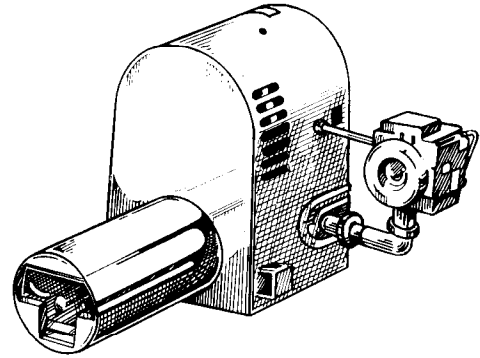


INSTALLATION AND SERVICE INSTRUCTIONS



ECONOMITE MODELS E20B & E20BP Gas Conversion Burner



The **ECONOMITE Models E20B and E20BP** conversion burners are adaptable to most common central heating plants 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 DS24A** 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 Z21.8** latest edition and **National Fuel Gas Code, ANSI Z223.1** latest edition 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 burner 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 a 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 the burner. 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 supplier's 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.

MIDCO International Inc.

SPECIFICATIONS

Model E20B -- NATURAL Gas Only

Model E20BP -- PROPANE Gas*

AIR DELIVERY (Approximate Air

Delivery at Zero Draft).....	47 SCFM**
MAXIMUM FIRING RATE***.....	225 MBH****
MINIMUM FIRING RATE***.....	50 MBH****
TUBE DIAMETER.....	4 inches
TUBE LENGTH.....	8 inches
MINIMUM COMBUSTION CHAMBER SIZE	
225 MBH.....	7" W x 11" L or 10" dia.
150 MBH.....	6" W x 10" L or 9" dia.
GAS PRESSURE REQUIRED:	
NATURAL and PROPANE.....	5.0" to 14.0" W.C.
STANDARD VOLTAGE.....	120 volts.....60 cycle
PILOT SAFETY.....	Thermoelectric, 100% shut-off

* Model E20BP is equipped with a Redundant Main Automatic Valve.

** SCFM = Standard Cubic Feet/Minute

*** Ratings based on 1000 BTU/cu. ft. NATURAL, 2500 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 of addition elevation

PART 1 INSTALLATION

⚠ CAUTION: The ECONOMITE E20B(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 confined 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 total input. When ventilating through horizontal ducts, grilles should be sized at not less than one square inch free area per 2,000 BTU of the total input rating of all gas utilization equipment. In the confined space 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 HEATING APPLIANCE

□ Clean the heating appliance, heat exchanger interior, combustion chamber and flue connections. Remove all adhering tars, scale, dirt and soot. Inspect for actual or potential leaks.

□ Cement all joints, including those in the heating appliance base and around the 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.

III COMBUSTION CHAMBER

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 an existing oil burner combustion chamber liner can be used, if in good condition.

□ In the case of wet base boilers, where the entire firing chamber is comprised of heat exchange surfaces and no 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 firing chamber is unusually short, in order to avoid excess flame contact on the heat exchanger walls or flueways.

□ If a built up chamber liner is required, use 2,300°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 and 2. The sleeve is preferred as it is 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.

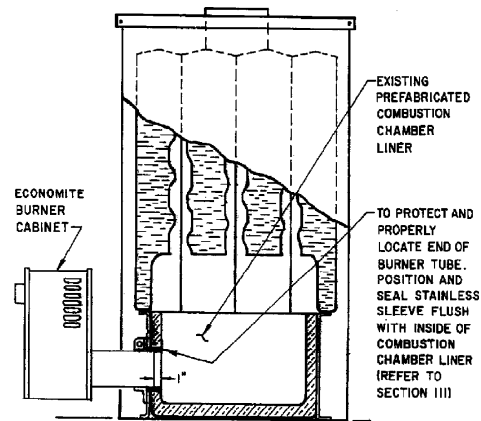


FIGURE 1 Dry Base Boiler with Combustion Chamber Liner (Furnace Construction is Similar)

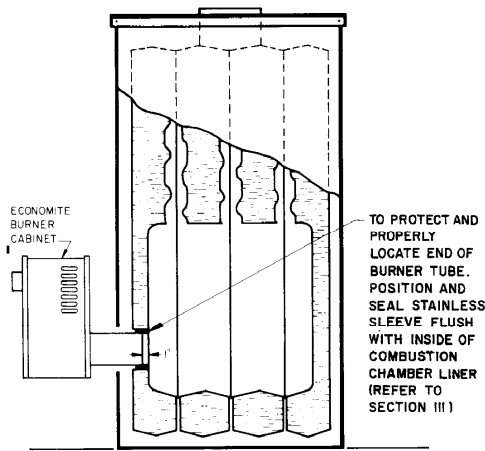


FIGURE 2 Wet Base Boiler with Unlined Combustion Chamber

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.

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).

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 that the nozzle ribbon and pilot assembly are free of foreign materials, and also that the spark electrode assembly has not been damaged or displaced. See Figure 6.

IV CHIMNEY, VENT CONNECTOR AND DRAFT CONTROL

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.

Maximum Firing Rate	Vent Pipe Diameter
100 MBH	5"
143 MBH	6"
195 MBH	7"
225 MBH	8"

TABLE 1 Recommended Vent Pipe Sizes

WARNING: THE VENT CONNECTOR SHALL NOT BE CONNECTED TO A CHIMNEY ALREADY VENTING SOLID FUEL BURNING EQUIPMENT, 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.

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 or sags and shall slope upward at least 1/4" per foot.

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.

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.

Gas utilization equipment requiring controlled draft may be equipped with a listed double acting barometric draft regulator, installed and adjusted in accordance with the manufacturer's instructions, if approved by Local Codes.

A device which will automatically shut off gas to the burner in the event of sustained backdraft is required. It shall be of the listed manual reset type and installed and adjusted by a qualified service technician in accordance with the manufacturer's instructions.

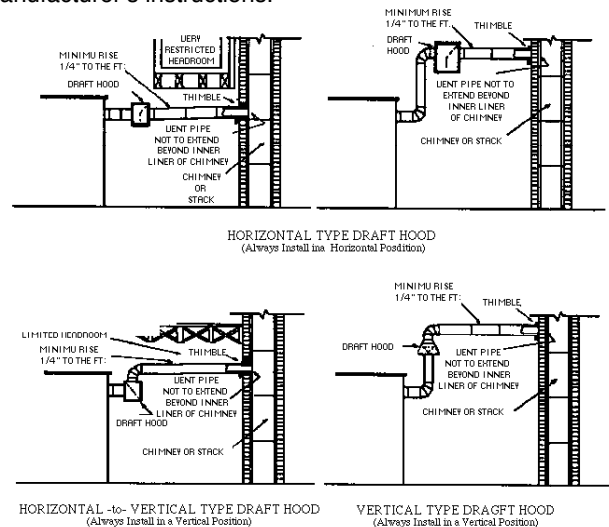


FIGURE 3 Draft Hoods

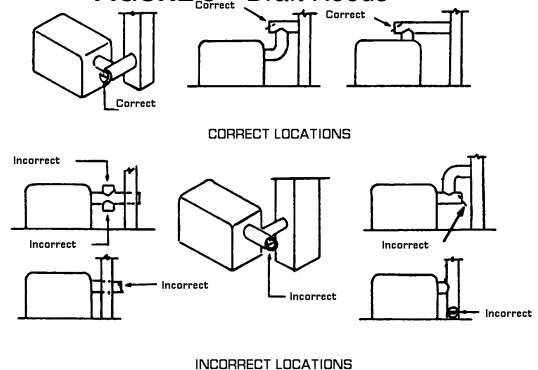
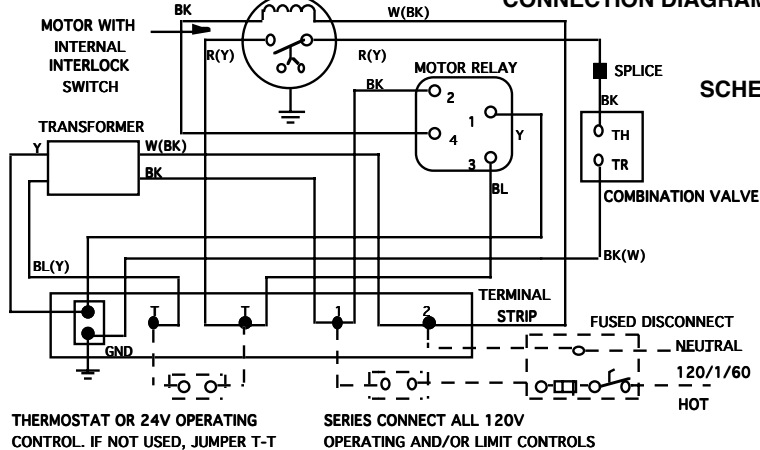


FIGURE 4: Barometric Dampers

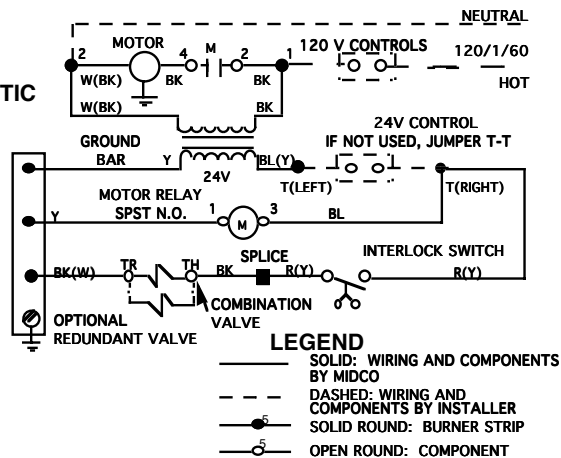
Figure 3 and 4: Copyright by the American Gas Association. Used by permission of the copyright holder.

MODEL E20B ECONOMITE

CONNECTION DIAGRAM



SCHEMATIC



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 overloading of motor relay contacts can result.
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.

FIGURE 5. Wiring Diagram

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 14 gage copper wire, for line voltage wiring. Be sure to hook up to a permanently live circuit. Provide a fused on-off disconnect switch carrying a minimum 3 amp fuse.
- The frame of the burner should be well grounded. 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 to strip terminal 1, neutral 2 and that the neutral line is not subject to induced low voltage (check 2 to ground) from other equipment.
- Each installation must include suitable limit controls. Existing oil burner combination limit and operating controls containing cad cells are NOT SUITABLE for gas burner use.
- Set the thermostat heat anticipator for total current draw handled by the thermostat. The current draw of the Economite 24V operating circuit is 0.3 amp on E20B (NATURAL) and 0.7 amp on E20BP (PROPANE). Setting may have to be increased on steam or gravity systems.

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

VI PIPING

CAUTION: The available gas pressure should be within the limits shown in SPECIFICATIONS section. If the supply pressure exceeds the 14.0" W.C. maximum, a suitable intermediate main regulator rated for main and pilot loads must be installed ahead of the main manual shut-off valve shown in Figure 5.

- 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 Figure 5.
- Use pipe joint compound resistant to Liquid Petroleum Gases.
- Piping must also comply with local codes.
- To obtain the maximum firing rate of 225 MBH, the NATURAL and PROPANE gas supply piping must be sized to provide a minimum of 5.0" W.C. pressure to the inlet of the combination valve when the burner and all other gas appliances are on.

CAUTION: Because it is difficult to accurately control pressure during supply pipe leak test, it is recommended that the Combination Valve be disconnected. Exposing the Combination Valve to pressures over 1/2 PSIG will damage the valve and void its warranty.

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 5. Install the combination valve in any position except up-side down.
- When the burner is installed in the vestibule of 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.

PIPE SIZE	TYPE OF GAS	APPROX. CAPACITY - MBH				
		LENGTH OF PIPE				
		10	20	40	60	100
1/2	NATURAL	130	90	60	50	
	PROPANE	200	145	100	80	60
3/4	NATURAL	225	190	130	105	80
	PROPANE		225	205	165	125
1	NATURAL			225	195	150
	PROPANE					225
1 1/4	NATURAL					225

Capacities shown are for a total pressure drop of 0.3" W.C. For a higher permissible pressure drops, consult your fuel supplier. Source, Gas Engineering Handbook - 1974

TABLE 2 Supply Pipe Capacities in MBH

VII MAIN GAS SPUD

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

▲ WARNING: The Model E20B is not suitable for conversion to PROPANE gas. Using PROPANE gas in the Model E20B may create a safety hazard and will void the approval agency listings and the burner warranty. The E20BP must be used for propane gas.

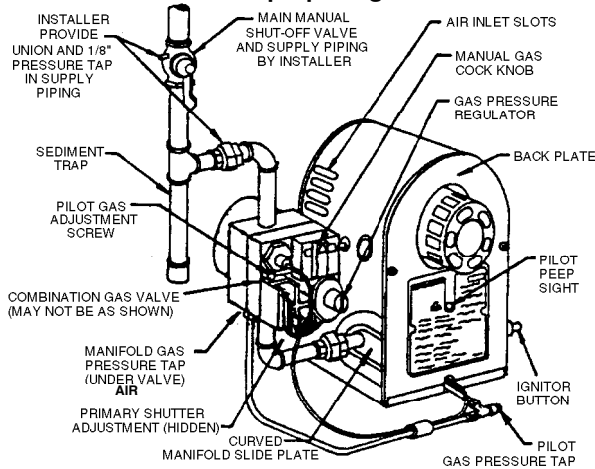


FIGURE 5 Piping Connections

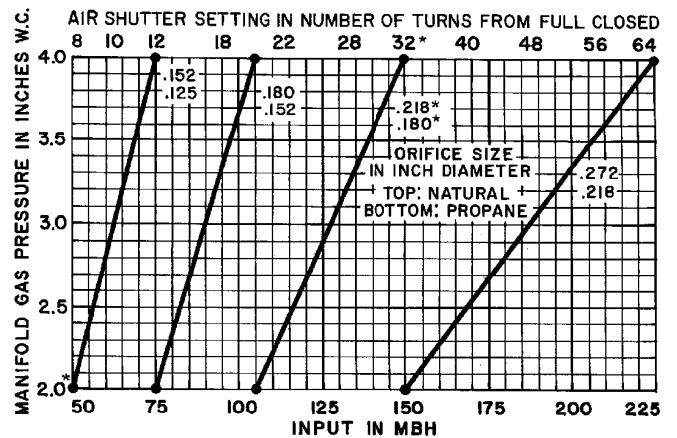
□ A standard E20B ECONOMITE (NATURAL) gas burner is shipped with a .218 diameter orifice installed, the E20BP ECONOMITE (PROPANE) a .180 diameter orifice installed for an input capacity range of approximately 105 to 150 MBH. Spare spuds are included in a spare spud bag (stamped with inch diameter) for other capacity ranges (see Table 3).

□ The combination valve pressure regulator is set to provide 2.0"W.C. manifold gas pressure for minimum spud input and the blower air shutter is set for a maximum spud input, 32 turns from full closed, so as to provide a lean gas/air mixture for initial start up.

□ If the required firing rate does not fall within the range of the installed spud, select the correct capacity range from Table 3 and the spud with the correct orifice size (stamped with inch diameter) from the spare spud bag. If the required firing rate is at the minimum of a capacity range, select the next lower range spud.

□ To change the main spud, turn off the Main Manual Shut-Off Valve and burner power, remove the backplate, disconnect the factory installed union located between the combination valve and manifold slide plate and pull out the curved manifold pipe. Unscrew the installed main spud from the end of the curved manifold pipe and install the selected main spud, making sure to reuse the fiber spud gasket. Reassemble burner in reverse order.

▲ WARNING: When reinstalling the curved manifold pipe, make sure the manifold slide plate is positioned in its holder and that the main spud is inserted into the end of the nozzle. Refer to Figures 5 and 6. Reconnect union and replace backplate.



*Main Gas Spud Orifice Size, approximate Manifold Pressure and Air Shutter setting as shipped.

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

TABLE 3 Main Gas Spud Capacity and Preliminary Gas and Air Settings.

▲ WARNING: Reposition the air shutter for the maximum firing rate of the selected spud capacity range. Do not change the combination gas valve 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.

VIII INITIAL START UP / ADJUSTMENT

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's combustion chamber.

3. To purge the heating appliance and chimney of any accumulated gases, turn manual gas cock knob on the combination valve to **OFF**, turn burner power on and set the 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.

4. **▲ CAUTION: Make sure that the capacity range of the installed main spud and the air shutter setting 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 the combination valve to **PILOT** and depress completely, hold firm and light pilot by depressing ignitor button several times. Pilot should light. Pilot may be viewed through Peep Sight located in rating plate (see Figure 5). 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 heating appliance and chimney as described in Step 3 above.

7. With pilot lit, wait one minute; then release Manual Gas Cock Knob on Combination Valve and turn to **ON**. If 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 pilotstat 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.

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

For PROPANE gas, consult your local supplier for method to determine firing rate.

10. Readjust the air shutter to provide a quiet, soft flame -- blue at the burner nozzle with well defined orange

and yellow tips for NATURAL gas or with well defined yellow tips for PROPANE gas.

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 air shutter by checking the flue gases with an **ORSAT** or similar combustion testing 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 reference 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 the 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.
14. **FILL OUT THE INSTALLATION ADJUSTMENT DATA TAG** and affix to the burner or converted appliance.

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

PART 2 SERVICE

▲ DANGER: Be sure the Main Manual Shut-Off Valve, Combination Valve and Burner Power Switch are turned off before removing any parts for service.

▲ WARNING: Do not attempt to FIRE the burner with the burner backplate removed as air from the blower will not reach the combustion chamber and a dangerous level of unburned gas could accumulate.

IX NOZZLE AND PILOT

The nozzle and pilot assembly can be removed as a unit by removing the back plate, disconnecting the factory installed union located between combination valve and manifold slide plate, and pulling out curved manifold pipe. Disconnect thermocouple and pilot tube at Combination Gas Valve. Withdraw nozzle assembly, enough to permit disconnecting ignitor wire before removing nozzle and pilot assembly completely.

When the pilot flame gas pressure is in the proper range, lint, dust or corrosion is the usual cause for most service problems. When servicing, clean the nozzle ribbon and pilot assembly including the pilot orifice and electrode porcelain.

If cleaning does not eliminate a pilot outage problem, further checks are required.

Check to verify that the burner nozzle is not installed in too far. See Figures 1 and 2.

A continuous draft is required for the proper operation of the pilot. This is no problem in the usual up-draft heating appliance. However, in down-draft or horizontal appliances,

especially during periods of infrequent operation, the available draft may become nil and result in the pilot products of combustion being recirculated and snuffing out the pilot. Excessive draft (over -.05" W.C.) or reverse draft may also result in nuisance pilot outages. Where a suitable continuous draft cannot be provided, a spark ignited burner should be considered.

Check that the pilot orifice size is correct (refer to Table 4).

▲ CAUTION: Do not indiscriminately increase pilot orifice size. 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.

	Nominal BTU/Hr. Value	
	NAT-1000	PROPANE-2500
Orifice Diameter	.018	.012
Pilot Flame Gas Pressure	3.5 - 7.0" W.C.	
Approx. Capacity	800 BTU/Hr.	

TABLE 4 Pilot Specifications

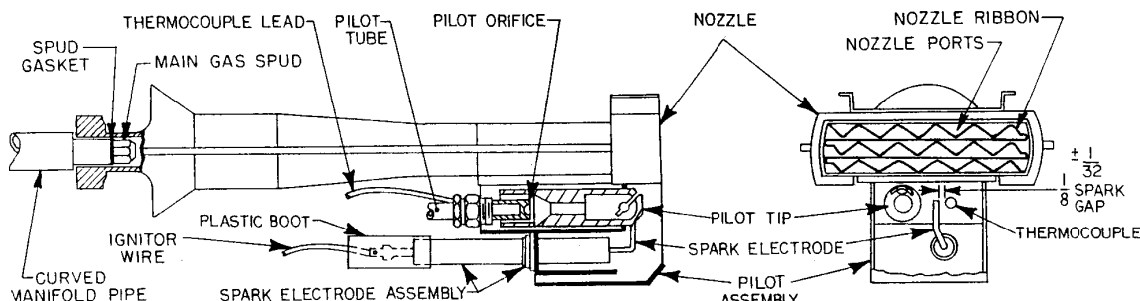


FIGURE 6 Nozzle and Pilot Assembly

Check for high or low pilot gas pressure. Pilot gas pressure tap is located in tee fitting in pilot gas line near bottom of back plate. If over 7.0" W.C. with burner on, the size of pilot flame should be reduced to increase heat on the thermocouple. Pilot gas adjustment screw (needle valve) is located on the inlet end of combination gas valve body and is factory set full open. Remove plug for access and turn clockwise to reduce flow (pressure).

▲ 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 (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.

Examine the thermocouple. If there is any serious corrosion or loss of metal at the tip, replace the thermocouple.

The efficiency of the thermocouple and pilotstat safety control of the combination valve can be determined by timing the safety shut-off. With power to the burner shut off and with the combustion chamber 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 pilotstat safety control in the Combination Valve. If less than 30 seconds or exceeds 3 minutes, the thermocouple, pilot flame adjustment or the pilotstat safety control is faulty and the entire Combination Valve must be replaced.

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 pilotstat safety control of combination valve). If millivolt reading is above maximum, readjust pilot gas input slightly to reduce voltage. Check results with blower motor on and off.

Tests to isolate thermocouple and/or pilotstat safety control 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 7 millivolts, the pilotstat safety control section is defective and entire valve must be replaced.

If the thermocouple develops 15 millivolts minimum open circuit and 7 millivolts minimum closed circuit but drop out timing is under 30 seconds or exceeds 3 minutes, the pilotstat safety control section is defective and entire valve must be replaced.

▲ WARNING: When reassembling burner, make sure that the manifold slide plate is positioned in its holder and that the main spud is inserted into the end of nozzle (see Figures 5 and 6).

X BLOWER SHELF ASSEMBLY

The shelf assembly including the blower and motor, motor relay, low voltage transformer and terminal board can be withdrawn as a unit after the back plate is removed and external wiring is disconnected.

Cleaning of the blower wheel is usually the only service required. Need for cleaning is indicated if the air inlet slots in the burner housing show an accumulation of dust and lint, or if the character of the flame -- long, hazy and yellow (sooty) -- indicates a deficiency of air. Motor air cooling vents should also be cleaned at this time.

If the motor must be replaced, remove the blower wheel first and remove the retainer clips at the rubber motor grommets, pull the motor out of keyhole brackets. Remount in reverse order noting that brass flanges of rubber motor mounts are located against motor. Do not omit the three clips. Position blower wheel on motor shaft to provide 1/8 inch clearance between blower inlet opening and blower wheel ring.

Shelf gaskets are installed on the inside of the back cover and inside of the front of the burner cabinet. Be sure they are in place when reinstalling the shelf assembly, otherwise blower air will be lost and combustion could be affected.

XI COMBINATION GAS VALVE

The 24 volt combination valve serves five functions:

1. Main manual and pilot gas shut-off,
2. Manifold gas pressure regulation,
3. Pilot gas input adjustment,
4. Automatic electric main gas valve; single seated on Model E20B, double seated (redundant) on E20BP Models, and
5. Pilotstat safety control.

A pilot filter is also included.

For manual control the manual gas cock knob is turned full **ON** or full **OFF**. The dial has to be depressed to be turned in one direction, but it depends on the manufacturer of the valve whether it is in the **ON** or **OFF** position.

Refer to Section IX for pilot adjustment.

The combination valve gas pressure regulator has an outlet pressure setting range of 2.0" to 4.0" W.C. and is factory set for 2.0" W.C. Manifold gas pressure tap is located on the outlet end of the combination gas valve body.

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.

▲ 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 ± 0.1 " W.C., with an inlet pressure within the specified 5"-14" W.C., the regulator section of the valve is defective and entire valve must be replaced.

The pilotstat safety control may be suspect if frequent "pilot outages" occur. Refer to Section IX to isolate 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.

If leakage through the valve occurs on standby, as evidenced by the presence of any flame other than pilot, the entire valve must be replaced.

▲ CAUTION: If the combination valve has been moved or replaced, soap bubble test for leaks with the burner running.

CONSUMER INSTRUCTIONS

MAINTENANCE

Keep the area around the burner clear and free of combustible materials, gasoline or 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.

IMPORTANT: Check the burner flame periodically. 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, READJUSTMENT AND/OR REPAIR

▲ 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 confined 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.

LIGHTING INSTRUCTIONS

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 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 appliance.
2. **Do not** shut off the power to the Economite burner, the equipment pump, or blower.

TROUBLE CHART

Make sure 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 THE ORDER LISTED.**

I. PILOT WILL NOT LIGHT.

- A. Manual gas cock knob on combination valve 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).
- D. High or low pilot flame gas pressure (see Section IX).
- E. Clogged pilot orifice(s) (see Section IX).
- F. Defective ignitor, ignitor wires, spark rod or improper spark gap (see Figure 6).
- G. Excessively high negative or positive draft condition (see Section I and Section IX).

II. PILOT GOES OUT FREQUENTLY.

- A. Excessively high negative or positive draft condition (see Section I and Section IX).
- B. High or low pilot flame gas pressure (see Section IX).
- C. Burner tube extends into combustion chamber (see Section III).
- D. Lint or dust in pilot (see Section IX).
- E. Clogged pilot orifice(s) (see Section IX).
- F. Defective thermocouple (see Section IX).
- G. Defective pilotstat safety control (see Section IX).
- H. Clogged pilot filter in combination valve; entire valve must be replaced.

III. MOTOR WILL NOT RUN.

- A. Confirm 120V between strip terminals **1** and **2** and verify the circuit polarity and electrical ground between strip terminals **1** and **GND**.(See Section V).
- B. Check 24V* operating control circuit:
 1. Between motor relay terminal **1** and left strip terminal **T**.
 - a. If no voltage, transformer is defective.
 - b. If very low voltage,* circuit is overloaded or transformer is defective.
 2. Between motor relay terminal **1** and right strip terminal **T**.
 - a. If no voltage, circuit between strip terminals **T** and **T** is open.
- C. Check for 120V between motor relay terminal **4** and strip terminal **2**.
 1. If no voltage, motor relay is defective.

2. If voltage present, motor is defective or Blower Wheel is binding.

IV. MOTOR RUNS IN REPEATED CYCLES – NO FLAME PRESENT.

- A. Motor relay drops out due to low voltage.* Check valve circuit for ground or overload.

V. 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 splice or valve TH and GND.
 1. If no voltage, motor interlock switch is defective.
 2. If voltage present, Electric Valve Operator(s) section of Combination Valve is defective and entire valve must be replaced.

VI. SHORT FLAME.**

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

VII. LONG, HAZY FLAME.**

- A. High manifold gas pressure.
- B. Main gas spud orifice too large.
- C. Air adjustment closed too far.
- D. Dirty blower wheel.

VIII. GAS FAILS TO SHUT OFF.

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

* Normal low voltage: Burner in standby -- 24V min.
Burner running (gas valve energized) -- 21V min.

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