INSTALLATION & OPERATING INSTRUCTIONS for PGC & PCC SERIES COMBINATION HEATING & COOLING OUTDOOR UNITS

All information contained herein is subject to change without notice.

I0-235

Goodman Manufacturing Company, L.P.
2550 North Loop West, Suite 400, Houston, TX 77092
www.goodmanmfg.com or www.amana-hac.com

10/03

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INTRODUCTION

CHECKING PRODUCT RECEIVED

When the equipment is received all items should be carefully checked against the bill of lading to be sure all crates and cartons have been received. Before accepting delivery, carefully inspect each carton or crate for visible shipping damage. If any damage is noticed, the carrier should make the proper notation on the delivery receipt acknowledging the damage. Make notations of all damage on all copies of the bill of lading and have all copies countersigned by the delivering carrier. The carrier should also fill out a Carrier Inspection Report. The factory Traffic Department should then be contacted. File claim for damage with the carrier. Physical damage to the unit after acceptance is not the responsibility of Goodman Manufacturing Company, L.P. Unpack each carton or crate and verify that all required parts and proper quantities of each item have been received. Refer to drawings for part descriptions. Report shortages or missing items to your local representative to arrange for replacement parts. Due to guarantee that all items will be shipped together. Verification of shipments must be limited to only those items on the bill of lading. The unit nameplate must be checked to make sure the voltage agrees with the power supply available.

BEFORE BEGINNING INSTALLATION

Carefully read all instructions for the installation prior to installing unit. Make sure each step or procedure is understood and any special considerations are taken into account before starting installation. Assemble all tools, hardware and supplies needed to complete the installation. Some items may need to be purchased locally. After deciding where to install unit, closely look the location over - both the inside and outside of home. Note any potential obstacles or problems that might be encountered as noted in this manual. Choose a more suitable location if necessary.

INSTALLING THE UNIT

Proper installation of the unit helps ensure trouble free operation. Improper installation can result in problems ranging from noisy operation to property or equipment damages, dangerous conditions that could result in injury or personal property damage and could void the warranty. Give this booklet to the user and explain it's provisions. The user should retain these instructions for future reference.

REPLACEMENT PARTS

ORDERING PARTS

When reporting shortages or damages, or ordering repair parts, give the complete unit model and serial numbers as stamped on the unit's nameplate.

Replacement parts for this appliance are available through your contractor or local distributor. For the location of your nearest distributor, consult the white business pages, the yellow page section of the local telephone book or contact:

SERVICE PARTS DEPARTMENT
GOODMAN MANUFACTURING COMPANY, L.P.
2550 NORTH LOOP WEST, SUITE 400
HOUSTON, TEXAS 77092
(713) 861 – 2500

IMPORTANT SAFETY INSTRUCTIONS

RECOGNIZE SAFETY SYMBOLS, WORDS, AND LABELS

The following symbols and labels are used throughout this manual to indicate immediate or potential hazards. It is the owner's responsibility to read and comply with all safety information and instructions accompanying these symbols. Failure to heed safety information increases the risk of property damage, product damage. serious personal injury or death.

DANGER

IMMEDIATE HAZARDS WHICH **WILL** RESULT IN PROPERTY DAMAGE, PRODUCT DAMAGE, SEVERE PERSONAL INJURY AND/OR DEATH.

WARNING

HAZARDS OR UNSAFE PRACTICES **COULD** RESULT IN PROPERTY DAMAGE, PRODUCT DAMAGE, SEVERE PERSONAL INJURY AND/OR DEATH.

CAUTION

HAZARDS OR UNSAFE PRACTICES WHICH **MAY** RESULT IN PROPERTY DAMAGE, PRODUCT DAMAGE, AND/OR PERSONAL INJURY.

DANGER

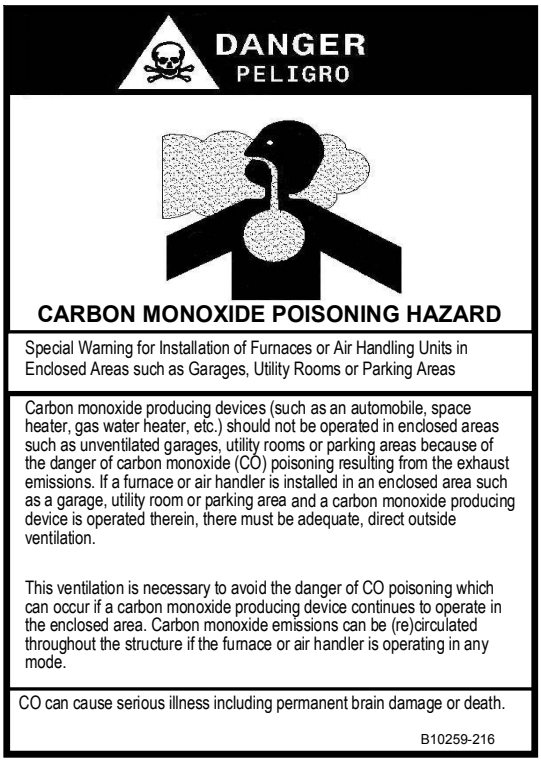
DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER UNIT OR APPLIANCE.

CAUTION

DO NOT DESTROY THESE INSTRUCTIONS. FOR YOUR SAFETY, PLEASE READ THIS CAREFULLY AND KEEP THIS IN A SAFE PLACE FOR FUTURE REFERENCE.

CAUTION

APPLIANCE IS SHIPPED FROM FACTORY FOR VERTICAL DUCT APPLICATION. ACCESSORY HORIZONTAL DUCT KIT MUST BE FIELD INSTALLED FOR HORIZONTAL DUCT APPLICATIONS. SEE HORIZONTAL DISCHARGE DUCT CONNECTIONS FOR DETAILS.



SAFETY INSTRUCTIONS IF YOU SMELL GAS

For your safety, if you smell gas, follow these instructions:

- Do not try to light any appliances.
- Do not touch any electrical switches.
- Do not use any phones in your building.
- Immediately, call your gas supplier from a neighbor's phone.
- Follow the gas supplier's instructions.
- If you cannot reach your gas supplier, call the fire department.

CODES AND REGULATIONS

CAUTION

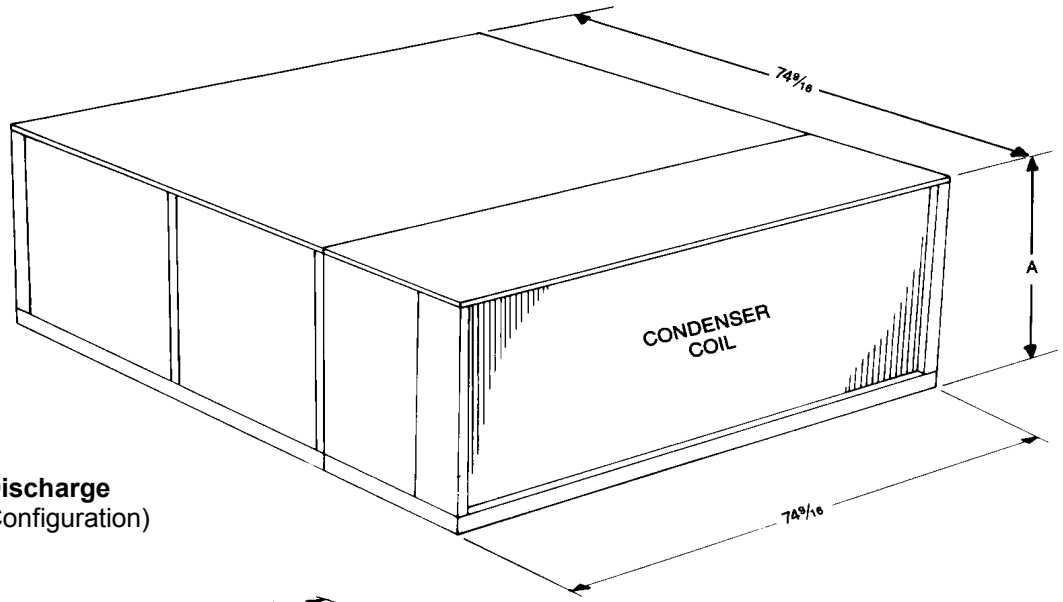
SHEET METAL PARTS, SCREWS, CLIPS AND SIMILAR ITEMS INHERENTLY HAVE SHARP EDGES, AND IT IS NECESSARY THAT THE INSTALLER AND SERVICE PERSONNEL EXERCISE CAUTION.

GENERAL

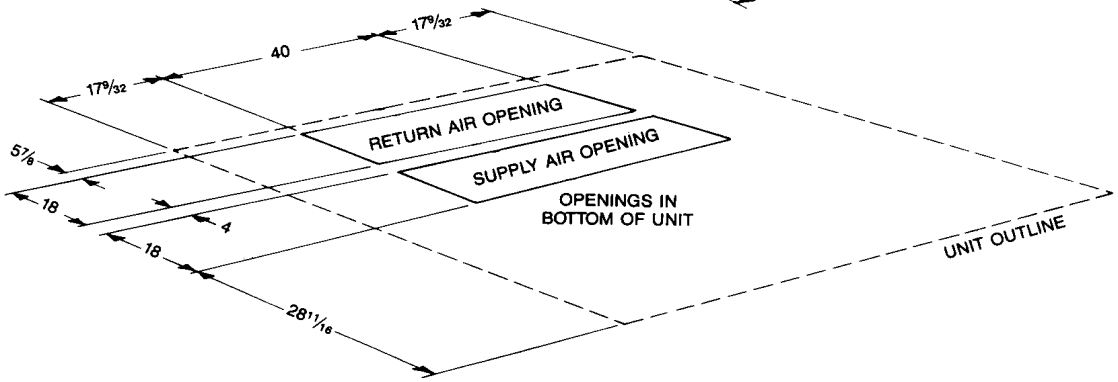
The installation of this equipment shall be in accordance with the regulations of authorities having jurisdiction and all applicable codes. It is the responsibility of the installer to determine and follow the applicable codes. This equipment is to be installed by an experienced installation company

Dimensional Data - Figure 1

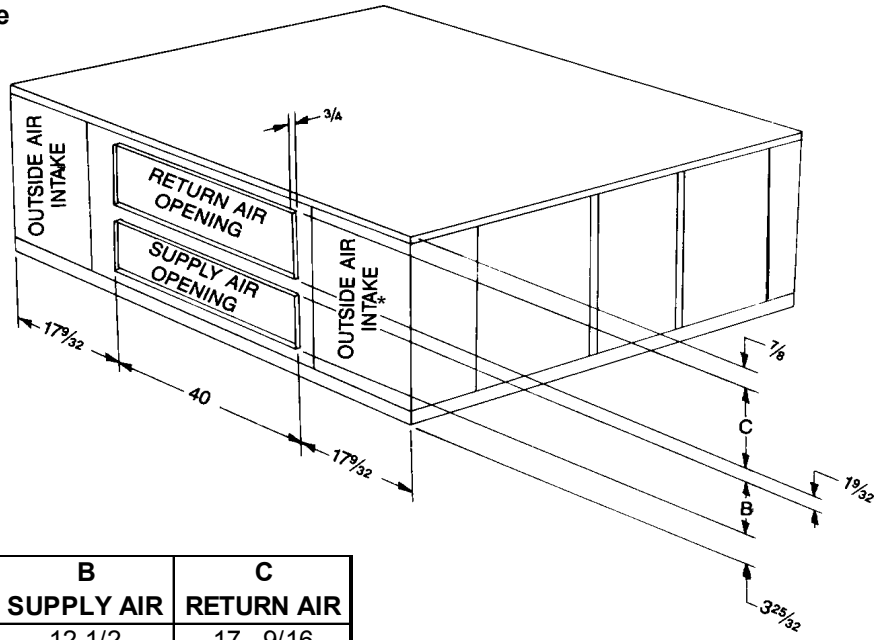
All dimensions in inches; no scale.



Vertical Discharge
(Factory Configuration)



Horizontal Discharge
(With Field Installed Accessory)



MODEL	A HEIGHT	B SUPPLY AIR	C RETURN AIR
090	36	12 1/2	17 9/16
120	52	20 1/4	25 13/16

TABLE 1

and fully trained personnel. System design and installation should, where applicable, follow information presented in accepted industry guides such as the ASHRAE Handbooks. The manufacturer assumes no responsibility for equipment installed in violation of any code or regulation. The mechanical installation of the packaged rooftop units consists of making final connections between the unit and building services; supply and return duct connections; and drain connections (if required). The internal systems of the unit are completely factory installed and tested prior to shipment.

UNIT DESCRIPTION

Rooftop units are shipped fully assembled and factory tested. They are generally installed on a steel roof mounting curb assembly which has been shipped to the job site for installation on the roof structure prior to the arrival of the unit. The model number shown on the unit's identification plate identifies the various components of the unit such as refrigeration tonnage, heating input and voltage as shown Nomenclature.

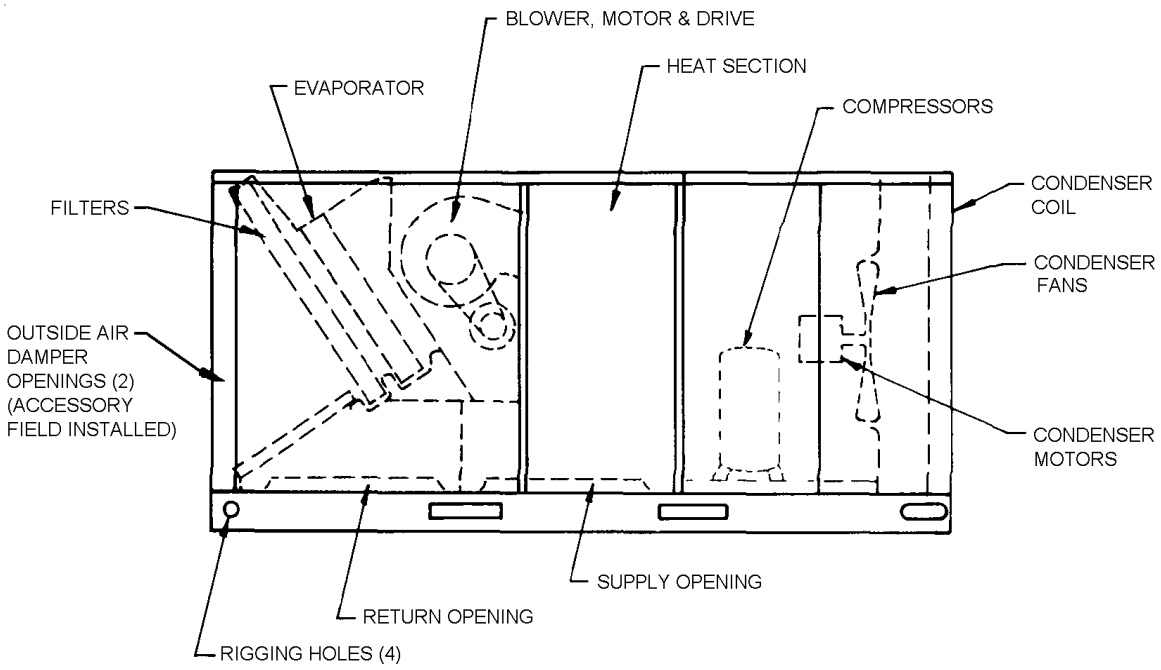
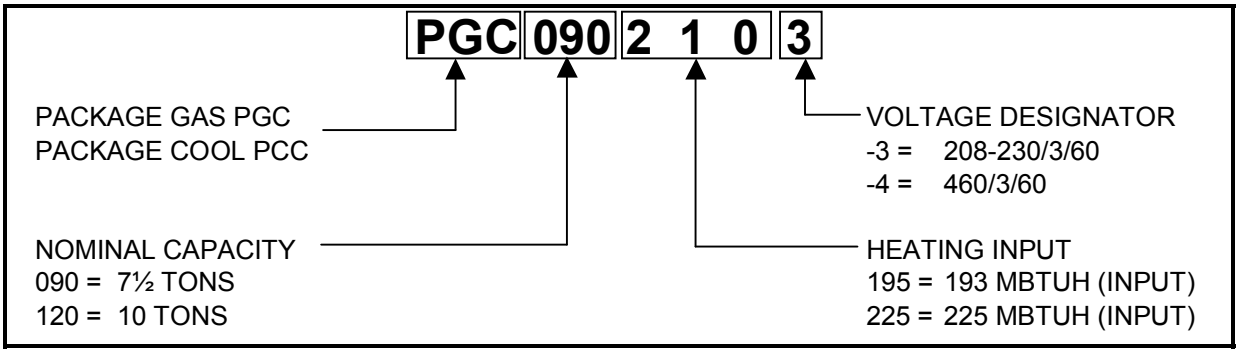


FIGURE 2 - TYPICAL COMPONENT LOCATION



NOMENCLATURE

CLEARANCES

Adequate clearance around the unit should be kept for safety, service, maintenance, and proper unit operation. A total clearance of 75" on the main control panel side of the unit is recommended to facilitate possible fan shaft, coil, electric heat and gas furnace removal. A clearance of 48" is recommended on all other sides of the unit to facilitate possible compressor removal, to allow service access and to insure proper ventilation and condenser airflow. The unit must not be installed beneath any obstruction. The unit should be installed remote from all building exhausts to inhibit ingestion of exhaust air into the unit fresh air intake.

GAS HEAT UNITS

1. As indicated in Figure 3 and on the unit's dataplate, a minimum clearance of 36" to any combustible material is required on the furnance access side of the unit. All combustible materials must be kept out of this area.

2. This 36" clearance must also be maintained to insure proper combustion air and flue gas flow. The combustion air intake and furance flue discharge must not be blocked for any reason, including blockage by snow.

3. Adequate clearances from the furnace flue discharge to any adjacent public walkways, adjacent buildings, building openings or openable windows must be maintained in accordance with the latest edition of the National Fuel Gas Code (ANSI Z223.1)

4. Minimum horizontal clearance of 48" from the furnace flue discharge to any electric meters, gas meters, regulators and relief equipment is required.

   NOTE: Model PGC090 through 120 rooftop units are designed for outdoor installation only. They may be installed over wood flooring or over Class A, B or C roof covering materials.

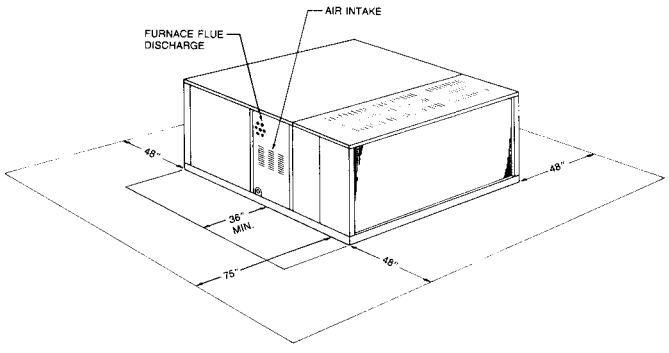


FIGURE 3

ROOF CURB ASSEMBLY & INSTALLATION

GENERAL

1. Roof curbs are shipped unassembled. Field assembly, squaring, leveling and mounting on the roof structure are the responsibility of the installing contractor. All curb installatons must comply with local codes and should be done in accordance with the established guidelines of the National Roofing Contractors Association.

2. All required hardware necessary for the assembly of the sheet metal curb is included in the curb accessory.

3. Full perimeter type curb accessories are available. Cantilever type curbs are not available from factory. Dimensions shown can be used for fabrication in the field. The full perimeter curb (PGC-5) includes a duct connection frame to be assembled with the curb. A separate duct connection frame can be constructed for use with the cantilever curb. The unit can be set on the cantilever curb so that either the condenser end or the two sides overhang the curb.

4. Curbs must be supported on at least two parallel sides by roof members. Roof members must not penetrate supply and return duct opening areas.

5. Curb insulation, cant strip, flashings and general roofing materials are to be furnished by the contractor. Wood nailing strip and curb gasketing is furnished with curb accessory.

6. The unit and curb accessories are designed to allow vertical duct installation before unit placement. Duct installaton after unit placement is not recommended.

ASSEMBLY

⚠ CAUTION

ALL CURBS LOOK SIMILAR. TO AVOID INCORRECT CURB POSITIONING, CHECK JOB PLANS CAREFULLY AND VERIFY MARKINGS ON CURB ASSEMBLY. INSTRUCTIONS MAY VARY IN CURB STYLES AND SUPERSEDES INFORMATION SHOWN.

Cantilever Curb:

1. Position perimeter pieces, items 1 and 2, as shown in Figure 4. Check lengths of all pieces against bill of material to insure proper placement and assembly.

2. Assemble side channels, item 1, to front and back channels, item 2, using bolts washers, lock washers, and nuts, items 3,4,5 and 6. Hand tighten ONLY at this time.

   NOTE: Flanges on item 1 must go outside of item 2 and under wood nailer strip. Curb styles may vary so check curb instructions.

3. Referring to Table2 and Figure 5, the assembled roof mounting curb should now be checked for squareness. The curb assembly must be adjusted until both diagonal measurements, dimension “C”, are equal within a tolerance of 1/8”. All hand tightened fasteners should now be fully secured.

4. Assemble duct connection frame accessory as shown in Figure 6. Fasten pieces together using sheet metal screws provided (3/8” hex head). NOTE: The duct connection frame can be oriented two ways when set into the curb. Frame position must correspond to the intended unit orientation on the curb. The gasket provided with the duct connection accessory should be applied aafter duct installation. Refer to the “Vertical Discharge Duct Connections” section of these instructions.

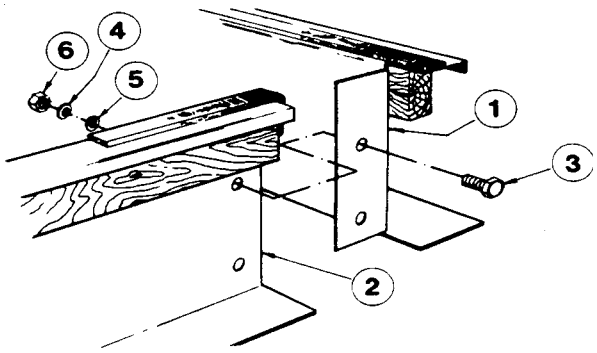


FIGURE 4 - CANTILEVER CURB JOINT

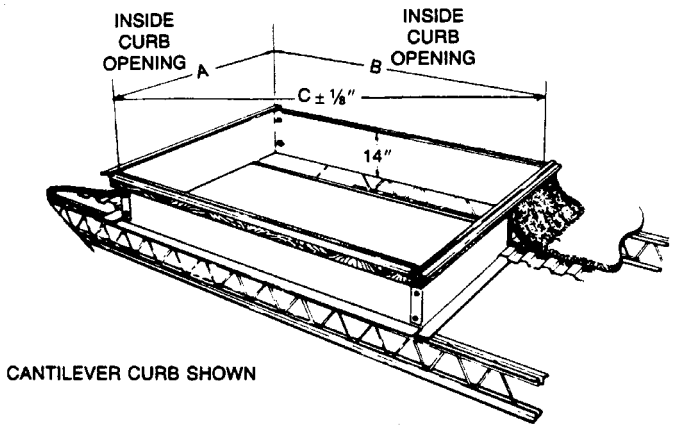
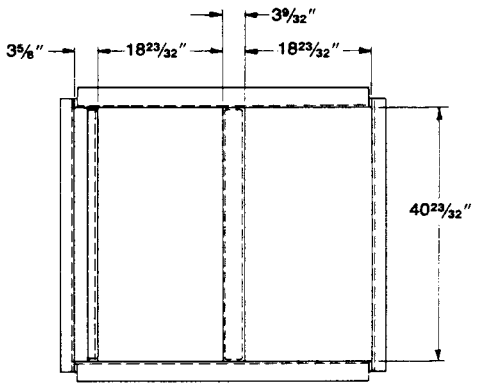


FIGURE 5 - TYPICAL CURB INSTALLATION

CURB TYPE	A	B	C
CANTILEVER	45	63 1/2	77 13/16
FULL PERIMETER	63 9/16	63 9/16	89 7/8

TABLE 2 - CURB DEMENSIONS



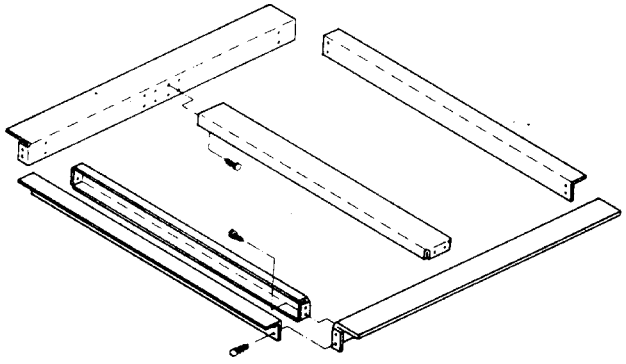


FIGURE 6 - CANTILEVER CURB DUCT CONNECTION ACCESSORY

Full Perimeter Curb:

1. Position perimeter pieces, item A, as shown in Figures 7 and 8. All perimeter pieces are identical.

2. The duct connection frame, items B and C, should be assembled with the curb as shown in Figures7 and 8.

   NOTE: The top of the duct connection frame must be flush with the top of the curb as shown in Figure 8.

3. Fasten pieces together using the sheet metal screws, item D, that are provided. Use three screws at each corner of the curb frame, item A when positioned, and two screws at each joint of the duct connection members, items B and C.

4. The assembled roof mounting curb should now be checked for squareness. Referring to Table 2 and Figure 5, the curb assembly must be adjusted until both diagonal measurements, dimension “C”, are equal within a tolerance of 1/8”.

5. Gasket material sufficient to seal the curb perimeter and the duct connection frame in included and attached to a duct connection member.

   NOTE: Gasket material should not be applied to the curb perimeter and the duct connection frame until the ducts are placed in the frame. Refer to the “Vertical Discharge Duct Connections” section of these instructions.

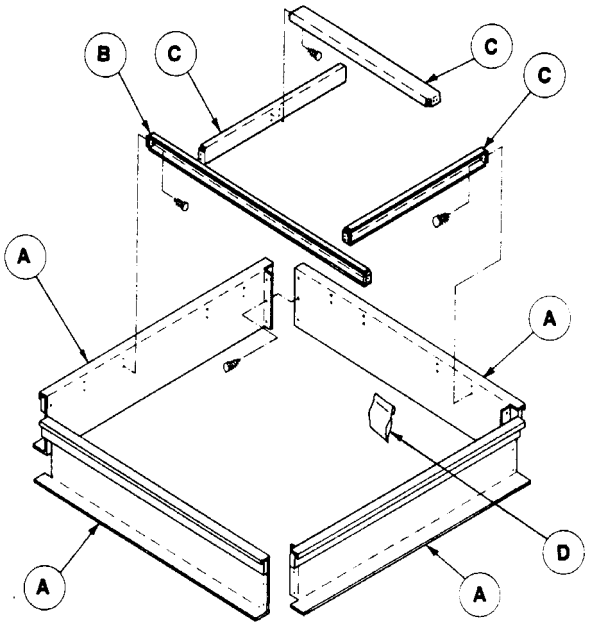


FIGURE 7 - FULL PERIMETER CURB

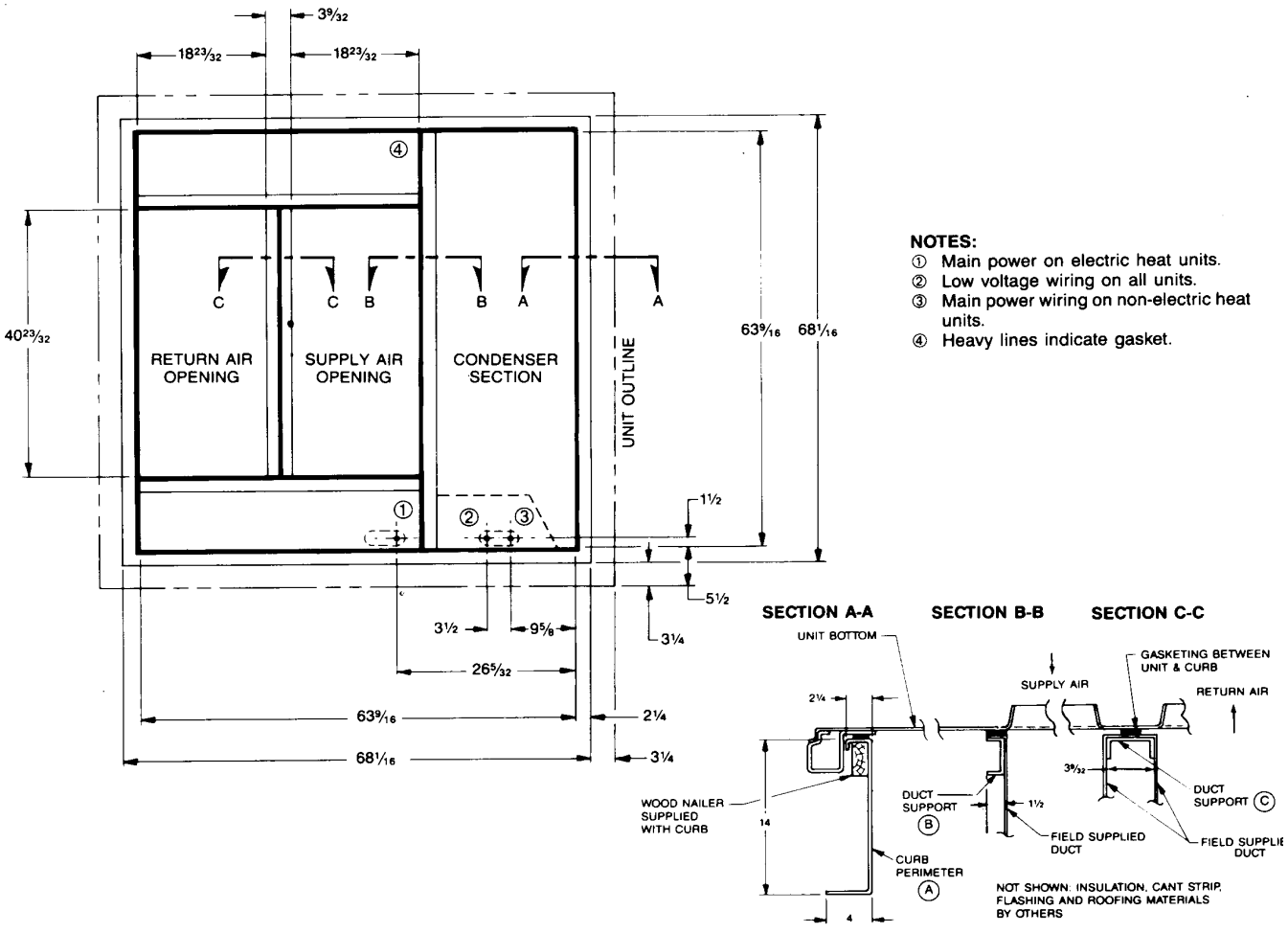


FIGURE 8 - FULL PERIMETER CURB

INSTALLATION

1. Place assembled curb in proper location over roof opening. Check for squareness and adjust if required.
2. Curb installation must be level. One method to achieve a level installation is to stretch two diagonal lines across curb and equip them with line levels. There must not be more than 1/8" spacing between the two lines at the point of intersection. Should the lines touch at the intersection, recheck by placing the bottom line on top. Shim curb as required to bring it within the specified tolerance.
3. Attach the squared and leveled curb to the roof structure following the industry accepted practice.
4. Install insulation, cant strip, roofing materials, flashing, and counterflashing in accordance with the established guidelines of the National Roofing Contractors Association. The finished roof, including counterflashing around the curb, must be installed prior to setting the unit on the curb.

VERTICAL DISCHARGE DUCT CONNECTIONS

The unit curb accessories have been designed to allow duct installation before unit placement. Duct installation after unit placement is possible, but not recommended. Ducts must never be fastened to the bottom of the unit causing the the base pan to be penetrated. Flexible duct connectors in the ducts near the unit are recommended. Support all ducts by securing them to the building structure. Weatherproof all external ductwork, joints and roof openings with flashing and mastic in accordance with applicable codes. Ducts in an unconditioned space must be insulated and covered with a vapor barrier.

DUCT INSTALLATION BEFORE UNIT PLACEMENT

Ductwork may be installed prior to unit placement by using a duct connection frame. Two duct connections frame systems fit into the three possible curb configurations as shown in Figures 8, 9 and 10. The frame to be used with full perimeter curbs is included with the curbs. It must be assembled and attached to the curb as shown in Figures 7 and 8. The frame to be used with either configuration of the cantilever curb should be fabricated by installing contractor. It must be assembled as shown in Figure 6 and then set into the curb as shown in Figures 9 and 10. Fastening the frame to the curb is not necessary.

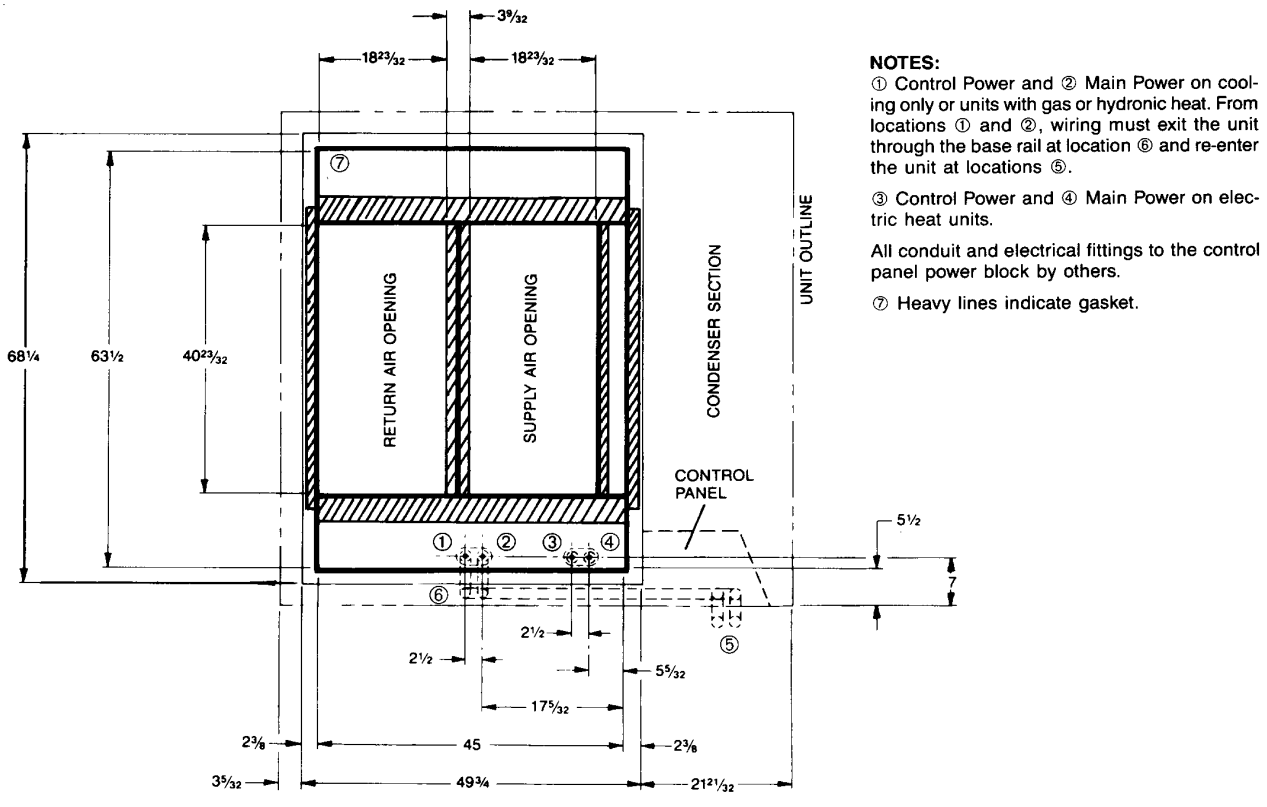
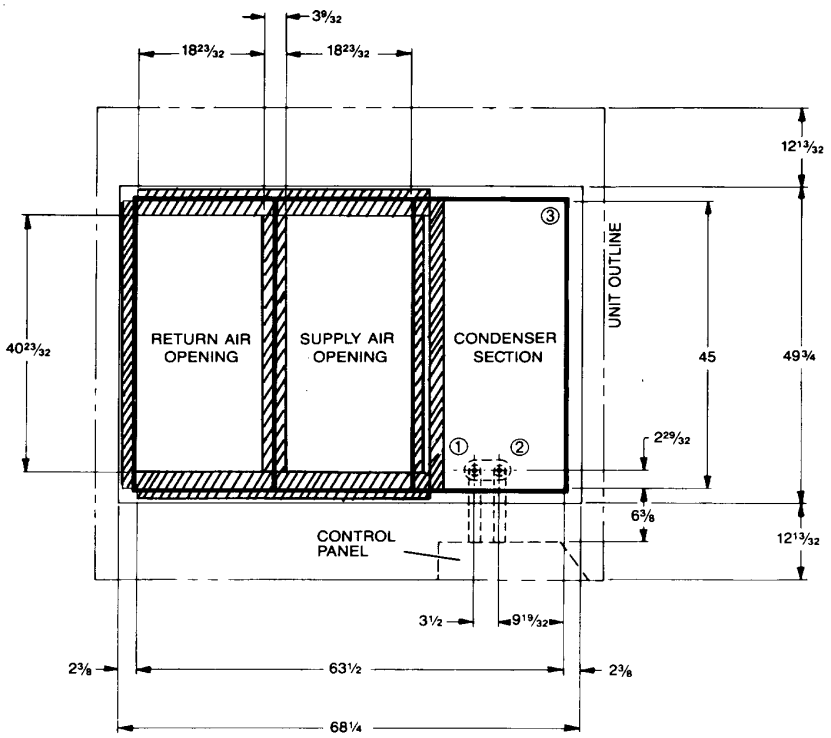


FIGURE 9 - CANTILEVER CURB AND DUCT CONNECTION FRAME KIT (CONDENSER SECTION OVERHANG)



NOTES:
① Low voltage wiring on non-hydronic units.
② Main power wiring on cooling only and gas heat units.
③ Heavy lines indicate gasket.

FIGURE 10 - CANTILEVER CURB AND DUCT CONNECTION FRAME KIT (SIDE OVERHANG)

DUCT INSTALLATION

After the duct connection system has been assembled and installed, the ductwork may be set in place. To make the connection, prepare the duct with a 1½ flange as shown in Figures 11 and 12. Afterwards, place the section into position on the connection frame. Riveting or bolting is not necessary and is not recommended. Both duct connection systems include gasketing, which must be applied to the connection frame and duct flanges after duct installation. Gasket must be installed over the duct flanges so that an airtight seal is made between the unit and the ductwork after the unit is placed on the curb.

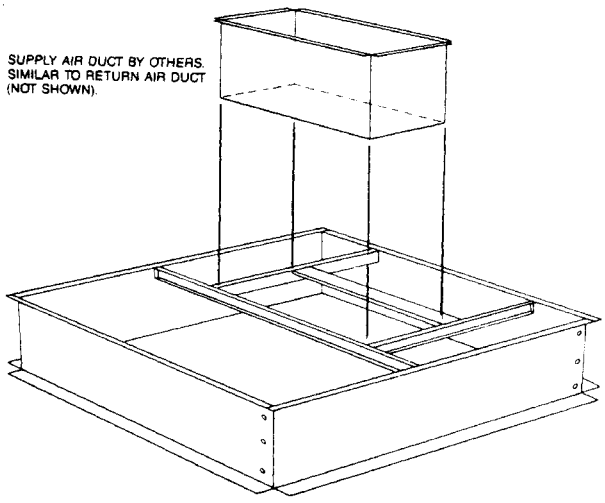
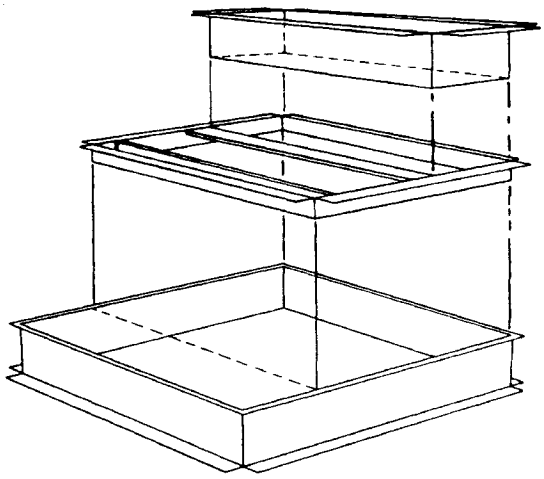


FIGURE 11 - DUCT PLACEMENT (FULL PERIMETER CURB)



SIDE OVERHANG POSITION SHOWN

FIGURE 12 - DUCT PLACEMENT (CANTILEVER CURB)

Full Perimeter Curb

All gasketing must be field installed on the full perimeter curbs as shown in Figure 8. After duct sections have been installed, gasketing supplied with the curb accessory should be applied over the duct flanges, exposed connection frame and curb perimeter.

Cantilever Curb

All gasketing must be field installed on the perimeter of the curb. After duct connection frame and duct sections have been set on the curb, gasketing supplied by field should be applied over duct flanges and exposed frame as shown in Figures 9 and 10.

DUCT INSTALLATION AFTER UNIT PLACEMENT

Duct installation after the unit has been placed is not recommended. If ductwork must be installed after the unit is placed on the curb, one of the duct connection frame systems should still be used. Apply gasketing to the curb and duct connection frames before unit placement as shown in Figures 8, 9, and 10. The duct sections should be fastened to the vertical flanges of the connection frame and curb and sealed as required. Ducts must never be fastened to the bottom of the unit causing the the base pan to be penetrated.

HANDLING AND RIGGING

GENERAL

To assist in determining rigging requirements, unit weights are shown as follows:

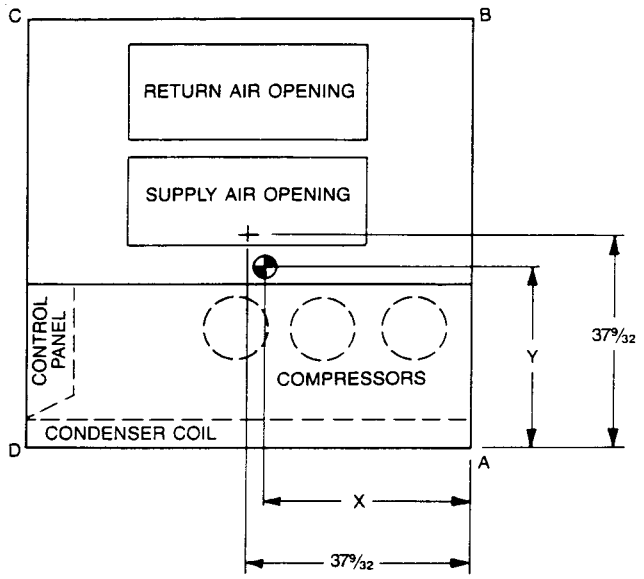


FIGURE 13 - CORNER & CENTER OF GRAVITY LOCATIONS

DATA	PGC (PCC)	
	090	120
Corner Weight - A1	304	367
Corner Weight - B1	245	318
Corner Weight - C1	196	267
Corner Weight - D1	235	318
Center of Gravity - X (in.) 5.	33.5	34.2
Center of Gravity - Y (in.) 5.	34.5	34.5
Unit Shipping Weight 1.	1000	1290
Unit Operating Weight 1.	980	1270
Coil Guards 2.	30	40
Motorized O.A. Actuator 3.	5	5
Economizer 3.	28	39
Gas Heat - Model 195 4.	110	120
Gas Heat - Model 222 4.	120	130
Electric Heater 4.	85	100
Full Perimeter Curb 4.	120	120
Cantilever Curb	112	112
Cantilever Curb Duct Support	27	27

TABLE 3 - UNIT AND COMPONENT WEIGHTS (LBS.) AND CENTER OF GRAVITY (INCHES)

NOTES:

1. Weights are for basic cooling only unit; no options.
2. Add 50% of weight listed to corners A and D.
3. Add 50% of weight listed to corners B and C.
4. Add 25% of weight listed to each corner.
5. Center of gravity's weight are for cooling only units without options

Provisions for forks have been included in the unit base frame on three sides. If unit is moved by forklift, no other fork locations are approved.

⚠ CAUTION

IF UNITS ARE TO BE LIFTED TWO AT A TIME, THE FORK HOLES ON THE CONDENSER END OF THE UNIT MUST NOT BE USED. MINIMUM FORK LENGTH IS 42" TO PREVENT DAMAGE TO THE UNIT; HOWEVER, 48" IS RECOMMENDED.

Do not stand or walk on the unit. Do not drill holes anywhere in panels or in the base frame of the unit. Unit access panels provide structural support. Do not remove any access panels until unit has been installed on roof curb or field supplied structure. Do not roll unit across finished roof without prior approval of owner or achitect. Do not skid or slide on any surface as this may damage unit base. The unit must be stored on a flat, level surface. Protect the condenser coil because it is easily damaged.

RIGGING DETAILS

1. Unit must be lifted by the four lifting holes located at the base frame corners.
2. Lifting cables should be attached to the unit with shackles as shown in Figure 14.
3. The distance between the crane hook and the top of the unit must not be less than 60".
4. Two spreader bars must span over the unit to prevent damage to the cabinet by the lift cables. Spreader bars must be of sufficient length so that cables do not come in contact with the unit during transport. Remove wood struts mounted beneath unit base frame before setting unit on roof curb. These struts are intended to protect unit base frame from forklift damage. Removal is accomplished by extracting the sheet metal retainers and pulling the struts through the base of the unit. Refer to rigging label on the unit.

⚠ CAUTION

DO NOT FORK LIFT UNIT AFTER WOOD STRUTS HAVE BEEN REMOVED; SEVERE DAMAGE WILL OCCUR TO THE BOTTOM OF THE UNIT.

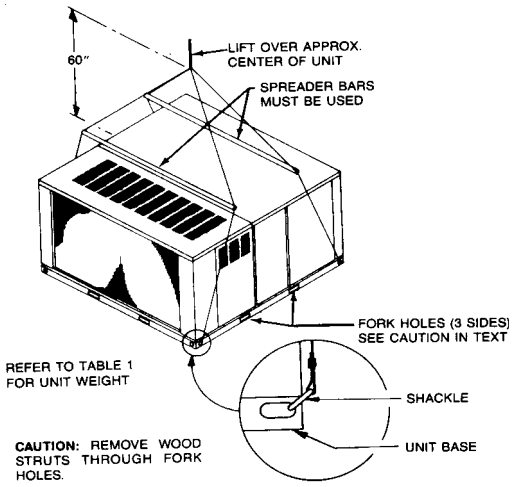


FIGURE 14 - RIGGING

RIGGING REMOVAL

Remove spreader bars, lifting cables and other rigging equipment.

UNIT INSTALLATION ON ROOF CURB

LOCATION

Units may look identical, but they can have significant internal differences. Check specific unit location carefully, referring to plans if necessary, prior to setting the unit.

CURB INSTALLATION

Proper unit installation requires that the roof curb be firmly and permanently attached to the roof structure. Check for adequate fastening method prior to setting the unit on the curb. Ensure that the top of the duct connection frame is flush with the top of the roof curb. Refer to the "Roof Curb Assembly & Installation" section of this manual. Check the top of the curb, duct connection frame and duct flanges to make sure gasket has been applied properly. Gasket should be firmly applied to the top of the curb perimeter, duct flanges and any exposed duct connection frame. If gasket is loose, re-apply using strong weather resistant adhesive.

PROTRUSION

Inspect curb to ensure that none of the utility services (electric) routed through the curb protrude above the curb.

CAUTION

DO NOT ATTEMPT TO SET UNIT ON THE CURB IF PROTRUSIONS EXIST.

UNIT INSTALLATION

Carefully lower the unit on the roof curb. While rigging unit, center of gravity may cause condenser end to be slightly lower than supply/return air end. Bring condenser end of unit into alignment with the curb. With condenser end of the unit resting on curb member and using curb as a fulcrum, lower opposite end of the unit until entire unit is seated on the curb. When a rectangular cantilever curb is used, care should be taken to center the unit. Check for proper alignment and orientation of supply and return openings with duct. Refer to the "Roof Curb Assembly & Installation" section of this manual.

CAUTION

DO NOT ALLOW CRANE HOOKS AND SPREADER BARS TO REST ON ON THE ROOF OF THE UNIT.

HORIZONTAL DISCHARGE DUCT CONNECTIONS

A 3/4" flange is provded for making duct connections on units with the optional field installed horizontal discharge kit. Refer to Figure 15. Units not equipped with an economizer may be converted from vertical to horizontal discharge in the field by using accessory number PGHDK 120/180-5A (PGC(PCC)120 or PGHDK 090/102-5A(PGC(PCC)090. The kits include parts for conversion to horizontal duct installation. The kit provides 3/4" duct flanges with the dimensions shown in Figure 15 and in the Horizontal Duct Connections Dimensions Table.

Flexible duct connectors between the unit and ducts are recommended. Insulate and weatherproof all external ductwork and joints as required and in accordance with local codes.

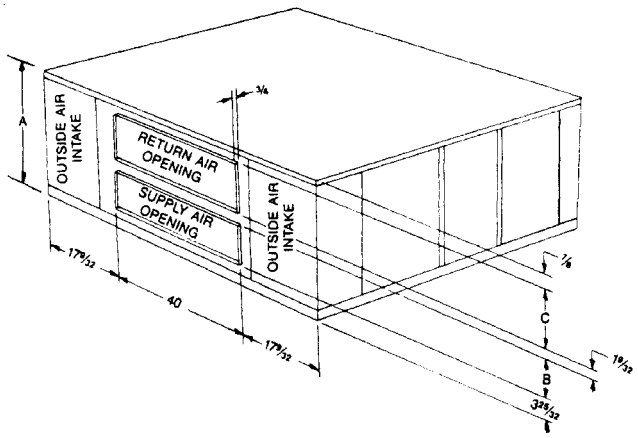


FIGURE 15
HORIZONTAL DISCHARGE DUCT CONNECTIONS

UNIT SIZE PGC (PCC)	A HEIGHT	B SUPPLY AIR	C RETURN AIR
090	36	12 1/2	17 9/16
120	52	20 1/4	25 13/16

TABLE4
HORIZONTAL DUCT CONNECTIONS DIMENSIONS

ACCESSORY OUTSIDE AIR OPTIONS - FIELD INSTALLED

If fresh air is required for the installation, three alternatives are available.

Manual Fresh Air Damper-A manual fresh air damper (PGMD-5) is available from the factory for 0% to 25% outside air. Two may used in the locations shown in Figure 2 for maximum 50% outside fresh air.

Motorized Fresh Air Damper-A motorized fresh air damper (PGMDM-5) is available also and is mounted in the same locations shown in Figure 2.

Economizer-(PGED 090/102-5 & PGED 120/.180-5) A full modulation enthalpy controlled economizer is available from the factory for field installation. It is mounted between fresh air damper blockoff locations. See accessory instructions for installation.

ELECTRICAL INSTALLATION

WARNING

DO NOT TAMPER WITH FACTORY WIRING. THE INTERNAL POWER AND CONTROL WIRING OF THESE UNITS IS FACTORY INSTALLED AND EACH UNIT IS THOROUGHLY TESTED PRIOR TO SHIPMENT. CONTACT THE FACTORY OR YOUR LOCAL REPRESENTATIVE IF ASSISTANCE IS REQUIRED.

INSTRUCTIONS

1. The main power supply wiring to the unit and low voltage wiring to accessory controls must be done in accordance with these instructions, the latest edition of the National Electriacl Code (ANSI/NFPA 70), and all local codes and ordinances. All field wiring shall conform with the temperature limitations for Type T wire (63°F/35°C rise).
2. Main power and low voltage wiring may enter the unit through the side or, with some models and curb configurations through the roof curb and base frame. Refer to Figures 16 and 17 for external electrical entrance locations. Refer to Table 5 and Figures 8, 9, 10 and 18 for the through-the-curb electrical entrance locations. Install conduit connectors at the desired entrance locations. External connectors must be weatherproof. All holes in the unit base must be sealed,including around conduit nuts, to prevent water leakage into building. All required conduit and fittings must be supplied by others.
3. It is recommeded that an independant 115V power source be brought to the vicinity of the rooftop unit for portable lights and tools used by the service mechanic.

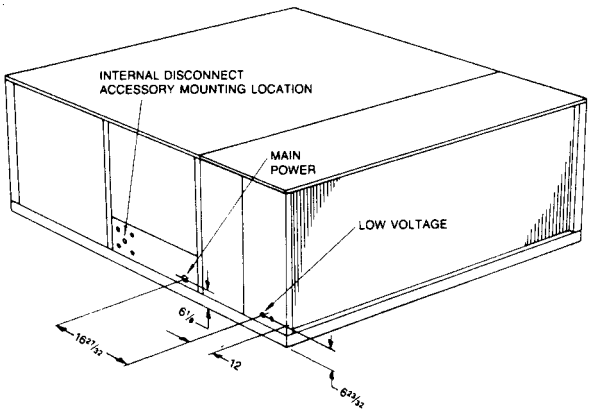


FIGURE 16 - EXTERNAL ELECTRICAL ENTRANCE LOCATIONS (ELECTRIC HEAT UNITS)

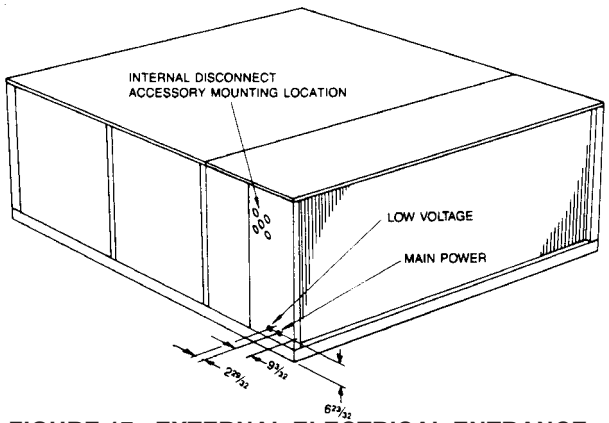


FIGURE 17 - EXTERNAL ELECTRICAL ENTRANCE LOCATIONS (NON-ELECTRIC HEAT UNITS)

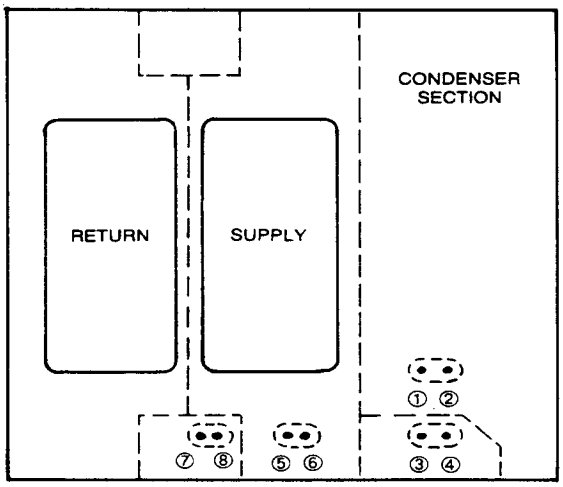


FIGURE 18 - THROUGH THE CURB ELECTRICAL ENTRANCE LOCATIONS

MODEL TYPE	CURB CONFIGURATION					
	FULL PERIMETER		CONDENSER OVERHANG		SIDE OVERHANG	
	POWER	LOW VOLTAGE	POWER	LOW VOLTAGE	POWER	LOW VOLTAGE
COOLING ONLY	4	3	8	7	2	1
GAS HEAT	4	3	8	7	2	1
ELECTRIC HEAT	6	3	5,6	7	N/A	1

TABLE 5 - THROUGH-THE-CURB ELECTRICAL ENTRANCE LOCATIONS

ELECTRICAL ENTRANCE LOCATIONS

1. Protect wiring from sharp edges. Follow National Electrical Code and all local codes and ordinances. Do not route wires through removable access panels.
2. Locations 7 and 8 require wiring to exit unit through the base rail and then re-enter unit at the external electrical entrance locations shown in Figures 9, 16, and 17.
3. Locations 1 and 2 require wiring to be routed through the back of the main control box. Refer to Figure 10.

CAUTION

CONDUIT AND FITTINGS MUST BE WEATHER TIGHT TO PREVENT WATER ENTRY INTO THE BUILDING.

4. Knockouts are provided at locations 3,4,5 and 6.
5. If an external field supplied disconnect is used, the power wiring will route as follows:
   a. Power entry location other than location 8. Exit unit via side location shown in Figures 16 and 17. Enter disconnect box. Connect to the disconnect and leave the disconnect box. Enter the unit again at the side location shown in Figures 16 and 17.
   b. Power entry at location 8: Exit the unit via base rail as shown in Figure 9. Enter the disconnect box, connect to the disconnect and then leave the disconnect box. Enter the unit again at the side location shown in Figure 17.

It may be easier to penetrate the roof outside the curb rather than use Locations 7 and 8.

MAIN POWER WIRING

1. The main power supply for the PGC(PCC) 090 through 120 rooftops units shall be three phase, three wire. The unit is factory wired for the voltage shown on the unit's dataplate.

   NOTE: If supply voltage is 208V, lead on primary of transformer TRANS1 must be moved from the 230V to the 208V tap.
2. Main power wiring should be sized for the minimum wire ampacity shown on the unit's database. Size wires in accordance with the ampacity tables in Artical 310 of the National Electrical Code. If long wires are required, it may be necessary to increase the wire size to prevent excessive voltage drop. Wires should be sized for a maximum of 3% voltage drop.

CAUTION

USE COPPER CONDUCTORS ONLY

3. A weather tight disconnect switch, properly sized for the unit total load, must be field installed. A non-fused internal disconnect can be used which fits into the unit at the locations shown in Figures 16 and 17. Knockouts for mounting disconnect are provided in the exterior panels. An external, field supplied disconnect may be mounted on the same fixed exterior panel shown in Figures 16 and 17.

   NOTE: Do not cover dataplate with field supplied disconnect switch.
4. Some disconnect switches are not fused. The power leads must be protected at the point of distribution in accordance with the unit's dataplate.
5. The unit must be electrically grounded in accordance with local codes or, in the absence of local codes, with the latest edition of the National Electrical Code (ANSII-NFPA 70). A ground lug is provided for this purpose. Size grounding conductor in accordance with Table 250-95 of the National Electrical Code. Do not use the ground lug for connecting a neutral conductor.
6. Power wiring should be connected to the main power terminal block. This terminal block is located within the main control box on units without electric heat (PB1) and within the electrical heat control box on units with electric heat (PB3).
7. Supply voltage to rooftop unit must not vary by more than 10% of the value indicated on the unit's dataplate. Phase voltage unbalance must not exceed 2%. Contact local power company for correction of improper voltage or phase unbalance.

WARNING

FAILURE OF UNIT DUE TO OPERATION ON IMPROPER LINE VOLTAGE OR WITH EXCESSIVE PHASE UNBALANCE CONSTITUTES PRODUCT ABUSE VOIDING OUR WARRANTY AND MAY CAUSE SEVERE DAMAGE TO THE UNIT'S ELECTRICAL COMPONENTS.

LOW VOLTAGE CONTROL WIRING

1. A 24 thermostat must be field installed. It may be purchased with the unit or field supplied. All cooling and heating systems available in Models PGC(PCC) 090 through 120 are 2-stage. Thermostats may be programmable or electromechanical as required.
2. Locate thermostat or remote sensor in the conditioned space where it will sense average temperature. Do not locate the device where it may be directly exposed to supply air, sunlight or other sources of heat. Follow installation instructions packaged with the thermostat.
3. Use #18 AWG wire for 24V control wiring runs not exceeding 75 feet. Use #16 AWG wire for 24V control wiring runs not exceeding 125 feet. Use #14 AWG wire for 24V control wiring runs not exceeding 200 feet. Low voltage wiring may be National Electrical Code (NEC) Class 2 where permitted by local codes.
4. Route thermostat wires from sub-base terminals to the unit. Control wiring should enter through the unit base frame as shown in Figure 18 or through the fixed side panel as shown in Figures 16 and 17. Connect thermostat and any accessory wiring to low voltage terminal block TB1 in the main control box as shown in Figures 19.

   NOTE: Field supplied conduit may need to be installed depending on unit/curb configuration.

   NOTE: Use 18 gauge solid conductor wire whenever connecting thermostat wires to terminals on sub-base. DO NOT use larger than 18 gauge wire. A transition to 18-gauge wire may be required before entering thermostat sub-base.

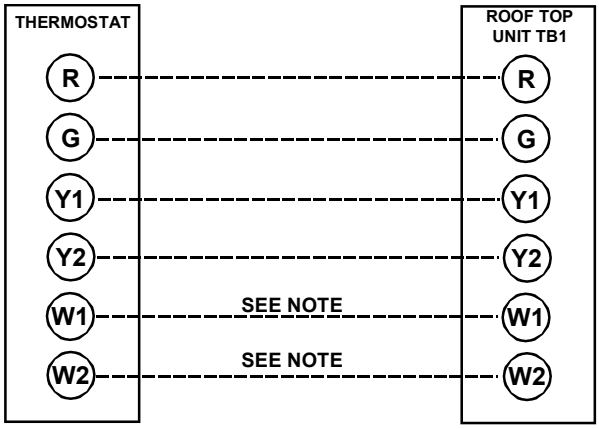


FIGURE 19 - PGC (PCC) 090 THROUGH 120 (COOLING ONLY, GAS HEAT ELECTRIC HEAT)

NOTE: Connections between unit terminals "W1" and "W2" and the corresponding thermostat terminals "W1", and "W2" are not required on cooling only units.

GAS SUPPLY PIPING

WARNING

IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE PERSONAL INJURY OR PROPERTY DAMAGE. REFER TO THE USER'S INFORMATION MANUAL PROVIDED WITH THIS FURNACE. FOR ASSISTANCE OR ADDITIONAL INFORMATION, CONSULT A QUALIFIED INSTALLER, SERVICE AGENCY OR THE GAS SUPPLIER.

LOCATION AND INSTALLATION

1. The gas supply piping location and installation on the rooftop unit must be in accordance with local codes or, in the absence of locals codes, with ordinances of the latest edition of the National Fuel Gas Code (ANSI Z223.1). A manual gas shutoff valve must be field installed external to the rooftop unit. In addition, a drip leg must be installed near the inlet connection. A ground joint union connection is required between the external shutoff valve and the unit connection to the gas valve to permit removal of the burner assembly for servicing. Union should be located near gas valveas shown in Figure 20. Route gas piping to unit so that it does not interfere with the removal of access panels. Piping must be supported and aligned to prevent strains or misalignment of the manifold assembly. Refer to Figure 20.
2. All units are furnished with standard female NPT pipe connections. Connection pipe sizes for PGC090 through 120 units is 3/4" NPT on 195 and 225 MBH furnaces. The size of the gas supply piping to the unit must be based on length of run, number of units on the system, gas characteristics, BTU requirement and available supply pressure. All piping must be done in accordance with local codes or, in the absence of local codes, with the latest edition of the National Fuel Gas Code (ANSI Z223.1).

   NOTE: The gas connection size at the unit does NOT establish the size of the supply line.
3. These units are designed for either natural or LP gas and are specifically constructed at the factory for only one of these fuels. The fuels are NOT interchangeable. However, the furnace can be converted in the field from natural gas to LP gas with the appropriate factory kit (LPW-06). Only a qualified contractor, experienced with natural and propane gas systems, should attempt conversion. Kit instructions must be followed closely to assure safe and reliable unit operation.
4. With all units on a common line operating under full fire, natural gas main supply pressure should be adjusted to approximately 7.0" W.C., measured at the unit gas valve. If the gas pressure at the unit is greater than 10.5" W.C., the contractor must furnish and install an external type positive shutoff service pressure regulator. The unit will not function satisfactorily if supply gas pressure is less than 5.5" W.C. or greater than 10.5" W.C.

   NOTE: A minimum horizontal distance of 48" between the regulator and the furnace flue discharge is required.
5. With all units on a common line operating under full LP gas main supply pressure should be at least 11.0", W.C. and must be no greater than 13.0"W.C., measured at the unit gas valve. Unit will not function satisfactorily if supply gas pressure is less than 11.0" W.C. or greater than 13.0" W.C.
6. All pipe connections should be sealed with a pipe thread compound, which is resistant to the fuel used with the furnace. A soapy water solution should be used to check all joints for leaks. A 1/8" NPT plugged tap is located on the entering side of the gas valve for test gauge connection to measure supply (main) gas pressure. Another 1/8" tap is provided on the side of the manifold for checking manifold pressure.

CAUTION

THE FURNACE AND ITS INDIVIDUAL SHUTOFF VALVE MUST BE DISCONNECTED FROM THE GAS SUPPLY SYSTEM DURING ANY PRESSURE TESTING OF THAT SYSTEM AT TEST PRESSURES IN EXCESS OF 1/2 PSIG (13.8" W.C.)

CAUTION

THE FURNACE MUST BE ISOLATED FROM THE GAS SUPPLY PIPING SYSTEM BY CLOSING ITS INDIVIDUAL MANUAL SHUTOFF VALVE DURING ANY PRESSURE TESTING EQUAL TO OR LESS THAN 1/2 PSIG.

7. There must be no obstruction to prevent the flow of combustion and ventilating air. A vent stack is not required and must never be used. The power ventor will supply an adequate amount of combustion air as long as the air passageways are kept free of any obstructions and the recommended external unit clearances are maintained. (The wind shield must be in place during furnace operation. See section on wind shield installation).

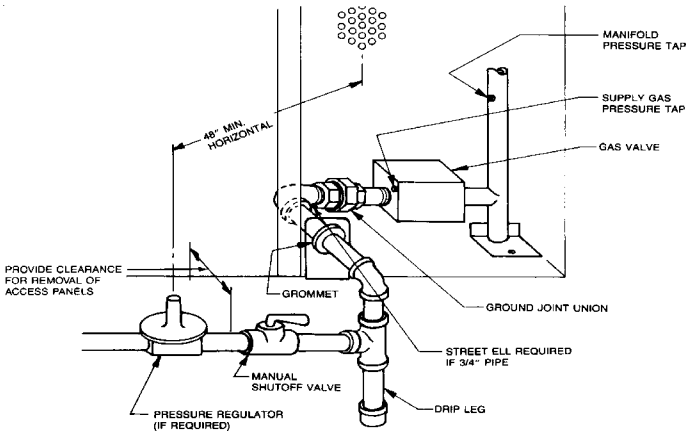


FIGURE 20 - GAS SUPPLY PIPING

CONDENSATE DRAIN CONNECTION

1. All units are equipped with a flexible tube condensate trap which may be connected to either side of the drain pan as shown in Figure 21.

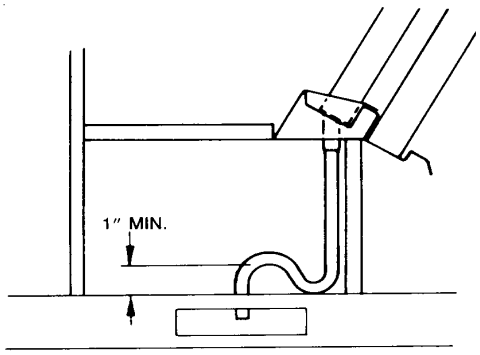


FIGURE 21 - INTERNAL CONDENSATE DRAIN ROUTING

CAUTION

THE END OF THE TUBE MUST BE ROUTED THROUGH THE INSULATION AND TOP OF BASE RAIL SO THAT THE CONDENSATE HAS FREE ACCESS TO THE ROOF OR EXTERNAL DRAINAGE SYSTEM. KNOCKOUTS ARE PROVIDED IN THE BASE RAILS. THE UNUSED HOLE ON THE OPPOSITE SIDE OF THE DRAIN PAN MUST BE BLOCKED WITH THE PLUG PROVIDED.

2. Drainage of condensate directly onto the roof may be acceptable; refer to local code. It is recommended that a small drip pad of either stone, mortar, wood or metal be provided to prevent any possible damage to the roof.
3. If condensate is to be piped into the building drainage system, the drain line must penetrate the roof external to the unit. Refer to local codes for additional requirements. The flexible tube condensate trap may be connected to an external drain line with a hose clamp.
4. Due to the fact that drain pans in any air conditioning unit will have some moisture in them, algae and fungus will grow due to airborne bacteria and spores. Periodic cleaning is necessary to prevent this build-up from plugging the drain and causing the drain pan to overflow.

EXTERIOR WIND SHIELD INSTALLATION

Details of exterior wind shield installation are as follows:

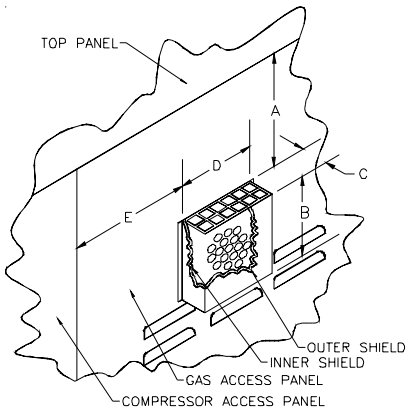


FIGURE 22 - EXTERIOR WIND SHIELD

MODEL	A	B	C	D	E
090,120	1 1/2"	11"	3 1/2"	8 1/4"	2 1/8"

TABLE 6 EXTERIOR WIND SHIELD DIMENSIONS

CHECK, TEST & START PROCEDURES

WARNING

ELECTRIC SHOCK HAZARD COULD CAUSE SEVERE INJURY OR DEATH. FAILURE TO BOND THE FRAME OF THIS EQUIPMENT TO THE BUILDING ELECTRICAL GROUND BY USE OF THE GROUNDING TERMINAL PROVIDED OR OTHER ACCEPTABLE MEANS MAY RESULT IN ELECTRICAL SHOCK. DISCONNECT THE ELECTRIC POWER BEFORE SERVICING EQUIPMENT. SERVICE TO BE PERFORMED ONLY BY QUALIFIED PERSONNEL.

BEFORE STARTUP

WARNING

MOVING MACHINERY HAZARD - DISCONNECT POWER TO THE UNIT AND PADLOCK IN THE "OFF" POSITION BEFORE SERVICING THE FANS.

This procedure has been prepared as a guide for the proper Check, Test & Start of the rooftop unit. The Check, Test & Start procedure provides a step-by-step sequence which, if followed, will assure the proper startup of the equipment in the minimum amount of time. Air balancing of duct system is not considered part of the Check, Test & Start of the roof-top unit. However, it is an important phase of any air conditioning system startup and should be performed upon completion of the Check, Test & Start procedure. The Check, Test & Start procedure at outside ambients below 55°F should be limited to a readiness check of the refrigeration system with the required final check and calibration left to be completed when the outside ambient rises above 55°F.

TOOLS REQUIRED TO PERFORM CHECK, TEST & START

1. Refrigeration gauge and manifold.
2. Voltmeter.
3. Clamp-on ammeter.
4. Ohmmeter.
5. Test lead. Minimum #16 AWG with insulated alligator clips.
6. Manometer for verifying gas pressure 0 to 20" W.C.
7. Air temperature measuring device.
8. General refrigeration mechanics' tools.

TEMPORARY HEATING OR COOLING

If it is planned that the unit will be used for temporary heating or cooling, Check, Test & Start must first be performed in accordance with this bulletin. Failure to comply with this requirement will void the warranty. New filters should be installed after the machines are used for temporary heating or cooling and the coils, fans, and motors checked for unacceptable levels of construction dust and dirt.

CONTRACTOR RESPONSIBILITY

The installing contractor must be certain that:

- All supply and return air ductwork is in place and corresponds with installation instructions.
- All thermostats are mounted and wired in accordance with installation instructions.
- All electric power, all gas, hot water or steam line connections, and the condensate drain installation have been made to each unit on the job. These main supply lines must be functional and capable of operating all units simultaneously.

PRELIMINARY IN BUILDING

Prior to the beginning of Check, Test & Start procedures on the roof, the following steps should be completed in the building.

CAUTION

WITH THE DISCONNECT ON AND THE THERMOSTAT NOT SATISFIED, THE MACHINE WILL RUN. DO NOT START THE MACHINE UNTIL ALL THE NECESSARY PRECHECKS AND TESTS HAVE BEEN PERFORMED.

1. THERMOSTAT. Set the thermostat in the conditioned space at a point at least 10°F below zone temperature. On cooling only models, set the thermostat system switch on COOL and the fan switch on AUTO. On heating/cooling models, set the thermostat system switch on AUTO and the fan switch on AUTO.
2. NIGHT SETBACK THERMOSTAT (OPTIONAL). Set thermostat at a point at least 10°F below zone temperature.

CHECK OF ROOF CURB INSTALLATION

The proper installation of the unit on the roof curb should be checked. Any deficiencies observed should be noted in a separate report and forwarded to the contractor. The unit and curb assembly should have been installed level. The flashing of the roof mounting curb to the roof should be checked, especially at the corners, for good workmanship.

CHECK FOR MINIMUM CLEARANCES

A minimum of 36" clearance must be provided on the main control box side of the unit. A minimum of 48" clearance is recommended on all other sides. A clearance of 75" is desirable on the control box side for removal of the fan shaft or heating section. The outside air intake must be remote from all building exhausts. The condenser air intake (if used) must be remote from all exhausts to assure full condenser capacity.

CHECK AND REPORT DAMAGE

Damaged or missing parts, if any, should be itemized in a separate report stating what action has been initiated by the contractor to correct them. The absence of this information will be the basis for assuming that the unit was complete and in good condition on date of Check, Test & Start.

CHECK FOR OBSTRUCTIONS, FAN CLEARANCE AND WIRING

During the performance of the Check, Test & Start procedure you will have occasion to work in the various sections of the unit. It is important that you remove extraneous construction and shipping materials that may be found during this procedure. All fans should be rotated manually to check for proper clearances and make certain that they rotate freely. Bolts and screws that may have jarred loose during shipment to the jobsite should be checked for tightness. All electrical connections should be re-tightened.

PRE-STARTUP PRECAUTIONS

It is important to your safety that the unit has been properly grounded during installation. Check ground lug connection in main control box for tightness prior to closing circuit breaker or disconnect switch. Verify that supply voltage on

line side of disconnect agrees with voltage on unit identification plate and is within the utilization voltage range as indicated in Table 7.

SYSTEM VOLTAGE	NAMEPLATE	UTILIZATION VOLTAGE	
		MIN.	MAX.
208-230/60/3	208/230	187	253
480/60/3	460	414	506

TABLE 7 - UTILIZATION VOLTAGE RANGE

System Voltage - That nominal voltage value assigned to a circuit or system for the purpose of designating its voltage class.

Nameplate Voltage - That voltage assigned to a piece of equipment for the purpose of designating its voltage class and for the purpose of defining the minimum and maximum voltage at which the equipment will operate.

Utilization Voltage - The voltage of the line terminals of the equipment at which the equipment must give fully satisfactory performance. Once it is established that supply voltage will be maintained within the utilization range under all system conditions, check and calculate if an unbalanced condition exists between phases. Calculate percent voltage unbalance as follows:

$$\text{3) PERCENT VOLTAGE UNBALANCE} = 100 \times \frac{\text{2) MAXIMUM VOLTAGE DEVIATIONS FROM AVERAGE VOLTAGE}}{\text{1) AVERAGE VOLTAGE}}$$

HOW TO USE THE FORMULA:
EXAMPLE: With voltage of 220, 216, and 213
1) Average Voltage = 220+216+213=649 / 3 = 216
2) Maximum Voltage Deviations from Average Voltage = 220 - 216 = 4

$$\text{3) Percent Voltage Unbalance} = 100 \times \frac{4}{216} = \frac{400}{216} = 1.8\%$$

Percent voltage unbalance MUST NOT exceed 2%.

CHECK FIELD DUCT CONNECTIONS

Verify that all duct connections are tight and that there is no air bypass between supply and return.

CONTROL SYSTEM CHECK, TEST & START PROCEDURE

CONTROL VOLTAGE CHECK

With disconnect switch in the open "OFF" position, disconnect blue wire from low voltage transformer TRANS1. Close the disconnect switch to energize TRANS1 control transformer. Check primary and secondary (24V) of control transformer TRANS1.

THERMOSTAT PRELIMINARY CHECK

With disconnect switch open and blue wire disconnected from TRANS1 transformer, attach one lead of ohmmeter to terminal R on TB1 terminal block. Touch, in order, the other ohmmeter lead to terminals Y1, Y2 and G at TB1 terminal block. There must be continuity from terminal R to terminals Y1, Y2 and G. R to Y1 indicates first stage cool. R to Y2 indicates second stage cool.R to G indicates fan (auto). Replace blue wire on TRANS1 transformer.

ECONOMIZER DAMPERS & FILTERS CHECK, TEST & START PROCEDURE

FILTER SECTION CHECK

Remove filter section access panels and check that filters are properly installed. Note airflow arrows on filter frames.

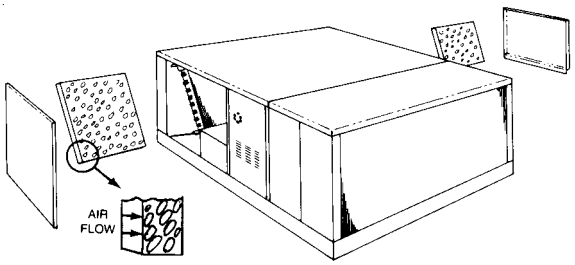


FIGURE 23 - FILTER ACCESS

EVAPORATOR BLOWER FAN CHECK, TEST & START PROCEDURE

ECONOMIZER & DAMPER SECTION CHECK

Follow instructions in accessory for check, test & start procedures.

BEARING CHECK

Prior to energizing any fans, check and make sure that all setscrews are tight so that bearings are properly secured to shafts.

SET EVAPORATOR FAN RPM

Actual RPM's must be set and verified with a tachometer or strobe light. Refer to Tables 8 and 9 for basic unit fan RPM. Refer also to "Air Balancing" section of this manual. With disconnect switch open, disconnect thermostat wires from terminals Y1, Y2, W1 and W2. This will prevent heating and mechanical cooling from coming on. Place a jumper wire across terminals R and G at TB1 terminal block. Close disconnect switch; evaporator fan motor will operate so RPM can be checked.

⚠ CAUTION

AIRFLOW MUST BE ADJUSTED SO THAT TEMPERATURE RISE DOES NOT EXCEED 40°F ON ELECTRIC HEAT UNITS WITH 70°F ENTERING AIR.

For gas heat units, the airflow must be adjusted so that the air temperature rise falls within the ranges given in Table 11.

PGC (PCC) MODEL	CFM	EXTERNAL STATIC PRESSURE (INCHES W.C.)															
		0.2		0.4		0.6		0.8		1		1.2		1.4		1.6	
		RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP	RPM	BHP
090	2600	***669***	***0.44***	816	0.59	916	0.75	1004	0.92	1084	1.09	1157	1.28	***1226***	***1.47***	***1291***	***1.67***
	2000	***734***	***0.53***	847	0.69	944	0.85	1030	1.03	1109	1.21	1181	1.4	***1249***	***1.6***	**1312**	**1.91**
	3000	770	0.62	877	0.79	973	0.97	1053	1.15	1135	1.34	1206	1.54	**1273**	**1.75**	**1336**	**1.96**
	3200	807	0.73	909	0.91	1002	1.1	1086	1.29	1162	1.49	**1232**	**1.7**	**1298**	**1.91**	**1360**	**2.12**
	3400	845	0.85	942	1.04	1032	1.24	1114	1.44	1159	1.65	**1259**	**1.87**	**1324**	**2.09**	**1384**	**2.31**
120	3400	***679***	***0.73***	***781***	***0.98***	873	1.26	957	1.58	1034	1.91	1105	2.26	1171	2.26	1233	2.99
	3600	**706**	**0.83**	805	1.1	894	1.39	975	1.71	1051	2.05	1121	2.41	1188	2.78	***1249***	***3.17***
	3800	**733**	**0.95**	829	1.23	916	1.53	995	1.85	1069	2.2	1139	2.57	1204	2.95	**1266**	**3.36**
	4000	**761**	**1.07**	855	1.37	938	1.68	1016	2.01	1088	2.36	1156	2.74	1221	3.14	**1282**	**3.55**
	4200	790	1.21	880	1.52	961	1.84	1037	2.18	1108	2.54	1175	2.93	**1239**	**3.33**	**1299**	**3.75**
	4400	818	1.36	906	1.68	985	2.01	1059	2.36	1128	2.73	1194	3.13	**1257**	**3.54**	**1316**	**3.97**

TABLE 8 - SUPPLY FAN PERFORMANCE DATA (5)

DO NOT SELECT IN SHADED AREAS (FOR INTERPOLATION ONLY)

1. Selections in ***BOLD ITALICS*** require a field drive change. See Table 8 for drive ranges.
2. Selections below **heavy line** require oversize motor.
3. Maximum fan RPM = 1500
4. Table includes all internal pressure drops including cabinet losses. See Table 27 in product catalog for additional pressure drops that must be considered as part of external static pressure drop.
5. Refer to catalog for fan curves.

PGC (PCC) MODEL	MOTOR SHEAVE FAN SHEAVE FIXED		ADJUSTABLE FACTORY SETTING 2 TURNS OPEN					
	MOTOR SHEAVE - TURN OPEN		0	1	2	3	4	5
090	FAN RPM	1.5 HP MOTOR	1209	1146	1082	1018	955	891
120	FAN RPM	3.0 HP MOTOR	1242	1186	1129	1073	1016	960

NOTE: Allow ± 5% Variation in blower RPM due to pulley manufacturing tolerances

TABLE 9 - SUPPLY FAN RPM RANGE

MODEL	QUANITY	HORSEPOWER	FLA	
			208-230/60/3	460/60/3
PGC(PCC) 090	2	1/2	2.6	1.3
PGC(PCC) 120	2	1/2	2.6	1.3

Note: All values are per compressor

TABLE 10 - CONDENSER FAN MOTORS

MODEL		195	225
NUMBER OF TUBE		6	7
VENTOR MOTOR HP		1/16	1/12
BTUH INPUT		193,000	225,000
BTUH OUTPUT		154,000	180,000
CFM	2600	55.0	-
	2800	51.1	-
	3000	47.7	55.6
	3200	44.7	52.1
	3400	42.1	49.1
	3600	39.7	46.3
	3800	-	43.9
	4000	-	41.7
	4200	-	39.7
	4400	-	37.9
	4600	-	36.3

NOTES:

1. Capacities are approved for altitudes to 2000 feet. At higher elevations, heating capacity must be reduced 4% (x0.96) for each 1000 feet above sea level.
2. Air temperature rise is for total heating capacity. Temperature rises at other conditions may be calculated by using the formula:

$$\text{Temperature Rise} = \frac{\text{Output Capacity (BTUH)}}{1.08 \times \text{CFM (Airflow)}}$$

3. For altitudes over 2000 feet, air temperature rise must be calculated using the formula:

$$\text{Temperature Rise} = \frac{\text{Output Capacity (BTUH)}}{14.4 \times \text{CFM (Airflow)} \times \text{Density of Air (Lbs./Cu.Ft.)}}$$

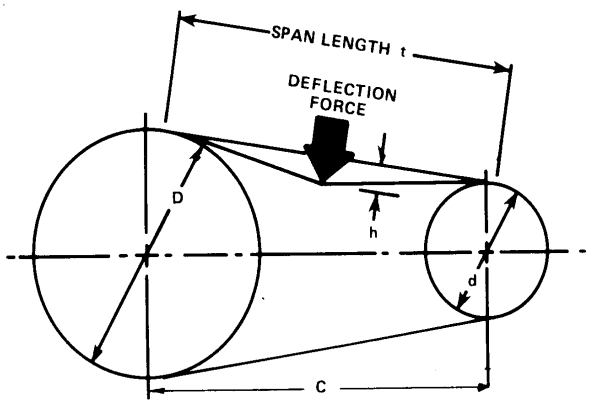
4. Two-stage control is standard.
5. Output capacity based on nominal 1000 Btu/Ft' natural gas or 2500 Btu/Ft3 propane.
6. See nameplate data for maximum air temp. rise for specific unit.

TABLE 11- EVAPORATOR FAN MOTORS

DRIVE BELT

TENSION AND ALIGNMENT ADJUSTMENT

Check drive for adequate run-in belt tension. Correct belt tension is very important. A belt that is loose will have a substantially shorter life, and a belt that is too tight may cause premature motor and bearing failure. Correct belt tension on these units can be checked by measuring the force required to deflect the belt 1/8" at the midpoint of the span length (Figure 28). Belt tension force can be measured using a belt tension checker, available through most belt manufacturers. The correct deflection force is 5 lbs. for a new belt and 3.5 lbs. for a belt that has been run in. New belt tension includes initial belt stretch. When new V-belts are installed on a drive the initial tension will drop rapidly during the first few hours. Check tension frequently during the first 24 hours of operation. Subsequent retensioning should fall between the minimum and maximum force. To determine the deflection distance from the normal position, use a straightedge or stretch a cord from sheave to sheave to use as a reference line. On multiple belt drives, an adjacent undeflected belt can be used as a reference.



t = Span length, inches
C = CENTER DISTANCE, INCHES
D = LARGER SHEAVE DIAMETER, INCHES
d = Smaller sheave diameter, inches
H = DEFLECTION HEIGHT, INCHES

FIGURE 24 - DRIVE BELT TENSION ADJUSTMENT

BELT SECTION	SMALL SHEAVE DIA. (IN.)	DRIVE RATIO			
		1	1.5	2	4.0 & Over
		Min. - Max.	Min. - Max.	Min. - Max.	Min. - Max.
A	3	2.0 - 3.0	2.3 - 3.5	2.4 - 3.6	2.6 - 3.9
	4	2.6 - 3.9	2.8 - 4.2	3.0 - 4.5	3.3 - 5.0
	5	3.0 - 4.5	3.3 - 5.0	3.4 - 5.1	3.7 - 5.6

TABLE 12
RECOMMENDED POUNDS OF FORCE PER BELT

EVAPORATOR FAN ROTATION CHECK

Check that fan rotates clockwise when viewed from the drive side of unit and in accordance with rotation arrow shown on blower housing. If it does not, reverse the two incoming power cables at PB1 terminal block. In this case, repeat bearing check.

Do not attempt to change load side wiring. Internal wiring assures all motors and compressors will rotate in correct direction once evaporator fan motor rotation check has been made.

ELECTRICAL INPUT CHECK

Make preliminary check of evaporator fan ampere draw and verify that motor nameplate amps are not exceeded. A final check of amp draw should be made upon completion of air balancing of the duct system.

HORSEPOWER	FLA	
	208-230/60/3	460/60/3
1.5	4.2/4.6	2.1
3	8.4/8.6	4.2

TABLE 13 - EVAPORATOR FAN MOTORS

RESTORING CONNECTIONS

With disconnect switch open, remove jumper wire from terminals R and G at TB1 terminal block, and reconnect thermostat wires to terminals Y1, Y2, W1 and W2.

REFRIGERATION SYSTEM

CHECK, TEST & START PROCEDURE PRELIMINARY CHECK

Make sure that hold-down bolts on compressors are secure and have not vibrated loose during shipment. Check that vibration grommets have been installed. Visually check all piping and clamps. The entire refrigeration system has been factory charged and tested, making it unnecessary to field charge. Factory charges are shown in Table 14 and on the unit's nameplate.

PGC (PCC)	CHARGE (OZ.)
090	115
120	150

TABLE 14 - REFRIGERANT CHARGE PER CIRCUIT

Install service manifold hoses. Gauges should read saturation pressure corresponding to ambient temperature. Charge should be checked to obtain 12° to 15° of sub-cooling per system. (i.e. compressor circuits)

REFRIGERATION SEQUENCE CHECK

With the disconnect switch open, remove the field connected thermostat wire from terminal R on TB1 terminal block. Place a jumper across terminals R and G, and across R and Y1 on TB1 terminal block. Close the disconnect switch. The following operational sequence should be observed.

1. Current through primary winding of transformer TRANS1 energizes the 24-volt control circuit.
2. The first stage of cooling is energized when the room temperature is above the thermostat set-point. The thermostat makes R to G and R to Y1.
   a. Supply contactor BC is energized.

b. UNITS WITHOUT ECONOMIZER OPTION: The first stage compressor circuit is energized through low-pressure switch LP1, high pressure switch HP1, and optional Freezestat. Compressors all rotate in the proper direction. Verification of correct supply fan rotation at initial startup will also indicate correct compressor rotation. Reconnect power and check for proper operation.

c. UNITS WITH ECONOMIZER OPTION: The first stage of cooling is interlocked through terminal 1 and 2 on the economizer module. Control power must be available to the damper motor DM through terminal ECON on terminal block IIC (refer to economizer instructions). If the outdoor enthalpy is not suitable for cooling, the economizer module terminals will be closed permitting the compressor circuit to be energized.

3. Contactor BC closes its contacts L1, L2 and L3 to T1, T2 and T3 to provide power to the supply fan motor (refer to "Evaporator Blower Fan Check, Test & Start Procedure"). Check supply fan rotation. If the supply fan is rotating in the wrong direction, disconnect and lock off power block PB1. Do not attempt to change load side wiring. Internal wiring is set at the factory to assure that the supply fan and compressors all rotate in the proper direction. Verification of correct supply fan rotation at initial startup will also indicate correct compressor rotation. Reconnect power and check for proper operation.
4. Contactor C1 closes its contacts L1, L2 and L3 to LT1, T2 and T3 to provide power to the compressor motor COMP. 1. In addition, contactor C1 closes its contact L3 to T4 , energizing all of the condenser fan motors.
5. Check that the compressors are operating correctly. The scroll compressors in these units must operate in the proper rotation. Check the compressor discharge line pressure or temperature.

⚠ CAUTION

DO NOT TOUCH BECAUSE DISCHARGE LINE MAY BE HOT.

After each compressor is started, the discharge pressure and discharge line temperature should increase. If this does not occur, and if the compressor is producing an exceptional amount of noise, the compressor motor may be operating in the wrong direction. If a problem is encountered, it will be necessary to check all of the compressors and the supply fan motor. If a single motor is operating backward,check the power wiring for that motor and correct any leads that have been interchanged at the contactor or at the motor. If all of the motors are operating backward, disconnect the unit power supply and lock it in the "OFF" position. Switch two leads of the power supply at the unit power terminal block PB1. Reconnect power and check for compressor and supply fan motor operation.

6. To simulate a second stage mechanical call for cooling from the wall thermostat, place a jumper across terminals R and Y2 of terminal block TB1. The second stage of cooling is energized when the room temperature is above the thermostat set-point for both first and second stages of cooling. The thermostat makes R to Y2.

   a. UNITS WITHOUT ECONOMIZER OPTION: The second stage compressor circuit is energized through low pressure switch LP2, high pressure switch HP2, time delay IIC (pin 11 & 12) and optional freezestat.

   b. UNIT WITH ECONOMIZER OPTION: The second stage compressor circuit is interlocked through terminals 3 and 4 of the economizer module (refer to 2c). If the outdoor air enthalpy is not suitable for cooling, the economizer terminals will be closed permitting compressor circuit 2 to be energized.
7. Contactor C2 closes its contacts L1, L2 and L3 to T1, T2 and T3 to provide power to the compressor motor COMP. 2. In addition, contactor C2 closes its contact L3 to T4 duplicating the power circuit to all of the condenser fan motors allowing condenser air for compressor circuit 2 to operate if compressor circuit 1 is tripped).
8. With all safety devices closed, the system will continue cooling operation until the thermostat is satisfied.
9. Disconnecting the jumper wire between R and Y2 on TB1 terminal block will simulate a satisfied second stage of the thermostat. The second stage compressor will cycle off and IIC (pin 12) will initiate its time delay cycle.
10. Disconnecting the jumper wire between R and Y1 and between R and G on TB1 terminal block will simulate a satisfied first stage of the thermostat. The first stage compressor and the supply fan will cycle off.
11. After a time delay of approximately 3 minutes, the second stage compressor control circuits will be ready to respond to a subsequent call for cooling from the wall thermostat.
12. Open disconnect switch. Reconnect the field thermostat wire at terminal R on terminal block TB1.

REFRIGERATION PERFORMANCE CHECK

Under normal summertime (full load) operating conditions, superheat should be between 8°F and 12°F and sub-cooling measured at the condenser outlet should be 15°F (nominal). A 25°F to 35°F temperature difference should exist between the entering condenser air and the temperature corresponding to the compressor saturated discharge pressure. The adjustable expansion valves can be used to obtain the proper subcooling setting. This is factory set and should not need to be used unless operation is

unsatisfactory. Check that compressor RLA corresponds to values shown in Table 15. RLA draw can be much lower than values in Table 15 at low load conditions and low ambient condensing temperatures. Values in Table 15 can be slightly exceeded at high load conditions and high ambient condensing temperatures.

MODEL	QTY.	HORSE-POWER	208-230/60/3		460/60/3	
			RLA	LRA	RLA	LRA
PGC(PCC) 090	2	2.9	12.5	88	5.9	44
PGC(PCC) 120	2	3.9	17.4	123	6.8	49.5

Note: All values are per compressor

TABLE 15 - COMPRESSORS

GAS HEAT CHECK, TEST & START PROCEDURE

WARNING

SHOULD OVERHEATING OCCUR OR THE GAS SUPPLY FAIL TO SHUT OFF, TURN OFF THE MANUAL GAS VALVE TO THE APPLIANCE BEFORE SHUTTING OFF THE ELECTRICAL SUPPLY.

WARNING

DO NOT FIRE GAS FURNACE WITH FLUE BOX COVER REMOVED. THIS IS EXTREMELY HAZARDOUS.

CAUTION

EXCEPT DURING BRIEF PERIODS WHEN GAS PRESSURES ARE BEING MEASURED BY QUALIFIED SERVICE PERSONNEL, THE FURNACE ACCESS PANEL MUST ALWAYS BE SECURED IN PLACE WHEN THE FURNACE IS IN OPERATION. AN INSPECTION PORT IN THE ACCESS PANEL IS PROVIDED TO MONITOR THE FLAME.

GAS SUPPLY PRESSURES & REGULATOR ADJUSTMENTS

The first step in checking out the gas-fired furnace is to test the gas supply piping to the unit for tightness and purge the system of air using methods outlined in the latest edition of the National Fuel Gas Code (ANSI Z223.1). Verify that the disconnect switch is in the "OFF" position. A soapy water solution should be used to check for gas leaks. Since the unit is subject to considerable jarring during shipment, it is extremely important that all gas connections and joints be tested for tightness. Gas piping downstream from the unit inlet should be checked for leaks during the subsequent sequence check.

The supply gas pressure should be adjusted to 7.0" W.C. on natural gas and 11.0" on propane gas with the gas burners operating. If there is more than one unit on a common gas line, the pressures should be checked with all units under full fire. A supply pressure tap is provided on the upstream side of the gas valve. A manifold pressure tap is provided on the manifold as shown in Figure 20. The normal manifold pressure for full input is 3.5" W.C. on natural gas and 9.5" W.C. for propane gas. Minimum gas supply pressure is 5.5" W.C. for natural gas and 11.0" for propane gas. In order to obtain rating, gas supply pressure must be 11.0" W.C. for propane gas. The pressure regulator on propane gas models is adjusted for 9.5" W.C. manifold pressure and is intended to prevent over-firing only. Do not attempt adjustment of the built-in pressure regulator unless the supply pressure is at least 7.0" W.C. on natural gas or 13.0" W.C. on propane gas. Check the location of the ignition electrode and the flame sensor for correct gap setting. Refer to Figure 25 and Tables 16 and 17. Due to the fact that gas appliances located more than 2000 feet above sea level must be derated 4% per 1000 feet of total elevation and that variance in gas heating value and specific gravity require change in manifold pressure to obtain rating, it is mandatory that the input be adjusted at the installation site. All installations should be made as outlined in the latest edition of the National Fuel Gas Code **ANSI Z223.1.** The section entitled "Procedures To Be Followed To Place An Appliance in Operation" should be followed. Refer also to the "User's Information Manual" supplied with the unit for additional information on the gas furnace.

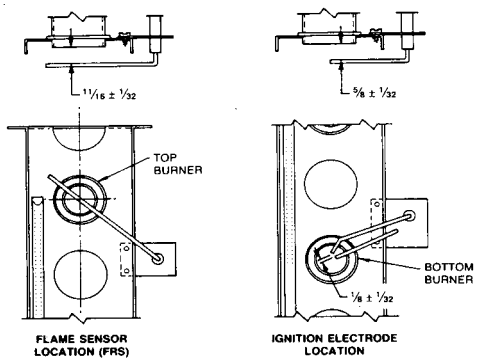


FIGURE 25

MAXIMUM INPUT BTUH	NUMBER OF BURNERS	MAXIMUM BTUH PER BURNER
193,000	6	32,200
225,000	7	32,000

TABLE 16 - HEAT EXCHANGER SPECIFICATIONS

GAS FURNACE NO. OF TUBES	DRILL SIZE NUMBER (DIA.)			
	NATURAL GAS		LP GAS	
	MAIN ORIFICES	CARRYOVER ORIFICES	MAIN ORIFICES	CARRYOVER ORIFICES
6, & 8	36 (.111")	58 (.042")	52 (.070")	73 (.024")

TABLE 17 - BURNER ORIFICE SPECIFICATIONS

SEQUENCE OF OPERATION - GAS HEATING

1. This unit has one Manual Reset Limit Control. Check the limit to make sure it has not tripped. The limit may arrive at the job site tripped as a result of shipping shock.
2. If the ventor motor comes on, but the unit does not attempt ignition, check if the ALS requires resetting.
3. With electricity and gas turned on, the system switch in the “HEAT” or “AUTO” position and the fan switch in the “AUTO” position, the thermostat will close the circuit between unit terminals R and W1 (R-W1) when the temperature falls below the thermostat setting.
4. D1 on IIC energizes relay IDMR.
5. Relay IDMR energizes the ventor motor IDM.
6. Operation of the ventor motor closes the centrifugal switch ES located in the ventor motor. Unless excessive temperatures or shipping shock have opened high limit control ALS, power is fed to the integrated ignition control, which then initiates a 15-second pre-purge time delay. During this period, the ventor motor will clear the combustion chamber of any residual gas.
7. After the pre-purge period, the ignition control energizes the first stage operator (WI-C) on the gas valve and simultaneously initiates a “3-try” spark ignition sequence.
8. When the burners are ignited, a minimum 4 micro-amp DC current will flow through the flame between the sensor electrode and the grounded burner.
9. When the controller proves that the flame has been established, it will keep the gas valve energized and discontinue the ignition spark. First stage manifold pressure will be approximately 1.6" W.C. for natural gas and 4.5" W.C. for propane.
10. If the control is unable to ignite the burners after its initial attempt, it will initiate another purge and spark sequence. A third purge and spark sequence will be initiated if the second attempt is unsuccessful. If the third attempt is unsuccessful, the controller will close the gas valve and lock itself out. It may be reset by momentarily interrupting power. This may be accomplished by briefly lowering the room thermostat set-point below room temperature, or by shutting off the main power to the unit. (See TP-105 for more details.)
11. Integrated ignition control will close its normally open contacts after a delay of approximately 30 seconds. This action energizes contactor BC and starts the supply fan motor. Operation of the supply fan circulates air across the heat exchanger and delivers heated air to the conditioned space.
12. In the event that the temperature at the thermostat continues to fall, the thermostat will also close the contact between terminals R and W2. This will energize the second stage of the gas valve (W2-C). After a delay of about 30 seconds, the gas manifold pressure will increase to approximately 3.5" W.C. for natural gas and 9.5" W.C. for propane.
13. When the space temperature rises, the thermostat will first open R-W2 and finally R-W1. Opening R-W1 will cause the gas valve to close, and the furnace to shut down.
14. The furnace has three high temperature limit controls, which can shut down the burner. They do not shut down the ventor motor.

LS AUTOMATIC RESET HIGH LIMIT CONTROL.

Located in the blower compartment next to the rear blower, its sensing element projects through the blower section bulkhead and senses the temperature at the rear of the furnace. It will cycle the furnace off if the temperature exceeds 100°F plus maximum rise.

ALS AUTOMATIC RESET HIGH LIMIT CONTROL.

Located next to LS in the blower compartment, it senses air temperature within the blower compartment and protects the filters from excessive temperature. It will shut down the furnace if it senses excessive temperatures.

RS Manual Reset Flame Rollout Control.

Located in the burner compartment on the top shelf behind the ventor motor, it senses high temperature that could occur if the heat exchanger tubes were plugged and the flame was rolling out instead of entering the tubes. It has a manual push-button reset that cannot be actuated until the limit control has cooled.

INPUT RATING

It is the responsibility of the contractor to adjust the gas input to the unit. The input rate can be calculated by using the formula:

$$\text{INPUT Btu/Hr} = \frac{3600 \times HV}{T}$$

WHERE:

HV = Heating value of fuel = Btu/Ft3 of gas

T = Time in seconds per Ft3 of gas flow as read from gas meter

Adjust input rate by varying the adjustment of the gas pressure regulator on the gas valve. See Figure 26. All adjustments must be made with furnace operating at high fire and at normal operating temperature. Clockwise (↻) rotation of the pressure regulator screw increases pressure and gas flow rate. Turn screw counterclockwise (↺) to decrease pressure and gas flow rate. After adjustment the furnace temperature rise must be within the range specified on the unit data plate. **NOTE:** Thermal efficiency of the furnace is a product efficiency rating determined under continuous operating conditions independent of any installed system.

CAUTION

DO NOT EXCEED INPUT RATING OR MANIFOLD PRESSURE VALUES ON THE UNIT DATA PLATE. IF INPUT RATING ON DATA PLATE CANNOT BE ATTAINED WITHOUT EXCEEDING LISTED MANIFOLD PRESSURE, CONTACT YOUR LOCAL SERVICE REPRESENTATIVE.

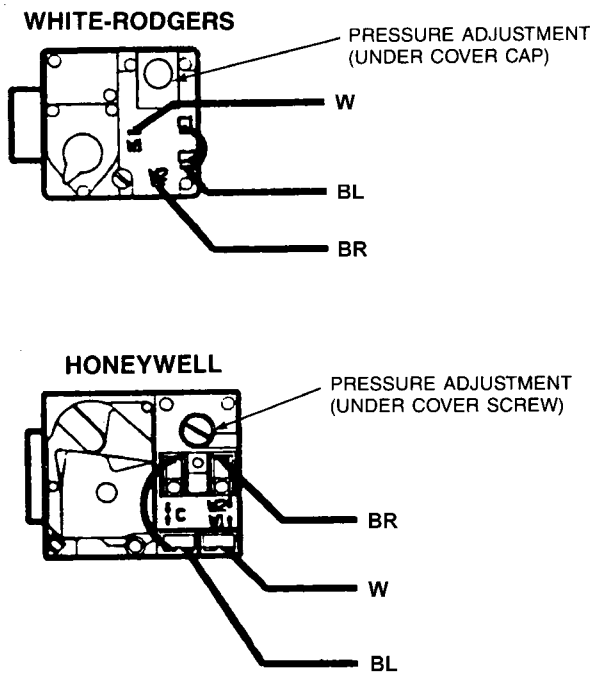


FIGURE 26 - PRESSURE ADJUSTMENTS

AIR BALANCING

The drive on the supply fan is typically set in the middle of the RPM range. The drive motor sheave pitch diameter is field adjustable for the required airflow. Refer to “Drive Adjustments” section below.

When the final adjustments are complete, the current draw of the motor should be checked and compared to the full load current rating of the motor. The amperage must not exceed the service factor stamped on the motor nameplate. The total airflow must not be less than that required for operation of the electric heaters or the furnace.

The operating balance should be checked with the economizer at full outside air and at minimum outside air. Upon completion of the air balance, it is a common industry recommendation that the variable pitched motor sheave be replaced with a properly sized fixed sheave. A matching fixed sheave will provide longer belt and bearing life and vibration free operation. Initially, it is best to have a variable pitched motor sheave for the purpose of air balancing, but once the balance has been achieved, fixed sheaves maintain alignment and minimize vibration more effectively.

DRIVE ADJUSTMENTS

MOUNTING & ADJUSTING MOTOR SHEAVES VL, VM & 2VP VARIABLE PITCH KEY TYPE SHEAVES

MOUNTING:

1. All sheaves should be mounted on the motor or driving shaft with the set screw “A” toward the motor.
2. Be sure both driving and driven sheaves are in alignment and that shafts are parallel.
3. Fit internal key “C” between sheave and shaft, and lock set screw “A” securely in place.

ADJUSTING VL & VM SHEAVES:

1. Loosen set screw “B” (5/32" Allen key).
2. Adjust sheave pitch diameter for desired speed by opening moving part by half or full turns from closed position. DO NOT OPEN MORE THAN FIVE FULL TURNS.

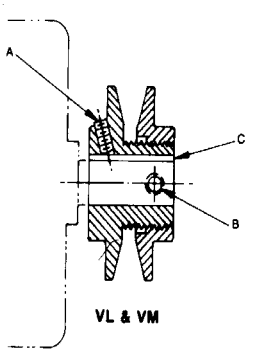
3. Securely tighten set screw “B” over flat.

AFTER ADJUSTING:

1. Put on belts and adjust belt tension. DO NOT FORCE BELTS OVER GROOVES.

2. Future adjustments should be made by loosening the belt tension and increasing or decreasing the pitch diameter of the sheave by half or full turns as required. Readjust belt tension before starting drive.

3. Be sure that all keys are in place and that all set screws are tight before starting drive. Check set screws and belt tension after 24 hours service.



Do not operate sheave with flange projecting beyond the hub end.

FIGURE 27

MAINTENANCE

CAUTION

INSTALLATION AND MAINTENANCE ARE TO BE PERFORMED ONLY BY QUALIFIED PERSONNEL WHO ARE FAMILIAR WITH LOCAL CODES AND REGULATIONS AND EXPERIENCED WITH THIS TYPE OF EQUIPMENT.

CAUTION

AVOID SHARP EDGES AND COIL SURFACES BECAUSE THEY ARE POTENTIAL INJURY HAZARDS.

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have this system inspected at regular intervals by qualified service personnel, at least twice a year. Routine maintenance should cover the following items:

1. Tighten all belts, set screws, and wire connections.
2. Clean evaporator and condenser coils mechanically or with cold water, if necessary. Usually any fouling is only matted on the entering air face of the coil and can be removed by brushing.
3. Lubricate motor bearings (see below).
4. Align or replace belts as needed.
5. Replace filters as needed (see below).
6. Check for blockage of condensate drain.
7. Check power and control voltages.
8. Check running amperage.
9. Check operating temperatures and pressures.
10. Check and adjust temperature and pressure controls.
11. Check and adjust damper linkages.
12. Check operation of all safety controls.
13. Examine gas furnaces (see below and the User's Information Manual).
14. Check condenser fans and tighten set screws.

FILTERS

Every application may require a different frequency of replacement of dirty filters. Filters must be replaced at least every three (3) months during operating seasons.

Filters supplied with the units are the disposable type and are as follows:

UNIT SIZE	QUANTITY	FILTER SIZE	PART NO. (ONE FILTER)
090	3	25 x 25 x 2	B13696-12
120	3	16 x 25 x 2	B13696-10
	3	20 x 25 x 2	B13696-11

TABLE 18 - FILTERS

To remove the filters, remove the filter access panel on either side of the unit. See Figure 23.

LUBRICATION

The fan shaft bearings, the 1 to 3 HP supply fan motors, and the condenser fan motors are permanently lubricated. For lubrication of the compressors, use Suniso 3GS, Texaco WF32, or Calumet R015 oils. All three oils are compatible if mixed, and are suitable for both high and low temperature systems.

CAUTION

EXCESSIVE GREASE WILL OVERHEAT THE BEARINGS. USE ONLY A HIGH GRADE LITHIUM BASE GREASE WITH A 200°F SAFE OPERATING TEMPERATURE.

NOTE: Specific greasing instructions may be found on a tag attached to the motor. If special lubrication instructions are shown on the motor nameplate, they will supersede all other instructions.

VENTOR MOTOR

To lubricate the ventor motor, remove the furnace access panel. Lubricate the motor in two locations as shown in Figure 28. Use SAE 2OW lubricant and add five (5) drops to each location. The motor should be lubricated at the beginning of each heating season.

CAUTION

DO NOT OVER LUBRICATE.

WARNING

DO NOT DRIP OIL ON THE GAS VALVE. THE OIL MAY DAMAGE THE NON-METALLIC PARTS AND RENDER THE VALVE INOPERATIVE. REMOVE ANY OIL RESIDUES FROM THE BURNER COMPARTMENT.

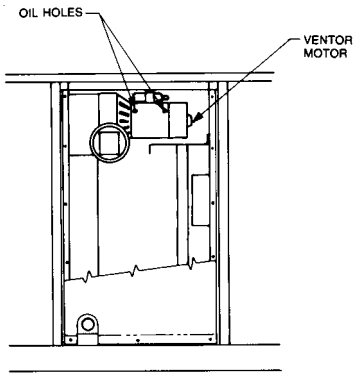


FIGURE 28 - VENTOR MOTOR

INSPECTION & CLEANING

All flue product carrying areas of the furnace, its vent system, and main burners should be examined by a qualified service agency before the start of each heating season. This examination is necessary for continued safe operation. Particular attention should be given to deterioration from corrosion or other sources. This examination is accomplished in the following manner.

1. Disconnect power to the unit and remove furnace section access panel.
2. Refer to Figure 29. Remove burner assembly:
   a. Disconnect the three wires from the gas valve after noting which wires are connected to each terminal.

b. Disconnect wires from the flame rod and ignition electrode.

c. Disconnect the gas piping at the union.

d. The entire burner assembly can now be removed from the unit. Note how the front of the burner assembly nests around wide location tabs, one at the top and one at the bottom.

3. Remove the flue box cover. The cover consists of two pieces which can be removed as a single unit. Remove the flue baffle.

4. Remove the turbulator from within each heat exchanger tube. The end corner of the turbulator mates with the groove at the tube end seam. To release the turbulator, grip the end of the turbulator with a pliers, force the corner away from the groove, and pull the turbulator out of the tube.

5. Inspect the burner assembly, the heat exchanger tubes, the turbulators, the flue box, the ventor fan and the ventor fan outlet openings for accumulations of soot and deterioration. Soot can be removed with a flexible wire brush. The inside of the tubes can be cleaned with a boiler tube type wire brush. If the bends of the tubes must be cleaned, remove the plate surrounding the burner end of the tubes. A brush or wad of steel wool can then be pulled through the tube with a cable. Be cautious not to damage the corrosion resistant coating on the various metal parts. Remove all residue.

6. If deterioration is evident, contact a qualified service agency. Minor deterioration of the turbulator ends is not cause for concern.

7. Upon completion of inspection and cleaning, replace all parts in the reverse order in which they were removed.

⚠ CAUTION

USE ALL SCREWS THAT WERE REMOVED; THEY ARE NECESSARY FOR SAFE AND PROPER OPERATION OF THE UNIT.

8. Inspect and periodically clean the vent outlet (bird screen) on the access panel.

   NOTE: Periodic observation of the flame through the inspection port and a log of C02 measurements are recommended. This will aid in determining whether the furnace is operating efficiently or if the furnace requires cleaning.

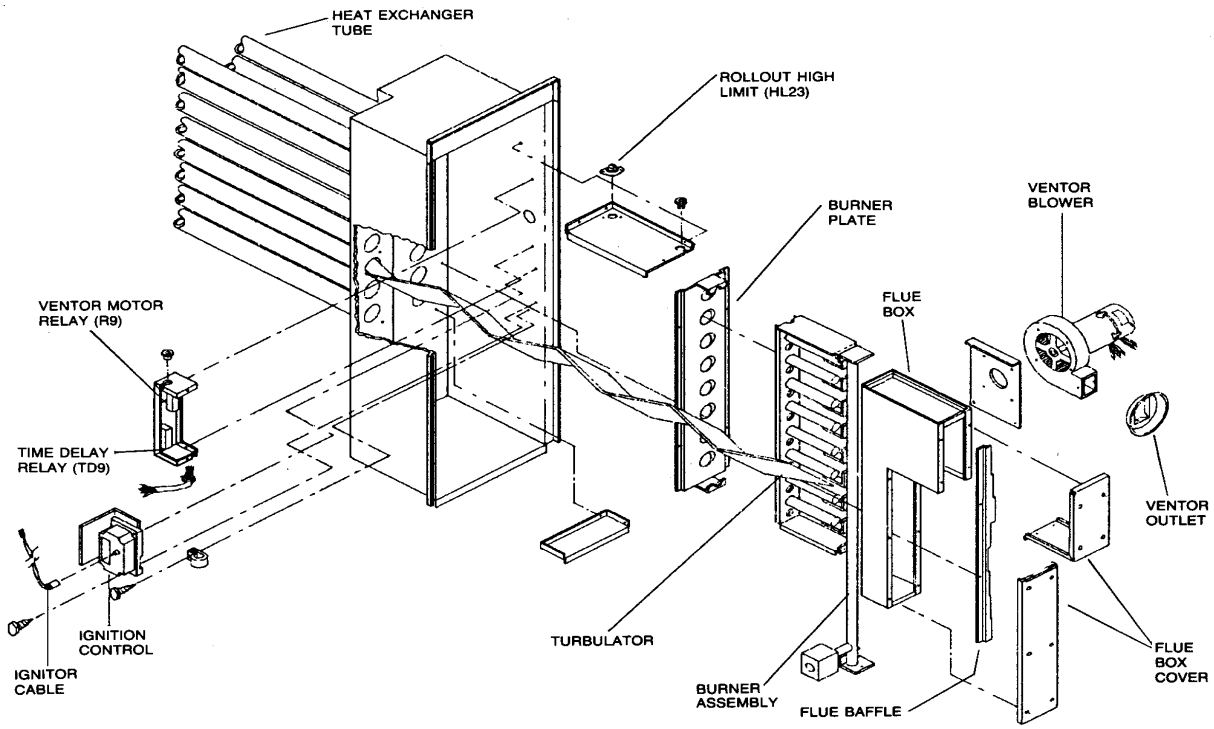


FIGURE 29 - GAS FIRED FURNACE

NOTE: SPECIFICATIONS AND PERFORMANCE DATA LISTED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE

Quality Makes the Difference!

All of our systems are designed and manufactured with the same high quality standards regardless of size or efficiency. We have designed these units to significantly reduce the most frequent causes of product failure. They are simple to service and forgiving to operate. We use quality materials and components. Finally, every unit is run tested before it leaves the factory. That's why we know. . .**There's No Better Quality.**

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