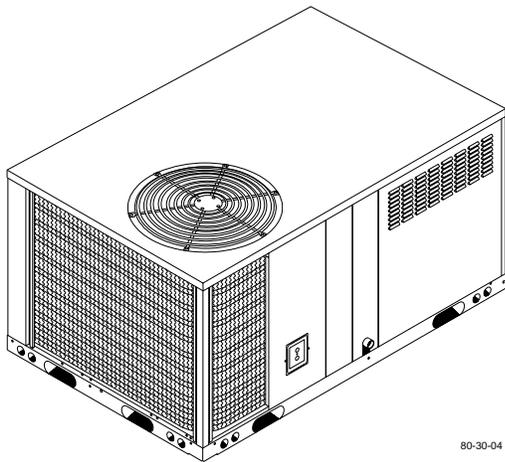


Installation Instructions



80-30-04

Three Phase 3 to 5 Ton
Direct Drive Blower

Contents

Unit Dimensions	2-3
1. Safety Labeling / Signal Words .	4
2. Safe Installation Requirements .	4
3. Locating the Unit	5
4. Gas Supply and Piping	8
5. Electrical Wiring	11
6. Ductwork	11
7. Economizer	12
8. Start-up Procedures	13
9. Operation	14
10. Maintenance	15
11. Rigging Instructions	20

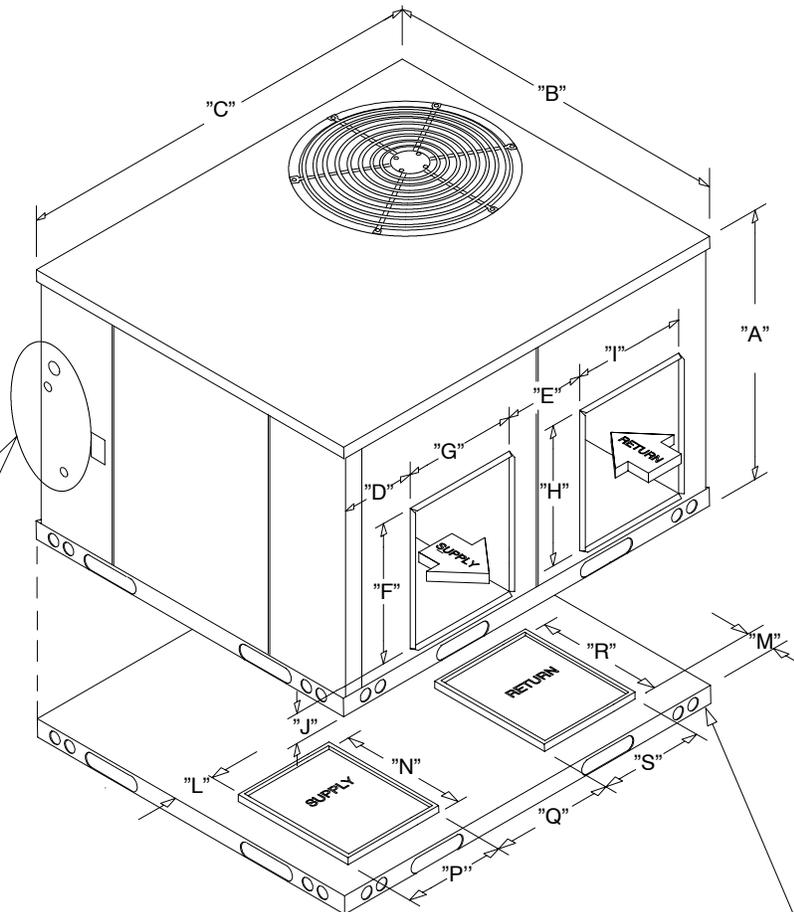
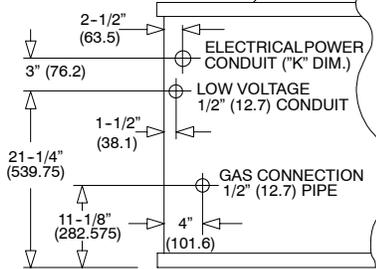


COMBINATION UNITS GAS HEAT / ELECTRIC COOL

"B" CHASSIS UNIT DIMENSIONS

COMBINATION GAS/ ELECTRIC UNITS "B" Chassis (47³/₈ x 47³/₈)

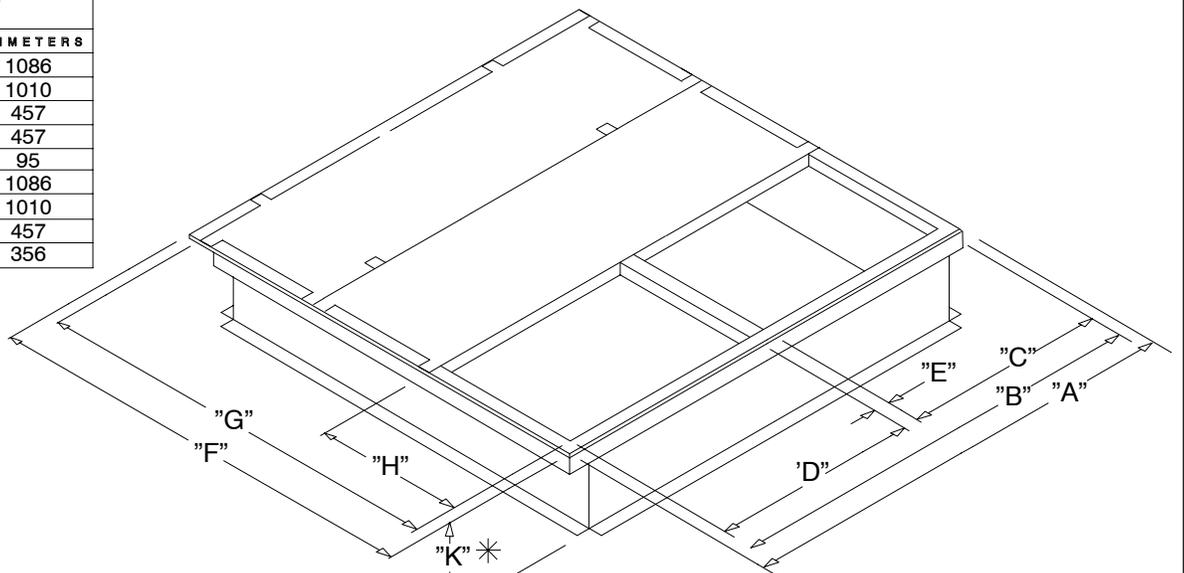
DIM.	INCHES	MILLIMETERS
A	32-1/2	826
B	47-3/8	1203
C	47-3/8	1203
D	3-1/8	79
E	11-1/8	283
F	12	306
G	14-1/4	363
H	14-1/4	363
I	12	306
J	4	102
K	3/4 & 1	19 & 25
L	4-1/4	108
M	4-3/8	111
N	14-1/2	368
P	12-1/4	311
Q	12-1/8	308
R	14-1/4	363
S	12-1/4	318



UNIT BASE SHOWN SEPARATELY TO ILLUSTRATE BOTTOM DUCT OPENINGS

ROOF CURB for units in "B" Chassis (47³/₈ x 47³/₈)

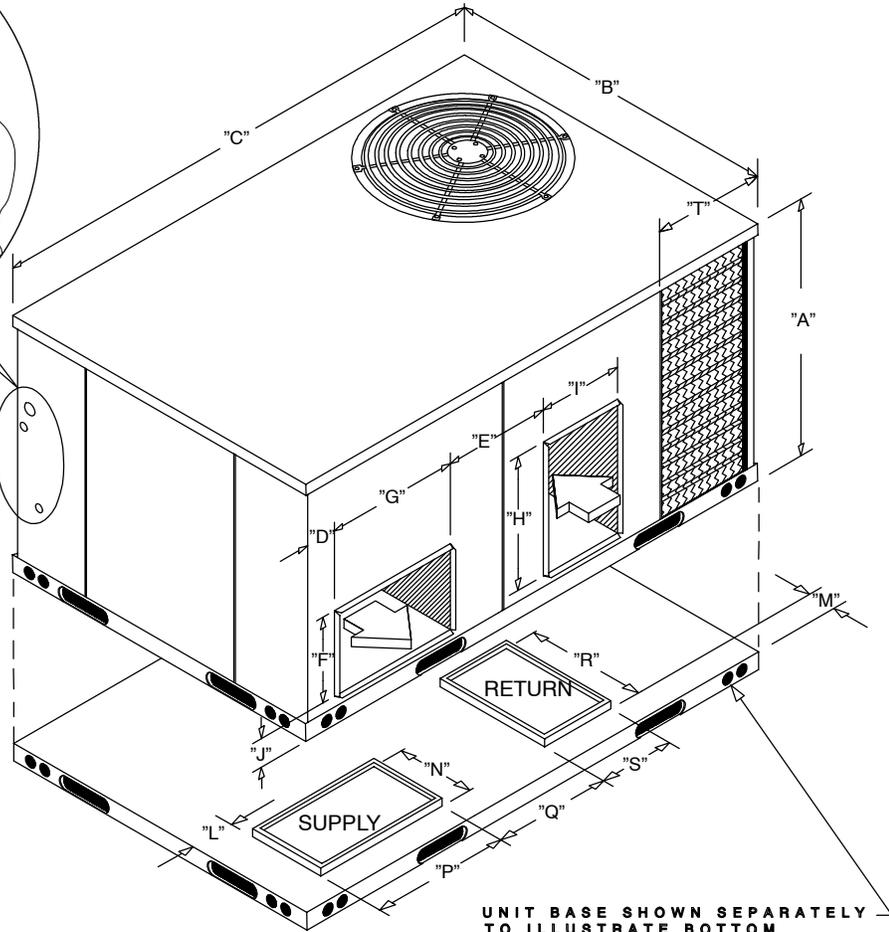
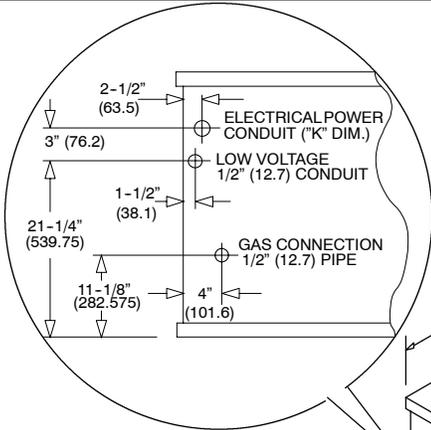
DIM.	INCHES	MILLIMETERS
A	42-3/4	1086
B	39-3/4	1010
C	18	457
D	18	457
E	3-3/4	95
F	42-3/4	1086
G	39-3/4	1010
H	18	457
K*	14	356



* ROOF CURBS ARE ALSO AVAILABLE IN 8" (203) AND 24" (610) HEIGHTS (K DIMENSION).

80-10-12

"C" CHASSIS UNIT DIMENSIONS

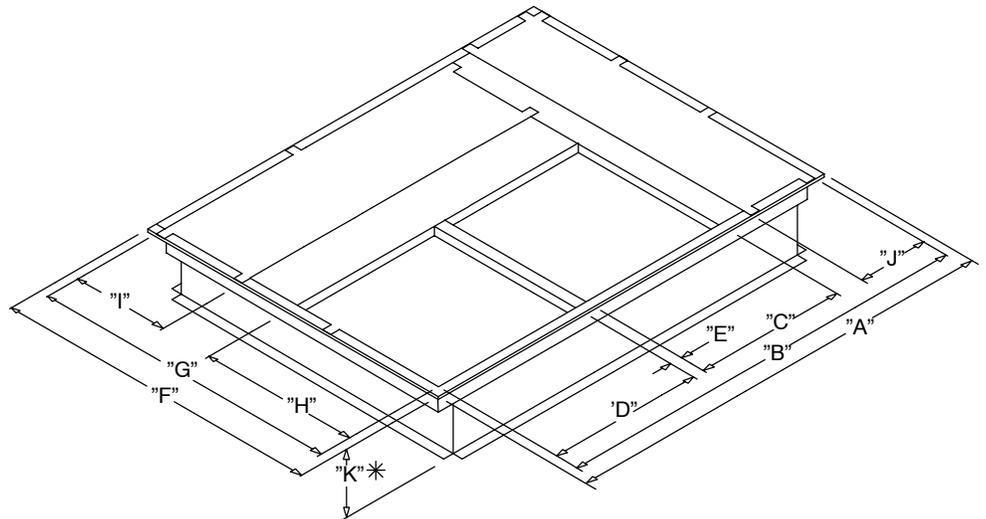


**COMBINATION GAS/
ELECTRIC UNITS
"C" Chassis
(47³/₈ x 73)**

DIM.	INCHES	MILLIMETERS
A	36	914
B	47-3/8	1203
C	73	1354
D	4-5/8	117
E	15	361
F	12	307
G	18-3/4	476
H	18-3/4	476
I	12	306
J	4	102
K	1 & 1-1/4	25 & 31
L	4-1/4	108
M	5-1/4	133
N	12-1/4	311
P	19	483
Q	15	381
R	19	483
S	12-1/4	318
T	16-7/8	429

**ROOF CURB
for
"C" Chassis
(47³/₈ x 73)**

DIM.	INCHES	MILLIMETERS
A	67-3/4	1721
B	64-3/4	1645
C	23	584
D	23	584
E	2-1/2	64
F	42-3/4	1086
G	39-3/4	1010
H	23	584
I	12	305
J	12	305
K*	14	356



* ROOF CURBS ARE ALSO AVAILABLE IN 8" (203) AND 24" (610) HEIGHTS (K DIMENSION).

1. Safety Labeling and Signal Words

Danger, Warning and Caution

The signal words **DANGER**, **WARNING** and **CAUTION** are used to identify levels of hazard seriousness. The signal word **DANGER** is only used on product labels to signify an immediate hazard. The signal words **WARNING** and **CAUTION** will be used on product labels and throughout this manual and other manuals that may apply to the product.

Signal Words

DANGER – Immediate hazards which **WILL** result in severe personal injury or death.

WARNING – Hazards or unsafe practices which **COULD** result in severe personal injury or death.

2. Safe Installation Requirements

WARNING

Installation or repairs made by unqualified persons can result in hazards to you and others. Installation **MUST** conform with local building codes or, in the absence of local codes, with the ANSI Z223.1-1990 National Fuel Gas Code and the National Electrical Code NFPA70-1990 or in Canada the National Standard CAN/CGA B149.1 and CSA C.22.1 - Canadian Electrical Code Part 1.

The information contained in this manual is intended for use by a qualified service technician familiar with safety procedures and equipped with the proper tools and test instruments.

Failure to carefully read and follow all instructions in this manual can result in furnace malfunction, property damage, personal injury and/or death.

- Installation **MUST** conform to the most current version of the following standards or a superseding standard.

In the USA:

- ANSI Z223.1-1990 National Fuel Gas Code
- National Electrical Code NFPA70-1990

In Canada:

- National Standard CAN/CGA B149.1
- CSA C.22.1 - Canadian Electrical Code Part 1.
- Do **NOT** use this furnace as a construction heater.
- Use only the type of gas approved for this furnace (see rating plate).
- Do **NOT** use open flame to test for gas leak.
- Seal supply and return air ducts.

CAUTION – Hazards or unsafe practices which **COULD** result in minor personal injury or product or property damage.

Signal Words in Manuals

The signal word **WARNING** is used throughout this manual in the following manner:

WARNING

The signal word **CAUTION** is used throughout this manual in the following manner:

CAUTION

NOTE: It is the personal responsibility and obligation of the customer to contact a qualified installer to ensure that the installation is adequate and conforms to governing codes and ordinances.

CAUTION

It is recommended that a qualified service technician check the heat exchanger integrity every two (2) years, after the first four (4) years of operation.

Check Pre-existing Common Vent From Old Furnace

If the installation of the combination unit involves removing an existing furnace from a common vent with other appliances, the venting system will probably be too large for the remaining appliances and they will not vent properly. The venting system **MUST** be checked according to the following procedure.

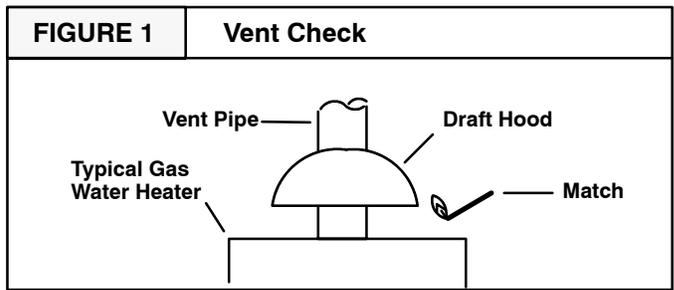
NOTE: The following steps shall be followed with each appliance remaining connected to the common venting system placed in operation, while the other appliances remaining connected to the common venting system are not in operation.

1. Seal any unused openings in the common venting system.
2. Visually inspect the venting system for proper size and horizontal pitch to ensure there is no blockage or restriction, leakage, corrosion or other deficiencies which could cause an unsafe condition.
3. Insofar as is practical, close all doors and windows and all doors between the space in which the appliances remaining connected to the common venting system are located and other spaces of the building
4. Turn on clothes dryers and any appliance not connected to the common venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they will operate at maximum speed. Do **NOT** operate a summer exhaust fan. Close fireplace dampers.
5. Follow the lighting instructions. Place the appliance being inspected in operation. Adjust thermostat so appliance will operate continuously.
6. Test for spillage at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or

candle. (see **FIGURE 1**). Flame or smoke should draw towards vent pipe.

7. After it has been determined that each appliance remaining connected to the common venting system properly vents when tested as outlined, return doors, windows, exhaust fans, fireplace dampers and any other gas-burning appliance to their previous condition of use.

8. If improper venting is observed during any of the above tests, the common venting system **MUST** be corrected using the appropriate tables in Appendix G in the National Fuel Gas Code, ANSI Z223.1, 1990.



NOTE: If flame pulls towards draft hood, this indicates adequate venting.

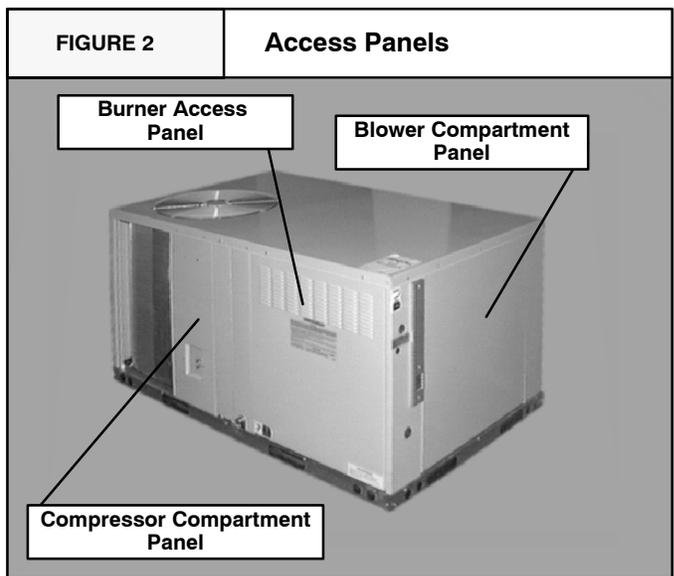
3. Locating the Unit

The unit is designed for outdoor installation only. The unit may be installed on a concrete mounting base at ground level, or on a rooftop with an adequate platform or if using as a downflow model, with a roof curb.

CAUTION

Do NOT operate unit in a corrosive atmosphere containing chlorine, fluorine, or any other corrosive chemicals.

Do **NOT** install the unit in a location that will permit discharged air from the condenser to recirculate to the condenser inlet.



Access Panels

See **FIGURE 2** below for a general view of unit and location of access panels.

WARNING

Carbon monoxide poisoning hazard.

Keep blower door closed.

Failure to keep blower door closed can result in bodily injury and/or death.

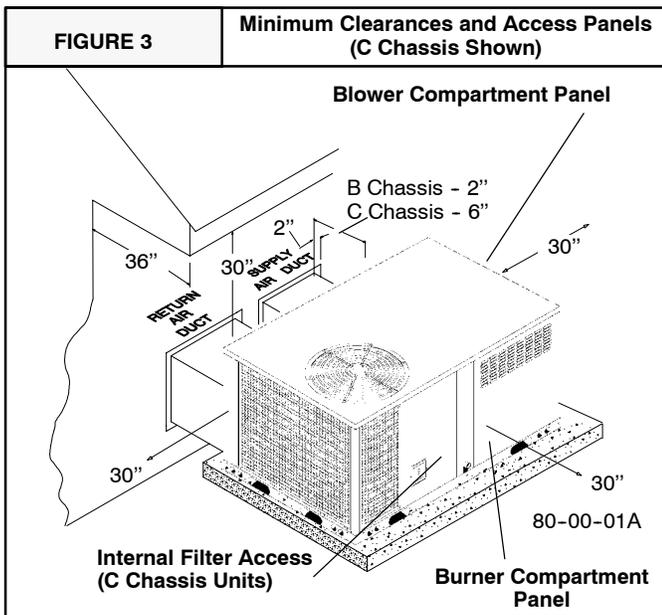
Clearances

The location **MUST** allow for minimum clearances and should not be adjacent to a patio or other area where the unit's operating sound level might be objectionable. The combustion air inlet openings **MUST** not be obstructed (see **FIGURE 5**). In addition, local codes **MUST** be observed.

Clearances **MUST** be maintained from adjacent structures to provide adequate fire protection, adequate combustion air, and room for service personnel.

NOTE: Filter racks need a 26" minimum clearance at front of unit for removal of filters. See chart below if unit is going to be placed near combustible construction or materials.

While minimum clearances are acceptable for safety reasons, they may not allow adequate air circulation around the unit for proper operation in the cooling mode. Whenever possible, it is desirable to allow additional clearance, especially around the condenser inlet and discharge openings.



Minimum Clearances to Combustible Construction

Furnace Plenum	2"
Duct Side	2" (6" on large chassis models)
Condenser Inlet Side	30"
Blower Service (Rear)	30"
Control Service Side (Front Combustion Air Inlet)	30"
Clearance between 3 Ft. Overhang and Top of Unit	30"
Combustible Base (Wood or Class A, B or C roof covering material)	0"

Installation

CAUTION

Unit will NOT operate properly unless it is installed level front to rear and side to side.

The slope MUST NOT be greater than 1/8" per foot (10mm per meter). For side to side leveling, the control box side MUST always be lower.

Ground Level Installation

Ground level platform requirements:

- The unit **MUST** be situated to provide safe access for servicing.
- Platform may be made of either concrete or pressure treated wood and **MUST** be level and strong enough to support unit weight.
- Position platform separate from building foundation.
- Install in well-drained area, with top surface of platform above grade level.
- Platform **MUST** be high enough to allow for proper condensate trap installation and drainage. See **Figure 9** and associated text for more information about condensate drainage.

Rooftop Installation

Rooftop platform requirements:

- The unit **MUST** be situated to provide safe access for servicing.
 - The existing roof structure **MUST** be adequate to support the weight of the unit or the roof **MUST** be reinforced. Check the weight of the unit in relation to the roof structure and local building codes or ordinances and reinforce roof structure if necessary. See **FIGURE 25** on the back cover of this manual for unit weights and corner weights.
 - Support for the unit **MUST** be level and strong enough to carry unit weight. The support may consist of a platform or a combination of platform and roof beams or curb.
- The platform may be constructed of pressure treated wood and may be covered with Class A, B or C roof covering.
- Platform **MUST** allow for proper condensate trap installation and drainage. See **FIGURE 6** and associated text for more information about condensate drainage.

NOTE: Cardboard covers on downflow supply and return duct openings **MUST** be removed before starting unit.

Hoisting

NOTE: All access panels **MUST** be secured in place before hoisting.

The unit should be hoisted with two lifting slings. Attach the slings to rigging shackles that have been hooked through holes in the base rail.

Two spreader bars **MUST** be placed on top of the unit to protect the unit from damage from the pressure exerted by the slings. Make sure that all equipment is adequate to handle the weight of the unit and that the slings will not allow the unit to shift.

Refer to **FIGURE 25** on the back cover of this manual for illustrated rigging instructions and weight chart.

Downflow Conversion

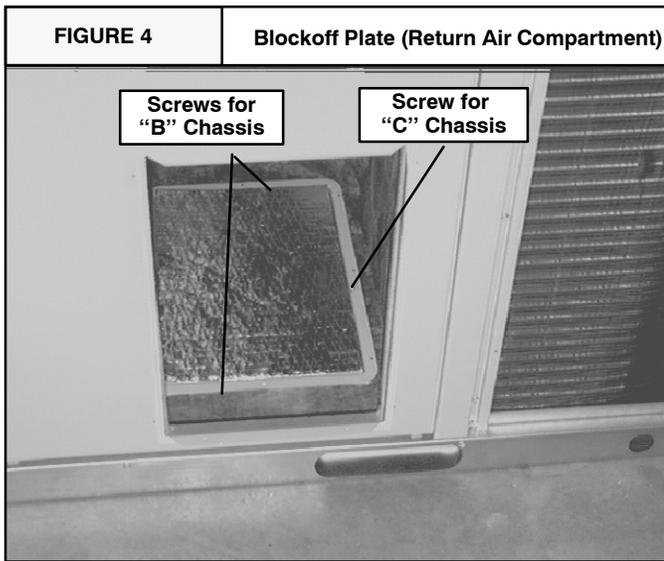
These units are adaptable to downflow use. To convert to downflow use, follow these steps:

1. Remove the blockoff plates found in the return air compartment and the supply air compartment. See **FIGURE 4** for plate location.

NOTE: Blockoff plate in the supply air compartment only contains one screw. If reinstalling plate, back part of plate **MUST** fit into mating dimples on flange. To reinstall, slant plate into dimples, then put plate into position and fasten with screw.

2. Install the removed plates on the horizontal return and supply air openings.
3. Install roof curb on your building. Be sure to follow all directions included with curb and all applicable building codes.
4. Install unit on the appropriate roof curb.

NOTE: It is the installer's personal responsibility to follow all local codes and ordinances and instructions contained herein, as well as instructions included with accessory items when installing unit.

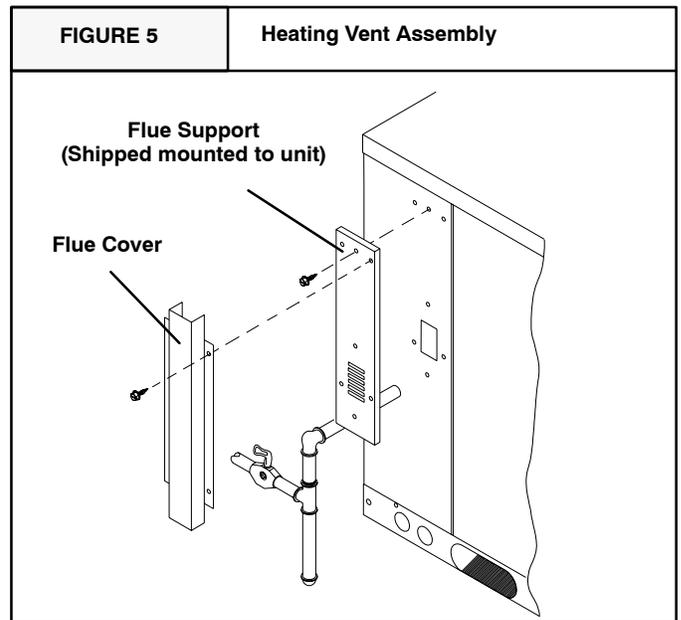


Heating Vent Assembly

The flue cover is packed with screws in the return air compartment. Refer to **FIGURE 5** and assemble as shown.

CAUTION

DO NOT OPERATE THE UNIT WITHOUT THE VENT ASSEMBLY INSTALLED

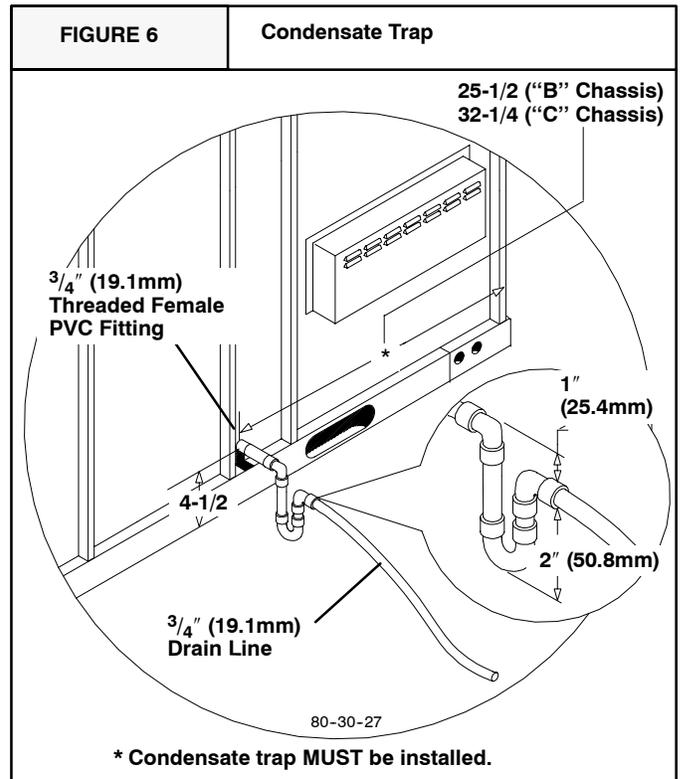


Condensate Drain

A 3/4" O.D. condensate drain connection is located at the front end of the unit. A 3/4" drain line **MUST** be installed if required by local codes or location of unit, and run to an open drain or other suitable disposal point. **A condensate trap MUST be installed as near the unit as possible for proper drainage.**

Condensate Trap

Condensate trap **MUST** have proper height and fall as shown in **FIGURE 6**.



4. Gas Supply and Piping

Because there are many types of liquefied petroleum (LP) gases, the term LP as used in this manual refers to *propane* gas. If you intend to use any type of LP gas, proper precautions **MUST** be used in the handling, piping, and use of such gas. **NOTE:** In Canada, LP installations **MUST** be performed by licensed LP installers.

The Rating Plate located on the side panel on the unit contains the model number, type of gas and gas input rating, and other important information.

WARNING

Fire and/or explosion hazard.

Make certain the unit is equipped to operate on the type of gas available. Models designated as natural gas are to be used with natural gas only. Models designated for use with liquefied petroleum (LP) gas are shipped with orifices sized for commercially pure propane gas. They **MUST** not be used with butane or a mixture of butane and propane unless properly sized orifices are installed by a licensed LP installer.

Failure to follow this warning can result in property damage, personal injury, and/or death.

Gas Pressures

1. Do **NOT** allow minimum gas supply pressure to fall below the minimums. Doing so will decrease input to furnace. Refer to **FIGURE 7** for gas supply pressures.
2. Gas input **MUST NOT** exceed rated input shown on rating plate.
3. Do **NOT** allow pressures to exceed the maximum limits as listed in **FIGURE 7**.

NOTE: If gas supply pressures are not correct, contact your gas supplier.

FIGURE 7		Gas Pressures	
	Natural Gas	LP Gas	
Minimum Inlet Pressure	4.5" W.C. (1120 Pa)	11" W.C. (2740 Pa)	
Recom. Inlet Pressure	7" W.C. (1740 Pa)	11" W.C. (2740 Pa)	
Maximum Inlet Pressure	13" W.C. (3230 Pa)	13" W.C. (3230 Pa)	
Manifold Pressure	3.5" W.C. (870 Pa)	10" W.C. (2490 Pa)	

Manifold Pressures

Manifold pressures are covered in the startup procedure section. Refer to **Chapter 8. Start-Up Procedures** on **Page 13**.

Gas Piping

The gas supply line **MUST** be of adequate size to handle the Btu/hr requirements and length of the run for the unit being installed. Determine the minimum pipe size for natural gas from the table in **Figure 8 & Figure 9**. Base the length of the run from the gas meter or source to the unit.

Gas Pipe Size

Btu ratings of all other gas appliances **MUST** be considered for sizing of main gas line. Check gas line to installation for compliance with local codes or, in the absence of local codes, with the National Fuel Gas Code ANSI Z223.1-1990 and in Canada the National Standard CAN/CGA B149.1 current editions.

FIGURE 8		Gas Pipe Size, Length and Btu/hr Capacity for Schedule 40 Iron Pipe (English)				
NATURAL GAS						
Pipe Length (Includes Fittings)	Btu/hr (in thousands)					
	3/4"	1"	1 1/4"	1 1/2"	2"	
20'	190	350	730	1,100	2,100	
40'	130	245	500	760	1,450	
60'	105	195	400	610	1,150	
LP GAS						
Pipe Length (Includes Fittings)	Btu/hr (in thousands)					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	
20'	189	393	732	1,496	2,299	
40'	129	267	504	1,039	1,559	
60'	103	217	409	834	1,275	

FIGURE 9		Gas Pipe Size, Length and Btu/hr Capacity for Schedule 40 Iron Pipe (English)				
NATURAL GAS						
Pipe Length (Includes Fittings)	kW**					
	3/4"	1"	1 1/4"	1 1/2"	2"	
6.1m	56	103	214	322	615	
12.2m	38	72	147	223	425	
18.3m	31	57	117	179	337	
LP GAS						
Pipe Length (Includes Fittings)	kW**					
	1/2"	3/4"	1"	1 1/4"	1 1/2"	
6.1m	55	115	215	438	674	
12.2m	38	78	148	305	457	
18.3m	30	64	120	244	374	

**kW (Kilowatts) is the metric equivalent of Btu/hr.

FIGURE 10		Orifice Sizes	
Gas Type	Specific Gravity	Btu/ft ³ (kJ/L)	Pilot Orifice Sizes
Natural	0.6	1000	.018#
Propane	1.53	2500	.012#

#Adjust pilot flame as needed

TABLE 1: Equivalent Orifice Sizes at High Altitudes
(Includes 4% input reduction for each 1,000 ft.)

Natural Gas Manifold Orifice Size Required by Elevation								
BTU INPUT	0'-2000'	2000'-4000'	4500'-5000'	6000'	7000'	8000'	9000'	10000'
40,000 to 60,000	44	45	46	47	47	48	48	49
90,000 to 150,000	43	44	45	45	46	47	47	48

LP Gas Manifold Orifice Size Required by Elevation								
BTU INPUT	0'-2000'	2000'-4000'	4500'-5000'	6000'	7000'	8000'	9000'	10000'
40,000 to 60,000	55	56	56	56	56	56	56	57
90,000 to 150,000	54	55	55	55	55	56	56	56

* 2-1/2 & 3 Ton with 3 burners.
** 3-1/2 & 4 ton with 4 burners.

Orifices

Orifice Sizes

Orifice sizes **MUST** be matched to the heating value of the gas (see **FIGURE 10 and Table 1**). Check with your gas supplier and the National Fuel Gas Code ANSI Z223.1-1990 and in Canada the National Standard CAN/CGA B149.1; current edition.

NOTE: An LP Conversion Kit, which contains pilot and burner orifices, a two-stage LP gas valve and an instruction manual, **MUST** be used for conversion to LP gas.

NOTE: For elevations above 2000 feet (610 meters), the Btu input rating **MUST** be reduced by 4% for each 1000 feet (305 meters) above sea level, unless the gas supplier's Btu/ft³ content has already been adjusted for altitude. See **Table 1** for the proper orifice sizes.

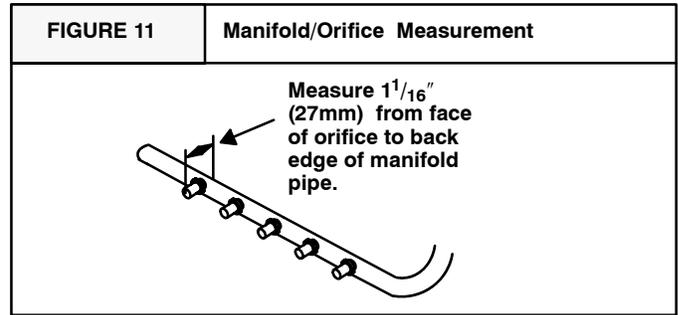
Changing Orifices

WARNING

Electrical shock, fire and/or explosion hazard.
Shut off electric power at unit disconnect or service panel and shut off gas at manual shut off valve before beginning the following procedure.
Changing orifices requires a qualified service technician.
Failure to follow this warning can result in property damage, personal injury, and/or death.

1. Shut **OFF** gas at manual shut off valve.
2. Shut **OFF** electric power at unit disconnect or service panel.
3. Remove the burner access panel.
4. Disconnect the gas line from the gas valve.
5. Disconnect the wires from the gas valve.

6. Disconnect the pilot tubing from the gas valve.
7. Remove the four screws holding the manifold to the manifold brackets.
8. Carefully remove the manifold with the gas valve attached.
9. Remove the orifices from the manifold with a 7/16" box end or socket wrench.
10. Check to be sure that the size of each orifice is correct for the Btu input desired.



11. Install the correct orifices. Gauge the size of the orifices with a new twist drill bit of the correct size.

Make sure that the orifices go in straight so that they form a right angle (90°) to the manifold pipe.

Tighten the orifices so that there is a 1 1/16" (27mm) distance between the faces of the orifices to the back of the manifold pipe.

Measure the distance with a set of calipers. If you do not have a calipers, you can use an adjustable wrench and measure between the face of the jaws.

12. Reassemble in reverse order.

Piping at Unit

Connections

NOTE: Refer to **FIGURE 13** for the general layout at the furnace. The rules listed apply to natural and LP gas pipe installations.

1. If installation is for LP gas, have LP gas installer use **TWO-STAGE REGULATION** and make all connections from storage tank to unit.
2. Use black iron or steel pipe and fittings or other pipe approved by local code.

NOTE: If a flexible gas connector is used, it **MUST** be acceptable to local authority. Connector **MUST NOT** be used inside the furnace or be secured or supported by the furnace or ductwork. Connectors **MUST** comply with one of the following standards or a superseding standard:

- ANSI Z21.24a-1983, *Metal Connectors for Gas Appliances.*
- ANSI Z21.45b-1983, *Flexible Connectors of Other Than All-Metal Construction for Gas Appliances.*

WARNING

Fire and/or explosion hazard.

Gas connector MUST be properly installed and can NOT be used inside the furnace.

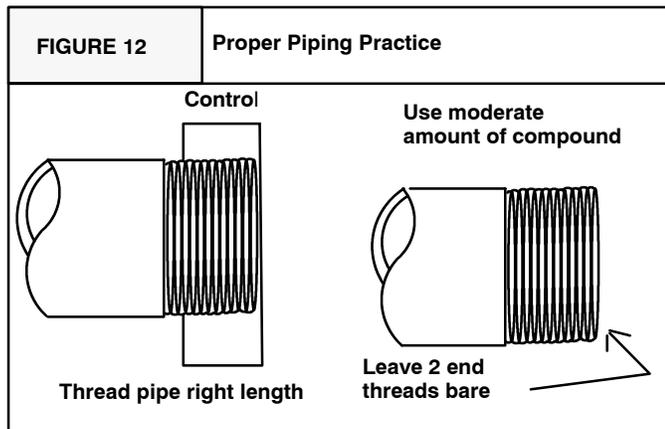
Failure to do so can result in property damage, bodily injury or death.

- Use pipe joint compound on external (male) threads **ONLY**. Joint compound **MUST** be resistant to any chemical action of LP gases (**FIGURE 12**).
- Use ground joint unions and install a drip leg no less than 3 inches (76 mm) long to trap dirt and moisture before it can enter gas valve.
- Use a flat jawed wrench on gas valve when making connections to prevent gas valve from turning. Do **NOT** use a pipe wrench on the gas valve body.

CAUTION

Overtightening assembly may cause damage to the gas valve and/or wiring and may misalign the burners.

- Provide a $\frac{1}{8}$ inch (3mm) National Pipe Thread (NPT) plug for test gauge connection immediately upstream of the gas supply connection to the furnace.



- Install a manual shutoff valve and tighten all joints securely.

LP Connection Requirements

- Have a licensed LP gas dealer make all connections at storage tank and check all connections from tank to furnace.
- If copper tubing is used, it **MUST** comply with limitation set in National Fuel Gas Code or in Canada the National Standard CAN/CGA B149.1; current edition..
- Two-stage regulation of LP gas is required.

Leak Check

- Gas pressure **MUST NOT** exceed $\frac{1}{2}$ PSIG (3450 Pa). Checking gas piping above $\frac{1}{2}$ PSIG (3450 Pa) requires the gas valve and manual shutoff valve to be disconnected during testing.
- When checking gas piping to furnace, shut **OFF** manual shutoff valve to furnace.
- Test all pipes for leaks.

WARNING

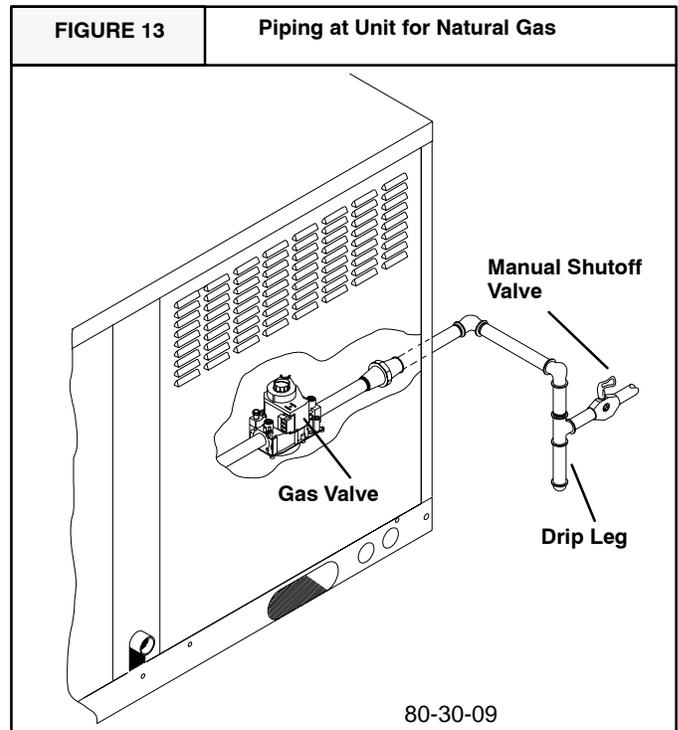
Fire and/or explosion hazard.

Never exceed specified pressures. Higher pressures may damage the gas valve. Such damage may result in overfiring and possible heat exchanger failure.

Do NOT use a match or open flame to test for leaks.

Failure to follow this warning can result in property damage, personal injury, and/or death.

- Apply soap suds (or a liquid detergent) to each joint. Bubbles forming indicate a leak.
- Make sure pilot tube and burner orifices are checked for leakage.
- Correct even the smallest leak at once.



5. Electrical Wiring

WARNING

Electrical shock hazard.

Disconnect power at fuse box or service panel before making any electrical connections.
Unit **MUST** be grounded to electrical service panel.

Failure to follow this warning can result in property damage, personal injury, and/or death.

NOTE: All electrical work **MUST** conform with the requirements of local codes and ordinances and the National Electrical Code ANSI/NFPA-No. 70-1990 or current edition. Provide line voltage power supply from a separate protected circuit with a disconnect switch (when required) located within sight of the unit. Supply voltage, amperage, wire, fuse and disconnect switch sizes **MUST** conform with specifications in the *Technical Support Manual* and with unit rating plate.

All exposed wiring or connections **MUST** be made with weather-proof cable or wire unless installed in conduit. Wiring **MUST** be protected from possible mechanical damage.

Connections for line voltage are made in the unit control box. Low voltage connections are made outside the control box. For access, remove the burner access panel and the control box cover. See **FIGURE 2**.

Low Voltage Wiring

Low voltage wiring connections for the thermostat are made at the 24V terminal board outside the control box. Refer to the wiring diagram for the applicable model and the instructions included with the thermostat.

Thermostat

NOTE: Do **NOT** attempt to use a thermostat designed for electric heat or heat pump use. Such thermostats will **NOT** control the unit properly.

6. Ductwork

Maximum recommended velocity in trunk ducts is 1000 feet per minute. Velocity in branches should not exceed 800 feet per minute.

NOTE: Ductwork sizing affects temperature rise and cooling temperature differential. Be sure to properly size ductwork to the capacity and airflow characteristics of your unit. Failure to do so can affect limit controls, compressors, motors, and other components and will lead to premature failure of components. This will also adversely affect day to day unit performance. Refer to rating plate and *Temperature Rise Check* section in this manual.

Ductwork Insulation

Ductwork installed outdoors should have a minimum of 2" Fiberglass insulation and a weatherproof vapor barrier. It should be pro-

ected against damage. Caulking and flashings, or other means adequate to provide a permanent weather seal, should be used.

Heat Anticipator

Set the thermostat heat anticipator to .58 in accordance with thermostat instructions.

Line Voltage Wiring

Connections for line voltage are made in the unit control box. For access, remove the burner access panel and the control box cover.

Do **NOT** complete line voltage connections until unit is permanently grounded. All line voltage connections and the ground connection **MUST** be made with copper wire.

Ground Connections

A ground lug is installed in the control box for the ground connection. Use a copper conductor of the appropriate size from the unit to a grounded connection in the electrical service panel.

Line Connections

Complete the line service connections to the contactor 'L' terminals inside the control box. Refer to applicable wiring diagram in *Technical Support Manual*. Check all screw terminals to ensure they are tight.

Field Installed Equipment

Wiring to be done in the field between the unit and devices not attached to the unit, or between separate devices which are field installed and located, shall conform with the temperature limitations for type T wire and shall be installed with the manufacturer's instructions applicable to such devices.

Final Electrical Check

Make a final wiring check to be sure system is correctly wired. Inspect field installed wiring and the routing to ensure that rubbing or chafing due to vibration will not occur.

Ductwork installed in attics or other areas exposed to outside temperatures should be installed with a minimum of 2" Fiberglass insulation and have an indoor type vapor barrier.

Ductwork installed in attics or other areas exposed to outside temperatures should be installed with a minimum of 2" Fiberglass insulation and have an indoor type vapor barrier.

Ductwork Connections

The use of flexible, **non-combustible** connectors between main trunk ducts and supply and return air plenums is recommended to minimize vibration transmission .

NOTE: Connect supply and return air plenums to unit in a manner that will allow the top of the unit to be removed without removing plenums. Plenums **MUST** be individually sealed to unit casing with ducts terminating inside structure.

Filters

All return air, including economizer air and outside damper air, **MUST** pass through a filter before entering the evaporator. An electronic air cleaner or other accessible filter arrangement **MUST** be installed in the *return* air ductwork. This can **ONLY** be done when the internal filters are removed and **NO** outdoor air ac-

cessories are used. Minimum recommended filter areas are based on a velocity of 300 ft/min for disposable filters and 500 ft/min for high velocity filters (washable).

CAUTION

DO NOT OPERATE THE UNIT WITHOUT A FILTER.

7. Economizer

The purpose of an economizer is to:

- Provide cool outside air to the conditioned space during the cooling cycle to minimize the use of the compressors.
- Bring outside air into the conditioned space to meet minimum fresh air requirements whenever the circulation blower is running.

The economizer is controlled by a logic module which field connects to the unit controls through a plug harness. The logic module also controls the compressor staging based on the thermostat input.

The minimum opening position of the fresh air dampers is field settable. It is set on the logic module of modulating economizers or on the actuator motor of three-position economizers.

The enthalpy sensor is factory installed on the fresh air dampers of the economizer. The enthalpy change-over point is adjustable on the logic module.

A discharge air sensor is field installed in the blower inlet. The discharge air sensor keeps the discharge air above 56°F (13.3°C).

A positive pressure is created when the fresh air dampers open and the return dampers close. This pressure must be vented or the air will not circulate properly. This is the function of the barometric relief dampers. A positive pressure forces the passive exhaust dampers to swing open.

The fresh air dampers open to the minimum position for outside air whenever the circulation blower is **ON**.

When the thermostat is in the **FAN AUTO** position, the fresh air dampers will close completely whenever heating or cooling is not called for.

When the thermostat is in the **FAN ON** position:

1. The fresh air dampers will open to the minimum position for fresh air.

If Using a 2-Stage Thermostat

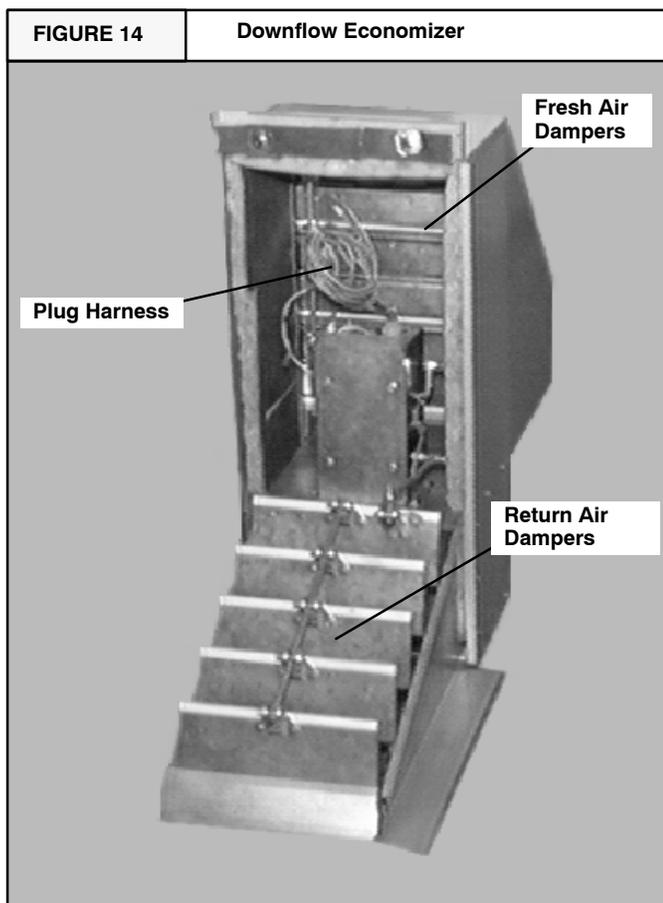
2. On a call for cooling, if the economizer outdoor air sensor determines that the outside air is cool enough (and in the case of an enthalpy sensor, dry enough), the fresh air dampers will modulate open and the return air dampers will modulate closed.

If the conditioned space is not being maintained at the selected temperature, the thermostat will make **Y2** and call for second stage cooling by energizing the economizer logic module at low voltage terminal board terminal **Y4**. This energizes the **Y1** anti-cycle delay and contactor which energizes the condenser fan and compressor for cooling to assist the economizer.

If Using a Single-Stage Thermostat

When using a single stage thermostat, all steps as outlined above will be followed with the exception of the following:

The compressor will only be energized when the outside air reaches a temperature above the preset limit of the economizer. When ambient conditions are not suitable for economizer operation, **ONLY** the compressor will run, and the economizer will **NOT** be energized.



Theory of Operation

The economizer has two sets of dampers that are mechanically linked together. The fresh air dampers regulate the intake of outside air and the return air dampers regulate the flow of return air (see **FIGURE 14**). When the fresh air dampers modulate open, the linkage causes the return air dampers to modulate closed.

8. Start-up Procedures

WARNING

Fire and/or explosion hazard.

Do NOT attempt to light the pilot or burner with a match or flame of any kind.

Failure to follow this warning can result in property damage, personal injury, and/or death.

Check Before Starting

1. Check that the blower motor speed terminal block is set for the correct heating and cooling speeds. Refer to the unit wiring diagram and tech sheet label and/or *Technical Information Manual*.
2. Check to see that clean, properly sized air filters are installed.
3. Replace all service access panels.

Reverse Rotation (Scroll Compressors Only)

Three phase scroll compressor equipped units **CAN** run in reverse if improperly wired. If the compressor makes an unusually loud noise, or if high and low side pressures are nearly identical, this indicates reverse rotation. To correct, reverse any two wires at line voltage connections **ONLY**. Do **NOT** rewire any circuits inside the unit to attempt correction of reverse rotation.

Manifold Gas Pressure Adjustment

NOTE: Make adjustment to manifold pressure with burners operating.

WARNING

Fire or explosion hazard.

Turn OFF gas at shut off before connecting U-tube manometer.

Do NOT adjust manifold pressure more than ± 0.3 inches water column to obtain rated input.

Failure to properly set input pressure can result in property damage, personal injury and/or death.

1. With gas **OFF**, Connect U-Tube manometer to tapped opening on gas valve. Use manometer with a 0 to 12 inches water column range.

FIGURE 15	Manifold Pressure Settings
Gas Type	Manifold Pressure
Natural	3.5 Inches Water Column (870 Pa)
Propane	10 Inches Water Column (2490 Pa)

2. Turn gas **ON** and remove adjustment screw cover on gas valve. Turn counterclockwise to decrease pressure and clockwise to increase.

NOTE: Adjustment screw cover **MUST** be placed on gas valve before reading manifold pressure and operating furnace.

3. Set pressure to value shown in **FIGURE 15**, ± 0.07 kPa (0.3 inches) water column. Pressure is also listed on furnace rating plate. In **NO** case should final manifold pressure vary more than ± 0.07 kPa (0.3 inches) water column.

Circulating Air Blower

Check the unit's operation as outlined in the following instructions. If any unusual sparking, odors or unusual noises are encountered, shut off electric power immediately. Recheck for wiring errors, or obstructions in or near blower motors.

NOTE: If spark wire is removed or replaced, always be certain to remount wire on support bracket standoff.

1. Set thermostat Heat-Cool selector to **OFF**.
2. Set thermostat fan switch to **AUTO**.
3. Turn electric power **ON**. Nothing should start running.
4. Turn manual gas valve **ON**.
5. Turn gas control valve **ON**.
6. Set thermostat fan switch to **ON**. After 30 seconds, the circulating air blower should come **ON**.
7. Reset thermostat fan switch to **AUTO**. After 30 seconds, the circulating air blower should go **OFF**. Nothing should be running.

Heating

1. Adjust thermostat setting above room temperature and set thermostat selector to **HEAT**. The combustion air blower should come **ON**.
2. The ignitor should begin to glow and pilot flame should light.

NOTE: On a call for heat the ignitor and pilot valve will remain energized until a flame is detected by the flame sensor. It may take several minutes to purge the air out of the gas lines at initial start-up of the unit.

3. Once the flame sensor detects that a flame is present, the hot surface ignitor will de-energize and the main burners will light from the pilot.
4. 30 seconds after the burners light, the circulating blower should begin to run.

Temperature Rise Check

NOTE: Air temperature rise is the temperature difference between supply and return air. With a properly designed distribution system, the proper amount of temperature rise will normally be obtained when the unit is operating at rated input with the recommended blower speed.

2. The temperature rise must be within the specifications marked on the unit rating plate.

To check the temperature rise through the unit, place thermometers in the supply and return air ducts as close to the unit as possible.

Open **ALL** registers and duct dampers. Operate unit **AT LEAST** 15 minutes before taking readings.

If the correct amount of temperature rise is not obtained when operating on the recommended blower speed, it may be necessary to change the blower speed. A faster blower speed will decrease the temperature rise. A slower blower speed will increase the temperature rise.

NOTE: The blower speed **MUST** be set to give the correct air temperature rise through the furnace as marked on the rating plate.

3. After 15 minutes of operation check the limit control function by blocking the return air grille(s).

After several minutes the main burners and pilot should go **OFF**. The circulating air blower should continue to run.

Remove air restrictions. Pilot and main burners should relight after a cool down period of a few minutes.

NOTE: The maximum outlet air setting for all models is 175°F.

4. Adjust the thermostat setting below room temperature.

Pilot and main burners and combustion air blower should go **OFF**.

The circulating air blower should continue to run for 60, 100, 140 or 180 seconds. This time is adjustable.

5. Set thermostat Heat-Cool selector to **OFF**.

Cooling

1. Turn electric power **OFF**
2. Set thermostat Heat-Cool select to **COOL**.
3. Adjust thermostat setting to below room temperature.
4. Turn power **ON**, for approximately one minute, then **OFF**. During power application check the following:
 - a. Contactor – Contacts Closing
 - b. Compressor – **ON**
 - c. Condenser fan motor – **ON**
 - d. Circulating Air Blower – **ON** after a 30 second delay
5. Turn power **OFF**, check the following:
 - a. Contactor contacts opening.
 - b. Compressor – **OFF**
 - c. Condenser fan motor – **OFF**
 - d. Circulating blower – **OFF** after a 30 second delay.

9. Operation

WARNING

Electrical shock hazard.

Turn off electric power supply at disconnect switch or service panel before removing any access or service panel from unit.

Failure to follow this warning can result in property damage, personal injury, and/or death.

Controls and Features

Cooling Time Delay Relay (Not All Models)

A cooling time delay relay is used on the evaporator blower motor to increase efficiency (SEER). On a call for cooling, the blower motor starting is delayed for 30 seconds. Also, after the thermostat is satisfied, the blower motor continues to run for 30 seconds after the condenser fan motor and compressor have shut off.

Scroll Anti-cycle Timer (Not All Models)

Single phase scroll compressor equipped units are equipped with an anti-cycle device which delays start of the compressor in the

event of a power interruption. This feature is to allow pressure equalization throughout the system and to prevent possible reverse rotation of the scroll compressor. Three phase units do not require this device.

High and Low Pressure Switches (Not All Models)

High and low pressure switches are provided on these units which will shut down the system when high pressures exceed 420 psi and low system pressures fall below 27 psi. The switches automatically reset after a fault. They are accessed through the compressor compartment access panel.

Fan Cycle Pressure Switch Port (optional)

If your unit will be operated in low ambient conditions (below 40° F) and you elect to install a low ambient fan cycle control, you can find the low ambient pressure port located on the discharge line just inside the compressor compartment panel opening.

Freeze Protection Thermostat (Not All Models)

The freeze protection thermostat is located on the evaporator coil bends on the burner side of the unit. It is designed to shut down the cooling circuit if the evaporator coil temperature falls below 35° F.

Filter Drier

A liquid line filter drier is located inside the compressor compartment access panel opening. Be certain to replace filter driers with the correct size and type as found in the *Technical Data Sheets* available from your dealer.

Economizer Plug

A pre-wired economizer plug is located just inside the return air opening. See **Page 12** for more information about the economizer.

Starting the Unit After Shutdown

Heating

1. Set thermostat to **OFF**.
2. Remove burner compartment access panel. Locate gas control valve knob (**NO TAG**), and turn to **OFF**. Wait 5 minutes.
3. Turn gas control knob to **ON**. (Honeywell valve must be depressed to turn). Replace burner compartment access panel. Turn manual gas valve to supply pipe **ON**.
4. Turn electric power **ON**.
5. Set thermostat to **HEAT** and to desired temperature. Unit will come on and operate automatically under control of the thermostat. Never attempt to light the pilot manually.

WARNING

Fire and/or explosion hazard

Do not operate the unit on heating (except during service checks) unless all access panels are securely fastened in place. Abnormal and possibly hazardous burner operation could result.

Failure to follow this warning can result in property damage, personal injury, and/or death.

Cooling

Set thermostat to desired temperature and set system switch to **COOL**. The unit will come on and operate automatically under control of the thermostat. Close all doors and windows. The unit

10. Maintenance

Monthly Maintenance and Inspection Checks

Air Filters

CAUTION

Do NOT operate without air filters.

may run continuously for several hours or longer on the initial run because of residual heat and moisture in the house. This is normal for any air conditioning system.

CAUTION

Do not operate on cooling when outdoor temperature is below 40°F. This is necessary to prevent possible damage to the compressor.

Turning The Unit Off

1. Set the thermostat switch and **OFF** fan switch to **AUTO**. To restart, set to **HEAT** or **COOL** and temperature desired.
2. To shut the unit down completely, turn electric power **OFF**. Turn manual gas valve off.

CAUTION

To prevent heat exchanger damage, wait at least 2 minutes after blower stops before shutting off power to unit.

NOTE: If the furnace overheats or fails to shut off, turn **OFF** the manual gas valve for the furnace then wait at least 2 minutes before turning off electric power.

Thermostat Fan Switch Operation

With the selector switch in the **ON** position the circulating air blower will run continuously (after the 30 second delay) at the speed used for cooling. In the **AUTO** position the blower will only be on during each heating or cooling cycle.

CAUTION

Some units use a lower blower speed for cooling than for heating. Do NOT position selector switch to ON for continuous operation during heating cycle if the cooling blower speed is lower than the heating speed. Blower speeds for each model are listed on the units Tech Label.

Adjusting Room Temperatures

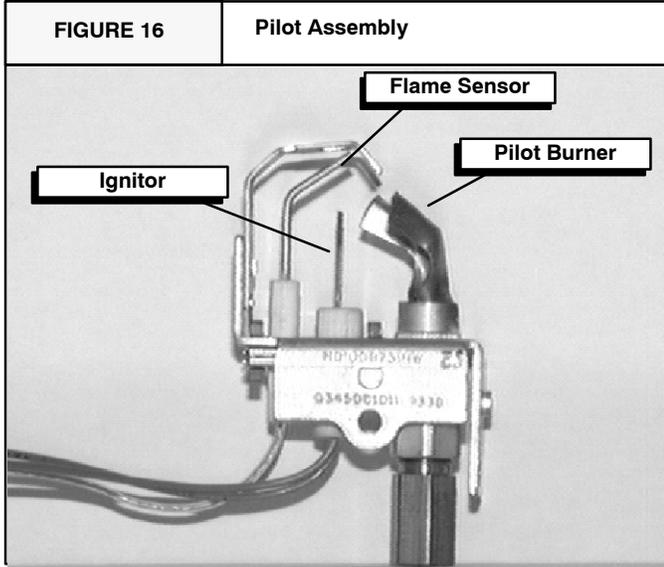
If the temperature in individual rooms is not as desired, balance the system by adjusting the dampers in the branch ducts. Adjust a little at a time and wait a day after each change to judge the effect. Once the dampers are adjusted for normal weather conditions, it is best to leave them that way. Compensate for temporary weather changes by adjusting the thermostat setting .

Inspect filters at least monthly and replace or clean as required. Washable filters may be cleaned by soaking in mild detergent and rinsing with cold water. Replace filters with the arrows on the side pointing in the direction of air flow. Dirty filters are the most common cause of inadequate heating or cooling performance, and of compressor failures.

Refer to **FIGURE 19** to illustrate location of filter racks and filter access panel. Filters should be removed and replaced through this access panel.

Heating Season Checks (Monthly)

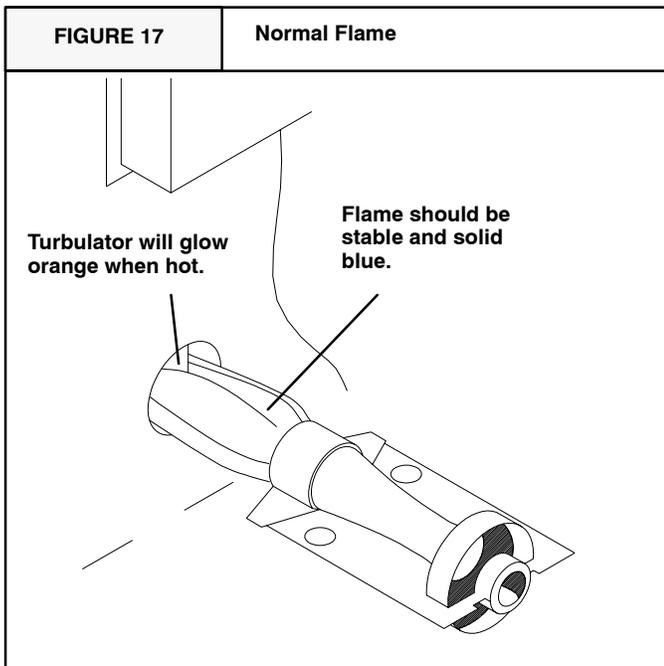
Pilot Flame



While the main burner is on, the flame should envelop the upper part of the flame sensor, as shown in **FIGURE 16**.

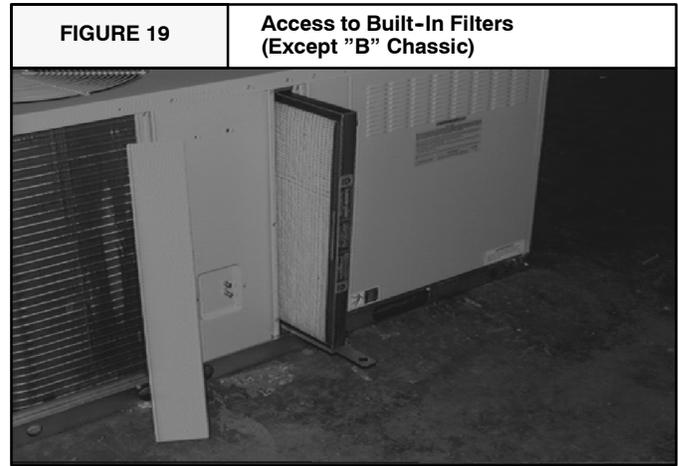
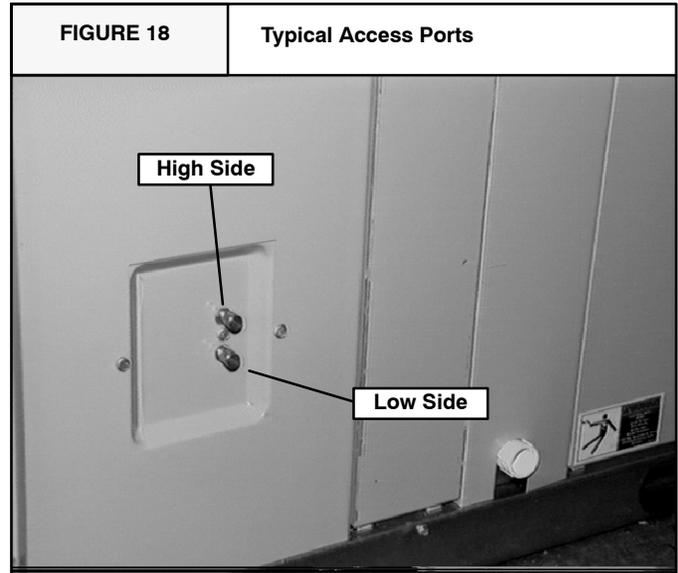
Main Burner Flame

Flames should be stable and solid blue, (dust may cause orange tips or they may have wisps of yellow, but they **MUST** not have solid yellow tips). They should extend directly into the heat exchanger tubes and the turbulators should glow orange (after about five minutes of operation). Main burner flame should be inspected monthly.



Refrigeration Access Ports

This unit is equipped with refrigeration access ports mounted on the side of the unit. Refer to **FIGURE 18** for identification of ports.



Vent Assembly

WARNING

Burn hazard.

Flue cover may be hot! Allow adequate time for flue cover to cool.

Failure to follow this warning can result in property damage or personal injury.

Using a light and mirror (as required) inspect the inside of the vent hood and the inlet air opening in the burner compartment. Look for

soot and severe rust or corrosion and any obstructions due to leaves, spider webs, etc. Clean as required.

Cooling Season Checks (Monthly)

Condenser Coil

Keep the condenser inlet and outlet area clean and free of leaves, grass clippings or other debris. Grass should be kept short in front of the condenser inlet. Shrubbery **MUST** be trimmed back so it is no closer than 30 inches to unit.

Condensate Drain

Check for condensate drainage. Clean as required.

NOTE: When unit is operating in cooling mode under high humidity ambient conditions, condensate can form in the burner compartment and may drip from front of the compartment. This condition is **NOT** harmful to unit.

Annual Maintenance and Inspection

WARNING

Electrical shock hazard.

Turn off electric power supply at disconnect switch or service panel before removing any access or service panel from unit.

Failure to follow this warning can result in property damage, personal injury, and/or death.

The annual inspection should include lubrication and cleaning as required to ensure efficient operation of the unit. To simplify access, remove all access panels and the top from the unit if possible.

Condenser Fan Motor

Oil the condenser fan motor after five years of operation and every five years thereafter.

Use SAE 10W30 motor oil. To oil, remove the hole plugs from the motor end bells and add several drops (approximately 1/2 teaspoonful) of oil with a squeeze type, flexible tube oiler. Replace hole plugs after oiling. Do not over oil.

Clean the surrounding area and the condenser and evaporator coils. Use caution to avoid damage to coil fins.

Blower Motor Access

Refer to **NO TAG** for a view of blower motor and compartment.

Method 1

This method allows you to work on the motor and housing while still in the unit. The blower motor can be replaced with this method, but some may prefer to work on the housing assembly separately. If this is your preference, use method 2.

1. Remove the blower access panel

2. Remove the four screws securing the blower motor housing. If unit has a support bracket, remove the two screws securing the bracket.
3. Remove the two red wires attached to the limit switch.
4. Slide entire housing toward you. This will allow easier access to the speed tap block, motor, and wires.
5. After access, replace all wires, screws, and connections.

Motor removal and replacement

The blower motor may be replaced while accessing it using method 1. To replace motor, reach behind blower housing and locate blower wheel set nut. Loosen set nut, all wires from motor, and four pins on mounting cradle. Pull motor towards you. To replace motor, reverse this procedure.

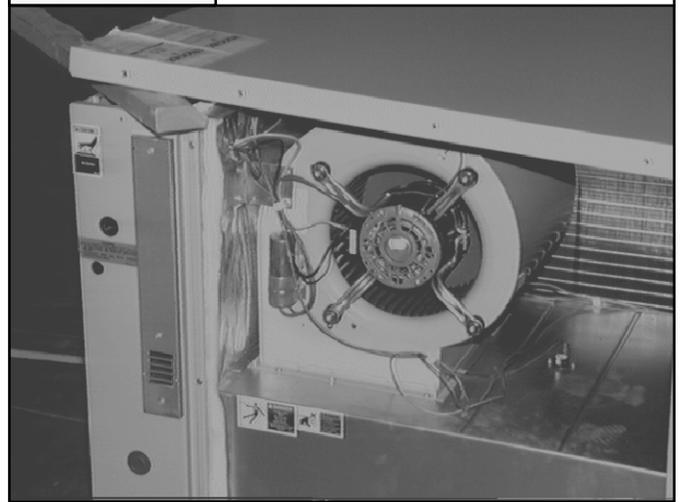
Method 2

This method is required to replace or repair blower wheel, blower housing, or any unreachable components behind blower assembly.

1. Repeat steps 1 through 4 in method 1.
2. Remove all screws around rim of unit top, (except screws which are inaccessible because of proximity to structure).
3. Raise unit top at corner of unit closest to blower at least 2" and place a sturdy brace at least 2" thick between top and unit corner. See **FIGURE 20**. A 2X4 piece of wood is ideal for this.
4. Disconnect all wires from housing and slide housing out of unit. Reverse this process to reinstall.

FIGURE 20

Blower Access Showing Lid Propped with 2X4



Speed Taps

After determining necessary CFM and speed tap data on from tech data label on the unit or in the *Technical Information Manual* follow the steps below to change speeds.

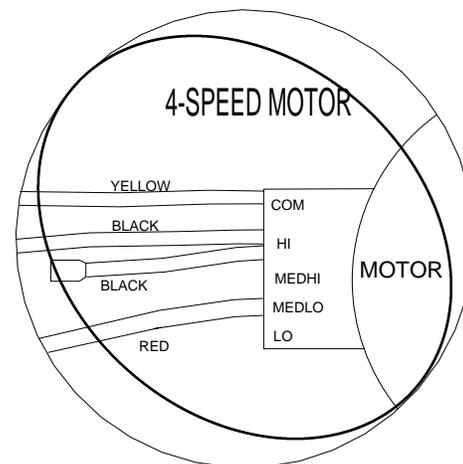
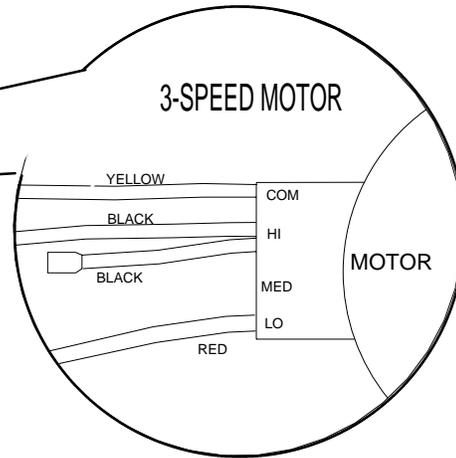
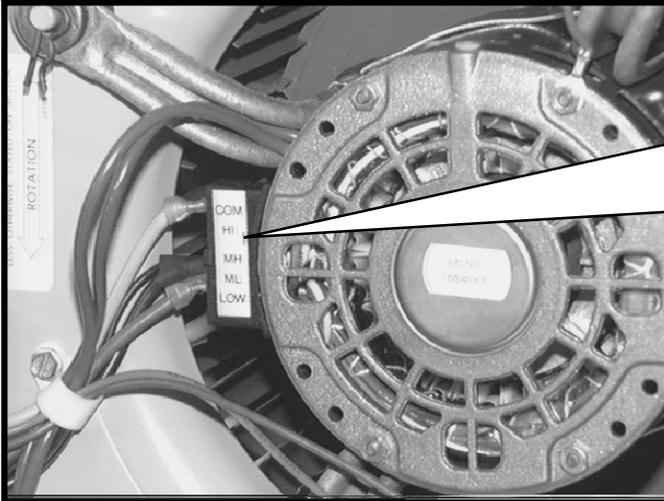
1. Refer to **FIGURE 21** below and locate the speed tap block on blower motor.
2. The yellow lead **MUST** always be connected to the speed tap block at the common quick connect terminal. The terminal is identified as **COM**. Also, this is the only lead which is 3/16" wide. All other quick connects are 1/4" wide.

- If it has been determined that cooling and heating speeds are needed on the same speed tap, remove the red heating lead from the speed tap block and connect it to the insu-

lated male terminal on the black cooling lead. Then place the insulated black female quick connect to the required speed tap.

FIGURE 21

Blower Motor Speed Taps (3-Speed and 4-Speed Motors)



BE SURE TO CHECK BLOWER MOTOR SPEED DATA ON UNITS TECH LABEL

Circulating Air Blower

Visually inspect the blower wheel for accumulations of dirt or lint. Clean the compartment and the blower wheel. If accumulation is excessive on blower wheel, or does not easily remove, it will be necessary to remove the blower assembly.

Oil the blower motor by adding 1/2 teaspoonful (1cc) of SAE 10W30 to each motor bearing. The blower motor should be oiled after five years of operation and every five years thereafter.

CAUTION

Do not use 3 in 1 oil, penetrating oil, WD40 or similar oils to oil motor bearings.

Burners / Heat Exchangers / Flue Gas Passages

To inspect the burners, heat exchanger and interior flue gas passages, use a light and small mirror on an extension handle.

Check the exterior of the heat exchanger and the interior flue gas passages for any evidence of deterioration due to corrosion, cracking or other causes. If signs of scaling or sooting exist, remove the burners and clean the heat exchanger, as required.

Inspection And Cleaning Of Burner Assembly/Heat Exchangers/Flue Gas Passages

For Qualified Service Technician Only

See **FIGURE 24** for identification of parts.

1. Disconnect electrical power to unit.
2. Turn **OFF** gas at manual shut off valve.
3. Remove burner access panel.
4. Remove the vent assembly flue cover.
5. Disconnect gas pipe at union.
6. Disconnect wires from gas valve, note connections.
7. Remove screws that secure the flame shield and remove gas control valve, manifold and burners as an assembly.
8. Remove collector box, injector plate, and restrictor plate, including gaskets. See **FIGURE 23**.
9. Hold the burner assembly vertically and lightly tap it against a wood block. Clean also with a stiff brush. Severe cases of lint clogging may require washing the burners in hot water.
10. Remove turbulators and clean with small brush. Reinspect after cleaning and replace turbulators if defective.
11. Clean flue gas passages by using small brushes and a vacuum cleaner. It may be necessary to fabricate handle extensions for the brushes to reach the areas that require cleaning. Reinspect after cleaning and replace the heat exchanger if defective.
12. Reinstall parts and gaskets in reverse order. On spark to pilot models check the spark gap. $\frac{1}{8}$ inch is required between the igniter and pilot hood.
13. Turn gas on and check for leaks.
14. Install all access panels, turn power on and check for normal operation.

FIGURE 22

Access to Burners

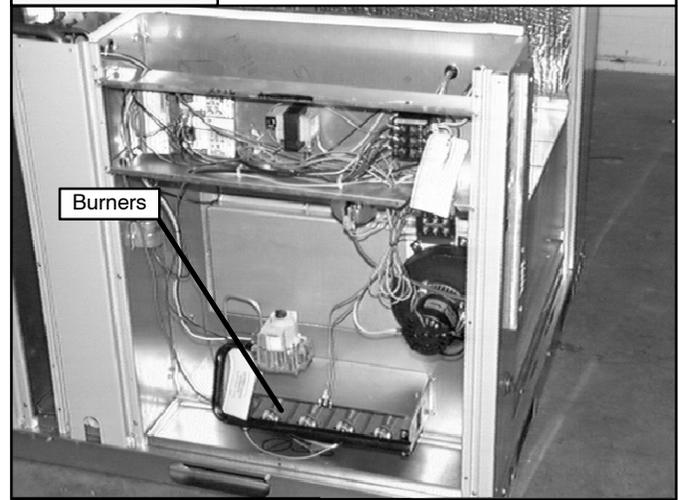


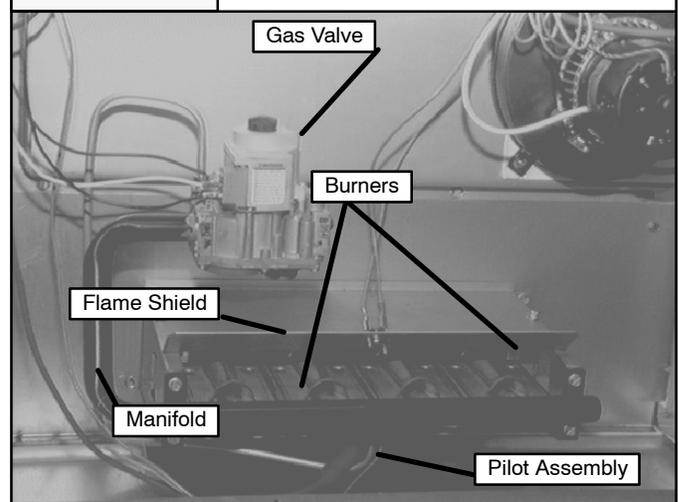
FIGURE 23

Burners, Valve, and Burner Box Removed



FIGURE 24

Burner Assembly Removed



11. Rigging Instructions

FIGURE 25

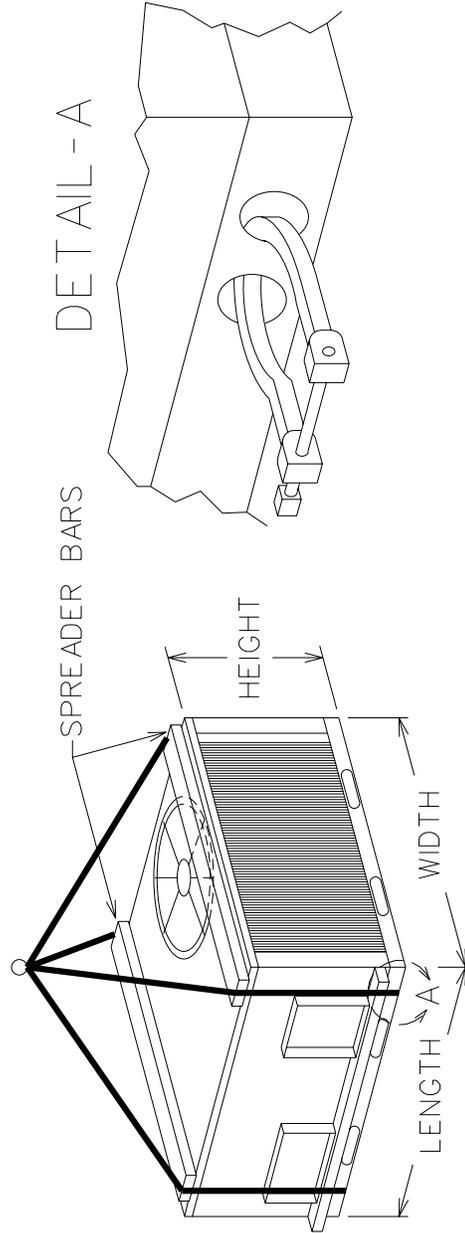
Rigging Instructions

RIGGING INSTRUCTIONS

FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN PROPERTY DAMAGE, BODILY INJURY OR DEATH.

⚠ WARNING

- ALL PANELS MUST BE IN PLACE WHEN RIGGING AND LIFTING.
- HOOK RIGGING SHACKLES THROUGH HOLES IN BASE RAIL, AS SHOWN IN DETAIL-A.
- USE SPREADER BARS, WHEN RIGGING, TO PREVENT UNIT DAMAGE.
- BE SURE RIGGING AND SHACKLES ARE SUFFICIENT TO HANDLE WEIGHT LISTED BELOW.



CABINET	COOLING CAPACITY RANGE	LENGTH		WIDTH		HEIGHT		MAX. WEIGHT	
		IN	MM	IN	MM	IN	MM	LB	KG
B	1.5-3.5 TONS	48.00	1219	48.00	1219	33.00	838	450	204
C	3-6.3 TONS	73.00	1854	48.00	1219	36.50	927	700	318