

PRICE: \$2.50
Part No. 50010
Code No. 0388



HUNTER

FalconAire

HEATERS

Installation

Operation

Service

Model DH 22-15A

Model GH 21-15A

-16A

-16A

-17A*

-19A*

*Auto-Start Units

DHM 22-20A*

20,000 BTU/HR.

GASOLINE AND DIESEL FUELED HEATERS

HUNTER MANUFACTURING CO.

30525 Aurora Road

Solon, Ohio 44139

WARNING

EXHAUST GASES

Do not operate heater in an enclosed area unless the combustion air intake and the exhaust gases are piped from the outside. Exhaust gases may contain carbon monoxide, a colorless, odorless and poisonous gas.

WARNING

Heater must be grounded through ground screw supplied. Do not use the fuel line as an electrical conductor or ground connection. Use of the fuel line as electrical or ground conductor may result in fire or explosion.

Before performing maintenance or inspection (except operating tests), disconnect the power source.

Do not operate the heater with the covers off.

Do not operate the heater at less than 10.5 volts (21.0 volts for 24-volt heaters).

The tilt switch is a safety device which stops heater operation in case the vehicle overturns. Do not remove this switch or defeat its purpose.

The heat exchanger must be inspected annually, or more frequently if heater usage is heavy. A damaged heat exchanger can allow poisonous gases to seep into the heated enclosure causing illness or death.

CAUTION

All heaters are shipped from the factory wired for negative ground installation. Before installing the heater in a vehicle with positive ground, make the modifications described in MODIFICATION FOR POSITIVE GROUND OPERATION, page 8.

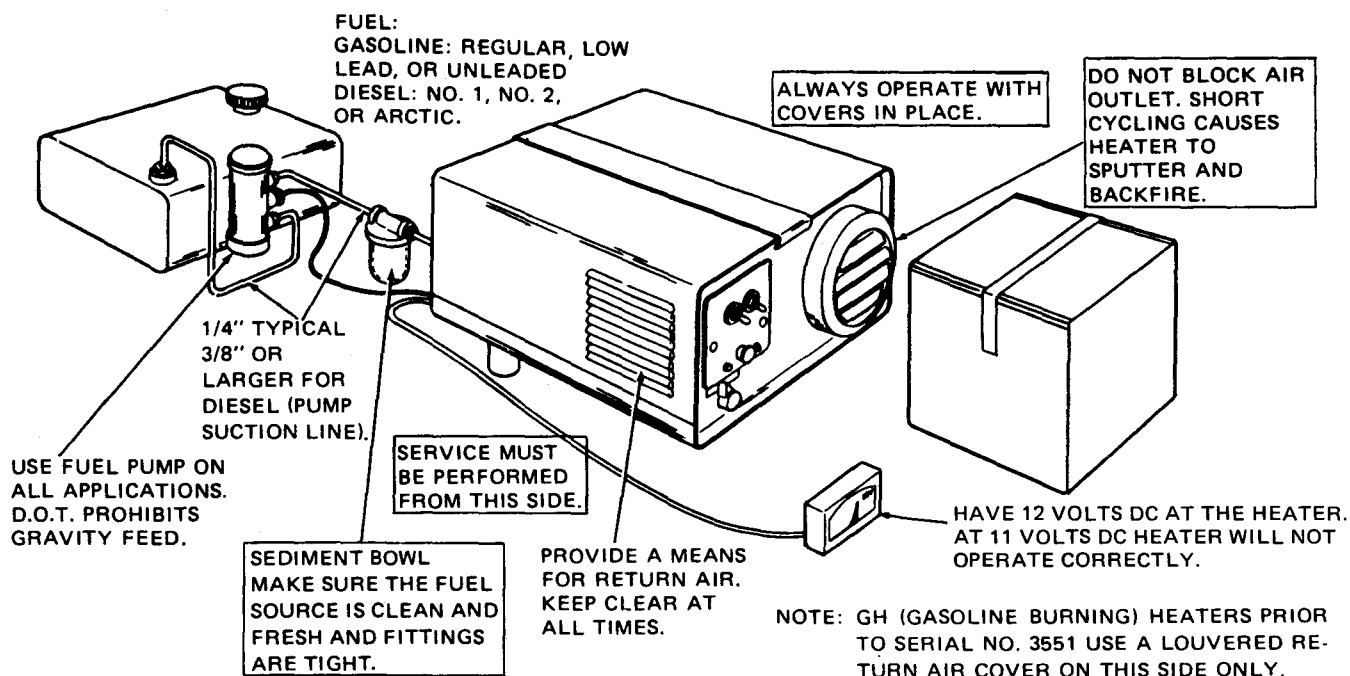
The fuel needle is factory set for best heater performance, using sophisticated exhaust gas analyzing equipment. Do not drastically change the factory setting in an attempt to speed starting. A lean fuel mixture extends heater life and reduces maintenance.



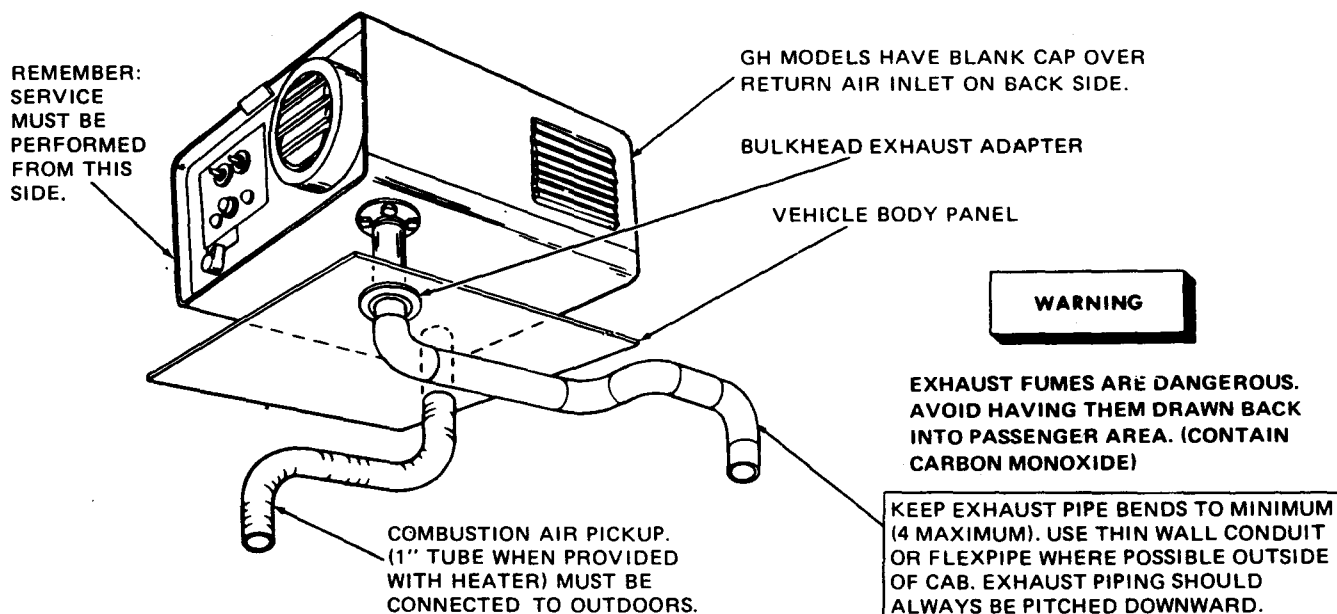
HUNTER MANUFACTURING COMPANY

30525 AURORA ROAD
CLEVELAND (OLON), OHIO 44139
PHONE (216) 248-6111/TELEX: 98-0516

GENERAL INSTALLATION "TIPS" DIESEL AND GASOLINE MODELS ONLY



INLET AND EXHAUST PIPING



NOTE: NEVER MOUNT HEATER EXPOSED TO WEATHER. HEATER MUST BE SHIELDED FROM RAIN, SNOW, ETC.

- CHECK VEHICLE FOR POSITIVE OR NEGATIVE GROUND BEFORE MAKING ELECTRICAL CONNECTIONS. (SEE INSTALLATION AND SERVICE MANUAL)

INSTALLATION "TIPS"

DIESEL AND GASOLINE MODELS ONLY

WARNING

DIESEL FUEL LIMITATIONS

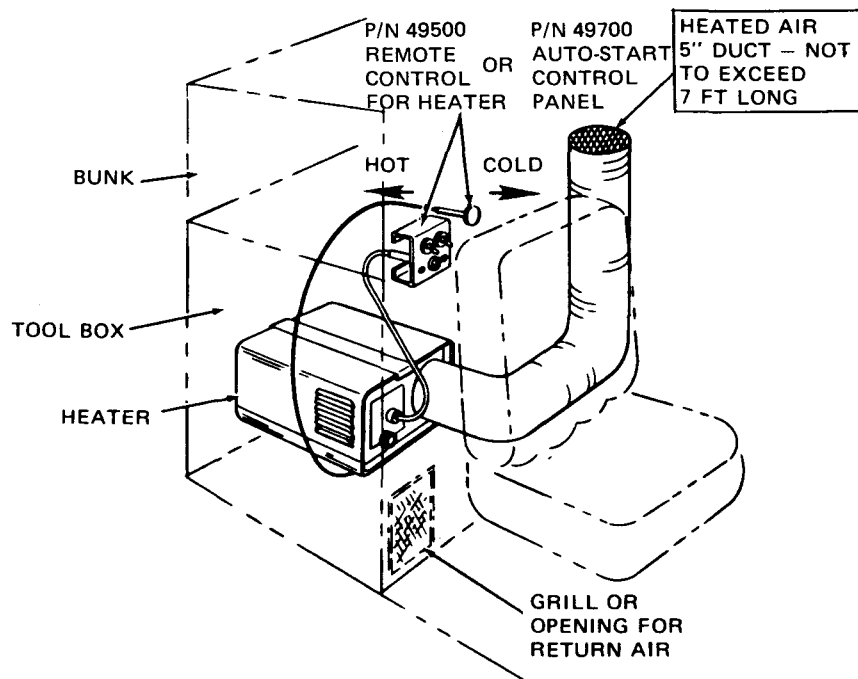
DF-2	DOWN TO +15 °F
DF-1	+15 °F TO -25 °F
DF-ARTIC	BELOW -25 °F

NOTE: WHEN CHANGING FROM DF-2 TO DF-1 OR DF-ARTIC
TURN CARBURETOR NEEDLE 1/8" TURN CLOCKWISE
TO MAINTAIN GOOD FUEL/AIR RATIO.

HEATERS MUST BE MOUNTED IN A
HORIZONTAL POSITION AS SHOWN.

NOTE: NEVER OPERATE TWO
OR MORE HEATERS FROM
ONE CONTROL PANEL.
EACH HEATER MUST BE
CAPABLE OF BEING
SHUT DOWN BY ITS
OWN SAFETY CONTROLS.

TOOL BOX MOUNTING



ENGINE HOUSING MOUNTING

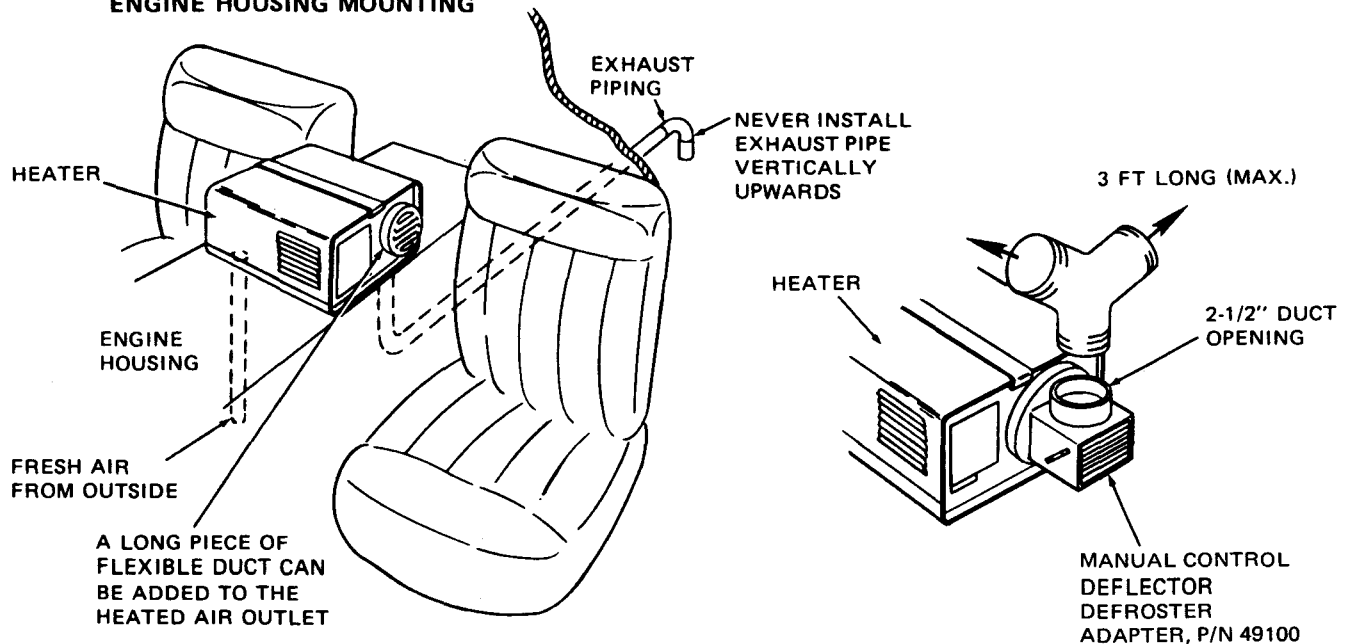


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SECTION 1 DESCRIPTION

GENERAL

This manual contains installation, operation, and service instructions for Models DH-22 and GH-21 FalconAire Diesel Heaters manufactured by Hunter Manufacturing Company, Solon, Ohio.

DESCRIPTION

The heater (figure 1) is a thermostatically controlled, internal combustion heating device. It is intended primarily to heat truck cabs and off-highway equipment cabs and boats, but its compact design permits its use wherever additional heat is required. The heater has a completely isolated combustion system which allows it to be operated within the compartment being heated without emitting dangerous or offensive fumes into the compartment.

Air for heat circulation and for combustion is provided by a 12- or 24-volt motor-blower assembly. Spark for combustion is supplied by an ignition system consisting of a solid state ignition pack and an igniter.

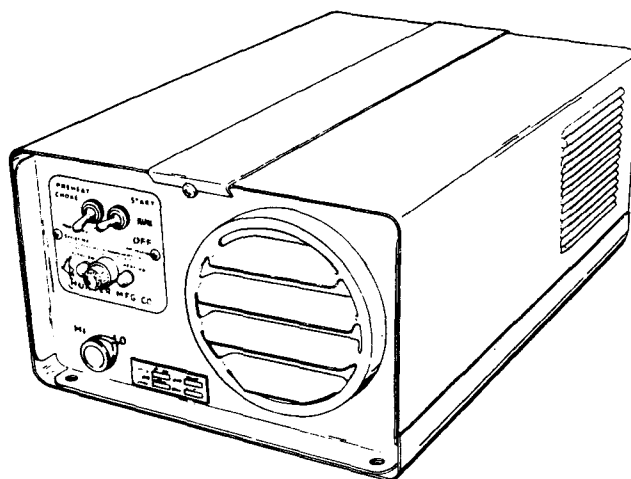


Figure 1. Heater, Models DH-22 and GH-21

Model DH-22 is designed for use solely with diesel fuel while GH-21 units are strictly gasoline models. Combustion air is supplied by a combustion air blower, and fuel flow to the burner head is controlled by a carburetor. Fuel flow to the carburetor bowl is controlled by a float-actuated needle-and-seat valve. A fuel needle (factory adjusted to burn efficiently) regulates the amount of fuel siphoned by the air/fuel mixing nozzle as shown in figure 2. DF-1, DF-2, and DFA will burn in the heater, as required by ambient temperature. Additionally, for gasoline models, the carburetor is adjusted to efficiently burn regular, low lead, or unleaded gasoline in the same manner as noted in figure 2.

The carburetor body is also provided with a fuel heater which is energized through the PREHEAT/CHOKE switch. The fuel heater facilitates fuel flow while starting at low ambient temperatures. A glow plug is also energized by the PREHEAT/CHOKE switch to preheat the burner head to aid ignition, which is accomplished with a spark plug-like igniter.

SPECIFICATIONS

Heater specifications are listed in Table 1.

Table 1. Specifications and Auxiliary Equipment

SPECIFICATIONS	
Heater case dimensions	16 in. long x 11 in. wide x 6-3/4 in. high
Weight	28 lbs
Shipping weight	30 lbs
Rating (input)	20,000 BTU
Heated air outlet diameter	5 in.
Exhaust outlet	1 in. dia standard steel pipe
Combustion air inlet	1 in. OD tube
Fuel connection	1/8 in. NPT female fitting
Electrical requirements	12 volts or 24 volts DC*
Current draw	
Starting	25 amps*
Run	7 amps (average)*
Blower only	3 to 4 amps*
*Current draw specifications for 24-volt heaters are exactly one-half of those for 12-volt heaters.	

Table 1. Specifications and Auxiliary Equipment (Cont)

SPECIFICATIONS (cont)

Fuel requirement	Regular, low lead, or unleaded gasoline* No. 1 or No. 2 diesel fuel or arctic diesel fuel**
Fuel supply pressure	4 to 5 psi***
Fuel consumption	6-1/4 hours/gallon on high thermostat setting
Burner	Low pressure atomizing type
Ignition	Solid state ignition pack (8000 volts)

*Heater is factory adjusted to burn the gasolines listed above.

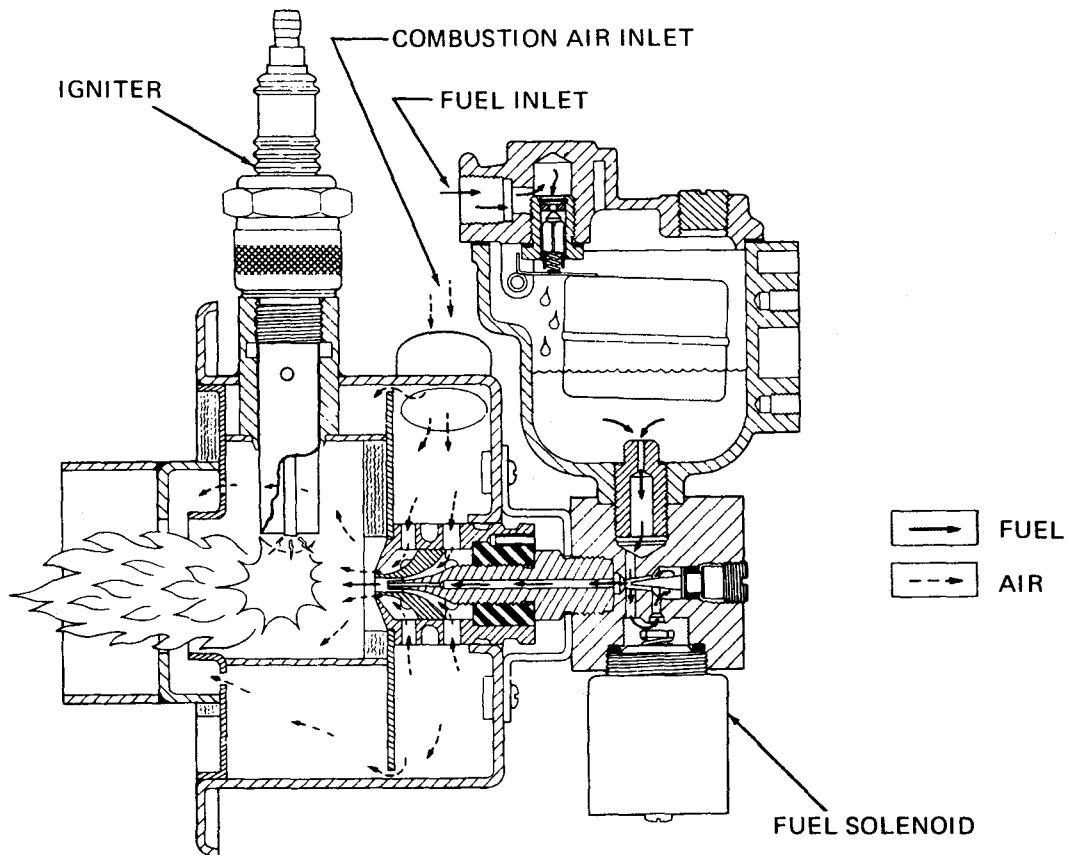
**Heater is factory-adjusted to burn No. 2 diesel fuel. If No. 1 fuel or arctic diesel is used, readjust carburetor as directed in Section 6, under CARBURETOR ASSEMBLY. Proper fuel adjustment is the key to dependable operation with minimal service requirements.

***Fuel pressure of 4 to 5 psi is normally adequate for pressure lifts of up to six feet. For higher lifts, contact Hunter Manufacturing Company for recommendations.

AUXILIARY EQUIPMENT — TO BE ORDERED SEPARATELY

Electric fuel pump	12 volt, negative ground - Part No. 15421 24 volt, negative ground - Part No. 58422
Fuel strainer	Part No. 47329
Defroster adapter	Part No. 49100
Duct adapter for 4-inch tubing	Part No. 49097
Duct adapter for 5-inch tubing	Integral flange
Solenoid valve	12 volt - Part No. 47396 24 volt - Part No. 86347
Remote control kit	Part No. 49500*

*Not needed with Auto-Start



WARNING: THIS ILLUSTRATION IS PROVIDED ONLY TO AID UNDERSTANDING OF HEATER OPERATION. DO NOT ATTEMPT TO IGNITE THE BURNER AFTER IT HAS BEEN REMOVED FROM HEAT EXCHANGER.

Figure 2. Sectional View of Carburetor and Burner Head

SECTION 2

INSTALLATION INSTRUCTIONS

PRE-INSTALLATION INSPECTION

WARNING

Read all warning tags supplied with the heater. Perform all duties indicated on the tags.

1. Inspect the heater for damage which may have occurred during shipment. Check against the packing list or invoice for lost parts.
2. Inspect the controls for loose or missing hardware.
3. Inspect all lines, tubing, and fittings to see that they are secure and free of breaks, kinks, or other damage.

NOTE

A warranty card is packed with each heater leaving the factory. Attached is a return postal card. It is the duty of the dealer to ensure that both the owner's copy and the registration card are completed and the registration card returned to Hunter Manufacturing Company. To be certain that you obtain the benefits of the above warranty, this card should be returned within 10 days from the date you purchased this equipment.

LOCATION AND MOUNTING

CAUTION

The heater is designed for use in the horizontal position with the heat exchanger exhaust outlet and fuel drain tube down. Operation in any other attitude voids all warranties and may result in damage or rapid heater wear unless modified for such use by Hunter Manufacturing Company.

The heater is normally installed within the compartment being heated. It can be installed outside the compartment being heated by using a flexible heat duct to direct the heated air into the compartments. If this is done, the heater must be shielded against direct contact from rain and snow.

WARNING

The tilt switch is a safety device which stops heater operation in case the vehicle overturns. Do not remove this switch or defeat its purpose.

1. Mount the heater horizontally as shown in figure 1. Choose a mounting location which will enable mounting the heater on a level surface, with adequate room around the heater for removal and service. Refer to figure 3 for mounting dimensions and clearances.
2. After selecting a location, remove all combustible material from area where the heater will be located. This includes carpeting, rubber mats, plywood flooring, etc.
3. Cut holes as required for air inlet and exhaust. Remove covers and cross bar. Set heater in place over inlet and exhaust holes and mark mounting holes. A reduced-size template is provided on page 41. Remove heater and drill 5/16 inch diameter holes for mounting studs (5, fig. 12).

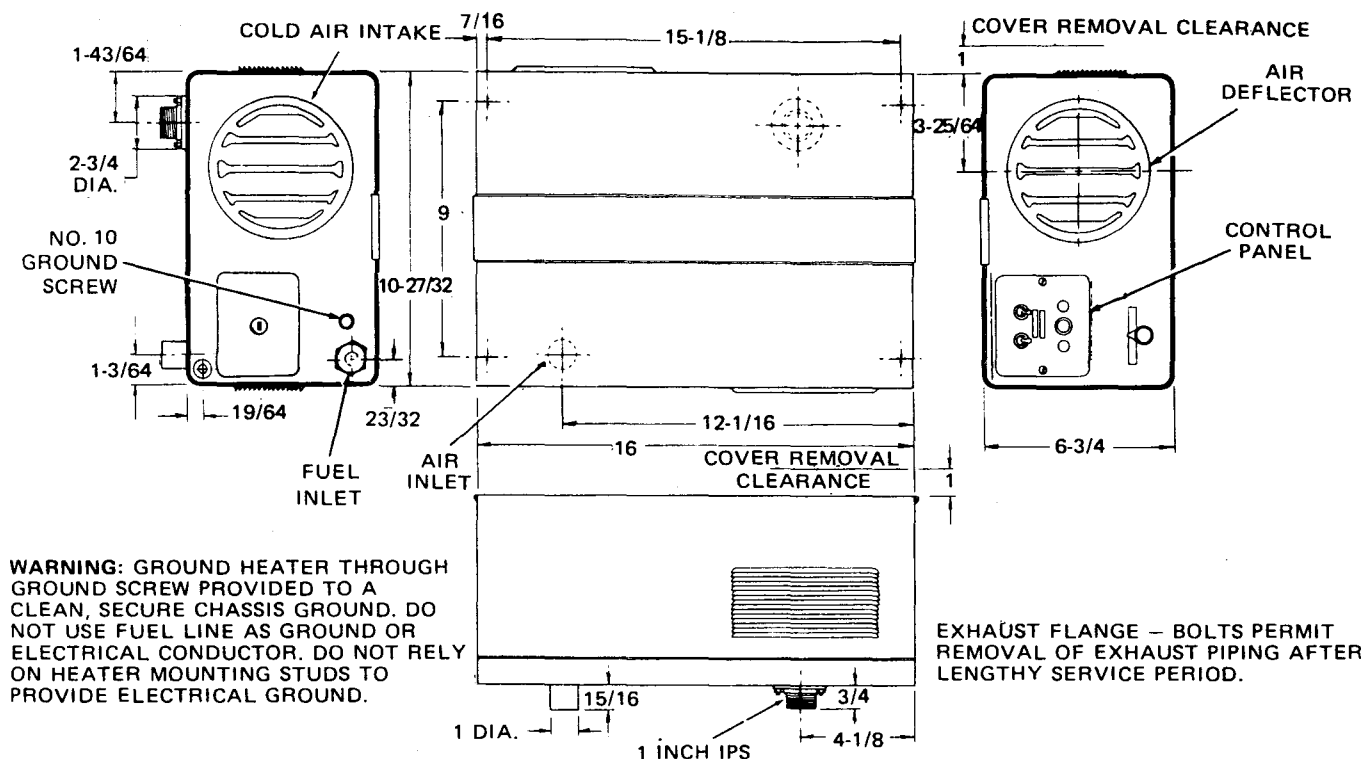


Figure 3. Heater Mounting Dimensions

CAUTION

Use heat shield and exhaust insulator as described below to prevent damage to paint and furnishings of vehicle from excessive heat.

4. Position heat shield (4) around the hole for the exhaust connection, as shown in figure 4. The heater case becomes hot in this area during operation, and the heat shield is required to protect the vehicle from excessive heat. Set the heater over the mounting holes and secure with mounting studs (5, fig. 12) using the nuts and lock washers supplied with the heater.

WARNING

Exhaust gas must be piped to the outside of the heated compartment.
Do not allow the exhaust gas to exit directly beneath the vehicle.

5. Direct the exhaust away from the compartment using elbow (3) and nipple (2), and additional 1-inch nipples as required. If the exhaust must pass through a vehicle body panel or floor, use exhaust insulator (1) to protect paint and/or trim. Cut a hole in the panel 2-7/8 to 3 inches in diameter to ensure adequate clearance between the hot pipe and the painted panel, and to provide access for later servicing. Cover the opening with exhaust insulator (1) and direct the exhaust pipe through the insulator.

6. If the heater is mounted entirely within the cab, connect a 1-inch rubber or plastic hose to the air inlet and run it outside the cab to provide fresh air for combustion.

FUEL CONNECTIONS

1. The vehicle's primary or secondary fuel tank is typically used as the heater fuel source, and the heater fuel pump inlet is connected to the spare supply or tank drain port. If a different fuel source is used, a separate fuel tank must be provided.

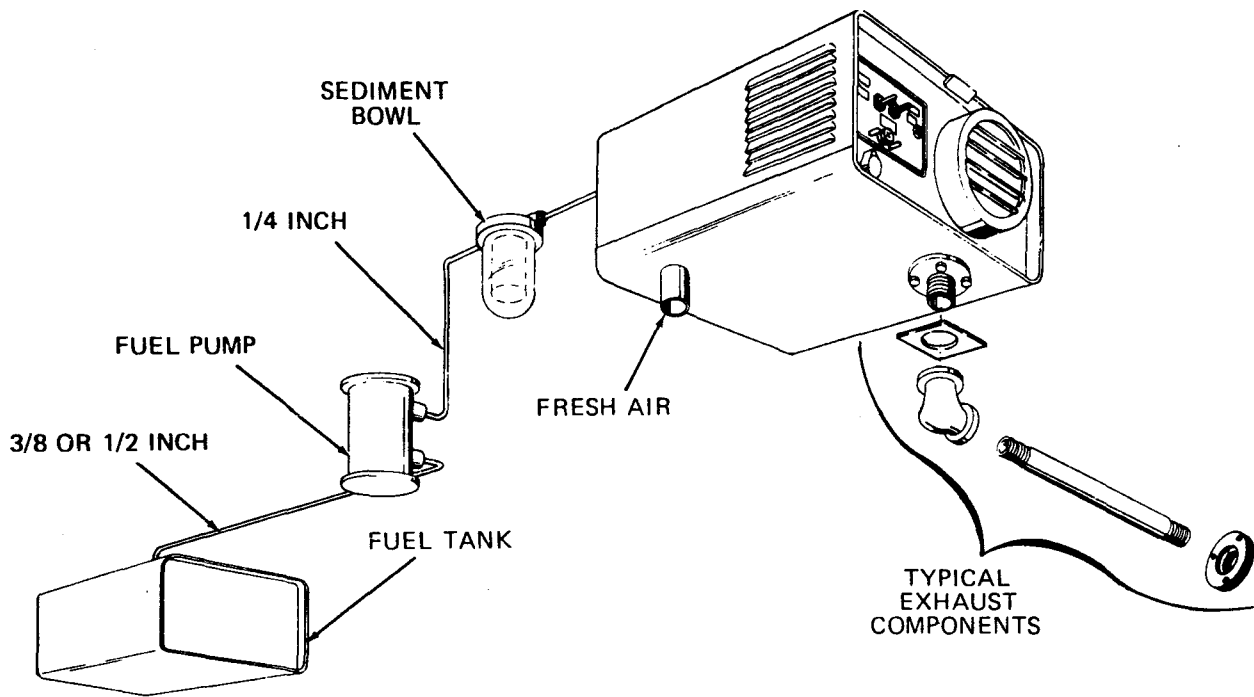


Figure 4. Typical Fuel and Exhaust Connections

NOTE

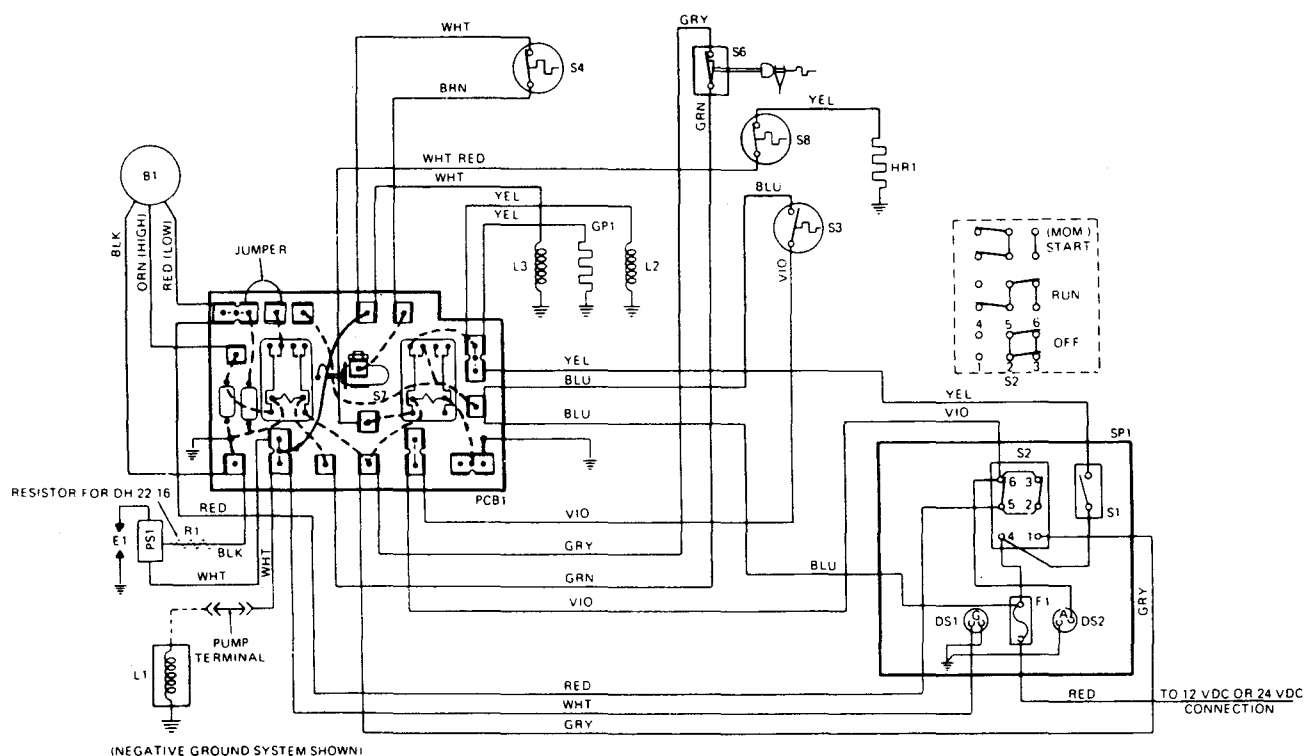
Whenever the fuel source is above the heater, gravity feed exists. Gravity feed is not allowed or approved by D.O.T. Gravity feed may be desired when compliance to D.O.T. regulations is not required. However, a solenoid valve must be used in the fuel line when gravity feed is used.

2. When a separate fuel tank is being installed, mount the tank in a convenient location below the level of the fuel inlet on the heater. Figure 4 shows typical connections.
3. An electric fuel pump is necessary in all installations except when gravity feed is used. Mount the fuel pump at the level of and near the fuel tank, preferably on the vehicle frame. Connect the fuel pump power lead to the male 1/4-inch quick disconnect terminal connector (22, fig. 13) on the back panel. (Fuel pump draws 1.5 amps.)
4. Connect a fuel line from the fuel supply (tank or pump) to the fuel fitting on heater. If the heater will be operated in sub-zero weather, use 3/8-inch or 1/2-inch tubing from the fuel source to the pump inlet, and 1/4-inch (minimum) tubing from the pump to the heater. Route fuel lines away from exhaust pipes and anchor them to prevent chafing and breakage.
5. Use a good quality fuel filter between the fuel source and the heater.
6. If a solenoid valve is used to control fuel flow in a gravity feed fuel system, install the valve in the fuel line near the heater. Attach the electrical lead of the solenoid valve to fuel connector on back of heater.

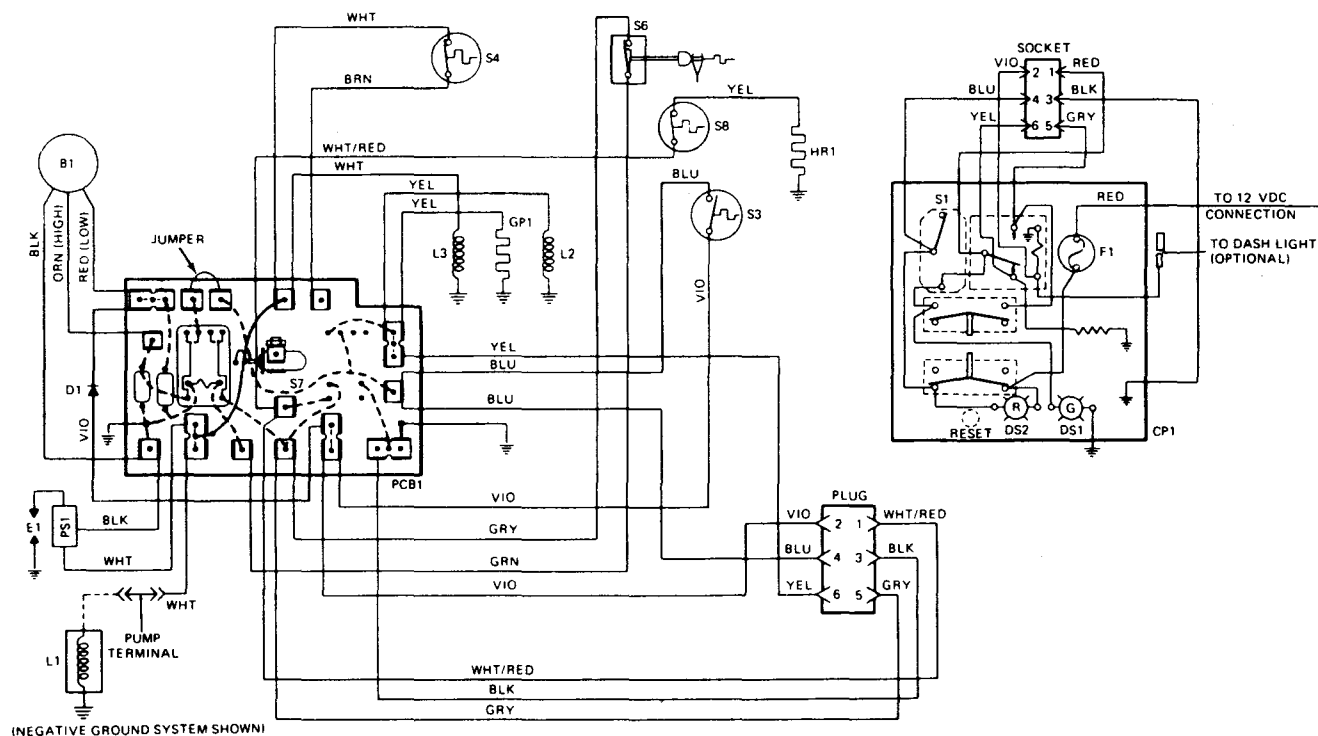
ELECTRICAL CONNECTIONS

WARNING

Ground the heater through the ground screw provided to a clean, secure chassis ground. Do not use the fuel line as a ground or electrical conductor. Do not rely on heater mounting bolts to provide electrical ground.



Models GH 21-15A, GH 21-16A, DH 22-15A, and 22-16A



Models DH 22-17A, DH 22-19A, and DHM 22-20A

Figure 5. Wiring Diagram, 12- and 24-Volt Heaters

KEY TO DIAGRAM			Model						Voltage		
			Diesel					Gasoline		12 VDC	24 VDC
			DH22-15A	DH22-16A	DH22-17A	DH22-19A	DH22-20A	GH21-15A	GH21-16A		
Symbol	Description	Part Number									
B1	Blower Assembly	50580-12	X		X	X	X	X		X	
B1	Blower Assembly	50580-24		X					X	X	
F1	Fuse (30 amps)	47273	X		X	X	X	X		X	
F1	Fuse (20 amps)	46273		X					X	X	
SP1	Switch Panel	50625-12	X							X	
SP1	Switch Panel	50625-24		X						X	
SP1	Switch Panel	50624-12						X		X	
SP1	Switch Panel	50624-24							X	X	
CP1	Control Panel	49700			X	X	X			X	
S2	Start-Run Switch	49521	X	X				X	X	X	
DS1	Panel Light (green)	49778-02		X					X	X	
DS1	Panel Light (green)	170855-03	X		X	X	X	X		X	
DS2	Panel Light (amber)	49778-01		X					X	X	
DS2	Panel Light (amber)	170855-01	X		X	X	X	X		X	
D1	Diode S/A	49716			X	X	X			X	
E1	Igniter (spark plug)	49149	X	X	X	X	X	X	X	X	
GP1	Glow Plug	49166	X		X	X	X	X		X	
GP1	Glow Plug	48862-02		X					X	X	
HR1	Carburetor Heater Cartridge	49238	X		X	X	X	X		X	
HR1	Carburetor Heater Cartridge	49854		X					X	X	
L1	Fuel Pump (external)	15421	X		X	X	X	X	X	X	
L1	Fuel Pump (external)	58422		X						X	
L2	Choke Solenoid	50627	X		X	X	X	X		X	
L2	Choke Solenoid	50629		X					X	X	
L3	Fuel Solenoid	50626	X		X	X	X	X		X	
L3	Fuel Solenoid	50628		X					X	X	
PCB1	Printed Circuit Board Assembly	49946	X		X	X	X	X		X	
PCB1	Printed Circuit Board Assembly	49951		X					X	X	
PS1	Ignition Pack Assembly	49461-02						X	X	X	
PS1	Ignition Pack Assembly	49461	X	X	X	X	X			X	
R1	Series Resistor	49203		X						X	
S1	Preheat Switch	47237	X	X				X	X	X	
S1	Preheat Switch	49639			X	X	X			X	
S3	Flame Switch	49734	X	X	X	X	X	X	X	X	
S4	Overheat Switch	4347	X	X	X	X	X	X	X	X	
S6	Hi/Lo Switch	2282	X	X	X	X	X	X	X	X	
S7	Mercury Tilt Switch	70294	X	X	X	X	X	X	X	X	
S8	Carburetor Heater Thermostat	49690	X	X	X	X	X	X	X	X	

1. Refer to the appropriate wiring diagram in figure 5 and locate the power and ground connections on your heater. The ground terminal is located next to the fuel inlet. Connect this terminal to a good, clean chassis ground using the wire size indicated in Table 2.

NOTE

If you are using Remote Control Kit, part number 49500, refer to the separate Remote Control Kit Instructions in back of book. Install the remote control kit before proceeding, and omit step 2.

2. Refer to the wiring diagram and connect the red power lead from the heater fuse to the vehicle electrical system, using the wire size specified in Table 2. This line should be hot at all times so the heater can purge even if the vehicle ignition is off. Protect the vehicle with a circuit breaker or fuse in the feed line.

Table 2. Wire Sizes

Length of Run (feet)	Wire Size
Less than 10	12 gauge
10 to 30	10 gauge
over 30	8 gauge

3. Connect the fuel pump, external fuel solenoid, or other electrical fuel control device to the rear PUMP terminal on rear panel.

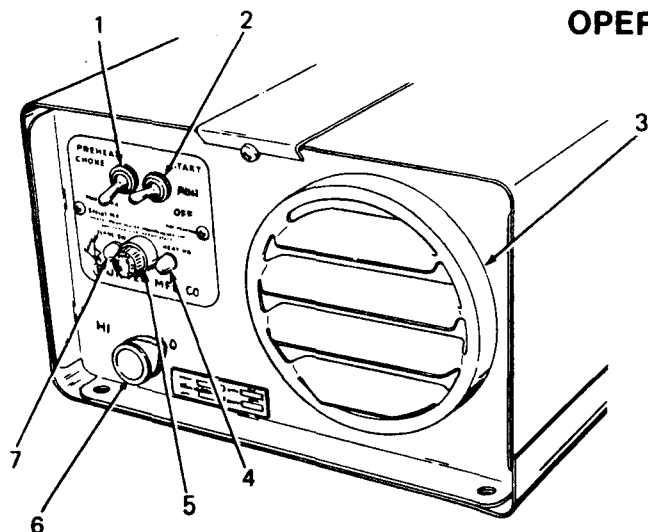
MODIFICATION FOR POSITIVE GROUND OPERATION

CAUTION

The heater is shipped from the factory wired for 12 or 24 volts negative ground. For installation in a vehicle with positive ground, make the modifications described below.

Interchange the black lead and the white lead from the ignition pack to the printed circuit board to accommodate the ignition pack to positive or negative ground. For operation with negative ground, the black goes to the terminal marked black and the white to the terminal marked white. For operation with positive ground, reverse the black and white wires.

SECTION 3 OPERATION



CONTROLS AND INDICATORS

Controls and indicators used during operation of the heater are listed in Table 3.

1. PREHEAT/CHOKE switch
2. START RUN OFF switch
3. Air deflector
4. HEATING indicator
5. Fuseholder
6. HI-LO switch
7. FLAME SW indicator

Figure 6. Controls and Indicators

Table 3. Control and Indicator Functions

Fig. 6 Index No.	Name	Function
1	PREHEAT/CHOKE switch	When held operated, it energizes the choke solenoid to supply a richer fuel mixture for starting. It also energizes the glow plug in the burner head, and the fuel heater in the carburetor body to aid starting at low ambient temperatures.
2	START RUN OFF switch	<p>When held in the START position, this switch energizes the blower motor, primary carburetor fuel solenoid, ignition pack, and fuel pump or fuel feed solenoid.</p> <p>After the amber FLAME SW indicator glows, this switch is moved to the RUN position. This transfers power to the flame switch, which maintains the fuel, ignition, and blower motor circuits so that the heater cycles under control of the HI-LO microswitch.</p> <p>When moved to the OFF position, this switch deenergizes the fuel and ignition circuits to stop spark and fuel flow, but it allows the blower motor to run until the heat exchanger has cooled. The motor then shuts off under control of the flame switch.</p>
3	Air deflector	Turn this to adjust the direction of warm air flow, or use to attach 5-inch flexible ducting. Second deflector at rear permits cold air intake or provides connection for return air ducting.
4	HEATING indicator (green)	Lights to indicate that electrical power is applied to heater circuits during starting and running. This light goes out when the burner is cycled off under control of the HI-LO microswitch, and when the START RUN OFF switch is moved to OFF.
5	Fuseholder	Holds heater fuse (F1) shown in the wiring diagram. Press in and rotate the cap counterclockwise to remove the fuse.
6	HI-LO control	Controls the temperature of the heated air delivered to the compartment. This control moves a lever which limits the travel of the bi-metal blade, thus determining the temperature at which the bi-metal blade actuates the HI-LO microswitch. Turning the knob toward HI increases the permissible bi-metal blade travel and raises the temperature of the heated air. When the microswitch is actuated, the blower continues to run, but fuel flow and ignition are stopped.
7	FLAME SW indicator (amber)	During starting, this indicator lights to show that the burner has ignited and is burning properly. After the heater is turned off, this light will remain on indicating that the heater is in the purge cycle.

STARTING

1. Turn the HI-LO control to HI.
2. Raise the PREHEAT/CHOKE switch and hold it in this position. This switch applies power to heat the carburetor body and to preheat the burner head to facilitate combustion. Approximate preheating times are listed below.

<u>Temperature (°F)</u>	<u>Diesel Approximate Preheat Time</u>	<u>Gasoline</u>
+40°	20 to 30 seconds	10 seconds
+20°	1 minute	30 seconds
0°	1-1/2 to 2 minutes	45 seconds
-20°	2 to 2-1/2 minutes	1 minute
-40°	3 minutes or more	1 minute

3. During the last 5 to 10 seconds of preheating time, move the START RUN OFF switch to the START position and hold it there. The green HEATING indicator must light immediately. Release the PREHEAT/CHOKE switch at the end of the allotted time.

4. When the amber FLAME SW indicator lights, move the START RUN OFF switch to the RUN position. Both lights must be on. If the amber light goes out, repeat steps 2 and 3.

HEATING

1. The heater will continue to run as long as fuel and power are provided to it, and the flame switch remains closed.
2. The HI-LO microswitch (actuated by a wishbone-shaped bi-metal blade seen in the warm air outlet) controls heater cycling and blower motor speed. As the air temperature cools, the bi-metal blade contracts and closes the microswitch. Blower motor speed increases, fuel flow and spark resume, and the fuel burns in the burner head. The heater will continue to cycle in this manner as long as power and fuel are available.

STOPPING

1. Move the START RUN OFF switch to the OFF position. The green indicator should go out immediately.
2. The heater should not shut off immediately, since the heater incorporates circuits for a purge cycle. The blower will run until all fuel in the burner is consumed and the heat exchanger cools sufficiently to open the flame switch. When this occurs, the blower motor will stop and the amber FLAME SW indicator will go out.

SECTION 4 TROUBLESHOOTING

TROUBLESHOOTING

1. Refer to Table 4 for assistance in determining the cause of heater malfunctions.
2. Refer to the wiring diagram in figure 5 for assistance in locating wires. Component locations are shown in figure 7.
3. Illustrations of active circuits follow the troubleshooting chart as a further aid to troubleshooting.

Table 4. Troubleshooting Chart

Trouble	Cause and/or Remedy
<p>A. Heater fails to start - motor does not run.</p> <p>B. Heater fails to start - motor runs.</p> <p>C. Motor runs, but there is no combustion.</p>	<ol style="list-style-type: none"> 1. Check fuse. 2. Check all electrical connections, including ground. 3. Check power at the heater; at least 11 VDC is required (at least 22 VDC for 24-volt heaters). 4. Check motor. Replace if necessary. <ol style="list-style-type: none"> 1. Excessive voltage drop during preheat. Use of PREHEAT/CHOKE switch draws 18 amps at 12 volts (9 amps at 24 volts), and START switch adds 8 amps (4 amps for 24-volt heaters). If wire size is too small or ground connection is poor, low voltage at the heater may result. 2. Too much fuel during starting. Do not operate PREHEAT/CHOKE and START switches simultaneously for long periods of time, or burner may be flooded. 3. Incorrect starting procedure. <div data-bbox="979 761 1207 846" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>CAUTION</p> </div> <p>If the high tension lead is disconnected from the igniter for any reason, DO NOT energize the unit without first providing a discharge gap of 1/8 inch or less from the high tension lead to the grounded igniter. With a larger gap, electrical potential can cause an insulation breakdown in the ignition pack or in the high tension lead. The same also applies if the high tension lead is attached to the igniter with the igniter removed from the unit. Provide a gap of 1/8 inch or less here also.</p> <div data-bbox="963 1123 1235 1219" style="border: 1px solid black; padding: 5px; text-align: center;"> <p>WARNING</p> </div> <p>Use insulated tools and take care to prevent contact with the high tension lead. High voltage is present which could cause injury.</p> <ol style="list-style-type: none"> 4. Check for spark by holding an insulated-handle screwdriver with the shaft grounded and the tip approximately 1/8 inch away from the high tension lug of the ignition pack. There should be a continuous strong spark. If no spark is produced, check that there is voltage applied to the ignition power supply. If input voltage is present and no spark or a weak spark is produced, replace the ignition pack. 5. Check the igniter. To check, remove and examine. The electrode should be centered, and not clogged or shorted with carbon. Visually check operation with the igniter removed from burner head, but connected to the high tension lead with body grounded. Shut off fuel and ground igniter on heater case to check for spark. Replace if defective. 6. Check for adequate fuel supply and correct grade of fuel. <ol style="list-style-type: none"> 1. Check for fuel at the float bowl. Remove the pipe plug at the side of the float bowl and gently depress the float. If fuel is present, it will show on the object used to depress the float and buoyancy can be felt.

Table 4. Troubleshooting Chart (Cont)

Trouble	Cause and/or Remedy
C. Motor runs, but there is no combustion. (cont)	<ol style="list-style-type: none"> 2. Check HI-LO control and microswitch adjustment. Refer to Section 6, Adjustment and Repair. 3. Check for spark as described in B.4. 4. Check the igniter as described in B.5. 5. Check tilt switch mounted on printed circuit board. The switch must be secure in its bracket and be in the vertical position with the electrical leads pointing down. Check leads on both sides of switch for power. 6. Check float level, fuel pressure, and carburetor fuel needle setting. Excessive fuel flow will cause rapid buildup of carbon in the heat exchanger. Correct fuel feed is 8 cc per minute (3-1/2 minutes per ounce). 7. Check for restricted circulating air flow, which could cause overheating. 8. Check fuel heater and glow plug circuits with PREHEAT/CHOKE switch energized. If there is power but no heat from these parts, replace the faulty component. If there is no power to the fuel heater during preheating, check all connections, wires, and the switch.
D. Inadequate heat output.	<ol style="list-style-type: none"> 1. Check for low voltage. Heater must have 11 volts minimum (22 volts minimum for 24-volt heaters) so that motor turns fast enough to ensure adequate combustion air flow. 2. The heat exchanger may have a heavy coating of carbon internally. Check fuel flow as described in C.6. 3. Incorrect adjustment of HI-LO microswitch and bi-metal blade. See HI-LO CONTROL AND MICROSWITCH in Section 6.
E. Fan fails to go to high speed during burning cycle.	<ol style="list-style-type: none"> 1. Check relay. Replace printed circuit board assembly if defective. 2. Check motor and connections. With the power on, touch orange motor lead to red motor lead; speed must increase. Replace motor if defective. 3. Check electrical connections. 4. Check HI-LO control and microswitch. See Section 6.
F. Heater remains on burner cycle after heat demands are met.	<ol style="list-style-type: none"> 1. HI-LO control or microswitch out of adjustment. See Section 6. 2. Bi-metal blade broken or linkage out of adjustment. 3. Dirt on fuel solenoid valve lip.
G. Excessive smoke in exhaust.	<ol style="list-style-type: none"> 1. Check for low voltage causing slow motor speed and inadequate combustion air flow. Combustion air pressure should be at least 4 to 4-1/2 inches of water. 2. Excessive fuel flow with fuel needle open too far. Adjust fuel needle as described in Section 6.

Table 4. Troubleshooting Chart (Cont)

Trouble	Cause and/or Remedy
G. Excessive smoke in exhaust. (cont)	<p>3. Check for mechanical binding in combustion air blower motor. See Section 6.</p> <p>4. Check for spark as described in B.4.</p> <p>5. Check the igniter as described in B.5.</p>

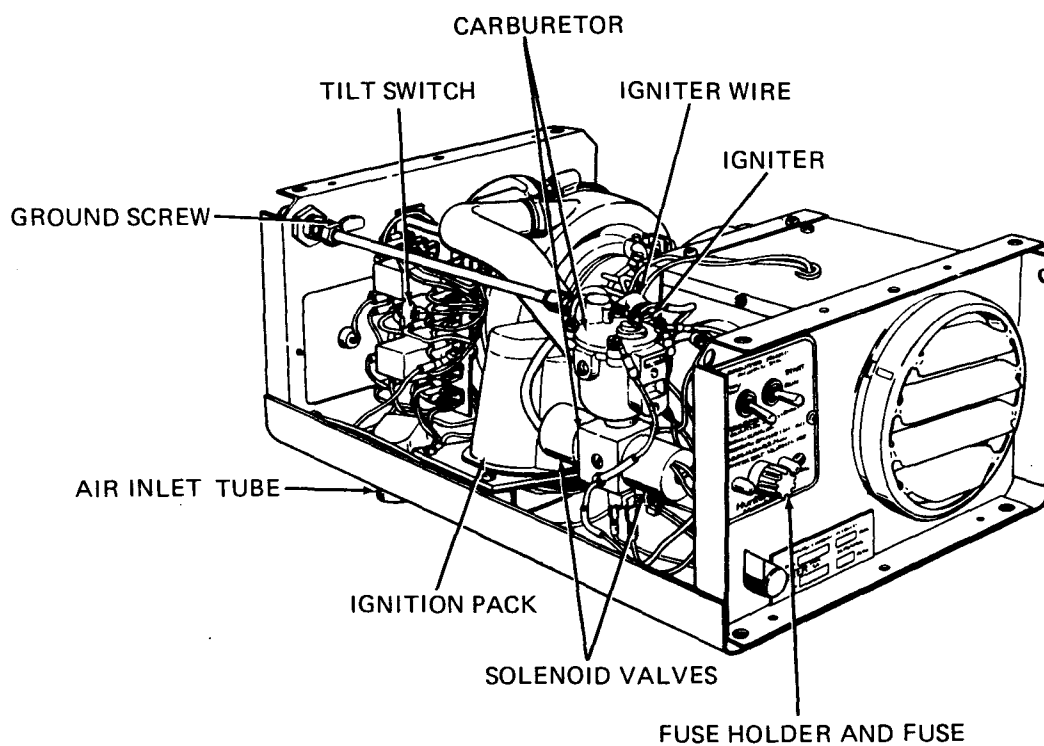


Figure 7. Component Locations

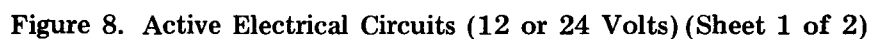
Refer to figure 8 and follow the circuits illustrating heater electrical operation.

The diagram illustrates the electrical system for a 1971-1972 Chevrolet engine. It shows the following components and their connections:

- Power Source:** +12 VDC OR +24 VDC.
- Fuse:** F1.
- Wiring Colors:** BLUE, GREEN, RED, ORN, WHITE, BLACK, GRY, YEL.
- Switches:** S3 FLAME SWITCH, S2 START RUN OFF, S6 HI-LO MICROSWITCH, S4 OVERHEAT, S7 TILT, S1 PREHEAT CHOKE.
- Relays:** K1 RELAY, K2 RELAY.
- Solenoids:** L1 FUEL PUMP (EXTERNAL), L2 CHOKE SOLENOID, L3 PRIMARY FUEL SOLENOID.
- Capacitors:** C2 SUPPRESSION CAPACITOR, C3 SUPPRESSION CAPACITOR.
- Heating Elements:** DS1 HEATING, HR1 FUEL HEATER, GP1 GLOW PLUG.
- Other Components:** DS2 FLAME SWITCH, B1 BLOWER MOTOR, G G, PSI, E1, PCB1 PRINTED CIRCUIT BOARD, S8 CARBURETOR HEATER THERMOSTAT.

HEAVY LINES INDICATE ACTIVE CIRCUITS

NOTE: SHADED AREAS ARE PRINTED CIRCUIT BOARD MOUNTED COMPONENTS.



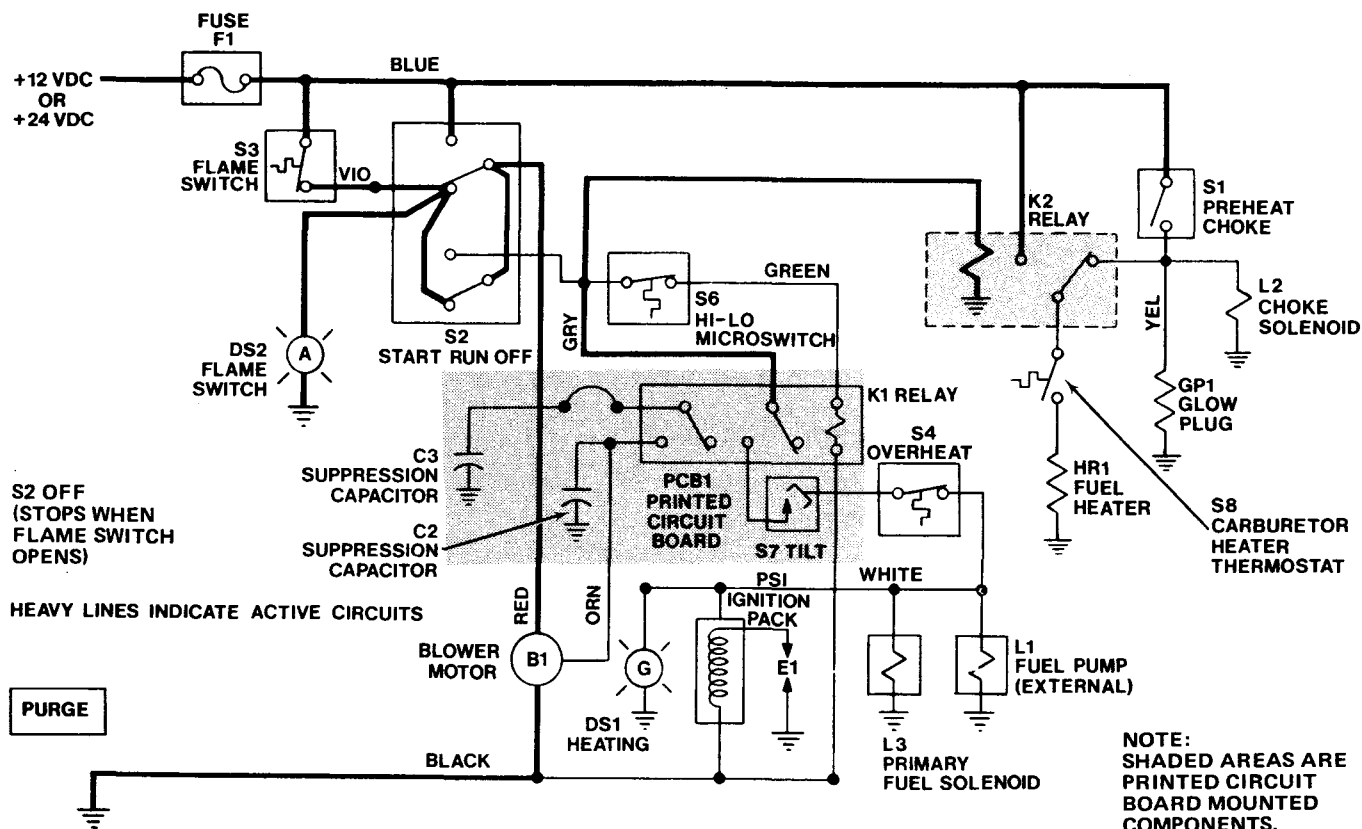
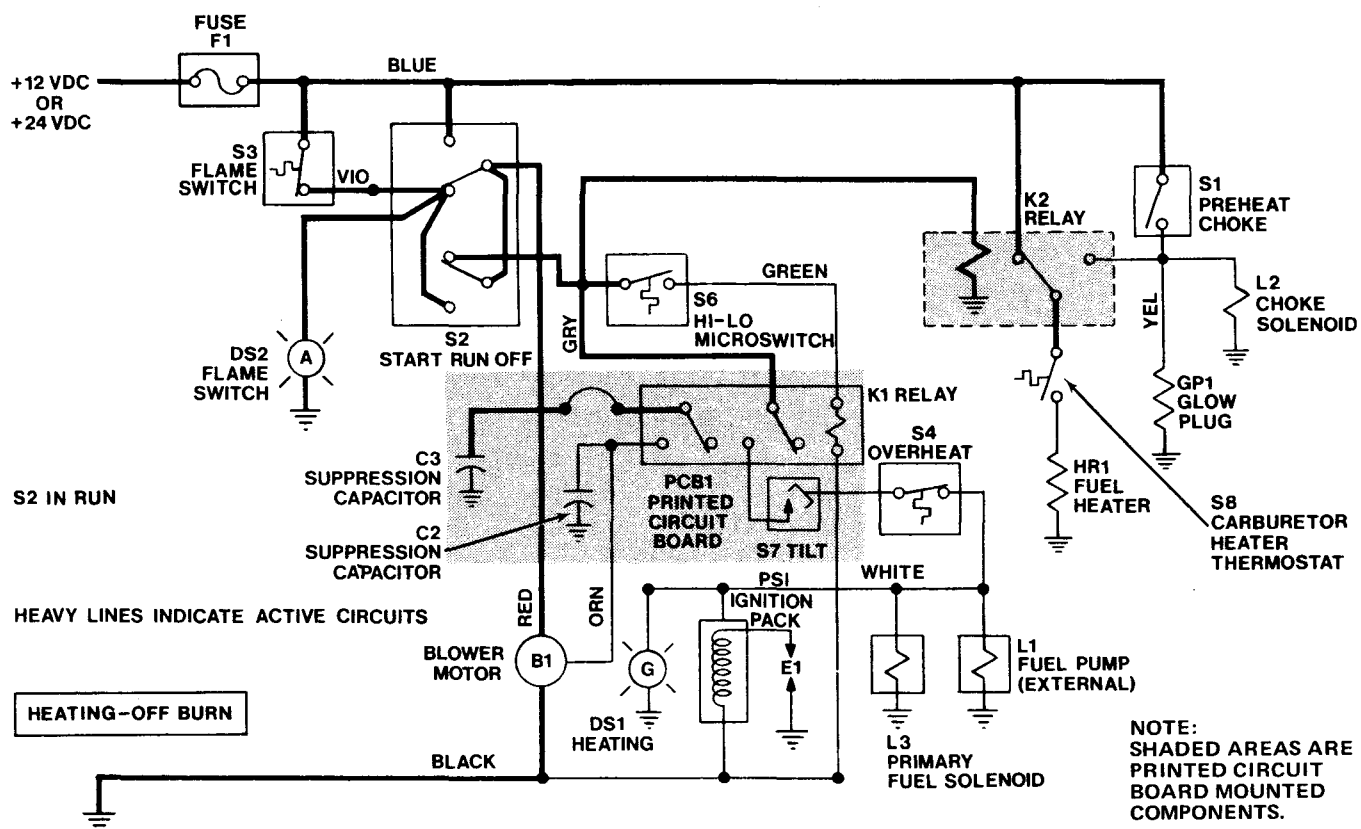


Figure 8. Active Electrical Circuits (12 or 24 Volts) (Sheet 2 of 2)

SECTION 5

ANNUAL SERVICE INSTRUCTIONS

GENERAL

The following service procedures, if performed each year, will help ensure proper operation and will extend the life of the heater.

TOOLS REQUIRED

Allen wrenches
Screwdrivers, flat blade and phillips
8-inch adjustable wrench
DC voltmeter
Pliers
Rubber hose, 1/4-inch id, 18 inches long
Inflation needle (such as used for inflating a football)

PRESEASON CLEANING

1. Drain old fuel from the fuel lines and fuel system.
2. Remove the igniter; clean and inspect. Remove carbon between the electrode and shroud. Check that the electrode is centered in the body.
3. Remove the burner head and remove excess carbon deposits.

NOTE

Use a new gasket when refitting burner head.

4. Clean the blower and motor by using compressed air on combustion air inlet. Apply 2 drops of light oil on the motor shaft next to the front end bearing.
5. Run the heater at least once every week during the warm seasons of the year. This will help prevent varnish buildup caused by evaporating fuel, and will help keep the motor bearings turning freely.
6. Perform check and adjustment described below.

OPERATING CHECK AND ADJUSTMENT

Annual service checkout should be done before the heating season starts, to ensure that the heater will be ready when required.

A proper air/fuel ratio, combined with a hot spark from the Hunter solid state ignition pack, will ensure that your FalconAire Heater provides trouble-free service. A well-tuned burner system will maintain a clean, carbon-free heat exchanger. An incorrect air/fuel ratio wastes fuel and produces excessive smoke from the exhaust, which will soon lead to a heavy buildup of carbon in the heat exchanger.

Proper combustion air pressure in the burner head and fuel mixer siphons the exact amount of fuel from the carburetor float bowl when the fuel needle is correctly adjusted. Opening the fuel needle too far in an attempt to speed starting or increase heat output always results in heater shutdown because of carbon buildup.

Blower motor speed determines the amount of combustion air delivered to the burner head. Motor speed varies directly with voltage. Factory setting of the carburetor fuel needle is made with 11 volts (22 volts for 24-volt heaters) applied at the control panel fuse. Higher voltage up to 13-1/2 volts maximum (27 volts maximum for 24-volt heaters) produces higher heat output while maintaining the correct air/fuel ratio. Lower voltages, however, produce insufficient combustion air flow, causing smoky exhaust and subsequent carbon formation in the heat exchanger and burner head.

Check as follows:

1. Use a DC voltmeter to measure the voltage at the heater fuse. There must be 10-1/2 volts minimum measured to ground (21 volts minimum for 24-volt heaters). If the voltage is low, check for:

- Vehicle electrical system problems
- Loose or corroded connections
- Undersized supply wires (see Table 2)
- Poor ground

2. If the supply voltage is within limits, check combustion air pressure as follows:

- a. You will need an 18-inch length of 1/4-inch id rubber hose, a football inflating needle, and a tall jar or glass containing at least 6 inches of water. Insert the inflating needle into one end of the rubber hose, and push the inflation needle into the combustion air hose between the blower and the burner head.

- b. Hold the START RUN OFF switch in the START position to obtain high blower speed, and immerse the end of the hose in the jar of water. Push the hose deeper under the surface until the bubbling just stops. Measure the length of hose that is submerged; this length must be at least 4 inches. The submerged depth represents the water column pressure produced by the blower.

- c. If the air pressure is less than 4 inches of water, the air/fuel ratio will be incorrect. Check the voltage at the motor orange lead; there must be 10-1/2 volts minimum (21 volts for 24-volt heaters). If the voltage is high enough but air pressure is low, check the following:

- Motor is defective
- Motor bearings need oil
- Combustion air inlet is plugged or restricted
- Blower wheels are loose on motor shaft
- Carburetor or fuel mixer is not seated in burner head

3. If air pressure is correct, check fuel needle adjustment.

- a. Mark the position of the fuel needle slot on the carburetor body. Turn the fuel needle fully clockwise until it bottoms, and count the number of turns it takes. If full shutoff requires more than 1-3/4 to 2 turns, flow rate is probably excessive.

- b. Back out the fuel needle one full turn. Start the heater.

- c. Allow the heater to run for a few minutes and observe the heat exchanger. When the fuel needle adjustment is correct, the cross-over joint between the main burner section and top shell of the heat exchanger will glow dull red. There will be no smoke from the heater exhaust.

- d. If the heater does not burn in this manner, adjust the fuel needle in 1/8-turn increments, allowing the heater to run for 5 minutes after each increment, until the heater burns as described in step c.

SECTION 6

ADJUSTMENT AND REPAIR

HEATER HOUSING

1. The heater is designed for easy service. To remove it from the vehicle, disconnect fuel lines, electric wires, and exhaust connections. Remove the mounting bolts and remove the heater. If the heater has been in service for a long time, it may be easier to remove exhaust connector (13, fig. 13) than to disconnect the exhaust piping from the connector.

WARNING

Disconnect electrical power from the heater before removing the covers. Do not run the heater with covers removed except for troubleshooting or adjustment. The ignition pack generates a voltage that is high enough to cause severe injury.

2. The covers (2, fig. 13) are a slide fit. From the sides of the heater, pull outward on the covers to disengage them from the cross bar (1) at top center of the heater.
3. Three clips hold each of the air deflectors (10) to the case. Pull or pry deflectors out of clips. Clips should stay attached to heater's flange.
4. When reinstalling the heater, the use of Exhaust Seal Kit, part number 49530, will facilitate heater installation.

CARBURETOR ASSEMBLY

NOTE

The fuel needle has been adjusted at the factory for the proper air/fuel ratio, using sophisticated equipment. This setting should not be changed unless the characteristics of the fuel have changed. A lean burning heater will last longer and will require less frequent service.

1. Field Adjustment. Carburetor adjustment must be made while the heater is running.
 - a. If the carburetor fuel needle (figure 9) is seated so that no fuel is allowed to pass to start combustion, back it off one turn and then start the heater. Adjust the setting of the fuel needle after the heater has reached operating temperature. When properly adjusted, the heater will burn evenly and smoothly with the fuel needle turned counterclockwise just to the point that no smoke is visible in the exhaust. This will provide the maximum efficient heating.

CAUTION

Disconnect the fuel pump during the following test to prevent fuel from spilling around the heater.

- b. The fuel feed rate should be 7 cc per minute with 11 volts (22 volts for 24-volt heaters) applied to the heater fuse. This is equivalent to 4-1/4 minutes time for one ounce of fuel to flow. Approximate flow rate measurement can be made by connecting a calibrated container of fuel to the carburetor fuel inlet. Start the heater and measure the time it takes for the heater to consume the calibrated amount of fuel.

2. Removal (figure 17).
 - a. Disconnect the fuel line at the float bowl.
 - b. Tag and disconnect the leads from the solenoid coils and the fuel heater at the printed circuit board.
 - c. Remove the four screws that secure the carburetor assembly to the burner head. Pull straight out to remove the carburetor. Slide the tubing (2) from the over-flow fitting.

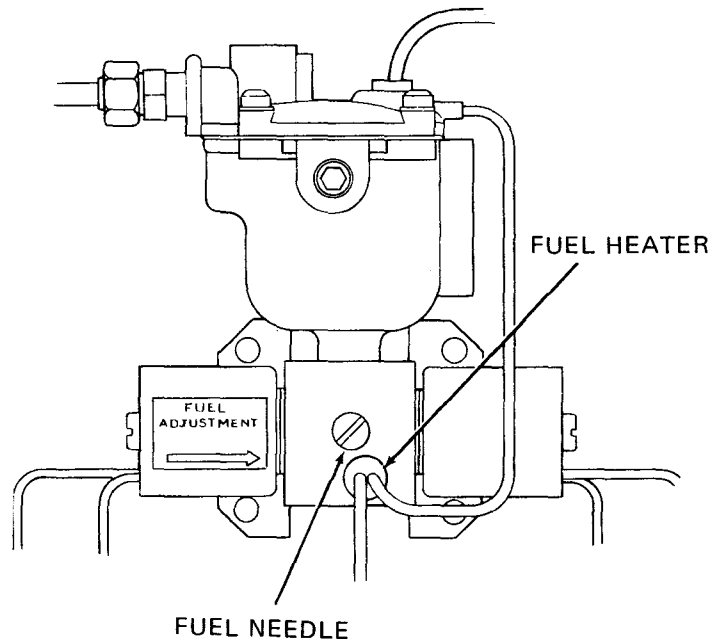


Figure 9. Fuel Needle Adjustment

d. Remove the fuel needle (15). If it is distorted or has a broken tip, damaged threads, or a sheared O-ring, it must be replaced.

3. Installation. Installation of the carburetor is the reverse of removal. If necessary, refer to the wiring diagram in figure 5 for reconnection of electrical leads.

CARBURETOR SOLENOID VALVES

No repair to the solenoid valves is possible. Remove and replace as follows:

1. Disconnect the solenoid leads. Insert a large screwdriver into the slot at the end of the coil. Turn the screwdriver blade with a wrench to unscrew the coil from the carburetor body. Remove the O-ring from the body. Do not lose the poppet or poppet spring.

2. Inspect the solenoid for dirt embedded in the face of the poppet or collecting in the poppet cavity. Inspect the poppet seat; it must be smooth and free from contaminants.

NOTE

Replace a defective solenoid as an assembly. If the solenoid must be reused, handle all parts carefully to avoid damage or contamination.

3. To install a new solenoid and O-ring, reverse the disassembly procedure. Again use a wrench to turn screwdriver blade. Be sure the solenoid bottoms, compressing the O-ring completely into the 45-degree chamfer at the end of the coil threads.

CARBURETOR FLOAT BOWL

1. Removal and Disassembly (figure 17).

a. Disconnect the fuel line from the float bowl body (21).

b. Remove the four screws that secure the float bowl cover (24) to the float bowl. Lift up the cover, and slide the tube of the overflow fitting (1) out of the tubing (2).

c. Pull out the pin (23) that secures the float to the cover. Remove the float, taking care not to lose the needle of the needle and seat assembly (5). High mortality parts are contained in the service kit listed in the parts list.

2. Cleaning and Inspection.

a. Clean all parts with diesel fuel or carburetor cleaning solvent. Wipe dry or air dry.

b. Inspect the float (6) for cracks and dents. If it is damaged or loaded with fuel, replace it.

c. Inspect the needle and seat (5) for scoring, damaged seat or worn needle. If either part is damaged, the set must be replaced with the contents of Fuel Bowl Assembly Kit, part number 48307.

d. Check the inlet screen (25) in the cover for clogging and for holes. Replace a damaged screen.

3. Reassembly and Installation. Reassembly and installation are the reverse of the removal and disassembly. The use of Carburetor Seal Kit, part number 49525, is recommended.

FUEL JET

1. Removal and Disassembly (figure 17).

a. Remove the carburetor.

b. Unscrew the fuel mixer (9) from the fuel jet (8).

c. Unscrew the fuel jet from the body (13). Remove and retain gasket (11).

2. Cleaning and Inspection.

- a. Clean the parts in diesel fuel. Carefully remove all carbon from the face of the fuel mixer.
- b. Inspect the fuel mixer for eroded or clogged holes and other damage.
- c. Inspect the fuel jet for contaminants in its bore. (Note: gasoline jet has spiral pin in its bore.)
- d. Replace the gasket (11) and any other damaged parts.

3. Reassembly and Installation. Reassembly and installation are the reverse of the removal and disassembly.

BURNER HEAD

1. Removal and Disassembly (figure 14).

- a. Remove the carburetor assembly.
- b. Disconnect the high tension lead to the igniter (10).
- c. Disconnect the electrical lead from the glow plug (6).
- d. Disconnect the combustion air hose from the burner head (3).
- e. Remove the five screws that secure the burner head to the heat exchanger mounting bracket; remove the burner head and gasket (2).
- f. Remove the igniter and glow plug from the burner head.

2. Cleaning and Inspection.

- a. Verify that ceramic felt is still found cemented to rear of burner chamber and ceramic felt washer is cemented just inside mounting flange on inner face of burner head. Clean the igniter and glow plug with cleaning solvent or diesel fuel.
- b. Clean the carbon from the burner head interior.
- c. Inspect the burner head for cracks, dents, damaged threads, loose or kinked overflow drain line, or other damage.
- d. Inspect the igniter for an eroded or damaged electrode, cracked porcelain and damaged threads. Check that the electrode is centered in the body.
- e. Inspect the glow plug for cracks, burned out heating element, damaged threads, or cracked porcelain.
- f. Replace damaged parts.

3. Reassembly and Installation. Reassembly and installation are the reverse of removal and disassembly. Refer to figure 14. Make sure the gasket (2) is in place before positioning the burner head.

IGNITION PACK ASSEMBLY

1. Testing. Test the igniter and ignition pack assembly as described in the troubleshooting chart, Table 4, or, a quicker test is to simply hold a neon lamp (test light) near igniter wire — lamp should glow when ignition is operating.

2. Removal (figure 14).

- a. Pull off the high tension lead from the ignition pack to the igniter. Disconnect the white and black leads (and purple lead on certain 1981 models).
- b. Remove the two mounting screws from the bracket on the bottom of the ignition pack. Tilt the ignition pack and lift it from the case.

NOTE

If necessary to provide clearance, loosen the motor and blower assembly clamp and shift the assembly slightly when removing the ignition pack.

3. Cleaning and Inspection.

- a. Wipe the exterior of the ignition pack with a dry cloth.
- b. Inspect the ignition pack for cracks, loose or broken output terminal, and broken input lead. Replace if defective.

NOTE

The ignition pack base plate is sealed in place. Do not attempt to remove it. No repair of the unit is authorized.

4. Installation. Installation is the reverse of removal.

CAUTION

The ignition pack will not function if it is operated with the wrong polarity. Refer to MODIFICATION OF POSITIVE GROUND OPERATION, page 10, before connecting ignition pack white and black leads. Purple lead is ground connection (on some 1981 models, later eliminated).

MOTOR AND BLOWER ASSEMBLY (Refer to figure 18)

1. Removal.

- a. Carefully note the connection of the motor leads to the printed circuit board, and disconnect leads, tagging them for ease of reconnection.
- b. Remove air hose (20) and air duct (22).
- c. Remove screws holding mounting plate (1) to heat exchanger wrap-around.
- d. Complete motor and blower assembly can now be removed from the heater.

2. Disassembly.

- a. It is recommended that the motor and blower assembly not be disassembled since blower wheels are press fit securely onto motor shaft. This unit can be supplied as a single assembly.
- b. After noting relation of blade tips to orifice in mounting plate (1), remove prop fan (15) and loosen screw (6) to permit withdrawing motor from motor mount (5).

3. Cleaning and Inspection.

- a. Clean the parts with a cloth lightly dampened with diesel fuel. Blow off dust and dirt with compressed air.
- b. Inspect the motor for signs of overheating and for rough, catching, or binding operation of the motor shaft. Check the motor using a 12-volt or 24-volt battery as appropriate. Connect the black lead to battery negative. When the red lead is connected to battery positive, the motor will run at low speed. When both the red and orange leads are connected to battery positive, the motor will run at high speed.
- c. Inspect the propeller for cracks, distortion, and other damage.
- d. Inspect blower housing for distortion, cracks, or rubbing blower wheels.
- e. Check all non-metallic parts for brittleness, deterioration, and damage.
- f. Replace all defective parts.

4. Reassembly. Reassembly is essentially the reverse of disassembly. Refer to figure 18 and note the following:

- a. Insert motor/blower into motor mount and tighten screw (6).
- b. Install propeller fan (15) on the motor shaft with the same clearance measured at disassembly.
- c. When installing the propeller fan, use thread sealant on the setscrews, if possible, and check that the setscrews engage flats on the motor shaft. The thread sealant will ensure that the setscrews do not loosen in service.
- d. Be certain prop is centered in mount plate and turns freely without rubbing.

5. Installation. Installation is the reverse of removal. If necessary, refer to the wiring diagram in figure 5 for wire connection information.

HI-LO CONTROL AND MICROSWITCH

1. Adjustment. These parts constitute a thermostat assembly which is adjustable to provide the desired heat level for the cab. Adjust as follows:

a. Remove the air deflector adjacent to the control panel. Squeeze the outside diameter of the deflector at one of the clips, and disengage the deflector from the heater case.

b. The V-shaped bi-metal blade (figure 10) expands to widen the gap at the top of the V when heated. As the bi-metal blade expands, it strokes the actuator stop and pushes the actuating rod against the microswitch. This causes the heating circuits to deenergize.

c. Adjustment is made by changing the position of the actuator stop on the actuating rod. Loosen the two setscrews in the stop to permit adjustment. Hold the rod and shift the stop toward the microswitch to increase the temperature within the control range. Shift the stop toward the bi-metal blade to decrease the temperature within the control range. Tighten the setscrews.

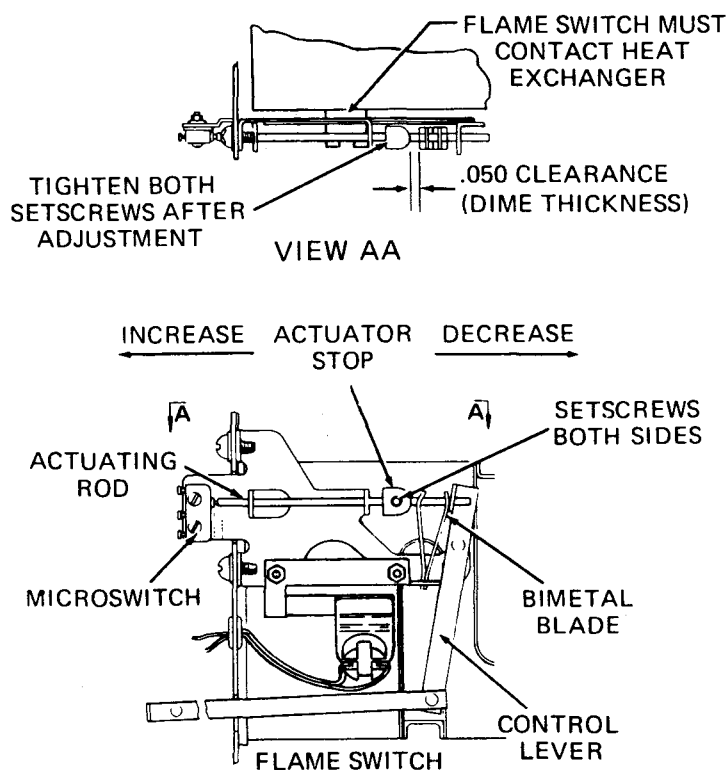


Figure 10. HI-LO Control and Microswitch Adjustment

NOTE

After adjustment there must be a minimum gap of .050 inch between the bi-metal blade and the actuator stop when the control knob is in the LO position. Insufficient clearance will result in incorrect operation.

d. Install the air deflector and operate the heater to determine if it provides the required temperature. Readjust if necessary.

2. Removal and Disassembly (figure 15).

- a. Remove the deflector from the heater outlet.
- b. Remove the stop nut (21) and disengage the pivot arm (20) from the lever.
- c. Remove flame switch (7) by unscrewing hex nuts (6) near the bottom of V-shaped bi-metal blade (4). Be careful to retain spacers (25). Allow switch to hang loose on its wires.
- d. Disconnect leads from microswitch at P.C. board. Remove bracket (5) and heat shield (24), if necessary, and pull out the assembly through the heater outlet.

e. Loosen the setscrews (2) in actuator stop (3). Pull out the actuating rod (1) to release the stop and bi-metal blade (4).

f. Remove two screws through microswitch (22). Pull off the microswitch and insulator (23). These two parts are kitted as shown in the parts list.

3. Cleaning and Inspection.

a. Wipe all parts with a clean cloth. Do not use solvent or diesel fuel.

b. Check continuity of the microswitch (22). Continuity between the two end terminals must break when the switch plunger is depressed. Inspect switch for cracks and for faulty operation.

c. Check continuity of the flame switch (7). At normal temperature it should be open, closing at approximately $120 \pm 5^\circ \text{F}$. It must open upon cooling at $105 \pm 5^\circ \text{F}$. Inspect the switch for cracks and for loose terminals.

d. Inspect all other parts for cracks, burrs, distortion, and damage. Replace damaged parts with service kits listed in the parts list.

e. Inspect the bracket and its levers for cracks and damage. The levers must pivot freely. Wipe off the actuating rod. If desired, lubricate all moving parts (except the microswitch) with automotive speedometer cable lubricant, or equivalent.

4. Reassembly and Installation. Reassembly and installation are the reverse of removal and disassembly. Refer to the wiring diagram in figure 5 for wire connections. After installation, adjust the switch and bi-metal blade as described in paragraph 1.

CONTROL PANEL (For Manual Start Models Only)

CAUTION

Disconnect power from heater to prevent accidental short circuit.

1. Removal and Test (figure 15).

a. Follow harness of wires from the rear of the control panel to the printed circuit board.

b. Remove wires in the harness from the PC board, using pliers to loosen the push-on connectors.

c. Remove two screws holding control panel to heater. Rotate the panel clockwise slightly and pull it out.

d. Use a continuity tester, meter, or test light to check out panel components: fuse, pilot lights, PREHEAT/CHOKE switch, and START RUN OFF switch.

NOTE

Refer to figure 5 for an illustration of START RUN OFF switch continuity in each of its three positions.

2. Parts Replacement. Replace any parts found to be faulty during the above tests. Note the following:

a. Use a large-tipped soldering iron when removing and resoldering switch wires.

b. Provide a good mechanical joint at each terminal before soldering the wire to the switch terminal. Solder is not mechanically strong itself, and can fail from vibration if the wire-to-terminal mechanical joint is not strong.

3. Reassembly and Installation. Reinstall wires on terminals from which they were removed. Observe the wire color code and refer to the wiring diagram (figure 5) if in doubt.

4. See page 32 through 35 for auto-start control panel components and servicing.

5. See page 39 for Remote Control Kit Installation for servicing Kit no. 49500.

HEAT EXCHANGER

WARNING

The heat exchanger must be inspected annually, or more frequently if heater usage is heavy. A damaged heat exchanger can allow poisonous gases to seep into the heated enclosure causing illness or death to occupants. Remove heater from vehicle whenever heat exchanger is removed; washer (12, fig. 13) and exhaust gasket (13) must be replaced upon reinstallation.

NOTE

Heavy carbon deposits may accumulate in the heat exchanger if fuel input is too high, or if combustion air supply is reduced because of low motor voltage, clogged air inlet, or loose blower wheels. If the heater will start, operation with kerosene for a day may help burn out deposits. Extra combustion air fed into air hose to burner head will also help to burn off carbon deposits.

1. Removal (figure 13).

- a. Remove the two screws that secure the cross bar (1) to the case.
- b. Remove the carburetor and the burner head.
- c. Remove the heat exchanger top cover (5).
- d. Spread sides of heat exchanger wrap-around and pull straight up to remove heat exchanger.

2. Cleaning and Inspection.

- a. Clean the exterior of the heat exchanger with a wire brush to remove all dust and dirt.
- b. Inspect the heat exchanger for cracks, holes, broken weldments, and other damage. If defective, replace with Heat Exchanger and Control Subassembly service kit, part number 49742.

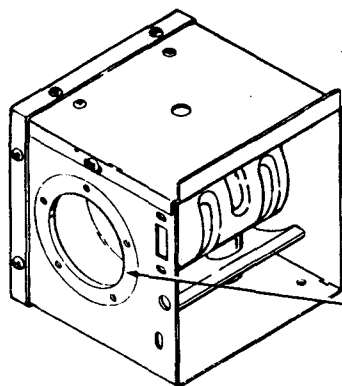
3. Installation (figure 13). Installation is essentially the reverse of removal. Note the following:

- a. Check that exhaust connector (13), exhaust gasket (12), and washer (11) have been removed from the heater case.

CAUTION

Heat exchanger must be installed as shown to prevent exhaust gases from leaking around the burner head.

- b. Carefully align the heat exchanger (16) to the bracket (14). Alignment between the heat exchanger and the bracket is critical to correct sealing of the burner head. Install the heat exchanger in the bracket and carefully align the



HEAT EXCHANGER
BURNER HEAD
MOUNTING RING
SHOULDER MUST
SEAT EVENLY
INSIDE OPENING

heat exchanger within the extrusion in the bracket as shown in figure 11. At the same time, the exhaust outlet must be aligned with the hole in the bottom of the bracket. Make sure all parts are aligned before installing the burner head.

c. Carefully press a new washer (11) and exhaust gasket (12) onto the exhaust tube which protrudes from the heat exchanger. Reinstall exhaust connector (13).

SECTION 7 PARTS LIST

GENERAL

This section lists and illustrates the major parts of Models DH-22 and GH-21 FalconAire Heaters. In general, attaching parts such as screws, nuts, and lock washers have not been listed or illustrated since their application is obvious. If a part has not been assigned a part number or if the abbreviation COML appears, the part can be replaced with a commercially available equivalent.

All available service kits are listed. Parts shown with an asterisk (*) are available only as part of a service kit.

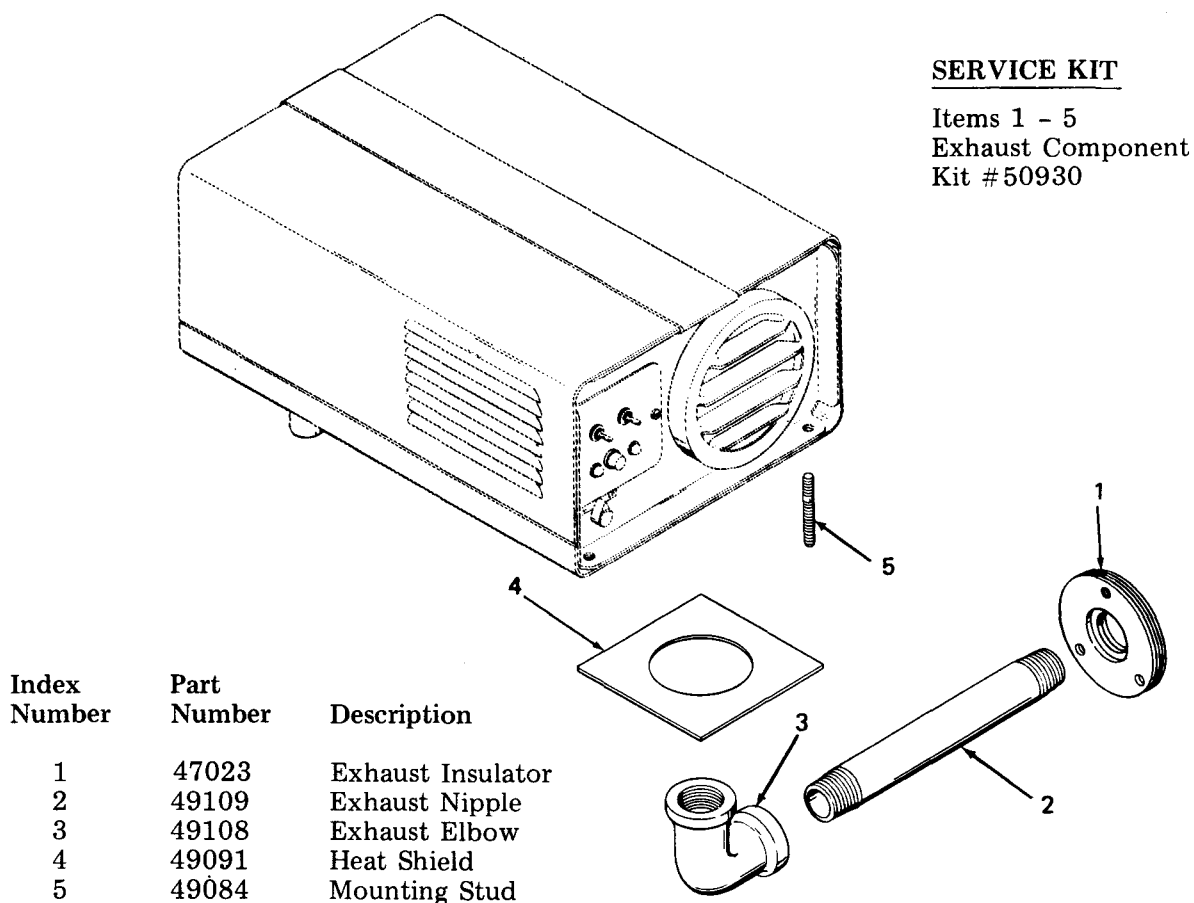
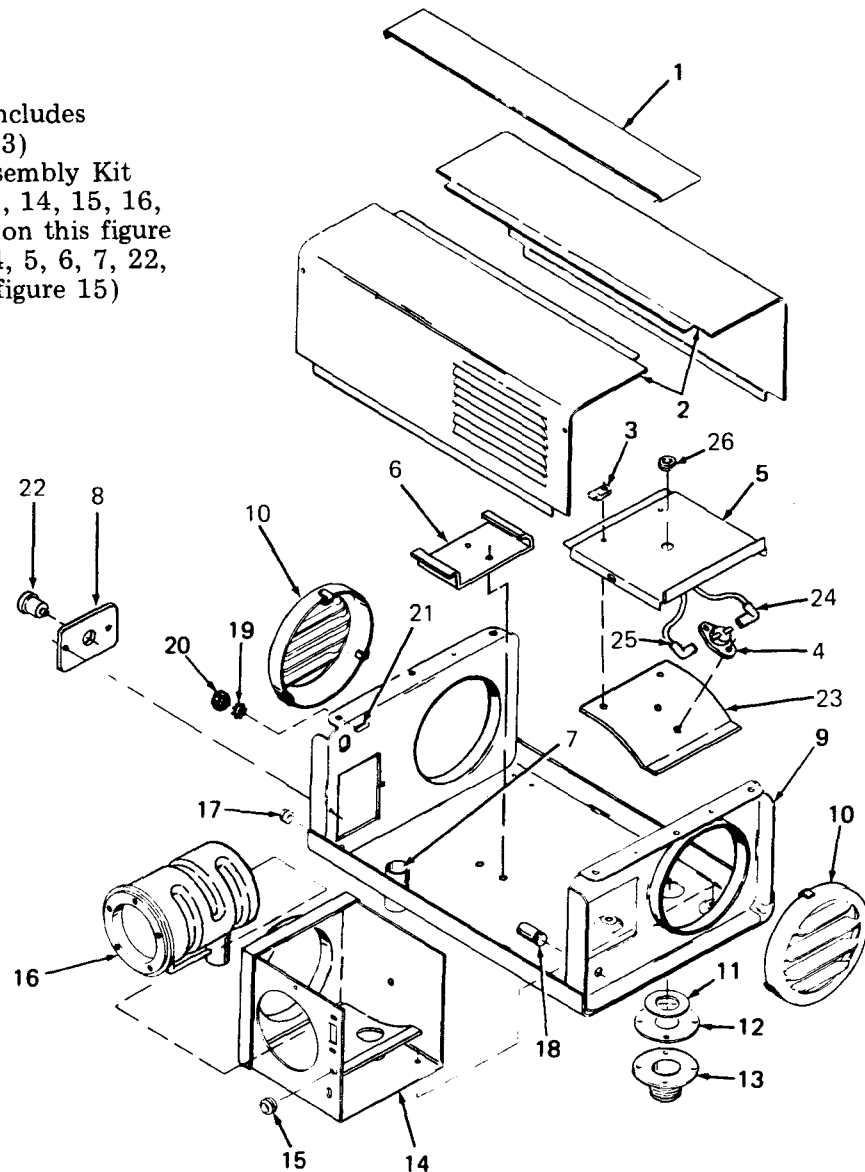


Figure 12. Heater Installation

SERVICE KITS

- 49530 Exhaust Seal Kit (includes items 11, 12, and 13)
 49742 Heat Exchanger Assembly Kit (includes items 4, 5, 14, 15, 16, 23, 24, 25, and 26 on this figure and items 1, 2, 3, 4, 5, 6, 7, 22, 23, 24, and 25 on figure 15)



Index Number	Part Number	Description	Index Number	Part Number	Description
1	49131	Cross Bar	13	*49112	Exhaust Connector
2	49196	Cover	14	49522	Bracket
3	*3634	Clamp	15	3657	Grommet
4	4347	Thermostat (overheat switch)	16	49415	Heat Exchanger
5	*49315	Top Cover	17	3657	Grommet
6	50830	Igniter Pack Mounting Bracket	18		Spacer (part of 9)
7		Air Tube (part of 9)	19	COML	Lock Washer, No. 10 ext tooth
8	50565	Cover Plate	20	COML	Nut, No. 10-24
9	49973	Case Assembly (includes 7, 18, 21)	21		Ground Stud (part of 9)
10	50734	Air Deflector Kit (with 50789 clips)	22	49828	Terminal Connector
11	*49013	Washer	23	*49436	Upper Baffle
12	*49113	Exhaust Gasket	24	*48982-02	Wire Assembly
			25	*48984-01	Wire Assembly
			26	*7047	Grommet

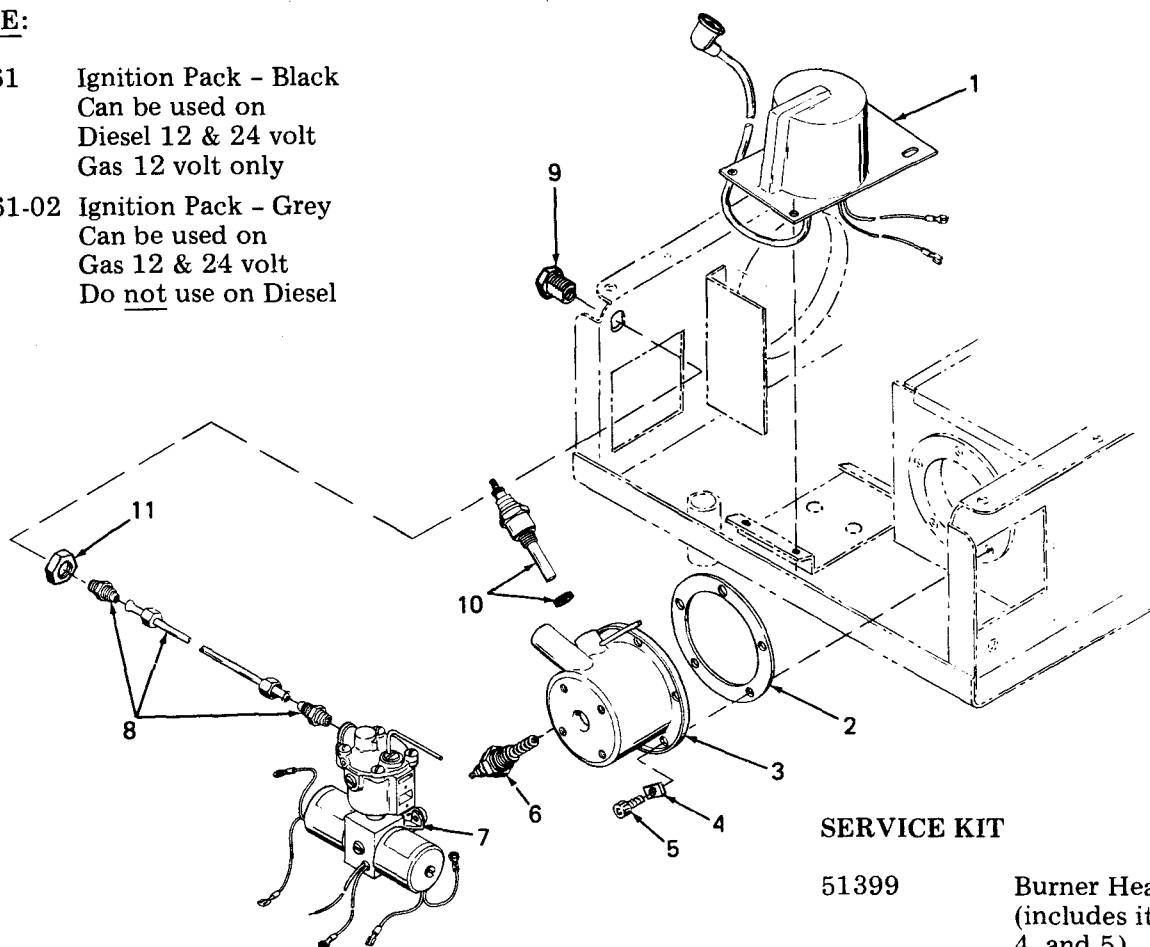
*Items not sold separately - available only in a kit.

Figure 13. Case and Heat Exchanger

NOTE:

49461 Ignition Pack - Black
Can be used on
Diesel 12 & 24 volt
Gas 12 volt only

49461-02 Ignition Pack - Grey
Can be used on
Gas 12 & 24 volt
Do not use on Diesel



SERVICE KIT

51399

Burner Head Kit
(includes items 2, 3,
4, and 5)

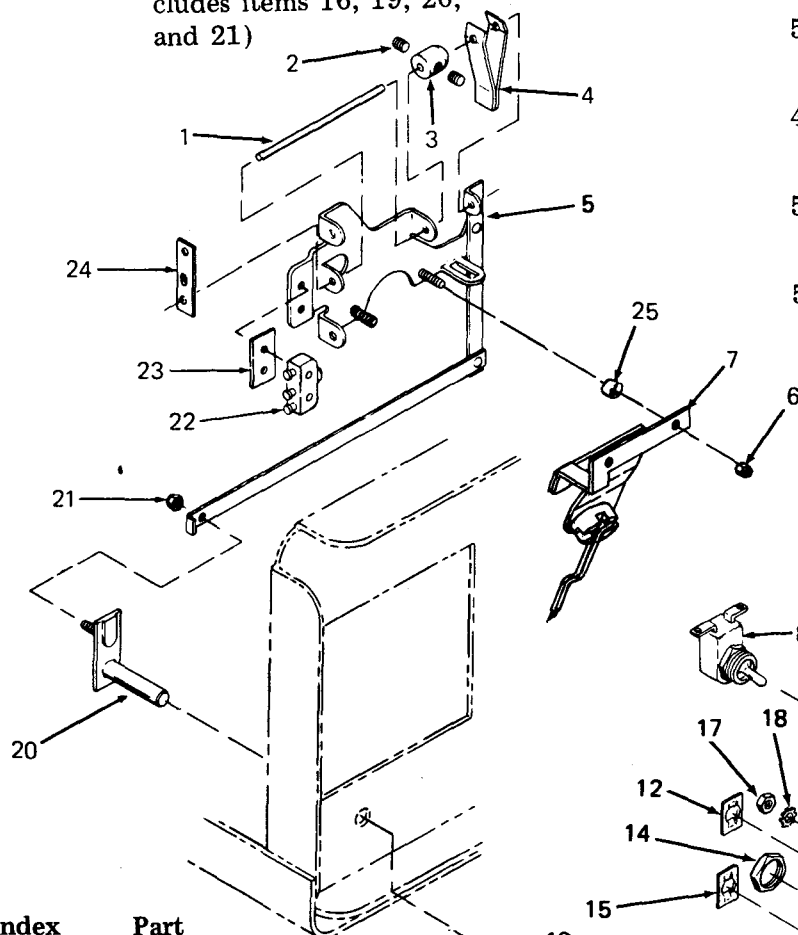
Index Number	Part Number	Description
1a	49461	Ignition Pack Assembly (Diesel) (Black)
1b	49461-02	Ignition Pack Assembly (Gasoline) (Grey)
2	49093	Gasket
3	*49320	Burner Head
4	168680	Pressure Pad
5	7521	Mounting Screw
6	49166	Glow Plug (12 volts)
	48862-02	Glow Plug (24 volts)
7a	50632-12	Carburetor (Diesel) (12 volts)
	50632-24	Carburetor (Diesel) (24 volts)
7b	50632-112	Carburetor (Gasoline) (12 volts)
	50632-124	Carburetor (Gasoline) (24 volts)
8	49529	Fuel Line Assembly
9	47632	Connector
10	49149	Igniter and Gasket
11	5697	Lock Nut

*Items not sold separately - available only in a kit.

Figure 14. Fuel and Ignition Systems

SERVICE KITS

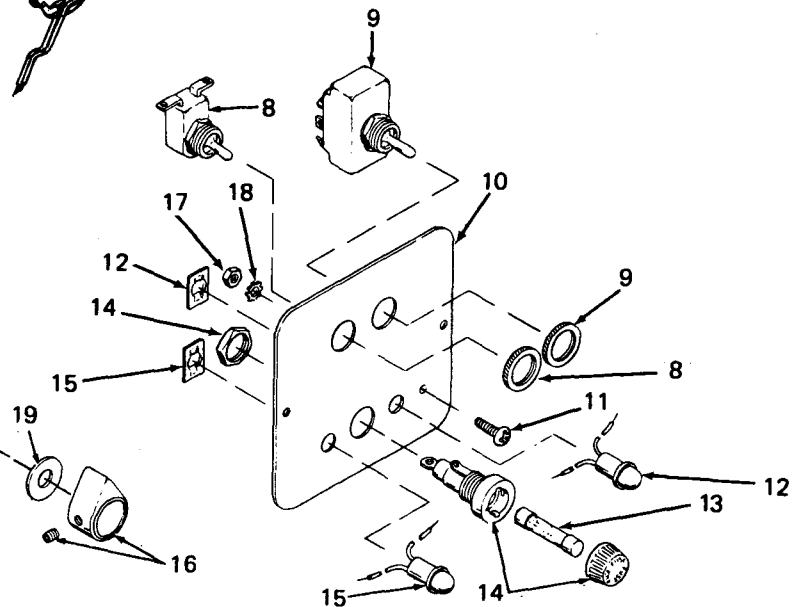
- 51708 Thermo Control Kit (includes items 1, 2, 3, 4, 5, 6, 7, 22, 23, 24, and 25)
- 49527 Pivot and Knob Kit (includes items 16, 19, 20, and 21)



Index Number	Part Number	Description
1	*49069	Actuating Rod
2	*2086	Setscrew
3	*400383	Actuator Stop
4	*47741-01	Bi-Metal Blade
5	*49740	Bracket
6	*49733	Hex Nut
7	49734	Flame Switch
8	47237	Toggle Switch (preheat switch) (momentary contact)
9	49521	Toggle Switch (start-run switch) (2-pole) (w/jumpers)
10	49656	Plate (Diesel only)
	49657	Plate (Gasoline only)
11	COML	Ground Screw, No. 6-32 x 3/8 inch)
12	170855-03	Pilot Light (green, 12 VDC)
	49778-02	Pilot Light (green, 24 VDC)
13	47273	Fuse, 30 amp (12-volt only)
	46273	Fuse, 20 amp (24-volt only)
14	73270	Fuseholder

SERVICE KITS

- 49528 Microswitch Kit (includes items 22 and 23)
- 50625-12 Control Panel Assembly for DH22-15A (includes items 8 through 15, 17 and 18)
- 50625-24 Control Panel Assembly for DH22-16A (includes items 8 through 15, 17 and 18)
- 49700 Control Panel Assembly for DH22-17A (includes items 8 through 15, 17 and 18)
- 50624-12 Control Panel Assembly for GH21-15A (includes items 8 through 15, 17 and 18)
- 50624-24 Control Panel Assembly for GH21-16A (includes items 8 through 15, 17 and 18)



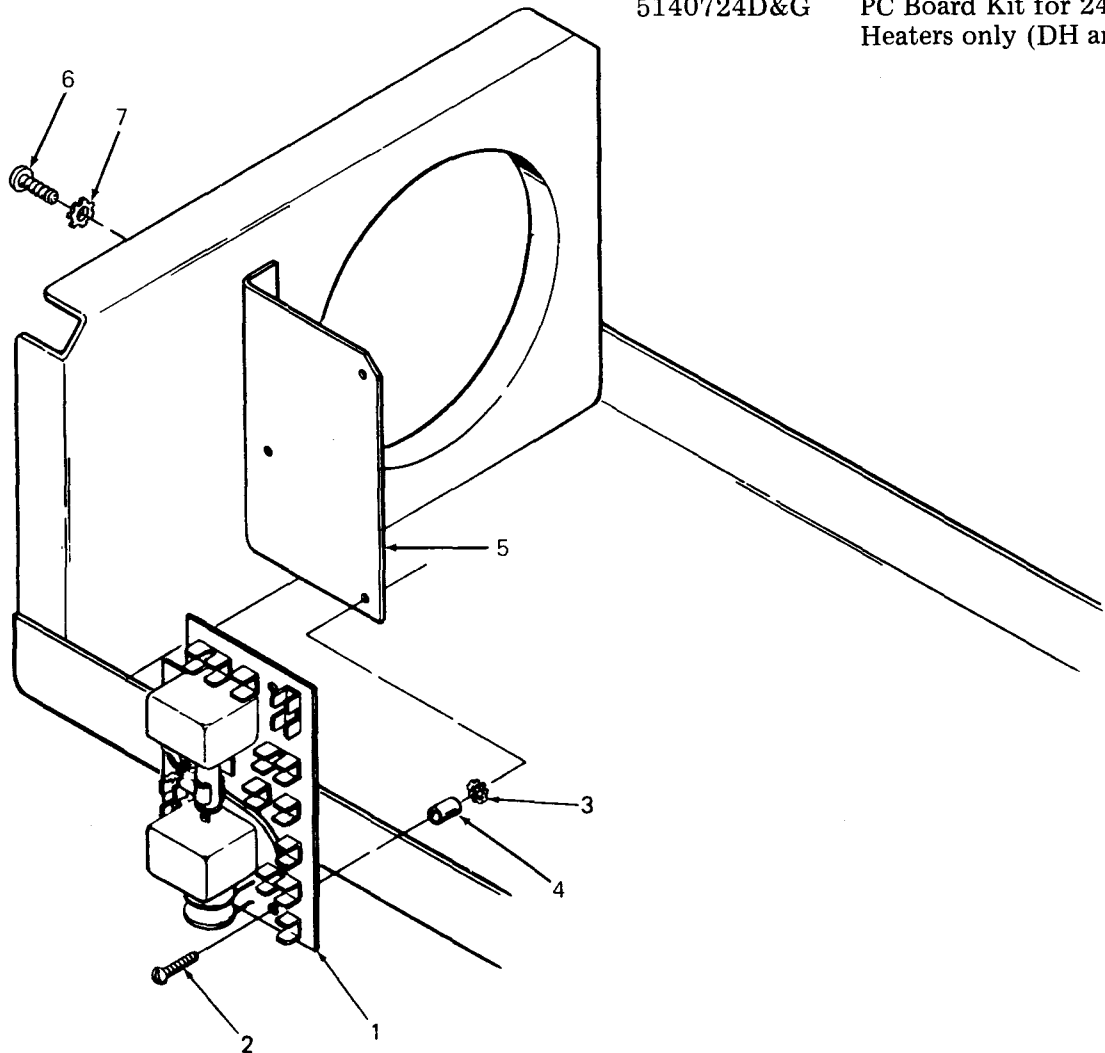
Index Number	Part Number	Description
15	170855-01	Pilot Light (amber, 12 VDC)
	49778-01	Pilot Light (amber, 24 VDC)
16	49241	Knob
17	COML	Nut, No. 6-32
18	COML	Lock Washer, No. 6
19	190369	Spring Washer
20	*49210	Pivot Arm
21	*4330	Stop Nut
22	*2282	Microswitch
23	*47649	Insulator
24	*49662	Heat Shield
25	51596	Spacer

*Items not separately priced - available as kit item only.

Figure 15. Control Panel

SERVICE KITS

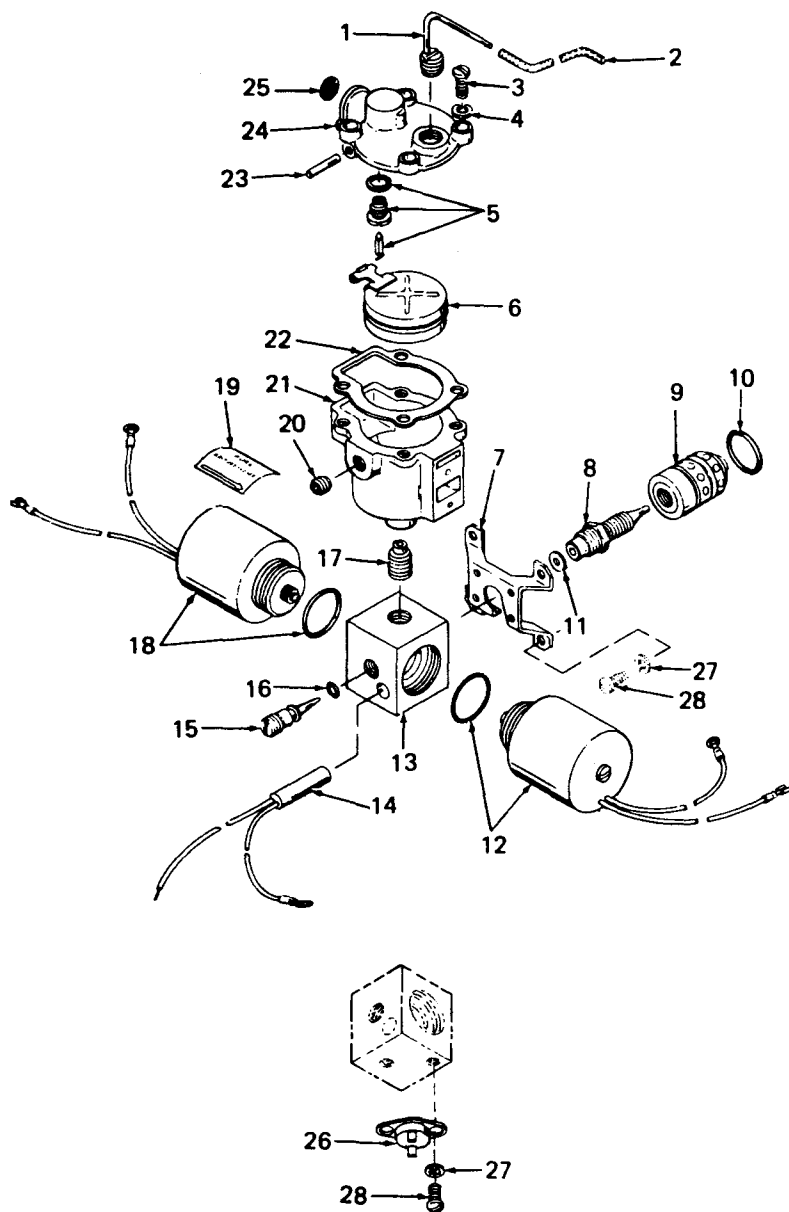
5140712D&G	PC Board Kit for 12 VDC Heaters only (DH and GH)
5140724D&G	PC Board Kit for 24 VDC Heaters only (DH and GH)



Index Number	Part Number	Description
1	*49946	Terminal and Relay Printed Circuit Board (12 VDC) Manual
	*49754	Terminal and Relay Printed Circuit Board (12 VDC) Auto Start
	*49951	Terminal and Relay Printed Circuit Board (24 VDC) Manual and Auto Start
2	*50853	Screw, No. 6 x 3/4 inch
3	*MS45904-54	Lock Washer, No. 6
4	*50329	Spacer
5	*50563	PC Board Mounting Bracket
6	*3145	Screw, No. 8 x 1/4 inch
7	*MS35333-38	Lock Washer, No. 8

*Items not sold separately - available only in a kit.

Figure 16. Ignition Pack



SERVICE KITS

50632-12	Carburetor Assembly, 12 volts, Diesel (includes all items shown)
50632-24	Carburetor Assembly, 24 volts, Diesel (includes all items shown)
50632-112	Carburetor Assembly, 12 volts, Gasoline (includes all items shown)
50632-124	Carburetor Assembly, 24 volts, Gasoline (includes all items shown)
48307	Fuel Bowl Assembly Kit (all) (includes items 1, 3, 4, 5, 6, 20, 21, 22, 23, 24, and 25)
49525	Carburetor Seal Kit (all) (includes items 5, 6, 15, 16, 17, 22, 23, 25, two O-rings for solenoids 12 and 18, and Loctite)
49526	Fuel Mixer and Jet Kit, Diesel (includes items 8, 9, and 10)
50868	Fuel Mixer and Jet Kit, Gasoline (includes items 8, 9, and 10)
50869	Fuel Heater and Thermo Kit, 12 volts (includes items 14 and 26)
50871	Fuel Heater and Thermo Kit, 24 volts, (includes items 14 and 26)

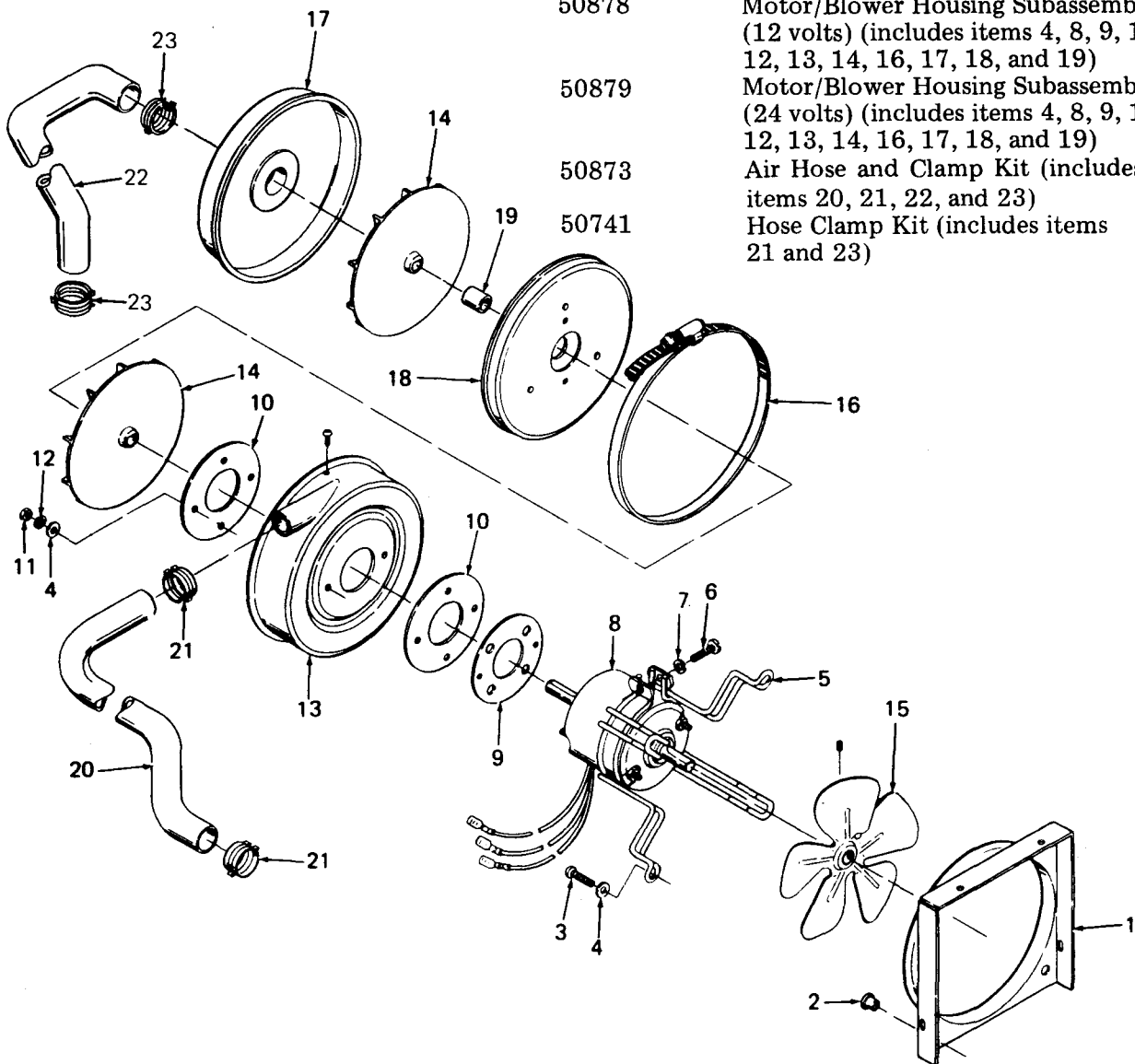
NOTE: All parts shown are available only in Service Kits as listed above.

Index Number	Part Number	Description	Index Number	Part Number	Description
1	47971	Overflow Fitting	15	49189	Fuel Needle
2	10512-01	Teflon Tubing	16	7009	O-ring
3	1586	Screw, No. 8-32, 1/2 inch	17	49031	Orifice
4	1554	Lock Washer, No. 8, split	18	50626	Solenoid (12 volts)
5	48389	Needle and Seat		50628	Solenoid (24 volts)
6	48390	Float	19	47907	Label
7	49032	Bracket	20	49384	Pipe Plug
8	49419	Fuel Jet	21	3671	Float Bowl Body
9	49185	Fuel Mixer	22	1601	Gasket
10	5360	O-ring	23	1591	Pin
11	49323	Gasket	24	3670	Float Bowl Cover
12	50627	Solenoid (12 volts)	25	26370	Inlet Screen
	50629	Solenoid (24 volts)	26	49690	Thermostat
13	49401	Body	27	MS35333-38	Washer, No. 6L
14	49238	Fuel Heater (12 volts)	28	7520	Screw, No. 10/24 x 3/8, SHCS
	5970	Fuel Heater (24 volts)			

Figure 17. Carburetor

SERVICE KITS

- 50580-12 2 Stage Combustion Blower (12 volts)
(includes items 1 through 19)
- 50580-24 2 Stage Combustion Blower (24 volts)
(includes items 1 through 19)
- 50878 Motor/Blower Housing Subassembly
(12 volts) (includes items 4, 8, 9, 10, 11,
12, 13, 14, 16, 17, 18, and 19)
- 50879 Motor/Blower Housing Subassembly
(24 volts) (includes items 4, 8, 9, 10, 11,
12, 13, 14, 16, 17, 18, and 19)
- 50873 Air Hose and Clamp Kit (includes
items 20, 21, 22, and 23)
- 50741 Hose Clamp Kit (includes items
21 and 23)



Index Number	Part Number	Description	Index Number	Part Number	Description
1	49399	Mount Plate	*13	50576	Housing
2	49374	Well Nut (4)	*14	49948	Wheel (2)
3	49287	Screw, No. 10-24 x 1 (4)	15	49976	Propeller
4	MS27183-42	Washer, No. 10 (6)	*16	50861	Vee Clamp Subassembly
5	50783	Motor Mount	*17	50575	Cover
6	50863	Screw, No. 1/4-20 x 1	*18	50828	Stationary Wheel Subassembly
7	7020	Washer	*19	50579	Spacer
*8	49226	Motor (12 volts)	*20	49152	Air Hose
	49601	Motor (24 volts)	*21	50554	Hose Clamp (2)
*9	170039	Gasket	*22	1059907	Air Duct
*10	50583	Washer (2)	*23	49602	Hose Clamp (2)
*11	MS35650-302	Hex Nut, 10-32 (2)			
*12	MS35333-39	Washer, No. 10 (2)			

*Motor must be bought with Kit No. 50878 or 50879

Figure 18. Motor and Blower

SECTION 8

AUTO-START

GENERAL

The Auto-Start circuit control panel eliminates the need for separate operator control of the PRE-HEAT/CHOKE switch used with the manual control panel. Operating instructions for the heater are printed on the face of the panel.

DESCRIPTION

Refer to figure 19 for a schematic diagram of the heater as modified.

When toggle switch SW1 is moved to START, the following operations occur:

1. The green light on the panel comes on immediately to let you know power is on.
2. Power is applied through normally closed (NC) contacts on the control panel relay (KA) to energize the time delay heater, the choke solenoid, and the glow plug. These circuits will remain energized until the burner ignites.
3. Power is applied to the fuel thermostat on the underside of the carburetor body. When the body is cold, the thermostat closes. No operator attention is required.
4. Time delay switch TD1 provides a delay before power is applied to the fuel circuit and the ignition circuit. This gives the glow plug time to preheat the burner before fuel flow and spark start.
5. The flame switch is in contact with the heat exchanger, and responds quickly to ignition of the burner. Within a few seconds after the burner ignites, the flame switch closes, energizing relay KA. This cuts off power to the time delay circuit, choke solenoid, and glow plug, and supplies an additional path for power to the ignition and fuel circuits. Heater operation proceeds as described in the service manual.
6. If the burner does not ignite for any reason within the time preset into the time delay assembly, switch TD2 of the time delay will open, cutting off power to other operating components in the heater, and lighting the red FAULT indicator. If this occurs, turn off the toggle switch and wait a few minutes for the time delay switch to cool. Push the RESET button. Check the fuel supply, fuel pump, and other items listed in the troubleshooting chart in the service manual.
7. After a few minutes, try to restart the heater. If it still fails to start, more detailed troubleshooting will be required.

TROUBLESHOOTING

1. Refer to Table 5 for assistance in determining the causes of malfunction in the Auto-Start components.
2. Refer to the service manual for causes of other heater malfunctions.

SERVICE AND REPAIR

Refer to the heater service manual for all service and repair instructions. A modified heater schematic for the new Auto-Start control panel is provided in figure 19.

OPERATING ADJUSTMENTS

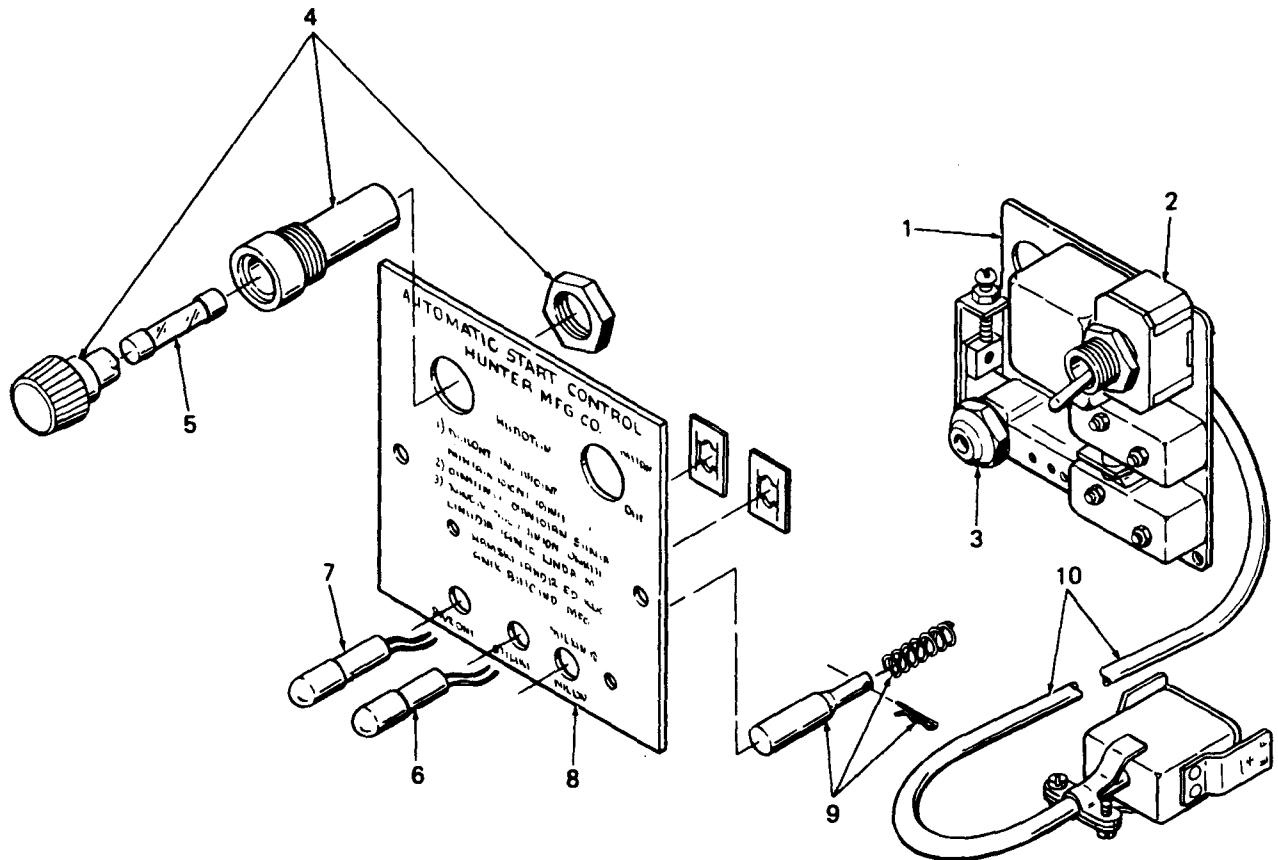
1. The carburetor was adjusted at the factory for the proper burning of fuel with the correct air/fuel ratio. Do not readjust the fuel needle unless the type of fuel has changed. Increasing the flow of fuel will not increase heat output.
2. The igniter was also adjusted at the factory. Clean and readjust the igniter during the annual service described in the heater service manual.
3. There are no field adjustments possible on any components in the Auto-Start control panel.

Table 5. Troubleshooting Chart

Trouble	Cause and/or Remedy
<p>A. Green light does not come on with toggle switch in START position.</p> <p>B. Heater fails to start - red FAULT light comes on.</p> <p>C. Green light comes on, but heater fails to start - red light does not come on.</p>	<ol style="list-style-type: none"> 1. Check fuse. 2. Check all electrical connections, including ground. 3. Check for power at the heater; at least 10-1/2 volts is required. <ol style="list-style-type: none"> 1. Refer to the heater service manual and check the following: <ul style="list-style-type: none"> Fuel to the float bowl HI-LO control and microswitch Spark from the ignition pack Igniter Tilt switch Float level, fuel pressure, and fuel needle setting Circulating air flow Fuel heater and thermostat Glow plug 2. Check installation of the flame switch. Switch must contact the heat exchanger. 3. Check all wiring connections. Make sure quick disconnect terminals are tight on the wires. Make sure electrical connector on harness is tight on connector in dummy panel. 4. If all the above items are in good condition, replace the Auto-Start control panel. No repair parts are available for the control panel circuits. <ol style="list-style-type: none"> 1. Check all wiring connections. Make sure quick disconnect terminals are tight on the wires. Make sure electrical connector on harness is tight on connector in dummy panel. 2. Check that the RESET button on the control panel operates freely. 3. Check for a burned out red indicator light. 4. Replace the Auto-Start control panel. No repair parts are available except for pilot lamps, start switch, and fuse assembly. Refer to figure 20 for part numbers.

SERVICE KITS

49763	PC Board Kit (includes items 1, 2, 3, and 10)
50881	Auto Start Nameplate Kit (includes items 4, 5, 6, 7, 8, and 9)



Index Number	Part Number	Description
1		PC Board Assembly
2		Switch
3		Boot
4	73270	Fuse Holder
5	47273	Fuse (12 V)
	46273	Fuse (24 V)
6	170855-01	Pilot Light (red)
7	170855-03	Pilot Light (green)
8		Nameplate
9		Reset Button Assembly
10		Harness

Figure 20. Auto-Start Control Panel Complete (P/N 49700)

SECTION 9

REMOTE THERMOSTAT INSTALLATION

REMOTE THERMOSTAT (48286) AND CONNECTIONS KIT (51167)

NOTE

Parts of kit number 51167 needed to connect the thermostat are illustrated below.

WARNING

Make sure that power source has been disconnected and controls tagged before touching electrical circuits. Voltage is high enough to cause electrical shock.

Mount room thermostat (1) in an upright position on an inside or insulated wall in the area to be heated. Remove cover (2). Obtain two 16-gage insulated wires (3 and 4) long enough to connect thermostat to heater; crimp a terminal ring (5) to one end of each wire and connect terminal rings to normally closed (NC) contacts (6) on thermostat. Attach insulated nylon female coupler (7) to free end of wire (3) and plug into AUTO terminals (8) on back of power control board (9). Attach female quick-disconnect terminal (10) to free end of wire (4). Connect a new white/red wire (11) to the existing white/red wire in heater's internal wiring harness using snap-on female disconnect (12). Attach female quick-disconnect terminal (13) to free end of white/red wire (11). Connect terminals (10 and 13) using male tab coupler (14). Reinstall cover (2). Make sure that AUTO START panel switch (not shown) is off. Set temperature adjustment knob (15) to desired temperature; room thermostat will act like an ON-OFF switch to regulate temperature.

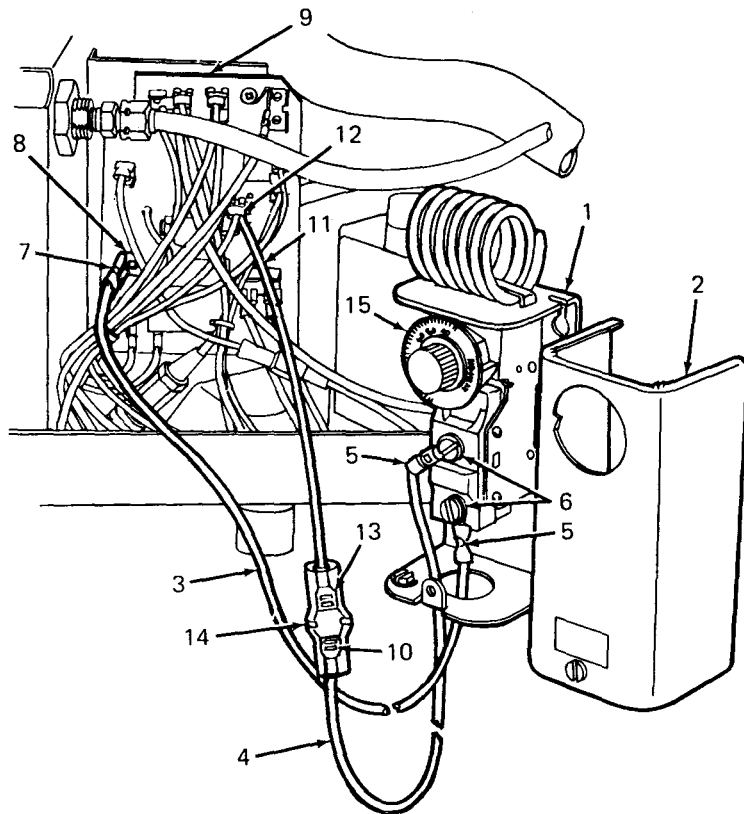
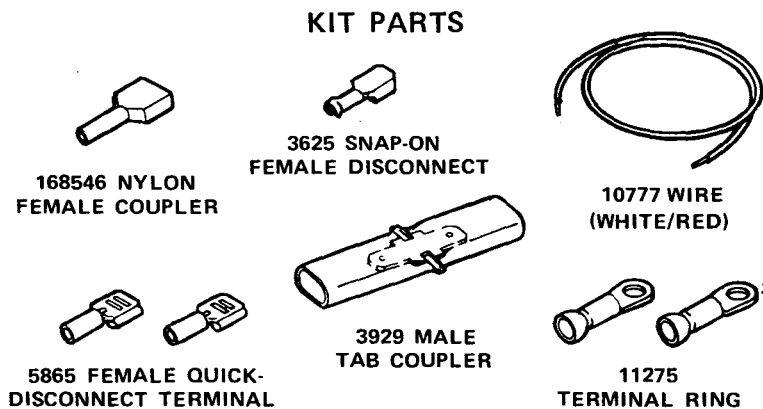


Figure 21. Remote Thermostat Connections



48286 THERMOSTAT (NOT SHOWN)

Figure 22. Remote Thermostat and Connection Kit

SECTION 10

REMOTE CONTROL KIT INSTALLATION

GENERAL

This section provides installation instructions for Remote Control Kit, part number 49500. This kit can be ordered as an accessory to any 20 Series heater.

LOCATION AND MOUNTING

WARNING

Disconnect the power lead to the heater at the power source before proceeding with installation.

1. When selecting the locations for the heater and a remote control panel, note that push pull control (11, fig. 24) can be attached to either of the two front corners of the heater. Select the location for the push pull control so that it will reach the heater with a minimum of sharp bends.
2. Install mounting bracket (10) in a convenient location within reach of the driver and within the length of harness (7). Mount the bracket with the hardware supplied with the kit. If possible, use all four mounting holes to ensure firm mounting. Do not install bracket ends (8) at this time.
3. Remove but do not discard the two sheet metal screws securing the existing heater control panel to the case assembly. Refer to the heater wiring diagram and note carefully the location of each wire. Cut the wire tie that bundles the wires to the control panel, then disconnect each wire and pull out the panel.
4. Install a grommet (6) in the center hole of dummy panel (5). Feed the wires at one end of the harness (7) through the grommet in the dummy panel.
5. Refer to the heater wiring diagram. Match wire colors and connect the loose harness wires to the terminal block. Position the dummy panel over the hole in the case previously used for the control panel, and secure the dummy panel with two screws used for the control panel.
6. Push the harness sheath through the grommet until there is slack in the wires to the terminal block. Install one of the larger wire ties around the harness just inside the grommet as a strain relief.

PUSH PULL CONTROL (Refer to figure 24)

1. The push pull control replaces the HI-LO control knob. Loosen the setscrew in the knob, hold the pivot mechanism, and pull off the knob.
2. Slide control lever and pin (2) onto the pivot arm on the heater and tighten setscrew (1). See figure 23.
3. Mount bracket (12) in a convenient location on the dashboard, kickpanel, or other area near the driver. Secure the bracket with two No. 10-24 screws and lock washers supplied with the kit. Thread the push pull control (11) through the hole in the bracket, and secure with lock nut (15).
4. Secure clamp base (13) to the heater and its mounting at either of the two front mounting holes, as shown in figure 23. Position push pull control (11) on the clamp base and install cable clamp (16). Push the end of the control wire through the cross hole in the lever and pin. Tighten nut (4) against collar (3) to secure the wire. Tighten the cable clamp to secure the control sheath.
5. Push and pull the control to check operation. If possible, the control should be connected so that the pivot arm is in the LO position when the push pull control is pushed all the way in, and in the HI position when it is pulled out. If necessary, change the position of the push pull control and/or the control lever and pin to obtain this operation without kinking the control cable wire.

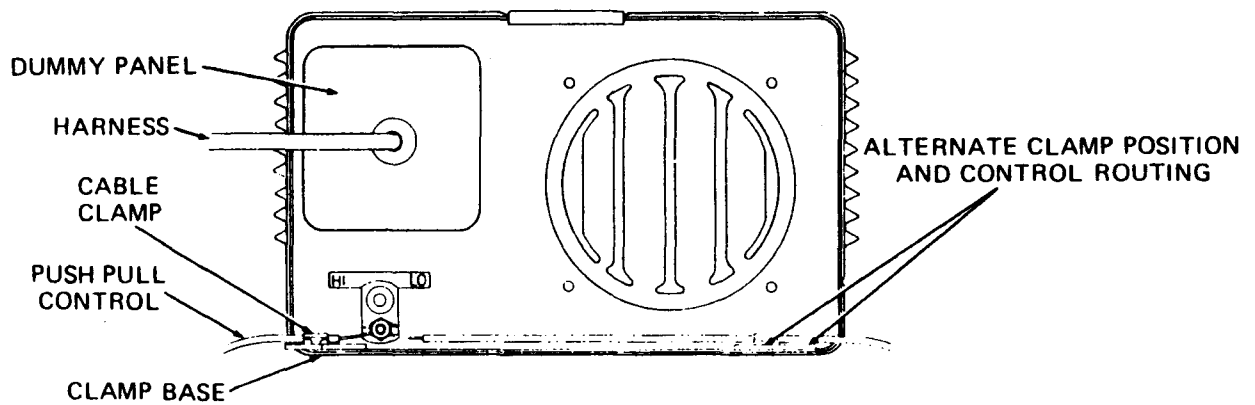
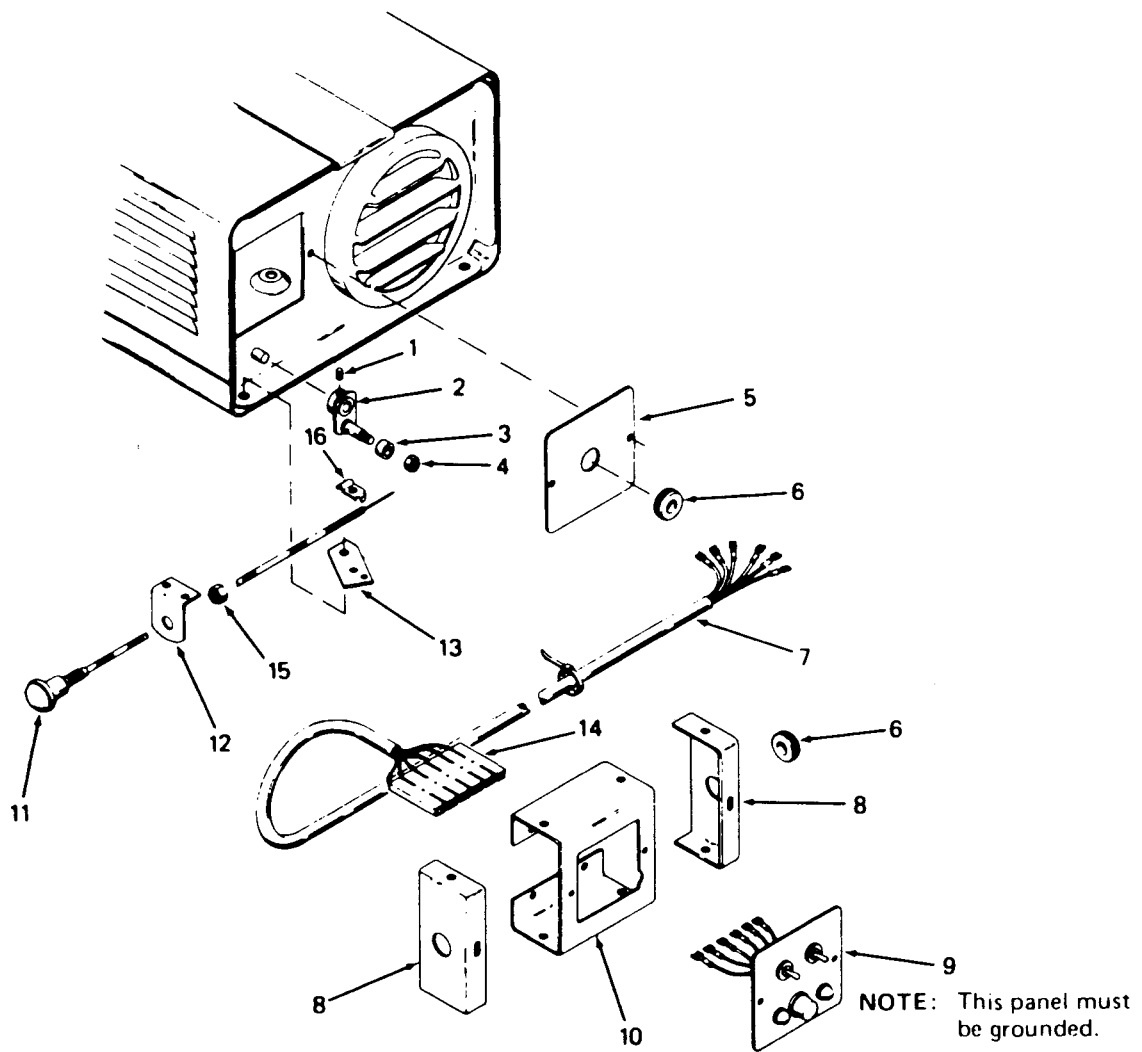


Figure 23. Push Pull Control Installation

REMOTE CONTROL PANEL (Refer to figure 24)

1. Install a grommet (6) in one of the bracket ends (8). Feed the harness wires through the grommet, install the bracket end, and pull the harness wires out through mounting bracket (10).
2. Install the other bracket end (8), and screw both bracket ends to the mounting bracket.
3. Push each of the six harness wires into a separate slot in terminal block (14). Match wire colors and connect the wires from the heater control panel to the slots at the other side of the terminal block.
4. Push the heavy red wire from the fuseholder through the grommet in the bracket end and connect it to the vehicle electrical system, using the wire size specified in the heater manual. It is recommended that the red lead be connected to the controlled side of a fuse or circuit breaker to protect the vehicle electrical system.
5. Use the second larger wire tie supplied with the kit as a strain relief for the harness and red wire at this location.
6. Check that all wires are tight. Push the wires and harness into mounting bracket (10), and secure control panel (9) to the mounting bracket with two sheet metal screws.
7. Operate the heater as described in the heater manual. Operation of all control panel controls and indicators is the same as described in the manual. Use the push pull control whenever operation of the HI-LO control is described.



Index Number	Part Number	Description
1	13802	Setscrew
2	49070	Control Lever and Pin
3	49213	Collar
4	MS51967-2	Nut
5	49499	Dummy Panel
6	3708	Grommet
7	49498	Harness
8	49118	Bracket End
9		Control Panel Supplied with Heater
10	49104	Mounting Bracket
11	6357	Push Pull Control
12	47483	Bracket
13	49095	Clamp Base
14	49497	Terminal Block
15	5762	Lock Nut
16	49096	Cable Clamp

Figure 24. Remote Control Kit Part Number 49500 and 4950001

