

# DUO-THERM



**65900  
SERIES**

**Gas Direct-Vent Forced Air  
Furnaces for Mobile Homes  
or Recreational Vehicles**

**INSTALLATION MANUAL**

# INSTALLATION INSTRUCTIONS

## AGENCY LISTINGS OR APPROVALS

The 65900 Series DUO-THERM Direct Vent Furnaces are listed by the UNDERWRITERS LABORATORIES and certified by the CANADIAN GAS ASSOCIATION for installation in mobile homes or recreational vehicles. These furnaces are for use with propane gas only and must be installed in accordance with these instructions for proper performance. The installation must also conform to local codes and the following applicable codes: A.N.S. A119.1- and Standard C.G.A. 10.1/C.S.A. Z240.4 Federal Standard for Mobile Home Construction and Safety, Title 24, HUD (Part 280) Gas Equipped Recreational Vehicles and Mobile Housing. Authorities having local jurisdiction or local municipal and provincial laws shall be considered before installations are made. These units are C.G.A. listed for use from 0-4500 Ft. Altitude. Units are not listed for use with cooling. The installation shall be adjusted to operate with a maximum outlet air temperature of 200 F or less, an air rise of 85-115 F at a static pressure not to exceed 0.20" w.c.

## DESCRIPTION

These furnaces are of the direct vent system design using a sectional type heat exchanger consisting of drawn steel sections welded together. The burners are designed for use with Propane gas and are of the slotted port design. Gas controls supplied with this furnace are of the 100% shut-off type. Ignition is provided by a direct spark ignitor or a standing pilot, lit by a manual spark device. Two small vent-air terminals are supplied with the unit, one for combustion air and one for flue exhaust. The proper length must be selected by the installer. A sliding arrangement of parts makes the heating element assembly easy to remove and replace. The furnace is equipped with a relay that automatically switches the power supply source from DC current to AC current when AC current is connected to the vehicle. The relay also automatically switches back to DC current when the AC current is disconnected.

## SPECIFICATIONS

Model No.	Input BTUH	Output BTUH	Gas Connection	Actual Casing Dim.				
				*A	*B	C	*D	E
65917	17,000	13,600	3/8 NPT	14 $\frac{1}{4}$	12 $\frac{1}{2}$	23	1 $\frac{5}{8}$	6 $\frac{1}{4}$
65920	20,000	16,000						
65925	25,000	20,000	3/8 NPT	14 $\frac{1}{4}$	15 $\frac{1}{2}$	23	1 $\frac{15}{16}$	7 $\frac{1}{4}$
65930	30,000	24,000						
65935	35,000	28,000	3/8 NPT	15 $\frac{1}{4}$	18 $\frac{1}{2}$	24	1 $\frac{15}{16}$	8 $\frac{1}{2}$
65940	40,000	32,000						

\*TO SPACERS, IF ANY

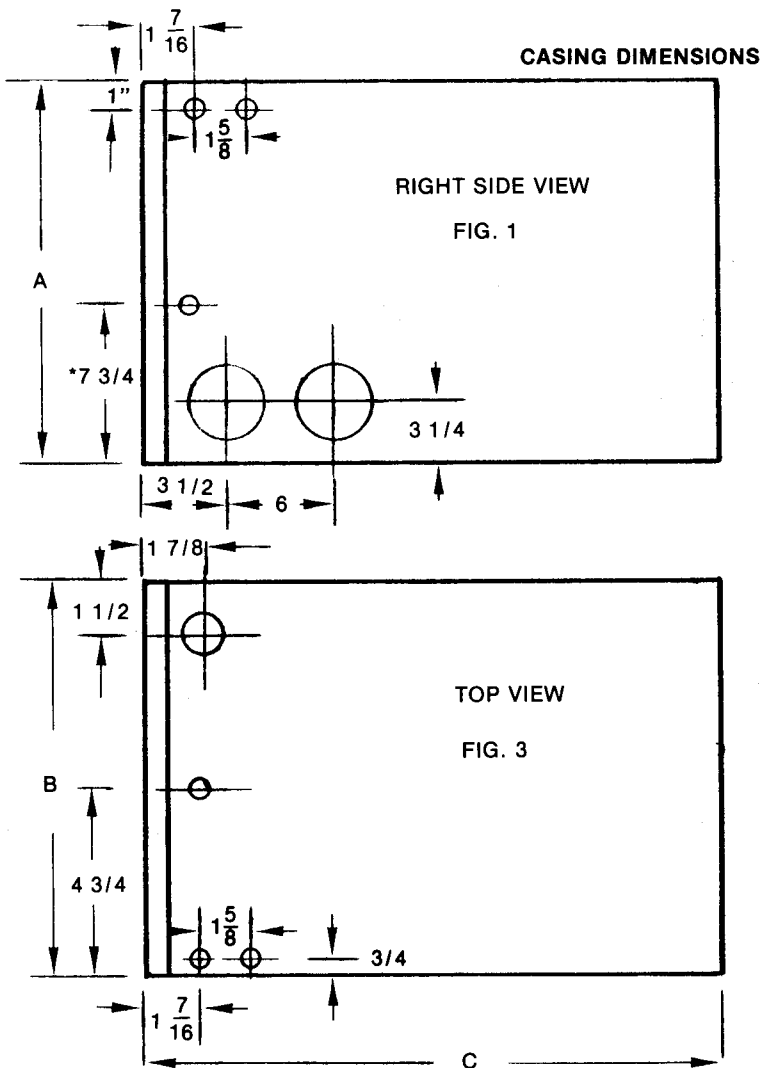
## INSTALLATION CLEARANCES TO ADJACENT CONSTRUCTION

### SPACERS CASING

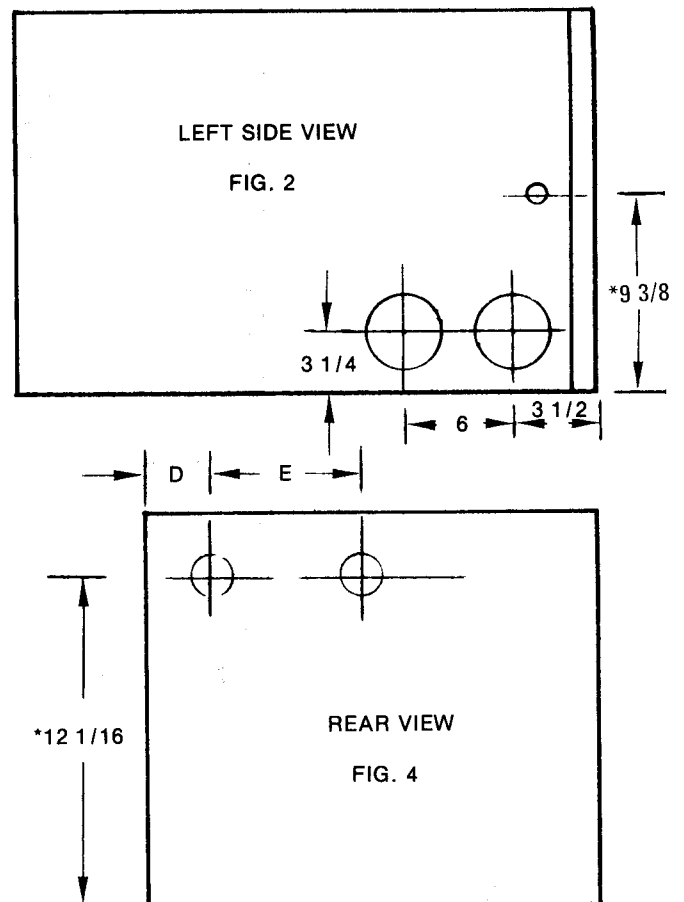
	SPACERS	CASING	
Sides	0"	1/4"	Ducts within 3' of furnace 1/4"
Bottom	0"	1/4"	
Rear		0"	
Top		0"	
Front		6"	(1" when using decorator door in front of furnace, also a 1/2" high by full width opening at bottom of the decorator door and the following sq. in. of free area opening adjacent to louvered opening in furnace door).

6" (1" when using decorator door in front of furnace, also a 1/2" high by full width opening at bottom of the decorator door and the following sq. in. of free area opening adjacent to louvered opening in furnace door).

65917-65920	59 sq. in.
65925-65930	75 sq. in.
65935-65940	91 sq. in.



\*DIMENSIONS INCLUDE SPACERS



## PREPARING FOR INSTALLATION

1. Select a location for the furnace on an outside wall as near the center of the coach as possible. Check for obstructions.
2. Provide opening in cabinet or enclosure as specified in Figure 5.
3. Cut two (2) 2-3/4" to 3" openings for vent-air terminals. See Figure 5 for opening locations.

## CONSTRUCTION OPENINGS

	A	B	C	D	E
65917 65920	14-3/8	12-5/8	1-5/8	6-1/4	23-1/8
65925 65930	14-3/8	15-5/8	1-15/16	7-1/4	23-1/8
65935 65940	15-3/8	18-5/8	1-15/16	8-1/2	24-1/8

If a cabinet or decorator door is placed in front of unit it must be a minimum of 1" from the furnace door and contain the free area openings as specified under installation clearances.

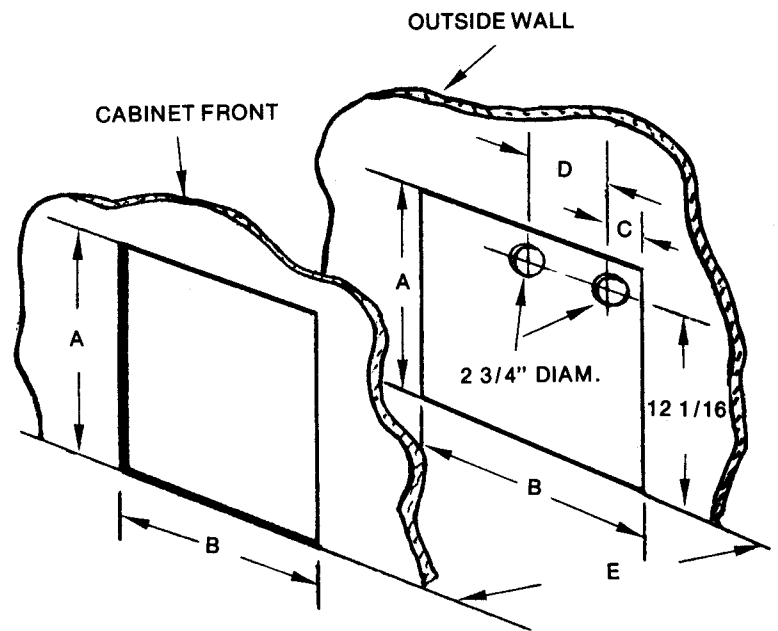


FIG. 5

## INSTALLATION FOR SIDE DUCT DISCHARGE

The furnace can be installed at 0" clearance to the side spacers when employing special duct connectors No. 3-12622.

The furnace casing has two knockouts on each side, each with prepunched holes for 4 inch diameter side duct connector attachment. The duct connectors are designed for quick and easy attachment and are installed as shown in Figure 7. For side discharge installation, the following number of 4 inch diameter duct connectors are supplied with the unit: Two for the 65917 and 65920; Three for the 65925 and 65930; and Four for the 65935 and 65940 units.

4 inch diameter ducts must be installed on opposite sides on the 65917 and 65920 units. Any three of four positions may be used on the 65925 and 65930 units.

Duct installation is important to the operation of this product. The number of turns should be kept to a minimum. Flexible ducts should be stretched and care should be taken to prevent pinching of ducts.

1. Remove front panel of cabinet.
2. Remove desired number of 4 inch knockouts, from sides of casing as required for the installation.
3. Slide furnace into openings. Secure to floor with screws through front of cabinet base. See Figure 7.
4. Attach side duct connectors to casing sides with 3/8" long screws. See Figure 7.
5. Install the vent-air assemblies on the outside wall of the vehicle. Follow vent installation instructions of page 3.

**BE SURE TO USE DISCHARGE AIR REGISTERS, EACH HAVING A MINIMUM OF 12 SQ. IN. TOTAL FREE AREA PER DUCT RUN.**

## SIDE DUCT CONNECTOR #3-12622



FIG. 6

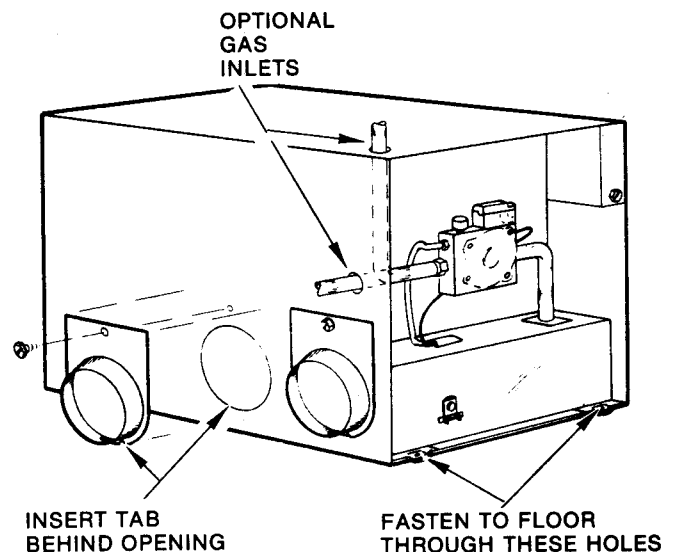


FIG. 7

## INSTALLATION FOR BOTTOM DUCT DISCHARGE

The furnace can be installed at 0 inch clearance to the bottom spacers when employing special duct connectors listed below.

The furnace casing has one knockout in the bottom of the cabinet. Remove this knockout. The following total duct areas are recommended for bottom discharge: 65917 and 65920 = 24 Sq. in.; 65925 and 65930 = 36 Sq. in.; 65935 and 65940 = 48 Sq. in.

The only part required for bottom discharge installation is bottom duct connector kit as follows:

MODEL	KIT NO.	ASSY. NO.
65917	3-13034-001	3-13032-001
65920		
65925	3-13034-002	3-13032-002
65930		
65935	3-13034-003	3-13032-003
65940		

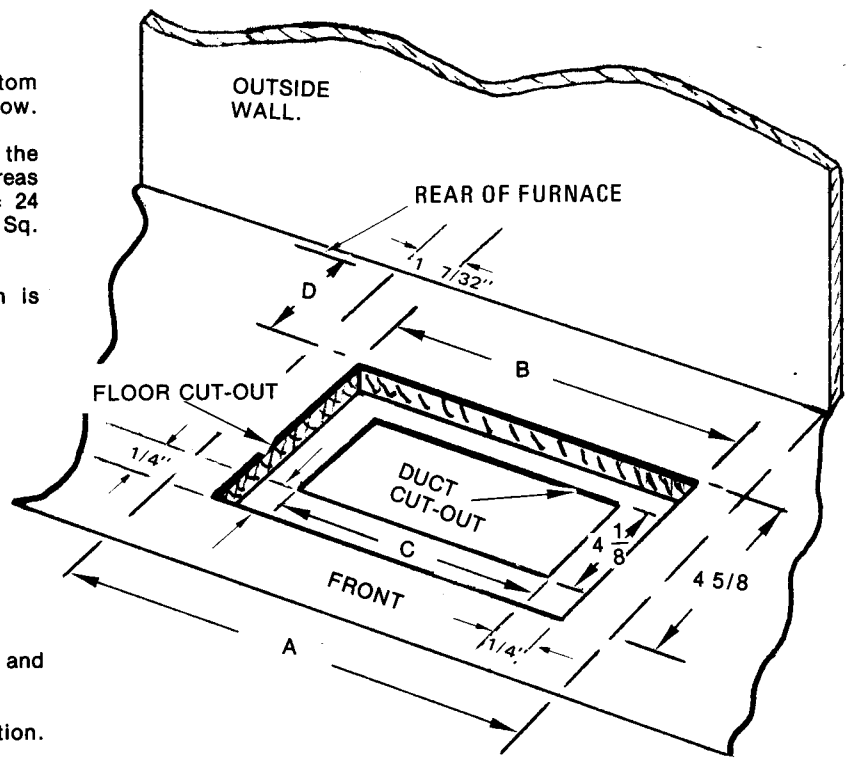
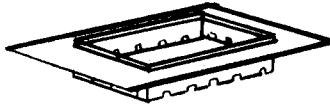


FIG. 8

1. Cut hole through flooring. See Figure 8 for proper size and location.
2. Cut hole in duct. See Figure 8 for proper size and location.
3. Insert bottom duct connector into openings through floor and duct and bend over tabs to secure the connector in place and to minimize air leakage.
4. Remove bottom knockout from furnace casing.
5. Raise furnace assembly so that assembly slides over the raised portion of the duct connector and continue sliding in place until the bottom opening slides over the upturned flanges. Furnace assembly will then drop down into place and effect a good seal at this connection.
6. Secure to floor with screws through front of cabinet base. See Figure 7.
7. Install the vent-air terminals on the outside wall of the vehicle as shown in Figure 9.

### FLOOR CUT-OUT DIMENSIONS

	A	B	C	D
65917-65920	12-9/16	10-1/8	9-5/8	15-5/8
65925-65930	15-9/16	13-1/8	12-5/8	15-5/8
65935-65940	18-9/16	16-1/8	15-5/8	15-5/8

BE SURE TO USE DISCHARGE AIR REGISTER(S) THAT PROVIDE THE FOLLOWING MINIMUM TOTAL FREE AREA:

65917 & 65920 = 24 sq. in.  
 65925 & 65930 = 36 sq. in.  
 65935 & 65940 = 48 sq. in.

## VENT INSTALLATION

Slide vent assemblies in place, caulk to effect a seal against weather and secure in place using selected screws.

**NOTE:** Be sure proper vents are used.

- A. Vent with cone is the flue exhaust vent. It must be installed on the right side as viewed from rear of unit.
- B. Three lengths are available. Be sure to use the one having the proper length for your application.
  1. 3-13031-001 - 0" - 2" vents for use when furnace back is 0" to 2" from outside surface of wall. Over-all vent length is 3 3/4".
  2. 3-13031-002 - 2" - 4" vents for use when furnace back is 2" to 4" from outside surface of wall. Over-all vent length is 5 3/4".
  3. 3-13031-003 - 4" - 6" vents for use when furnace back is 4" to 6" from outside surface of wall. Over-all vent length is 7 3/4".

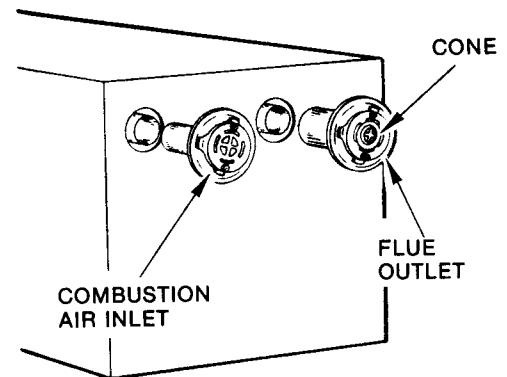


FIG. 9

VENT KIT NO.	3-13031-001	3-13031-002	3-13031-003
FLUE ASSY.	3-13041-001	3-13041-002	3-13041-003
COMB. AIR ASSY.	3-13042-001	3-13042-002	3-13042-003

**ELECTRICAL WIRING**

**CAUTION:** Be sure all power supply wiring to the furnace is properly sized to keep voltage drop to the unit to a minimum. The following is recommended for the 12V DC power supply:

MODEL	MAX. WIRE LENGTH OF EACH CONDUCTOR	MIN. WIRE GAGE
65917 65920	40 Ft.	#14
65925 65930	24 Ft.	#14
65935 65940	21 Ft.	#14

IF LONGER WIRE LENGTHS ARE REQUIRED, A MAXIMUM VOLTAGE DROP OF .4 VOLTS/CONDUCTOR SHOULD BE MAINTAINED BETWEEN THE POWER SUPPLY AND FURNACE.

**AMP DRAW FOR 12 V DC OPERATION**

MODEL	AMPERAGE
65917 - 65920	4.5
65925 - 65930	6.5
65935 - 65940	8.0

Circuit breakers, when applicable, shall be sized in accordance with the National Electrical Code. Local codes where applicable take precedence over these recommendations.

Knockouts are provided in both top and right side of casing for power supply and thermostat wiring entry to the unit. Select the desired positions for power supply entry into the casing and remove the selected knockouts. The wiring junction box is located in the upper right front corner of the casing.

**ROOM THERMOSTAT LOCATION AND WIRING**

Locate the room thermostat approximately 4-1/2 feet above the floor and on an inside wall where it will not be affected by heat from any source except room air. Use 18 gauge stranded or solid thermostat wires and route the thermostat wires to the unit location. The thermostat wires may also be routed into the casing either thru top or side. Knockout desired hole, install rubber grommet and complete thermostat wiring by connecting to the two blue pigtails provided inside the casing.

**If the furnace contains a power converter, do not attempt to check it out by shorting to ground. Do not disconnect any power lead and short to ground. Any shorting or arcing of the leads may damage the furnace components.**

**GAS PIPING**

A 3/8" female NPT connection is provided at the control valve inlet for gas supply connection to the furnace. The gas supply line to the furnace must be of adequate size to provide 11 inches water column gas pressure. This pressure must be maintained under maximum flow conditions with all gas appliances in operation. Tubing may be type "K" for Propane Gas (Bottle Gas). However, be sure to check with ANS, CGA and CSA Standards for any other requirements concerning gas piping. Piping sealant compounds shall be resistant to the actions of LP gases.

Gas line hook-up is made through a knockout hole provided in the left side or top of the furnace casing. **BE SURE TO INSTALL FURNISHED NYLON GROMMET IN SELECTED HOLE.** Actual hook-up is accomplished inside the furnace casing immediately ahead of the gas control valve.

**120VAC WIRING CONNECTIONS (IF REQUIRED)**

Route the 120V AC wiring thru the front hole selected in the junction box and connect to the black and white wire pigtails located in the front portion of the junction box. Be sure to securely connect the grounding wire to the grounding terminal which is also located within the same portion of the box. Install the required strain relief in side of casing when hooking up supply wires.

**12VDC WIRING CONNECTIONS**

Route the 12V DC wiring thru the rear hole selected into the junction box and connect to the yellow and red wire pigtails located in the rear portion of the junction box. Install the required strain relief in side of casing when hooking up supply wires.

**WARNING:** Connect positive (+) of battery or external converter to positive (+) red wire. Connect negative (-) of battery or external converter to negative (-) yellow wire provided with unit.

**WIRING CAUTION:** Polarity must be strictly observed when connecting the unit to a 12V DC power supply. If polarity is reversed to the unit the blower will run in reverse and the furnace will not heat.

**CAUTION:**

**Do not perform any high potential test on this furnace. These tests have been conducted on the furnace before leaving the factory. If vehicle hi-pot testing is required, disconnect the furnace wiring before testing.**

Furnace models equipped for dual voltage usage are equipped with an internal relay which automatically switches the power supply source to the furnace from DC to AC when the AC power is connected to the vehicle. The relay automatically switches back to a 12V DC power supply when the 120V AC power supply is disconnected.

**CAUTION: DO NOT TWIST GAS VALVE DURING PIPING.**

**NOTE:** Standards may require installation of an external manual shut-off valve. If required, the manual valve must be located outside the confines of the furnace casing.

After connections have been made, apply pressure, not less than 10" or more than 14" water column, and check all joints for leaks with a soap solution. This also should include a check of the furnace controls and piping. **NEVER CHECK FOR LEAKS WITH A LIGHTED MATCH.**

# Sequence of Normal Operation

1. When the thermostat calls for heat, the blower motor is energized immediately.
2. As the blower motor reaches approximately 75 percent of the normal r.p.m. (within 1 to 2 seconds) the combustion air switch in response to the air flow, will engage allowing current flow to the gas valve.
3. The current to the gas valve opens it and allows gas to flow to the burner. The pilot light then ignites the main burner gas.

NOTE: If the furnace is equipped with direct spark ignition, the spark produced from the ignitor electrode ignites the main burner.

4. If within a period of approximately 1 minute after the main burner is lit, the thermostat is turned back, both the blower motor and gas valve are de-energized. However, if the furnace continues to run longer than 1 minute, which it normally should, a slight snap can be heard from within the casing. The snap is caused by the fan switch as it changes its position. After this occurs, if the thermostat is satisfied or turned back, the gas valve will close, the flame on the main burner will go out, but the blower will continue to run for a short period of time and will then shut off. The purpose of this is to remove most of the remaining gases and heat from the heat exchanger.

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## OPERATIONAL CHECKOUT – PILOT MODELS

**IMPORTANT** - FAILURE TO FOLLOW THESE LIGHTING INSTRUCTIONS EXACTLY MAY RESULT IN DAMAGE TO THE UNIT.

1. SET THERMOSTAT TO HIGHEST SETTING. REMOVE FRONT PANEL.
2. TURN GAS VALVE KNOB TO "OFF" POSITION. WAIT 5 MINUTES.
3. RESET THERMOSTAT TO LOWEST SETTING.
4. TURN GAS VALVE KNOB TO "PILOT" POSITION. DEPRESS KNOB AND LIGHT PILOT BY DEPRESSING IGNITOR. SEVERAL STROKES MAY BE REQUIRED BEFORE PILOT GAS WILL IGNITE.

On the initial lighting the pilot may not light immediately due to air in the gas line. If such is the case, it may be necessary to hold the reset button "in" for a minute or more before the pilot lights.

5. When the pilot continues to burn, hold the reset button in for approximately 30 seconds or until the pilot remains lighted when the reset button is released. IF PILOT GOES OUT, REPEAT STEPS 2 AND 4, ALLOWING LONGER TIME BEFORE RELEASING GAS VALVE KNOB.
6. Turn gas valve knob to full "on" position. Correct operation of the unit depends on this valve being in the full "on" position. Never attempt to operate the unit with valve partially closed.

7. Replace furnace front panel.
8. Set thermostat at desired temperature. Furnace will now operate automatically.

If ignitor should fail for any reason, the pilot may be manually lighted as follows:

- A. Set thermostat to highest setting. Remove front panel.
- B. Turn gas valve knob to "off" position. Wait 5 minutes.
- C. Reset thermostat to lowest setting.
- D. Open pilot lighting door.
- E. Turn gas valve knob to "pilot" position. Depress knob and light pilot using lighter rod and match.
- F. Hold gas valve knob down for 30 seconds and release. If pilot goes out, repeat Steps B and E, allowing longer time before releasing knob. Close pilot lighting door.
- G. Turn gas valve knob to full "on" position.
- H. Replace front panel. Set thermostat to desired setting.

FOR COMPLETE SHUT-DOWN PRESS VALVE DIAL AND TURN TO "OFF". SET THERMOSTAT TO "OFF" SETTING.

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## OPERATIONAL CHECKOUT—DIRECT SPARK IGNITION MODELS

**IMPORTANT**— FAILURE TO FOLLOW THESE LIGHTING INSTRUCTIONS EXACTLY MAY RESULT IN DAMAGE TO THE UNIT.

1. SET THERMOSTAT ON "OFF" POSITION. TURN GAS VALVE TO "OFF" POSITION. WAIT 5 MINUTES.
2. TURN GAS VALVE TO "ON" POSITION. SET THERMOSTAT TO "ON" POSITION AND ADJUST TO DESIRED SETTING.
3. ALLOW 15 SECONDS FOR BURNERS TO IGNITE.
4. IF BURNERS DO NOT LIGHT, SET THERMOSTAT ON "OFF" POSITION, WAIT 15 SECONDS AND REPEAT STEPS 2 & 3.
5. IF IGNITION IS NOT OBTAINED AFTER 3 TRYS, GO TO COMPLETE SHUT DOWN AND DETERMINE CAUSE.

## Short Circuit Checkout

If fuses are blown either in the furnace or vehicle, a short is indicated and should be checked.

1. Turn off all appliances including furnace.
2. Install an ammeter on the positive (+) lead of the battery. Amperage reading should be 0. If an amperage reading is noted, a short exists in the vehicle system.
3. Disconnect the red (+) DC lead at the furnace. If the amperage continues, the short is exterior to the furnace. If the amperage reading ceases, the furnace electrical system is shorted and should be checked.
4. Refer to the operational and service instructions for a complete checkout.

## COMPLETE SHUT DOWN

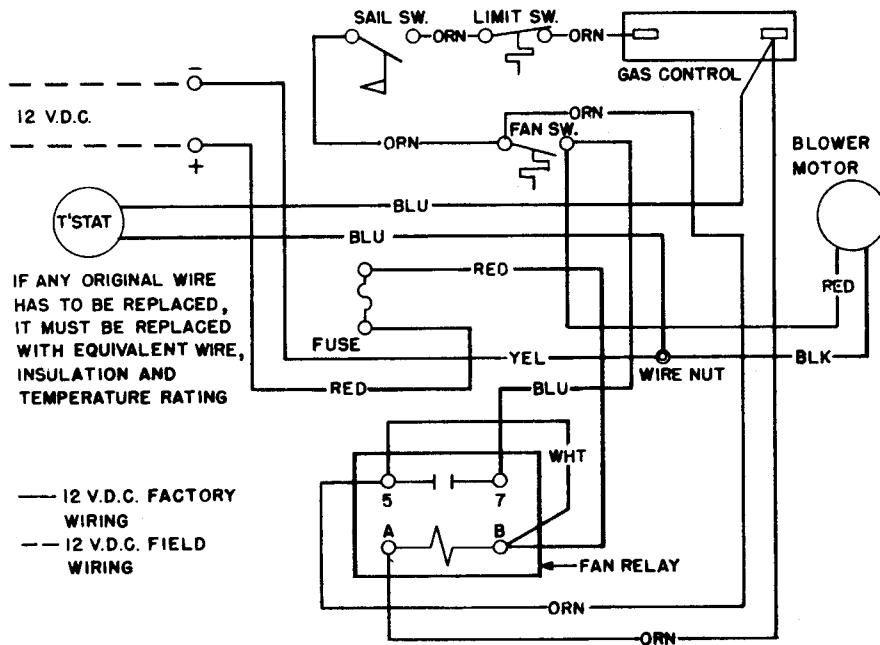
1. TURN GAS VALVE KNOB TO "OFF" POSITION.
2. SET THERMOSTAT ON "OFF" POSITION.

### WIRING DIAGRAM

12 VDC

-022, -024, -032, AND -034 MODELS

—PILOT MODELS—

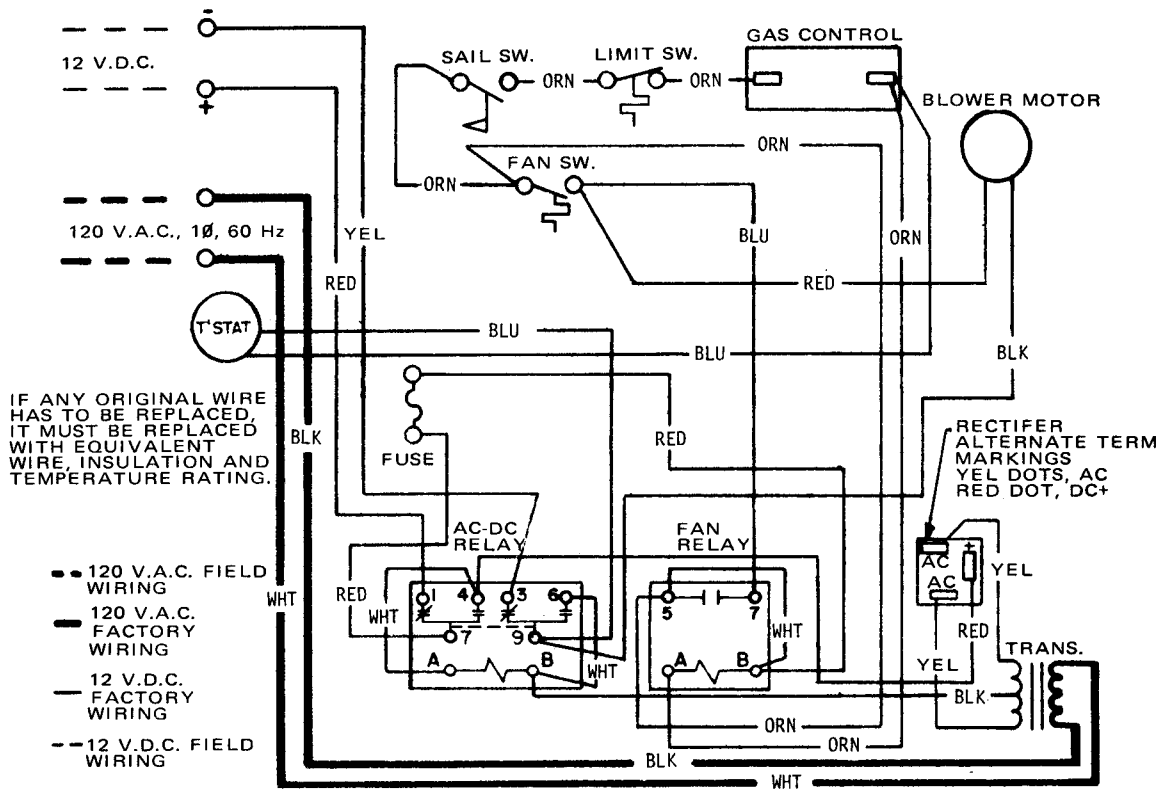


### WIRING DIAGRAM

120 VAC/12 VDC

-021, -023, -031, AND -033 MODELS

—PILOT MODELS—

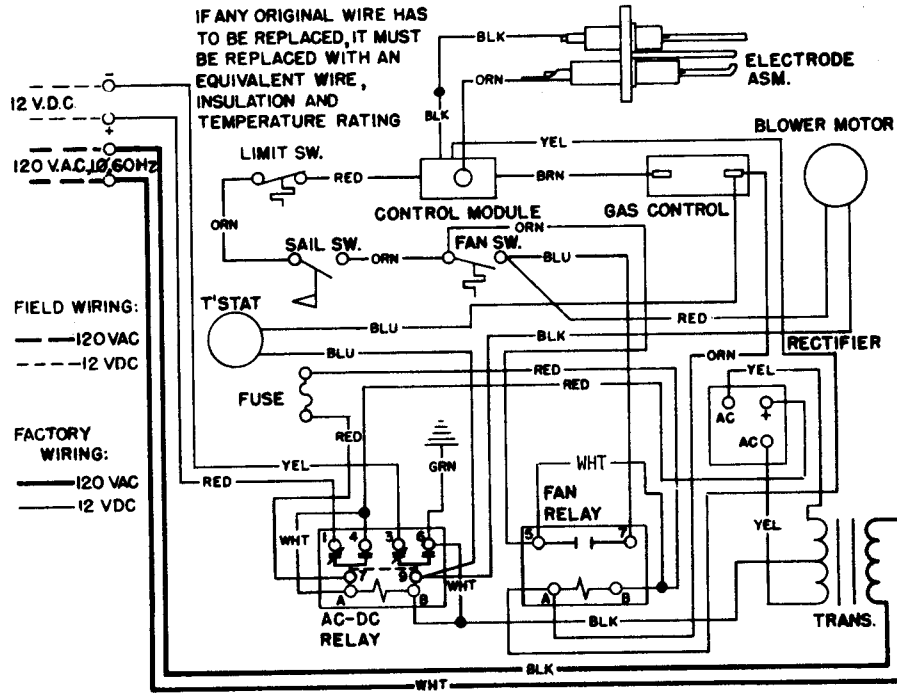


# WIRING DIAGRAM

120V AC/12V DC

-025, -027, -029, -035, -037, AND -039 MODELS

—DIRECT SPARK IGNITION—

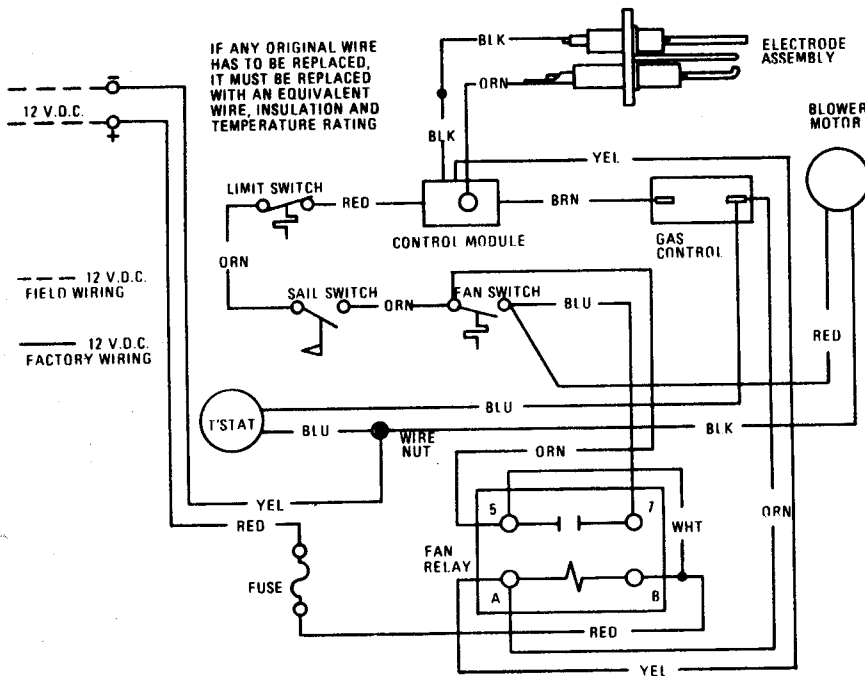


# WIRING DIAGRAM

12 VDC

-026, -028, -030, -036, -038, AND -040 MODELS

—DIRECT SPARK IGNITION—

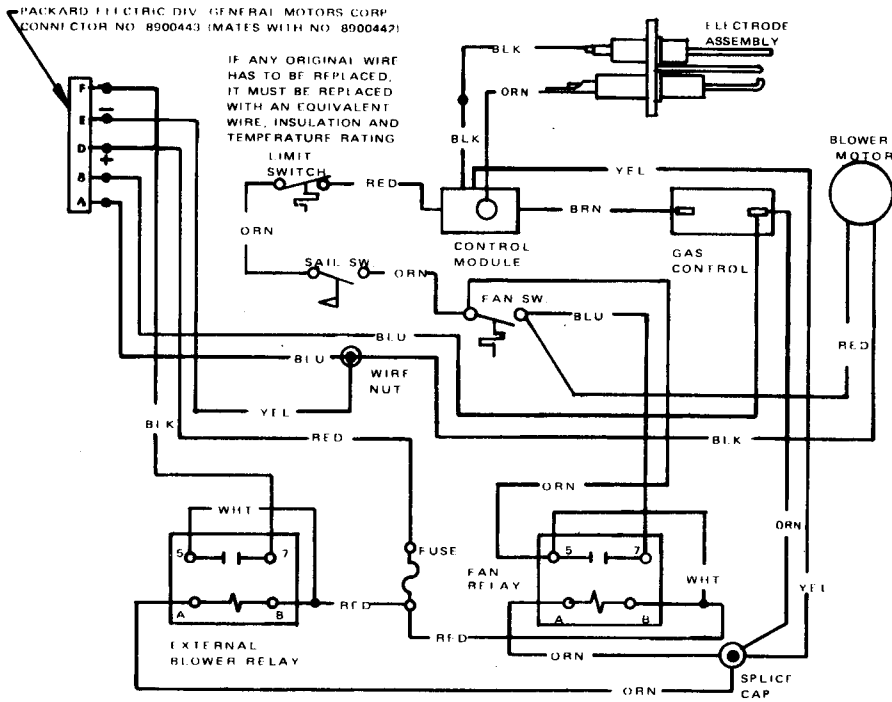




# MODEL 65930-926

## WIRING DIAGRAM

12VDC



MODEL 65930-926 INCLUDES A RELAY TO POWER THE REMOTE BLOWER LOCATED WITHIN THE DUCT SYSTEM. THE OPERATIONAL SEQUENCE PERMITS THE REMOTE BLOWER AND THE FURNACE BLOWER TO OPERATE WHEN THE THERMOSTAT IS CALLING FOR HEAT. WHEN THE THERMOSTAT IS SATISFIED, THE REMOTE BLOWER WILL STOP AND THE FURNACE BLOWER WILL CONTINUE TO RUN UNTIL THE FAN SWITCH WITHIN THE FURNACE IS SATISFIED.

# DUO-THERM



**65900  
SERIES**

**Gas Direct-Vent Forced Air  
Furnaces for Mobile Homes  
or Recreational Vehicles**

**OWNERS    MANUAL**

NOTE: Standards may require installation of an external manual shut-off valve. If required, the manual valve must be located outside the confines of the furnace casing.

After connections have been made, be sure all joints are checked with soap solution to detect leaks. This also should include a check of the furnace controls and piping. **NEVER CHECK FOR LEAKS WITH A LIGHTED MATCH.**

### OPERATIONAL CHECKOUT

**IMPORTANT: Failure to follow these lighting instructions exactly may result in damage to the unit.**

1. Set thermostat to highest setting. Remove front panel.
2. Turn gas valve knob to "Off" position. Wait 5 minutes.
3. Reset thermostat to lowest setting.
4. Turn gas valve knob to "Pilot" position. Depress knob and light pilot by depressing ignitor. Several strokes may be required before pilot gas will ignite.

On the initial lighting the pilot may not light immediately due to air in the gas line. If such is the case, it may be necessary to hold the reset button "In" for a minute or more before the pilot lights.

5. When the pilot continues to burn, hold the reset button in for approximately 30 seconds or until the pilot remains lighted when the reset button is released. IF PILOT GOES OUT, Repeat Steps 2 and 4, allowing longer time before releasing gas valve knob.
6. Turn gas valve knob to full "On" position. Correct operation of the unit depends on this valve being in the full "On" position. Never attempt to operate the unit with valve partially closed.
7. Replace furnace front panel.
8. Set thermostat at desired temperature. Furnace will now operate automatically.

If ignitor should fail for any reason, the pilot may be manually lighted as follows:

- A. Set thermostat to highest setting. Remove front panel.
- B. Turn gas valve knob to "Off" position. Wait 5 minutes.
- C. Reset thermostat to lowest setting.
- D. Open pilot lighting door.
- E. Turn gas valve knob to "Pilot" position. Depress knob and light pilot using lighter rod and match.
- F. Hold gas valve knob down for 30 seconds and release. If pilot goes out, repeat Steps B and E, allowing longer time before releasing knob. Close pilot lighting door.
- G. Turn gas valve knob to full "On" position.
- H. Replace front panel. Set thermostat to desired setting.

**FOR COMPLETE SHUT-DOWN PRESS VALVE DIAL AND TURN TO "OFF". SET THERMOSTAT TO "OFF" SETTING.**

### OPERATIONAL CHECKOUT - DIRECT SPARK IGNITION MODELS

**IMPORTANT - FAILURE TO FOLLOW THESE LIGHTING INSTRUCTIONS EXACTLY MAY RESULT IN DAMAGE TO THE UNIT.**

1. Set thermostat on "OFF" position. Turn gas valve to "OFF" position. Wait 5 minutes.
2. Turn gas valve to "ON" position. Set thermostat to "ON" position and adjust to desired setting.
3. Allow 15 seconds for burners to ignite.
4. If burners do not light, set thermostat on "OFF" position, wait 15 seconds and repeat steps 2 & 3.
5. If ignition is not obtained after 3 tries, go to complete shut down and determine cause.

### COMPLETE SHUT DOWN

1. Turn gas valve knob to "OFF" position.
2. Set thermostat on "OFF" position.

### SEQUENCE OF NORMAL OPERATION

1. When the thermostat calls for heat, the blower motor is energized immediately.
2. As the blower motor reaches approximately 75 percent of the normal r.p.m. (within 1 to 2 seconds) the combustion air switch, in response to the air flow and providing supply of air for combustion, will engage allowing current flow to the gas valve.
3. The current to the gas valve opens it and allows gas to the main burner. The pilot light then ignites the main burner. If the furnace is equipt with direct spark ignition, the spark produced from the ignitor electrode ignites the main burner.
4. If within a period of approximately 1 minute after the main burner is lit, the thermostat is turned back, both the blower motor and gas valve are de-energized. However, if the furnace continues to run longer than 1 minute, which it normally should, a slight snap can be heard from within the casing. The snap is caused by the fan switch as it changes its position. After this occurs, if the thermostat is satisfied or turned back, the gas valve will close, the flame on the main burner will go out, but the blower will continue to run for a short period of time and will then shut off. The purpose of this is to remove most of the remaining gases and heat from the heat exchanger.

### BLOWER ASSEMBLY

One motor is used to drive both the combustion air and the circulating air blower wheels. Although one motor drives all wheels the blowers are separate. The combustion-air blower is sealed so as to allow no passage of air between it and the circulating room-air blower. The combustion-air blower draws air from the outside atmosphere, discharges it into the combustion chamber, and forces the combustion products out the exhaust tube. The circulating room-air blower pulls return air in and forces it across the heat chamber, discharging it to the area to be heated.

### AUTOMATIC SOLID STATE RECTIFIER SYSTEM ON DUAL VOLTAGE MODELS

Diodes are mounted on a large heat sink and combine with the transformer to create a full-wave rectifier which converts 115-volt a.c. to 12-volt d.c.

A double-pole, double-throw relay switches the unit from a.c. to d.c. / d.c. to a.c. automatically.

### NEW "PIEZOELECTRIC" IGNITION SYSTEM FOR PILOT MODELS

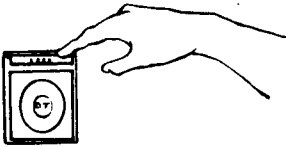
This new spark ignitor has been added to facilitate lighting. It is a solid state device with no outside current required.

Depressing the "Ignition Button" creates a spark at the ignitor tip. Normally the unit will ignite with the first spark. In the event the unit does not readily light with the ignitor, it is possible the ignitor tip may need repositioning-aligning the ignitor tip with the pilot gas flow can be accomplished through the lighter hole.

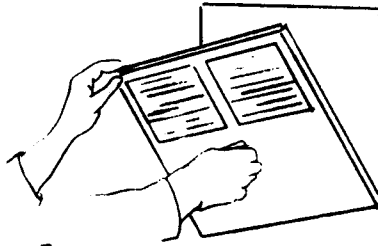
On initial lighting, air in the gas line may require several pumps of the "Ignitor Button" for ignition.

The new ignitor does not prevent the lighting by match if necessary.

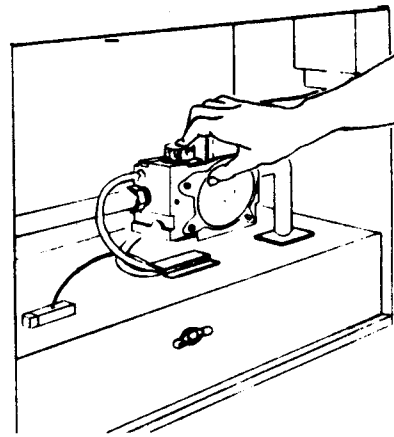
# PILOT MODELS



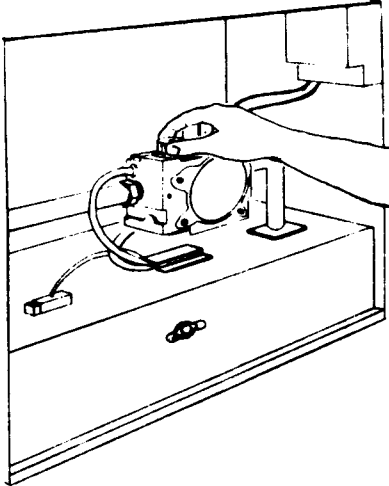
1. Set thermostat to highest setting.



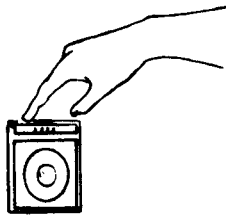
Remove front panel.



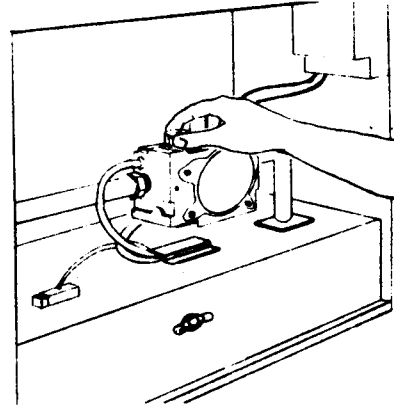
5. When the pilot continues to burn hold the reset button in for approximately 30 seconds or until the pilot remains lighted when the reset button is released. If pilot goes out, repeat Steps 2 and 4 allowing longer time before releasing gas valve knob.



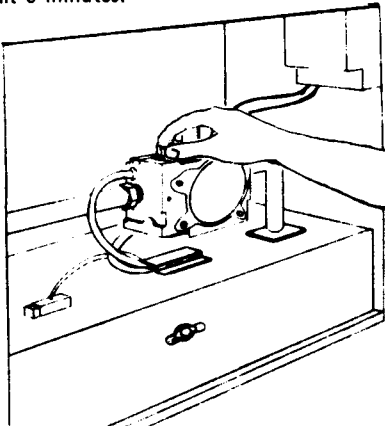
2. Turn gas valve knob to "Off" position. Wait 5 minutes.



3. Reset thermostat to lowest setting.

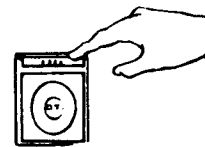
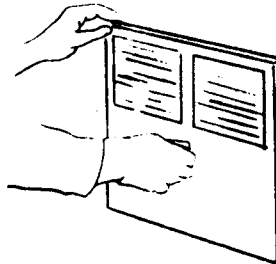


6. Turn gas valve knob to full "On" position. Correct operation of the unit depends on this valve being in the full "On" position. Never attempt to operate the unit with valve partially closed.

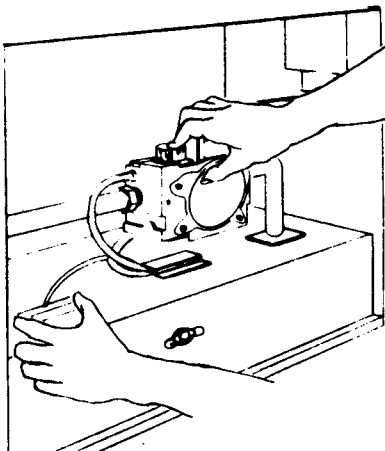


4. Turn gas valve knob to "Pilot" position.

7. Replace furnace front panel.

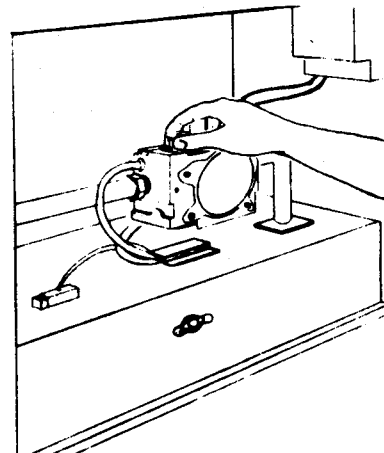


8. Set thermostat at desired temperature. Furnace will now operate automatically.

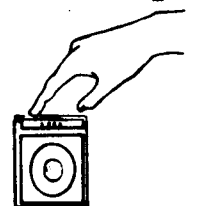


Depress knob and light pilot by depressing ignitor. Several strokes may be required before pilot gas will ignite.

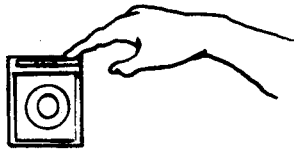
On the initial lighting, the pilot may not light immediately due to air in the gas line. If such is the case it may be necessary to hold the reset button "In" for a minute or more before the pilot lights.



For complete shut-down, press valve dial and turn to "Off". Set thermostat to "Off" setting.

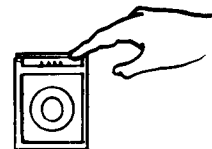


## DIRECT SPARK IGNITION MODELS

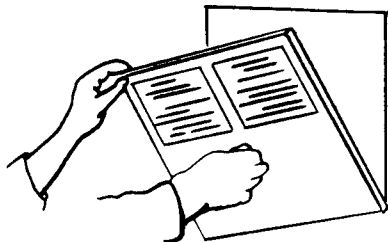


1. Set thermostat to "OFF" position.

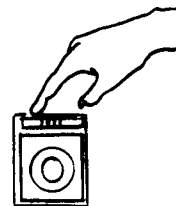
4. Set thermostat at desired temperature.  
Furnace will now operate automatically.



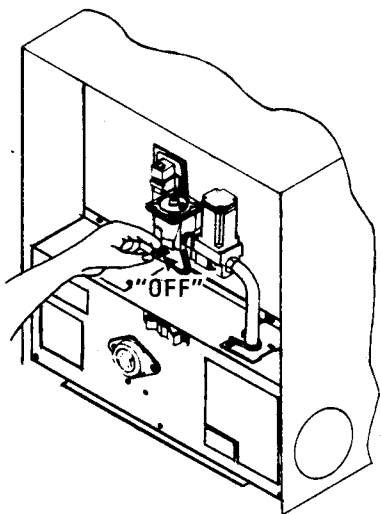
Remove front panel.



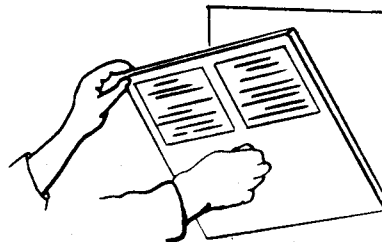
5. Allow 15 seconds for burners to ignite.



6. If burners do not light, set thermostat on "OFF" position. Wait 15 seconds. Repeat steps 4 and 5.

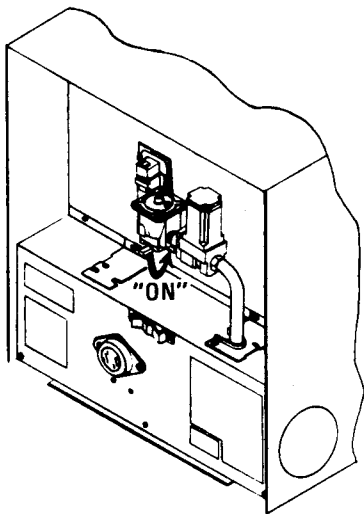


2. Turn gas valve knob to "OFF" position.  
Wait 5 minutes.

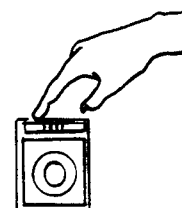
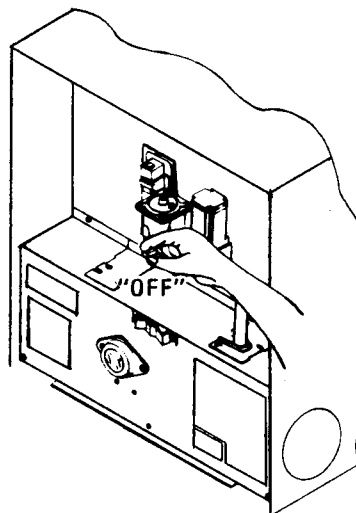


7. Replace furnace front panel when ignition is obtained.

8. If ignition is not obtained after three tries, go to complete shut-down and determine cause.



3. Turn gas valve knob to full "ON" position. Correct operation of the unit depends on this valve being in the full "ON" position. Never attempt to operate the unit with valve partially closed.



FOR COMPLETE SHUT-DOWN, TURN GAS VALVE KNOB TO "OFF". SET THERMOSTAT TO "OFF" SETTING.

## FAN SWITCH

The fan switch is to control the sequence of the blower operation. The fan switch is a two pole switch. When the bimetal disc of the fan switch is heated to the operating temperature, the switch changes positions to close 1 and 3. This completes a circuit through the motor from a direct source. The blower will continue to run as long as the chamber is hot even though the thermostat is satisfied and the main burner is off. When the chamber cools, the fan switch changes back to its original position and shuts the blower off.

## LIMIT SWITCH

The purpose of the limit control is to turn off the gas to the main burner if for any reason the furnace becomes hotter than that which is safe. Improper operation of the furnace due to the limit control does not always indicate a defective control. If the circulating air is blocked or only partially so, the limit control will function and cause the main burner to short cycle. If short cycling exists, the furnace blower and the circulating air system should be thoroughly cleaned.

If for any reason the limit control is found to be defective, there is no recommended method of repairing it. Because of its importance for safety reasons, it should be replaced with a new one. **CAUTION: Never short across or bypass the Limit Control even for only temporary operation.**

## AIR SWITCH

The combustion air switch has two purposes:

1. It is an "air prover". It operates in response to the current of air generated by the blower. Hence, if for any reason the air from the blower is not sufficient, the switch will not operate. This may be caused by a slow motor due to low voltage, restricted return air, or lint accumulation on the blower wheel.
2. The switch allows time for the blower to pull in sufficient amount of air to support combustion before it engages. Once it engages, the solenoid valve opens, gas flows to burner, and ignition occurs.

## MAINTENANCE AND CLEANING

**NOTE:** For continued satisfactory performance of this unit it is necessary that the control compartment be kept clean. Routine inspection, maintenance and cleaning is recommended at least on a yearly basis.

If for any reason the main burner has been allowed to operate with a high yellow flame, a soot formation is sometimes deposited inside the combustion chamber. The carbon deposit may be of such quantity that cleaning will be necessary. To clean the combustion chamber, a vacuum cleaner is ideal to clean out any carbon deposit.

The unit is equipped with an oiled, sealed motor and requires no oiling.

## SERVICE HINTS, DIAGNOSIS AND CORRECTIVE MEASURES

### A. Complaint — NO HEAT

1. Check electrical supply to make sure that 120-volt a.c. or 12-volt d.c., or both, are available at unit. Electrical connections and power — Battery must be charged. If battery is low, there will be sufficient power to run the blower, but not enough to run the blower at full speed. If blower does not run at its prescribed speed, the combustion air switch cannot engage and gas will not flow to the main burner. Be sure the connections of the voltage lines in the terminal block are tight.
2. Check fuse located in electrical box. These furnaces use a standard automotive type fuse.

65917 & 65920	— 8 amp.
65925 & 65930	— 10 amp.
65935 & 65940	— 15 amp.

## SHORT CIRCUIT CHECKOUT

If fuses are blown either in the furnace or vehicle a short is indicated and should be checked.

3. A. Turn off all appliances including furnace.  
B. Install an ammeter on the positive (+) lead of the battery. Amperage reading should be 0. If an amperage reading is noted, a short exists in the vehicle electrical system.  
C. Disconnect the red (+) DC lead at the furnace. If the amperage continues, the short is exterior to the furnace. If the amperage reading ceases, the furnace electrical system is shorted and should be checked.
4. GAS SUPPLY — Be sure manual gas valve is in the open position.
5. PILOT — Check to be sure pilot is lit (pilot outage discussed in "B" category).
6. THERMOSTAT OFF — Check to be sure thermostat is calling for heat. Wire to thermostat could be off terminal.
7. MALFUNCTIONING COMBUSTION AIR SWITCH — Be sure the combustion air switch blade is moving far enough to close its contacts. If the switch is not closing, clean any dust or dirt from the actuator pin. Other reasons for switch not operating are:
  - A. Insufficient blower speed (slow motor due to low charged battery, faulty motor, or lint and dust accumulation on the blower wheels, or restriction of return air to furnace). Check wiring in accordance with unit's wiring diagram to assure the proper polarity of the 12-volt d.c. power supply is observed. This polarity must be observed so the motor will run the proper direction of rotation to insure correct air delivery.
  - B. Faulty combustion air switch — Replace switch if valve does not open when switch is engaged. Switch should also be replaced if battery is fully charged and blower motor running at top speed fails to engage switch within 3 to 4 seconds.

**NOTE:** To service switch, combustion chamber must be pulled out as far as needed to visually and manually check the switch.

8. GAS CONTROL VALVE — With test light check valve terminals. If current is present, but valve is not opening (when combustion air switch engages), replace control valve.
9. BLOWER NOT OPERATING — Check for burned-out motor. On dual voltage model furnaces, the a.c./d.c. switching relay could be faulty. If relay clicks, but motor fails to start, replace motor. If no click is evident, replace relay.
10. SHORT CYCLING (FAN SWITCH) — If burner and fan shut off simultaneously when the fan switch closed (2 or 3 minutes after burner comes on) it indicates a shorted fan switch. Replace switch (chamber must be removed).
11. DEFECTIVE RELAY — Relay may be faulty if motor fails to start when thermostat calls for heat. This will be evidenced by a "click" when the thermostat is raised and motor fails to operate, replace relay.

### B. Complaint — PILOT OUTAGE ON PILOT MODELS

Pilot outage can be due to several reasons. To isolate the source of a pilot outage complaint, it is very helpful to determine exactly when the pilot is going out. There are three phases of the unit operation:

1. "Off" phase.
2. Start up or ignition phase.
3. Operating phase.

## "OFF" PHASE

1. **WEAK THERMOCOUPLE OR SAFETY PILOT VALVE** – Thermocouples are generally long lived, but failures can occur after a period of use. If the pilot is observed going out during the off cycle, it could be due either to a weak thermocouple or safety pilot valve. A simple check can be made in the field by a time check. Remove the lighter hole cap and extinguish the flame after the pilot has been lit for approximately 5 minutes. Use a watch to check the time that elapses between extinguishing the pilot and the snap of the safety valve. If this is less than 30 seconds, it indicates a weak thermocouple or safety pilot valve. Replace the thermocouple first and repeat the test for the safety pilot valve. If the time lapse is still less than 30 seconds, replace the gas control valve.
2. **AIR LEAKAGE** – Draft should not affect the pilot. The unit has a sealed combustion chamber with an air intake and exhaust subject to the same atmospheric pressure. Therefore, the pressure within the chamber is equalized and air is steady. Regardless of the wind or draft condition the pilot will not be blown out as long as the chamber is sealed properly. If, however, a leak is evident, it would disrupt the pressurized chamber, and a draft air movement would commence. As a result the pilot could possibly go out.  
  
The following are points to check for air leakage. The unit should be pulled and all of these points should be carefully checked.
  - A. Pilot burner gasket must be absolutely tight.
  - B. All other gasket points, e.g., blower assemblies, gaskets.
  - C. It is possible that the gasket on the interior of the blower assembly may not be properly sealed. If not, air can flow from the sealed combustion compartment which is, in effect, air leakage. Checking this point will necessitate breaking down the blower assembly; therefore, it should be the last point to check. Nevertheless, this is an important hint as this could also be a contributing factor to pilot outage.
  - D. Restriction of exhaust tube – Visually check rear exhaust tube opening for blocking of discharge of exhaust products.
  - E. Crossover tube between lower section of blower assembly and burner tunnel may be cracked, deteriorated, or off the blower assembly flange or burner tunnel. Replace if cracked or deteriorated.
3. **LACK OF SUFFICIENT AIR** – Another reason for pilot outage during the off cycle is the lack of sufficient air to support proper pilot flame adjustment. It is important that the flame be the proper size. Unlike most heating equipment, too large a flame is a common cause of pilot outage. It should be just high enough to envelope the thermocouple. If the pilot flame is other than this or yellowish in color, replace the pilot orifice.
4. **LEAKY GAS VALVE** – If gas leaks by the gas valve during the off burner periods, it burns, using the oxygen in the chamber and causing the pilot to go out because of lack of oxygen. Observe the main burner through the lighter hole to be sure that the burner cuts off completely on the off cycle. If a flame is present, no matter how small, it indicates that a small amount of gas is leaking through. If there is leakage, replace the control valve.
5. **MALFUNCTIONING COMBUSTION AIR SWITCH** – Make sure the switch is dropping all the way out and breaking the connection in the gas valve on the off cycle of the blower.
6. **GAS SUPPLY** – Check gauge for proper gas supply and pressure.
7. **CLOGGED PILOT ORIFICE** – Evident by small pilot flame.
8. **PILOT ADJUSTMENT** – Pilot should be adjusted to where the pilot flame just envelopes the thermocouple tip.
9. **INCORRECT INSTALLATION OF INNER VENT ASSEMBLY** – This must be installed on the exterior of the trailer or motor home.

## START-UP OR IGNITION PHASE

If the pilot is observed and is going out when the burner comes on, check for the following:

1. **MALFUNCTIONING COMBUSTION AIR SWITCH** – The switch allows gas to reach the main burner by closing the circuit through the gas valve, after the blower motor has started and reached approximately 75 percent of its maximum r.p.m. This takes about 1 to 2 seconds. If the microswitch opens the gas valve too soon, the main burner flame may float and pull the pilot flame out. This is caused by lack of oxygen in the combustion chamber. If switch is engaging too fast, replace switch.

## OPERATION PHASE

If burner and fan shut off simultaneously when the fan switch closes 1 to 2 minutes after the burner comes on, it indicates a shorted fan switch. Replace the switch. If this symptom occurs, it is also possible for the pilot to go out because the blower was not allowed to turn and purge out the combustion products. The excessive amount of combustion products can smother the pilot.

### C. Complaint – EXCESSIVE NOISE

1. Blower out of balance – Replace blower.
2. Motor Hum – Replace Motor

### D. Complaint – ERRATIC BLOWER OPERATION

1. Automatic blower motor overload switch may be defective—Replace blower motor.
2. Blower assembly may be loose causing squirrel cage wheel to drag – Check assembly; secure if loose.

### E. Complaint – UNIT WILL NOT OPERATE

1. Check all wiring to assure proper connections or detect possible shorts.
2. On dual voltage furnaces check the following:
  - a. Proper wiring connections to a.c./d.c. convertor;
  - b. Transformer for burnout or shorts;
  - c. Diodes;
  - d. A.C./D.C. switching relay.

**NOTE:** On dual voltage units, replace the entire convertor under the following conditions:

1. Source of problem cannot be traced to any one convertor component.
2. Excessive voltage or lightning has been placed on the input of the convertor.

## DIRECT SPARK IGNITION

### 1. PRINCIPLE OF OPERATION

To ignite the burner, it is necessary only to set the thermostat. The thermostat powers the ignitor to simultaneously open the main burner valve and provide the ignition spark. As soon as the flame is established, the spark ceases. Should the flame not be established within a period of 15 seconds the system provides safety shut down.

Electronic flame sensing circuitry in the ignitor detects the presence or absence of main burner flame. If the flame is not established during the Flame Establishing Period, the system closes the gas valve and locks out. If the flame is extinguished during the duty cycle, the ignitor will provide one retry for ignition, before going into lock-out. To reactivate, or retry for ignition, follow the procedure outlined under "OPERATIONAL CHECKOUT-DIRECT SPARK IGNITION MODELS"

## 2. DESCRIPTION

The direct spark ignition system consists of a solid state printed circuit control module, an electrode assembly and connecting high and low voltage wires.

## 3. REPAIRS

The solid state control module is not field repairable. Any modifications or repairs will invalidate the warranty and agency certifications.

**WARNING:** Do not apply power to control module unless wiring connections are complete and electrode is properly grounded.

### CAUTION: HIGH VOLTAGE

## 4. SYSTEM CHECKS

A. Input polarity - if a spark is present and the gas valve opens but the system shuts down after the trial period, check input voltage for proper polarity.

B. Grounding - It is essential to proper operation that the system be properly grounded. If a spark is present and the gas valve opens but the system shuts down after the trial for ignition period, check for proper ground. The following items should be checked:

1. Green wire to bottom of electrical box must be secure.
2. The burners and mounting brackets must be secure.

C. Wiring - Check all wiring for proper and secure connections. Be sure the AMP connector is fully engaged in the control board. Check the high voltage wire for proper connection at both ends. Clean any corrosion that may interfere with good electrical contact.

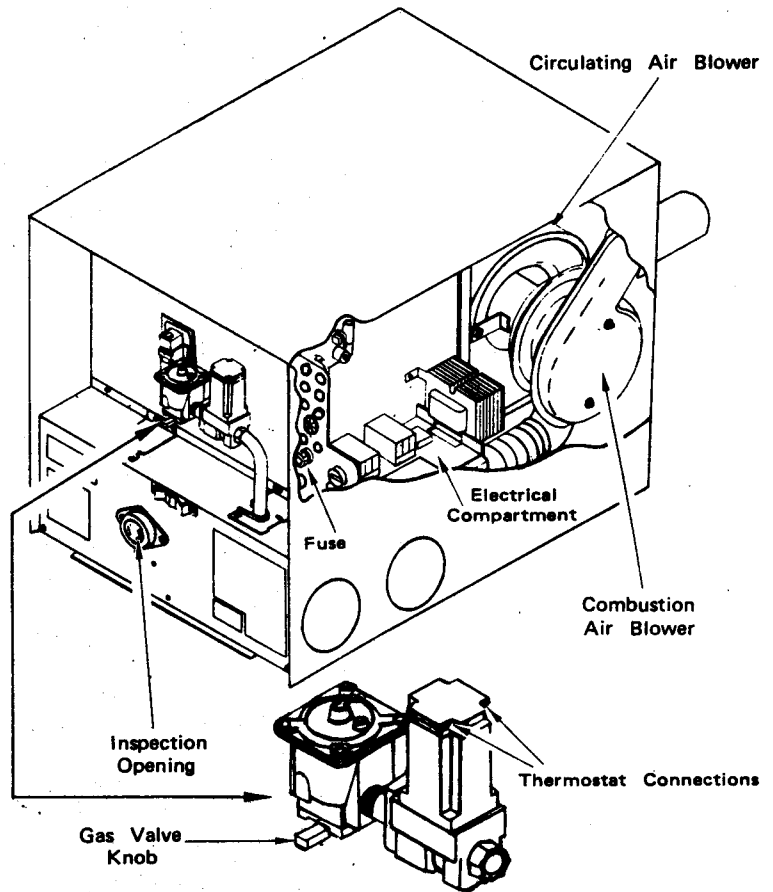
D. High Voltage Malfunction - If during the trial for ignition, the spark is intermittent and the valve may or may not open, the following should be checked:

1. Electrode spark gap - should be  $1/8'' \pm 1/32''$ .
2. Ceramic housing - check for cracks.
3. Electrode lead wires - check for cracks or breaks.

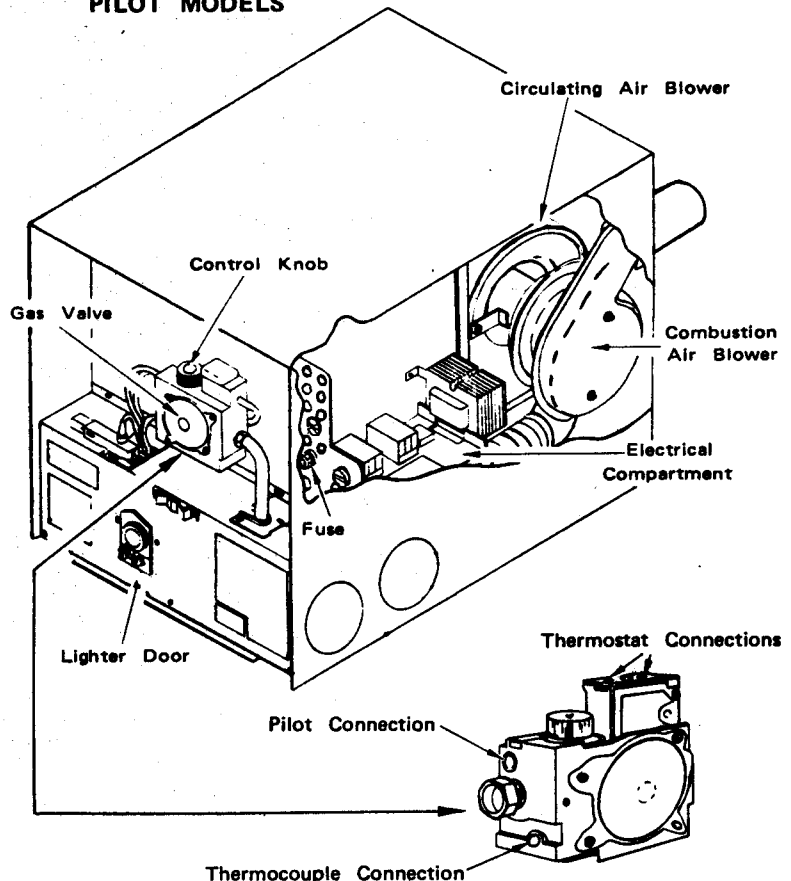
E. Valve Malfunction - If there is power to the control module and a spark during the trial for ignition, but the valve will not open, check the valve for an open coil or other malfunction.

F. Erratic Operation - If the system operates properly for a period of time, but randomly shuts down during the duty cycle, or will not operate during cold starts, check the flame proving circuit (sensor wire) with a D.C. Microamp Meter. The current should be 5 - 15 microamps. A low or marginal flame current may cause nuisance tripping. If this condition is experienced, the electrode location should be checked to make sure the sensor electrode is in the flame.

## HEATING ASSEMBLY D.S.I. MODELS



## PILOT MODELS

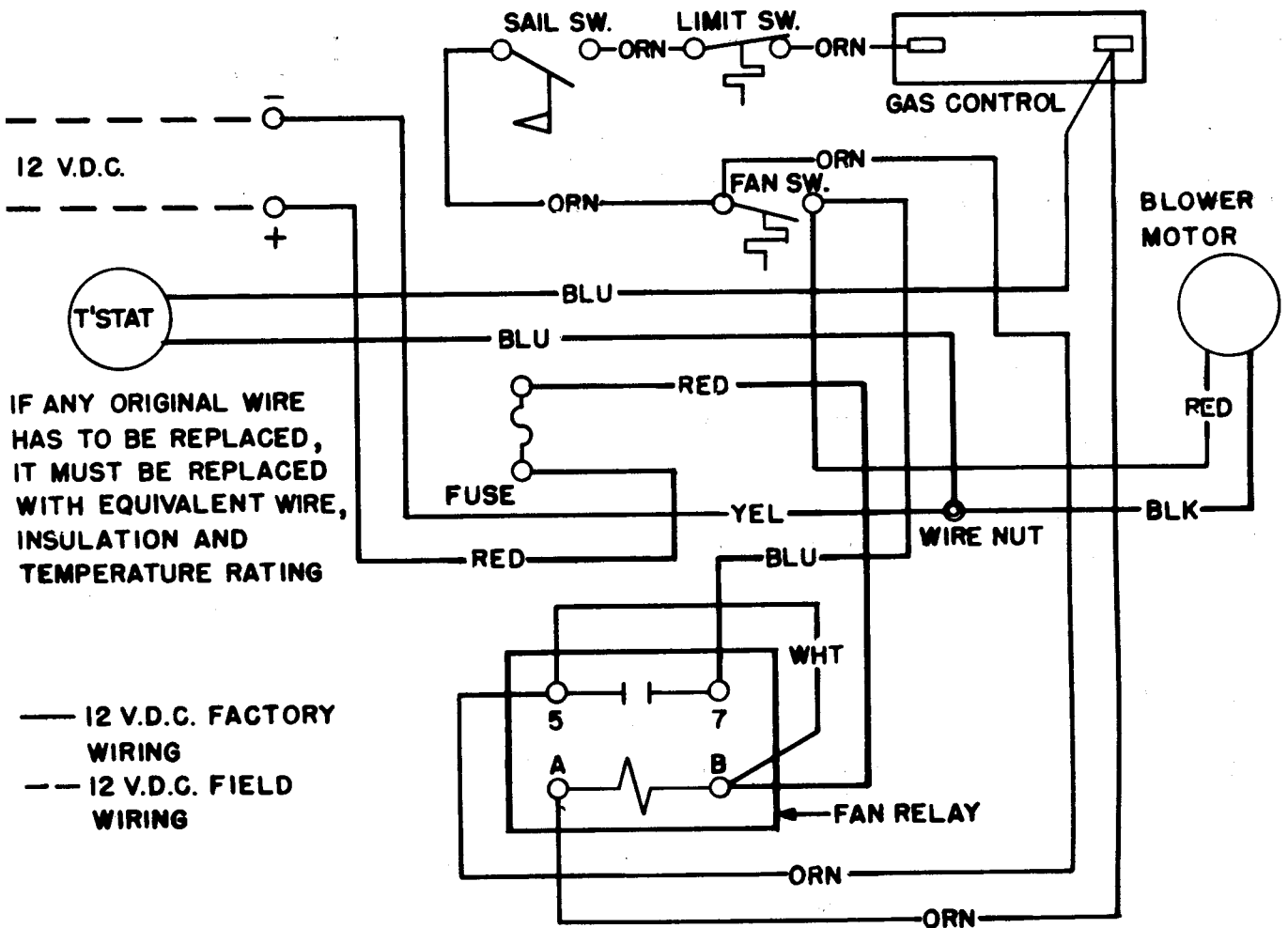




WIRING DIAGRAM

12VDC

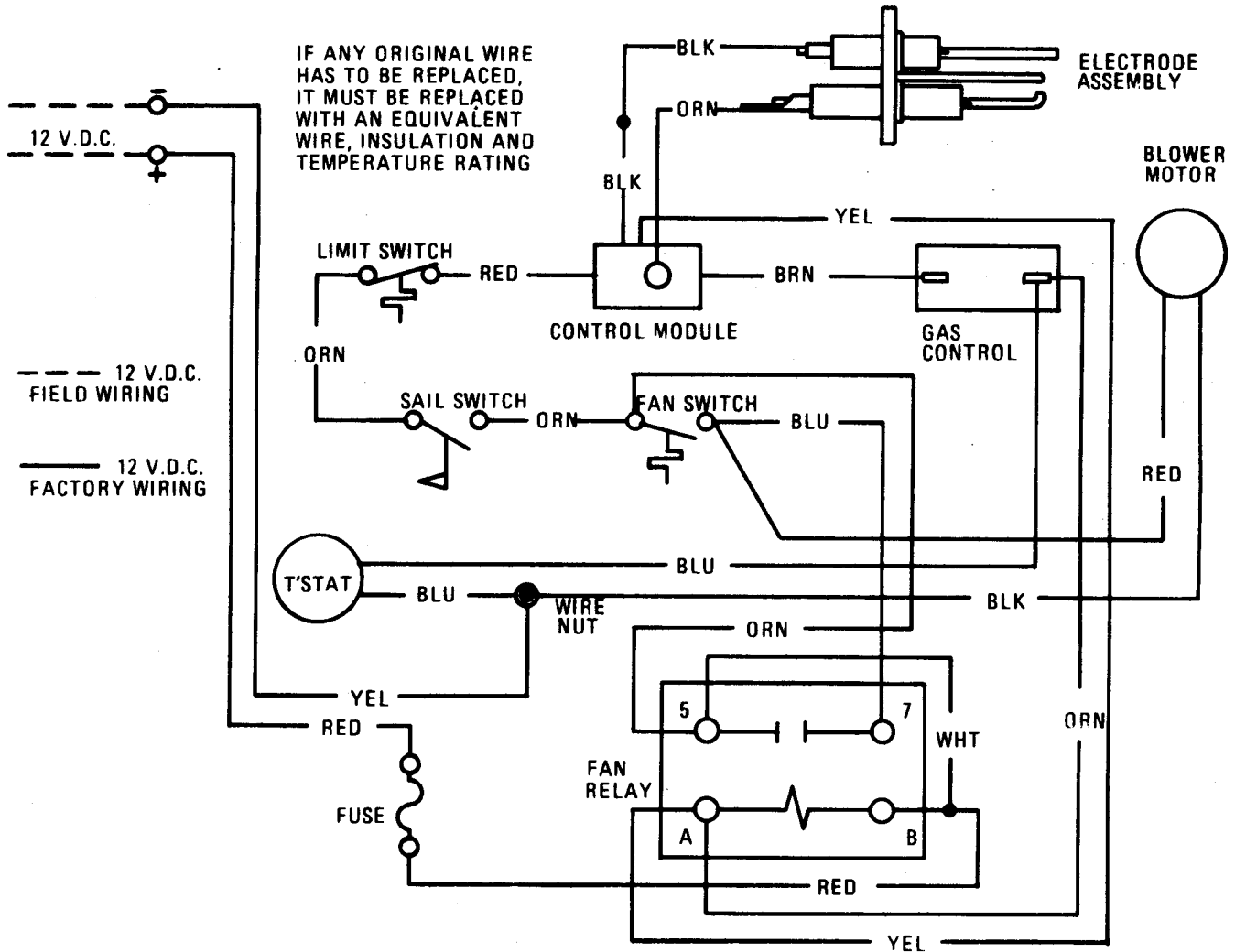
-022, -024, -032 AND -034 MODELS



# WIRING DIAGRAM

12 VDC

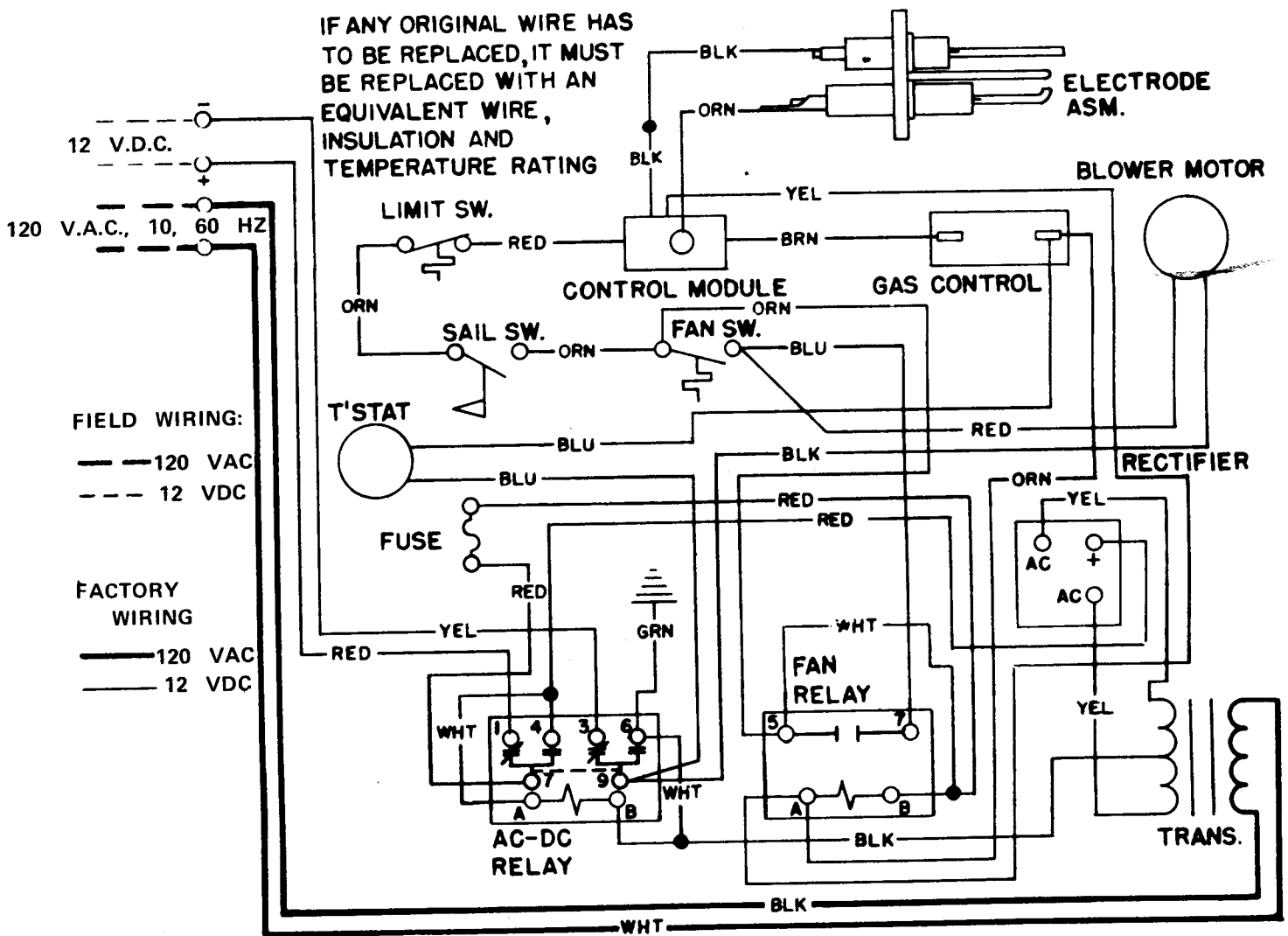
-026, -028, -030, -036, -038, -040 MODELS



# WIRING DIAGRAM

120V AC / 12V DC

-025, -027, -029, -035, -037, -039 MODELS



WIRING DIAGRAM  
120 VAC / 12 VDC  
-021, -023, -031 AND -033 MODELS

