



**Midco**<sup>®</sup>  
INTERNATIONAL



## Economite 400B-02 Conversion Burners

The **ECONOMITE Models 400B-02** and **400B-02P** conversion burners are adaptable to most common central gas utilization equipment, including up-draft gravity and forced circulation furnaces and boilers. Power burner design makes it perfectly suited for oil burner replacement. For horizontal and downdraft gas utilization equipment, **ECONOMITE Model DS45B** conversion burner with direct spark ignition is recommended.

**In the United States**, installation must conform with local codes or, in the absence of local codes, with **Installation of Domestic Gas Conversion Burners, ANSI Z21.8a**-latest edition and **National Fuel Gas Code, ANSI Z223.1**-latest edition(s) available from American National Standard Institute. Further reference should be made to the recommendation of your fuel supplier.

**Note:** Any additions, changes or conversions required in order for the gas utilization equipment to satisfactorily meet the application needs must be made by a MIDCO distributor (or other qualified agency) using factory specified and approved parts.

**In Canada**, installation must conform with local codes or, in the absence of local codes, with **Installation Codes for Gas Burning Appliances and Equipment, CGA Standard CAN/CGA 1-B149.1** or **2**. When the conversion burner is used on Forced Air Central Furnace, the two yellow and black warning labels in the literature envelope shall be attached in accordance with **Installation Code, CGA Standard CAN/CGA 1-B149, Clause 5.4.4.4**. Further reference should be made to the recommendation of your fuel supplier.

**INSTALLER: Inform and demonstrate to the user the correct operation and maintenance of this gas utilization equipment. Inform the user of the hazards of storing flammable liquids and vapors in the vicinity of this gas utilization equipment and remove such hazards. Affix this manual adjacent to the conversion burner.**

**CODE COMPLIANCE IS THE SOLE RESPONSIBILITY OF THE INSTALLER.**

**USER: Retain this manual for future reference. If other than routine service or maintenance as described in this manual is required, contact a qualified service agency. DO NOT ATTEMPT REPAIRS. An inadvertent service error could result in a dangerous condition.**

**SAFETY INFORMATION TERMS:** The following terms are used to identify hazards, safety precautions or special notations and have standard meanings throughout this manual. When you see the safety alert symbol and one of the safety information terms as shown below, be aware of the hazard potential.



**DANGER:** Identifies the most serious hazards which **will** result in severe personal injury or death.

**WARNING:** Signifies a hazard that **could** result in personal injury or death.

**CAUTION:** Identifies unsafe practices which would result in minor personal injury or product and property damage.

**▲ WARNING:** If the information in these instructions is 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 switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas suppliers' instructions.
- If you cannot reach your gas supplier, call the fire department.

Installation and service must be performed by a qualified installer, service agency or the gas supplier.

## Specifications

Model 400B-02 NATURAL Gas only	
Model 400B-02P PROPANE Gas*	
Air Delivery	
(Approximate air delivery at zero draft)	85 SCFM**
Maximum Firing Rate***	400 MBH****
Minimum Firing Rate***	200 MBH****
Tube Diameter	4 inches
Tube Length	9 inches
Minimum Combustion Chamber Size	
400 MBH	10" W x 16 <sup>1</sup> / <sub>2</sub> L or 15" dia.
300 MBH	9" W x 14" L or 13" dia.
200 MBH	7" W x 11" L or 10" dia.
Gas Pressure Required	
NATURAL	5.0" to 14.0" W.C.
PROPANE	11.0" to 14.0" W.C.
Standard Voltage	120 Volts 60 Cycle
Pilot Safety	Thermoelectric, 100% shut-off

### Notes:

- \* Model 400B-02P is equipped with a 4-Function Redundant Main Automatic Valve.
  - \*\* SCFM=Standard Cubic Feet/Minute
  - \*\*\* Ratings based on 1,000 BTU/cu. ft. NATURAL, 2,500 BTU/cu. ft. PROPANE at Sea Level.
  - \*\*\*\* 1 MBH=1,000 BTU/Hr.
- One gallon of fuel oil=140,000 BTU.  
Derate burner for altitudes over 2,000 feet by 4% for each 1,000 feet above sea level.

**⚠ CAUTION: The ECONOMITE 400B-02(P) is not intended for outdoor installation and must be protected from excessive moisture. Provide adequate clearance for service and proper operation.**

## I Ventilation

If the former automatic oil burner gave trouble-free operation, it is probable that the gas utilization equipment area has sufficient infiltration of air for combustion and dilution of flue gases.

### Nevertheless, the area must be checked:

- Open basement or utility areas of normal construction, without storm windows or tight doors, will generally allow sufficient air infiltration. However, if the gas utilization equipment is located in a tight or separate room, ventilation to an open area as described above will be required. Install two permanently open grilles, each sized on the basis of one square inch free area per 1,000 BTU (but not less than 100 square inches) of the total input rating of all gas utilization equipment in the combined space. One grille should be located within 12 inches of the ceiling, the other within 12 inches of the floor.
- If the gas utilization equipment is located in an area of unusually tight construction, or if an exhaust fan, kitchen ventilation system, clothes dryer and/or fireplace is installed in the building, provision must be made for an outside air supply near the gas utilization equipment area. Install permanently open grilles sized at not less than one square inch free area per 4,000 BTU of burner input. When ventilating through horizontal ducts, grilles should be sized at not less than one square inch free area per 2,000 BTU of burner input. In any case, the minimum dimension of rectangular air ducts shall not be less than 3 inches.
- In Canada, for detailed ventilation requirements, refer to standard CAN/CGA 1-B149.1 or .2 and/or local codes.

## II Preparation of the Gas Utilization Equipment

- Clean the gas utilization equipment, heat exchanger interior, combustion chamber, and flue connections. Remove all adhering tars, scale, dirt and soot. Inspect for actual leaks and/or potential leaks.
- Cement all joints, including those in the gas utilization equipment base and around door frames, to prevent leakage into or out of the combustion chamber.
- The access or firing door should open easily to relieve pressure. If positive latches exist, they should be modified to permit easy opening; a spring loaded door holder is recommended.
- On all boilers, make certain the pressure relief safety valve is in good operating condition.

A combustion chamber liner is normally required to protect non-heat transfer surfaces and to provide a radiant bed for rapid heat transfer to the primary surfaces of the heat exchanger. In most cases, the oil burner combustion chamber liner formerly used can be used, if in good condition.

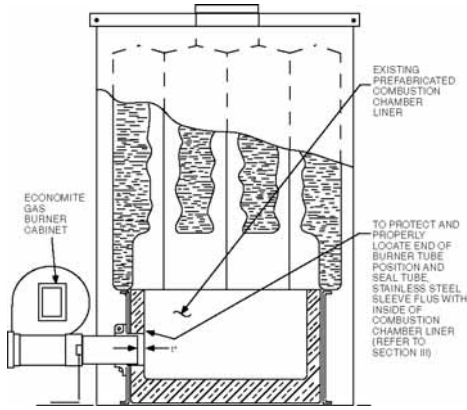


Figure 1: Dry Base Boiler with Combustion Chamber Liner (Warm Air Furnace Construction is Similar)

designed to properly locate the end of the tube relative to the inside wall of the combustion chamber, and to permit burner removal without breaking the seal.

**CAUTION:** In no case should the burner tube be allowed to extend into the chamber proper; it must be set at least 1" short of the inside surface, because high combustion chamber temperatures will cause premature thermocouple and pilot deterioration.

Special heat resistant alloy extension tubes and instructions are available for those applications where the burner tube is too short to reach the combustion chamber (such as old-fashioned gravity warm air furnace installations).

□ In the case of wet base boilers, where the entire combustion chamber is comprised of heat exchange surfaces and no combustion chamber liner was provided for oil firing, a liner is usually not required for the ECONOMITE. However, a liner or target wall may be necessary if the combustion chamber is unusually short, in order to avoid flame contact on the heat exchanger walls or flueways.

□ If a built up chamber liner is required, use 2300°F minimum insulating material.

□ The burner tube, or the stainless steel sleeve that is included with the burner, must be sealed air tight into the combustion chamber liner opening with refractory material as shown by Figures 1, 2 and 7. The sleeve is preferred as it is

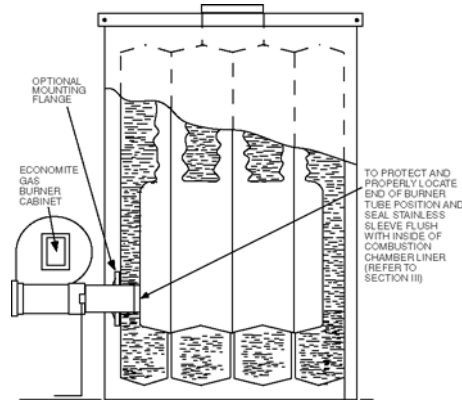


Figure 2: Wet Base Boiler with Combustion Chamber Unlined

**WARNING:** Burner cabinet must be mounted in orientation shown in figures 1 and 2. Any other mountings may cause a dangerous condition, and will void burner warranty and agency approvals. Non-standard arrangements may be available for some models; consult factory for details if required.

□ Before permanently setting the burner in place, check venturi casting openings and pilot assembly to make sure they are free of foreign materials. See Figure 8.

**WARNING:** The chimney shall be inspected for unsafe conditions such as deteriorated masonry and excessive soot or other blockage or potential blockage.. Installation must conform with local codes or in the absence of local codes with ANSI Z21.8 latest edition and NFPA, ANSI Z223.1 latest edition.

or other blockage or potential blockage.. Installation must conform with local codes or in the absence of local codes with ANSI Z21.8 latest edition and NFPA, ANSI Z223.1 latest edition.

Maximum Firing Rate	Vent Connector
250 MBH	7"
320 MBH	8"
400 MBH	9"

Table 1: Recommended Vent Connector Sizes

**WARNING:** The Vent Connector shall not be connected to a chimney already venting solid fuel burning appliances, an incinerator or an open fireplace.

□ The Vent Connector shall be made of non-combustible, corrosion resistant material capable of withstanding the vent gas temperature produced by the gas utilization equipment and of sufficient thickness to withstand physical damage.

□ The Vent Connector shall be as short as possible. The entire length shall be readily accessible for inspection, cleaning and replacement.

□ The length of horizontal uninsulated Vent Connector between chimney and a single gas utilization equipment shall not exceed 75% of the height of the chimney above the connector, or 100% if the Vent Connector is insulated.

IV Chimney, Vent Connector\*, and Draft Control

\*Formerly referred to as Flue Pipe

## IV Vent Connector Continued

- The Vent Connector shall be installed so as to avoid turns or other construction features which create excessive resistance to flow of vent gas. It shall be installed without any dips sags and shall slope upward at least  $\frac{1}{4}$ " per foot.

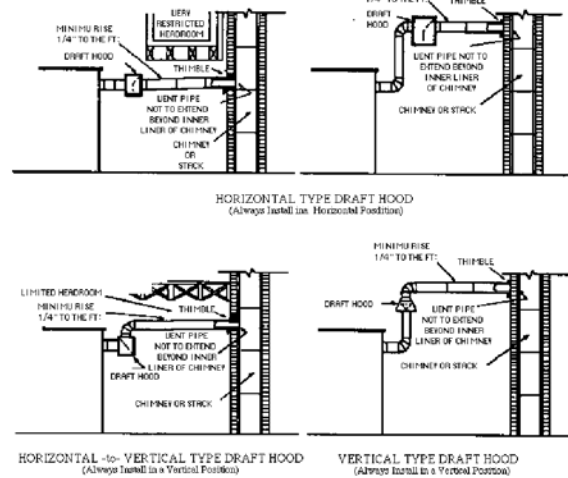


Figure 3: Draft Hoods

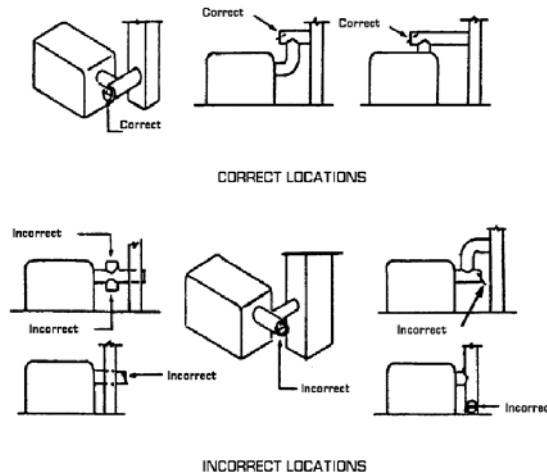


Figure 4: Barometric Dampers

Figures 3 and 4: Copyright by the American Gas Association. Used by permission of the copyright holder.

- A manually operated damper shall **not** be placed in the Vent Connector or chimney of any gas utilization equipment.

□ The Vent Connector shall be firmly attached to draft hood outlets and flue collars. Joints between sections of connector piping shall be fastened by sheet-metal screws or other approved means. The Vent Connector shall be supported for the design and weight of the material employed to maintain clearance and prevent physical damage and separation of joints.

- Gas utilization equipment requiring controlled draft may be equipped with a listed double acting barometric draft regulator, **if approved by local codes**. It must be installed and adjusted in accordance with the manufacturer's instructions.

□ A draft hood or a barometric draft regulator shall be installed in the same room or enclosure as the equipment in such a manner as to prevent any difference in the pressure between the hood or regulator and the combustion air supply. In no case shall the relief opening of the draft hood or barometric draft regulator be located at a point lower than the top of the highest flue passage in the equipment.

- A device which will automatically shut off gas to the burner in the event of sustained backdraft is recommended if such backdraft might adversely affect burner operation or if flue gas spillage might introduce a hazard. If such a device is used, it shall be of the listed type and installed and adjusted by a qualified service technician in accordance with the manufacturer's instructions.

## V Electrical

Installation wiring and grounding of the burner must conform to local codes, or in their absence in the **United States to National Electric code, ANSI/NFPA No. 70-latest edition; in Canada, to Canadian Electrical Code Part 1, CSA Standard C22.1.**

- Use copper wire not less than 14 gauge for line voltage wiring. Hook up to a dedicated line with an on-off disconnect switch and a minimum 10 amp breaker.
- The frame of the burner should be well grounded. Normally the piping and/or electric conduit will provide sufficient grounding. However, a terminal is provided on the terminal strip for positive grounding where insulated pipe couplings are used or where any doubt exists regarding grounding sufficiency.
- Confirm that the polarity is correct—hot wire strip terminal **1**, neutral **2**— and that the neutral line is not subject to induced low voltage (check **2** to earth ground) from other equipment.
- Each installation must include suitable limit controls. Existing oil burner combination limit and operating controls are normally **NOT SUITABLE** for gas burner use.
- Set the thermostat heat anticipator for the total current draw handled by the thermostat. The current draw of the ECONOMITE 24V operating circuit is 0.3 amps on 400B-02 (NATURAL) and 0.7 amps on 400B-02P (PROPANE).

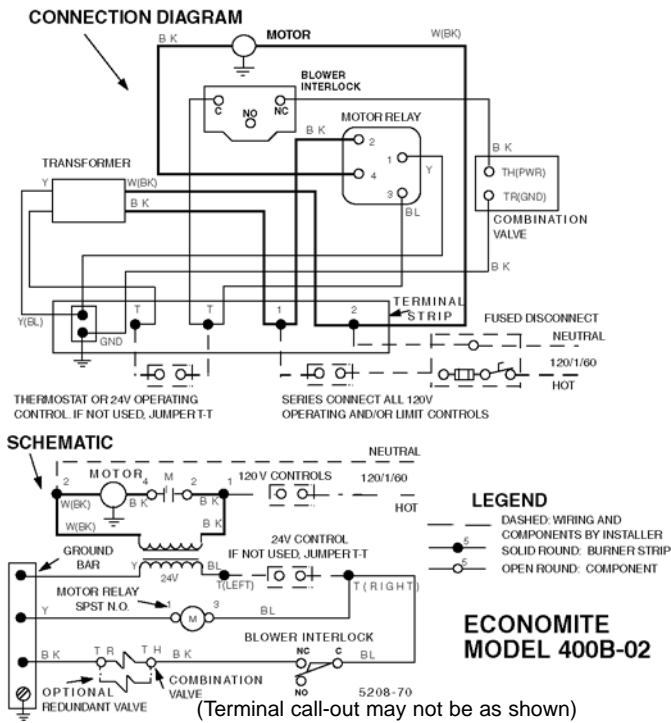


Figure 5: Wiring Diagram

**CAUTION:** The available gas pressure should be within the limits shown in the SPECIFICATIONS section. Excessive pressure will damage Combination Valve and Regulator. If the supply pressure exceeds the 14.0" W.C. maximum, a suitable intermediate main regulator must be installed ahead of the Main Manual Shut-Off Valve shown in Figure 6.

- The burner gas supply piping should branch off from the main line as close to the gas meter as possible. Do not connect to the bottom of a horizontal section. Use new black pipe and malleable fittings free of cutting and threading burrs or defects.
- Provide a sediment trap, union and 1/8" pressure tap in piping close to burner as shown in Fig 6.
- Use pipe joint compound approved for use with Liquid Petroleum Gases.
- Piping must comply with local codes.
- To obtain the maximum firing rate of 400 MBH, the NATURAL gas supply piping must be sized to provide minimum of 5.0" W.C. pressure (11.0" W.C. PROPANE) to the inlet of the Combination Valve when the burner and all other gas utilization equipment are on.

**Note:** If there is more than 1.0" W.C. differential in the inlet pressure to the burner compared to when all other gas utilization equipment are off, refer to Section IX, last paragraph "CAUTION..."

Pipe Size	Type of Gas	Capacity-MBH Length of Pipe				
		10	20	40	60	100
3/4	NATURAL	250				
	PROPANE	400		200		
1	NATURAL	400	350	200	200	
	PROPANE		400	350	300	200
1 1/4	NATURAL		400	400	400	300
	PROPANE			400	400	400
1 1/2	NATURAL					400

Table 2: Supply Pipe Capacities in MBH

the Combination Valve to pressures over 1/2 PSIG (14.0" W.C.) will damage the valve and void all warranties.

**⚠ DANGER: Explosion hazard.**  
Do not use oxygen for pressure testing.  
An explosion could occur during initial start-up.

- If the burner piping must be rearranged because of space limitations, be sure to carry out the general arrangement shown in Figure 6. Install the Combination Valve in any position except up-side down.
- When the burner is installed in jacketed equipment, it is recommended that the Combination Valve be left adjacent to the burner within the vestibule and the Main Manual Shut-Off Valve be installed outside.

**⚠ CAUTION:** Do not add any power consuming devices in the low voltage circuit as overloading of the transformer can result. Do not use Motor Relay to operate any external devices as the extra load could damage the relay contacts.  
**Note:** If any of the original wiring as supplied with the conversion burner must be replaced, it must be replaced with type TFF wire or its equivalent.

## VI Piping Continued

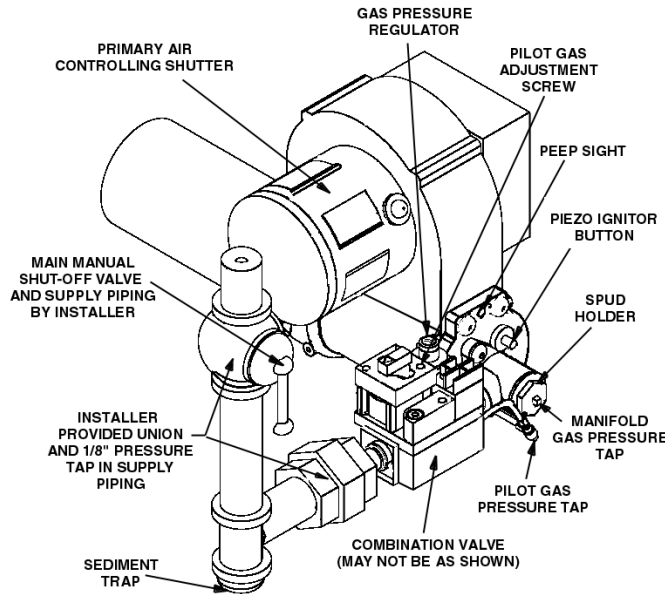


Figure 6: Piping Connections

Standard burners are approved for use with NATURAL or PROPANE gas only, and should be used only with the gas specified on rating plate.

□ A Standard Model 400B-02 burner is equipped with a single seated Combination Valve and is suitable for NATURAL gas only. A Standard Model 400B-02P is equipped with a double seated (redundant) Combination Valve and is suitable for PROPANE gas use.

**⚠ WARNING: The Model 400B-02 is not suitable for conversion to PROPANE gas. Using PROPANE gas in the Model 400B-02 is a safety hazard and will void the approval listing and the burner warranty.**

## VII Main Gas Spud

□ Model 400B-02 (NATURAL gas burner is shipped with a .343 diameter orifice installed for an input capacity range of approximately 200 to 325 MBH. A Standard Model 400B-02P (PROPANE) gas burner is shipped with a .180 diameter orifice installed for an input capacity range of approximately 225 to 260 MBH. If the required rate does not fall within the capacity range of the installed spud, select the correct input capacity range from Table 3 and install the spud with the correct orifice size (stamped with inch diameter) from the SPUD KIT bag. If the required firing rate is at the minimum of a capacity range, select the next lower range spud.

□ TO CHANGE SPUD: Turn Manual Gas Cock Knob on Combination Valve to **OFF**. Remove the Spud Holder. See Table 3, and Figure 6 or 7.

□ The Combination Valve Gas Pressure Regulator is set to provide 2.0" W.C. NATURAL (8.0" W.C. PROPANE) manifold gas pressure for low to minimum spud capacity input. Both models are shipped with the primary air controlling shutter set WIDE OPEN to provide a lean gas/air mixture during the initial start-up. Do not change the Combination Valve Gas Pressure Regulator setting at this time.

**⚠ CAUTION: The approximate air and gas settings described above are for initial start-up only. Final settings must be made in accordance with Section VIII. Instructions for adjustment of the manifold gas pressure are detailed in Section XI.**

\* Main Gas Spud Orifice Size, approximate Manifold Pressure.

Data shown is approximate and based on "0" overfire pressure at sea level.

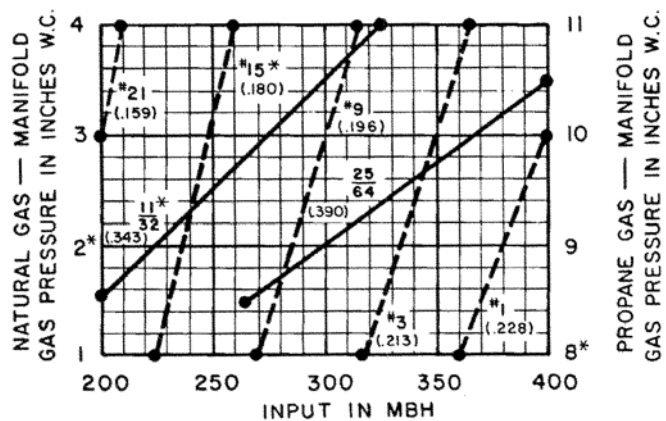


Table 3: Main Gas Spud Capacity and Preliminary Gas and Air Settings

1. Check the burner piping and valves for gas leaks by applying a weak liquid soap solution to unions and joints with the gas supply on. Leakage will be indicated by the appearance of soap bubbles. Locate and correct all gas leaks before proceeding.

**⚠ WARNING: DO NOT USE OPEN FLAME.**

2. Purging the air from the gas supply line at this step will expedite the first light-off.

**⚠ CAUTION: Purge outside the building. Do not purge into the gas utilization equipment.**

3. To purge the gas utilization equipment and chimney of any accumulated gases, turn Manual Gas Cock Knob on the Combination Valve to **OFF**, turn burner power on and set operating control to **ON** or thermostat to call for heat. Let the blower run long enough to accomplish four air changes, but not less than five minutes.

**⚠ CAUTION: Make sure that the capacity range of the installed spud and the preliminary primary air shutter settings are suitable for capacity rating of the gas utilization equipment. Refer to Section VII and Table 3.**

5. Stop motor by setting operating control to OFF or thermostat below room temperature.

6. Turn Manual Gas Cock Knob on Combination Valve to PILOT and depress knob, or red button if so equipped. Hold firm and light pilot by depressing piezo ignitor button several times. Pilot should light. Pilot may be viewed through Peep Sight located in Back Plate (See Figure 6). Failure to light is probably due to air in pilot gas line. Attempt several relights. Then, if necessary, refer to Trouble Chart or Section IX to isolate the problem.

**⚠ WARNING: Repeated unsuccessful attempts to light pilot will result in accumulated gases in gas utilization equipment and chimney. To prevent these gases from reaching an explosive level, periodically purge the gas utilization equipment and chimney as described in Step 3 above.**

7. With pilot lit, wait one minute; then release Manual Gas Cock Knob on Combination Valve, or red button if so equipped, and turn to **ON**. If a pilot goes out when knob is released, turn to **OFF** then **PILOT** and repeat purging and pilot lighting instructions detailed above. Incorrect pilot flame gas pressure may prevent proper heating of thermocouple causing the pilot safety control to drop out. Refer to Section IX for pilot adjustment.

8. Turn operating control to ON or set thermostat above room temperature. Main flame should come on when the motor reaches operating speed. If not, refer to Trouble Chart. To make a preliminary setting of the burner input, determine the manifold gas pressure required from Table 3 and adjust the Combination Valve Pressure Regulator accordingly. See Section XI.

9. To determine the firing rate for NATURAL gas, accurately time test dial for the number of seconds for one revolution and use the following formula. All other gas utilization equipment must be off.

$$\frac{3600 \times \text{test dial size} \times \text{BTU value}}{\text{No. of seconds for one rev. test dial}} = \text{BTU/Hr.}$$

Then divide by 1,000 for MBH value

$$\text{Example: } \frac{3600 \times 1 \times 1000}{20} = 180,000 \text{ BTU/Hr.} = 180 \text{ MBH}$$

For PROPANE gas, consult your supplier for method of determining firing rate.

10. Readjust the primary air shutter to provide a quiet, soft blue flame with well defined orange and yellow tips for NATURAL gas or with well defined yellow tips for PROPANE.

11. Check the operation of the burner; start and stop it several times with the thermostat or operating control.

12. With the burner running, check the operation of all limit and associated controls.

13. PERFORM THE FOLLOWING FINAL ADJUSTMENTS for combustion and flue gas temperature. Take the flue gas samples and temperature immediately ahead of the draft control.

A. Check the draft control to make sure there is no spillage of flue products into the room.

B. Make the final setting of the primary air shutter by checking the flue gases with an ORSAT or similar combustion instrument. The carbon monoxide content should conform to local codes, or in their absence to the level specified in the United States or Canadian Standard referenced on the front cover of this manual; and the carbon dioxide content should be approximately 9.5% for NATURAL and 12.1% for PROPANE, or within the limits prescribed by local codes.

C. The flue gas temperature should be above 325°F but not exceeding 550°F. Excessive flue gas temperatures will result in low efficiencies. Low flue gas temperature may cause excessive condensation. Reset gas input if necessary to adjust stack temperature.

14. **FILL OUT THE INSTALLATION ADJUSTMENT DATA TAG** and affix to the burner or gas utilization equipment.

**Note:** For subsequent normal starting and shut-off procedure, refer to CONSUMER INSTRUCTIONS or the instruction plate mounted on the burner.

IX Venturi Casting and Pilot

**⚠ DANGER:** Be sure that the Main Manual Shut-Off Valve, Combination Valve and Burner Power Switch are turned off before removing any parts for service. When the pilot gas pressure is in the proper range (see Table 4) lint, dust or corrosion is then the usual cause for most pilot problems.

□ The Venturi Casting and Pilot Assembly are part of the drawer assembly which can be removed as a unit. Remove the two back plate screws, two elbow screws. Disconnect thermocouple and pilot tube at Pilot Pressure Tap. Swing away Combination Valve and pull out drawer assembly.

□ When servicing, clean the Venturi Casting Ports and Pilot Assembly, including the pilot orifice, and the spark electrode. Also, examine the thermocouple. If there is any serious corrosion or loss of metal at the tip replace the thermocouple.

	Nominal BTU/cu. ft. Value	
	NAT-1000	PROP-2500
Orifice Diameter	.021	.012
Pilot Gas Pressure	3.5-7"	7.5-11"
Approximate Capacity	1000 BTU/Hr.	

Table 4: Pilot Specifications

- Check that the pilot orifice diameter is correct (see Table 4).
- Make sure that the burner tube is properly positioned in the combustion chamber entry. It must be set 1" short of the inside of the combustion chamber as shown in Figure 1,2, or 7. It must not protrude into

the chamber, because high combustion chamber temperatures will cause premature thermocouple and pilot deterioration.

□ If cleaning does not eliminate the lighting problem, further checks are required.

**⚠ CAUTION:** Do not indiscriminately increase pilot orifice diameter. Pilot troubles are rarely cured in this manner and new troubles may be introduced by causing the pilot flame to float and lose contact with the thermocouple.

**⚠ CAUTION:** If there is more than a 1.0" W.C. differential between STANDBY inlet pressure when all appliances are OFF, and the inlet pressure when the burner and all other appliances are ON, a 1/8 inch Maxitrol RV12-Series (or equal) pressure regulator must be installed in the pilot gas line. With the adjustment screw wide open, set the pilot flame gas pressure at 4.0" W.C. for NATURAL gas, 8.0" W.C. for PROPANE.

1. Standby gas pressure-inches W.C.
2. The efficiency of the thermocouple and the pilotstat safety control can be determined by timing the safety shut-off. With the burner power switch off and with the combustion chamber

NATURAL	PROPANE	REMARKS
over 14.0" below 4.0"	over 14.0" below 8.0"	See Section VI
4.0 to 7.0"	8.0 to 11.0"	Set pilot adjustment screw wide open
7.0 to 14.0"	11.0 to 14.0"	Set pilot gas pressure at 6.5" NATURAL, 7.5" PROPANE

cool, allow the pilot to operate at least five minutes. Then turn off the pilot and time the period until a click is heard from the Combination Valve. If less than 30 seconds, the thermocouple, pilot flame adjustment, or the pilotstat safety control of the main valve is faulty.

3. An accurate check of the thermocouple and pilot flame adjustment can be made with a millivoltmeter. The thermocouple, when heated by the pilot, should develop at least 15 millivolts minimum to 25 millivolts maximum open circuit (thermocouple disconnected from valve). If millivolt reading is above maximum, readjust pilot gas input slightly to reduce voltage. Check results with blower motor off and on.

4. Tests to isolate thermocouple and/or valve pilotstat problems can be conducted under closed circuit conditions (thermocouple connected to valve through an adaptor that provides for connecting the millivoltmeter). If the thermocouple does not develop at least 7 millivolts when the pilot flame is properly adjusted, it is defective. If the valve does not hold in with a 7 millivolts, the pilotstat is defective and entire valve must be replaced.

5. If the thermocouple meets conditions of paragraph 3 or 4, but timing test of paragraph 2 remains under 30 seconds, the pilotstat safety control can be suspected of being defective and entire valve must be replaced.

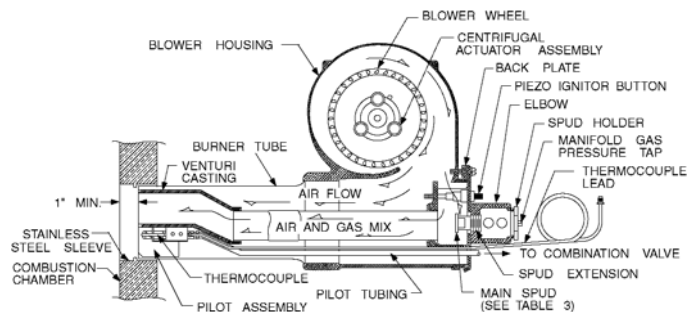
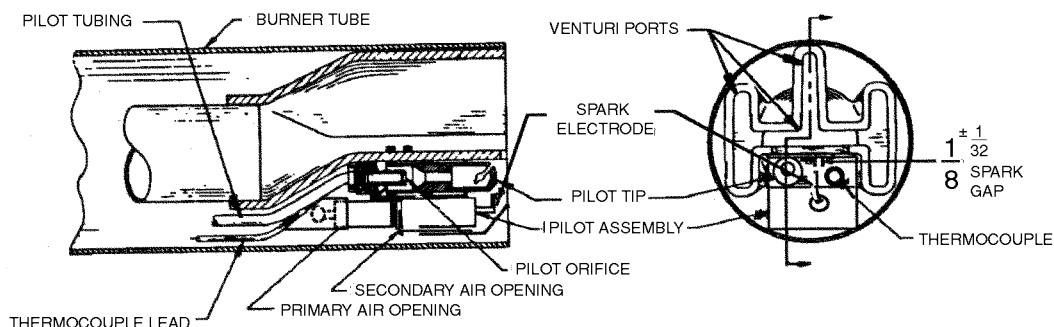


Figure 7: General Assembly



**Figure 8: Venturi Casting and Pilot Assembly**

- Check for possibility of reverse draft which can be caused by wind deflecting from an obstruction in the proximity of the chimney exit or by exhaust fans in the building.
- A continuous draft is required for the proper operation of the pilot. This is no problem in the usual up-draft gas utilization equipment. However, in down-draft or horizontal gas utilization equipment, especially during periods of infrequent operation, the available draft may become nil and result in persistent pilot outages. ECONOMITE Model DS45B with direct spark ignited main flame is recommended for those applications.
- Maximum acceptable draft: minus 0.2" W.C.

**Note: BEFORE SERVICING**, mark with a scribe line or measure opening of primary air shutter so that it can be reset to its original position following servicing.

□ Cleaning of the blower wheel is usually the only service required. Need for cleaning is indicated if the air cage assembly shows an accumulation of dust and lint, or if the character of the flame indicates a deficiency of air. Motor cooling air vents, if present, should also be cleaned at this time.

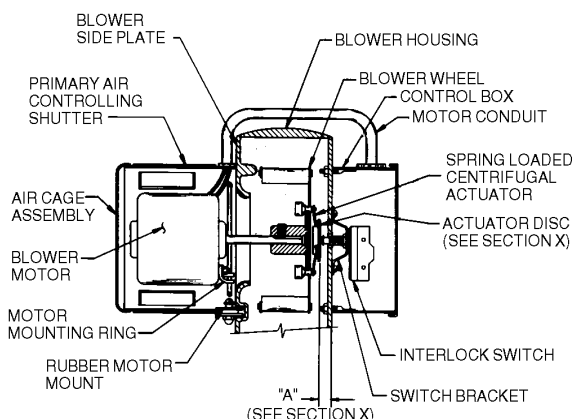
□ The Blower side Plate, Motor and Wheel are removed as an assembly. Disconnect the motor wires from Burner Terminal **2** and Motor Relay **4**. Disconnect the Motor Conduit from the Control Box and remove the Side Plate screws.

□ The Blower Wheel is equipped with a spring loaded centrifugal actuator to operate and electrical interlock switch, so as to prevent the burner from firing if the Blower Wheel is not running at its operating speed. When the motor is off, the actuator spring forces the disk against the switch plunger to push it past its operating point. When running, the actuator pulls the disk clear of the plunger.

□ To make a specific test of the interlock circuit:

1. Turn burner power OFF.
2. Turn Manual Gas Cock Knob on Combination Valve to OFF.
3. Disconnect the motor wire from Terminal **4** of the motor relay to keep the motor off.
4. Turn burner power **ON** and set the operating control to **ON** or thermostat to call for heat. Check for 24V between the Combination Valve Terminals.
  - A. No voltage: Interlock Circuit OK.
  - B. Voltage present: check that switch bracket is screwed down tight (See Figure 9). If so, without disconnecting switch wires, remove switch bracket and manually depress switch plunger. If voltage is still present, or if the plunger has to be depressed to where dimension **A** of Figure 9 is less than  $\frac{9}{32}$ " when switch clicks over, replace the switch.
5. If the switch tests OK, check dimension A of Figure 9 as follows:
  - Switch plunger free..... $\frac{9}{32}$ "to  $\frac{11}{32}$ "
  - Disk free..... $\frac{7}{32}$  to  $\frac{1}{4}$ "
  - Disk held all the way in.... $\frac{15}{32}$ " min.
6. If plunger dimension is wrong, replace switch. If disk dimension is wrong, check that the actuator operates freely with a minimum movement of  $\frac{1}{4}$ " from the free position. If movement is OK, reposition blower wheel on motor shaft, if not replace wheel.

*X Blower Assembly*



**Figure 9: Blower Assembly**

## *XI Combination Gas Valve*

The 24 volt Combination Valve serves four functions: **1.** Main Manual Gas Shut-off, **2.** Manifold gas pressure regulation, **3.** Automatic electric main gas valve; single seated on Model 400B-02, double seated (redundant) on Model 400B-02P, and **4.** Pilotstat safety control. A pilot adjustment screw and filter are also included.

□ The pilot adjustment screw is located on the inlet end of the valve body. Remove plug for access and turn clockwise to reduce flow.

□ The main gas regulator, which has an outlet pressure setting range of 2.0" to 4.0" W.C. NATURAL (8.0" to 11.0" W.C. PROPANE) is factory set for a manifold gas pressure of 2.0" W.C. NATURAL (8.0" W.C. PROPANE). If pressure adjustment is required for setting capacity, remove regulator cap for access to slotted adjustment screw. Turning of adjustment screw counterclockwise reduces pressure; clockwise increases pressure. Do not adjust past point where no change in pressure is noted.

**Note:** Pressure setting can only be made with burner running and gas on. Manifold gas pressure tap is located in spud holder (See Figure 6 or 7).

**⚠ CAUTION: If gas supply pressure is below its specified range during adjustment, an overfire condition could result when pressure returns to normal, particularly if the regulator adjustment screw is bottomed out. ALWAYS confirm that at least the minimum rated gas pressure is being supplied to the burner during regulator adjustments, and NEVER bottom out regulator screw.**

□ If the pressure regulator fails to maintain a constant manifold gas pressure within  $\pm 0.1$ " W.C., and it is confirmed that the inlet gas pressure to the Combination Valve is a steady 14.0" W.C. maximum during standby, and a steady 5.0" W.C. minimum with the flame on, the regulator portion of the valve is defective and the entire valve must be replaced.

□ The pilotstat safety control may be suspect, if frequent **pilot outages** occur. Refer to Section IX, 2 thru 5, for the method of isolating the problem.

□ If, on a call for heat, the main burner fails to operate even though the pilot is burning and the motor is running, failure of the electric valve operator(s) may be indicated. Refer to the **Trouble Chart** for further information.

## Consumer Instructions

### *Maintenance*

**⚠ CAUTION: If the Combination Valve has been moved or replaced, soap bubble test for leaks with the burner running.**

□ If leakage through the valve occurs, as evidenced by an abnormally large yellow (sooty) flame on standby, the entire valve should be replaced.

□ Keep the area around the burner clear and free of combustible materials, gasoline and other flammable liquids or vapors. Do not obstruct burner air inlet slots or ventilation grilles for combustion air.

□ The motor features permanently lubricated ball bearings and requires no routine oiling maintenance.

**IMPORTANT:** Check the burner flame seasonally. A proper NATURAL gas flame will appear blue at the burner face with orange and yellow tips. A proper PROPANE gas flame will appear blue at the burner face with yellow tips. If the flame is too rich, it will appear billowy and yellow with hazy tips. If too lean, it will appear short and all blue. If the flame does not appear proper, **CONTACT A QUALIFIED SERVICE TECHNICIAN FOR CLEANING AND/OR READJUSTMENT.**

**⚠ WARNING: If any flame is observed other than pilot when the burner is on standby, or valve operator is heard to come on before the motor reaches operating speed, immediately turn off the manual gas control and burner power. A dangerous condition has developed and must be corrected. CONTACT A QUALIFIED SERVICE TECHNICIAN FOR CLEANING READJUSTMENT AND/OR REPAIR.**

**⚠ WARNING: If PROPANE gas is used and the burner is located in a basement, crawl space or confining space, contact your gas supplier about installing a GAS LEAK warning device. PROPANE gas is heavier than air and can settle in low areas or confined spaces. This would create a danger of explosion or fire. If you suspect a gas leak, follow instructions on front cover of this manual.**

1. TURN (DEPRESS) MANUAL GAS COCK KNOB ON COMBINATION VALVE TO OFF.
2. TURN BURNER POWER ON. SET THERMOSTAT OR OPERATING CONTROL TO CALL FOR HEAT. **LET MOTOR RUN 5 MINUTES** TO PURGE COMBUSTION CHAMBER AND CHIMNEY.
3. SET OPERATING CONTROL TO OFF OR THERMOSTAT BELOW ROOM TEMPERATURE.
4. TURN MANUAL GAS COCK KNOB ON COMBINATION VALVE TO **PILOT**. DEPRESS KNOB, OR RED BUTTON IF SO EQUIPPED, AND HOLD.
5. PUSH PIEZO IGNITOR BUTTON SEVERAL TIMES TO LIGHT THE PILOT.
6. AFTER ONE MINUTE, RELEASE MANUAL GAS COCK KNOB ON COMBINATION VALVE, OR RED BUTTON IF SO EQUIPPED, AND TURN TO **ON**.
7. ADJUST THERMOSTAT OR OPERATING CONTROL TO DESIRED SETTING.

**TO SHUT OFF**

1. TURN (DEPRESS) MANUAL GAS COCK KNOB ON COMBINATION VALVE TO **OFF**.
2. TURN BURNER POWER OFF.

**SHOULD OVERHEATING OF THE GAS UTILIZATION EQUIPMENT OCCUR:**

1. SHUT OFF THE MAIN MANUAL SHUT-OFF VALVE TO THE EQUIPMENT.
2. DO NOT SHUT OFF THE POWER SWITCH TO THE ECONOMITE BURNER, OR THE EQUIPMENT PUMP OR BLOWER.

## *Trouble Chart*

Make sure the thermostat and operating controls are calling for heat. Defective wiring or loose connections can simulate the component defects outlined below. Check associated wiring before replacing a component. **ELECTRICAL AND FLAME CHECKS MUST BE MADE IN ORDER LISTED.**

- A. Manual Gas Cock Knob on Combination Valve, or red button if so equipped, is not depressed in the **PILOT** position.
  - B. Main Manual Shut-Off Valve is not in open position.
  - C. Air in pilot gas line (See Section *VIII Initial Start-up/Adjustment*).
  - D. High or low pilot flame gas pressure (See Section *IX Venturi Casting and Pilot*).
  - E. Clogged pilot orifice(s) (See Section *IX Venturi Casting and Pilot*).
  - F. Defective ignitor, ignitor wires, spark rod or improper spark gap (See Figure 8).
  - G. Excessively high or negative draft condition (See Section *I Ventilation* and Section *IV Chimney, Vent Connector and Draft Control*).
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- A. Excessively high or negative draft condition (See Section *I Ventilation* and Section *IV Chimney, Vent Connector and Draft Control*).
  - B. High or low pilot flame gas pressure ( See Section *IX Venturi Casting and Pilot*).
  - C. Burner tube extends into combustion chamber (See Section *III Combustion Chamber*).
  - D. Lint or dust in pilot (See Section *IX Venturi Casting and Pilot*).
  - E. Clogged pilot orifice(s) (See Section *IX Venturi Casting and Pilot*).
  - F. Defective thermocouple (See Section *IX Venturi Casting and Pilot*).
  - G. Defective pilotstat safety control (See Section *IX Venturi Casting and Pilot*).
  - H. Clogged pilot filter in Combination Valve; entire valve must be replaced.
- 
- A. Confirm 120V between strip terminals **1** and **2** and verify the circuit polarity and electrical ground between strip terminal **1** and burner chassis metal.
  - B. Check 24V\* operating control circuit;
    1. Between left strip terminal **T** and **GND**.
      - a. No voltage, transformer defective.
      - b. Very low voltage\*, circuit overloaded or transformer defective.
    2. Between right strip terminal **T** and **GND**.  
No voltage, circuit between **T** and **T** is open.
  - C. Confirm 120V between strip terminal **2** and motor relay terminal **4**:
    1. No voltage, motor relay is defective.
    2. Voltage present, motor is defective.

### *I. Pilot Will Not Light*

### *II. Pilot Goes Out Frequently*

### *III. Motor Will Not Run*

## **IV. Motor Runs Continuously, Pilot is On, But No Main Flame**

- A. Manual Gas Cock Knob on Combination Valve not in **ON** position.
- B. Check for 24V\* between blower interlock switch terminal **NC** and **GND**;
  - 1. If no voltage, motor interlock switch or centrifugal actuator is defective. (See Section **X Blower Assembly**).
  - 2. If voltage is present, valve operator is defective; entire valve must be replaced.

## **V. Short Flame\*\***

- A. Low manifold gas pressure.
- B. Main gas spud orifice too small.
- C. Primary air adjustment open too far.

## **VI. Long, Hazy Flame\*\***

- A. High manifold gas pressure.
- B. Main gas spud orifice too large.
- C. Primary air adjustment closed too far.
- D. Dirty Blower Wheel

## **VII. Gas Fails to Shut Off**

- A. Electric Valve Operator(s) of Combination Valve is defective and entire valve must be replaced.

\* Normal low voltage:

Motor running-24V minimum

Combination Valve energized-21V minimum.

\*\* **IMPORTANT:** If changes are made in the main spud orifice size manifold gas pressure or primary air adjustment, change the installation data tag accordingly.