

AUTOMATIC



NO PILOT

FURNACE

INSTALLATION OPERATING AND MAINTENANCE INSTRUCTIONS FOR MODEL NUMBERS

12-I-12	16-I-12	25-I-12
12-O-12	16-O-12	25-I-120
12-I-120	16-I-120	30-I-12
12-O-120	16-O-120	30-I-120

This manual is provided to purchasers of recreational vehicles with factory-installed Sol-Aire furnaces and yet to be installed furnaces, phone or write Tri-Men Mfg., Inc. and request additional installation instructions if required. Improper installation or modification of the factory installation will void the furnace warranty and may result in unsafe operation.

This manual contains complete instructions for the operation of your furnace. KEEP WITH UNIT AT ALL TIMES. Should you require further service or information, contact your nearest Authorized Service Center or Tri-Men Mfg., Inc.

The design of the Sol-Aire Furnace has been tested and certified by The American Gas Association and Canadian Gas Association to be used in accordance with the specifications and instructions contained herein. THESE INSTRUCTIONS MUST BE FOLLOWED. Failure to comply will void the manufacturer's responsibility and warranty.



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SOL-AIRE FURNACE
OPERATING AND MAINTENANCE
INSTRUCTIONS

I. IDENTIFICATION OF MODEL NUMBERS

Model and serial numbers are located on the blower housing inside the furnace casing and on the upper right hand corner (from inside the vehicle) of the furnace casting. The latter location is visible without removing the furnace from the vehicle. The former location is not visible until the outer casing is removed.

Models are designated as follows:

16 - I - 3P - 120

			Electrical Input, 12 or 120
			Plenum Designation
			Mounting Style, I or O
			Fuel Input Designation

FUEL INPUT

This number designates the fuel input in 1,000 BTUH, and will be one of the following:

12-12,000 BTUH	}	same physical size
16-16,000 BTUH		
25-25,000 BTUH	}	same physical size
30-30,000 BTUH		

MOUNTING STYLE

I - Inside mount, removable and installed from inside vehicle.
O - Outside mount, furnace is removed from outside of vehicle, furnace casing remains in place.

PLENUM DESIGNATION

The plenum is determined only by the type and arrangement of ducting in the vehicle, and does not affect furnace operation.

ELECTRICAL INPUT

12 - Operates on 12 Volt DC power only, from a battery or converter.
120 - Operates on 12 Volt DC or 120 Volt AC power.

II. SPECIFICATIONS

The Sol-Aire Furnace installed in your Recreational Vehicle or Mobile Home is a forced air furnace design certified by the American Gas Association under ANSI Z21.47 and the Canadian Gas Association under C.G.A. 2.3 Central Furnaces as a direct vent forced air furnace for installation in a Mobile Home or Recreational Vehicle for use with LP Gas only. Use no other fuel.

All models have the following general specifications:

FuelLP Gas only
 Maximum Fuel Pressure11" W.C.
 Maximum Duct Static Pressure0.12" W.C.
 Maximum Outlet Temperature200°F
 Minimum Voltage at Furnace10.2 Volts DC

The Sol-Aire Furnace has no pilot, but is ignited by an integral, solid-state, direct-spark ignition system. No manual lighting is required.

MOUNTING CLEARANCES TO COMBUSTIBLES

Right Side0"
 Left Side0"
 Bottom0"
 Top0"
 BackOutside of vehicle,
 minimum distance from outside corner is 12"

The following specifications depend upon the fuel input designation of your unit.

FUEL INPUT DESIGNATION

	<u>12</u>	<u>16</u>	<u>25</u>	<u>30</u>
Fuel Input, BTUH	12,000	16,000	25,000	30,000
Fuel Input, lbs/hr.	0.56	0.75	1.16	1.39
Weight, lbs.	36	36	48	48
Free Air Delivery, SCFM	185	185	320	420
Amperage Draw @ 12V DC	3.2	3.2	6.8	6.8
Amperage Draw @ 120V AC (120 units only)	0.6	0.6	1.0	1.0

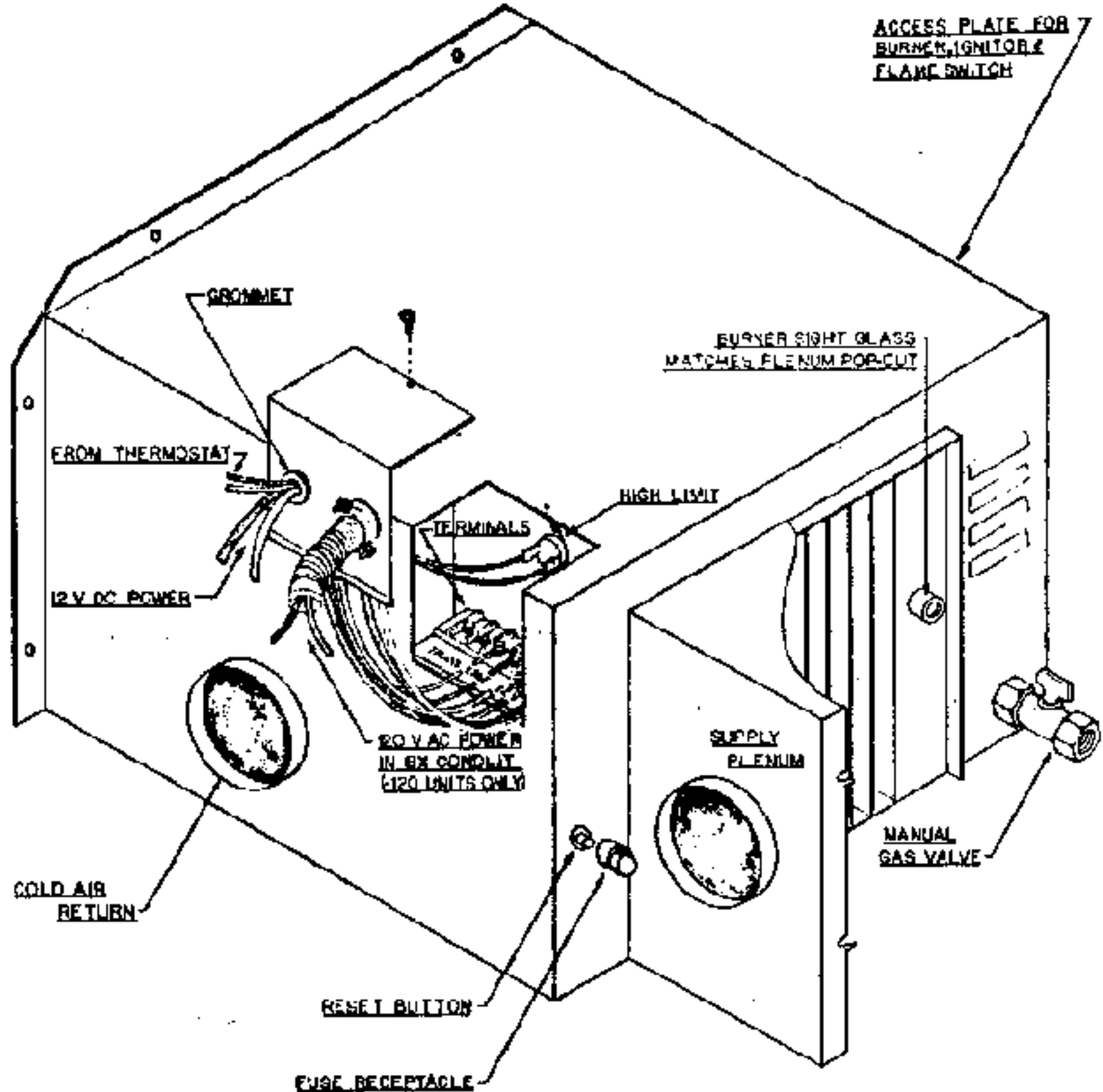


Figure 1. Sol-Aire Furnace viewed from inside vehicle.

III. OPERATION

This is an automatic, Spark Ignition unit and has no pilot. To operate the furnace:

1. Open Tank Valve - Open Line Valve.
2. Place 120V-12V switch (if provided in vehicle) to electrical power being used.
3. Turn thermostat to lowest setting.
4. Press manual reset button on furnace (see Figure 1).
5. Turn thermostat to a temperature above room temperature. Furnace should start. Note: A rumbling or growling noise is not normal. If this occurs, adjust primary air (see Page 9).
6. Set thermostat to desired temperature and it will cycle the furnace on and off as the temperature satisfies the thermostat.

III. OPERATION (Cont'd)

The safety circuit includes devices to stop the furnace in event of:

BURNER IGNITION FAILURE
BURNER FLAME-OUT DURING OPERATION
POOR COMBUSTION
BLOWER SPEED TOO LOW
LACK OF FUEL OR INADEQUATE FUEL PRESSURE
LOW VOLTAGE

If the furnace has shut off for any of these reasons, the Reset Button must be pressed to reset the control circuit. A wait of at least 5 minutes is required, after the furnace has stopped, before the Thermal Relay will properly reset.

The burner will shut off if the heat exchanger temperature rises too high. Normally, this will not require resetting of the Thermal Relay, but may under certain conditions.

If excessive fuel pressure is supplied to the furnace, the gas valve may be damaged or the valve coil may burn out.

The DC portion of the control circuit is also fused to protect against internal short circuits.

Sol-Aire furnaces with automatic AC-DC controls (-120 suffix models) will operate on 120 volt AC power or 12 volt DC power. If both power sources are available at the control box terminal strip, the control will use 120 volt AC power.

IV. SEQUENCE OF OPERATION

1. THERMOSTAT CONTACTS CLOSE, CALLING FOR HEAT (START CYCLE).
 - a. Control relay 2CR is energized providing power to the ignition pak, thermal relay heater and the blower motor.
 - b. When the blower reaches minimum operating speed (approximately 2-3 seconds), the blower switch contacts close providing power to the solenoid gas valve.
2. BURNER IGNITES (START CYCLE).
 - a. Approximately 10-15 seconds after ignition the flame switch contacts close, de-energizing the TH1 thermal relay heater through control relay 3CR. The furnace will continue running until the thermostat is satisfied and its contacts open.

IV. SEQUENCE OF OPERATION (Cont'd)

3. THERMOSTAT CONTACTS OPEN (PURGE CYCLE).

- a. The coil of control relay 2CR is de-energized, stopping the flow of power to the ignition pak and the gas valve. Power is maintained to the blower motor through the still closed 3CR contacts.
- b. After approximately two minutes the flame switch cools, opening the circuit to control relay 3CR and de-energizing the blower motor.

OPERATION ON 120 VOLT AC POWER, (-120 suffix models only).

The presence of 120 volt AC power at the "AC 120V" terminals maintains the current to control relay coil 1CR. Normally open relay contacts close to provide 120 volt power to the transformer primary. The transformer secondary and rectifier provide 12 volt DC power to terminals No. 6 (+) and 4 (-). Normally open 1CR contacts are closed, providing rectified 12 volt DC power through the fuse (F1) to terminal No. 9. Normally closed 1CR contacts open, disconnecting the positive battery terminal (+DC, 12V) from the control circuit.

V. MAINTENANCE

Annual inspection. The first time you operate your Sol-Aire furnace, or after your vehicle has not been operated for a period, the following check-out is recommended. Open cabinet doors or remove panels as necessary to provide access to the furnace reset button and the burner view port.

1. Check fuel pressure with gas range burners on. If not 11" W.C., adjust tank regulator to provide 11" W.C. Be sure battery is fully charged. All Sol-Aire Furnaces are designed (while operating on battery voltage) to shut off and trip reset button if less than 10.2 VDC is applied at the Furnace terminal block with blower running.
2. Shut off manual gas valve at furnace.
3. Depress reset button.
4. Turn up thermostat and check the number of seconds it takes to pop reset button. This time should be between 36 and 60 seconds.
5. Now you must purge air from Gas line. Open valve to furnace and hold in reset until burner lights. Observe thru Sight Hole on front of Plenum, this may take several minutes. Note: A rumbling or growling noise after burner ignites is not normal. Adjust primary air if this occurs.

V. MAINTENANCE (Cont'd)

6. Allow furnace to set for at least 5 minutes to cool reset.
7. After cooling, depress reset button again and check the number of seconds it takes for flame switch to trip, which can be heard by listening for the "click" of a relay in the control box. This time must be between 10 and 15 seconds.
8. Set thermostat to a temperature 5° - 10° above outside temperature. Allow vehicle to reach this temperature.
9. After thermostat is satisfied, burner will shut off and blower will run for several minutes to cool furnace.
10. When flame switch cools to proper temperature, blower will stop.
11. Open doors and windows to cool vehicle.
12. When vehicle has cooled, thermostat will re-light furnace automatically. Allow 2 or 3 cycles of this type.

If a problem occurs in proceeding through this check list, refer to the TROUBLE-SHOOTING CHECK LIST on Page 10, or contact your nearest SOL-AIRE Service Center or TRI-MEN MANUFACTURING, INC.

LUBRICATION INSTRUCTIONS:

The Blower Assembly as supplied, is a permanently lubricated assembly and requires no lubrication.

DO NOT LUBRICATE AUTOMATIC FUEL VALVE OR MANUAL VALVE.

VI. SERVICE

Should your furnace malfunction or operate in an erratic or noisy manner, go through the recommended check out instructions on Page 5, to isolate the exact nature of the malfunction, then refer to the trouble-shooting check list on Page 10, to determine the cause and correction.

The following items can be inspected or replaced without removing the furnace from the vehicle.

FLAME SWITCH
HIGH TEMP. LIMIT SWITCH

BURNER ASSEMBLY
SPARK ELECTRODE

The burner primary air can also be adjusted without removing the furnace. See Page 9 for instructions.

Removal of the furnace from the vehicle is required for replacement of other components. If furnace removal becomes necessary, contact an authorized Service Center or TRI-MEN MANUFACTURING, INC.

The burner, spark electrode, primary air adjustment, and flame switch are all located on the right side of the furnace (from inside the vehicle). The high temperature limit switch is located on the left side of the furnace, under the terminal strip access plate. To replace or inspect any of these components, first turn the power supply to the furnace "off". On dual voltage units (-120 suffix in model number), insure that both the 12V DC and 120V AC power supplies are "off". Then remove the appropriate access plate.

FLAME SWITCH REMOVAL

1. Pull wire terminals off tabs on flame switch.
2. With an 11/16" wrench, unscrew flame switch from heat exchanger.
3. A new flame switch can now be screwed in, tightened, and the wires reconnected.

SPARK ELECTRODE REMOVAL

1. Loosen hand-tight hex nut at base of ignitor. Remove automotive type rubber connector on top of ignitor.
2. Withdraw ignitor from burner. If end of ignitor is broken or cracked, it should be replaced.
3. To replace ignitor, insert new ignitor into burner, hand tighten hex nut at base of ignitor, push rubber connector onto top of ignitor.

VI. SERVICE (Cont'd)

BURNER REMOVAL

1. Remove ignitor (see Page 7).
2. Unscrew gas supply compression hex nut.
3. With pliers, squeeze spring clamp on combustion air tube and slide clamp about 1" away from burner along tube.
4. Unscrew (4) machine screws at top, bottom and both sides of burner. Note which ones have ground connections attached so they will be replaced on proper screws.
5. Remove burner

HIGH TEMPERATURE LIMIT SWITCH REMOVAL

1. Pull wire terminals off tabs on limit switch.
2. Carefully unscrew screws at top and bottom of limit switch. A hold-easy type screw driver will help avoid losing screws.
3. A new limit switch can now be attached, and the wires reconnected.

VI. SERVICE (Cont'd)

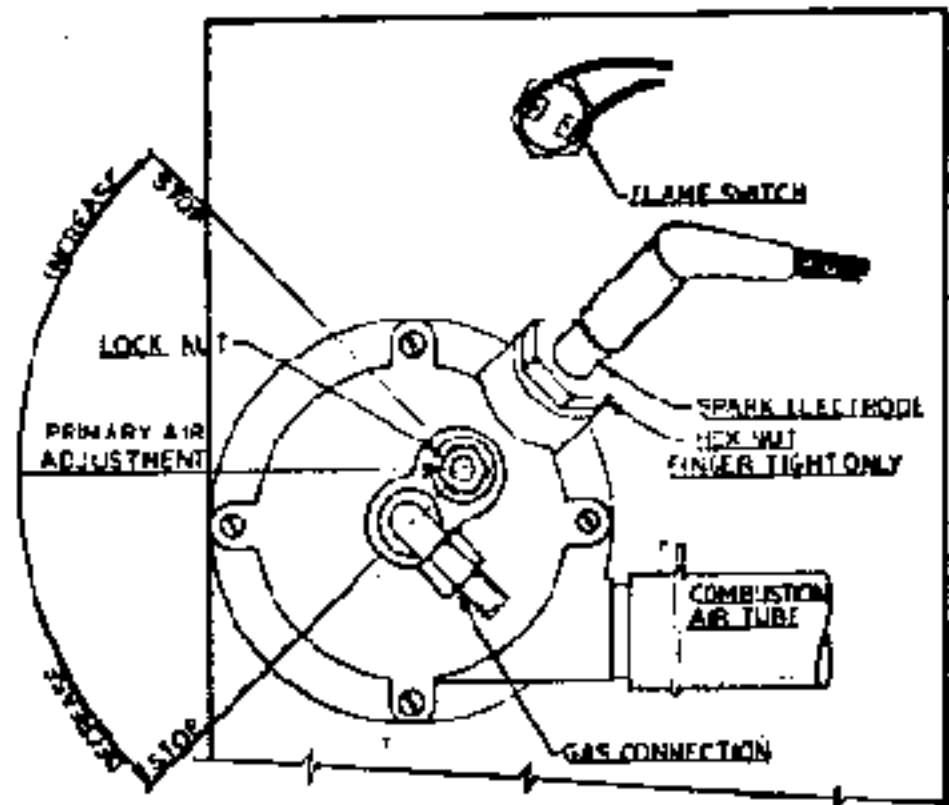


Figure 2. Burner Assembly.

PRIMARY AIR ADJUSTMENT

1. Insure gas pressure is set at 11" W.C. Loosen hex lock-nut slightly till burner adjusting rod can be turned with a screw-driver.
2. Start furnace and watch burner through view-port in plenum. Decrease primary air to give a slightly yellow flame with green cones. The cones are formed at each of the ports in the burner. Then increase air slowly till the yellow disappears and the cones become sharply defined and blue. Note that the total adjustment available, from one extreme to the other, is only about $\frac{1}{4}$ turn. Do not force adjusting rod past the stops.
3. Hold the screwdriver adjustment in place and tighten the hex lock-nut. Recheck flame to see that it is still properly adjusted.

TROUBLE-SHOOTING CHECK LIST

<u>MALFUNCTION</u>	<u>CAUSE</u>	<u>CORRECTION</u>
Noisy, rumbling burner or smoke or carbon at exhaust vent.	Faulty (broken) electrode	Replace electrode
	Improper air adjustment	Adjust primary air (see Pg. 9)
	Excess fuel pressure	Check LP Tank Regulator
Thermostat calling for heat, furnace blower does not start	Safety Lock-out	Press reset button
	Blown fuse	Replace fuse
	Dead Battery or loose wiring	Check Battery and examine wiring to furnace
Blower runs for 30-60 seconds then stops and requires manual reset before it will start. Burner does not ignite.	No fuel or low fuel pressure	Check LP Tank
	Tank or Furnace manual valve closed	Open valve
	Low voltage at furnace	With Blower running, check voltage at terminals on furnace. If below 10.2 volts, check wiring, battery or converter
	Ignition connection loose at ignitor or ignition pak.	Tighten both connections.
Blower runs 30-60 seconds, then stops and requires manual reset before it will restart. Burner does ignite.	Low fuel pressure	Check LP Tank
	Faulty Flame Switch	Replace Flame Switch
	Poor Burner Flame	Adjust Primary Air (see Pg. 9)
	Broken Electrode	Replace

WARRANTY

Tri-Men Manufacturing, Incorporated, hereinafter called the company, warrants the Sol-Aire Furnace to the original owner-user to be free from defects in material and workmanship under normal use and service for a period of one (1) year from date of purchase, provided a completed warranty card is returned to the company within thirty (30) days of purchase date. The company's obligation under this warranty is limited to the repair or replacement of the furnace, at the company's option. The owner-user is responsible for transportation of the furnace to and from a service center authorized by the company.

This warranty is void if the furnace has been repaired or tampered with in any way by unauthorized persons, or installed, adjusted or operated other than in accordance with the company's instructions. This warranty is also void on any furnace which has been subjected to misuse, neglect or accident, or which has had the serial number altered, defaced or removed.

In consideration for this warranty, the owner-user agrees to assume all liability for any damages or injuries resulting from the use or misuse of this furnace by any person; and further agrees that the company, its agents and employees shall incur no liability for direct or consequential damages of any kind. This warranty is provided in lieu of all other warranties, express or implied, written or oral. No agent or employee of the company is authorized to assume any additional responsibility in connection with the sale and/or use of this furnace.

The company reserves the right to discontinue or change models, specifications, prices or designs at any time, without notice. Parts will be made available for a maximum period of five (5) years from the last date of manufacture of any standard model.

Malfunctions caused by contingencies beyond our control such as accident, misuse, neglect, faulty installation, fire, flood and other acts of God are not covered under this warranty.

Certain services are not included under warranty repairs, such as:

1. Initial checkout and subsequent checkouts which determine that the furnace is operating properly.
2. Cleaning.
3. Water or dirt in controls, fuel lines, or gas tanks.
4. Broken or shorted wires to furnace, or low voltage.
5. Restriction or alteration of warm air or return air circulation.
6. Thermostat adjustments.
7. Instructing owners in operation.
8. Primary air adjustment.

SOL-AIRE FURNACE
INSTALLATION INSTRUCTIONS

VII. INTRODUCTION:

The Sol-Aire Furnace you are installing in your Recreational Vehicle or Mobile Home, is a forced air Furnace, the design of which is certified by the American Gas Association and the Canadian Gas Association Laboratories for use with LP Gas only. The unit, as supplied, has been rated and tested with Propane Gas, no other Gas is to be used.

PRELIMINARY INSPECTION:

Before making installation, read entire manual first and check contents against Packing List, making sure you have all necessary items for a complete installation.

Prior to installation of this unit, we recommend you Bench Test and adjust, if necessary. (Par.V.)

VIII. INSTALLATION:

This unit may be installed through the inside wall or panel or bulkhead, at any selected location for the intended use. For balanced heat distribution, the most favorable location would be a spot midway of your vehicle. Closets and cupboards are usually excellent locations. Having chosen the location, cut the opening through the wall or inside panel, and lay out mounting holes as shown in illustrations.

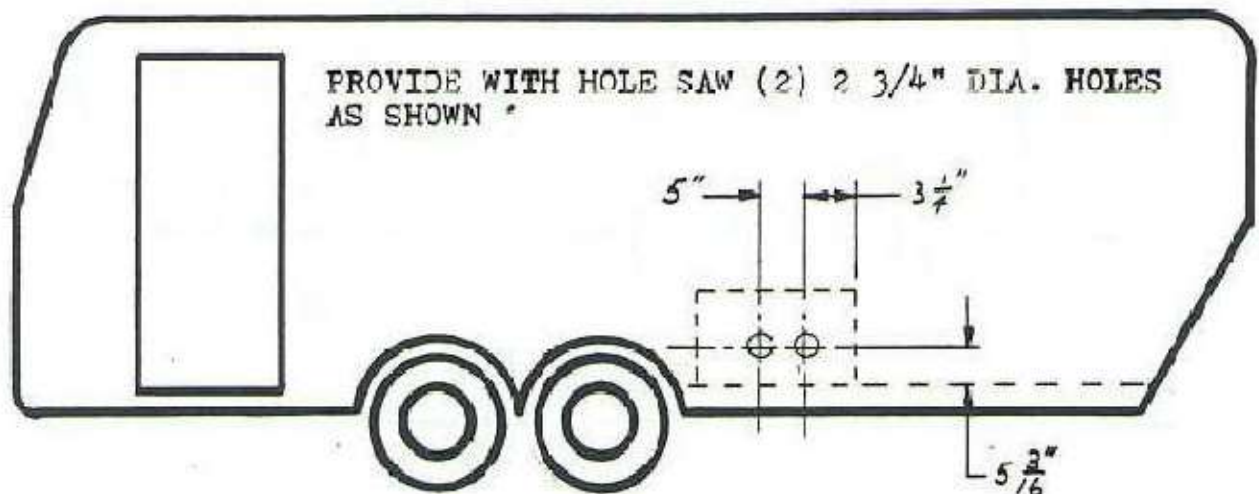
Note: Installation should contain sufficient clearance for accessibility and servicing.

Unit should be installed in accordance with American National Standard Z223.1-1974 and C.G.A. Standard 10.1 Gas Equipment for Recreational Vehicles and Mobile Housing.

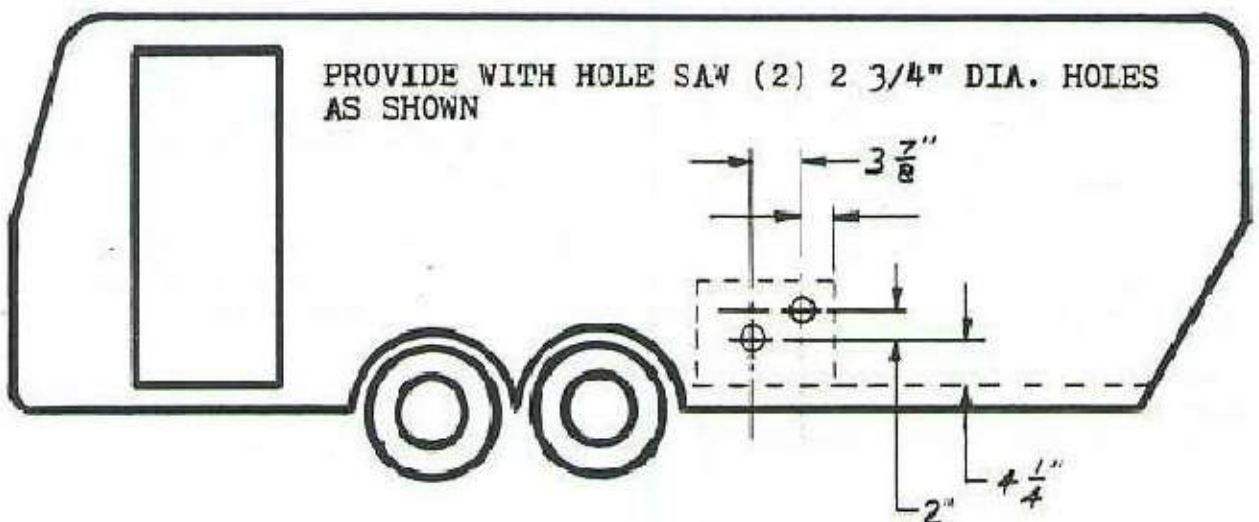
VIII INSTALLATION: (Cont'd)

PREPARATION FOR INSIDE MOUNTING TYPE FURNACE

Models: 25-I-12 30-I-12
 25-I-120 30-I-120



Models: 12-I-12 16-I-12
 12-I-120 16-I-120

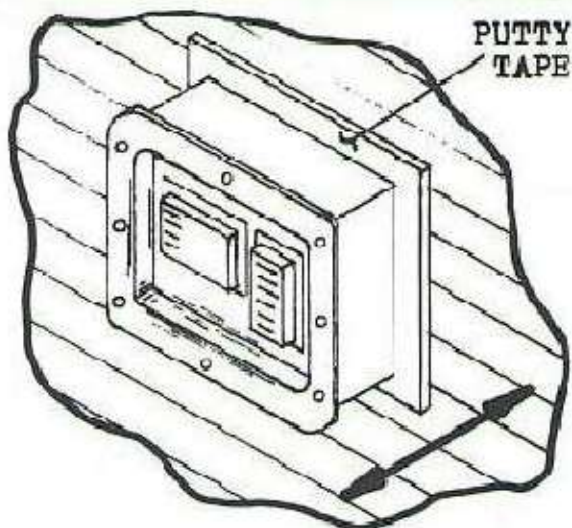
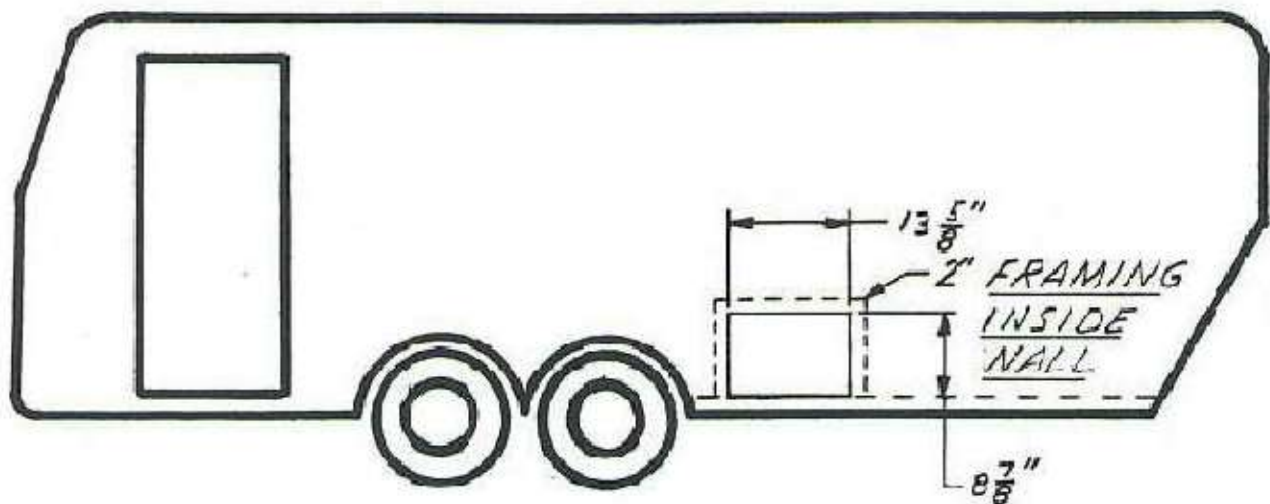


VIII. INSTALLATION: (Cont'd)

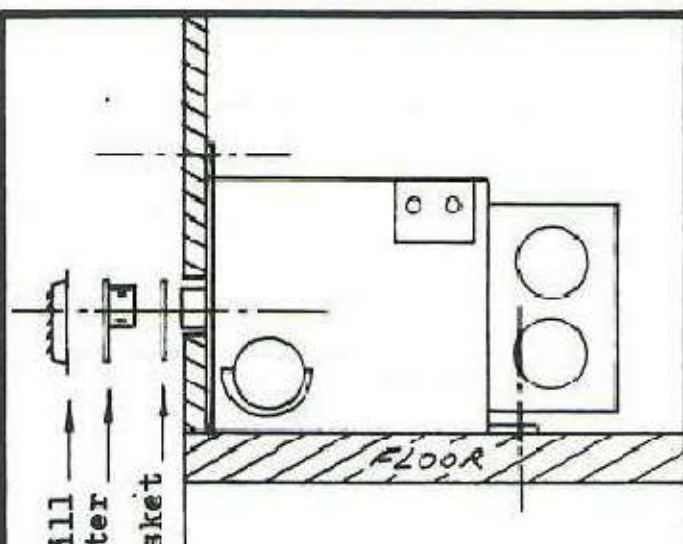
PREPARATION FOR OUTSIDE MOUNTING TYPE FURNACE

Models: 12-0-12
12-0-120

16-0-12
16-0-120



1. Apply 1" wide Putty Tape as shown.
2. Insert furnace.
3. Attach furnace to vehicle skin and framing with (8) 1" long sheet metal screws.
4. Trim excess Putty.



Fasten furnace securely to wall and floor.

IX. WIRING:

All Electric Wiring shall conform to the rules of the National Electric Code NFPA No. 70-1975; or ANSI C1-1974; or CSA Standard 2-240.6.1, A-240.6.2; or the code legally authorized in the locality where installation is made.

All 120V AC power lines should be connected to a Junction Box and internally wired to Terminal Strip.

The 12V DC system, when employed should be 12 Ga. 105C insulated, U.L. approved, wire, and should be connected thru a Junction Box to the Heater Terminal Strip.

NOTE: All wire connections mounted to the Terminal Strip should utilize Wire Terminals.

When installing 12V DC lead wires up to 6 Ft. in length, 14 Ga. stranded wiring should be used, and for 15 Ft. lengths, 12 Ga. wire should be used.

All 120V lines should conform to electric code as controlled by the area.

For Thermostatic operation, mount Thermostat #B-70109 on a wall, or in a position where it will not be affected by discharge air or drafts. Use light gauge Thermostat lead wire. All wiring should conform to the electrical code as controlled by the area.

If any of the original wire supplied with the original appliance must be replaced, it must be replaced with the Type 105C wire or its equivalent.

All models designated (-120) use a dual voltage electrical system, incorporating the use of a 120V AC power source or a 12V DC power source. This integral system is factory wired and requires no installation wiring other than 120V AC and 12V DC connections to the Terminal Block, and Thermostat.

To place Furnace in operation electrically, the electrical system in the Furnace, Blowers and Controls, less Combustion system, should operate until safety lock-out device is activated, approximately 30-60 seconds.

X. FUEL LINE INSTALLATION:

Gas Piping must be installed in accordance with the local codes. Reference should be made to the latest addition of the American National Standard National Fuel Gas Code Z223.1-1974 or C.G.A. Standard 10.1 Gas Equipped Recreational Vehicles and Mobile Housing.

Determine the length of Fuel Line required. All Fuel Line should be either steel, or internally tinned copper. The manufacturer recommends the use of 3/8" O.D. copper internally tinned.

Install Line thru wall or floor to the Furnace location.

NOTE: Be sure that fuel supply lines are installed without bends or kinks.

Solid Gas Line may be used for alternate installation. Threaded 1/4" standard gas pipe can be used.

Use a good pipe compound, resistant to action of liquefied petroleum gas, on all threaded joints.

TRAPS:

Whether Solid Gas Lines or Copper Lines are used, all installations must employ the use of a Trap and A.G.A. or C.G.A. listed Manual Shut-off Valve.

After the Furnace Line connections have been made to the Gas Supply, all joints must be checked for leaks.

CAUTION: DO NOT USE OPEN FLAME TO LOCATE LEAKS.

Apply soapy water to all joints, turn on the gas supply, and bubbles will indicate a leaky joint.

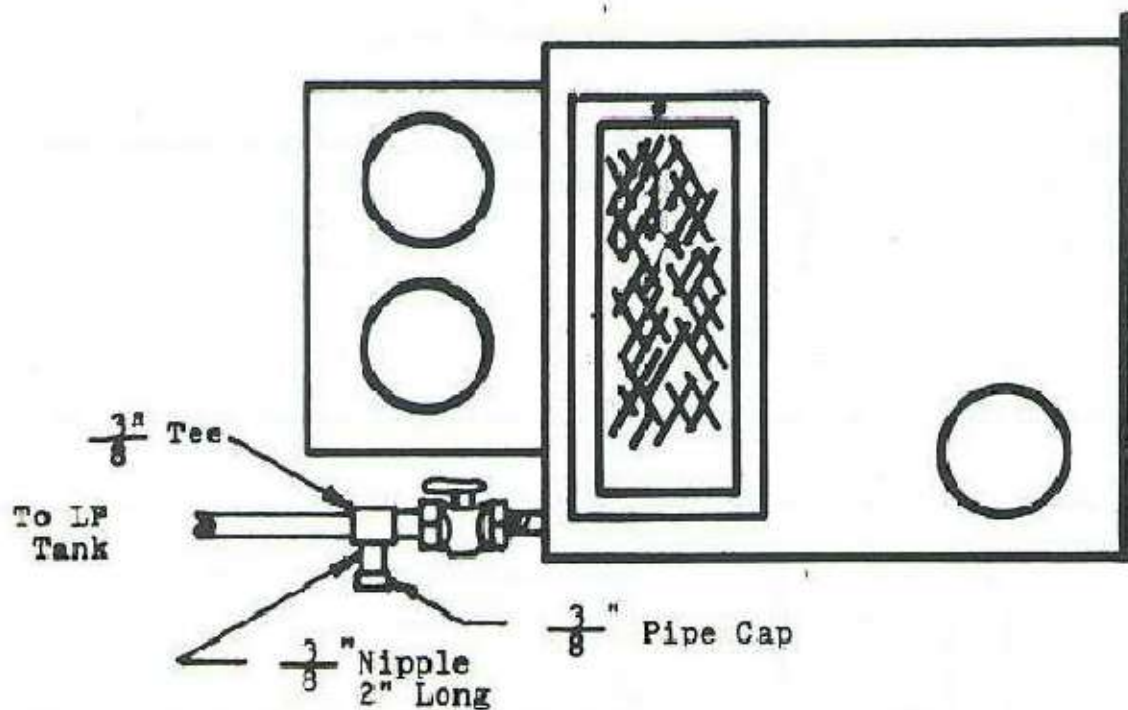
LUBRICATION INSTRUCTIONS:

The Blower Assembly as supplied, is a permanently lubricated assembly and requires no lubrication.

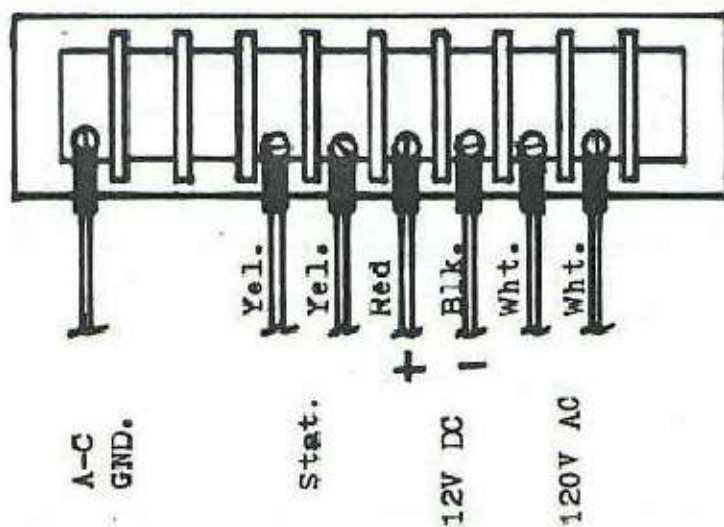
DO NOT LUBRICATE Automatic Fuel Valve.

Lubricants used on Manual Shut-off Valve, shall be resistant to the action of liquefied petroleum gases.

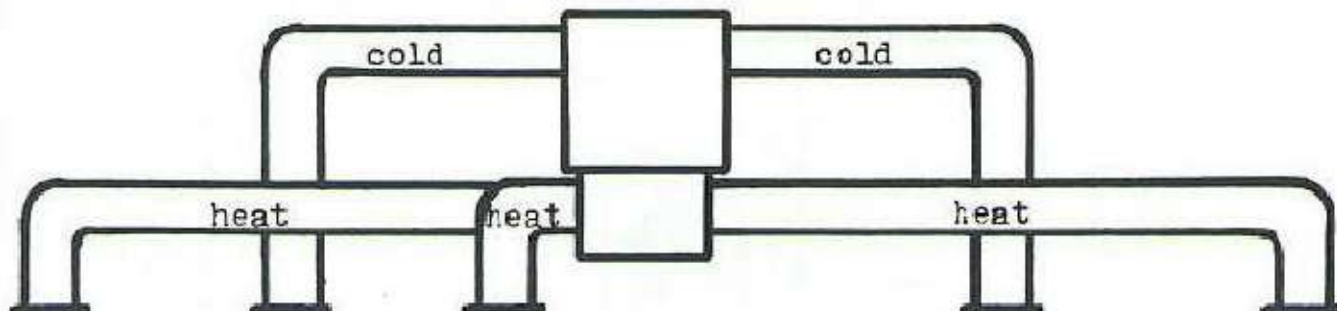
X. FUEL LINE INSTALLATION (Cont'd)



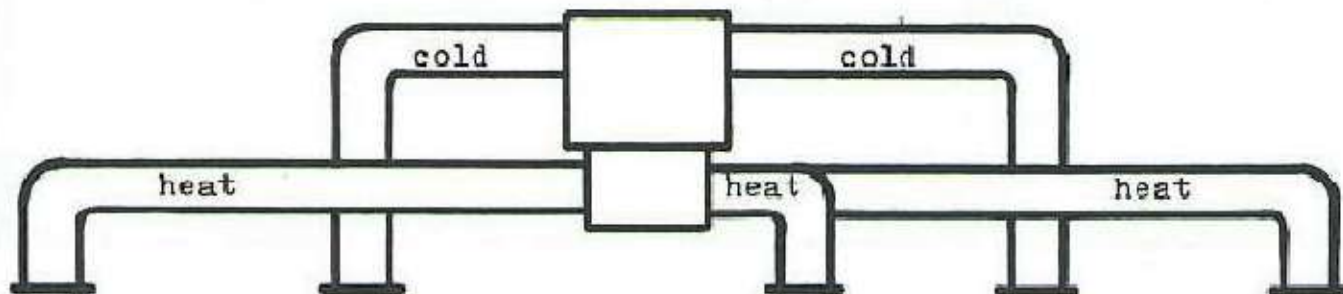
IX. WIRING (Cont'd) See Page 15



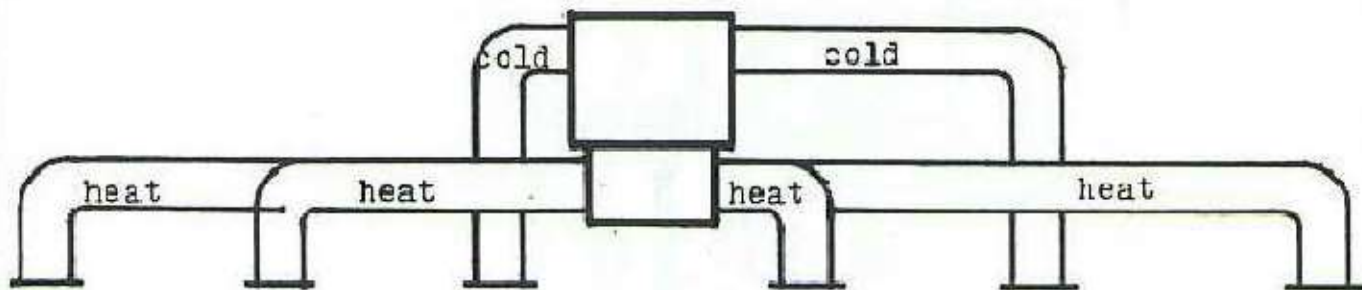
XI. DUCTING



Typical Left Layout for 25,000 & 30,000 BTU Furnace with (3) outlets.

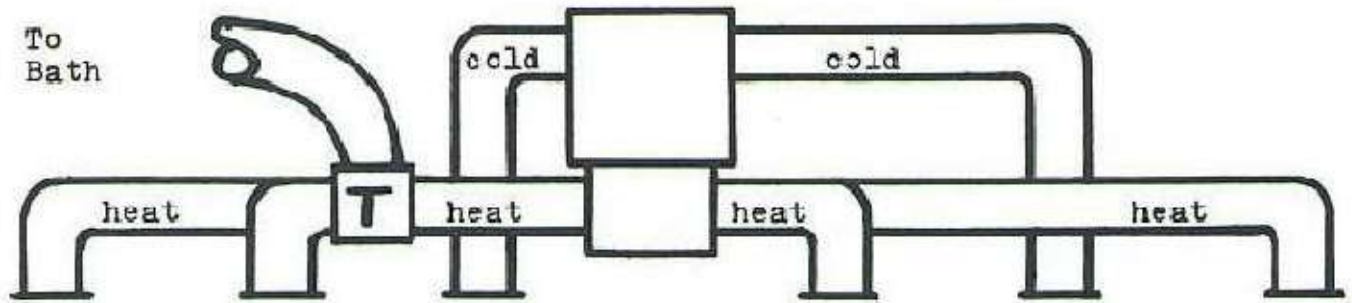


Typical Right Layout for 25,000 & 30,000 BTU Furnace with (3) outlets.

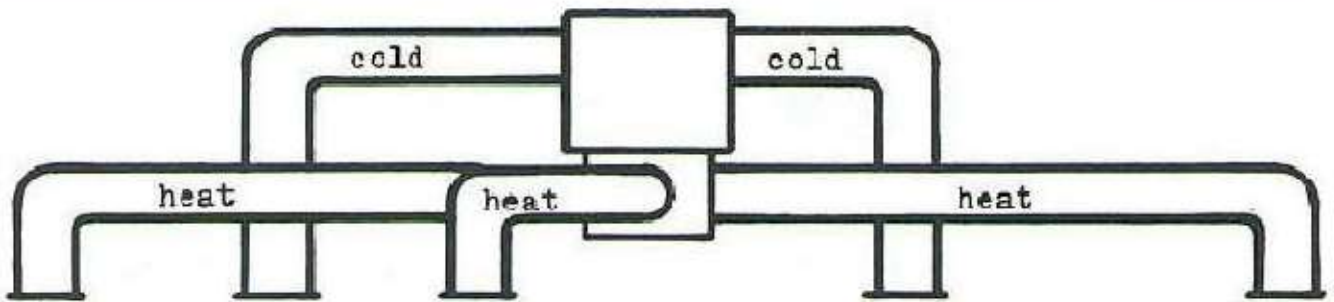


Typical Layout for 30,000 BTU Furnace with (4) outlets.

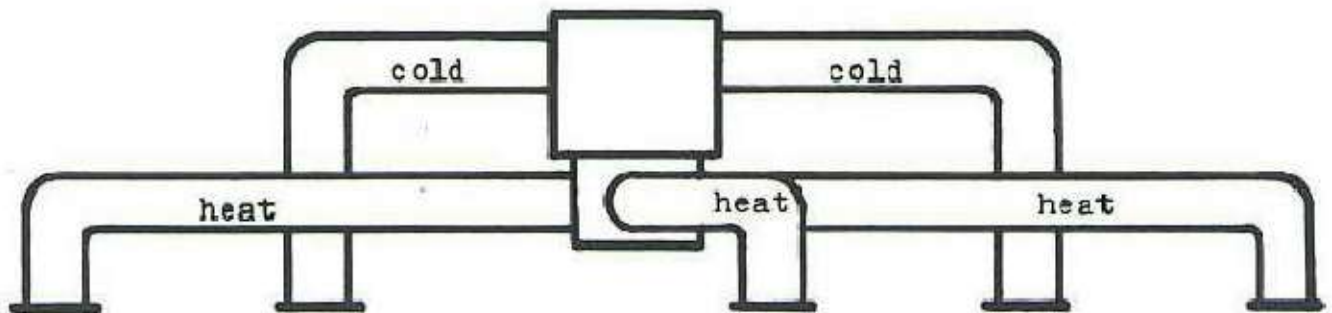
XI. DUCTING (Cont'd)



Typical Bath hook-up using Tee junction.



Typical Left Duct layout for 12,000 & 16,000 BTU Furnace with (3) outlets.



Typical Right Duct layout for 12,000 & 16,000 BTU Furnace with (3) outlets.

DUCTING:

All Ducting to be hi-temp. 3 1/2 I.D. approved U.L. flexible type tubing, U.L. listed air duct connector Class 1 issue 3377.

GRILLS:

All Grills should adapt to 3 1/2 I.D. Ducting to a 5" x 5" face Grill (louvered).

CAUTION:

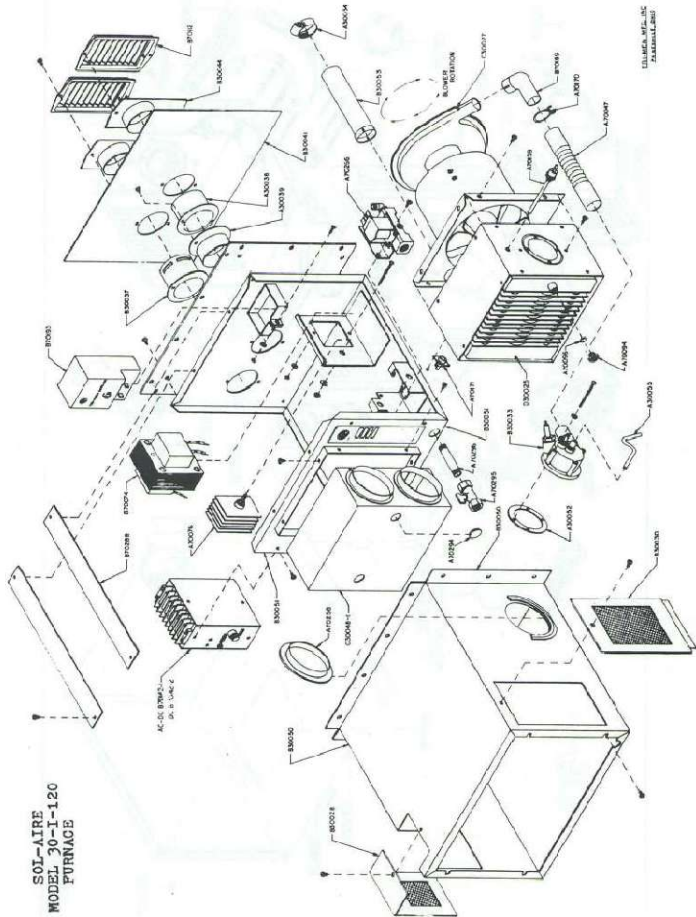
Keep all Ducting runs as short as possible, and free of sharp kinks and bends.

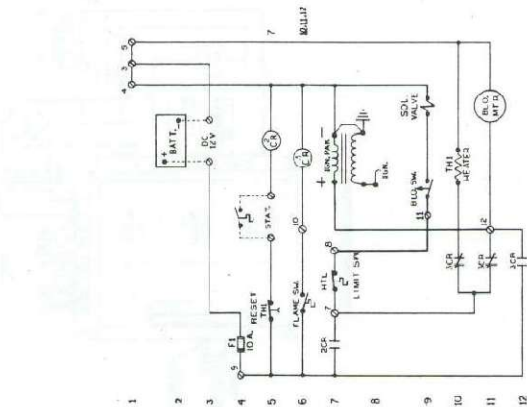
LOCATE COLD AIR RETURNS: To prevent recycling of warm air.

FASTENERS:

Secure all Duct connections with approved Duct Clamps.

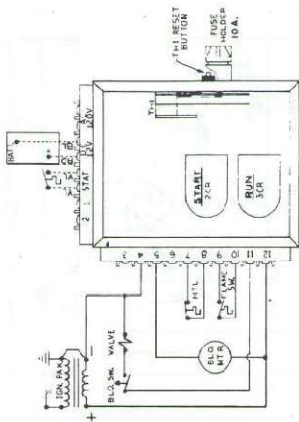
**SOL-AIRE
MODEL 30-I-120
FURNACE**





NOTES

1. WASHED LINES DENOTE EXTERNAL CONNECTIONS TO FURNACE.
2. ALL WIRE TO BE UL AND CSA LISTED WITH 105°C, 600V INSULATION AND UL LISTED TERMINALS.



INTERCONNECTION DIAGRAM

SOL-AIRE FURNACE			
AUTOMATIC D.C. CIRCUIT			
REV.	DATE	BY	REVISIONS
1	10/27/73	WHE	
2	10/27/73	WHE	
3	10/27/73	WHE	
4	10/27/73	WHE	
5	10/27/73	WHE	
6	10/27/73	WHE	
7	10/27/73	WHE	
8	10/27/73	WHE	
9	10/27/73	WHE	
10	10/27/73	WHE	
11	10/27/73	WHE	
12	10/27/73	WHE	
13	10/27/73	WHE	
14	10/27/73	WHE	
15	10/27/73	WHE	
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30	10/27/73	WHE	
31	10/27/73	WHE	
32	10/27/73	WHE	
33	10/27/73	WHE	
34	10/27/73	WHE	
35	10/27/73	WHE	
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TRI-MEN MFG., INC.
Painesville, Ohio

DATE 10/27/73
BY WHE
CHECKED G.E.H.
APPROVED 4/18
REVISED 10/27/73
B-70X RO-2