

APPLICATION

The VS820 and VS821 are used on gas fired, standing pilot appliances with 750 mV self-powered control systems. The gas controls include a manual gas valve, safety shutoff, single millivoltage automatic operator and pressure regulator. Refer to Table 1 for capacity ratings and Table 2 for pressure regulators and temperature ratings. Separate

models are available for natural and LP gas; the controls cannot be field converted.

Power for the gas control and the control system is provided by a 750 mV Powerpile generator. We recommend the Q313 Thermopile Generator or the CS82, CS893, CS894, or CS897 Pilot Burner Generators.

TABLE 1—VS820 AND VS821 PIPE SIZE AND CAPACITY RATINGS.

MODEL	INLET x OUTLET		REDUCER FITTINGS ^b			
	PIPE SIZE	CAPACITY ^a		SIZE	CAPACITY	
		cfh	m ³ /hr		cfh	m ³ /hr
VS821	1/2 x 3/8	110	3.1	—	—	—
VS820	1/2 x 1/2	225	6.4	—	—	—
	1/2 x 3/4	250	7.1	3/4 x 1/2	225	6.4
				1/2 x 3/8	110	3.1
VS820 High Capacity	1 x 1	600	17.0	3/4 x 1/2	250	7.1
				3/4 x 1/2	225	6.4
				1 x 3/4	503	14.2
				1 x 3/4	450	12.7

^a Capacity is based on 1000Btuh/ft³, 0.64 sp gr natural gas at 1 in. wc pressure drop [37.3 MH/m³, 0.64 sp gr natural gas at 0.25 kPa pressure drop]. Use conversion factors in Table 3 to convert for other gases.

^b Reducer fittings must be obtained locally.

TABLE 2—PRESSURE REGULATOR AND TEMPERATURE RATINGS.

MODEL	PRESSURE TYPE	REGULATOR MODEL	TEMPERATURE RATING	
			°F	°C
VS820A,H	Standard	V5306A	32 to 175	0 to 79
VS821A				
VS820C, VS821C	Step	V5307A		
VS820D	Hi-Low	V5308A		
VS820P	Step	V5307B	-40 to 175	-40 to 79
VS820V	Standard	V5306A		

TABLE 3—GAS CAPACITY CONVERSION FACTORS.

TYPE OF GAS	SPECIFIC GRAVITY	MULTIPLY LISTED CAPACITY BY
Manufactured	0.60	0.516
Mixed	0.70	0.765
Propane	1.53	1.62

INSTALLATION

WHEN INSTALLING THIS PRODUCT...

1. Read these instructions carefully. Failure to follow them could damage the product or cause a hazardous condition.

2. Check the ratings given in these instructions and on the product to make sure the product is suitable for your application.

3. Make sure installer is a trained, experienced service technician.

4. After completing installation, use these instructions to check product operation.

WARNING

FIRE OR EXPLOSION HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY, OR DEATH

Follow these warnings exactly:

1. Disconnect power supply before wiring to prevent electrical shock or equipment damage.
2. To avoid dangerous accumulation of fuel gas, turn off gas supply at appliance service valve before starting installation and perform Gas Leak Test following installation.
3. Do not bend pilot tubing at control or at pilot after compression fitting has been tightened. Gas leakage at the connection fitting may result.
4. Always install sediment trap in gas supply line to prevent contamination of gas control.
5. Do not force gas control knob. Use only your hand to turn gas control knob. If the knob will not operate by hand, the control should be replaced by a qualified service technician. Force or attempted repair may result in fire or explosion.

CAUTION

Never apply a jumper across (or short) valve coil terminals. This may burn out thermostat heat anticipator.

IMPORTANT

These gas controls are shipped with protective seals over inlet and outlet tappings. Do not remove seals until ready to connect piping.

Follow the appliance manufacturer's instructions if available; otherwise, use the instructions provided below as a guide.

CHOSE LOCATION

Do not locate the combination gas control where it may be affected by steam cleaning, high humidity or dripping water, corrosive chemicals, dust or grease accumulation, or excessive heat. To ensure proper operation, follow these guidelines:

- Locate in a well ventilated area.
- Mount high enough above the cabinet bottom to avoid exposure to flooding or splashing water.
- Ensure that the ambient temperature does not exceed the ambient temperature ratings for each component.
- Cover if appliance is cleaned with water, steam, or chemicals or to avoid dust and grease accumulation.
- Avoid locating where exposure to corrosive chemical fumes or dripping water is likely.

Mount the combination gas control in the appliance vestibule on the gas manifold. If this is a replacement application, mount the gas control in the same location as the old control. Make sure the total control circuit wire length does not exceed 30 ft [9.2 m] or 2-wire, 18 gauge cable or 50 ft [15.3 m] of 2-wire, 16 gauge cable.

INLET AND OUTLET ADAPTERS

If adapters are needed, prepare control as follows:

1. Remove seal over control inlet or outlet.
2. Apply moderate amount of good quality pipe compound to adapter, leaving two end threads bare. Refer to Fig. 1. On LP installation, use compound resistant to LP gas. Do NOT use Teflon tape.
3. Insert adapter in control and thread carefully until tight.

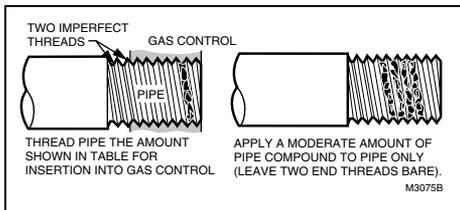


Fig. 1—Use moderate amount of pipe compound.

INSTALL PIPING TO CONTROL

All piping must comply with local codes and ordinances or with National Fuel Gas Code (ANSI Z223.1 NFPA No. 54), whichever applies. Tubing installation must comply with approved standards and practices.

1. Use new, properly reamed pipe free from chips. If tubing is used, make sure the ends are square, deburred and clean. All tubing bends must be smooth and without deformation.

2. Run pipe or tubing to control. If tubing is used, obtain a tube-to-pipe coupling to connect tubing to the control.

3. Install sediment trap in the supply line to the gas control. Refer to Fig. 2.

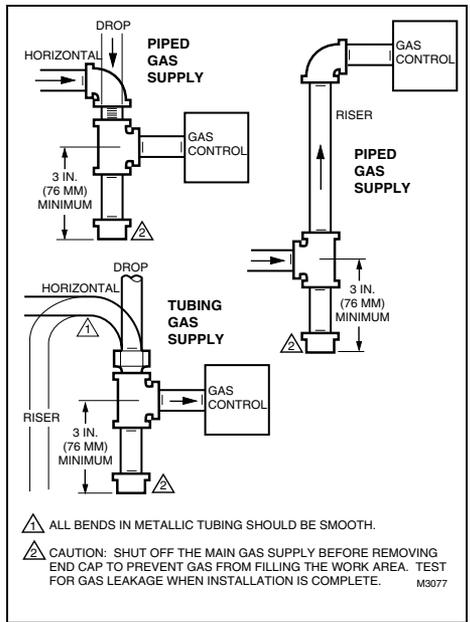


Fig. 2—Sediment trap installation.

INSTALL CONTROL

1. This control can be mounted 0-90 degrees, in any direction, from the upright position of the gas control knob, including vertically.

2. Mount the control so gas inlet is on the end with projecting wrench boss. Refer to Figs. 3 and 4.

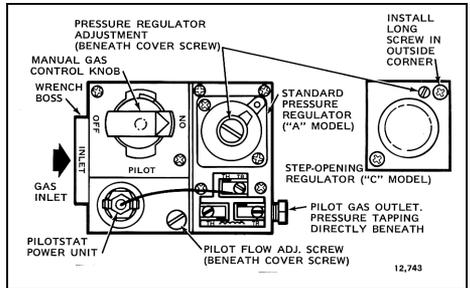


Fig. 3—Top view of standard capacity models.

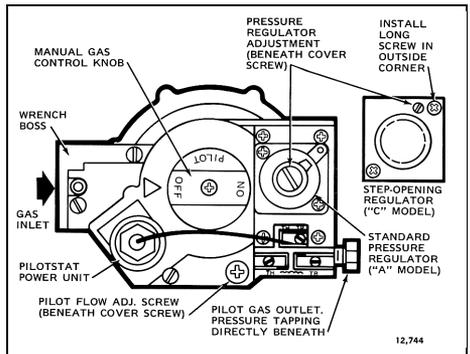


Fig. 4—Top view of high capacity models.

3. Thread pipe the amount shown in Table 4 for insertion into control. **DO NOT THREAD PIPE TOO FAR.** Valve distortion or malfunction may result if the pipe is inserted too deeply.

TABLE 4—NPT PIPE THREAD LENGTH (in.).

PIPE SIZE	THREAD PIPE THIS AMOUNT	MAXIMUM DEPTH PIPE CAN BE INSERTED INTO CONTROL
3/8	9/16	3/8
1/2	3/4	1/2
3/4	13/16	3/4

4. Apply a moderate amount of good quality pipe compound (DO NOT use Teflon tape) to pipe or coupling only, leaving two end threads bare. On LP installations, use compound resistant to LP gas. Refer to Fig. 1.

5. Remove seals over control inlet and outlet, if necessary.

6. Connect pipe or coupling to control inlet and outlet. To tighten inlet and outlet connections, use wrench on wrench boss only. Refer to Figs. 3 and 4. If tubing is used, connect tubing to coupling.

CONNECT PILOT GAS TUBING

1. Cut tubing to desired length and bend as necessary for routing to pilot burner. Do not make sharp bends or deform tubing. Do not bend tubing at control after compression nut has been tightened, as this may result in gas leakage at the connection.

2. Square off and remove burrs from end of tubing.

3. Unscrew brass compression fitting from the pilot outlet (Fig. 3 or 4). Depending on gas control model, fitting supplied may be for 1/8 or 1/4 in. tubing. Slip the fitting over the tubing and slide out of the way.

NOTE: When replacing a control, also replace the compression fitting. Never use the old compression fitting as it may not provide a gas-tight seal. Refer to Fig. 6.

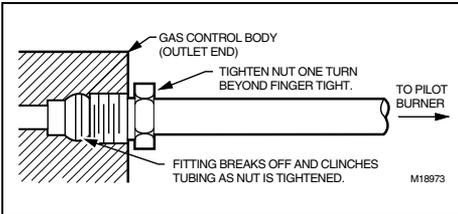


Fig. 6—Always use new compression fitting.

4. Push tubing into the pilot gas tapping on the outlet end of the control until it bottoms. While holding tubing all the way in, slide fitting into place and engage threads. Turn until finger tight. Then tighten one more turn with wrench. Do not overtighten.

5. Connect other end of tubing to pilot burner according to pilot burner manufacturer's instructions.

CONNECT ECO

In all applications, use Q313B Thermopile Generator with pilot burner to act as the high-limit for the system.

WIRING

IMPORTANT

1. Since the entire control system is powered by the millivoltage generated by the Powerpile generator, clean and scrape all wires before connecting. Solder and tape all necessary splices using rosin flux to prevent corrosion.
2. Control circuit cable length must not exceed 30 ft [9 mm] of 2-wire, 18 gauge cable, or 50 ft [15 m] of 2-wire, 16 gauge cable.

Follow appliance manufacturer's wiring instructions, if available, or use general instructions provided below. Where instructions differ, follow appliance manufacturer instructions.

All wiring must comply with local electrical codes and ordinances or with the National Electrical Code (ANSI/NFPA 70), whichever applies.

Never connect these millivoltage controls to line voltage or to a transformer.

To prevent electrical shock or equipment damage, disconnect power supply before making wiring connections.

1. After Powerpile generator is installed in pilot burner, route generator lead to gas control.
2. Connect lead to gas control terminals labeled PP.
3. Connect thermostat leads as shown in Fig. 7 or 8.

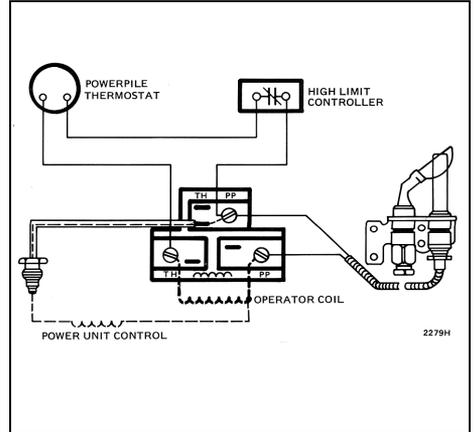


Fig. 7—Typical wiring connections for gas control with three-terminal operator.

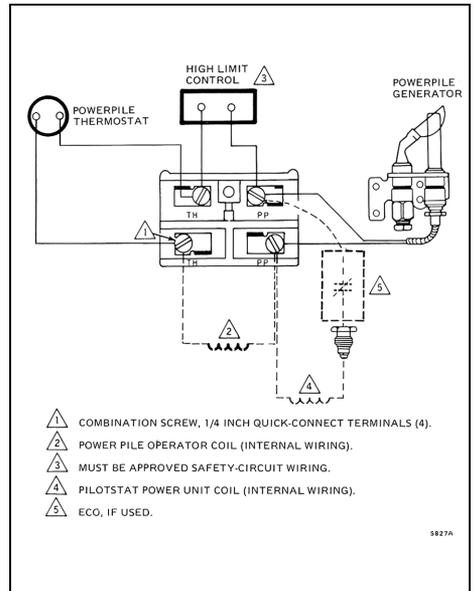


Fig. 8—Typical wiring connections for gas control with four-terminal operator.

STARTUP AND CHECKOUT

WARNING

FIRE OR EXPLOSION HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY, OR DEATH

1. Do not force the gas control knob. Only use your hand to push down or turn the gas control knob. Never use any tools.
2. If the gas control knob will not operate by hand, or if the knob stays depressed after it is released, the control should be replaced by a qualified service technician.
3. Perform the gas leak test described below any time work is done on a gas system.

GAS CONTROL KNOB SETTINGS

The gas control knob has three settings:

OFF prevents pilot and main gas flow through the control.

PILOT permits gas flow to pilot burner as long as gas control knob is held down or generator current is above the power unit dropout value.

ON permits gas flow into the combination gas control body. Pilot gas is controlled as in the PILOT position. Main burner gas is controlled by the thermostat and automatic valve operator.

PERFORM GAS LEAK TEST

WARNING

**FIRE OR EXPLOSION HAZARD
CAN CAUSE PROPERTY DAMAGE, SEVERE INJURY, OR DEATH**
Check for gas leaks with soap and water solution any time work is done on a gas system.

GAS LEAK TEST:

1. Paint pipe connections upstream of gas control with rich soap and water solution. Bubbles indicate gas leak.
2. If leak is detected, tighten pipe connections.
3. Stand clear of main burner while lighting to prevent injury caused from hidden leaks which could cause flashback in the appliance vestibule. Light main burner.
4. With main burner in operation, paint pipe joints (including adapters) and control inlet and outlet with rich soap and water solution.
5. If another leak is detected, tighten adapter screws, joints, and pipe connections.
6. Replace part if leak can't be stopped.

LIGHT PILOT

1. Turn gas control knob clockwise  to OFF. Wait five minutes to dissipate any unburned gas. Sniff around the appliance near the floor. Don't relight pilot if you smell gas.
2. Turn gas control knob counterclockwise  to PILOT. Push down and hold the knob while you light pilot burner.
3. Hold the gas control knob down about one minute, then release. If the pilot goes out, turn gas control knob clockwise  to OFF. Repeat steps 1-3.
4. Release gas control knob. If pilot remains lit, turn counterclockwise  to ON.

ADJUST PILOT FLAME

The pilot flame should envelop 3/8 to 1/2 in. [10 to 13 mm] of the tip of the generator. Refer to Fig. 9.

To adjust:

1. Remove pilot adjustment cover screw. Refer to Fig. 2 or 3.
2. Turn inner adjustment screw clockwise  to decrease or counterclockwise  to increase pilot flame.
3. Always replace cover screw after adjustment and tighten firmly to ensure proper operation.

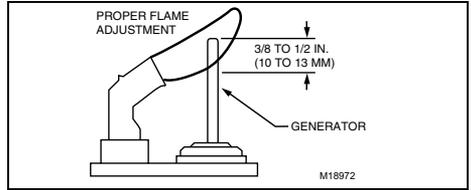


Fig. 9—Proper flame adjustment.

TURN ON MAIN BURNER

Follow instructions provided by appliance manufacturer or turn up thermostat to call for heat.

CHECK AND ADJUST GAS INPUT TO MAIN BURNER

CAUTION

1. Do not exceed input rating stamped on appliance nameplate, or manufacturer's recommended burner orifice pressure for size orifice(s) used. Make certain primary air supply to main burner is properly adjusted for complete combustion. Follow appliance manufacturer's instructions.
2. IF CHECKING GAS INPUT BY CLOCKING GAS METER: Make certain there is no gas flow through the meter other than to the appliance being checked. Other appliances must remain off with their pilots extinguished (or their consumption must be deducted from the meter reading). Convert flow rate to Btuh as described in form 70-2602, Gas Controls Handbook, and compare to the Btuh input rating on appliance nameplate.
3. IF CHECKING GAS INPUT WITH MANOMETER: Make certain gas control is in PILOT position before removing outlet pressure tap plug to connect manometer (pressure gauge). Also turn gas control knob back to PILOT when removing gauge and replacing plug. Before removing inlet pressure tap plug, shut off gas supply at the manual valve in the gas piping to the appliance or, for LP, at the tank. Also shut off gas supply before disconnecting manometer and replacing plug. Repeat Gas Leak Test at plug with main burner operating.

VS820A,V; VS821A (Standard Pressure Regulator)

1. Check the manifold rating listed on the appliance nameplate. Gas control outlet pressure should match the nameplate.
2. With main burner operating, check gas control outlet gas flow using the meter clamping method or pressure using a manometer connected to the outlet pressure tap on the gas control. Refer to Fig. 2 or 3.
3. If necessary, adjust pressure regulator to match appliance rating. Refer to Table 5 for factory set nominal outlet pressure and adjustment range.
 - a. Remove pressure regulator adjustment cap screw.
 - b. Using screwdriver, turn inner adjustment screw clockwise  to increase or counterclockwise  to decrease gas pressure to burner.
 - c. Always replace cap screw and tighten firmly to ensure system functions properly.
4. If desired outlet pressure or flow rate cannot be

achieved by adjusting the gas control, check gas control inlet pressure using a manometer at inlet pressure tap. If inlet pressure is in the nominal range (refer to Table 5), replace gas control. Otherwise, take the necessary steps to provide proper gas pressure to the control.

VS820C,P; VS821C (Step-Opening Pressure Regulator)

1. Check the full rate manifold pressure listed on the appliance nameplate. Gas control full rate outlet pressure should match this rating.

2. With main burner operating, check gas control outlet flow rate using the meter clocking method or outlet pressure using a manometer connected to the outlet pressure tap on the control. Refer to Fig. 3 or 4.

3. If necessary, adjust pressure regulator to match appliance rating. Refer to Table 5 for factory set nominal outlet pressure and adjustment range.

a. Remove pressure regulator adjustment cap screw.

b. Using screwdriver, turn inner adjustment screw clockwise  to increase or counterclockwise  to decrease gas pressure to burner.

c. Always replace cap screw and tighten firmly to ensure system functions properly.

4. If desired outlet pressure or flow rate cannot be achieved by adjusting the gas control, check gas control inlet pressure using a manometer upstream of the gas control. If inlet pressure is in the nominal range (refer to Table 5), replace gas control. Otherwise, take the necessary steps to provide proper gas pressure to the control.

5. Carefully check burner lightoff at step pressure. Make sure burner lights smoothly and without flashback to orifice. Make sure all ports remain lit. Cycle burner several times, allowing at least 30 sec. between cycles for regulator to resume step function. Repeat after allowing burner to cool. Readjust full rate outlet pressure if necessary to step lightoff rate.

VS820D (High/Low Rate Pressure Regulator)

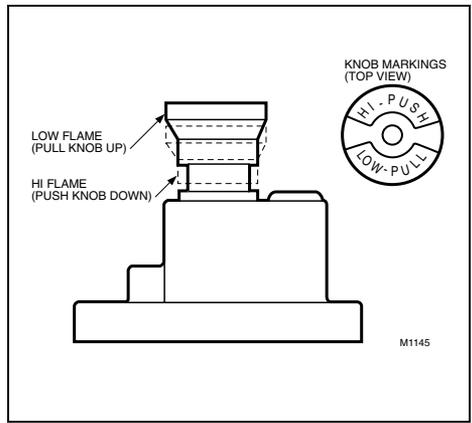


Fig. 10—HI and LOW settings for VS820D.

1. Check the LOW flame setting listed on the appliance nameplate. Gas control LOW flame setting should match this rating.

2. With main burner operating, check gas control outlet flow rate using the meter clocking method or outlet pressure using a manometer connected to the outlet pressure tap on the control. Refer to Fig. 3 or 4.

3. Check gas control inlet pressure using a manometer at inlet pressure tap. If inlet pressure is in the nominal range (refer to Table 5), replace gas control. Otherwise, take the necessary steps to provide proper gas pressure to the control.

4. Carefully check burner lightoff at LOW flame setting. Make sure burner lights smoothly and without flashback to orifice. Make sure all ports remain lit. Cycle several times and repeat after allowing burner to cool.

5. Check the HI flame setting listed on the appliance nameplate and repeat the above steps for the HI flame setting.

IMPORTANT

The VS308 on the VS820D is not field adjustable. The HI or LOW flame setting is selected by positioning the white knob on the regulator. Refer to Fig. 10.

TABLE 5—PRESSURE REGULATOR SPECIFICATION PRESSURES IN in. wc.

MODEL	TYPE OF GAS	NOMINAL INLET PRESSURE RANGE	FACTORY SET NOMINAL OUTLET PRESSURE		SETTING RANGE	
			STEP	FULL RATE	STEP	FULL RATE
VS820A,H,V;	NAT	5.0-7.0	—	3.5	—	3-5
VS821A	LP	12.0-14.0	—	11.0	—	8-12
VS820C,P	NAT	5.0-7.0	0.9	3.5	None	3-5
VS821C	LP	12.0-14.0	2.2	11.0	None	8-12
VS820D	NAT	5.0-7.0	—	1.0 Low 3.5 Hi	Nonadjustable	
	LP	12.0-14.0	—	2.75 Low 11.0 Hi	Nonadjustable	

TABLE 5A—PRESSURE REGULATOR SPECIFICATION PRESSURES IN kPa.

MODEL	TYPE OF GAS	NOMINAL INLET PRESSURE RANGE	FACTORY SET NOMINAL OUTLET PRESSURE		SETTING RANGE	
			STEP	FULL RATE	STEP	FULL RATE
VS820A,H,V;	NAT	1.2-1.7	—	0.9	—	0.7-1.2
VS821A	LP	2.9-3.9	—	2.7	—	2-3
VS820C	NAT	1.2-1.7	0.2	0.9	None	0.7-1.2
VS821C	LP	2.9-3.9	0.5	2.7	None	2-3
VS820D	NAT	1.2-1.7	—	0.2 Low 0.9 Hi	Nonadjustable	
	LP	2.9-3.9	—	0.7 Low 2.7 Hi	Nonadjustable	

CHECK SAFETY SHUTDOWN PERFORMANCE

WARNING

FIRE OR EXPLOSION HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE IN- JURY, OR DEATH

Perform the safety shutdown test anytime work is done on a gas system.

1. Place gas control knob in PILOT position. Main burner should go out and pilot should remain lit.
2. Extinguish pilot flame. Pilot gas flow should stop within 2-1/2 minutes. Safety shutoff of pilot gas proves complete shutdown since safety shutoff valve blocks flow of gas to main burner and pilot.
3. Relight pilot burner and turn gas control knob to ON.
4. Set thermostat to call for heat and observe appliance through one complete cycle to make sure it operates as intended.

SERVICE

CAUTION

Never apply a jumper across (or short) valve coil terminals. This may burn out thermostat heat anticipator.

IMPORTANT

Allow 30 seconds after shutdown before reenergizing step-opening model to ensure lightoff at step pressure.

IF PILOT WILL NOT LIGHT

1. Make sure the main gas supply valve is open and the pilot gas supply line is purged of air.
2. Attempt to light pilot following procedure in "Light Pilot", page 4.
3. Then if:
 - a. Pilot gas adjustment screw is closed, readjust pilot flame. Refer to page 4.
 - b. Compression fitting has a gas leak, replace old compression fitting or tighten new one. Refer to page 3.
 - c. Pilot burner tubing or orifice is clogged, replace combination gas control. Refer to page 1.

IF PILOT GOES OUT WHEN GAS CONTROL KNOB IS RELEASED

1. Make sure the gas control knob is held in at least one minute to allow the generator time to heat.
2. Check pilot flame adjustment, refer to page 4.
3. Check the wiring between the generator and the valve operator in the gas control.
4. Make sure jumper between valve operator and power unit is secure and connections are clean. Connection to power unit should be tightened 1/4 turn beyond finger tight.
5. If pilot still goes out, measure the open and closed generator circuit output voltages. Compare to acceptable range charts in the generator specifications or in the Gas Controls Handbook. Replace the generator if voltages are outside the acceptable range.
6. Check power unit resistance. If above 11 ohms, replace gas control.

IF MAIN BURNER WILL NOT COME ON WITH CALL FOR HEAT

1. Make sure gas control knob is in the ON position.
2. Adjust thermostat several degrees above room temperature.
3. Disconnect leadwires to lower left TH terminal and lower right PP terminal to isolate valve operator coil from balance of circuit. Measure resistance of coil. If coil is not 2 ohms \pm 10 percent, replace VS824A Valve Operator.
4. Measure the open and closed generator circuit output voltages and compare to acceptable range charts in the generator specifications or in the Gas Controls Handbook. Replace the generator if voltages are outside the acceptable range.

IF BURNER IS OVERFIRING

Adjust pressure regulator to correct pressure. If regulator cannot be adjusted and supply pressure is in normal range, replace complete gas control.

INSTRUCTIONS TO THE HOMEOWNER

WARNING

FIRE OR EXPLOSION HAZARD CAN CAUSE PROPERTY DAMAGE, SEVERE IN- JURY, OR DEATH

Follow these warnings and lighting instructions exactly.

1. Before lighting, smell all around the appliance area for gas. If appliance uses LP (bottled) gas, also be sure to smell next to floor because LP gas is heavier than air. If you smell gas, immediately shut off the manual valve in the gas piping to the appliance. ON LP SYSTEMS, AT THE TANK. Do not try to light any appliances in the house. Do not touch electrical switches or use the phone. LEAVE THE BUILDING and call your gas supplier from a neighbor's house. If your gas supplier cannot be reached, call the fire department.
2. Do not force the gas control knob on the appliance. Use only your hand to push down or turn the gas control knob. Never use any tools. If the gas control knob will not operate by hand, the control should be replaced by a qualified service technician. Force or attempted repair may result in fire or explosion.
3. The control must be replaced if it has been flooded with water.
4. The control is a SAFETY DEVICE. It must be replaced in case of any physical damage, tampering, bent terminals, missing or broken parts, stripped threads, or evidence of exposure to heat.

IMPORTANT

Follow the appliance manufacturer's instructions. The information below will assist in typical control applications, but the specific controls may require special manufacturer instructions.

Lighting the Pilot Burner

STOP: Read the warning above.

This appliance has a pilot burner which must be lit by hand. If the pilot flame has gone out, follow these instructions exactly.

1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance.

3. Remove control access panel.
4. Push in gas control knob (refer to Fig. 3 or 4) slightly and turn clockwise  to OFF.

NOTE: Knob cannot be turned from PILOT to OFF unless knob is pushed in slightly. Do not force.

5. Wait five (5) minutes to clear out any gas. If you then smell gas, STOP! Follow item 1 in the Warning above. If you don't smell gas, go to next step.

6. Remove the pilot access panel located below and behind the gas control unit.

7. Find the pilot—follow metal tube from gas control. The pilot is between the two burner tubes behind the pilot access panel.

8. Turn knob on gas control counterclockwise  to PILOT.

9. Push in control knob all the way and hold in. Immediately light the pilot with a match. Continue to hold the control knob in for about one (1) minute after the pilot is lit. Release knob and it will pop back up. Pilot should remain

lit. If it goes out, repeat steps 5-10.

10. Replace pilot access panel.

11. Turn gas control knob counterclockwise  to ON.

12. Replace control access panel.

13. Turn on all electric power to the appliance.

14. Set thermostat to desired setting.

To Turn Off Appliance

VACATION SHUTDOWN—Turn gas control knob clockwise  from ON to PILOT. Pilot will remain lit, ready for return to normal service without relighting.

COMPLETE SHUTDOWN—Push in gas control knob slightly and turn clockwise  to OFF. Do not force. Both pilot and main burner are shut off. Follow lighting procedure above to resume normal operation.

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