



## Manual for: SU-2A Gas Burner

50,000 BTU/H to 250,000 BTU/H

The burner shall be used only with NATURAL GAS or LP GAS as specified on the nameplate.

**Warning:** If the following instructions are not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

### - WHAT TO DO IF YOU SMELL GAS -

- Do not try to light any appliance.
- Do not touch any electrical appliance.
- Do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone.
- Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

- A qualified installer, service agency or the gas supplier must perform installation and service.
- All installations must be made in accordance with all state and local codes, which may differ from instructions in this manual.
- The installer should inform and demonstrate to the user the correct operation and maintenance of the appliance.
- The installer shall also inform the user of hazards of flammable liquids and vapors and shall remove such liquids and vapors from the vicinity of the burner.
- The installation adjustment data trap, or label supplied, shall be filled in and affixed to the burner or the covered appliance.

These instructions should be affixed to the burner or adjacent to the heating appliance

NYC MEA # 382-03-E



Massachusetts Plumbing Board G1-0903-40:09/03/2004

**Manufactured by Heat Wise, Inc.  
1528 Rocky Point Road, Middle Island, NY 11953**

rev 2004-2

Chart 1: Natural Gas and LP								
Burner Model	Length of Flame Tube	Firing Rate		Primary Electric Input	Secondary Electric Input	Total Watts	Total Amps	Gas Conn.
		Min BTU/H	Max BTU/H					
SU-2A	4 1/4"	50,000	250,000	120 Volt 60 Hz 1 Ph	24 Volts	150 Max	3 or less	1/2"

- Control System: Fenwal Model 2466H936-111 with 15 Second Pre-Purge and 60 Second Post-Purge OR Honeywell S89F with 34 second Pre-Purge.
- The system uses a remote ignition system with a separate Ignition Transformer.
- Gas Valve: VR8205A 2008 or VR 8305 P with step opening (special applications).

## BURNER DESCRIPTION

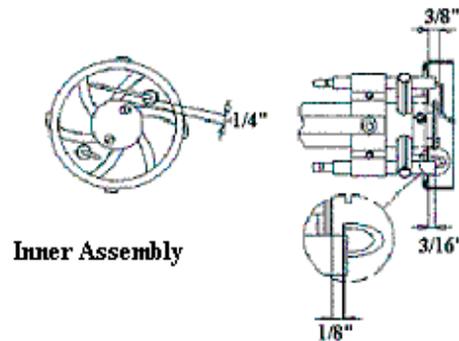
The SU-2A Gas Burner is a fully automatic, flame retention burner and is suitable for combustion of natural gas or LP. Changing orifices alters the firing rate. The combustion air can be adjusted for proper O<sub>2</sub> or CO<sub>2</sub> by the dial located on top of the burner housing, which allows the air to flow more or flow less within the burner.

Two electrodes act as a sparker and a flame rod (See Fig. 1). Flame rectification by this flame rod monitors the continued presence of the burner flame. With three trials for ignition consistency (with Fenwal control), trouble free, safe operation is achieved.

**Warning: Should overheating occur, 1) shut off the manual gas shut off valve to control the appliance; 2) DO NOT shut off the control switch to the pump or blower**

This power gas burner is designed to convert oil and/or coal fired boilers and furnaces to a gas-burning appliance. The conversion must conform to local codes. In the absence of such codes, the American National Standard for the Installations of gas conversion burners, ANSI Z21.17-1984, Z21.8A-1990 and the National Fuel Gas Code ANSI 223.1-1992 or current standards should be applied.

Fig. 1 Electrode and Flame Sensor Dimensions



## CONVERTING OIL TO GAS

Before attempting the gas conversion, check to insure the heating system is properly sized for the total heating demand and the entire system is in good operating condition, including the fire chamber and flue passages. It is important to allow adequate clearance around the appliance for servicing and proper operation of the burner.

## CONVERTING COAL TO GAS

When converting a coal appliance to gas, the coal firing chamber or the ash pit chamber may be used as a gas firing chamber, provided the flame does not impinge on the walls of the appliance (see Chart 2). It is important to allow adequate clearance around the appliance for servicing and proper operation of the burner.

Chart 2: Minimum Firing Chamber Dimensions				
Input Rate BTU per hour	Rectangular		Round	
	Length	Width	Diameter	Minimum Height
50,000 to 80,000	6"	6"	6"	6"
80,000 to 150,000	9"	8"	9"	8"
150,000 to 180,000	11"	8"	11"	8"
180,000 to 200,000	14"	8"	14"	12"
200,000 to 250,000	15"	8"	15"	13"

## AIR FOR COMBUSTION

If the boiler or furnace room is unusually tight, or if the house has a ventilation fan, it is recommended that the combustion air be supplied to the furnace room through intakes from the outside of the building. The intakes must terminate facing down in order to avoid obstruction from rain, snow, leaves, etc. Openings must have one square inch of free area per 10,000 BTU input rate (see Example 1). Follow the heat exchanger manufacturer's recommendations for installing louvers, etc.

**Example 1:** 150,000 BTU/hr firing rate

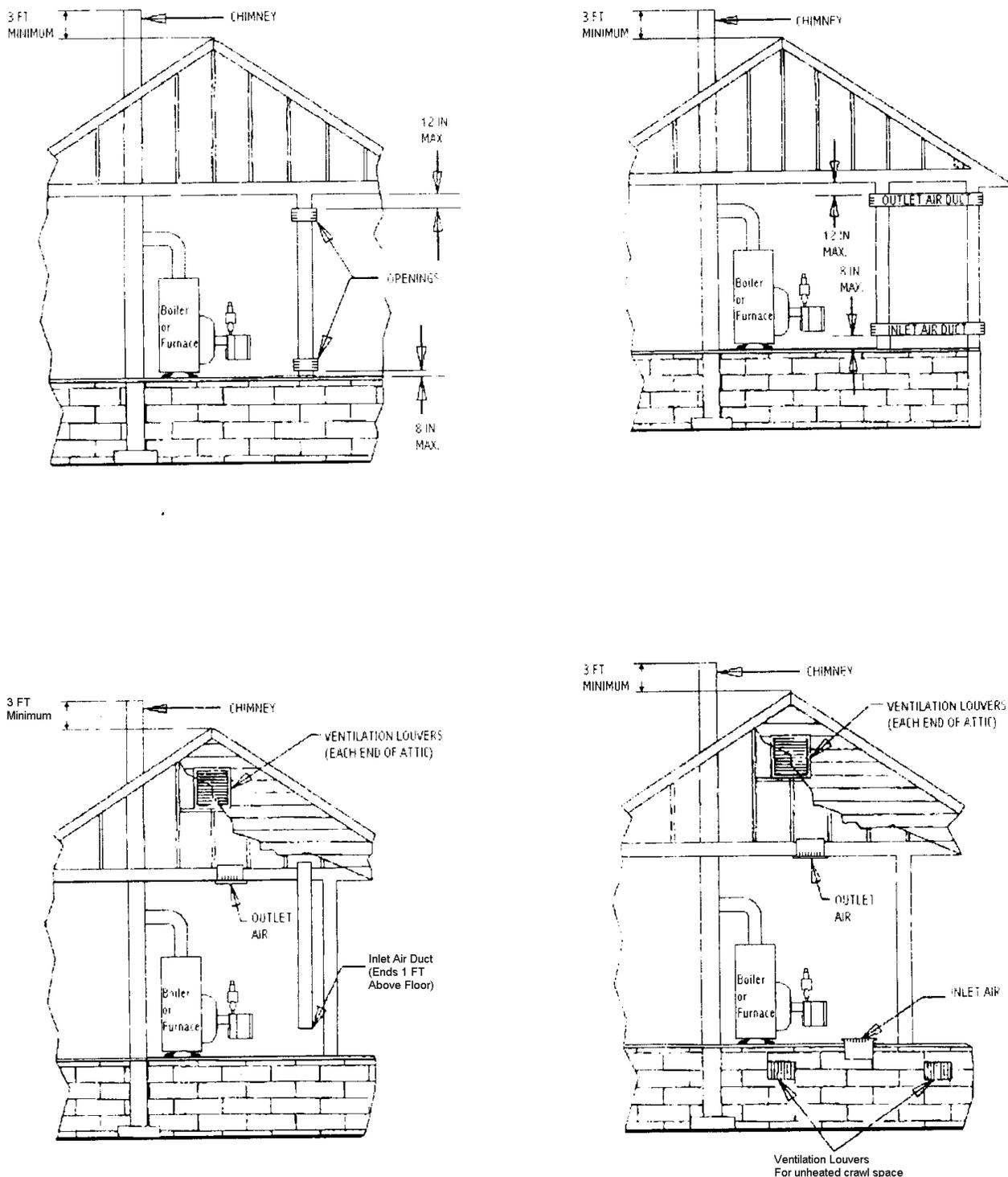
$$(150,000 \text{ BTU} / \text{hr}) * \frac{(1 \text{ in}^2)}{10,000 \text{ BTU} / \text{hr}} = 15 \text{ in}^2$$

## CHIMNEY REQUIREMENTS

The chimney should extend **at least 3'** above a flat roof or the highest roof ridge (see Fig. 2) and be free in a **radius of 30'** of objects such as tree limbs, other buildings, etc, which may cause a down draft. The chimney should be lined as required by the local Gas Company or local codes.

Some utilities require new chimney liners for all gas installations. Use a corrosion resistant chimney liner (approved for gas service) of the same size as the vent pipe.

Fig. 2 Chimney and Fresh Air Dimensions



## VENT PIPE AND DRAFT HOOD SIZES

Refer to Chart 3 to properly size the flue pipe. If the flue pipe exceeds 10' in length (including elbows), use the next larger diameter flue pipe and draft hood. If a draft regulator is required, any Canadian Standards Association (CSA) or Underwriter's Laboratory (UL) listed double swing draft regulator must be used. ***A movable internal damper is not permitted on gas installations.*** When the burner is used as a conversion burner, draft over fire should be maintained as  $-0.02''$  W.C. by adjusting the regulator when the burner is fired. The installer should follow the barometric draft regulator manufacturer's instructions for complete details for installations and adjustments. The vent pipe should extend only to (but not beyond) the inside wall of the chimney.

The sizing below does not apply on any factory listed packaged units.

Chart 3: Vent Pipe Sizing	
Input per Hour	Draft Hood and Flue Pipe Sizes
Up to 120,000 BTU	5" diameter
120,000 to 160,000 BTU	6" diameter
160,000 to 250,000 BTU	7" diameter

## INSTALLING THE BURNER

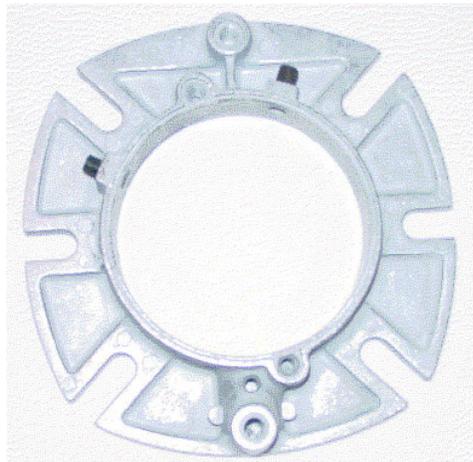
If the burner being installed is a conversion burner, use a prefabricated chamber or build a firing chamber that can withstand  $2000^{\circ}$  F (See Chart 2 on page 3). Measure the boiler or furnace mounting plate to determine the flame tube insertion required. Deduct  $\frac{1}{4}''$  from the total length and tighten the flange on the flame tube with the deducted insertion depth. The  $\frac{1}{4}''$  deduction will prevent the tip of the flame tube from burning off. Install the burner on the unit and then tighten the nuts on the flange so that the burner is permanently secured. Seal off any free openings with high temperature cement.

Refer to the pictures below to determine which flange is installed on the SU-2A



### Picture 1: STANDARD FLANGE:

Install the gasket and the Standard flange to the boiler. Tighten the bolts. Measure the boiler or furnace-mounting plate to determine the flame tube insertion depth required and make a mark on the tube (with a marker or screwdriver). Deduct  $\frac{1}{4}''$  from the total length and tighten the flange on the flame tube with the deducted insertion depth. The  $\frac{1}{4}''$  deduction will prevent the tip of the flame tube from burning off. Slide the blast tube into the boiler to the proper depth and tighten the four  $\frac{1}{4}''$ -20 setscrews. Seal off any free openings with either high temperature cement or high temperature silicone.



**Picture 2: DIE CAST FLANGE:** (picture to the left)

Install the gasket and Die Cast flange to the boiler.

Tighten the bolts. Measure the boiler or furnace-mounting plate to determine the flame tube insertion depth required and make a mark on the tube (with a marker or screwdriver). Deduct ¼” from the total length and tighten the flange on the flame tube with the deducted insertion depth. The ¼” deduction will prevent the tip of the flame tube from burning off. Slide the blast tube into the boiler to the proper depth and tighten the two setscrews using a 4 mm allen key. Seal off any free openings with either high temperature cement or high temperature silicone.



**Picture 2: BODY FLANGE:** (picture to the left)

First, install the gasket and boiler flange to the boiler.

- For heat exchangers with a diamond stud pattern, one allen screw on the flange should be on the top, slightly to the left of the 12 o'clock stud. The second screw should be on the right (slightly above the 3 o'clock position stud). Tighten all the nuts equally. Make sure that the allen screws are backed out, to allow enough clearance. Then, insert the SU-2A gas burner into the boiler. Once the burner is inserted and pushed all the way forward, tighten the allen screw on the top of the flange. This screw **MUST** go into the groove that is on the burner housing. Tighten the second allen screw, located on the right side of the flange. This screw should be tight.
- For heat exchangers with a square stud pattern, move one of the allen screws so that both are under the top two boiler studs. Tighten the bolts and install the burner. Make sure the burner is straight and tighten the allen screws.
- Seal off any free openings with either high temperature cement or high temperature silicone.

## GAS SERVICE & PIPE CAPACITY

Before connecting the burner to the gas supply, insure that the gas pipes and service meter are large enough to permit the additional load of the gas burner (see Chart 4).

<b>Chart 4: Pipe Capacity Table*( x 1,000 BTU's)</b>				
<b>Pipe Length**</b>	<b>Nominal diameter of pipe in inches</b>			
	<b>¾"</b>	<b>1"</b>	<b>1 ¼"</b>	<b>1 ½"</b>
<b>15'</b>	172	345	750	
<b>30'</b>	120	241	535	850
<b>45'</b>	99	199	435	700
<b>60'</b>	86	173	380	610
<b>75'</b>	77	155	345	545
<b>90'</b>	70	141	310	490
<b>105'</b>	65	131	285	450
<b>120'</b>		120	270	380
<b>150'</b>		109	242	300
<b>180'</b>		100	225	225

\* Using 0.6 Specific Gravity Gas and a Pressure Drop of 0.3" of Water Column

\*\* Each 90° elbow counts as 3' for the purpose of these calculations

It is advisable to run a separate gas line from the meter to the gas burner to avoid pressure drops. Refer to the above Pipe Capacity table for the correct sizes. ***ALL PIPING MUST CONFORM TO LOCAL CODES.*** Use black steel pipe and malleable fittings (**do not use cast iron parts**) with a suitable pipe dope that is resistant to liquefied petroleum gases. Test for gas leaks using an approved gas leak tester.

Piping should consist of:

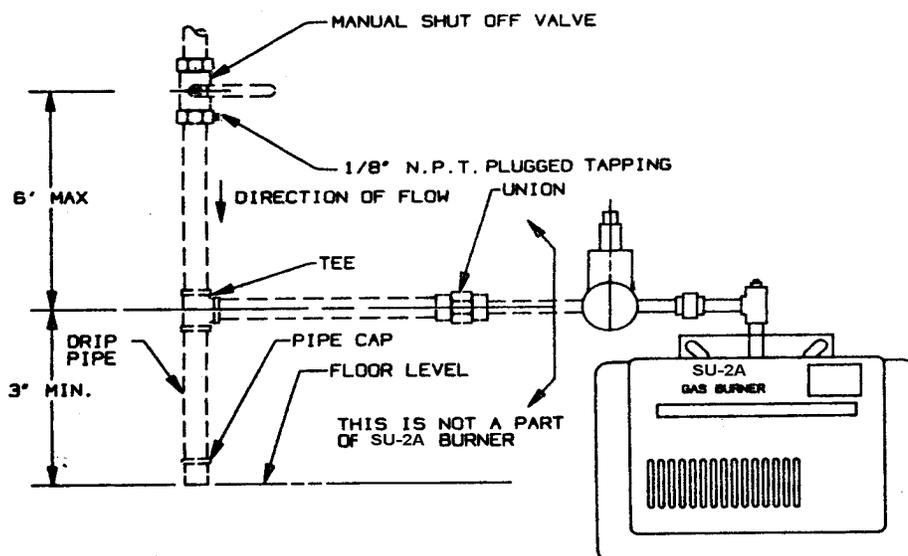
1. A shut off valve approximately 6' away from the unit.
2. A 1/8" plugged NPT tapping for gas pressure measurement preferably on the manual shut off valve (as shown or anywhere between the gas valve and the shut off valve).

***Note: The manual shut-off valve and tapping are NOT part of the SU-2A Gas Burner. Please make sure you conform to local and state codes.***

3. A gas union.
4. A drip pipe.

***Caution: The gas valve should not be subjected to more than 1/2" PSIG. Therefore, the burner should be isolated during high-pressure gas leak tests.*** The appliance and its individual shut off valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psig. The appliance must be isolated from the gas supply piping by closing its individual manual shut off valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psig.

**Fig. 3 Gas Burner Piping\***



*\*The dotted lines represent field installation.*

To determine the firing rate of the burner, multiply the heating capacity of the appliance by **1.2**, or multiply the flow rate in GPH by 140,000 BTU/gal.

**Example 2:** if the boiler or furnace is rated for 0.75 GPH of No. 2 oil, then:  
 $0.75 \text{ GPH} \times 140,000 = 105,000 \text{ BTU input rate.}$

Use the calculated input rate to fire the boiler or furnace.

## ORIFICE INSTALLATION

All burners are equipped with an orifice set at the minimum firing rate (except for OEM packaged units). Drilling the orifice increases the firing rate. To drill the orifice, first open the union and then unscrew the orifice from inside the union. Determine the proper orifice size for the desired firing rate and drill the orifice (see Chart 5). Replace the orifice in the union and tighten the union so that it is gas tight. Once installed, a higher or lower firing rate can be achieved by raising or lowering the manifold pressure by +/- 0.3". Pressure changes can only be made when the burner is running. The typical working manifold pressure for natural gas is **3.5" W.C.** (2.3" W.C. for LP). The maximum inlet pressure at the gas valve is **11" W.C.**; the minimum is **5" W.C.** (for the purpose of input adjustment).

**Note: The manifold pressure may vary for OEM packaged units.**

Orifice Size (inches)	Drill Size	Manifold Pressure at 3.5" W.C. for Nat Gas (BTU)	Manifold Pressure at 2.3" W.C. for L.P. (BTU)	Approximate Head Setting	Approximate Air Setting
5/32	0.156	50,000	50,000	21	0
3/16	0.188	80,000	80,000	18	2
7/32	0.219	90,000	90,000	12	6
15/64	0.234	122,000	122,000	18	14
9/32	0.281	146,000	146,000	14	11
19/64	0.297	160,000	160,000	10	10
27/64	0.422	200,000	200,000	3	15
1/2	no orifice	250,000	250,000	1	20

\* Assumes 0" to -0.02" Draft over fire

## INSTALLING THE CHIMNEY LINER, DRAFT DIVERTER AND VENT PIPE

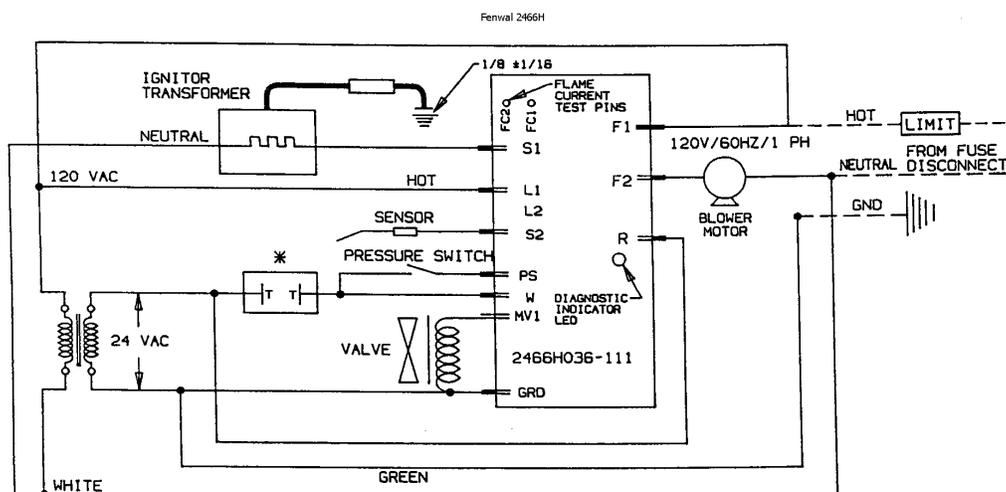
Some utilities require new chimney liners for all gas installations. Use a corrosion resistant chimney liner (approved for gas service) of the same size as the vent pipe. Use an CSA or U.L. listed draft diverter only if you can maintain draft over fire. Otherwise, it is better to use a double swing draft regulator, listed by CSA or U.L. When the burner is used as a conversion burner, draft over fire should be maintained as -0.02" W.C. by adjusting the regulator when the burner is fired. The installer should follow the barometric draft regulator manufacturer's instructions for complete details for installations and adjustments. The vent pipe should extend only to (but not beyond) the inside wall of the chimney.

## ELECTRIC WIRING

These gas burners are manufactured for use with 120 volt, 60 cycle, single-phase electric current. The installation must comply and be grounded in accordance with the National Board of Fire Underwriters and National Electric Code ANSI/NFPA No. 70-1987 (or the latest addition). All applicable local codes should be followed as well.

Installation wiring should be wired through each limit control or interlock, while operating controls (like the thermostat) should be treated as 24-Volt wiring. The burner has its own 24 Volt AC power supply. Do not add a 24 Volt AC transformer for the burner wiring. Do not use the 24 Volt transformer found on the burner to power other items in the heating system, such spill switches, etc. Follow the wiring diagrams provided below:

**Fig. 4 Wiring Diagram for Fenwal 2466H**



NOTE: 1. HOT & NEUTRAL CAN NOT BE CHANGED.

2. IF ANY OF THE ORIGINAL WIRE AS SUPPLIED WITH THIS CONVERSION BURNER MUST BE REPLACED, IT MUST BE REPLACED WITH TYPE 105°C WIRE OR IT'S EQUIVALENT.

\* 3. OPERATING LIMIT FOR POST-PURGE.

————— FACTORY WIRING  
 - - - - - FIELD WIRING  
 USE COPPER CONDUCTORS ONLY

## SEQUENCE OF OPERATIONS Fenwal 2466H 036-111

1. All limits are closed and 120-volt power is on for the burner.
2. T-T terminals are closed (24-volt power carrying lines; do not power this.) Sometimes, T-T terminals are jumped with a wire nut for burners *not* set for post-purge.
3. Burner motor starts and pre-purge begins
4. Burner housing pressurizes and proves air flow - contacts closed. {Note: if the contacts are closed before the motor starts, blower motor runs continuously. Diagnostic light flashes once every 3 seconds.}
5. At the end of pre-purge, ignition spark starts (audible sound) and the redundant gas valve opens for 4 seconds. (Trial for ignition)
6. Within 4 seconds, gas flame is established and the flame rod carries current to prove the flame {Note: a minimum of 0.7 micro amps are required; 5 micro amps is not uncommon.}
7. Flame remains till operating limit is open. If T-T is used to fire the burner (field wired for post-purge), the burner will go into post-purge once the thermostat is satisfied (T-T open). These burners have 60 seconds post purge.
8. If the flame is not established, the control will attempt ignition two more times before locking out for 60 minutes. The control will then attempt to re-establish the flame every 60 minutes. To reset the control, interrupt power for five minutes to start the sequence again.



## LIGHTING INSTRUCTIONS

### To light the SU-2A Gas Burner

1. Set the thermostat to the lowest temperature
2. The control knob on the gas valve should be in the "OFF" position for at least five minutes.
3. Rotate the control knob counter-clockwise to the "ON" position and set the thermostat to the desired temperature settings

### Reset, if Flame Lockout Occurs

1. Turn the thermostat off, or turn the main power off
2. Wait five minutes
3. Turn the main power on

### To shut the burner off

1. Rotate the control knob on the gas valve to the "OFF" position
2. Set the thermostat to the lowest temperature
3. Turn Main Power Off.

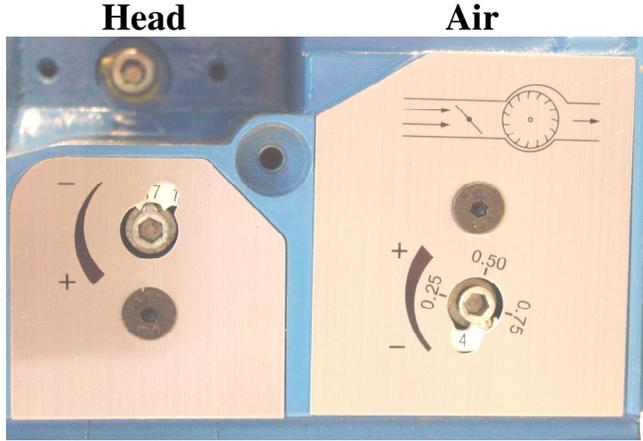
## BURNER OPERATION

Before turning the burner on, check for gas supply leaks. Check the wiring diagrams; install manometers before and after the gas valve. Keep the observation port of the boiler or furnace open. Follow the instructions on the nameplate of the burner to turn it on. Follow the sequence of operations for the control (see pages 9 and 10). **Use a combustion analyzer and record the readings below.**

### BURNER OPERATION: Record the Readings at Steady State

Draft over fire at steady state (should be -0.02 "W.C. or zero) <i>NOTE: This may vary for OEM applications.</i>	
Natural Gas CO <sub>2</sub> % = (9.0% to 9.8%) or O <sub>2</sub> % = (5.0% to 3.5%)	
LP Gas CO <sub>2</sub> % = (10.5% to 11.5%) or O <sub>2</sub> % = (5.0% to 3.5%)	
Stack Temperature (300°F minimum, 550°F maximum)	
Percentage of Carbon Monoxide (CO) in PPM	
Incoming Gas/LP pressure = "W.C. (minimum 5")	
Natural Gas manifold gas pressure = "W.C. (3.5" required + - 0.3") <i>NOTE: This may vary for OEM applications.</i>	
LP Gas manifold gas pressure = "W.C. (2.3" required + - 0.3")	
Carbon Monoxide in flue ( less than 100 PPM ideal; should not exceed 400 PPM Oxygen free)	

**PICTURE 4: HEAD AND AIR ADJUSTMENT**



To access the head and air adjustment, remove the plastic cover from the rear of the housing, using the supplied 4 mm allen key. The left dial is the head adjustment dial; the right dial is the air adjustment dial. These dials can spin 360° 22 times for the head and 32 times for the air. Using the same 4 mm allen key, turn the numbered dials to the appropriate head setting (please refer to Chart 5 on page 8). ***These recommended settings are only approximate settings. Actual field conditions will vary and require a certified technician to adjust the burner. OEM settings may differ.***

**When to adjust the Air**

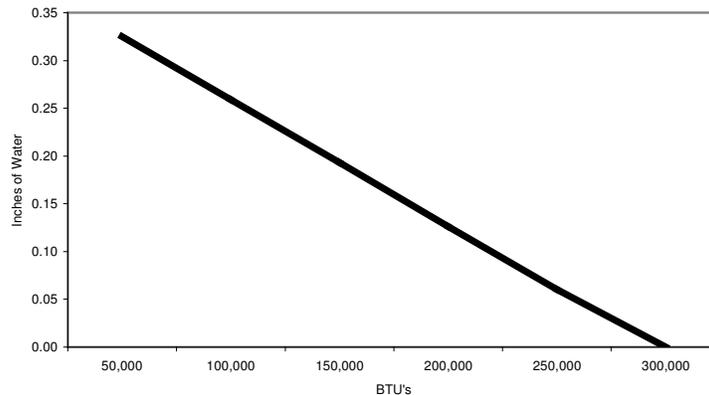
The air shutter is a mechanical shutter. Do NOT over crank the air shutter. General rule: if the CO<sub>2</sub> (Carbon Dioxide) is too low, then close the air shutter. If the CO<sub>2</sub> is too high, then open the air shutter. ***Note: Do NOT set the CO<sub>2</sub> higher than 9.8% for Natural Gas or 11.5% for LP Gas.*** If the CO (Carbon Monoxide) is above 100 ppm, there is either too much air or too little air. Check the CO<sub>2</sub> level and adjust the burner.

**When to adjust the Head**

The retention head is 1/8” inside the tube when the marking reads ‘22’. There is a full 1/2” movement for the retention disk to move backward (to increase secondary air) or forwards (to decrease secondary air). ***NOTE: the head physically moves within the blast tube. Do not over crank the head dial.*** This movement can also be used to compensate for backpressure in the combustion area, up to 0.3” W.C.

**Caution: If this is the case, the flange and the combustion chamber should be completely sealed.** This pressure firing decreases as the firing rate increases. See Graph 1. ***Note: the burner should be adjusted while it is firing.***

**Graph 1: Chamber Pressure versus Firing Rate (BTU)**



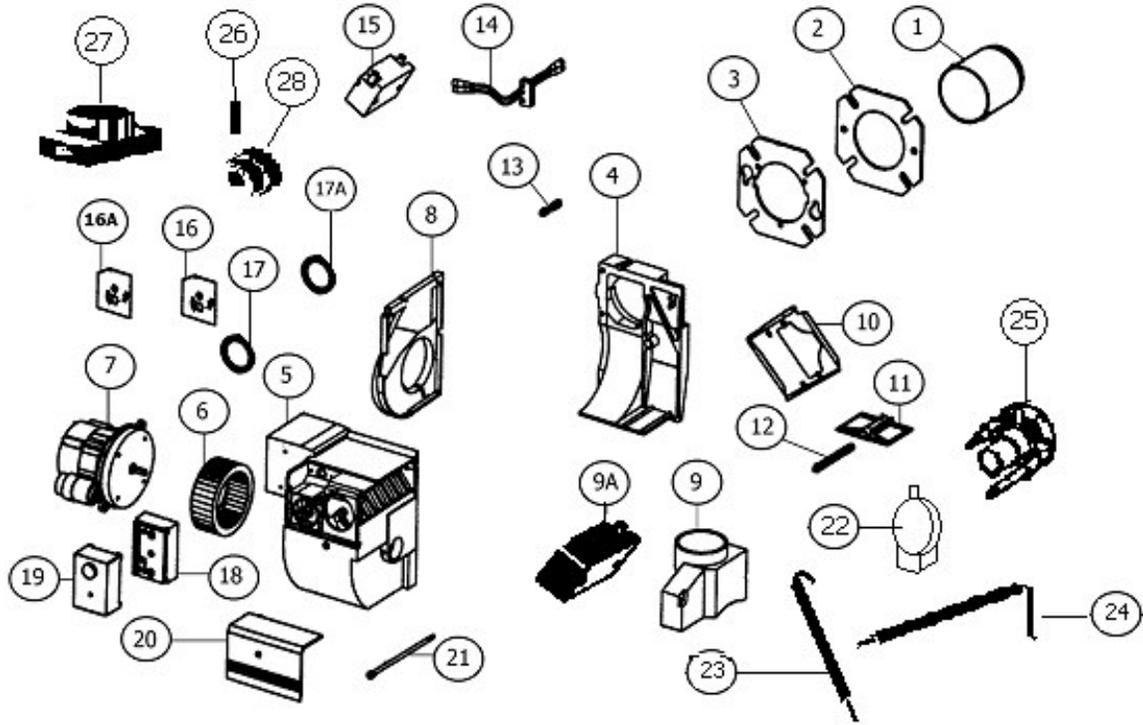
## Trouble shooting:

There are three factors to operate the gas burner properly:

1. Electricity {(main Power 120V/60 Hz /1 Ph)( secondary 24V)}
2. Gas flow (Incoming pressure should be 10" w.c. with proper gas line without pressure drop during burner operation).
3. Combustion air.

Check these three items properly before proceeding in detail for other problems.

Condition	Solutions
<b>1. Burner motor runs and:</b>	
No flame after pre-purge & no fuel indicator (where applicable)	Check 24V feed to airflow switch & after airflow switch to control. Fix or replace the airflow switch. If there is no secondary power, then replace the 24V transformer.
No flame, fuel indicator on (where applicable), faulty ignition transformer or spark separately	Check ignition transformer, electrode, cracked electrode or gap. Fix or replace.
Fenwal control defective after above tests.	Replace
<b>2. Burner locks out after 4 seconds</b>	
	First, check ionization electrode, ionization cable (for cracks) and boot. Fix as needed.
Polarity reversed	Check power feed for broken polarity
Bad earth grounding	Fix the ground wire
Gas pressure is too low	Check the gas pressure and adjust to proper pressure
<b>3. Pulsation at start</b>	
	First, check the burner head location with respect to the end of the flame tube. Adjust as necessary.
Gas pressure is too high.	Use manometer and readjust the pressures.
Blocked Flue	Check draft and clear flue of foreign materials.
<b>4. Pulsation during operation</b>	
Burner is not correctly adjusted.	Readjust with combustion analyzer.
The burner is dirty.	Clean the burner.
Defective chimney	Check and change if necessary with liners.
<b>5. Burner locks out</b>	
Ionization current is too low.	Check current. Minimum 0.8 micro amps. Check position of ionization electrode and the condition of the cable.
<b>6. The CO content is too high</b>	
Excess air is too high or too low.	Adjust air shutter.
The gas holes are clogged.	Clean them.
The fresh air intakes are too small.	Check and readjust.
The burner head is out of position.	Check and readjust.
<b>7. Condensation in the heat exchanger</b>	
Firing Rate is too low.	Increase the firing rate so that the stack temperature is 350° F or HIGHER. Insulate the chimney.



ITEM	PART	PART #	ITEM	PART	PART #
1	Blast Tube	11728410	16	Cover Plate - Air Regulation	11887001
2	Flange Gasket	10195-1	16A	Cover Plate - Nozzle Line	11887301
3	Adjustable Flange	10195	17	Scale - Nozzle Line	11888101
4	Front piece - Housing		17A	Scale - Air Regulation	11887801
5	Rear piece – Housing		18	24 Volt Transformer	2440VA
6	Fan Wheel	11417601	19	Safety Control	2466H or S89F
7	1/6 HP PSC Blower motor	D82132	20	Plastic Cover Plate	11850001
8	Shielding Plate Housing		21	Screw (Long Special)	11750702
9	Outside Air Boot	11859107	22	Airflow Switch Honeywell/Tridelta	6041A
9A	Silencer	11879302	23	Ignition Electrode	115 34708
10	Air Regulation Plate	11851001	24	Flame Rod	115 34707
11	Air Damper	11852201	25	Retention head	119 39701
12	Air Regulation Adjustment screw	11848501	26	Union	1139101
13	Adjustment Screw – Nozzle Line	11912901	27	Gas Valve	VR 8205A 2008 or VR 8305 P
14	Ionization Cable	11865805			
15	Ignition Transformer (cable included)	2709 or 5SAY	28	Brass orifice	12299

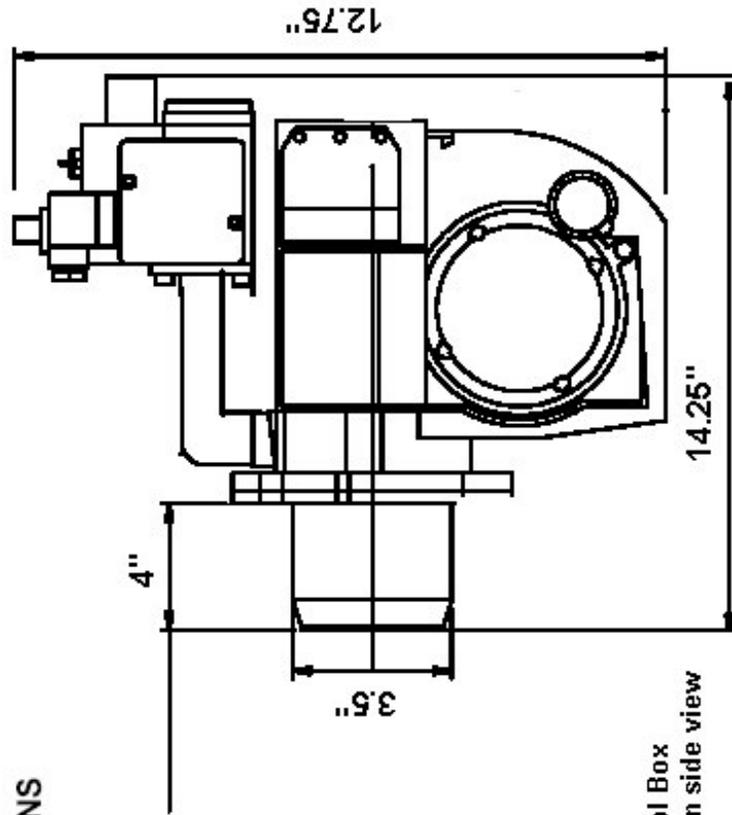
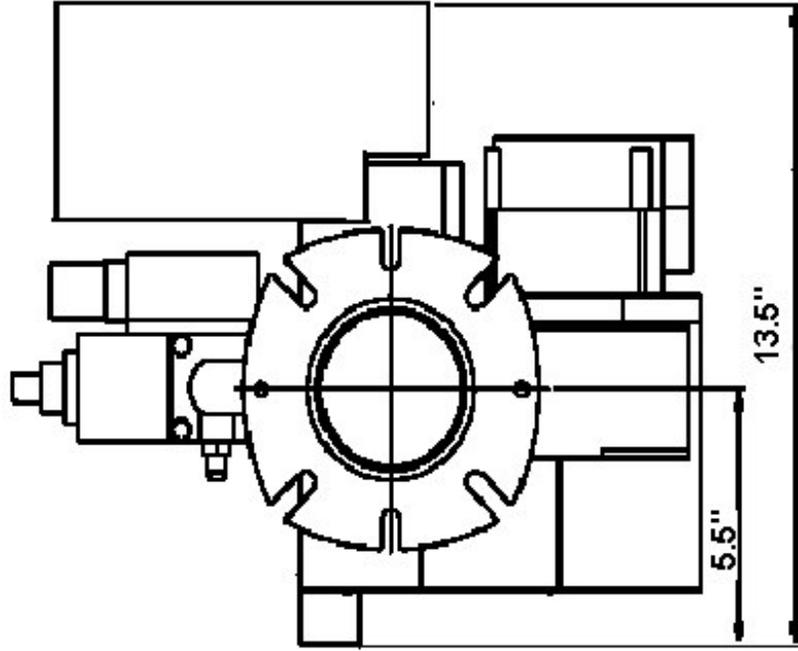
## Maintenance Instructions: **TO BE FIXED/ATTACHED NEAR BURNER**

Once a year, a qualified service agency needs to be contracted for other than routine maintenance.

1. The blower motor is the only moving part. It does not require lubrication, since the ball bearings have been permanently lubricated.
2. The user should do periodic visual checks of the burner and the flame.
3. Laundry lint or dog and/or cat hairs should not go inside the blower. If they are seen, they should be removed after disconnecting the power to the burner and cover parts should be installed before starting the burner.
4. Keep the area around the conversion burner clear and free from combustible materials, gasoline, and other flammable vapors and liquids.
5. No obstruction for the flow of combustion and ventilating air (ref. Page 4).

**Technical Data  
SU-2A Gas Burner**

**DIMENSIONS**



**Note: Control Box  
Omitted from side view**

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