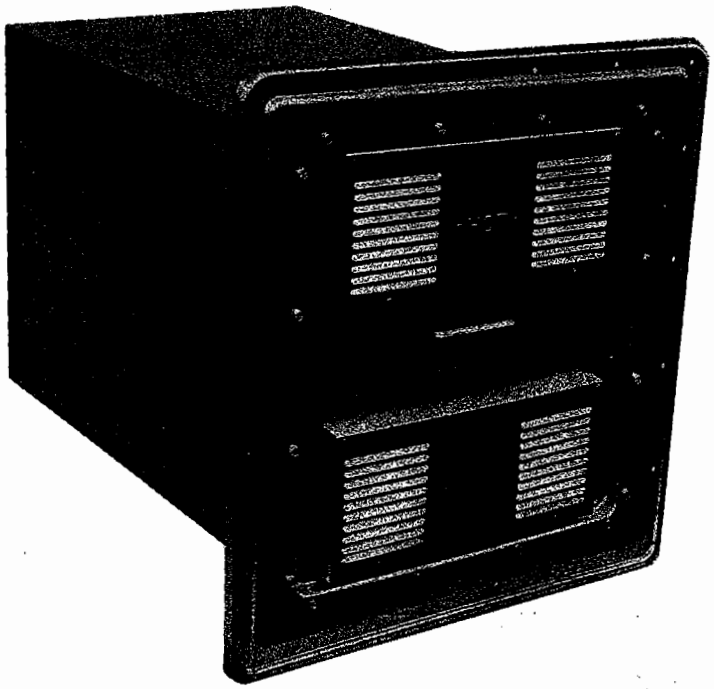
Coleman®

RECREATIONAL VEHICLE DIVISION



9200 SERIES

HORIZONTAL UNDER COUNTER FORCED-AIR FURNACE

SERVICE MANUAL

FORM A-307

TABLE OF CONTENTS

FURNACE FEATURES

MANUAL ELECTRIC IGNITION This manual covers installation and service on Recreational Vehicle horizontal furnaces, model #9216, 9223, and 9230.

An outstanding feature of model 9216, 9223, and 9230 furnace is the manual electric ignition which may be lit by an electric ignitor or a match. This furnace also incorporates a 100% safety pilot, forced air circulation and automatic temperature control.

FLUSH VENT The 9200 Series has a complete flush vent to end protrusion problems. The vent is made of embossed aluminum to give an attractive appearance to the side of your travel trailer.

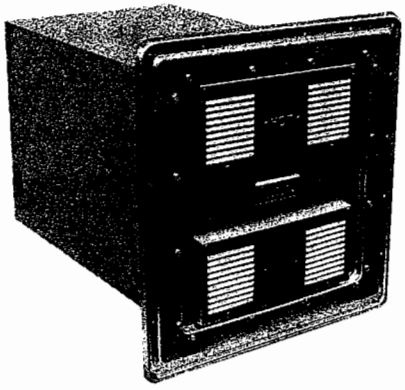


Figure 1-A 9200 Series Flush Vent

"CURRENT MISER" ELECTRICAL SYSTEM The 23,000 BTU furnace has an amp draw of 3.5 amps @ 12 V.D.C. The 9200 Series is engineered to move air at a higher temperature, resulting in a lower amp draw, more uniform heating and quieter operation.

COMFORT CONTROL THERMOSTAT Coleman's Comfort Control Thermostat gives fingertip control of heat level automatically. Setting the desired temperature means the 9200 Series will maintain the same level of lively, recirculated air as long as you like — no matter what the outside temperature or weather conditions — just like regular home central heat!

DUCT BOOT The duct boot surrounds the compact 9200 Series — makes duct connection a matter of slipping the furnace into place in the trailer from outside! Ends heat loss due to duct connector leakage. Easily installed during recreational vehicle manufacture or makes add-on of central heating easy!

NOTE: Duct Boot required for zero clearance in the floor or under floor duct systems.

FRESH AIR PACKAGE Another package allows the user to blend and mix fresh, outside air with the inside air that is constantly recirculated over the big, oversized heat exchanger. Reduces condensate problems.

"SOLID STATE" CONVERTOR Whether the power source is 115 volts or 12 volt. Coleman's "solid state" convertor means the electrical components are always operating on safe, low voltage (12 volts D. C.) A switch located on the return air grille provides positive separation of high and low voltage circuits and permits easy selection of power source. Entire system is fail-safe! Also available in a 12 volt D. C. only version.

OPTIONAL DISTRIBUTION SYSTEMS Optional side outlets for over-floor duct, or bottom outlet for in-floor or under-floor duct.

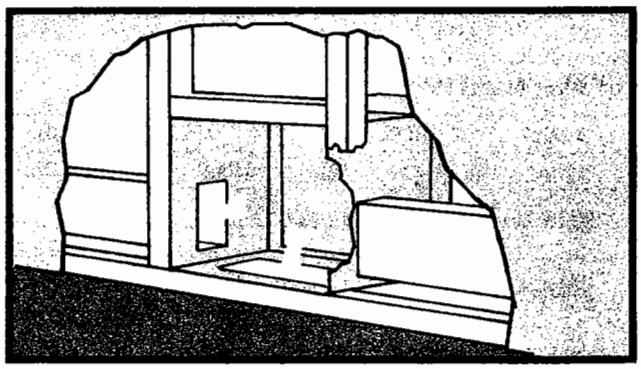


Figure 1-B Optional Discharge

ATTRACTIVE GRILLE & COUNTERFACING The sculptured return air grille, beautifully finished in fawn textured enamel, blends with every interior design.

SLIDES IN AND OUT LIKE A DRAWER Servicing is simple. Entire furnace unit slides out . . . slides in quickly to fit flush against outside surface.

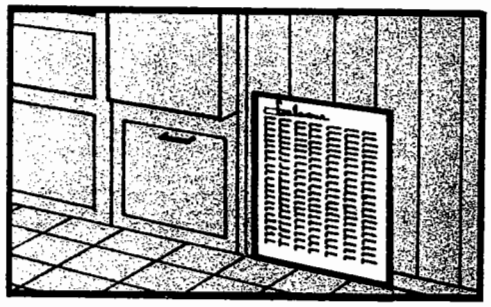


Figure I-C Return Grille

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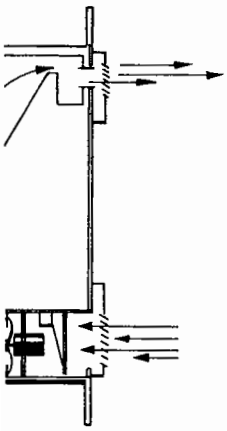


UNI-SEAL COMBUSTION Patented Uni-Seal combustion means that combustion air can never mix with circulating room air . . . for total safety. Clean-burning, sawed-slot burner with controlled draft designed for LP gas, resists wind gusts . . . burns efficiently.

ıstion

air delivery
; comfort. Air
.e blower and
into the duct

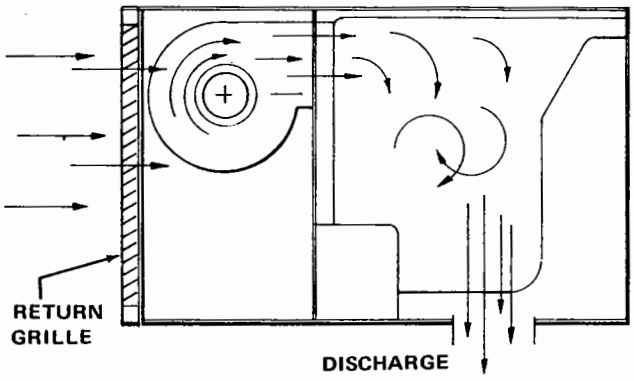


Figure 2-B High Blower Delivery

Dimensions		Warm Air Outlet Size		Elec. Service		Air	
Width	Depth	Sides	Bottom	Volts	AMPS	Delivery	Approval
14	24	3 x 7	3½ - 12	115 12	.65 3.2	150	A.G.A.
14	24	3 x 7	3½ - 12	12	3.2	150	A.G.A.
14	24	3 x 7	3½ - 12	115 12	.65 3.5	180	A.G.A.
14	24	3 x 7	3½ - 12	12	3.5	180	A.G.A.
14	24	3 x 7	3½ - 12	115 12	1.3 7.3	275	A.G.A.
14	24	3 x 7	3½ - 12	12	7.3	275	A.G.A.

'RIBUTION SYSTEMS

SIDE WALL DUCT SYSTEM

)200 Series furnace may be installed on any /eral duct systems. The side wall duct sys- ıs shown in figure 3-A may be used, or the ıce may be installed on an in-floor duct m shown in figure 3-A.

ı a side duct system is used, the supply connected to the duct boot should be 3" x :tending from both sides of the furnace the desired length. A minimum of 2 supply registers providing a minimum of 20 square inches free area in each duct is recommended.

IN-FLOOR DUCT SYSTEM

INFLOOR DUCT SYSTEM — When using an in floor duct system as shown in figure 3-B, the duct boot 3½" x 12", is connected to the 3" x 7" duct extending from both sides of the furnace the desired length. A minimum of 2 supply registers providing a minimum of 20 square inches free area in each duct is recommended.

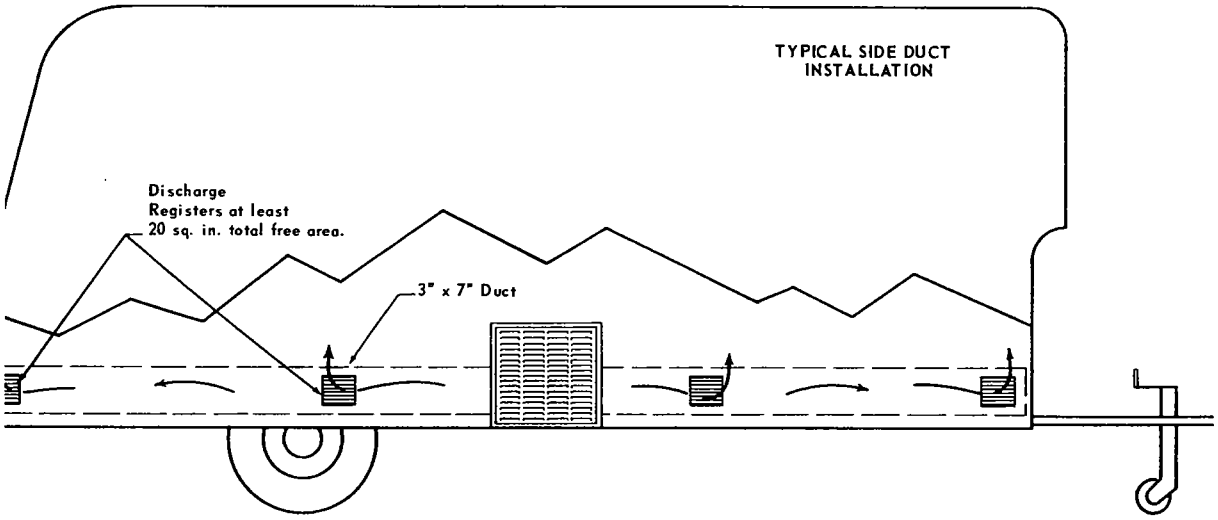
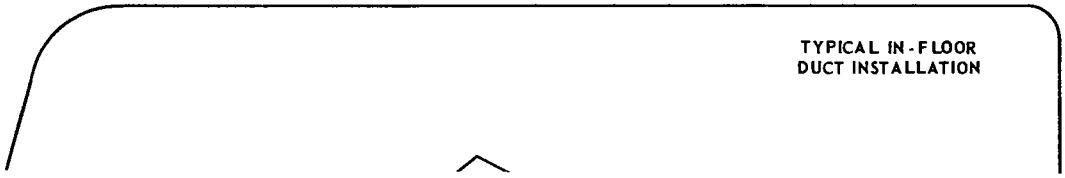


Figure 3-A Side Wall Duct System



INSTALLATION INSTRUCTIONS

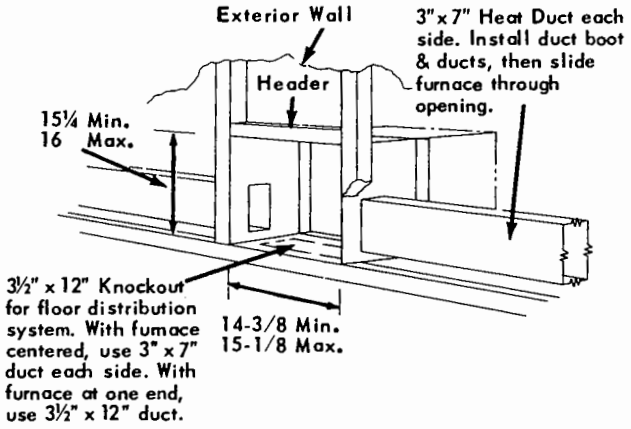


Figure 4-A Rough-In Dimensions

B. INSTALLATION REQUIREMENTS

FRAMING. Fig. 4-A shows the minimum and maximum space requirements for installation of the 9200 Series. While the furnace can be connected directly to a duct system, the duct boot installation is recommended, and required for zero clearance to a combustible floor. This optional duct boot makes duct connection a matter of sliding the furnace into place from outside the trailer, in addition to providing a positive seal.

C. DIMENSIONS AND CLEARANCES

DIMENSIONS		
ALL MODELS	A	14-⅝
	B	24
9216-789	C	14
9216-889	D	1-9/16
9223-789	E	2-3/16
9223-889	F	1-¼
9230-789	G	5¼
9230-889	H	1⅝
	J	1½

CLEARANCES	
Side	0"
Top	0"
Bottom*	0"

*When used with 8623-5101 Duct Boot.

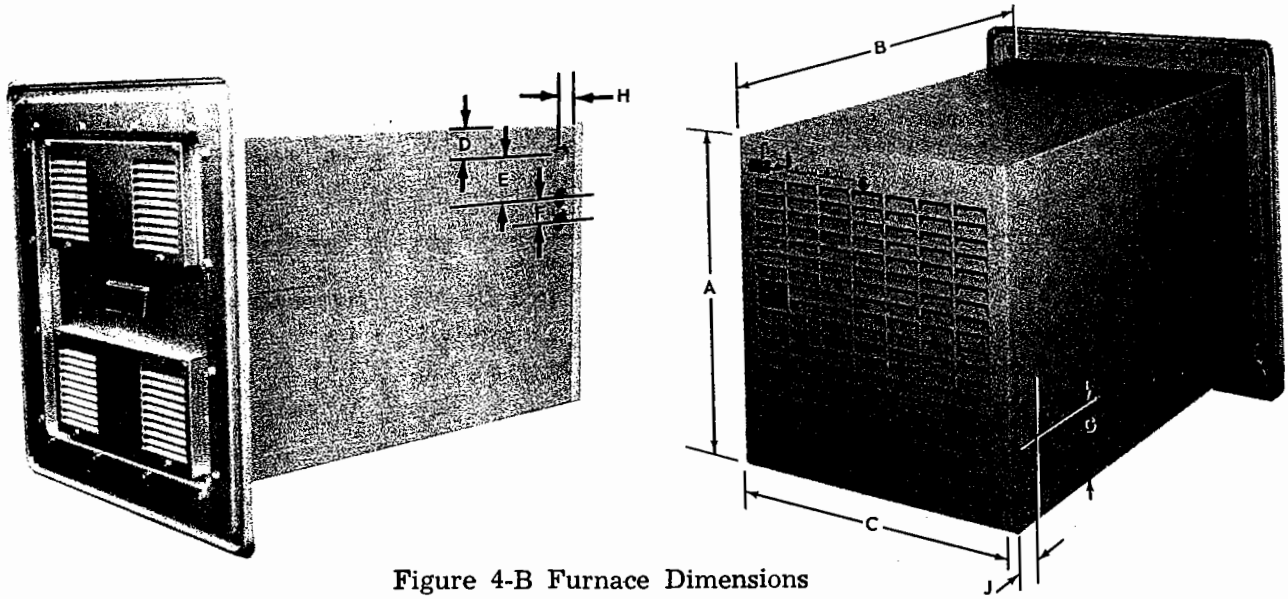


Figure 4-B Furnace Dimensions

D. INSTALLATION — GENERAL

The 9200 Series furnace can be installed in any of several configurations. The furnace is equipped with knockouts on the sides and bottom for installations on infloor ducts or above floor ducts. If an infloor duct is used, located other than directly under the furnace fabricate and install a plenum from the furnace bottom discharge to the duct.

OPTIONAL INSTALLATION ACCESSORIES. The optional duct boot is available to simplify installation. This duct boot is equipped with knockouts to allow for bottom discharge or side discharge. The duct boot must be used when installing with zero clearance to a combustible floor.

E. INSTALLATION — SIDEWALL DUCTS

1. If side discharge is desired and the duct boot is used, remove the side knockouts (3" x 7") from each side of the duct boot and furnace casing.
2. Assemble the duct boot and install in a trailer wall. Secure the duct boot to the trailer wall with nails or screws.
3. Install the 2-⅞" x 6-⅞" thimbles, supplied with the unit, through the duct boot knockouts from the inside. Bend the tabs of the thimbles down to secure them to the duct boot. Slide the duct into the thimbles and secure them with sheet metal screws.

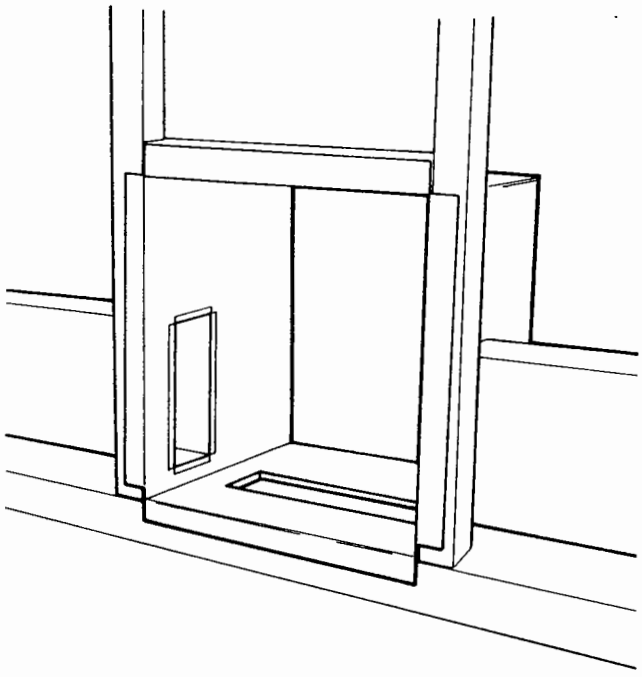


Figure 5-A Sidewall Duct Installation

F. INSTALLATION — UNDERFLOOR DUCTS.

1. Remove the bottom knockout from the duct boot and the furnace casing.
2. Lay the bottom of duct boot in position and mark the location of the knockout. Remove the duct boot bottom, mark the hole 1" larger on all sides. Cut the floor through this point.

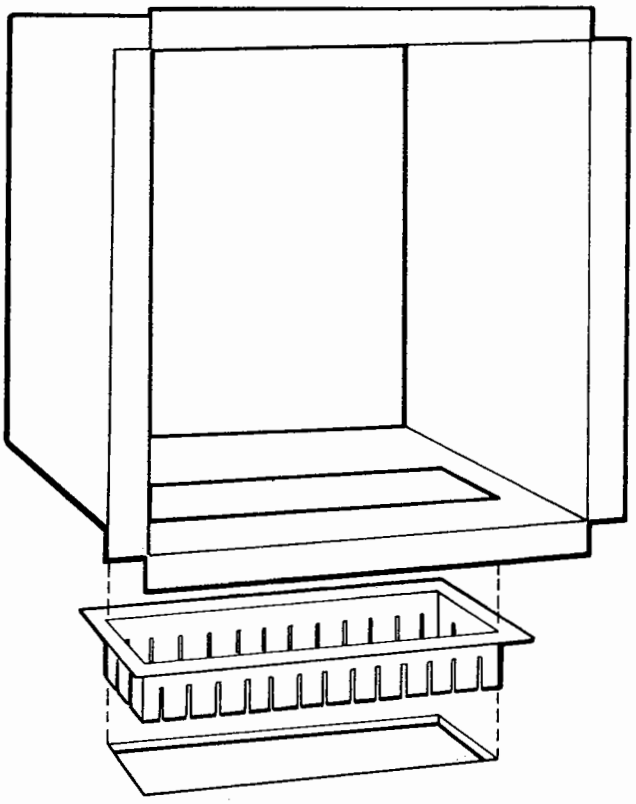


Figure 5-B Duct Boot and Connector

3. Cut a 3½" x 12" hole in the duct, centered in the floor opening.

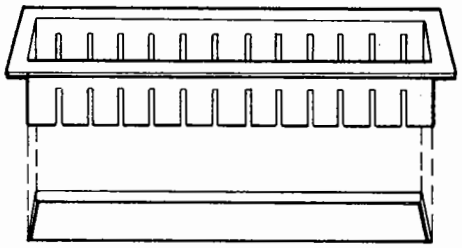


Figure 5-C Duct Connector

4. Place the optional duct connector in the duct opening, bending the tabs over to secure.

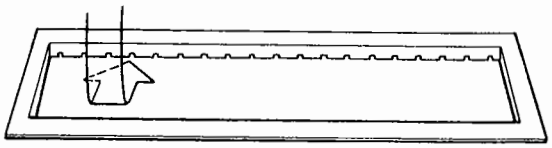
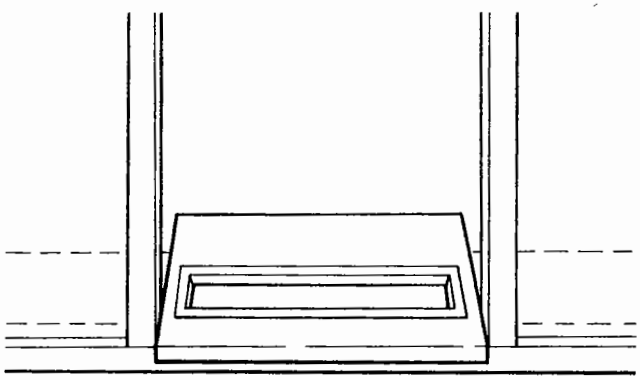


Figure 5-D Duct Connector Installed

5. Install the duct boot bottom, bend the duct connector tabs over to secure. Hammer the top tabs down securely.



6. Slide the sides and top of duct boot into position and secure to sill, wall studs, and header with screws or nails. The furnace can now be positioned for final installation.

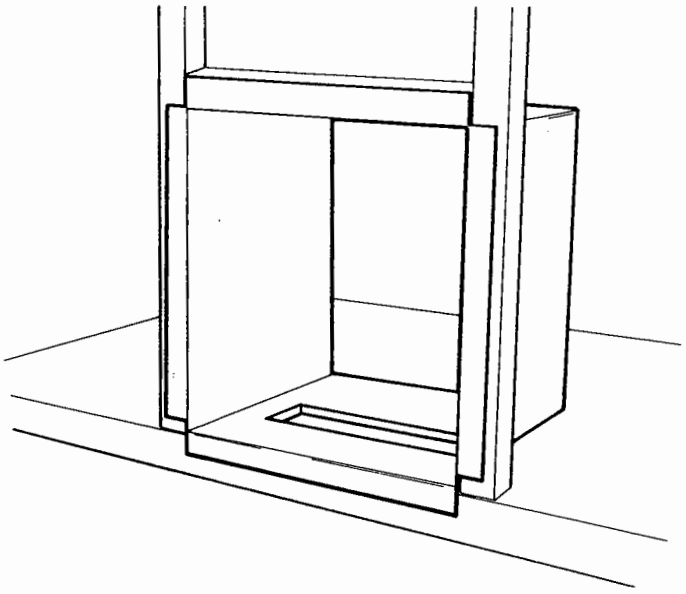


Figure 6-B Complete Duct Boot Installed

G. INSTALLING THE FURNACE.

After the duct boot is installed, slide the furnace partially into the boot. Apply mastic or permagum sealant to the back of the vent plate.

IMPORTANT

Be sure the corresponding knockouts in the furnace casing is removed. The proper knockout (bottom or sides) must align with the duct knockout to allow warm air discharge into the duct system.

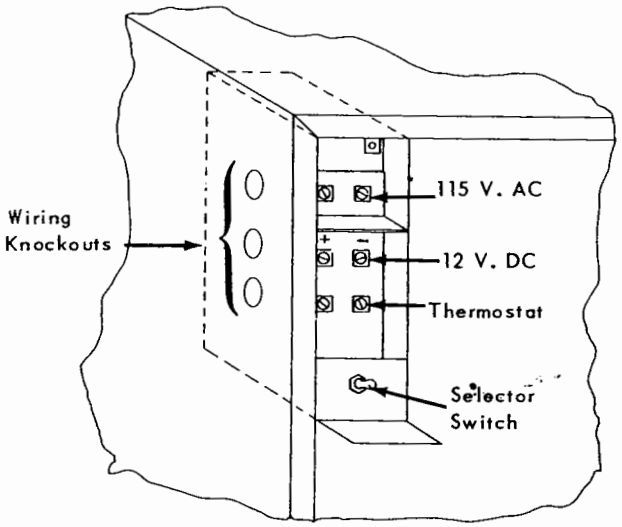
Slide the furnace into position and secure to the outer wall with screws.

H. ELECTRICAL CONNECTIONS

The furnace wiring box contains provisions for all wiring connections. The wiring box is located in the front of the furnace casing, directly behind the return grille. Since the same terminal board is used on multivoltage and DC models, the DC models will require installation of the DC power supply wiring and thermostat wiring only.

Knockouts for AC wiring, DC wiring, and the thermostat wiring are located in both sides of the furnace casing. Select the most suitable location for wiring entrance and remove the proper knockout.

	Recommended Wire Size
115-V.A.C.	No. 14 AWG.
12 V.D.C.	No. 14 AWG.
Thermostat	18 gauge solid or stranded (copper) 2/64 insulation.



Visually check that no bare terminals are in contact with the furnace casing.

Figure 6-C Electrical Connections

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

Route the supply wiring and thermostat wiring through the knockouts and secure to terminal board. Use a suitable connector to secure supply wires at the knockouts.

I. THERMOSTAT

The 9200 Series furnace is furnished with a

"Camstat" thermostat. Locate the thermostat on an inside wall at least four feet from the floor.* Select a location where the air circulation is good. Do not locate the thermostat near a door or window, near heat source such as lamps, etc., in direct sunlight, or on any surface subject to vibration during operation.

**Do not locate thermostat on outside wall.*

1. Remove the thermostat cover. Remove and discard the cardboard insert securing the Bi-Metal element.
2. Locate and fasten the thermostat directly to the wall, using the two wood screws supplied.
3. Connect the thermostat lead wires to the terminal screws, and replace the thermostat cover.

J. CHASSIS GROUNDING

Although chassis grounding may be used, it is recommended the DC supply circuit be completed wiring. If the chassis is used as a ground return path all metal components must be bonded or electrically connected to allow current flow. Grounding should be through the negative (-) side of the DC circuit.

K. GAS PIPING

A hole is provided on the right side of the furnace in line with the furnace gas valve connection. The valve is equipped with a 90° ⅜" flare elbow for ease of installation. A hole is also provided in the bottom of the furnace for below floor gas line. Turn the 90° elbow 180°. Run the line on through the floor, bend 90° and connect to the elbow. Piping should be no less than the equivalent of ⅜" OD tubing. **Caution:** Do not twist gas valve during piping.

NOTE

Local codes may require installation of an external manual shut off valve. If required, the manual shut off valve must be located outside the appliance.

L. AIR TEMPERATURE RISE

The 9200 Series furnace is approved for an air temperature rise of 70°F. to 100°F. over the return air temperature. When installed on the recommended size duct, adjust the discharge registers to obtain the desired discharge temperature.

M. COMBUSTION AIR

The combustion air system utilizes outside air for the burner flame. This sealed combustion furnace, with its draft booster must be installed in the recommended manner, allowing no combustion air to be drawn from the occupied space of the recreational vehicle.

NOTE

If air conditioning is installed on the heating duct system, the air conditioner should be installed to prevent air transmission through the heat exchanger of the furnace.

N. FRESH AIR

The optional fresh air package, part number 8623-5171, is available for installation on 9200 Series recreational vehicle furnaces. The kit provides a means of fresh air introduction into the circulating air. The introduction of fresh air combats moisture condensation inside the coach, in addition to allowing temperature modulation. The kit consists of a flexible duct, the inside connector and damper, the outside connector, and a rain cap. The 9200 Series furnace is provided with knockouts on the sides and bottom to allow installation of the fresh air inside connector. The outside connector may be located on the side or bottom of the coach.

O. FUEL SUPPLY

LP (Bottle Gas) tubing may be type K. Be sure to check with local authorities for any other requirements concerning gas piping.

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

P. FUEL SPECIFICATIONS

LP gas is used but Butane gas should not be used whenever the outside temperature is expected to be below 32 degrees F. Butane LP gas will not vaporize at temperatures below 32 degrees F. Propane gas will vaporize down to approximately -44 degrees F.

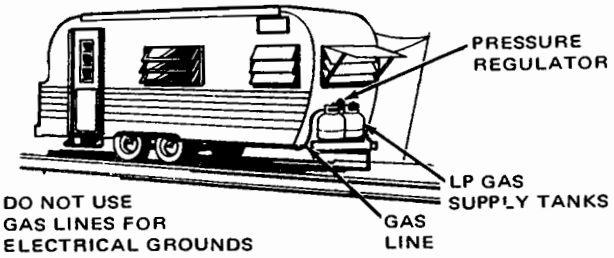


Figure 7 Fuel System

INSTALLATION INSTRUCTIONS

Q. SYSTEM INSPECTION

Every new furnace, or furnaces improperly operating, should be inspected for proper installation. This furnace is designed for installation on duct systems of at least 3" x 7" cross sectional area. If the furnace appears to cycle on the limit switch or the secondary limit switch must be reset frequently, the duct system should be examined for stoppage or restricted areas.

A limit switch is located at the fan switch. It controls heat exchanger temperatures and resets automatically. A back flow secondary limit switch is on the right hand side of the blower housing near the top on the 9223 or 9230 and must be manually reset. Press the red button and you will hear a click. The limit is not required on the 9216.

CAUTION: If it is necessary to reset this switch often, determination of the cause of its tripping is absolutely essential.

R. INSTALLATION CHECKOUT

1. Visually examine the installed furnace for proper installation. If the unit contains a power converter, be sure the converter plug is connected. Be sure the manual reset switch located on the blower housing is set. The manual reset switch is not required on the 9216.

DO NOT PERFORM ANY HIGH POTENTIAL TEST ON THIS FURNACE. THE FURNACE IS TESTED BEFORE LEAVING THE FAC-.TORY IF TRAILER HI-POT TESTING IS REQUIRED; DISCONNECT THE FURNACE BEFORE TESTING.

If the unit 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 will damage the furnace components.

Read the lighting instructions on the furnace data plate before attempting to operate the furnace.

If an accidental short occurs, the DC fuse will be blown. If this should occur, replace with the correct fuse. A fuse may be ordered from the Coleman Company or may be obtained from a local service center.

The 9216 and 9223 uses a standard automotive type fuse, 5 AMP Coleman part number 8623-3151. The 9230 uses a automotive type fuse, 8 AMP, Coleman part number 8630-3151.

S. OPERATIONAL CHECK

1. Check gas pressure at furnace gas valve. The gas pressure may be checked by turning off main gas cock and removing the ⅛" pipe plug from the right side of the gas valve. Screw in adapter and connect monometer. Check pressure by turning on main gas cock and depressing red lever on left side of gas valve. Pressure should be 11" water column on L.P. gas with all appliances "ON" in the Vehicle.
2. Turn selector switch "ON" and light furnace. (See Lighting Instructions below).
3. Adjust pilot flame as described under furnace adjustment.
4. Turn thermostat to setting above room temperature so burner will come on. Let operate for 15 minutes, then adjust burner flame as described under FURNACE ADJUSTMENT.
5. Cycle furnace system several times by turning the thermostat alternately "ON" and "OFF". This checks electrical system, making sure the furnace operates at the call of the thermostat and that there is no undue ignition or extinction noise.

LIGHTING INSTRUCTIONS ELECTRIC IGNITION

1. Remove front panel on furnace by turning screw ¼" turn pulling up and out.
2. Turn gas supply on at LP bottle. Turn main gas valve and pilot valve to "ON" position.
3. Turn thermostat to lowest possible temperature setting.
4. Set systems switch to correct power supply. (See rating plate on blower).
5. Depress "RED" lever on left side of control valve body as far as possible. Glow coil will be observed through observation window.
6. Continue to hold in "RED" lever for one minute after pilot flame is established or until pilot flame remains lighted after lever is released. If necessary, pilot may be adjusted by removing the cap screw in the center of the pilot valve and rotating the underlying screw counter-clockwise for more fire or clockwise for less fire.
7. Replace front panel.
8. Set wall thermostat to desired setting. Furnace will now operate automatically.

NOTE: If ignitor should fail for any reason, the pilot may be lit manually.

MANUAL IGNITION

1. Turn pilot and main gas valve to off position.
2. Turn thermostat to setting above room temperature which will start booster blower and purge the combustion chamber of any accumulation of gas which may exist.
3. Let booster run for approximately two minutes.
4. Turn thermostat to lowest possible temperature setting.
5. Turn main gas valve and pilot valve to "ON" position.
6. Remove observation window.
7. Insert a match in lighter rod supplied with furnace for your convenience.
8. Light match, insert into pilot area through opening while depressing lever, as far as possible.
9. Hold red lever for one minute after pilot is lit.
10. Replace window.
11. Replace front door.
12. Set thermostat to desired temperature.

T. SHORT CIRCUIT CHECKOUT

1. Turn off all appliances including furnace.
2. Install an ammeter on positive (+) lead of battery. Amp reading should be 0. If an amperage reading is noted, a short exists in the recreational vehicle electrical system.
3. Disconnect the red (+) DC lead at the furnace. If amperage reading continues, the short is exterior to the furnace. If amp reading ceases, the furnace electrical circuit is shorted.

U. BOOSTER SYSTEM CHECKOUT

1. Place the furnace operating switch in the 12 VDC or ON position. With electrical power applied to the furnace, jumper the thermostat terminals at the furnace terminal board. The booster motor should operate.
2. Remove the orange wire from the back flow limit switch on the (9223-9230) and connect a 12 volt DC test light from the orange wire to ground. With booster operating, the test light should light if the booster switch is operative. For the model 9216, remove hot wire from solenoid on gas valve. Connect a 12 volt DC test light from the black wire to ground. With the booster operating, the test light should light if the booster switch is operative.

Converter

All the undercounter furnaces, regardless of whether they are 115V-12V combination models or 12Volt only models, are designed with internal 12 volt circuits and components.

The converter simply transforms the 115V electrical power supply to 12 volts for use in the furnace. It is used, of course, only on the combination 115 volt-12 volt combination models. When operating the above models on 12 volt power source, the converter is out of the circuit and does not function.

Selector Switch

The selector switch is a double pole, double throw switch located on the outside of the wiring box.

Its function is to switch the furnace to the type of power being supplied — either 115 volt or 12 volt. See "Operational Sequence" section for a detailed description of its operation.

Fuse

The furnace is equipped with an automative type fuse which protects the wiring internal to the furnace. Should the fuse blow, the furnace will be inoperative, with all 12 volt circuits de-energized.

Fusing requirements are 5 AMP for the 9216 and 9223 and 8 AMP for the 9230.

COMPONENT PARTS

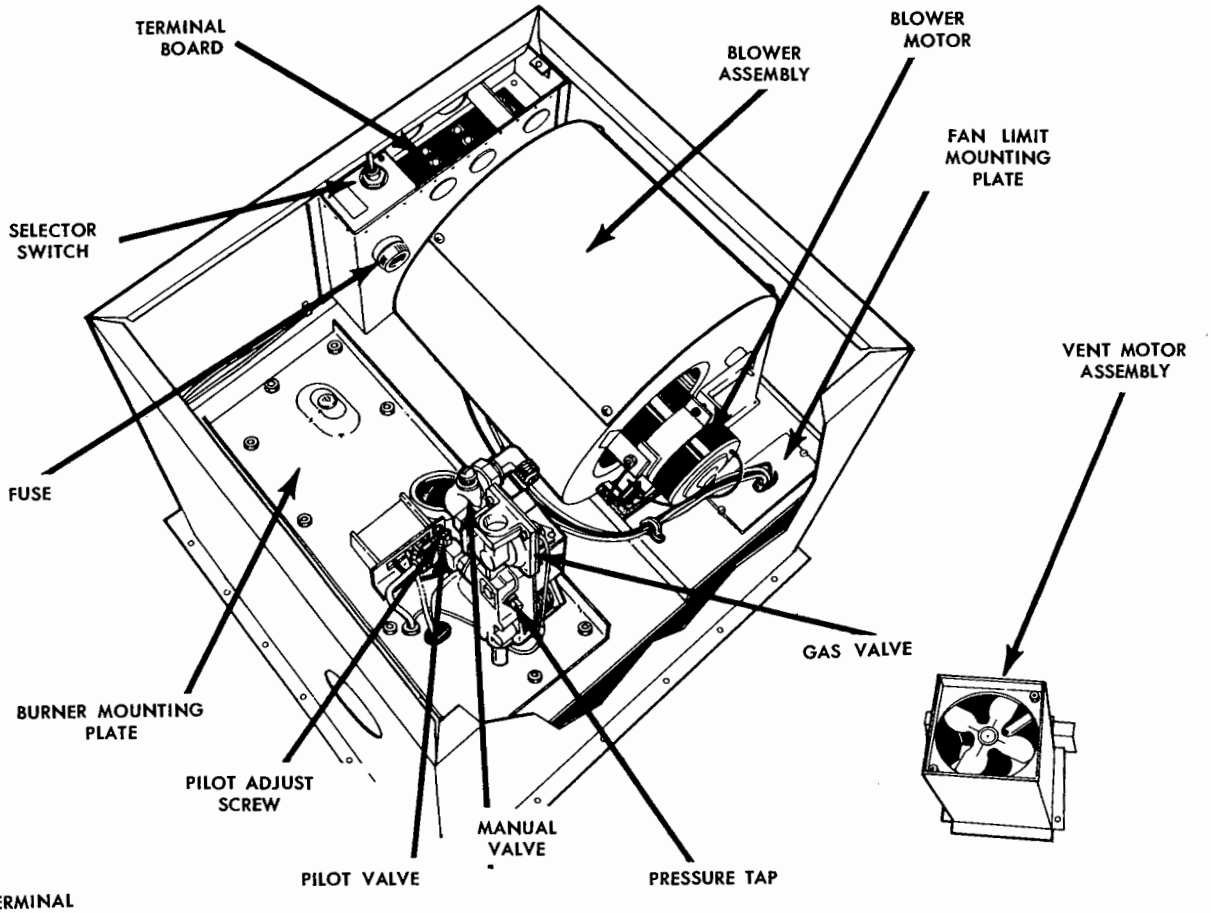


Figure 8A Model 9216-889 Shown

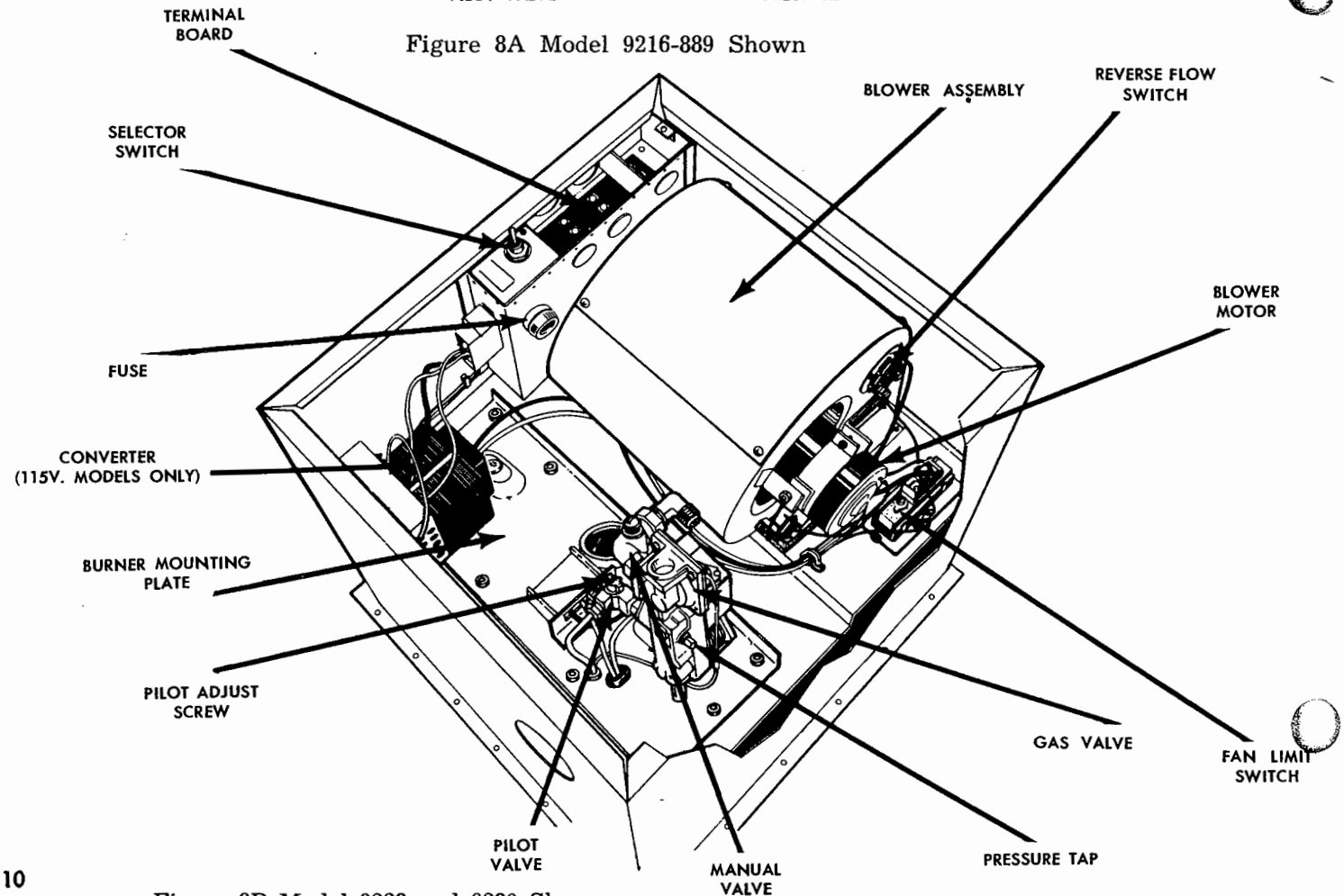


Figure 8B Model 9223 and 9230 Shown

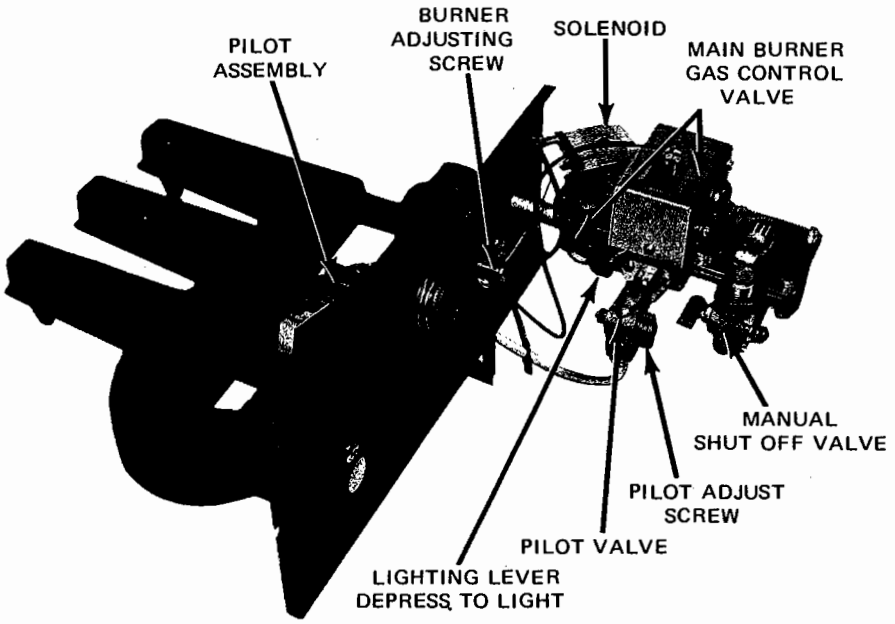


Figure 9-A Model 9216 Burner Assembly

Burner Assembly Complete

The burner and controls assembly are mounted on a removable panel located in the lower portion of the vestibule area. The entire assembly is removable as shown in figure 9-A.

The burner assembly is made up of the following parts:

1. Manual gas valve
2. Pilot and ignition assembly.
3. Main burner gas control valve.
4. Cast iron burner.

Manual Gas Valve

The manual gas valve serves to shut off gas supply to the main burner, control valve, and pilot.

Pilot Assembly

The pilot assembly consists of the pilot burner, thermal bulb (for pilot flame detection), and ignitor coil. The assembly is located just back of the venturi, opposite the observation port.

When "RED" lever on the gas control valve is depressed, the micro switch in the gas control valve, is switched to the N.O. (normally open) contacts. This permits current flow from "C" (common) terminal thru N.O.

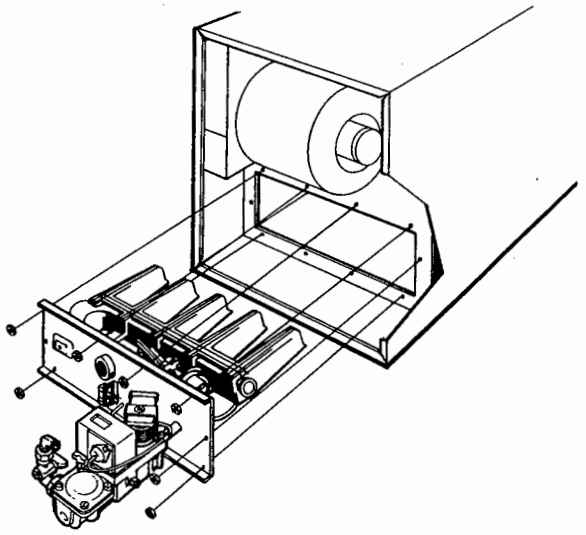


Figure 9-B

(normally open) terminal to the "glow coil' located just above the pilot burner. At the same time the safety shut-off valve, in the gas control, is being held open. If gas is available the pilot will light. With the pilot flame established it is then necessary to hold the "RED" lever for an additional 60 seconds This heats up the thermal bulb, which contains mercury. The mercury expands against a diaphram, in the gas control valve, which

in turn pushes a rod or plunger out. When the "RED" lever is released this plunger catches the safety valve of the gas control and holds the valve open. This allows gas to flow through the valve as long as the pilot is burning. If the pilot flame is extinguished for any reason, the mercury pressure on the diaphram is reduced. The plunger on the diaphram is pulled away from the safety shut-off valve allowing it to close, cutting off the flow of gas to the main burner.

Pilot Adjustment

Observe the pilot flame through the observation window. The pilot flame should be soft, and blue, with slight yellow tips.

To adjust pilot, remove cap screw from center of pilot shut-off valve. Rotate the underlying screw counter-clockwise for more flame or clockwise for less flame.

To remove and replace electric ignitor.

1. Remove burner assembly from furnace.
2. Remove two wire clips from bottom of ignitor assembly.
3. Remove screw at top of ignitor assembly.
4. Replace ignitor assembly using reverse procedure.

Main Burner Gas Control Valve

The main burner gas control valve is a solenoid operated valve. When the thermostat calls for heat, the gas valve opens permitting the flow of gas to the main burner.
The gas pressure may be checked by turning off the main gas valve, and removing the ⅛" pipe plug from the right side of the gas valve. Screw in adapter and connect the monometer. The gas pressure should be 11" water column on L.P. gas with all appliances "ON" in the vehicle.

Adjust the main burner flame, at the primary air adjustment screw located on the burner plate to the left of the gas valve. Loosen the wing nut and turn screw in or out as necessary. Main burner flame should be blue with slight yellow tips.

Cast Iron Burner

The main burner was designed to burn L.P. gas. It is a clean burning cast iron burner of the sawed-slot type. Using controlled draft, it resists wind gusts and burns efficiently.

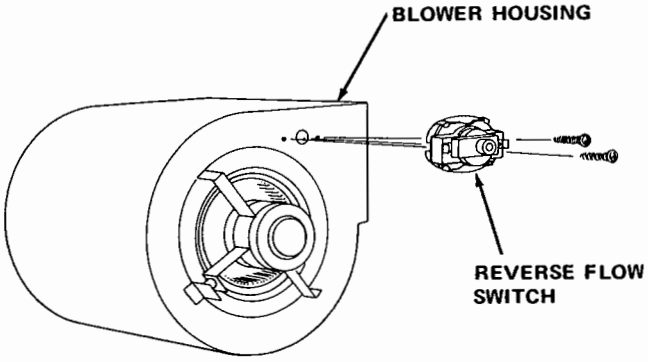


Figure 10-A Reverse Flow Switch

Reverse Flow Switch (9223, 9230)

The reverse flow switch is located on the right side of the blower housing. Its Purpose is to shut the main blower off in case the blower motor fails. The switch operates by sensing heat. During normal operation, when no overheating exists inside the furnace, the switch is in a closed position, completing the circuit to the main gas valve. If an overheating condition exists inside the furnace (due for instance, to blower motor failure) and the temperature exceeds 200 deg. F. the reverse flow switch will open, breaking the circuit to the burner, stopping burner operation.

The switch must have time to cool, then reset manually to resume operation of the furnace, (the reverse flow switch is not required on the 9216).

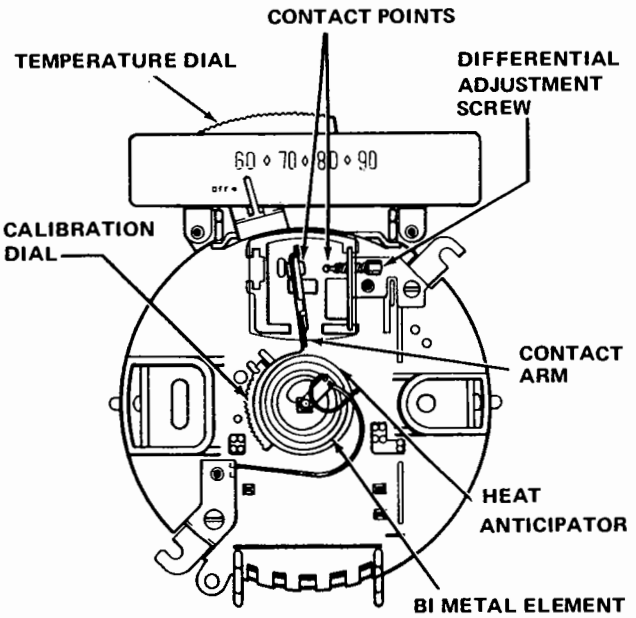


Figure 10-B Thermostat

Wall Thermostat

The wall thermostat supplied with the furnaces is a Cam-Stat T17H-2625, with a heat anticipation of .8 amps.

The thermostat is activated by the movement of the bimetal element in response to temperature. In "warm" temperatures, the bimetal element tends to "unwind", moving the contact arm to break contact. In "cool" temperatures the element contracts, moving the contact arm to make contact.

The use of a bimetal type thermostat is more desirable than the mercury filled types, since the bimetal element is not as sensitive to external vibrations, yet at the same time gives quite satisfactory temperature control.

The temperature at which the contact arm makes contact and breaks contact is determined by setting the temperature dial.

Heat anticipation is accomplished by running electrical current through a small portion of the bimetal element. When the contacts are closed, establishing a circuit, the current traveling through the bimetal element causes it to heat up and break contact just before the desired inside temperature is reached. The furnace blower continues to run and deliver heat until the furnace cools down. By the time the blower shuts off, the inside temperature reaches the thermostat setting. If no heat anticipation occurred, there would be a tendency to overheat due to the length of blower "on" time after the thermostat shut off.

The thermostat incorporates differential control established by the setting of the differential screw.

"Differential" is simply the difference in temperature at which the thermostat turns on and off. A differential of four degrees means that once the desired temperature is reached, a drop of four degrees in room temperature will occur before the thermostat turns back on. If there were no differential, a slight change in temperature would activate the thermostat, causing extremely short cycling of the furnace burner.

The differential is factory set and no attempt should be made to adjust the differential screw.

To calibrate the thermostat, set the thermostat dial at the inside temperature of the living space, as measured by a thermometer. Holding the thermostat dial firmly, turn the adjusting dial so that the contacts make — if they are not already made.

Then turn the dial counterclockwise until the contacts just break. The thermostat will then be calibrated. Be careful not to touch or breathe directly on the bimetal element while adjusting since it is sensitive to heat.

The thermostat should never be located near sources of heat, such as lamps, TV sets, or directly over warm air registers.

Vent Motor Assembly

The vent motor assembly is located in the air intake chute of the furnace.

The assembly consists of a small D.C. motor, fan blade and sail switch. Its basic purpose is to deliver combustion air to the burner. Without a positive delivery of air by a blower, outside wind or pressure conditions are more liable to affect the intake of air, causing improper combustion.

The sail switch controls the gas valve circuit, allowing the main burner to ignite only when the vent motor is operating and the sail switch is in the "on" position.

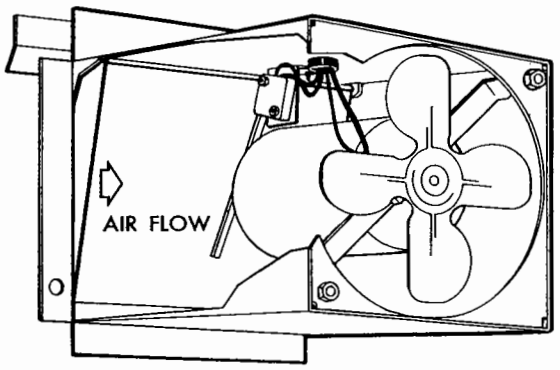


Figure 11-A Vent Motor Assembly

As shown in the above illustration, the switch is activated by the sail, which depresses the switch arm. When the motor is off and no air pressure is present, the sail hangs almost in the verticle position, resting lightly against the switch lever.

When the motor starts and air pressure is created, the sail is forced inward against the lever, turning the switch on.

Both the switch (with switch lever) and complete booster assembly are available as replacement parts.

When replacing the switch, care should be exercised to make sure the switch lever does not turn the switch on until the blower motor starts and air pressure is generated.

Make certain when installing a new booster assembly, that the black wire from the motor is grounded by the screw in the top of vent motor assembly housing.

The vent motor is equipped with capacitors internally mounted to protect against TV interference.

Fan-Limit Switch 9223, 9230

The fan-limit switch is located in the upper right hand corner of the furnace vestibule.

To remove the switch, take out the two mounting screws. Disconnect the black fan/limit switch wires at the reverse flow switch and at the connector plug. Remove the orange and red wires from the fan/limit switch. It may also be necessary to disconnect the blue, yellow, and red wires at the blower sail switch in order to provide enough clearance to remove the fan/limit switch.

The fan-limit is a dual purpose switch, containing two basic switches: a limit switch and a fan switch.

The limit switch senses the temperature of the air inside the furnace and shuts off the burner if the furnace gets too hot (200° degrees or over).

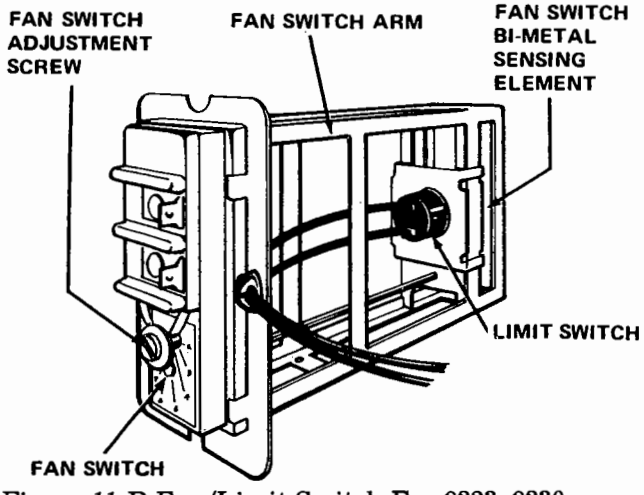


Figure 11-B Fan/Limit Switch For 9223, 9230

The fan switch also senses the temperature of the air inside the furnace, turning the blower on and off at temperatures high enough to prevent cold air from being discharged.

The fan switch can be adjusted by turning the adjustment screw. Turning to a higher number will cause the blower to start and stop at warmer air temperatures. Turning to a lower number causes the blower to turn on and off at cooler air temperatures. The control is set by factory at position no. 7, approximately 140 degrees. The range of temperature setting is from no. 1 (approx. 100° degrees to no. 9 (approx. 180° degrees.)

Should either the fan switch or limit switch be faulty, the entire fan-limit assembly must be replaced.

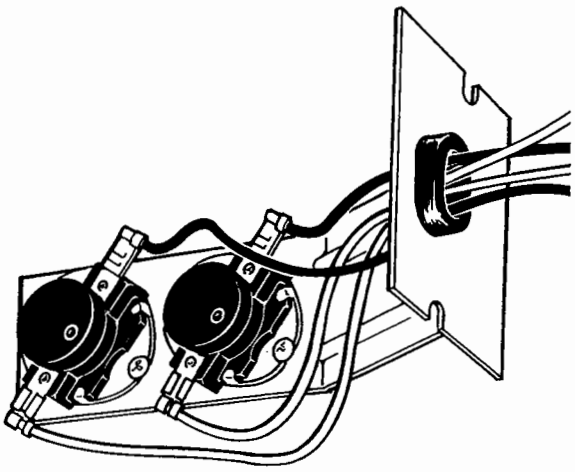


Figure 11-C Fan Limit Switch 9216

Fan-Limit Switch (9216)

Both the fan and limit switches are disc type and are separately mounted behind the vestibule panel in the upper right hand side of the furnace. To remove the switches, take out two mounting screws and pull out the assembly. The switch may be removed separately by removing two screws from each disc assembly, disconnect two fast-on terminals and remove switch.

The fan and limit switch is pre-set and not adjustable. The limit breaks and opens the burner circuit if temperatures exceeds 200 deg. F. and resets at 160. The fan switch closes and starts the blower at 140 deg. F. and opens at 100 deg. F. stopping the blower.

Blower Assembly

The blower assembly is located in the upper portion of the furnace vestibule. To remove, disconnect all wires attached to the assembly.

Take out the four mounting screws and pull the assembly out from the furnace.

The blower assembly consists of the scroll, impeller, D.C. motor, and motor mounts.

Different motors are used on the 8630 and 8623. Otherwise, all parts of the blower assemblies are identical.

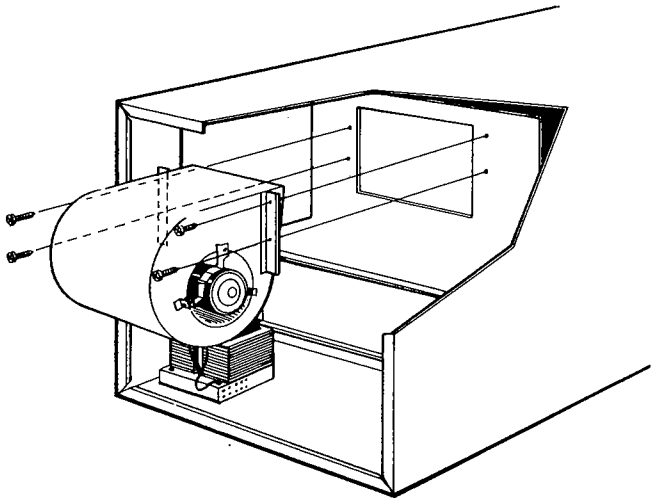


Figure 12-A Blower Assembly Removal

The impeller is secured to the motor shaft with an Allen set screw. To remove the impeller, use a long Allen wrench, insert it between the blades of the impeller and loosen the set screw.

The motor can be removed by loosening the screws holding the motor mounting band.

Furnace Number	air Delivery C.F.M.	Amp. draw	R. P. M.
9216	150	3.2	1800
9223	180	3.5	1800
9230	275	7.1	2200

Main Blower TVI Filter

A filter is available as an accessory to reduce interference on TV sets (Coleman part number 8623-6031).

Power Supply Capacitor

On all models, a capacitor is included in the power supply. This capacitor is used to "smooth" out the full wave rectified D.C. voltage from the converter by eliminating high peak voltages, thus prolonging motor life.

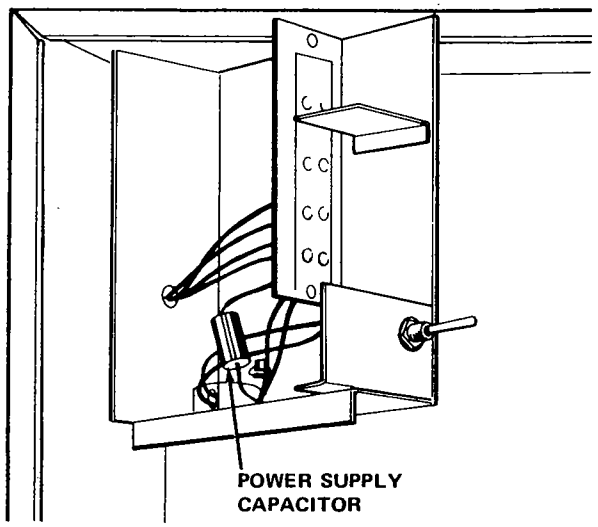


Figure 12-B Power Supply Capacitor

The capacitor is located inside the wiring box. To gain access to the capacitor, the wiring box must be removed.

Should the capacitor short out, the furnace fuse will blow.

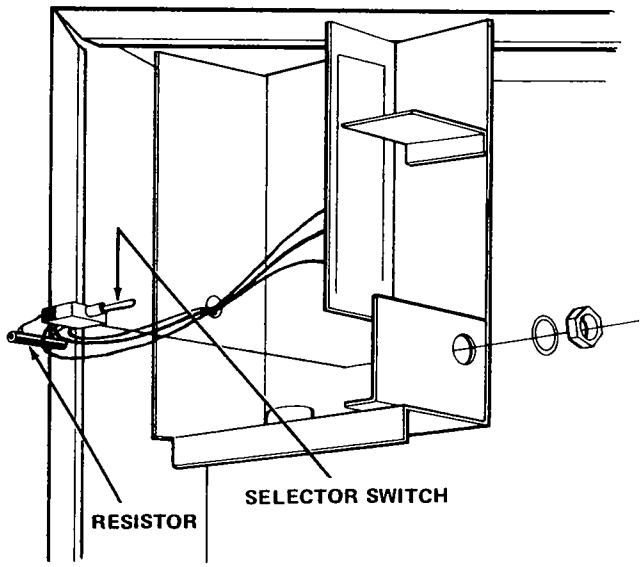


Figure 13 Ignitor Resistor

Ignitor Resistor

Located in the ignitor circuit, the ignitor resistor protects the pilot against high voltage burn-out on converter operation.

It is located inside the wiring box, attached to the selector switch.

If the resistor fails, the ignitor coil will not operate on converter operation.

OPERATION

OPERATION OF 9216, 9223, AND 9230

The following operational description is applicable to 9216, 9223, and 9230 model furnaces.

In this system, only the ignitor coil circuit is brought back through the selector switch before being grounded. The power source (12 volt), the vent motor, the blower motor, and the gas valve are all grounded directly to the frame of the furnace.

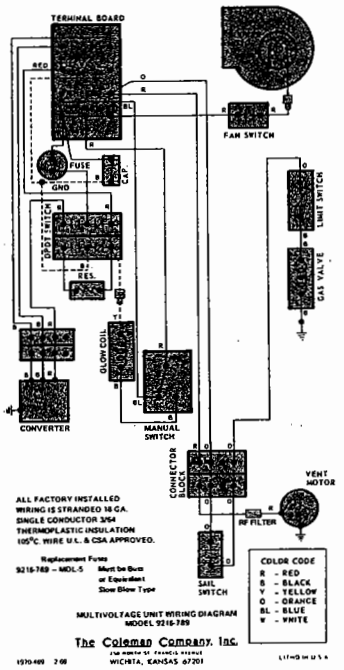


Figure 14 9216-789 Shown

Figure 14 shows the basic furnace wiring. Dotted lines indicate the negative side of the circuit, except when grounded to the furnace frame. Note that only the ignitor circuit is brought back to the selector switch before grounding.

All electrical components except the (ignitor) resistor are in the positive side of the circuit. The resister is in the negative side of the circuit only when the furnace is operated on 115 volt AC and converted to 12 volts DC. This resister protects the ignitor coil against excess voltage under this condition.

A. OPERATIONAL SEQUENCE

1. The selector switch is set to power used-12 volt DC or 115 volt AC.
2. Turn gas supply on.
3. Depress red manual lighting lever to right as far as possible.
4. Depressing the manual lever opens the gas valve and allows gas to flow to pilot. This also closes the N. O. contacts in the manual switch which supplies power to the ignitor coil to light the pilot. See figure 15-A The dotted line shows the power supply from the positive side of the electrical panel thru the manual switch to the ignitor coil.
5. After the pilot is lit, hold the lever down for approximately one minute or until pilot remains lighted. The pilot light heats a thermobulb filled with a liquid which expands against a bellows forcing a plunger outward to lock the safety valve in an open position. When the pilot lever is released the manual switch contacts goes back to the NC position which supplies power to the power side of the thermostat terminal. (see figure 15-B).
6. When the thermostat is set to heat, power is supplied to the combustion booster motor (see figure 15-B), which starts and closes the sail switch in the booster assembly and supplies power to the gas valve thru the limit switch and back flow switch (see figure 15-C). NOTE: The back flow switch is not required on the 9216.
7. After a few minutes operation, the furnace combustion chamber will heat up to a sufficient temperature causing the fan switch contacts to close starting the main blower assembly.

THERE ARE FIVE BASIC ELECTRICAL CIRCUITS IN THE FURNACE.

1. Power supply circuit
2. Pilot ignition circuit
3. Vent motor circuit
4. Gas valve circuit
5. Blower motor circuit.

B. POWER SUPPLY

There are two basic models of furnaces, one for combination 115 volt AC-12 volt DC and one for 12 volt DC only. The basic difference is simply that the 12 volt DC model has no converter.

CAUTION: 115 Volt combination unit should not be used in vehicle which has a built in converter. The 12 volt circuit on this model does not have the resistor in the ignitor circuit to protect the glow coil from excess voltage on the 12 volt DC side.

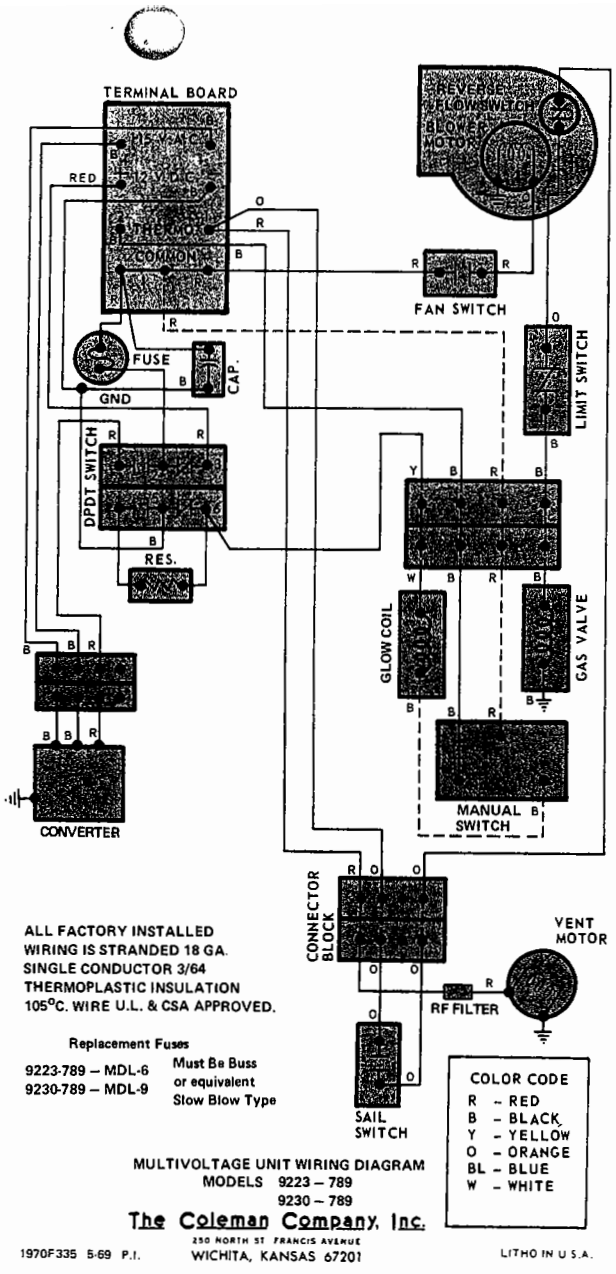


Figure 15-A 9230-789
9223-789

Multi Voltage Wiring
Diagram Shown
12V/115V Combination

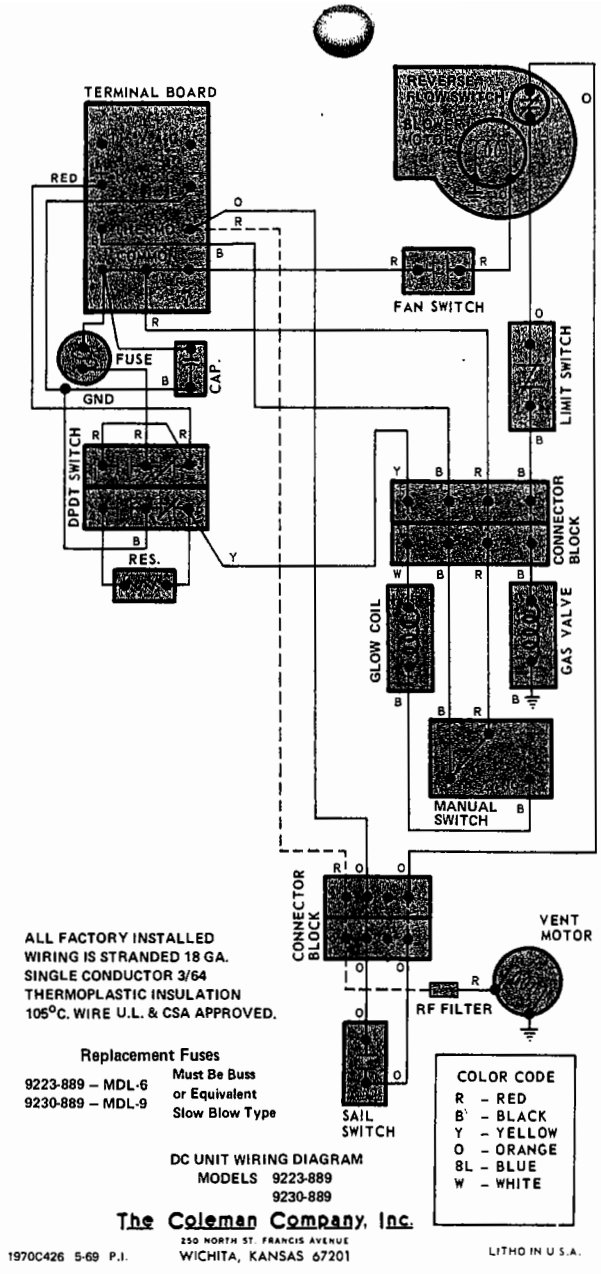


Figure 15-B 9230-889 DC
9223-889

Unit Wiring
Diagram Shown
12V Only

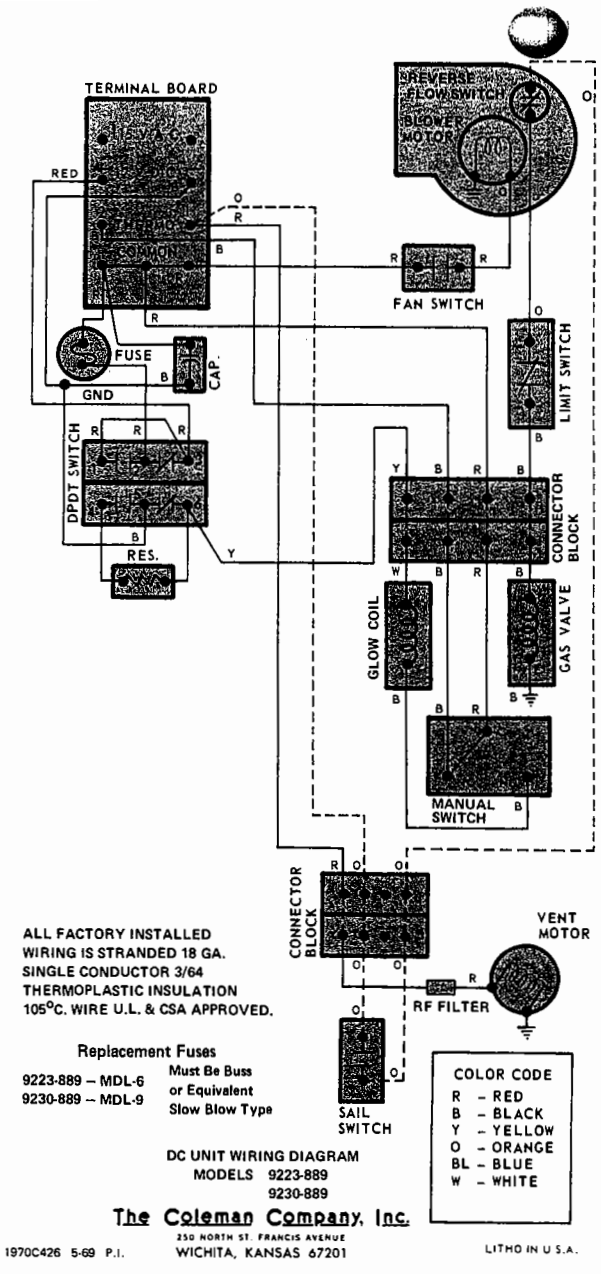


Figure 15-C 9223-889
9230-889

DC Unit Wiring
Diagram Shown
12V Only

OPERATION

1. Combination 115 volt - 12 volt model.

These models incorporate a converter which converts the 115 volt AC power to 12 volts DC for use in the furnace. By setting the selector switch, the converter can be by-passed for use on direct battery supply.

a. 115 volt operation

115 volt power is fed to the converter where it is converted into 12 volt DC. The negative 12 volt side of the converter is grounded directly to the converter support frame. The positive 12 volt side of the converter runs directly to terminal #1 on the selector switch, through the switch (when set on 115 volt operation) to terminal #2 and on to the fuse where the rest of the furnace circuits are served. A ground wire from the ignitor coil is brought back to terminal #6 on the selector switch. From terminal #6 the circuit is completed through the resistor to terminal #4, through the switch to terminal #5 and then to ground. The resistor controls high voltage output (which may occur with some converters) protecting the ignitor coil against burn-out.

b. 12 volt operation

On 12 volt operation, the negative side of the 12 volt power supply is grounded inside the wiring box. The positive side runs to terminal #3 through the switch (when set at 12 volt operation), to terminal #2 and on to the fuse. Notice that terminal #2 is a common terminal serving both the converter and the direct 12 volt circuit.

As explained previously, a ground wire runs from the ignitor back to terminal #6 on the selector switch. On 12 volt operation, the resistor is by-passed, with the circuit being completed through the switch to terminal #5 and then to ground.

2. 12 Volt only Models

NOTE: These models are for use with negative ground systems only.

These models are for use when the power supply to the furnace is 12 volts, either from a battery or from a converter in the recreational vehicle remote from the furnace.

The circuit is the same as for the combination units, except that no furnace converter is used. Therefore, terminals 1 and 3 are jumpered.

a. Battery Operation

When using only a 12 volt battery as a power source, the selector switch should be set at "Battery Only".

When the switch is set in this position, the positive side of the 12 volt supply will pass through the switch between terminals No. 3 and No. 2, then on to the fuse. The negative side of the 12 volt power supply is grounded in the wiring box.

The ground circuit from the ignitor runs to terminal No. 6, through the switch to terminal No. 5 and on to ground.

b. Vehicle Converter Operation

When using a converter as a power source (or while charging a battery supply) the switch should be set at "Converter" or "While charging battery."

In this case the positive side of the entering 12 volt power will pass through the switch between terminals No. 1 and No. 2, then on to the fuse.

The ground circuit from the ignitor runs to terminal No. 6, through the resistor to terminal No. 4, through the switch to terminal No. 5 and then on to ground.

As can be seen, the ground circuit from the ignitor is identical to the 115V-12V models, with the resistor being placed into the circuit whenever a converter is utilized. In the case of the combination models, 115 volt enters the furnace where it's converted. In the 12 volt models, the 115 volt current is converted before it reaches the furnace. In either case, the resistor is needed in the circuit to prevent ignitor burn-out due to high voltage.

3. Capacitor

On all models, a capacitor is included in the power supply. This capacitor is used to "smooth out" the full wave rectified D.C. voltage from the converter by eliminating high peak voltages.

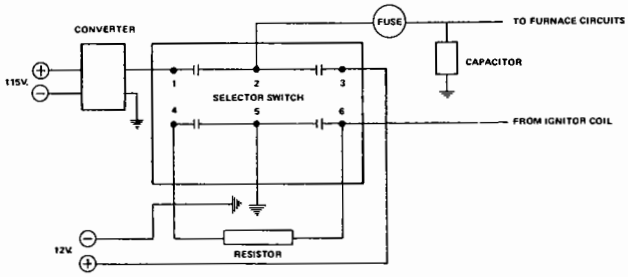


Figure 16-A

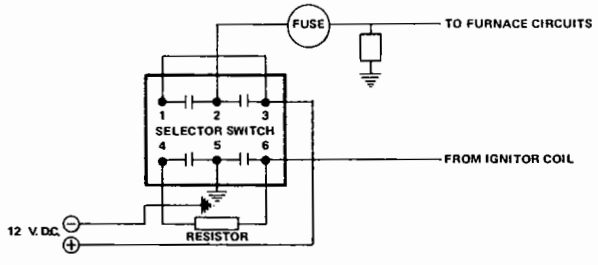


Figure 16-B

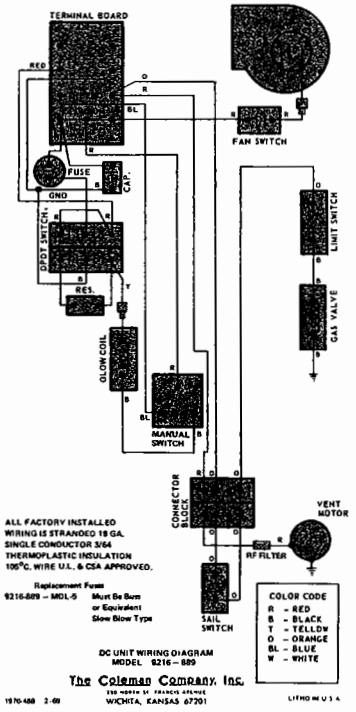
Isolating faulty circuits

When analyzing an electrical service problem, any faulty circuit can quickly be isolated by a simple process of elimination.

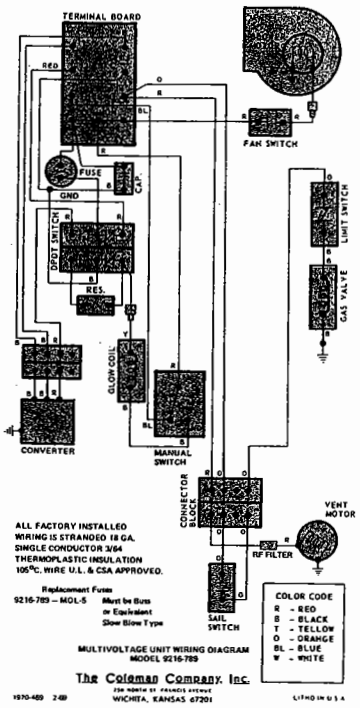
Once the proper sequence of operation is understood then by observing what functions are actually occuring, the basic trouble area becomes obvious.

1. Electrical power supplied by the power supply circuit.
2. The pilot is lighted by the ignitor circuit.
3. The vent motor circuit runs the vent motor.
4. The main gas burner is lighted due to the action of the gas valve circuit.
5. The blower motor circuit runs the blower motor.

In practically all instances, no subsequent function can occur with out the previous one happening. For example the main burner will not ignite unless the vent motor runs. (see fig. 17-A, 17-B, 18-A, and 18-B). Wiring diagrams are shown for all model furnaces.



DC Unit Wiring Diagram
Figure 17-A 9216-889 Shown



Multivoltage Unit Wiring Diagram
Figure 17-B 9216-789 Shown

SERVICE PROBLEMS

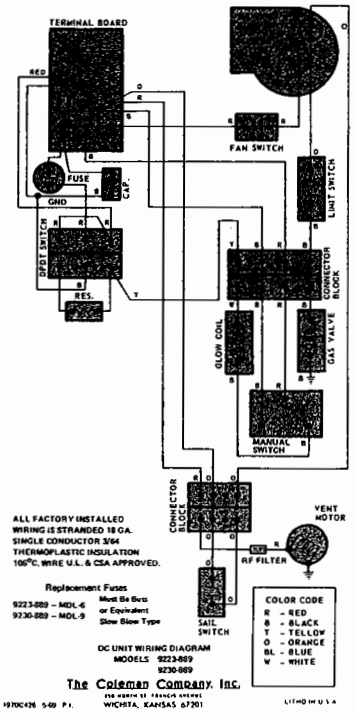
The following is an analysis of service problems which might be encountered in the field.

1. **Continuous furnace operation**

   If the furnace operates continuously, failing to shut off at the call of the thermostat, the wires leading to the wall thermostat may be shorted across, usually due to a wall panel nail. To check, simply remove the wall thermostat wires from the thermostat terminals on the terminal board. If the furnace shuts off, then the problem is in the wall thermostat circuit. If the furnace does not shut off, the gas valve should be replaced.

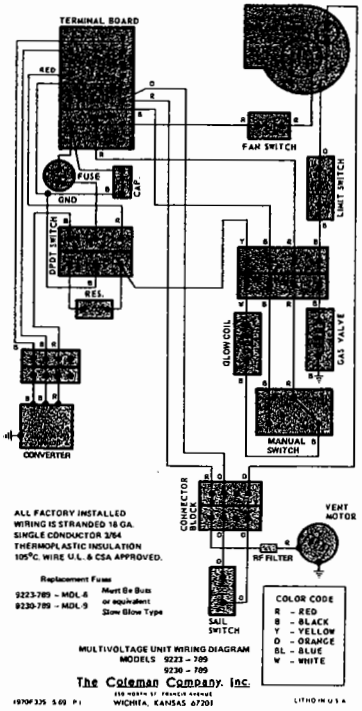
2. **Insufficient heat**

   The first step in checking on insufficient heat complaints is to determine if the furnace is operating at rated input. Check the gas pressure at the gas valve. It should be no less than 11 inches of water column on L.P. gas. If the gas pressure is low, it may be due to the gas piping being too small. Piping should be the equivalent of ⅜" O.D. tubing. See "Fuel Supply" and "Fuel Specifications". If the gas pressure is sufficient then the



DC Unit Wiring Diagram

Figure 18-A



Multivoltage Unit Wiring Diagram

Figure 18-B

orifice in the furnace should be checked to make certain it is the proper size. Orifice markings and part numbers are as follows:

Model Used on	Part No.	Orifice Mark
9216	9904-0431	43
9223	9904-0551	55
9230	9904-0591	59

If the input of the furnace is satisfactory, then the furnace may be limiting during operation because of restricted ducts.

To determine if the furnace is limiting, set the wall thermostat up as high as it will go, then observe the furnace burner.

Room temperatures during this test should be no higher than 60 degrees, and the furnace should be operated until room temperature reaches 75 degrees. If the furnace limits, then the duct system is probably too small or restricted. Orifices and gas pressures should be checked to make certain the furnace is not overfired.

3. **Noisy blower motor**
   If the blower vibrates excessively, then, either the motor mounts need replacing or the impeller (wheel) is out of balance.

   A metallic noise usually indicates that the impeller is loose on the motor shaft or is not located on the shaft properly, hitting the sides of the blower housing. The impeller is secured to the motor shaft with an Allen set screw which is accessible after removing the complete blower assembly.

4. **Pilot won't light**
   This problem can be caused by a malfunction in the ignitor circuit in the furnace, or to a power source problem. See Service Chart 1A to trace out the cause.

5. **Vent Motor Won't Run**
   This problem indicates a faulty vent motor circuit in the furnace. See Service Chart 2A.

6. **Main Burner Won't Ignite**
   This problem indicates a faulty gas valve circuit. See Service Chart 3A.

7. **Blower Motor Won't Run**
   This problem indicates a faulty Blower Motor Circuit. See Service Chart 4A.

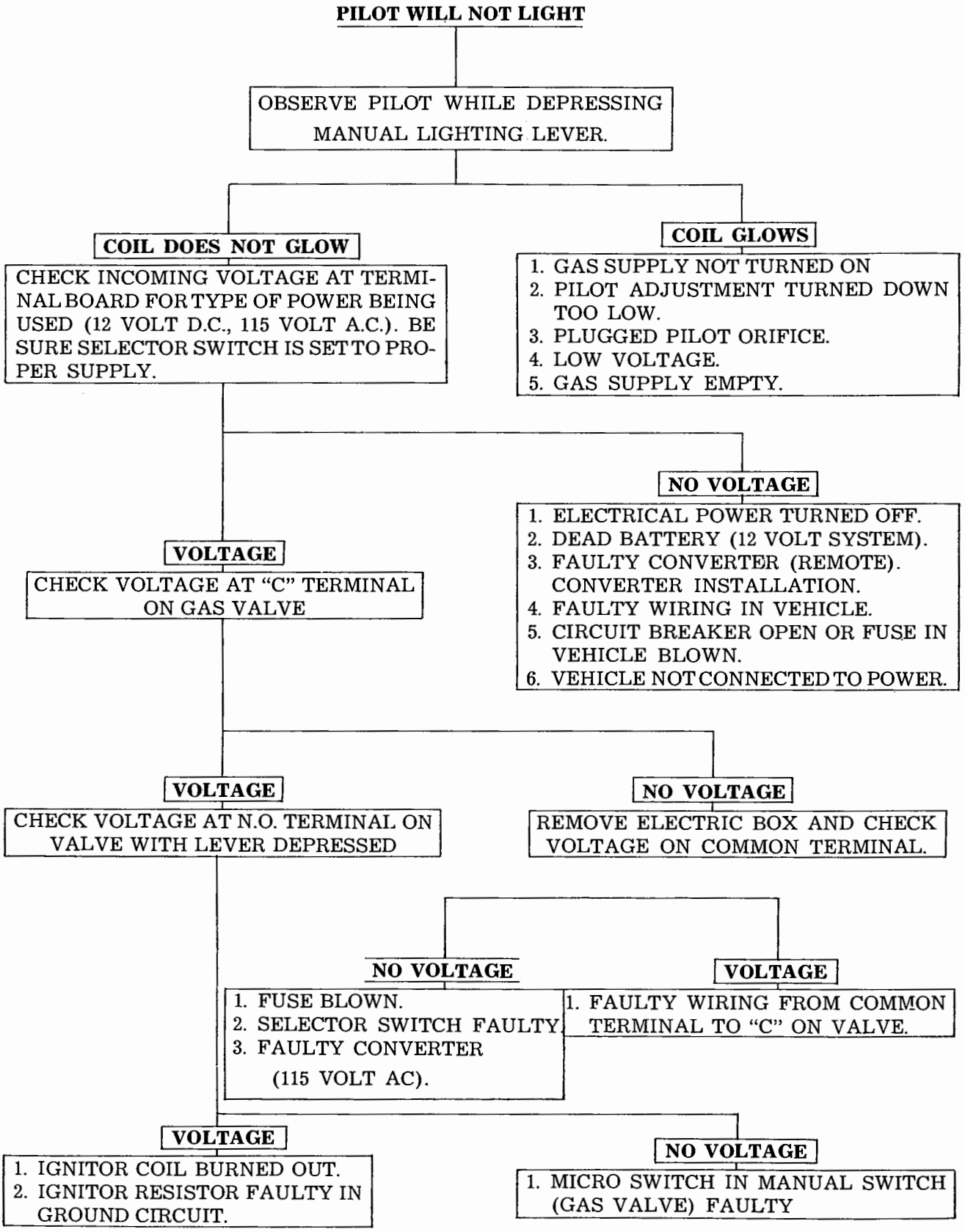
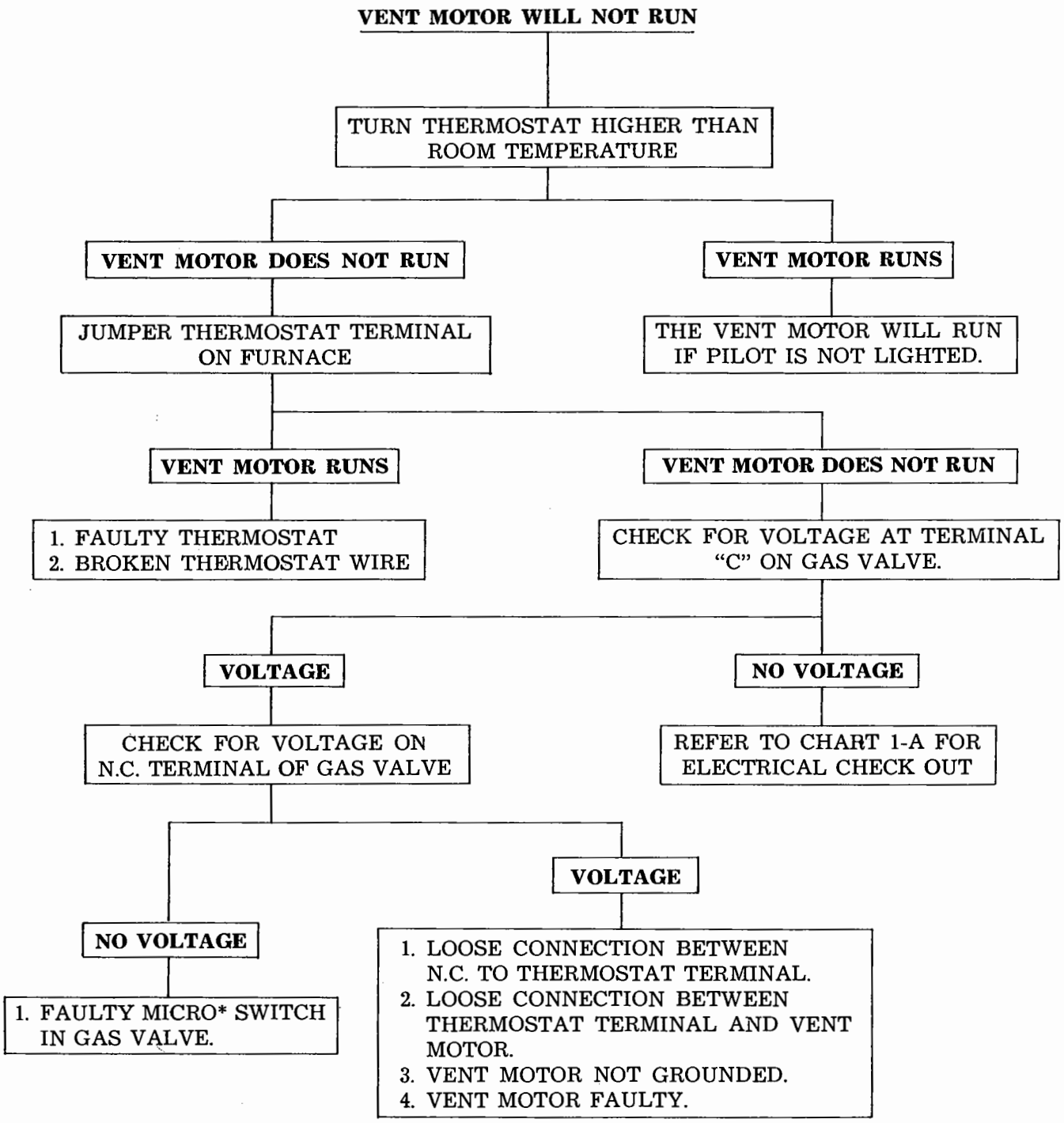

PILOT WILL NOT LIGHT
OBSERVE PILOT WHILE DEPRESSING MANUAL LIGHTING LEVER.
COIL DOES NOT GLOW
CHECK INCOMING VOLTAGE AT TERMINAL BOARD FOR TYPE OF POWER BEING USED (12 VOLT D.C., 115 VOLT A.C.). BE SURE SELECTOR SWITCH IS SET TO PROPER SUPPLY.
COIL GLOWS
1. GAS SUPPLY NOT TURNED ON
2. PILOT ADJUSTMENT TURNED DOWN TOO LOW.
3. PLUGGED PILOT ORIFICE.
4. LOW VOLTAGE.
5. GAS SUPPLY EMPTY.
NO VOLTAGE
1. ELECTRICAL POWER TURNED OFF.
2. DEAD BATTERY (12 VOLT SYSTEM).
3. FAULTY CONVERTER (REMOTE). CONVERTER INSTALLATION.
4. FAULTY WIRING IN VEHICLE.
5. CIRCUIT BREAKER OPEN OR FUSE IN VEHICLE BLOWN.
6. VEHICLE NOT CONNECTED TO POWER.
VOLTAGE
CHECK VOLTAGE AT "C" TERMINAL ON GAS VALVE
VOLTAGE
CHECK VOLTAGE AT N.O. TERMINAL ON VALVE WITH LEVER DEPRESSED
NO VOLTAGE
REMOVE ELECTRIC BOX AND CHECK VOLTAGE ON COMMON TERMINAL.
NO VOLTAGE
1. FUSE BLOWN.
2. SELECTOR SWITCH FAULTY
3. FAULTY CONVERTER (115 VOLT AC).
VOLTAGE
1. FAULTY WIRING FROM COMMON TERMINAL TO "C" ON VALVE.
VOLTAGE
1. IGNITOR COIL BURNED OUT.
2. IGNITOR RESISTOR FAULTY IN GROUND CIRCUIT.
NO VOLTAGE
1. MICRO SWITCH IN MANUAL SWITCH (GAS VALVE) FAULTY

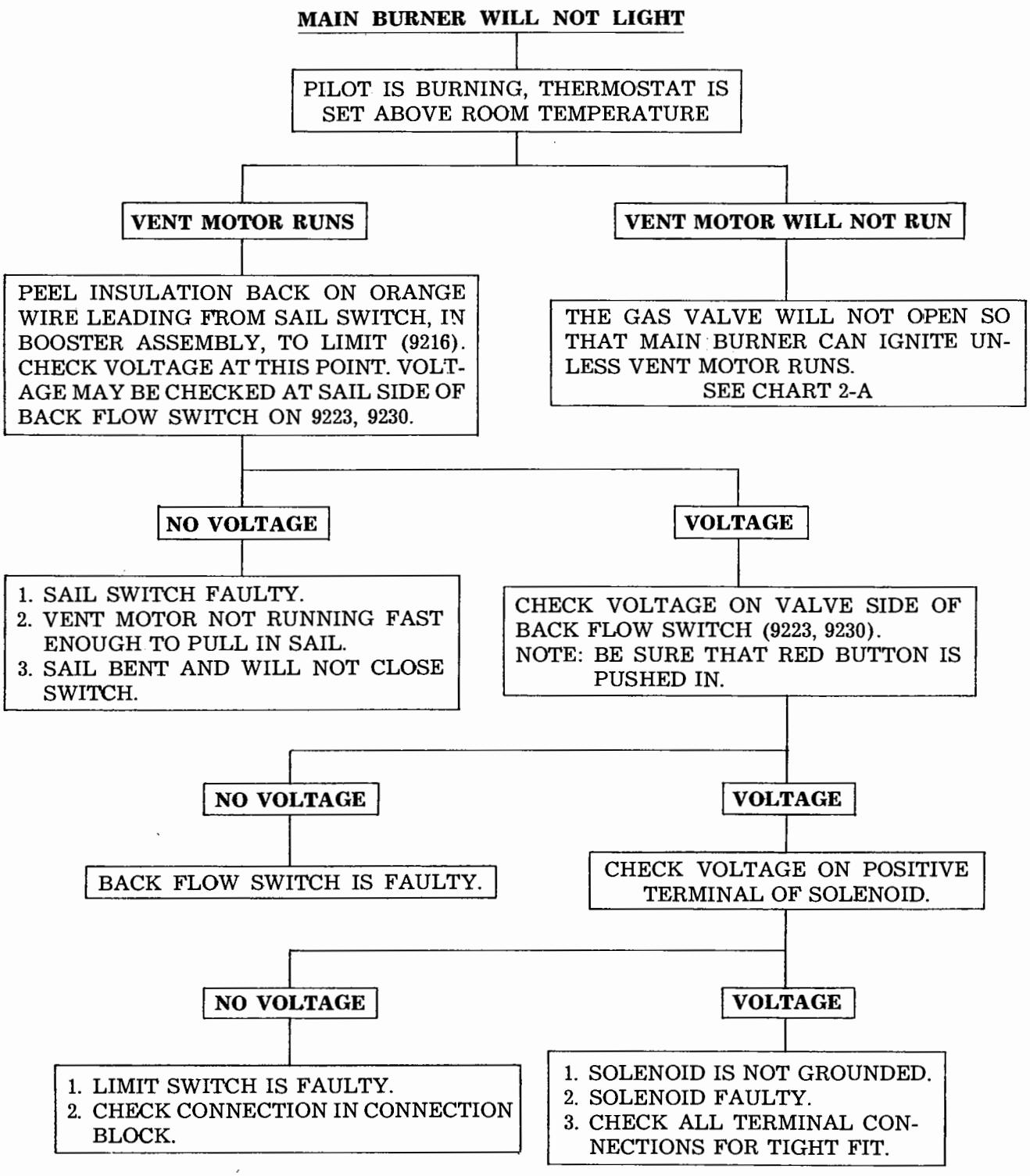
CHART 1-A

SERVICE PROCEDURE CHARTS



NOTE: SEE WIRING DIAGRAM ON PAGES 21 & 22 FOR MODEL OF FURNACE BEING SERVICED.

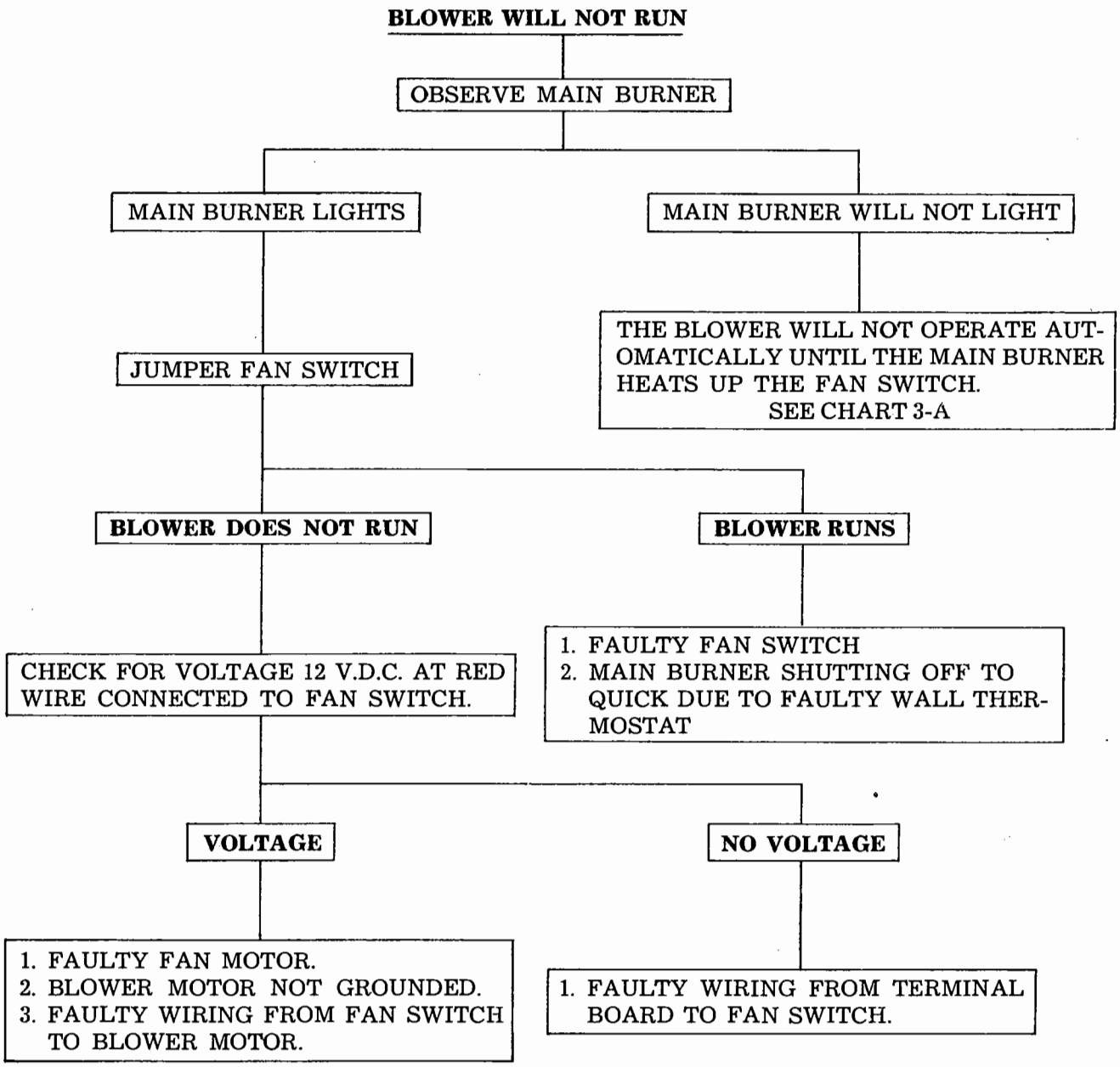
CHART 2-A



NOTE: SEE WIRING DIAGRAM ON PAGES 21 & 22 FOR MODEL OF FURNACE BEING SERVICED.

CHART 3-A

SERVICE PROCEDURE CHARTS



NOTE: SEE WIRING DIAGRAM ON PAGES 21 & 22 FOR MODEL OF FURNACE BEING SERVICED.

CHART 4-A