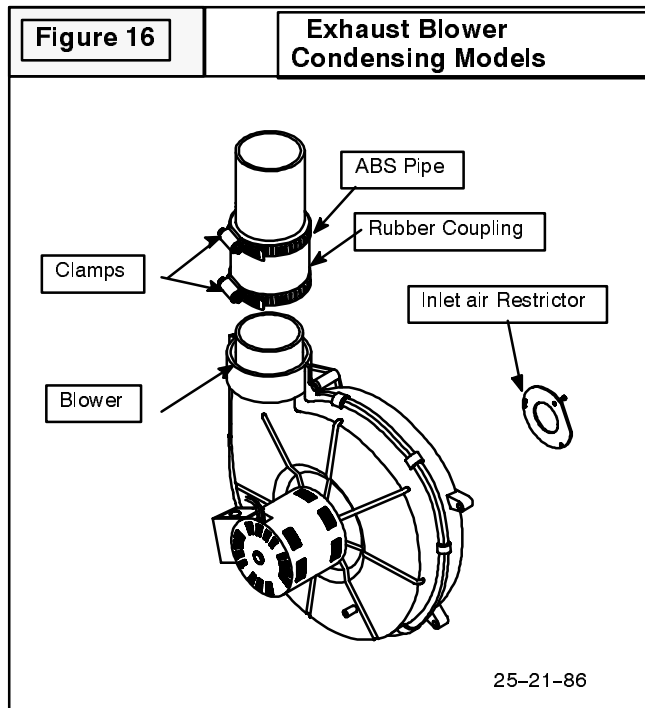
For example, most problems associated with pressure switch operation can normally be traced to shortcomings in the vent and/or combustion air piping. Anytime these type problems arise, a thorough inspection of the vent and/or combustion air piping should be conducted.

**ALL MODELS** require a vent (exhaust) pipe to carry flue products to the outside of the structure.

**CONDENSING MODELS** require a combustion air inlet pipe to bring in all air for combustion from outside the structure **only** when installed as a Direct Vent Furnace (I.E. Two Pipe Installation)

Consult the appropriate Installation Manual for the Venting tables and/or piping charts for the model (series) you are servicing.

## EXHAUST BLOWER – CONDENSING MODELS



split capacitor motor. For replacement parts purposes only one blower (the stronger of the two) is supplied.

All Condensing models use an inlet air restrictor mounted on the inlet (back) side of the blower. Since all models use the same (Setting) HIGH pressure switch, a DIFFERENT (size) inlet air restrictor orifice is used for the different size (BTU Input) models to maintain the correct airflow (Pressure) through the heat exchangers. When replacing an exhaust (combustion) blower, it is essential that the (Correct) inlet air restrictor orifice be installed on the replacement blower before it is mounted to the furnace.

### INLET AIR RESTRICTORS – 2 SPEED MODELS

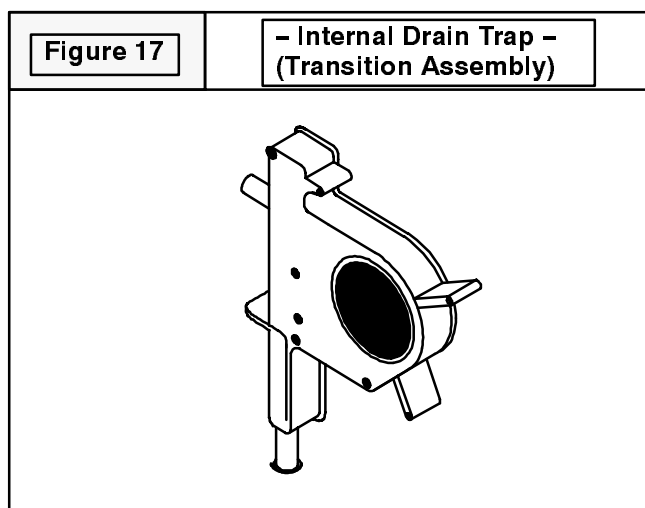
Model	Inside Diameter	I.D. Letter	Part #
50 Mbtu 75 Mbtu	1 3/16"	"A"	1008696
100 Mbtu	1 3/8"	"E"	1009386
125 Mbtu	1 3/4"	"B"	1008699

### INLET AIR RESTRICTORS – VARIABLE SPEED MODELS

Model	Inside Diameter	I.D. Letter	Part #
50 Mbtu	1 3/16"	"A"	1008696
75 Mbtu	1 5/32"	"H"	1011756
100 Mbtu	1 5/16"	"J"	1011757
125 Mbtu	1 9/16"	"K"	1011758

All Condensing models use one of two (2) different (Part#) induced draft exhaust (combustion) blowers mounted on the outlet side of the secondary heat exchanger. The purpose of the combustion blower is to establish a draft (flow) through the heat exchangers, to insure that all flue products are carried outside the structure via the vent pipe. The blower housing is made of plastic, and is driven by a 2 speed permanent

## CONDENSATE DRAIN TRAP



The removal of additional heat from the flue products which takes place in the secondary heat exchanger (condenser) causes them to drop below their dew point resulting in condensation. This condensation (water) then must be drained from the furnace, and routed to a remote drain, or condensate pump.

The combustion blower creates a negative pressure in excess of 2 inches W.C. while operating. Without a condensate drain trap of sufficient depth, condensate would be held in the furnace, (because of this negative pressure), and not be able to drain. Figure 17 shows the internal drain trap assembly, (also referred to as the transition assembly), which is mounted between the combustion blower, and the front partition.



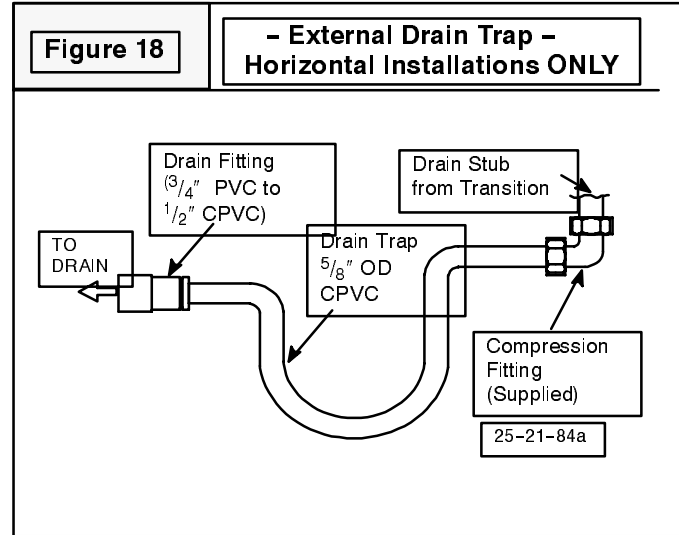
In standard **Upflow installations**, the internal drain trap provides sufficient depth (4" W.C.) to insure proper drainage of condensate from the furnace. Additional traps are NOT required, and should NOT be used. The use of additional traps will PREVENT proper drainage of condensate from the furnace. Care should be taken with the routing of the condensate drain hose, to eliminate all dips or sagging tubing which can create another trap, and cause drainage problems.

Floats and/or condensate sensors are NOT used in the drain trap. If the drain line becomes clogged, the condensate level will rise higher in the internal trap. When the level rises sufficiently, the furnace will begin to "Cycle" (On and Off) on the pressure switch. If the condensate level rises high enough in the trap, the pressure switch may not close at all, and water may be heard "Paddling" inside the combustion blower.

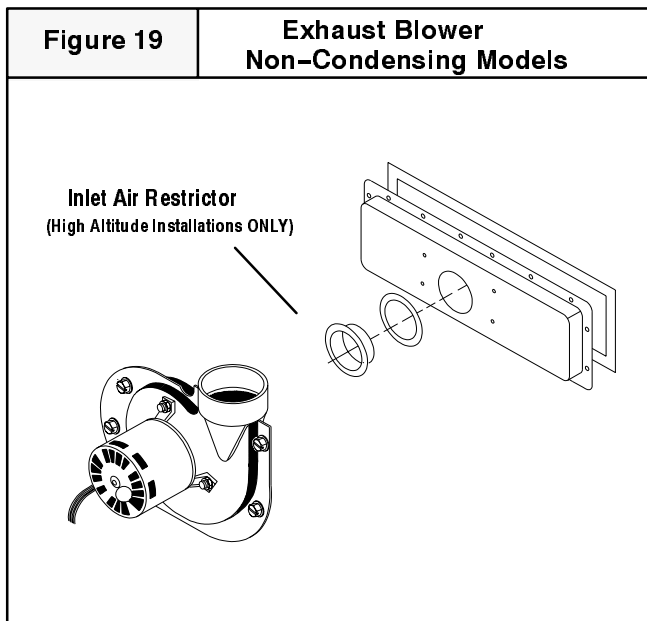
In **Horizontal installations** the internal drain trap does NOT provide sufficient depth to insure proper drainage of condensate from the furnace. An additional (External) trap (supplied with furnace) IS REQUIRED for horizontal installations and MUST be used. Failure

to use an external trap will PREVENT proper drainage of condensate from the furnace.

In horizontal installations, the LOW fire Pressure Switch (see Figure 15) will open, or begin to cycle when the condensate drain line begins to back-up.



## EXHAUST BLOWER – NON-CONDENSING MODELS



blower housing is made of metal, and is driven by a two (2) speed shaded pole motor.

Although similar in appearance to combustion blowers used on other series of furnaces, they have different performance characteristics, and consequently, are NOT INTERCHANGEABLE.

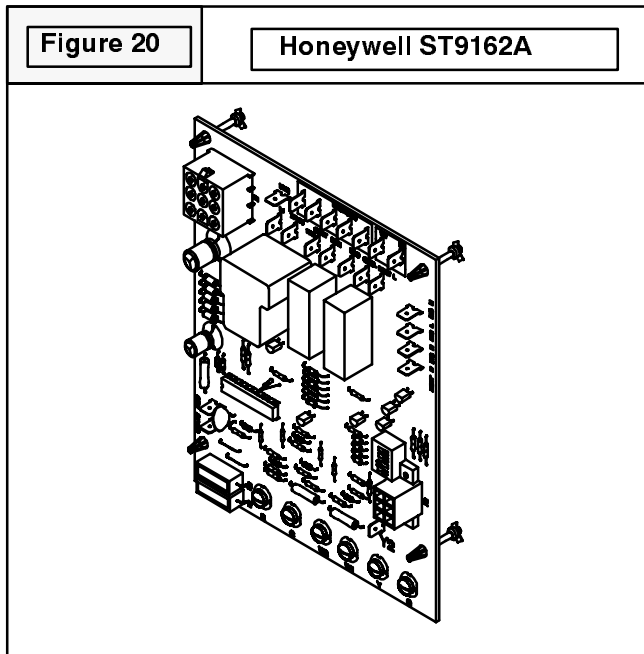
All Non-Condensing models installed in high altitude applications (Above 4000 Ft.) use an inlet air restrictor mounted to the collector box on the inlet (back) side of the blower. A different (size) inlet air restrictor orifice is used for the different (Btu input) models. When replacing a combustion blower on a model installed above 4000 Ft., it is essential that the orifice be re-installed on the collector box before blower is mounted to the furnace.

### INLET AIR RESTRICTORS – NON-CONDENSING MODELS

Model	Inside Diameter	Part #
50 Mbtu	0.87"	734020033
75 Mbtu	1.12"	734020026
100 Mbtu	1.37"	734020027
125 Mbtu	1.62"	734020035

All Non-Condensing models use the same (Part#) induced draft combustion blower mounted on the outlet side of the heat exchanger. The purpose of the combustion blower is to establish a draft (flow) through the heat exchanger, to insure that all flue products are carried outside the structure via the vent pipe. The

# HONEYWELL ST9162A Series FAN TIMER/FURNACE CONTROL



The HONEYWELL ST9162A Electronic Fan Timer/Furnace Control is an integrated electronic control, which contains NO USER SERVICEABLE COMPONENTS. In addition to controlling the fan operation for heating, it also takes the place of the blower relay, combustion air relay and/or system relay.

The ST9162A is used in conjunction with the SV9540Q GAS VALVE/IGNITION CONTROL. It provides the power source to begin the ignition sequence through a monitored safety circuit. It serves as a low voltage terminal strip, and provides accessory terminals for a Humidifier, Electronic Air cleaner and a "Continuous" terminal which can be used on models equipped with a P.S.C. motor (ONLY) to provide continuous fan operation at a speed other than either the heating or cooling speed.

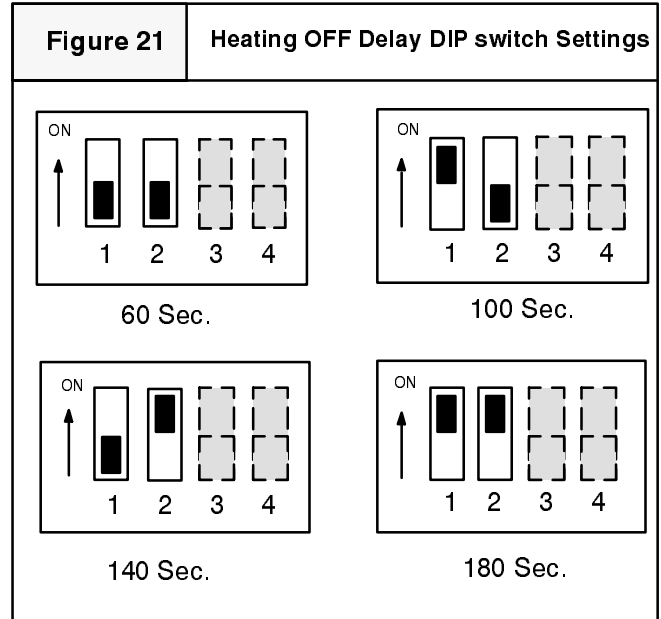
The control provides a fixed (non-adjustable) 5 second "ON" and 60 second "OFF" delay for the circulating blower in COOLING and an adjustable 30 or 60 second "ON" delay for the circulating blower in HEATING.

The ST9162A control also provides an adjustable HEATING "OFF" delay for the circulating blower which can be field adjusted to 60, 100, 140, or 180 seconds.

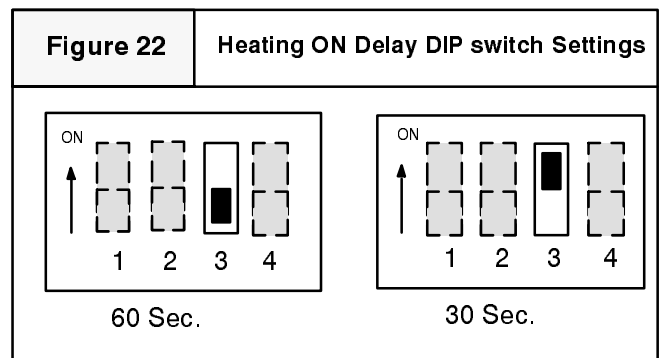
## Setting "OFF" and "ON" delays

Setting The ST9162A Heating Fan "ON" & "OFF" Delay is accomplished by the positioning of "DIP" switches. The illustrations Figure 21, & Figure 22, indicate how to position these switches to obtain the desired setting.

The ST9162A Heating Fan "OFF" delay can be set to either 60, 100, 140, or 180 seconds. The control was shipped out in the 140 second position. This may be satisfactory for some installations, but not for others.



The ST9162G Heating Fan "ON" delay may be set to either 30 or 60 seconds. The control is shipped out at 30 seconds. As with the "OFF" delay, this may be satisfactory for some installations, but not for others.



The "OFF" delay should be set as long as possible without creating "COLD AIR" complaints at the end of the cycle.

The "ON" delay should be set as short as possible without creating "COLD AIR" complaints at the beginning of the cycle.

The COOLING "ON" and "OFF" delays of the ST9162A are fixed at 5 seconds and 60 seconds respectively, and are not adjustable.

## HONEYWELL ST9162A/SV9540Q CONTROL SYSTEM UNIQUE CONTROL FUNCTIONS/RESPONSES

There are some unique responses from these controls that differ from what one would normally expect, and may be somewhat confusing. They are as follows:

The logic built into the control SYSTEM starts each heating cycle on HIGH HEAT (i.e. 2nd Stage) for a brief (30–60 seconds) heat exchanger warm-up period. Consequently, energizing the “W1” terminal (Only) of this control will cause the furnace to operate on LOW FIRE (I.E. 1st Stage Heating) AFTER the heat exchanger warm-up period expires. (With most other furnaces, energizing the “W1” terminal normally results in immediate 1st Stage operation.)

Energizing the “G” terminal of the ST9162A control will cause the blower to run on the LOW HEATING speed on models equipped with a P.S.C. motor, and the CIRCULATING speed on models equipped with a D.C. motor. (With most other furnaces, the blower relay is energized via the “G” terminal normally causing the blower to run on the cooling speed.)

Energizing the “G” & “Y” terminals (together) will cause the blower to run on the COOLING speed. It is important that you take note of this, since control wiring improperly connected can cause perceived as well as real equipment problems.

For example, in the past, the “Y” terminal in nearly all furnaces was simply a binding post. There was no electrical connection between this terminal and the rest of the furnace. Consequently, many installers would not use this terminal to connect the “Y” signal from the thermostat, but would run it directly from the thermostat to the condensing unit, then run the “Common” signal back to the furnace “C” terminal.

This method of wiring results in improper operation from this control. The control MUST receive a “Y” signal in order for it to energize the “COOL” terminal, bringing on the blower in the cooling speed. If wired as above, the condensing unit will come on, but the blower will run on either the LOW HEATING speed or the CIRCULATING speed, depending upon the model.

“NO TERMINALS” ENERGIZED (on low voltage terminal strip) – If a speed tap wire (Models with P.S.C. motor ONLY) has been connected to the “CONT” (continuous) terminal, (optional terminal provided) the blower will run on this speed. Maximum allowable connected load for this terminal is 8.0 FLA

This “Continuous” feature requires some explanation as to how it differs from “FAN ON” selected from the thermostat sub-base.

The “CONTINUOUS” terminal of the ST9162A control is energized **ONLY** when there is NO OTHER CALL FOR OPERATION of any kind. If there is a call for HEAT, COOL, or “FAN ON”, this terminal is DE-ENERGIZED. The purpose of this terminal is to provide a means of air circulation during “OFF CYCLES” at a different speed than either heating or cooling. **The use of this terminal is optional, and applies to models equipped with a P.S.C. motor ONLY. There will be no speed tap wires connected to this terminal when the furnace is shipped.**

“CONTINUOUS” fan should not be confused with “FAN ON” which is obtained by switching the fan selector switch on the thermostat sub-base to “FAN ON” (energizing the “G” terminal) which causes the blower to run on the “LOW HEATING” speed on models equipped with a P.S.C. motor.

**NOTE:** Models equipped with a D.C. motor MUST use “FAN ON” (selected from the thermostat sub-base) if air circulation is desired during thermostat “Off” cycles.

The **ST9162A Electronic Air Cleaner terminal (EAC)** IS **ONLY** energized in conjunction with the HEATING and COOLING speed terminals. It IS NOT ENERGIZED in conjunction with the “CONTINUOUS” fan speed terminal. **The maximum allowable connected load to the EAC terminal is 0.8 (eight tenths) Amp.\***

The **ST9162A HUMIDIFIER terminal (HUM)** is energized in conjunction with a call for heating operation. **The maximum allowable connected load to the HUM terminal is 0.8 (eight tenths) Amp.\***

\*The combined loads of the EAC and HUM terminals cannot exceed a total of 0.8 (eight tenths) amp.

### TROUBLESHOOTING

The operation of the HONEYWELL ST9162A/SV9540Q CONTROL SYSTEM (as well as the operation of the furnace in general) can be verified in a few minutes by using two (2) jumper wires (to jumper terminals of the low voltage terminal strip) and the testing sequence listed on the following page or the “SEQUENCE of OPERATION” and “TROUBLESHOOTING” charts on pages 44 & 45 of this manual.

## ST9162A/SV9540Q TESTING SEQUENCE

If furnace successfully passes this testing sequence, it can be assumed that there are no problems with the ST9162A/SV9540Q CONTROL SYSTEM. If it does not, however, it does not necessarily mean that there are problems with the control SYSTEM. Any malfunctions should be thoroughly investigated before replacing any components.

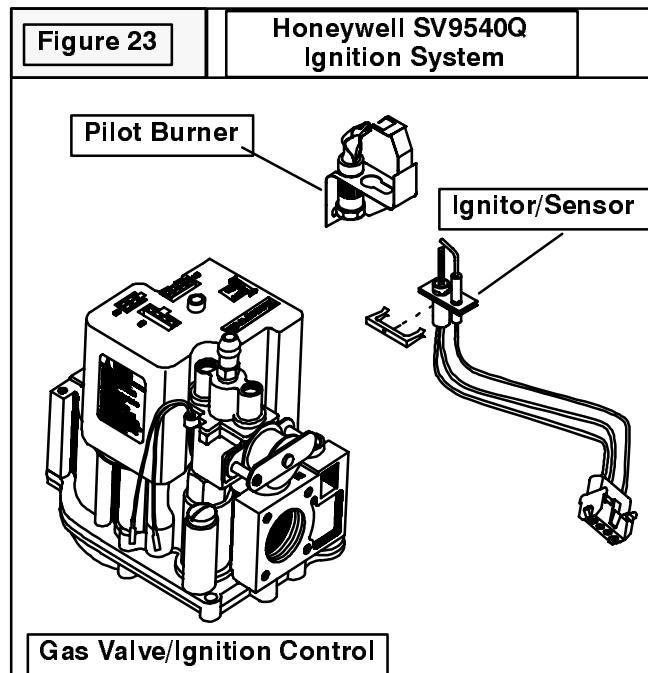
### CHECKING HEATING FUNCTIONS

1. JUMPER "W1, or W1 & W2" TO "R"
2. CHECK COMBUSTION BLOWER START-UP
3. CHECK IGNITION SYSTEM ACTIVATION
4. WHEN MAIN BURNER LIGHTS, CHECK HEATING FAN "ON" DELAY
5. CHECK HEATING SPEED FAN OPERATION
6. REMOVE JUMPER
7. CHECK POST PURGE DELAY
8. CHECK HEATING FAN "OFF" DELAY

### CHECKING COOLING FUNCTIONS

1. JUMPER "Y" & "G" TO "R"
2. CHECK COOLING FAN DELAY "ON"
3. CHECK COOLING SPEED FAN OPERATION
4. REMOVE JUMPER
5. CHECK COOLING FAN "OFF" DELAY

## HONEYWELL SV9540Q 2 STAGE GAS VALVE/IGNITION CONTROL



The system consists basically of only two (2) components. The Ignition System Control and the Pilot Hardware. They operate on Two (2) power circuits received from the ST9162A Fan Timer/Furnace Control. One is the 24 volt power supply for the ignitor, and to activate the ignition sequence. The second is a 115 volt circuit used to power the combustion blower.

The SV9540Q system is **both line voltage polarity and ground sensitive**. Accordingly, the furnace **MUST** have proper polarity and grounding, or malfunctions may be caused due to those reasons.

The SV9540Q Ignition System Control (working in conjunction with the ST9162A fan timer) manages the Ignition Sequence, and the flow of gas to the pilot and main burners. It is in essence a combination Gas Valve and Ignition control.

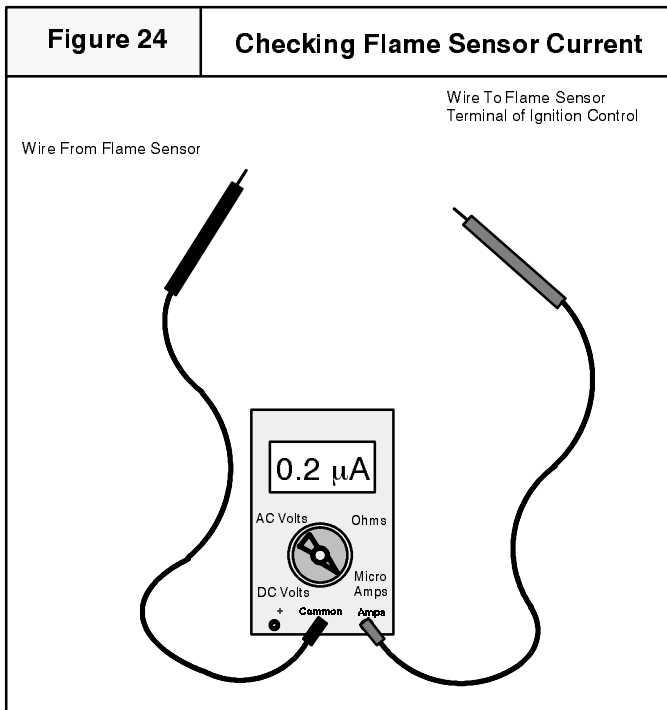
It contains sophisticated electronic components (internally) and has **NO USER SERVICEABLE COMPONENTS**. Should a problem be verified internally within the device, **IT IS NOT FIELD REPAIRABLE**, and must be replaced.

The Pilot Hardware includes the pilot burner, the hot surface element that lights the pilot burner, the flame rod that senses pilot flame, and the cable that attaches to the system control.

The hot surface element is made of a tough *break resistant* ceramic composite material. It operates on 24 Volts A.C. The Igniter/Flame Rod assembly can be replaced independently from the pilot burner assembly.

The hot surface igniter can be checked for resistance. A "Good" igniter will have a resistance of 10 Ohms or less. Flame current for this system should be 0.2 microamps or higher. Carrier voltage for flame signal (i.e. flame rod to valve body) is 80 volts or higher.

## CHECKING FLAME CURRENT



The Honeywell SV9540Q Ignition system used in this furnace series proves (verifies) flame via the Flame Rectification method.

Flame Rectification is a process of converting Alternating Current (A.C.) into Direct Current (D.C.). During the ignition sequence, an alternating current (A.C.) Voltage (of approximately 80 volts) is applied to the Flame probe.

When the burner lights the flame conducts an electrical current between the flame probe and the burner ground. Due to the difference in size between the flame probe and the burner ground area this current flows mostly in one direction. This creates a pulsating Direct Current that flows back to the ignition control proving flame.

This flame current (D.C. Microamps) may be checked (while flame is present) using a D.C. Microammeter IN SERIES (see Figure 24) with the flame sensor circuit. Flame current should be at least 0.2 μA for the Honeywell SV9540Q .

Lower than normal readings will not keep flame established, and may be due to flame not properly enveloping sensor, dirty sensor, low gas pressure or pilot flame, etc.

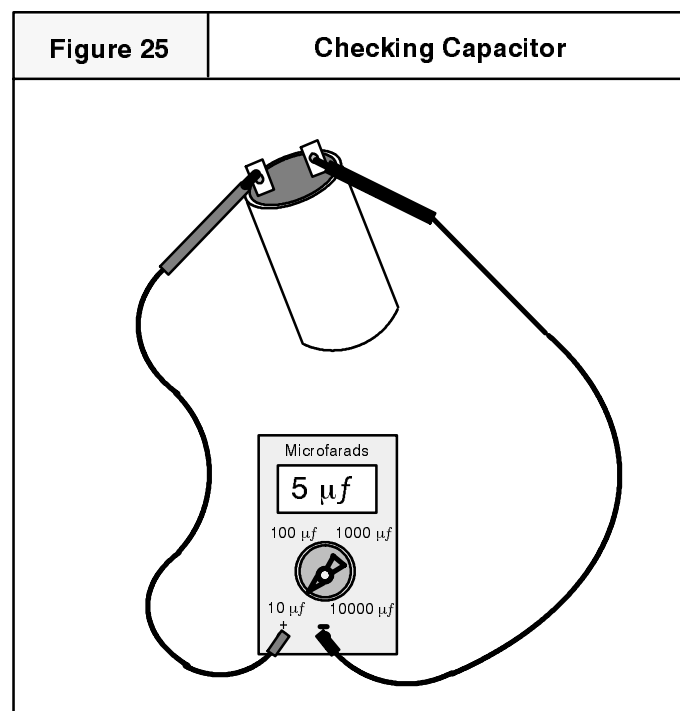
## CAPACITORS

Permanent Split Capacitor (P.S.C.) motors are used on the circulating (conditioned air) blower of 2 Speed models and on the exhaust (combustion) blower of condensing models. Before replacing one of these motors (assumed to be bad) the condition of its capacitor should be verified, since it, and not the motor, may be the source of the problem.

Before checking **any** capacitor, the supply power to the unit should be turned "OFF". The capacitor should then be discharged (through a resistor) before testing. A 20,000 Ohm 2 Watt resistor can be used for this purpose.

The condition of the capacitor should be verified with a capacitor analyzer (one that indicates the capacitor's value in microfarads) rather than with an Ohmmeter. The reason for this, is that an Ohmmeter test can only indicate if a capacitor is "OPEN", or "SHORTED", it cannot verify if its value (microfarads) is within an acceptable range.

Capacitor should test to within 10% of its rated value. Capacitors testing outside this range should be replaced. A Weak capacitor can be the cause of a motor failing to start.



## BLOWER ASSEMBLY

All variable Speed models use one of two different variable speed (D.C. motor), direct-drive, blower assemblies. Different size (HP) motors and/or different diameter blower wheels are used in the different models to obtain the required air flow.

All 2 Speed models use a multi-speed, permanent split capacitor motor, direct-drive, blower assembly. Different size (HP) motors and/or different diameter blower wheels are used in each model to obtain the required air flow.

In all models entire blower assembly slides out on rails for servicing after removing the two screws at the front of the blower deck.

### CHECKING BLOWER MOTOR

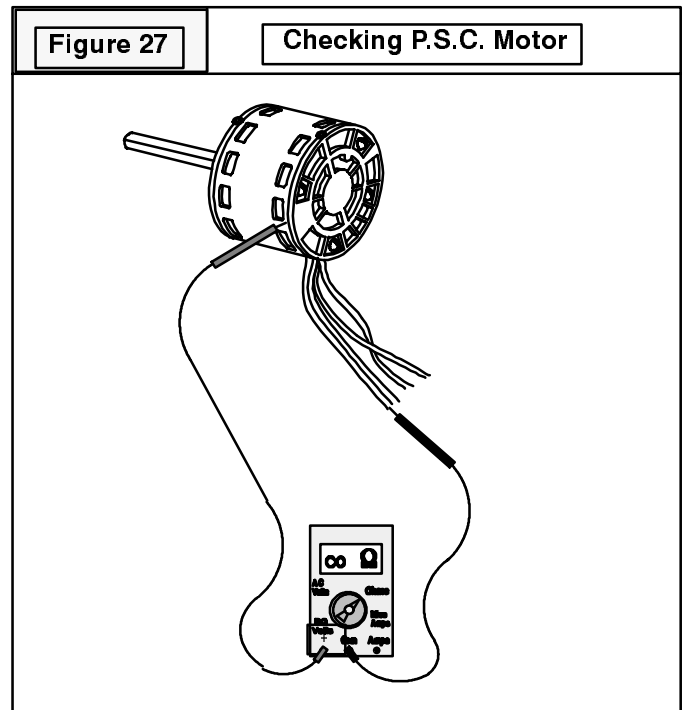
#### Variable Speed Models – D.C. Motor

The D.C. Motor used in the variable speed models *Cannot* be checked accurately using traditional methods. An Ohmmeter test will tell little or nothing about the condition of the motor. Because of this a “Special” test method is required to determine if the motor is good or bad.

The condition of this motor can ONLY be verified as follows: With the thermostat calling for operation in the desired mode, and line voltage applied to the motor, Check for 24 Volts across the “Common” (Blue) wire and the desired “Speed” wire of the six (6) pin connector *at the motor*. With 24 VAC **present**, motor should run. If the motor Does Not run, it is faulty and must be replaced. If 24 VAC **is not** present, a problem is indicated in the thermostat, wiring, or ST9162A.

Figure 26	Variable Speed Models D.C. Motor Speed Wires	
	Wire Color	Motor Speed
	Blue	Common
	White	Low Heat
	Green	Circulating
	Black	High Heat
	Yellow	Cooling
	Brown	Dehum. (80%)*

\* Function enabled only when energized with cooling speed. Motor runs at 80% of cooling speed.



#### 2 Speed Models – P.S.C. Motor

The P.S.C. motor used in 2 speed models may be checked using traditional Ohmmeter test methods. I.E. Checking from any speed tap lead (black, orange, blue, or red) to Neutral (white) should indicate continuity. While checking from any motor lead to the motor case should indicate infinity (no continuity). Before condemning *any* P.S.C. motor be sure to verify the condition of its capacitor.

### SELECTING BLOWER SPEEDS

The wide variety of applications and installations of furnaces throughout the country makes it impossible to “Factory Select” blower speeds that will provide proper operation for all installations. This means then, that the blower speeds for both heating and cooling must be “Field Selected” for each particular installation to insure proper operation.

The criteria for selecting the proper blower speeds **IS NOT** “High for Cooling, Low for Heating”. Although that may be how it works out **SOMETIMES**, It can (in many cases) be exactly the opposite. (I.E. a Lower speed for Cooling, and a Higher speed for Heating)

The PROPER CRITERIA FOR SELECTING BLOWER SPEEDS is as follows:

#### HEATING

A blower speed must be selected that will provide proper temperature rise through the furnace. (See

“checking temperature rise” found on page 13 of this manual). The required CFM for a particular temperature rise can also be calculated by using the following formula:

$$\frac{\text{Output BTU}}{\text{Temp. Rise} \times 1.08} = \text{CFM}$$

EXAMPLE: Using a 75 Mbtu Non-Condensing furnace (equipped with P.S.C. motor) of this series with an output of 60,000 Btuh and a desired temperature rise of 50°F (range of 35–65°F allowable) and a **measured** external static pressure of 0.2" W.C. while operating on medium–low speed with a dry coil.

$$\frac{60,000}{50 \times 1.08} \text{ or } \frac{60,000}{59.4} = 1010 \text{ CFM}$$

Checking the blower performance data for this model, (see Figure 28) indicates that @ 0.2" W.C. E.S.P. medium–low speed delivers 1030 CFM. Accordingly, medium–low speed is the proper speed to be used in this example for the HEATING speed.

## COOLING

A blower speed must be selected that will provide proper air flow (Nominal 400 CFM per ton) for the size (capacity) air conditioning coil being used at the external static pressure of the Duct system (installation). This requires CHECKING THE EXTERNAL STATIC PRESSURE, and then consulting the BLOWER PERFORMANCE DATA to determine the required speed tap.

EXAMPLE: A 24,000 BTU (2 ton) air conditioning system, using the same 75,000 BTU furnace as in the previous example. The external static pressure is measured with the unit operating on Low speed, and found to be 0.4" W.C. with a wet coil.

**400 CFM (nominal) per ton required**

**400 X 2 = 800 CFM required**

Checking the blower performance data (see Figure 28) for this model indicates that @ 0.4" W.C. ESP low speed is delivering 735 CFM. Accordingly, low speed is the proper speed to be used in this example for the COOLING speed.

**Figure 28 BLOWER PERFORMANCE DATA 75,000 BTUH**

Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)						
External Static Pressure Inches of W.C.	.TAP	LOW	MED L	MED	MED H	HIGH
	.10	815	1043	--	1324	1649
.20	783	1030	--	1302	1616	
.30	755	1021	--	1280	1592	
.40	735	989	--	1255	1546	
.50	704	968	--	1218	1502	
.60	668	941	--	1171	1425	
.70	646	881	--	1100	1353	

## EXTERNAL STATIC PRESSURE

External Static Pressure can best be defined as the pressure difference (drop) between the Positive Pressure (discharge) and the Negative Pressure (intake) sides of the blower. External Static Pressure is developed by the blower as a result of resistance to airflow (Friction) in the air distribution system EXTERNAL to the furnace cabinet.

Resistance applied **externally** to the furnace (I.E. Duct work, Coils, Humidifiers, Filters, Etc.) on either the Supply **or** Return side of the system, causes an INCREASE in External Static Pressure, accompanied by a REDUCTION in airflow.

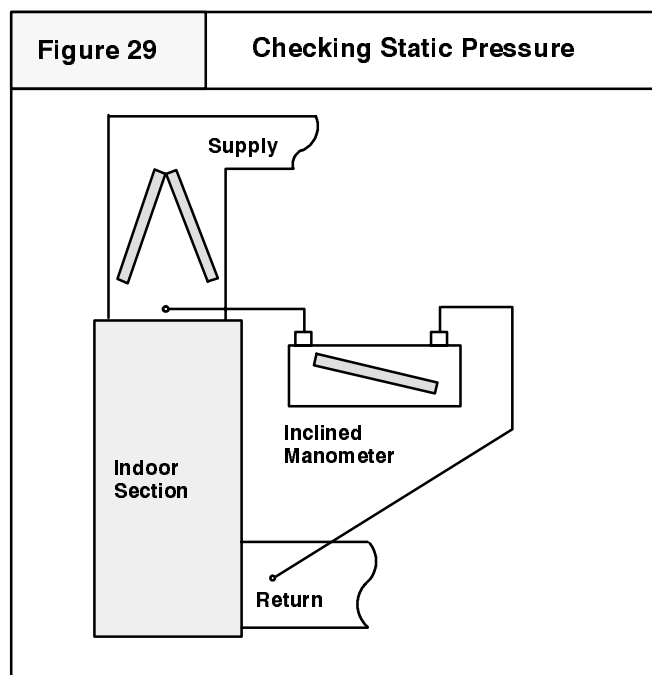
External Static Pressure is affected by two (2) factors.

1. Resistance to Airflow as explained above.
2. Blower Speed. Changing to a higher or lower blower speed tap will raise or lower the External Static Pressure accordingly.

These effects **MUST** be understood and taken into consideration when checking External Static Pressure/ Airflow to insure that the system is operating within design conditions.

Operating a system with Insufficient or Excessive air flow can cause a variety of different operating problems. Among these are premature heating component and/or compressor failures, reduced capacity, freezing evaporator coils, etc.

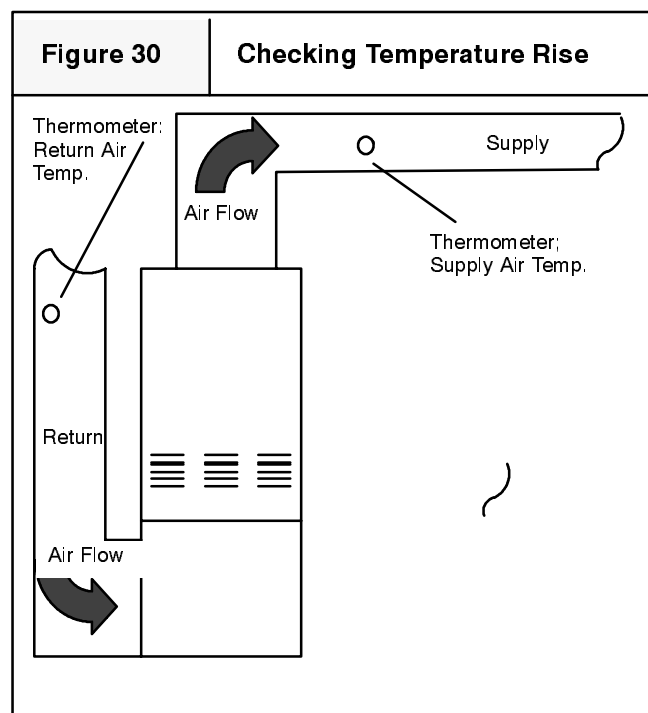
System air flow should **ALWAYS** be verified upon completion of a new installation, or **BEFORE** a change–out, heat exchanger replacement, or in the case of a compressor failure to insure that the failure was not caused by improper air flow.



## CHECKING EXTERNAL STATIC PRESSURE

The air flow through the unit can be determined by measuring the external static pressure of the system, and consulting the blower performance data for the particular model furnace you have.

1. Set up to measure external static pressure at the supply and return duct connections (See Figure 29).
2. Drill holes in the ducts for pressure taps, pitot tubes, or other accurate pressure sensing devices.
3. Connect these taps to a level inclined manometer or Magnehelic gauge.
4. Ensure the coil and filter are clean, and all the registers are open.
5. Determine the external static pressure with the blower operating.
6. Refer to the Air Flow Data for your particular furnace to find the actual airflow for the current speed tap (or dip switch setting).
7. If the Actual airflow is either too high, or too low, the blower speed tap (or dip switch setting) will need to be changed.
8. Refer to Changing Blower Speeds on the pages that follow for the proper procedure.
9. Select the speed tap (or dip switch setting) that appears to most closely provide the required air flow for the system.
10. Recheck the external static pressure with the new speed tap. External static pressure (and actual airflow) will both have changed (either higher, or lower), depending upon speed tap selected. Recheck the actual airflow (at this "new" static pressure) to confirm speed tap selection.
11. Repeat steps 9. and 10. (if necessary) until proper Speed Tap (and airflow) has been obtained.



## CHECKING APPROXIMATE AIR FLOW

If an inclined manometer or Magnehelic gauge IS NOT available to check the External Static Pressure, OR the blower performance data is unavailable for your furnace, *approximate air flow* can be calculated by **Measuring** the temperature rise, then using the following criteria:

The approximate CFM actually being delivered can be calculated (if the OUTPUT Btu of the furnace is known) by operating the system in HEATING, and using the following formula:

$$\frac{\text{Output BTU}}{\text{Temp. Rise} \times 1.08} = \text{CFM}$$

EXAMPLE: Using a (75 Mbtu Input) furnace with an OUTPUT of 59,000 Btuh and a measured temperature rise of 50°F.

$$\frac{59,000}{50 \times 1.08} \text{ or } \frac{59,000}{54} = 1093 \text{ CFM}$$

NOTE: This same method can be used (on models equipped with a P.S.C. motor) to determine the COOLING airflow, by TEMPORARILY connecting the cooling speed tap wire to the HEAT terminal of the FAN Control. NEVER connect two (2) speed tap wires to the same terminal. Doing so will cause motor failure.



## CHANGING BLOWER SPEEDS

The procedure for changing blower speeds (if needed) differs based on whether the unit is a variable speed model, or a 2 speed model.. (See Figure 31 and Figure 33 and the appropriate sections for the model you are servicing).

### WARNING

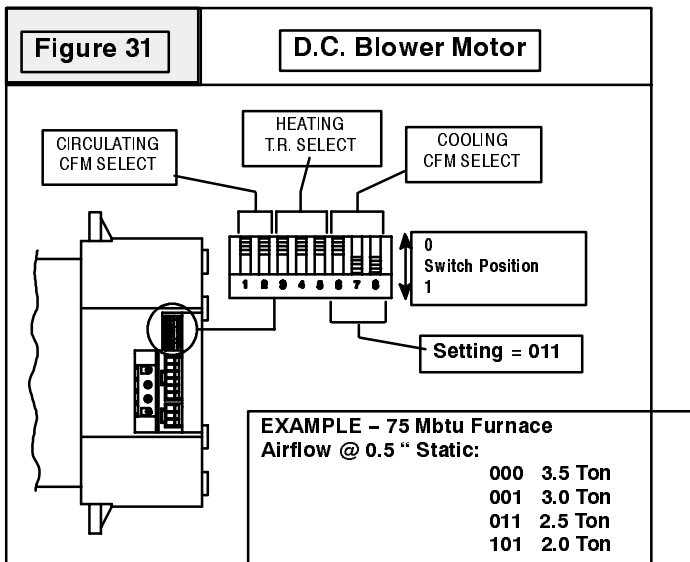
**Electrical shock hazard.**

**Turn OFF power to furnace before changing blower speeds.**

**Failure to do so can result in personal injury and/or death.**

## VARIABLE SPEED MODELS - D.C. MOTOR

The heating, cooling and circulating blower speeds can be adjusted by changing the switch settings that are located on the side of the blower motor (see Figure 31). Switches #1 and #2 adjust the circulating blower speed. Switches #3, #4 and #5 adjust the heating speeds. Switches #6, #7 and #8 adjust the cooling speed. See the Technical Service Data Sheet for the model you are servicing to obtain the switch settings for the desired airflow rates.



**NOTE:** Power must be completely OFF to unit any time switch settings are changed or settings will not take effect.

Circulating (CFM) @ 0.10" Static

Switch Settings		Furnace Model			
#1	#2	50K	75K	100K	125K
0*	0*	600	540	700	1000
0	1	730	660	860	1260
1	0	870	780	1020	1500
1	1	1000	900	1180	1725

\*Factory Setting

Heating Air Temperature Rise (° F)\*

Switch Settings			Furnace Model			
#3	#4	#5	50K	75K	100K	125K
1	1	1	46	46	46	47
1	1	0	48	48	48	52
1	0	1	51	51	51	55
0**	0**	0**	55	55	55	60
0	0	1	57	57	57	63
0	1	0	59	59	59	67
0	1	1	61	61	61	71
1	0	0	64	64	64	74

\*Approximate air temperature rise@ 0.20" static on high heat. (low heat speed changes with change of high heat speed on most settings)

\*\*Factory setting

Cooling (CFM) @ 0.50" Static

Switch Settings			Furnace Model			
#6	#7	#8	50K	75K	100K	125K
0*	0*	0*	1200	1350	1700	2100
0	0	1	1100	1200	1650	2000
0	1	0	1000	1100	1500	1800
0	1	1	900	1000	1400	1600
1	0	0	800	900	1200	1400
1	0	1	700	800	1000	1200
1	1	0	650	600	800	1000
1	1	1	550	550	700	800

\*Factory setting

## 2 SPEED MODELS - P.S.C. MOTOR

### HEATING SPEEDS

Should it be necessary to change blower speeds to obtain proper temperature rise on either (or both) High fire, and/or Low Fire, Simply take the appropriate speed tap wire, and plug it on to the terminal marked "HEAT HIGH" or "HEAT LOW" respectively on the HONEYWELL ST9162A control.

Figure 32		2 Speed Models Blower Speed Taps	
Wire Color		Motor Speed	
Black		High	
Orange		Medium-High	
Blue		Medium-Low	
Red		Low	

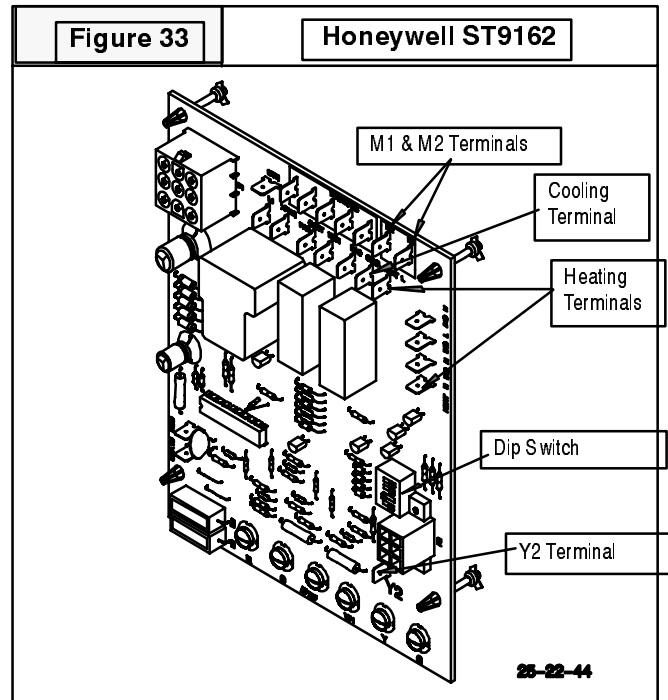
### COOLING SPEED

When the proper speed has been determined, simply plug it on to the terminal marked "COOL" on the HONEYWELL ST9162A control.

### "M1" & "M2" TERMINALS

There are two (2) terminals (marked "M1" & "M2") on the HONEYWELL ST9162A control which have no

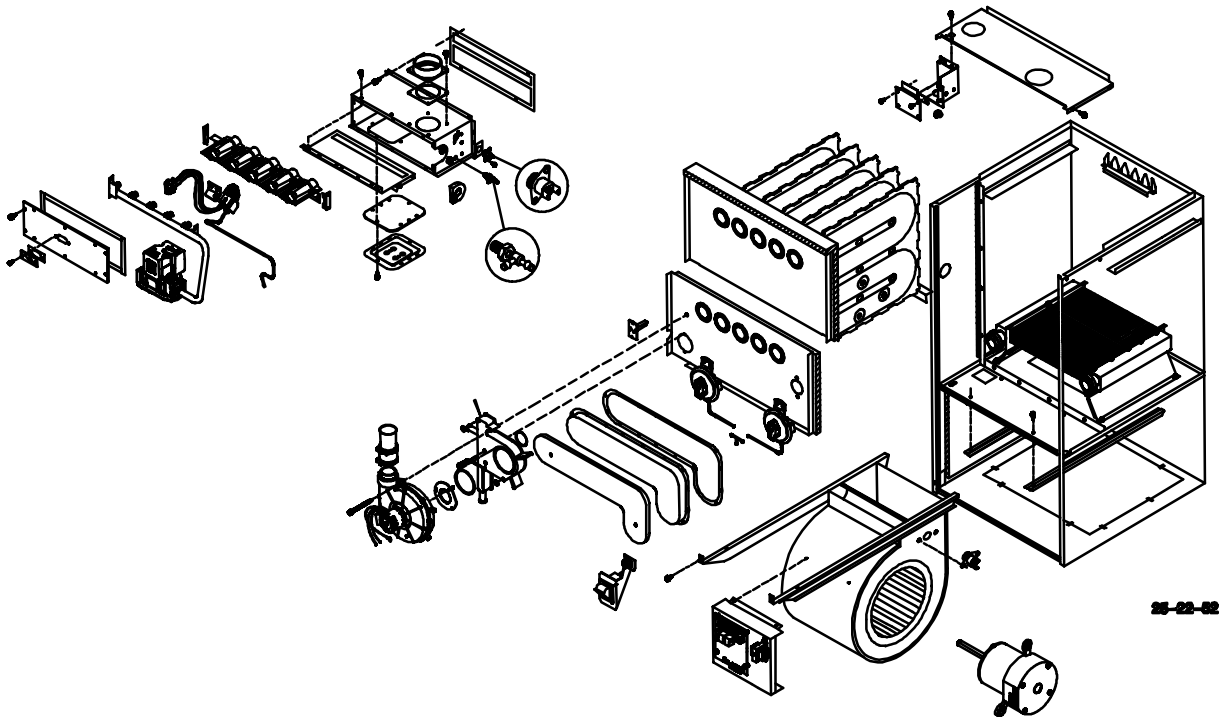
internal connection to the control. Their purpose is to provide a place to connect, or "PARK" any "UNUSED" speed tap wires (P.S.C. motors ONLY) to keep them out of the way and prevent them from shorting out against the furnace casing, or each other.



## HEAT EXCHANGER REMOVAL/REPLACEMENT (CONDENSING MODELS)

Figure 34

"Exploded" Parts View – Typical Condensing Model



### Secondary Heat Exchanger

1. Turn "OFF" electrical power and gas supply.
2. Disconnect vent pipe to furnace at flexible coupling.
3. Remove combustion blower.
4. Remove **machine screws** securing internal drain trap assembly to furnace front partition.
5. Remove the collector box.
6. Remove **machine screws** securing secondary heat exchanger inlet flange to lower partition.
7. Remove screws around perimeter of lower partition
8. Remove lower partition.
9. Remove conditioned air blower assembly.
10. Remove screws securing secondary heat exchanger to the supports.
11. Coil can now be removed from furnace.
12. Reverse procedure to reinstall.

### Primary Heat Exchanger

1. Turn "OFF" electrical power and gas supply.
2. Disconnect vent pipe to furnace at flexible coupling.
3. Disconnect combustion air inlet pipe at burner box.
4. Remove furnace top panel.
5. Disconnect gas piping to furnace at gas valve.

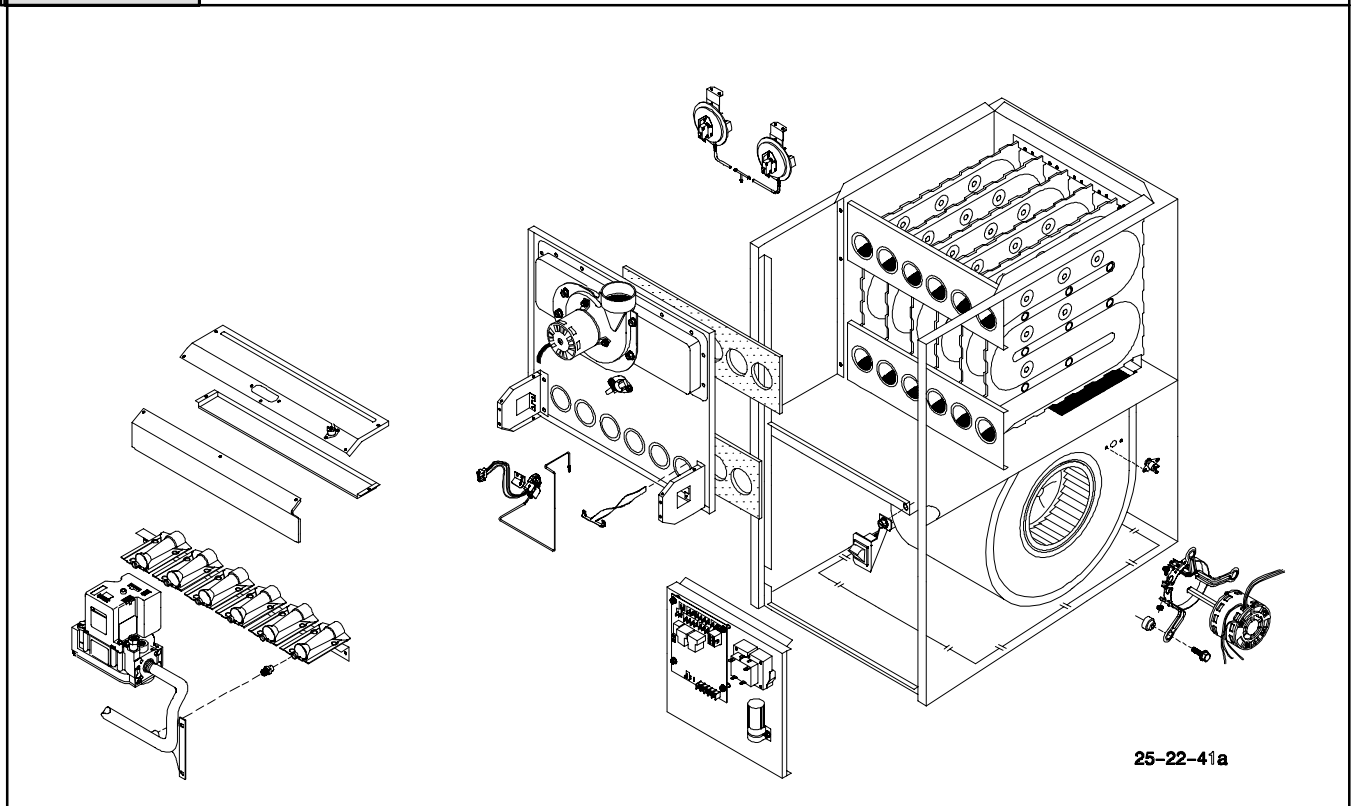
**Note:** Before performing next step, insure that the wiring diagram is available and readable, or tag all wires first.

6. Disconnect tubing and wiring to pressure switches, limit switches, and gas valve.
7. Remove screws securing burner box to front partition.
8. Remove combustion blower.
9. Remove **machine screws** securing transition assembly to furnace front partition.
10. Remove the collector box.
11. Remove **machine screws** securing secondary heat exchanger inlet flange to lower partition.
12. Remove screws around perimeter of **both** the upper and lower partitions (leaving the screws across the center of the two panels in place).
13. Primary Heat Exchanger can now be removed with both upper and lower partitions attached.
14. Reverse procedure to re-install, making sure that any gaskets that have been torn during disassembly are replaced with new ones.
15. After re-assembly, turn the gas supply on, and check for leaks. All leaks must be repaired immediately.
16. Perform an operational check of the furnace.

## HEAT EXCHANGER REMOVAL/REPLACEMENT (NON-CONDENSING MODELS)

Figure 35

"Exploded" Parts View – Typical Non-Condensing Model



1. Turn "OFF" electrical power and gas supply to furnace.
  2. Disconnect vent pipe to furnace at exhaust blower.
  3. Disconnect gas piping to gas valve.
  4. Remove cover from junction box in furnace, and disconnect electrical supply wiring inside junction box.
- Note:** Before performing next step, insure that the wiring diagram is available and readable, or tag all wires first.
5. Disconnect wiring to pressure switches, limit switch, roll-out switch(es), combustion blower, and gas valve.
  6. Remove junction box, pressure switches and limit switch.

7. Remove combustion blower
9. Remove the collector box
10. Remove screws securing burner enclosure and/or manifold support brackets to front partition.
11. Remove top panel
12. Remove screws around perimeter of front partition
13. Heat exchanger can now be removed from furnace.
14. Reverse procedure to re-install, making sure that any gaskets that have been torn during disassembly are replaced with new ones.
15. After re-assembly, turn the gas supply on, and check for leaks. All leaks must be repaired immediately.
16. Perform an operational check of the furnace.

# TECHNICAL SERVICE DATA INDEX

(Tech. Sheets Follow Index In Numerical Order)

MODEL NUMBER	TECH. SVC. DATA	MODEL NUMBER	TECH. SVC. DATA
<b>NTP6</b>			
NTP6050FBA1	Tech. Sheet # 1.	TNE050B12A1	Tech. Sheet # 1.
NTP6075GFA1	Tech. Sheet # 2.	TNE075F14A1	Tech. Sheet # 2.
NTP6100GFA1	Tech. Sheet # 3.	TNE100F14A1	Tech. Sheet # 3.
NTP6100KJA1	Tech. Sheet # 4.	TNE100J20A1	Tech. Sheet # 4.
NTP6125KJA1	Tech. Sheet # 5.	TNE125J20A1	Tech. Sheet # 5.
<b>NTPM</b>			
NTPM050FBA1	Tech. Sheet # 6.	TNK050F12A1	Tech. Sheet # 6.
NTPM075GFA1	Tech. Sheet # 7.	TNK075F14A1	Tech. Sheet # 7.
NTPM100GFA1	Tech. Sheet # 8.	TNK100J16A1	Tech. Sheet # 8.
NTPM125KJA1	Tech. Sheet # 9.	TNK125N20A1	Tech. Sheet # 9.
<b>NTVM</b>			
NTVM050FBA1	Tech. Sheet # 10.	VNK050F12A1	Tech. Sheet # 10.
NTVM075GFA1	Tech. Sheet # 11.	VNK075F14A1	Tech. Sheet # 11.
NTVM100GFA1	Tech. Sheet # 12.	VNK100J16A1	Tech. Sheet # 12.
NTVM125KJA1	Tech. Sheet # 13.	VNK125N20A1	Tech. Sheet # 13.

## Technical Service Data Sheet 1.

		Manufacturers Number (Mfr No -See Rating Plate) NTP6050FBA/TNE050B12A																																																								
		Specifications		Circulation Air Blower Data																																																						
GENERAL	Gas Type	Nat	LP	Type & Size	10-8	Filt Type	Washable																																																			
	Input (Btuh) Std/Alt. Hi Fire	50,000	50,000	Motor Amps/RPM	6.5/1050	Filt Size (")	14x25x1																																																			
GAS & IGNITION	Lo Fire	35,000	35,000	Motor Type/ H.P.	PSC <sup>1</sup> / <sub>3</sub>	Min. Cool	1.5																																																			
	Output (Btuh) Std/Alt. Hi Fire	40,000	40,000	Cap. MFD/Volts	5/370	Max. Cool	3																																																			
COMBUSTION	Lo Fire	28,000	28,000	<b>Air Delivery in Cubic Feet per Minute (C.F.M.)</b> (Furnace Rated @0.5" WC ESP)																																																						
	Temp. Rise (°F) Hi Fire	35-65	35-65																																																							
LIMITS & CONTROLS	Lo Fire	35-65	35-65	<b>Air Delivery in Liters per Second (L/S)</b> (Furnace Rated @0.5" WC ESP)																																																						
	Electrical (Volts/Hz/FLA)	115/60/5.3	115/60/5.3																																																							
LIMITS & CONTROLS	Transformer Size (VA)	40	40	External Static Pressure	Inches of W.C.	<table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr> <td>.10</td> <td>675</td> <td>859</td> <td>—</td> <td>1015</td> <td>1394</td> </tr> <tr> <td>.20</td> <td>662</td> <td>846</td> <td>—</td> <td>999</td> <td>1342</td> </tr> <tr> <td>.30</td> <td>651</td> <td>819</td> <td>—</td> <td>977</td> <td>1289</td> </tr> <tr> <td>.40</td> <td>636</td> <td>795</td> <td>—</td> <td>952</td> <td>1227</td> </tr> <tr> <td>.50</td> <td>608</td> <td>765</td> <td>—</td> <td>914</td> <td>1163</td> </tr> <tr> <td>.60</td> <td>564</td> <td>735</td> <td>—</td> <td>870</td> <td>1086</td> </tr> <tr> <td>.70</td> <td>514</td> <td>685</td> <td>—</td> <td>818</td> <td>1002</td> </tr> </tbody> </table>					.TAP	LOW	MED L	MED	MED H	HIGH	.10	675	859	—	1015	1394	.20	662	846	—	999	1342	.30	651	819	—	977	1289	.40	636	795	—	952	1227	.50	608	765	—	914	1163	.60	564	735	—	870	1086	.70	514	685	—	818	1002
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T'stat Heat Anticipator	.10	.10	<table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr> <td>.10</td> <td>318</td> <td>405</td> <td>—</td> <td>479</td> <td>658</td> </tr> <tr> <td>.20</td> <td>312</td> <td>399</td> <td>—</td> <td>472</td> <td>633</td> </tr> <tr> <td>.30</td> <td>307</td> <td>387</td> <td>—</td> <td>461</td> <td>608</td> </tr> <tr> <td>.40</td> <td>300</td> <td>375</td> <td>—</td> <td>449</td> <td>579</td> </tr> <tr> <td>.50</td> <td>287</td> <td>361</td> <td>—</td> <td>431</td> <td>549</td> </tr> <tr> <td>.60</td> <td>266</td> <td>347</td> <td>—</td> <td>411</td> <td>513</td> </tr> <tr> <td>.70</td> <td>243</td> <td>323</td> <td>—</td> <td>386</td> <td>473</td> </tr> </tbody> </table>				.TAP	LOW	MED L	MED	MED H	HIGH	.10	318	405	—	479	658	.20	312	399	—	472	633	.30	307	387	—	461	608	.40	300	375	—	449	579	.50	287	361	—	431	549	.60	266	347	—	411	513	.70	243	323	—	386	473				
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Gas Valve	HW SV9540	HW SV9540	<table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr> <td>.10</td> <td>318</td> <td>405</td> <td>—</td> <td>479</td> <td>658</td> </tr> <tr> <td>.20</td> <td>312</td> <td>399</td> <td>—</td> <td>472</td> <td>633</td> </tr> <tr> <td>.30</td> <td>307</td> <td>387</td> <td>—</td> <td>461</td> <td>608</td> </tr> <tr> <td>.40</td> <td>300</td> <td>375</td> <td>—</td> <td>449</td> <td>579</td> </tr> <tr> <td>.50</td> <td>287</td> <td>361</td> <td>—</td> <td>431</td> <td>549</td> </tr> <tr> <td>.60</td> <td>266</td> <td>347</td> <td>—</td> <td>411</td> <td>513</td> </tr> <tr> <td>.70</td> <td>243</td> <td>323</td> <td>—</td> <td>386</td> <td>473</td> </tr> </tbody> </table>				.TAP	LOW	MED L	MED	MED H	HIGH	.10	318	405	—	479	658	.20	312	399	—	472	633	.30	307	387	—	461	608	.40	300	375	—	449	579	.50	287	361	—	431	549	.60	266	347	—	411	513	.70	243	323	—	386	473				
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Manifold Press. Hi Fire (") WC)	3.5	10.0	<table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr> <td>.10</td> <td>318</td> <td>405</td> <td>—</td> <td>479</td> <td>658</td> </tr> <tr> <td>.20</td> <td>312</td> <td>399</td> <td>—</td> <td>472</td> <td>633</td> </tr> <tr> <td>.30</td> <td>307</td> <td>387</td> <td>—</td> <td>461</td> <td>608</td> </tr> <tr> <td>.40</td> <td>300</td> <td>375</td> <td>—</td> <td>449</td> <td>579</td> </tr> <tr> <td>.50</td> <td>287</td> <td>361</td> <td>—</td> <td>431</td> <td>549</td> </tr> <tr> <td>.60</td> <td>266</td> <td>347</td> <td>—</td> <td>411</td> <td>513</td> </tr> <tr> <td>.70</td> <td>243</td> <td>323</td> <td>—</td> <td>386</td> <td>473</td> </tr> </tbody> </table>				.TAP	LOW	MED L	MED	MED H	HIGH	.10	318	405	—	479	658	.20	312	399	—	472	633	.30	307	387	—	461	608	.40	300	375	—	449	579	.50	287	361	—	431	549	.60	266	347	—	411	513	.70	243	323	—	386	473				
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Technical Service Data Sheets 2. & 3.

THIS DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturers Number (Mfr No -See Rating Plate) NTP6075GFA/TNE075F14A										
Specifications			Circulation Air Blower Data							
GENERAL	Gas Type	Nat	LP	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	10-10 6.5/1050 PSC/1/2 7.5/370	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1 1.5 3.5			
	Input (Btuh) Std/Alt. Hi Fire	75,000	75,000							
	Lo Fire	52,500	52,500							
	Output (Btuh) Std/Alt. Hi Fire	60,000	60,000							
Lo Fire	42,000	42,000								
Temp. Rise (°F) Hi Fire	35-65	35-65								
Lo Fire	35-65	35-65								
Electrical (Volts/Hz/FLA)	115/60/9.2	115/60/9.2								
Transformer Size (VA)	40	40								
T'stat Heat Anticipator	.10	.10								
GAS & IGNITION	Gas Valve	HW SV9540	HW SV9540	External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)					
	Regulation Type	SNAP	SNAP		.TAP	LOW	MED L	MED	MED H	HIGH
	Manifold Press. Hi Fire (” WC)	3.5	10.0		.10	815	1043	—	1324	1649
	Lo Fire (” WC)	1.7	4.9		.20	783	1030	—	1302	1616
Std. Main Orifices (No/Size)	3/#42	3/#54	.30		755	1021	—	1280	1592	
Pilot Orifice Size	.018	.011	.40		735	989	—	1255	1546	
Ignition Type/Series	HW HSP	HW HSP	.50		704	968	—	1218	1502	
COMBUSTION	Flue Outlet Size (” )	3	3		.60	668	941	—	1171	1425
	Std. Outlet Temp (°F)	<480	<480		.70	646	881	—	1100	1353
LIMITS & CONTROLS	Thermal Sensor (°F)	300	300		Air Delivery in Liters per Second (L/S) (Furnace Rated @0.5" WC ESP)					
	Limit Control Setting (°F)	300	300	.TAP	LOW	MED L	MED	MED H	HIGH	
	Auxiliary Limit (°F)	130	130	.10	385	492	—	625	778	
	Fan Control (Type)	HW ST9162A	HW ST9162A	.20	370	486	—	615	763	
	Fan Control On	30/60	30/60	.30	356	482	—	604	751	
	(Timed—Secs) Off	60,100,140,180	60,100,140,180	.40	347	467	—	592	730	
	Std. Pressure Sw. Hi Fire (Part No)	1010945	1010945	.50	332	457	—	575	709	
	Neg. Pressure (Close)	-0.95	-0.95	.60	315	444	—	553	673	
	Neg. Pressure (Open)	-0.80	-0.80	.70	305	415	—	519	639	
	Std. Pressure Sw. Lo Fire (Part No)	1011739	1011739							
Neg. Pressure (Close)	-0.53	-0.53								
Neg. Pressure (Open)	-0.35	-0.35								
High Alt. Restrictor (Part No)(Size)	734020026(1.12)	734020026(1.12)								

THIS DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturers Number (Mfr No -See Rating Plate) NTP6100GFA/TNE100F14A										
Specifications			Circulation Air Blower Data							
GENERAL	Gas Type	Nat	LP	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	10-10 6.5/1050 PSC/1/2 7.5/370	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1 1.5 3.5			
	Input (Btuh) Std/Alt. Hi Fire	100,000	100,000							
	Lo Fire	70,000	70,000							
	Output (Btuh) Std/Alt. Hi Fire	80,000	80,000							
Lo Fire	56,000	56,000								
Temp. Rise (°F) Hi Fire	45-75	45-75								
Lo Fire	45-75	45-75								
Electrical (Volts/Hz/FLA)	115/60/9.2	115/60/9.2								
Transformer Size (VA)	40	40								
T'stat Heat Anticipator	.10	.10								
GAS & IGNITION	Gas Valve	HW SV9540	HW SV9540	External Static Pressure Inches of W.C.	Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)					
	Regulation Type	SNAP	SNAP		.TAP	LOW	MED L	MED	MED H	HIGH
	Manifold Press. Hi Fire (” WC)	3.5	10.0		.10	815	1043	—	1324	1649
	Lo Fire (” WC)	1.7	4.9		.20	783	1030	—	1302	1616
Std. Main Orifices (No/Size)	4/#42	4/#54	.30		755	1021	—	1280	1592	
Pilot Orifice Size	.018	.011	.40		735	989	—	1255	1546	
Ignition Type/Series	HW HSP	HW HSP	.50		704	968	—	1218	1502	
COMBUSTION	Flue Outlet Size (” )	3	3		.60	668	941	—	1171	1425
	Std. Outlet Temp (°F)	<480	<480		.70	646	881	—	1100	1353
LIMITS & CONTROLS	Thermal Sensor (°F)	300	300		Air Delivery in Liters per Second (L/S) (Furnace Rated @0.5" WC ESP)					
	Limit Control Setting (°F)	270	270	.TAP	LOW	MED L	MED	MED H	HIGH	
	Auxiliary Limit (°F)	130	130	.10	385	492	—	625	778	
	Fan Control (Type)	HW ST9162A	HW ST9162A	.20	370	486	—	615	763	
	Fan Control On	30/60	30/60	.30	356	482	—	604	751	
	(Timed—Secs) Off	60,100,140,180	60,100,140,180	.40	347	467	—	592	730	
	Std. Pressure Sw. Hi Fire (Part No)	1010945	1010945	.50	332	457	—	575	709	
	Neg. Pressure (Close)	-0.95	-0.95	.60	315	444	—	553	673	
	Neg. Pressure (Open)	-0.80	-0.80	.70	305	415	—	519	639	
	Std. Pressure Sw. Lo Fire (Part No)	1011739	1011739							
Neg. Pressure (Close)	-0.53	-0.53								
Neg. Pressure (Open)	-0.35	-0.35								
High Alt. Restrictor (Part No)(Size)	734020027(1.37)	734020027(1.37)								

Technical Service Data Sheets 4. & 5.

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Manufacturers Number (Mfr No -See Rating Plate) NTP6100KJA/TNE100J20A																																																																																																							
		Specifications		Circulation Air Blower Data																																																																																																			
GENERAL	Gas Type	Nat	LP	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	11-10 11.0/900 PSC <sup>3</sup> / <sub>4</sub> 10/370	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x2 3 5																																																																																																
	Input (Btuh) Std/Alt. Hi Fire	100,000	100,000																																																																																																				
	Lo Fire	70,000	70,000																																																																																																				
GENERAL	Output (Btuh) Std/Alt. Hi Fire	79,000	79,000	<b>Air Delivery in Cubic Feet per Minute (C.F.M.)</b> (Furnace Rated @0.5" WC ESP) <table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr><td>.10</td><td>1210</td><td>1441</td><td>—</td><td>1773</td><td>2104</td></tr> <tr><td>.20</td><td>1201</td><td>1430</td><td>—</td><td>1740</td><td>2078</td></tr> <tr><td>.30</td><td>1197</td><td>1453</td><td>—</td><td>1740</td><td>2061</td></tr> <tr><td>.40</td><td>1191</td><td>1441</td><td>—</td><td>1718</td><td>2020</td></tr> <tr><td>.50</td><td>1167</td><td>1425</td><td>—</td><td>1707</td><td>2005</td></tr> <tr><td>.60</td><td>1160</td><td>1390</td><td>—</td><td>1676</td><td>1953</td></tr> <tr><td>.70</td><td>1130</td><td>1365</td><td>—</td><td>1654</td><td>1917</td></tr> </tbody> </table> <b>Air Delivery in Liters per Second (L/S)</b> (Furnace Rated @0.5" WC ESP) <table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr><td>.10</td><td>571</td><td>680</td><td>—</td><td>837</td><td>993</td></tr> <tr><td>.20</td><td>567</td><td>675</td><td>—</td><td>821</td><td>981</td></tr> <tr><td>.30</td><td>565</td><td>686</td><td>—</td><td>821</td><td>973</td></tr> <tr><td>.40</td><td>562</td><td>680</td><td>—</td><td>811</td><td>953</td></tr> <tr><td>.50</td><td>552</td><td>673</td><td>—</td><td>806</td><td>946</td></tr> <tr><td>.60</td><td>548</td><td>656</td><td>—</td><td>791</td><td>922</td></tr> <tr><td>.70</td><td>533</td><td>644</td><td>—</td><td>781</td><td>905</td></tr> </tbody> </table>				.TAP	LOW	MED L	MED	MED H	HIGH	.10	1210	1441	—	1773	2104	.20	1201	1430	—	1740	2078	.30	1197	1453	—	1740	2061	.40	1191	1441	—	1718	2020	.50	1167	1425	—	1707	2005	.60	1160	1390	—	1676	1953	.70	1130	1365	—	1654	1917	.TAP	LOW	MED L	MED	MED H	HIGH	.10	571	680	—	837	993	.20	567	675	—	821	981	.30	565	686	—	821	973	.40	562	680	—	811	953	.50	552	673	—	806	946	.60	548	656	—	791	922	.70	533	644	—	781	905
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GAS & IGNITION	Transformer Size (VA)	40	40																																																																																																				
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GAS & IGNITION	Manifold Press. Hi Fire (") WC)	3.5	10.0																																																																																																				
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LIMITS & CONTROLS	Pilot Orifice Size	.018	.011																																																																																																				
	Ignition Type/Series	HW HSP	HW HSP																																																																																																				
	Flue Outlet Size (")	3	3																																																																																																				
COMBUSTION	Std. Outlet Temp (°F)	<480	<480																																																																																																				
	Thermal Sensor (°F)	300	300																																																																																																				
	Limit Control Setting (°F)	180	180																																																																																																				
LIMITS & CONTROLS	Auxiliary Limit (°F)	130	130																																																																																																				
	Fan Control (Type)	HW ST9162A	HW ST9162A																																																																																																				
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Manufacturers Number (Mfr No -See Rating Plate) NTP6125KJA/TNE125J20A																																																																																																							
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GENERAL	Gas Type	Nat	LP	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	11-10 11.9/900 PSC <sup>3</sup> / <sub>4</sub> 10/370	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1(2) 3 5																																																																																																
	Input (Btuh) Std/Alt. Hi Fire	125,000	100,000																																																																																																				
	Lo Fire	87,500	87,000																																																																																																				
GENERAL	Output (Btuh) Std/Alt. Hi Fire	89,000	89,000	<b>Air Delivery in Cubic Feet per Minute (C.F.M.)</b> (Furnace Rated @0.5" WC ESP) <table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr><td>.10</td><td>1264</td><td>1520</td><td>—</td><td>1841</td><td>2161</td></tr> <tr><td>.20</td><td>1251</td><td>1506</td><td>—</td><td>1803</td><td>2132</td></tr> <tr><td>.30</td><td>1249</td><td>1486</td><td>—</td><td>1772</td><td>2079</td></tr> <tr><td>.40</td><td>1219</td><td>1456</td><td>—</td><td>1736</td><td>2042</td></tr> <tr><td>.50</td><td>1168</td><td>1427</td><td>—</td><td>1702</td><td>1991</td></tr> <tr><td>.60</td><td>1178</td><td>1415</td><td>—</td><td>1672</td><td>1914</td></tr> <tr><td>.70</td><td>1143</td><td>1358</td><td>—</td><td>1614</td><td>1838</td></tr> </tbody> </table> <b>Air Delivery in Liters per Second (L/S)</b> (Furnace Rated @0.5" WC ESP) <table border="1"> <thead> <tr> <th>.TAP</th> <th>LOW</th> <th>MED L</th> <th>MED</th> <th>MED H</th> <th>HIGH</th> </tr> </thead> <tbody> <tr><td>.10</td><td>597</td><td>717</td><td>—</td><td>869</td><td>1020</td></tr> <tr><td>.20</td><td>590</td><td>711</td><td>—</td><td>851</td><td>1006</td></tr> <tr><td>.30</td><td>590</td><td>701</td><td>—</td><td>836</td><td>981</td></tr> <tr><td>.40</td><td>575</td><td>687</td><td>—</td><td>819</td><td>964</td></tr> <tr><td>.50</td><td>551</td><td>674</td><td>—</td><td>803</td><td>940</td></tr> <tr><td>.60</td><td>556</td><td>668</td><td>—</td><td>789</td><td>903</td></tr> <tr><td>.70</td><td>540</td><td>641</td><td>—</td><td>762</td><td>868</td></tr> </tbody> </table>				.TAP	LOW	MED L	MED	MED H	HIGH	.10	1264	1520	—	1841	2161	.20	1251	1506	—	1803	2132	.30	1249	1486	—	1772	2079	.40	1219	1456	—	1736	2042	.50	1168	1427	—	1702	1991	.60	1178	1415	—	1672	1914	.70	1143	1358	—	1614	1838	.TAP	LOW	MED L	MED	MED H	HIGH	.10	597	717	—	869	1020	.20	590	711	—	851	1006	.30	590	701	—	836	981	.40	575	687	—	819	964	.50	551	674	—	803	940	.60	556	668	—	789	903	.70	540	641	—	762	868
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.30	590	701	—	836	981																																																																																																		
.40	575	687	—	819	964																																																																																																		
.50	551	674	—	803	940																																																																																																		
.60	556	668	—	789	903																																																																																																		
.70	540	641	—	762	868																																																																																																		
GENERAL	Temp. Rise (°F) Hi Fire	40-70	40-70																																																																																																				
	Lo Fire	40-70	40-70																																																																																																				
	Electrical (Volts/Hz/FLA)	115/60/12	115/60/12																																																																																																				
GAS & IGNITION	Transformer Size (VA)	40	40																																																																																																				
	T'stat Heat Anticipator	.10	.10																																																																																																				
	Gas Valve Regulation Type	HW SV9540 SNAP	HW SV9540 SNAP																																																																																																				
GAS & IGNITION	Manifold Press. Hi Fire (") WC)	3.5	10.0																																																																																																				
	Lo Fire (") WC)	1.7	4.9																																																																																																				
	Std. Main Orifices (No/Size)	5/#42	5/#54																																																																																																				
LIMITS & CONTROLS	Pilot Orifice Size	.018	.011																																																																																																				
	Ignition Type/Series	HW HSP	HW HSP																																																																																																				
	Flue Outlet Size (")	3	3																																																																																																				
COMBUSTION	Std. Outlet Temp (°F)	<480	<480																																																																																																				
	Thermal Sensor (°F)	300	300																																																																																																				
	Limit Control Setting (°F)	150	150																																																																																																				
LIMITS & CONTROLS	Auxiliary Limit (°F)	130	130																																																																																																				
	Fan Control (Type)	HW ST9162A	HW ST9162A																																																																																																				
	Fan Control On (Timed—Secs)	30/60	30/60																																																																																																				
LIMITS & CONTROLS	Off	60,100,140,180	60,100,140,180																																																																																																				
	Std. Pressure Sw. Hi Fire (Part No)	1010945	1010945																																																																																																				
	Neg. Pressure (Close)	-0.95	-0.95																																																																																																				
LIMITS & CONTROLS	Neg. Pressure (Open)	-0.80	-0.80																																																																																																				
	Std. Pressure Sw. Lo Fire (Part No)	1011739	1011739																																																																																																				
	Neg. Pressure (Close)	-0.53	-0.53																																																																																																				
LIMITS & CONTROLS	Neg. Pressure (Open)	-0.35	-0.35																																																																																																				
	High Alt. Restrictor (Part No)(Size)	734020035(1.62)	734020035(1.62)																																																																																																				

Technical Service Data Sheets 6. & 7.

THIS DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturers Number (Mfr No –See Rating Plate)							NTPM050FFA1/TNK050F12A1						
Specifications							Circulation Air Blower Data						
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	10–8 4.6/1050 PSC <sup>1</sup> / <sub>3</sub> 5/370	Filter Type Filter Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1  1.5  3
	Input (Btuh) Std/Alt.	50,000	35,000	50,000	35,000								
	Output (Btuh) Std/Alt. Temp. Rise (°F)	46,000 40-70	32,200 30-60	46,000 40-70	32,200 30-60								
Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator		115/60/5.3 40 .10		115/60/5.3 40 .10									
GAS & IGNITION	Gas Valve Regulation Type	HW SV9540 SNAP		HW SV9540 SNAP						<b>Air Delivery in Cubic Feet per Minute (C.F.M.)</b> (Furnace Rated @0.5" WC ESP)			
	Manifold Press. (" WC)	3.5	1.7	10.0	4.9								
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011									
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---									
COMBUSTION	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	2 <140 4/370		2 <140 4/370						<b>Air Delivery in Liters Per Second (L/S)</b> (Furnace Rated @0.5" WC ESP)			
	Std. Pressures (" of WC)	@Blower @Transition		@Burner Box		Differential							
	5' No Elbows 40' +5-90° DWV Elbows	-2.30 -2.20	-1.56 -1.52	-1.10 -2.20	-0.04 -1.14	-2.2 -2.0	-1.52 -1.38						
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	250 160 130		250 160 130									
LIMITS & CONTROLS	Fan Control (Type) Fan Control On Fan Control Off (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180						<b>External Static Pressure</b> Inches of W.C.			
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011778 1.08 .90	1010895 1.62 1.38	1011778 1.08 .90								
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011777 .86 .70	1008817 1.40 1.18	1011777 .86 .70								

THIS DATA IS SUBJECT TO CHANGE WITHOUT NOTICE

Manufacturers Number (Mfr No –See Rating Plate)							NTPM075GFA1/TNK075F14A1						
Specifications							Circulation Air Blower Data						
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P. Cap. MFD/Volts	10–8 6.8/1050 PSC <sup>1</sup> / <sub>2</sub> 75/370	Filter Type Filter Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1  2  3.5
	Input (Btuh) Std/Alt.	75,000	53,000	75,000	53,000								
	Output (Btuh) Std/Alt. Temp. Rise (°F)	69,000 40-70	48,800 30-60	69,000 40-70	48,800 30-60								
Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator		115/60/7.5 40 .10		115/60/7.5 40 .10									
GAS & IGNITION	Gas Valve Regulation Type	HW SV9540 SNAP		HW SV9540 SNAP						<b>Air Delivery in Cubic Feet per Minute (C.F.M.)</b> (Furnace Rated @0.5" WC ESP)			
	Manifold Press. (" WC)	3.5	1.7	10.0	4.9								
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011									
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---									
COMBUSTION	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370		2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370						<b>Air Delivery in Liters Per Second (L/S)</b> (Furnace Rated @0.5" WC ESP)			
	Std. Pressures (" of WC)	@Blower @Transition		@Burner Box		Differential							
	5' No Elbows 40' +5-90° DWV Elbows	-2.30 -2.05	-.98 -.95	-1.10 -1.15	-0.08 -1.15	-2.2 -1.9	-0.90 -0.80						
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 190 130		200 190 130									
LIMITS & CONTROLS	Fan Control (Type) Fan Control On Fan Control Off (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180						<b>External Static Pressure</b> Inches of W.C.			
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011776 .65 .50	1010895 1.62 1.38	1011776 .65 .50								
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1010943 .52 .37	1008817 1.40 1.18	1010943 .52 .37								



Technical Service Data Sheets 8. & 9.

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Manufacturers Number (Mfr No –See Rating Plate)							NTPM100HJA1/TNK100J16A1										
Specifications							Circulation Air Blower Data										
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Hi Fire	Lo Fire	Type & Size	10–10	Filter Type	Washable				
	Input (Btuh) Std/Alt.	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Motor Amps/RPM	8.5/1050	Filter Size (")	16x25x1				
	Output (Btuh) Std/Alt. Temp. Rise (°F)	100,000 92,000	70,000 64,400	100,000 92,000	70,000 64,400	100,000 92,000	70,000 64,400	100,000 92,000	70,000 64,400	Motor Type/ H.P. Cap. MFD/Volts	DC/1 10/370	Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	2 4				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/9.2 40 .10		115/60/9.2 40 .10						Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9						External Static Pressure Inches of W.C.	TAP	LOW	MED L	MED H	HIGH		
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011							.10	954	1312	1698	1925		
Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---						.20		950	1292	1645	1853			
Flue Outlet Size (") Std. Outlet Temp (°F) Comb.Blower (MFD/Volts)	2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370		2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370						.30		946	1265	1596	1780			
Std. Pressures (" of WC) 5' No Elbows 40' +5-90° DWV Elbows	@Blower	@Transition	@Burner Box	Differential					.40		915	1231	1530	1708			
LIMITS & CONTROLS	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 180 130		200 180 130						External Static Pressure Inches of W.C.	TAP	LOW	MED L	MED H	HIGH		
	Fan Control (Type) Fan Control On Fan Control Off (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							.50	878	1175	1455	1638		
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011777 .86 .70	1010895 1.62 1.38	1011777 .86 .70						.60	830	1118	1362	1546		
High At. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011776 .65 .50	1008817 1.40 1.18	1011776 .65 .50					.70		778	1020	1241	1435			
							Air Delivery in Liters Per Second (L/S) (Furnace Rated @0.5" WC ESP)										
							TAP							LOW	MED L	MED H	HIGH
							.10							450	619	801	908
							.20							448	610	776	874
							.30							446	597	753	840
							.40							432	581	722	806
							.50							414	555	687	773
							.60							392	528	643	730
							.70							367	481	586	677

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Manufacturers Number (Mfr No –See Rating Plate)							NTPM125KNA1/TNK125N20A1										
Specifications							Circulation Air Blower Data										
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Hi Fire	Lo Fire	Type & Size	11.8–10.6	Filter Type	Washable				
	Input (Btuh) Std/Alt.	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Hi Fire	Lo Fire	Motor Amps/RPM	9.8/900	Filter Size (")	(2)16x25x1				
	Output (Btuh) Std/Alt. Temp. Rise (°F)	125,000 119,300	87,500 80,500	125,000 119,000	87,500 80,500	125,000 119,000	87,500 80,500	125,000 119,000	87,500 80,500	Motor Type/ H.P. Cap. MFD/Volts	DC <sup>3</sup> / <sub>4</sub> 10/370	Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	3.5 5				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/10.5 40 .10		115/60/10.5 40 .10						Air Delivery in Cubic Feet per Minute (C.F.M.) (Furnace Rated @0.5" WC ESP)							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9						External Static Pressure Inches of W.C.	TAP	LOW	MED L	MED H	HIGH		
	Std. Main Orifices (No/Size) Pilot Orifice Size	5/#42 .018		5/#54 .011							.10	1463	1650	1879	2214		
Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---						.20		1429	1635	1859	2154			
Flue Outlet Size (") Std. Outlet Temp (°F) Comb.Blower (MFD/Volts)	<140 4/370		3 <140 4/370						.30		1417	1614	1838	2152			
Std. Pressures (" of WC) 5' No Elbows 40' +5-90° DWV Elbows	@Blower	@Transition	@Burner Box	Differential					.40		1389	1579	1806	2106			
LIMITS & CONTROLS	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 180 130		200 180 130						External Static Pressure Inches of W.C.	TAP	LOW	MED L	MED H	HIGH		
	Fan Control (Type) Fan Control On Fan Control Off (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							.50	1364	1556	1773	2049		
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011779 .140 .120	1010895 1.62 1.38	1011779 .86 .120						.60	1339	1513	1725	1981		
High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011778 .108 .90	1008817 1.40 1.18	1011778 .108 .90					.70		1299	1470	1668	1903			
							Air Delivery in Liters Per Second (L/S) (Furnace Rated @0.5" WC ESP)										
							TAP							LOW	MED L	MED H	HIGH
							.10							690	779	887	1045
							.20							674	772	877	1017
							.30							669	762	867	1016
							.40							656	745	852	994
							.50							644	734	837	967
							.60							632	714	814	935
							.70							613	694	787	898

## Technical Service Data Sheets 10. & 11.

Manufacturers Number (Mfr No –See Rating Plate)		NTVM050FFA1/VNK050F12A									
		Specifications				Circulation Air Blower Data					
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P.	10–8 4.6/1050 DC/1/2	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1  1.5  3
	Input (Btuh) Std/Alt. Output (Btuh) Std/Alt. Temp. Rise (°F)	Hi Fire 50,000 47,000 40-70	Lo Fire 35,000 33,000 40-70	Hi Fire 50,000 47,000 40-70	Lo Fire 35,000 33,000 30-60	Hi Fire	Lo Fire				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/5.3 40 .10		115/60/5.3 40 .10							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9							
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011							
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---							
	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	2 <140 4/370		2 <140 4/370							
COMBUSTION	Std. Pressures (" of WC)	@Blower @Transition		@Burner Box		Differential					
	5' No Elbows 40' +5-90° DWV Elbows	-2.30 -2.20	-1.56 -1.52	-1.0 -2.20	-.04 -.14	-2.2 -2.0	-1.52 -1.38				
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	250 160 130		250 160 130							
LIMITS & CONTROLS	Fan Control (Type) Fan Control (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011778 1.08 .90	1010895 1.62 1.38	1011778 1.08 .90						
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011777 .86 .70	1008817 1.40 1.18	1011777 .86 .70						

Manufacturers Number (Mfr No –See Rating Plate)		NTVM075GFA1/VNK075F14A									
		Specifications				Circulation Air Blower Data					
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P.	10–8 6.8/1050 DC/1/2	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1  2  3.5
	Input (Btuh) Std/Alt. Output (Btuh) Std/Alt. Temp. Rise (°F)	Hi Fire 75,000 70,500 40-70	Lo Fire 53,000 49,800 40-70	Hi Fire 75,000 70,500 40-70	Lo Fire 53,000 49,800 40-70	Hi Fire	Lo Fire				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/7.5 40 .10		115/60/7.5 40 .10							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9							
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011							
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---							
	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	2,2 1/2,3 <140 4/370		2,2 1/2,3 <140 4/370							
COMBUSTION	Std. Pressures (" of WC)	@Blower @Transition		@Burner Box		Differential					
	5' No Elbows 40' +5-90° DWV Elbows	-2.30 -2.05	-.98 -.95	-1.0 -1.15	-.08 -.15	-2.2 -1.9	-.90 -.80				
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 190 130		200 190 130							
LIMITS & CONTROLS	Fan Control (Type) Fan Control (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011776 .65 .50	1010895 1.62 1.38	1011776 .65 .50						
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1010943 .52 .37	1008817 1.40 1.18	1010943 .52 .37						

Technical Service Data Sheets 12. & 13.

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Manufacturers Number (Mfr No –See Rating Plate)								NTVM100HJA1/VNK100J16A			
Specifications								Circulation Air Blower Data			
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P.	10–10 8.5/1050 DC/1	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable 16x25x1  2  4
	Input (Btuh) Std/Alt. Output (Btuh) Std/Alt. Temp. Rise (°F)	Hi Fire 100,000 94,000 40-70	Lo Fire 70,000 68,800 40-70	Hi Fire 100,000 94,000 40-70	Lo Fire 70,000 68,800 40-70	Hi Fire	Lo Fire				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/9.2 40 .10		115/60/9.2 40 .10							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9							
	Std. Main Orifices (No/Size) Pilot Orifice Size	2/#42 .018		2/#54 .011							
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---							
	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370		2,2 <sup>1</sup> / <sub>2</sub> ,3 <140 4/370							
COMBUSTION	Std. Pressures (" of WC)	<b>@Blower</b>		<b>@Transition</b>		<b>@Burner Box</b>		<b>Differential</b>			
	5' No Elbows 40' +5-90° DWV Elbows	-2.40 -1.98	-1.36 -1.22	-1.0 -2.0	-.06 -.18	-2.3 -1.78	-1.30 -1.22				
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 170 130		200 170 130							
LIMITS & CONTROLS	Fan Control (Type) Fan Control (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011777 .86 .70	1010895 1.62 1.38	1011777 .86 .70						
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011776 .65 .50	1008817 1.40 1.18	1011776 .65 .50						

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Manufacturers Number (Mfr No –See Rating Plate)								NTVM125KNA1/VNK125N20A			
Specifications								Circulation Air Blower Data			
GENERAL	Gas Type	Nat		LP		Hi Fire	Lo Fire	Type & Size Motor Amps/RPM Motor Type/ H.P.	11.8–10.6 9.8/900 DC/1	Filt Type Filt Size (") Min. Cool Cap. (Tons) Max. Cool Cap. (Tons)	Washable (2)16x25x1  2  5
	Input (Btuh) Std/Alt. Output (Btuh) Std/Alt. Temp. Rise (°F)	Hi Fire 125,000 119,300 45-75	Lo Fire 87,500 80,500 45-75	Hi Fire 125,000 119,300 45-75	Lo Fire 87,500 80,500 45-75	Hi Fire	Lo Fire				
GAS & IGNITION	Electrical (Volts/Hz/FLA) Transformer Size (VA) T'stat Heat Anticipator	115/60/10.5 40 .10		115/60/10.5 40 .10							
	Gas Valve Regulation Type Manifold Press. (" WC)	HW SV9540 SNAP 3.5   1.7		HW SV9540 SNAP 10.0   4.9							
	Std. Main Orifices (No/Size) Pilot Orifice Size	5/#42 .018		5/#54 .011							
	Ignition Type/Series Lock-Out Time	HW HSP ---		HW HSP ---							
	Flue Outlet Size (") Std. Outlet Temp (°F) Comb. Blower (MFD/Volts)	3 <140 4/370		3 <140 4/370							
COMBUSTION	Std. Pressures (" of WC)	<b>@Blower</b>		<b>@Transition</b>		<b>@Burner Box</b>		<b>Differential</b>			
	5' No Elbows 40' +5-90° DWV Elbows	-2.40 -1.98	-1.76 -1.64	-1.0 -2.0	-.08 -.12	-2.3 -1.78	-1.68 -1.52				
	Rollout Switch Limit Control Setting (°F) Auxiliary Limit (°F)	200 180 130		200 180 130							
LIMITS & CONTROLS	Fan Control (Type) Fan Control (Timed-Secs)	HW ST9162A 30/60 60,100,140,180		HW ST9162A 30/60 60,100,140,180							
	Std. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1010895 1.62 1.38	1011778 1.08 .90	1010895 1.62 1.38	1011778 1.08 .90						
	High Alt. Pressure Sw. (Part No) Press Differential (Close) Press Differential (Open)	1008817 1.40 1.18	1011777 .86 .70	1008817 1.40 1.18	1011777 .86 .70						

## WIRING DIAGRAM INDEX

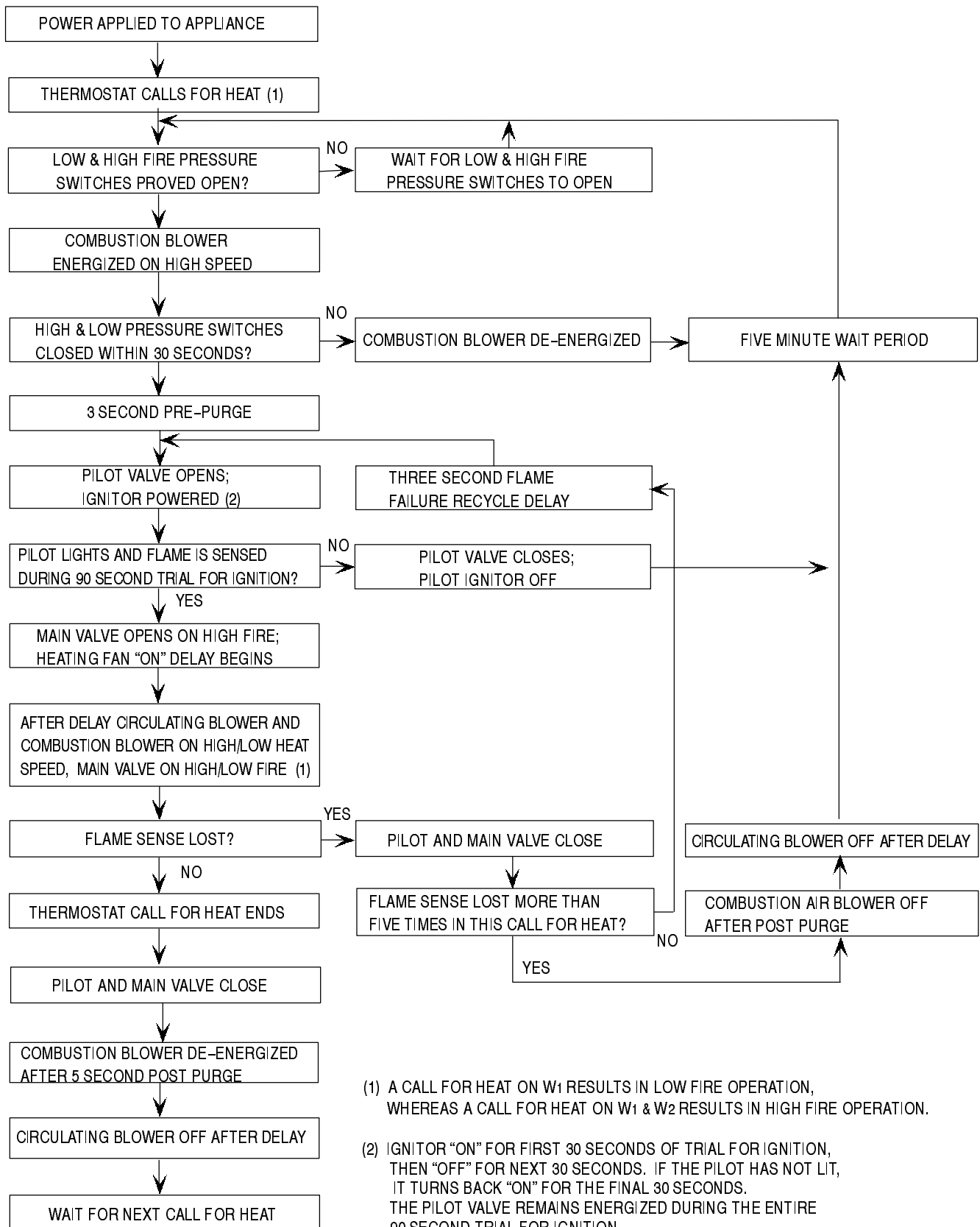
(Diagrams Follow Index In Numerical Order)

MODEL NUMBER	WIRING DIAGRAM	MODEL NUMBER	WIRING DIAGRAM
<b>NTP6</b>		<b>TNE</b>	
NTP6050FBA1	..... #1. (Part # 1011883-A)	TNE050B12A1	..... #1. (Part # 1011883-A)
NTP6075GFA1	..... #1. (Part # 1011883-A)	TNE075F14A1	..... #1. (Part # 1011883-A)
NTP6100GFA1	..... #1. (Part # 1011883-A)	TNE100F14A1	..... #1. (Part # 1011883-A)
NTP6100KJA1	..... #1. (Part # 1011883-A)	TNE100J20A1	..... #1. (Part # 1011883-A)
NTP6125KJA1	..... #1. (Part # 1011883-A)	TNE125J20A1	..... #1. (Part # 1011883-A)
<b>NTPM</b>		<b>TNK</b>	
NTPM050FBA1	..... #1. (Part # 1011883-A)	TNK050F12A1	..... #1. (Part # 1011883-A)
NTPM075GFA1	..... #1. (Part # 1011883-A)	TNK075F14A1	..... #1. (Part # 1011883-A)
NTPM100GFA1	..... #1. (Part # 1011883-A)	TNK100J16A1	..... #1. (Part # 1011883-A)
NTPM125KJA1	..... #1. (Part # 1011883-A)	TNK125N20A1	..... #1. (Part # 1011883-A)
<b>NTVM</b>		<b>VNK</b>	
NTVM050FBB1	..... #2. (Part # 1011884-A)	VNK050F12A1	..... #2. (Part # 1011884-A)
NTVM075GFA1	..... #2. (Part # 1011884-A)	VNK075F14A1	..... #2. (Part # 1011884-A)
NTVM100GFA1	..... #2. (Part # 1011884-A)	VNK100J16A1	..... #2. (Part # 1011884-A)
NTVM125KJA1	..... #2. (Part # 1011884-A)	VNK125N20A1	..... #2. (Part # 1011884-A)





# Honeywell SV9540Q 2 - STAGE "SMART VALVE" Sequence of Operation



## Honeywell SV9540Q 2 – STAGE “SMART VALVE” Troubleshooting

LED STATUS	INDICATES	CHECK/REPAIR
Off	No power to system control.	Line voltage input at L1 & Neutral connections of ST9162 Fan Timer. Low voltage (24V) power at 24 VAC and COM terminals on ST9162 System wiring harness is in good condition and securely connected.
Bright – Dim	Normal indication whenever the system is powered, unless some abnormal event has occurred.	Not Applicable – Normal Operation
2 Flashes	Low Fire pressure switch closed when it should be open (i.e. when call for heat begins). (Combustion blower is not energized until low Fire pressure switch opens)	Low Fire pressure switch stuck closed. Low Fire pressure switch miswired or jumpered.
3 Flashes	Low Fire pressure switch ,or Auxiliary limit switch open when they should be closed (i.e. longer than 30 seconds after combustion blower is energized) or control switch in OFF position.  System goes into 5–minute delay period, with combustion blower off. At end of the 5–minute delay, another cycle will begin.	Ignition system control switch must be in the ON position. Low Fire pressure switch operation, tubing, and wiring. Auxiliary limit switch operation, and wiring Restrictions in furnace air intake or vent piping.
4 Flashes	Main Limit or Roll Out Switch is open.  Combustion blower is energized, Circulating blower is energized heat speed after the “ON” delay.	Main limit switch. Manual reset burner rollout switch. Limit and roll–out switch wiring is in good condition and securely connected.
5 Flashes	Flame signal sensed out of proper sequence. Combustion blower is energized, Circulating blower is energized heat speed after the “ON” delay.	Flame at pilot burner.
6 Flashes	Soft Lockout.  Combustion air blower is de–energized, Circulating blower is de–energized after the “OFF” delay.  After 5–minute delay time, control system will reset and initiate a new ignition sequence,	Gas supply off or pressure too low or high for appliance to operate. Damaged or broken Ignitor Line voltage HOT leadwire not connected to L1 terminal on ST9162. Furnace not properly earth grounded. Flame sense rod contaminated or in incorrect position. Pilot burner located in incorrect position. Pilot burner leadwires are in good condition and properly connected.
8 Flashes	High Fire pressure switch closed when it should be open (i.e. when a call for heat begins).  (Combustion blower is not energized until High Fire pressure switch opens)	High Fire pressure switch stuck closed.  High Fire pressure switch miswired or jumpered.
9 Flashes	High Fire pressure switch open when it should be closed (i.e. longer than 30 seconds after combustion blower is energized).  System goes into 5–minute delay period, with combustion blower off. At end of the 5–minute delay, another cycle will begin.	Ignition system control switch must be in the ON position.  High Fire pressure switch operation, tubing, and wiring.  Restrictions in furnace air intake or vent piping.



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