

REZNOR®

**PCD/AEB SERIES
INDUSTRIAL / COMMERCIAL PACKAGED FURNACES
INSTALLATION, OPERATION AND MAINTENANCE MANUAL**
(Suitable for Operation with up to 100% Fresh Air)

READ MANUAL CAREFULLY BEFORE INSTALLING, OR OPERATING THE FURNACE

FOR YOUR SAFETY

If you smell gas follow these instructions

- 1) Open Windows.
- 2) Do not touch electrical switches.
- 3) Extinguish any open flame.
- 4) Call the gas supplier immediately

FOR YOUR SAFETY

The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous

Unit Model: _____

Serial #: _____

Factory Job #: _____

Installation Date: _____

WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.

***THIS UNIT IS TO BE SERVICED BY QUALIFIED PERSONNEL ONLY*
DO NOT TAMPER WITH THE UNIT OR CONTROLS**

WARNING: Install, operate and maintain unit in accordance with manufactures instructions to avoid exposure to fuel substances from incomplete combustion which can cause death or serious illness. The state of California has determined that these substances may cause cancer, birth defects or other reproductive harm.

INSTALLER'S RESPONSIBILITY

Installer please note: This equipment has been test fired and inspected. It has been shipped free from defects from our factory. However, during shipment and installation, problems such as loose wires, leaks or loose fasteners may occur. It is the installer's responsibility to inspect and correct any problems that may be found. Factory Authorized parts available at parts@ice-us.com

Installer / Service Contractor

Name: _____

Address: _____

Telephone: _____

Contact: _____





WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in serious injury, death or property damage.

Be sure to read and understand the installation, operation and service instructions in this manual.

Improper installation, adjustment alteration, service or maintenance can cause serious injury, death or property damages.

- Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance
- WHAT TO DO IF YOU SMELL GAS
 - Do not try to light any appliance.
 - Do not touch any electrical switch; do not use any phone in your building.
 - Leave the building immediately.
 - Immediately call you gas supplier from a phone remote from the building. Follow the gas supplier's instructions.
 - If you cannot reach your gas supplier, call the fire department or 911.
- Installation and service must be performed by a qualified installer, service agency or the gas supplier

These Instructions are to remain with the equipment for servicing. The heater shall be serviced monthly (or more frequently if bearing and filter service is necessary). The venting system must be inspected frequently by a qualified service agency.

305 Van Buren Road, Bolivar TN 38008

Tel: 731-658-7000

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RECEIVING AND WAREHOUSING

Shipments are made F.O.B. factory in Bolivar, Tennessee by truck. Inspect the unit upon arrival for any shipping damage. If there is any visible damage have the carrier's agent place a notation on your freight bill before you sign acceptance. Keep your bill of lading, it is a contract, and you will need it if it is necessary to file a claim. If any part is missing or damaged, notify the carrier at once.

If the unit cannot be installed immediately, store it and its accessories in a clean and dry place.

Only return damaged articles to factory with prior approval as they are the property of the transportation company and the freight company will usually advise disposition of damaged equipment.

HANDLING AND SUSPENSION

Typically the unit is designed and shipped in one piece where shipping limitations allow. During transit, unloading and setting of the unit nuts and bolts may loosen especially the pillow block bearings and fan assemblies. It is recommended that all bolts be tightened. Additionally turn shaft by hand to make sure the blower does not rub against the housing and tighten wheel and bearing set screws.

Do not handle the unit by attaching hooks, jacks or chains to the unit casing or any other component. Spreader bars are recommended when making single point lifts.

Horizontal indoor units may be handled and suspended using the lugs on the base frame. Horizontal rooftop units are provided with base frame lugs. All lifting lugs are to be utilized simultaneously and evenly, both for lifting, and for suspending.

Vertical up flow units (including AEB model) and vertical down flow models are provided with eye bolts to ease handling. Check that all eye bolts are tight, and have not loosened during shipping, prior to lifting.

IMPORTANT: Lift and install modules of unit separately as received. Flange connections for field-attached components are not structural, and damage will occur if any attempt is made to lift these sections together with other parts of the unit. Refer to as built dimensional prints for section weight and to determine proper orientation of each component.

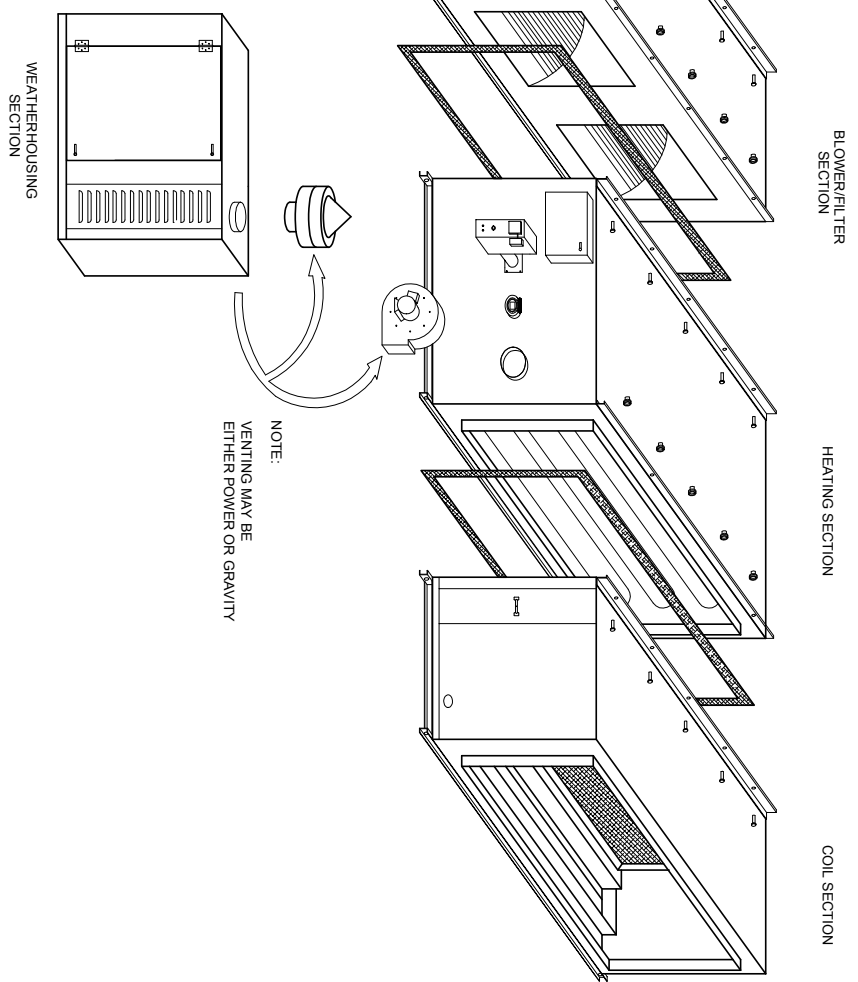
For some models, the heating and blower sections are shipped separately. (refer to as built assembly drawing in unit information packet). Assemble all unit sections by aligning the pre-drilled flanges and securing the assembly with the fasteners provided. Use gasket material to prevent infiltration at all joints. Some sheet metal section accessories will require drilling of Tek screws to secure section to the unit casing, line up these components to provide proper fit.

Optional sections such as mixing boxes may be shipped separately. Some accessories may require field mounting and/or assembly. A list of these, along with any other unit components that have been shipped separately from the unit, are included with the as built drawings in the unit information packet. The "as built" drawings include data specifications, unit dimensional drawing, curb drawing -if applicable, unit wiring diagram, field wiring diagram, sequence of operation and gas manifold diagram.

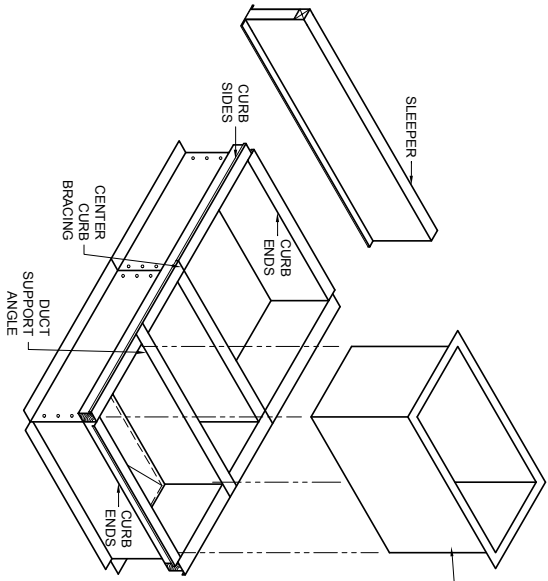
Outdoor units may be furnished with an optional roof curb. All curbs are shipped unassembled, refer to curb drawing for assembly of parts. Bolts and nuts are provided for assembly. Ensure the roof curb is assembled properly and fitted squarely and level before lifting and setting unit. Use a bubble level to confirm roof curb is level. Provide and install perimeter gasket material on all top curb flanges to properly seal unit bottom to curb. Make sure roof curb is properly flashed into the roof prior to setting unit.

Warning: To ensure a proper unit lift, suspend unit off the ground only 24 inches and verify proper center of gravity and tensions on all lifting cables or straps before setting. To avoid dropping the unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in death or serious injury or property and unit damage.

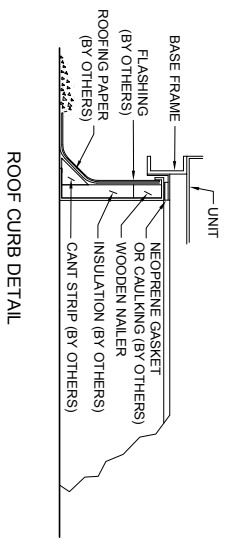
NOTE:
 SOME FIELD WIRING TO BE CONNECTED BETWEEN
 SECTIONS. BY CONTRACTORS ON UNITS
 SHIPPED IN SECTIONS TO JOB SITE.
 UNIT MAY NOT BE EXACTLY AS SHOWN.



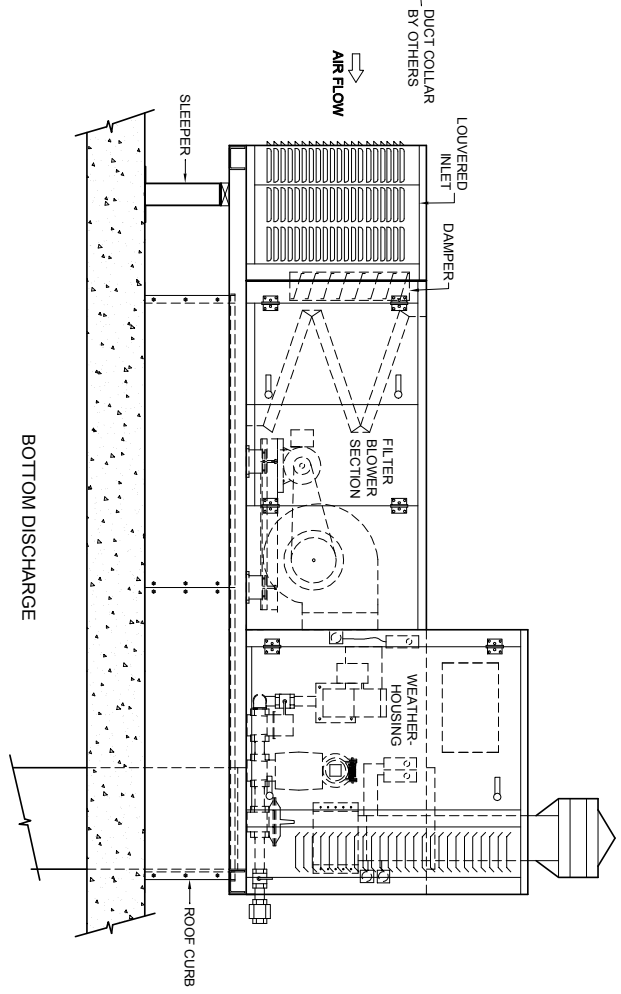
TITLE		POD FIELD ASSEMBLY	
Rev	By	Revision Description	Date
PCD SERIES		DRAWN BY	ISSUED BY
		JV	NTS
		CHK BY	DATE
		JS	DEC. 18/98
		SCALE	DRW. NO.
			FIG. I
			JOB NO.
			REV



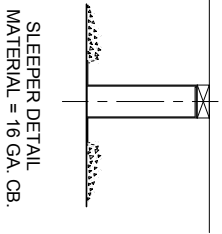
ONE EXAMPLE OF CURBING



ROOF CURB DETAIL

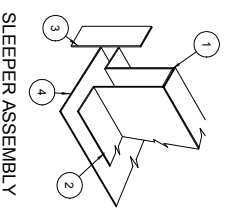


BOTTOM DISCHARGE



SLEEPER DETAIL MATERIAL = 16 GA. CB.

- ① LARGE SLEEPER SIDE
- ② SMALL SLEEPER SIDE
- ③ END PLATE
- ④ BASE PLATE



SLEEPER ASSEMBLY

TITLE		INDIRECT GAS FIRED MAKE-UP AIR HEATERS	
DRAWN BY		ROOF CURB AND SLEEPERS DETAILS	
CHK. BY	ISSUED BY	SCALE	DRW. NO.
MAR. 6/2000	NTS.	FIG. VIII	
DATE	JOB NO.	REV	

PCD
SERIES

GENERAL INSTALLATION NOTES:

Installation must be made in accordance with local codes, or in absence of local codes, with current ANSI Standard Z223.1 / (N.F.P.A. No 54) "National Fuel Gas Code", or the latest edition of. All ANSI and NFPA Standards referred to in these installation instructions are the ones that were applicable at the time the design of this appliance was certified. The ANSI Standards are available from the American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209. The NFPA Standards are available from the National Fire Protection Association, Batterymarch Park, Quincy, Massachusetts 02269. The heaters are designed for use in airplane hangers when installed in accordance with ANSI/NFPA No. 409 and in public garages when installed in accordance with the NFPA No. 88A and NFPA No. 88B. If heater is installed in a garage, it shall be installed with a minimum clearance above the floor of 18 in. (457mm).

This unit must be installed in accordance with the Natural Gas and Propane Installation Code current standard CAN/CSA/1-B149.1 or CAN/CSA/1-B149.2. Refer to installation codes for gas burning appliances and equipment, and/or the applicable provincial regulations for the class, which should be carefully followed in all cases. All electrical connections must be in accordance with Canadian Electric Code, Part 1, CSA Standard C22.1. Authorities having jurisdiction should be consulted before installations are made.

If a duct furnace is connected to a return air duct or any other inlet air restriction, the duct furnace shall be installed on the positive pressure side of the air-circulating blower. A duct furnace shall be installed with an inlet duct that will provide air distribution equivalent to a straight run of duct having the same cross sectional area as the inlet connection and not less than two equivalent diameters in length.

CLEARANCES

MODEL	PCD / AEB Series CONFIGURATION	CLEARANCES TO COMBUSTIBLE CONSTRUCTION (in inches)					
		TOP	FRONT	FLUE	BACK	SIDES	FLOOR
C	Horizontal Suspended	6	36	18	36	6	*
D	Vertical Upflow Floorset	6	36	18	36	6	C
R	Vertical Downflow Floorset	0	36	18	36	6	NC**
M	Horizontal Floorset	6	36	18	36	6	NC**
AC	Vertical Upflow High Velocity Floorset	6	36	18	36	6	C

Notes: *Three inch bottom clearance.

** May be installed on combustible floor when mounted on 4-inch steel base channels. Floor clearance is measured from bottom of unit casing.

For service, it is advisable to maintain a minimum 36-inch clearance around the perimeter of the unit. If this unit is to be operated within a confined space or within a building of unusually tight construction, air for combustion and ventilation must be obtained from outdoors or other spaces freely communicating with the outdoors. Combustion air should be provided at a rate of at least 0.2 CFM per 1,000 Btu/h which is at least one square inch of free area per 1000 Btu/h of total input rating of all appliances within the space provided up to 400,000 Btu/h. Refer to ASSI Z223.1 section 1.3.4.2 and 1.3.4.3 for combustion air requirements. For Canadian units refer to CAN/CSA/1-B149.1 natural gas, or CAN/CSA/1- B149.2 and B139, propane gas and B139 for air supply requirements of appliances heating input exceeding 400,000 Btu/h. If a separate mechanical means provides combustion air to the appliance, an interlock with the combustion blower shall be provided.

Ducts connected to the furnace shall have removable access panels on both the upstream and downstream sides of the furnace. These openings shall be accessible when the furnace is installed and shall be sized to allow the observation of smoke or reflected light inside the casing to indicate the presence of leaks in the heat exchanger. The covers for the openings shall be attached in such a manner as to prevent leaks. The furnace must not be operated in the presence of chlorinated vapors. When such vapors mix with the products of combustion, highly corrosive compounds result that will cause the premature failure of the heat exchanger and other components, voiding the warranty.

CONNECTING THE FLUE

In making flue connections to the unit, observe the following general recommendations. All venting installations shall be in accordance with the latest edition of Part 7, "Venting of Equipment", of the National

Fuel Gas Code, the latest edition of ANSI Z223.1, or applicable provisions of local building codes. Questions regarding venting should be directed to local authority having jurisdiction. For Canadian installations these connections must conform to the requirements of current CAN/CSA/B149.1 natural gas and CAN/CSA/ B149.2 and be in accordance with provincial and local authorities that have jurisdiction.

Venting is to be for Category III appliances. The flue venting shall be gas tight. Each unit must have an individual vent pipe and vent terminal. The Category III venting system may be “any listed vent system manufacturer”. Recommended vent pipe is 14 Gauge Series Stainless Steel listed by a nationally recognized testing agency. Note “B vent” is not acceptable. Do not intermix different vent system parts from different manufacturers in the same venting system. Install venting per manufacturers instructions.

- *See Fig. II and Fig. III for vent system recommendations.
- *Some jurisdiction may require a positive pressure vent system.
- *The flue must be securely attached to the unit with tight joints.
- *The pipe from the unit to the flue should rise at least ¼ inch per foot. A drain connection should be put at the low point of the flue, or bottom of exhauster (if so equipped) for condensate drainage.
- *The flue must not be sized to have a cross-sectional area less than that of the flue collar at the unit. See Fig. II and Fig. III.
- *Other appliances must not be connected so as to vent through the flue of this unit.
- *Do not use 90-degree tees or elbows greater than 45 degrees.
- *DO NOT support the weight of the stack on the flue connection of the heating section or on the induced draft fan housing if so equipped. Horizontal portions of venting shall be supported with hangers to prevent sagging as outlined in the flue manufacturer’s recommendations at a minimum of every six feet.
- *Insulate single wall vent pipe exposed to cold air or running through unheated areas to prevent condensation.
- *Minimize connecting pipe length and the number of bends by locating the unit as close to the flue pipe as possible.
- *Maintain clearances between the flue pipe and combustible materials that are acceptable to the federal, provincial and local authorities having jurisdiction.
- *Unit must be connected to a flue having sufficient draft to ensure proper operation of the unit. Vent terminal should be cleaned and periodically inspected. The heater venting system shall be inspected a minimum of once a year by a qualified service agency.
- *For horizontally vented appliance refer to National Fuel Gas Code, ANSI Z223.1/NFPA 54 and/or the Natural Gas and Propane Installation Code, CSA B149.1 for where vent terminal should terminate in relation to adjacent public walkways, adjacent buildings, opening windows, and building openings.

Warning: CARBON MONOXIDE! Debris, snow, or any other foreign matter must never block the venting system. Inspect the venting system to ensure adequate ventilation exists at all times! Failure to ensure proper venting could result in carbon monoxide poisoning. Symptoms may include lethargy, grogginess, tiredness and or flue like symptoms.

- *The venting system for these heaters shall terminate at least six feet below, four feet horizontally from, or two feet above any door, window or gravity air inlet into any building.
- *Ensure through the wall vents for these heaters do not terminate over public walkways or over an area that condensate or vapor could create a nuisance or hazard or detrimental disturbance to the operation of

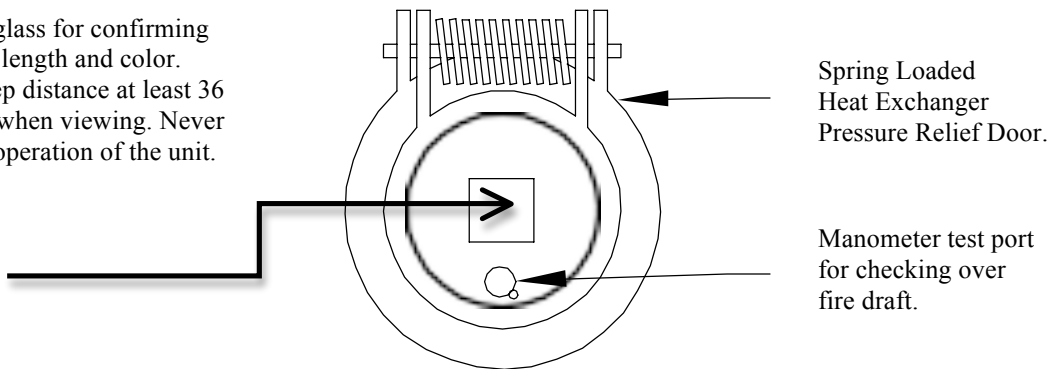
regulators, relief valves, electric meters or any other equipment. Minimum horizontal distance to be 6 feet.

WARNING: Never open spring-loaded pressure relief door while unit is operating. Under certain circumstances, such as a surge in gas pressure, the door may open abruptly to relieve pressure in the heat exchanger. There is a view port in the door for visual inspection of the flame, do not get closer to the door than 36 inches when the unit is under operation.

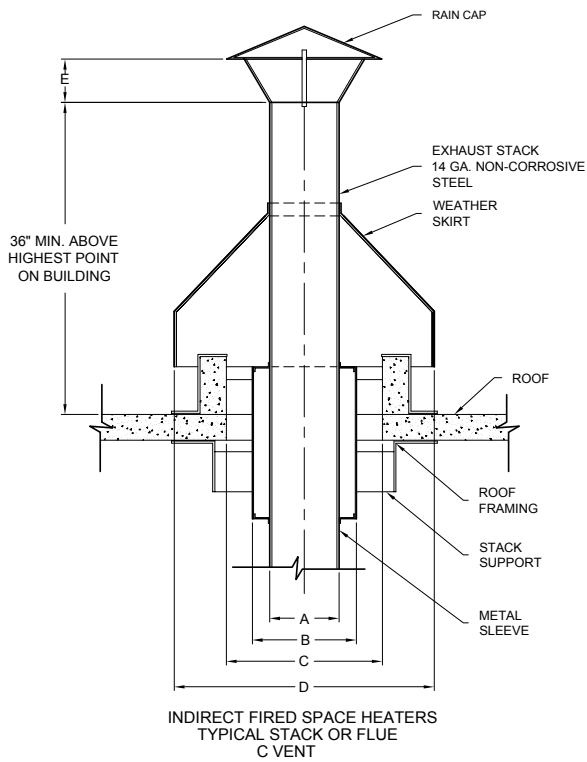
- 1) **FOR POWER VENTED UNITS:** The heat exchanger over fire draft should be adjusted at the damper of the induced draft fan when the unit is operating on high fire. The over fire draft measured with a manometer at the test port in the relief door should be minus 0.01 to minus 0.50 in w.c., while the unit is running at high fire as specified on the rating plate of the unit. Refer to section on setting the burner manifold pressure on page 20-22 of this manual.
- 2) **FOR GRAVITY VENTED UNITS:** The heat exchanger over fire draft should be adjusted at the damper of the burner fan when the unit is operating at high fire. The over fire draft measured with a manometer at the test port in the relief door should be positive 0.01 to positive 1.0 in w.c., while the unit is running at high fire as specified on the rating plate. Refer to section on setting the burner manifold pressure on page 20-22 of this manual.

Caution: Only trained service technicians are allowed to adjust and handle this equipment. Always use instruments to ensure proper flame. In addition to visually inspecting the flame a combustion analyzer must be used to verify carbon monoxide levels, as well as carbon dioxide, oxygen levels and temperature of flue venting.

Visual sight glass for confirming proper flame length and color.
Warning: keep distance at least 36 inches away when viewing. Never open during operation of the unit.



Note: The Vent pipe diameter must be as shown in specification chart shown in figure II & III on the following page. An adaptor from induced draft fan housing to vent pipe on indoor units must be field supplied.

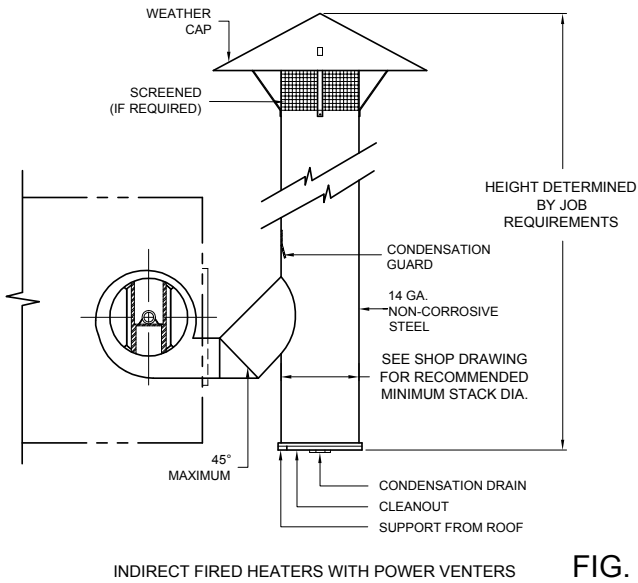


MODEL	STACK SIZE	A	B	C	D	E
25-75	8"Ø	8	12	18	30	5
85-100	10"Ø	10	14	20	32	5
125-175	12"Ø	12	16	22	34	6
200-250	14"Ø	14	20	24	36	8
275-400	16"Ø	16	24	28	38	10
500-600	18"Ø	18	26	32	42	12

NOTES:

1. REFER TO ENGINEERING RATING FOR MINIMUM RECOMMENDED STACK SIZES. (FORM GIDM-S100) FOR POWER VENTERS.
2. DIMENSIONS B, C & D SUBJECT TO LOCAL CODE REQUIREMENTS. CONSULT LOCAL AUTHORITIES HAVING JURISDICTION BEFORE INSTALLATIONS ARE MADE.

FIG. II



MODEL	STACK SIZE	MAX. L&H	
25-75	8"Ø	100"	0.11" P.D.
85-100	10"Ø	125"	0.10" P.D.
125-175	12"Ø	125"	0.10" P.D.
200-250	14"Ø	135"	0.10" P.D.
275-400	16"Ø	100"	0.11" P.D.
500-600	18"Ø	125"	0.11" P.D.

NOTE:

RECOMMENDATIONS ONLY, AUTHORITIES HAVING JURISDICTION SHOULD BE CONSULTED BEFORE INSTALLATION ARE MADE.

FIG. III

Rev	By	Revision Description	Date	TITLE			
				INDIRECT FIRED SPACE HEATERS			
PCD SERIES				DRAWN BY	ISSUED BY	SCALE	DRW. NO.
				JV		1:1	FIG. II & FIG. III
				CHK. BY	DATE	JOB NO.	REV
					MAY 19/98		-

ELECTRICAL CONNECTIONS

Warning: Open all disconnects switches and ensure power to unit is off before wiring unit. Failure to ensure power is cut off to unit may result in personal injury or death from electrical shock.

All electrical connections must conform to the current edition of: ANSI/NFPA No. 70 National Electrical Code and applicable state and local codes. When installed the appliance must be electrically grounded in accordance with local codes or in the absence of local codes, with the National Electrical Code, ANSI/NFPA 70, and/or the Canadian Electrical Code, CSA C22.1.

For Canadian installations: **NOTE:** This unit has been examined and tested for compliance with CSA C22.2 No. 0 and CSA C22.2 No. 3. All electrical work must conform to the requirements of the current CSA standard C22.1 Canadian Electric Code Part 1 and local ordinances.

Carefully check the unit rating plate to confirm supply voltage prior to connecting. Control voltage is as indicated on the rating plate.

Follow the “as built” wiring diagram supplied with the unit. This type of unit is available with a variety of fuel control schemes. Please ensure that you are using the correct wiring diagram for installation or troubleshooting. If any of the original wire as supplied with the unit must be replaced, it must be replaced with type TEW 105 Degrees Celsius or its equivalent except where noted. **NOTE:** Because bolts and setscrews may become loose during unit shipment, such fasteners should be tightened upon installation.

If a space thermostat is used with the furnace, locate the thermostat so that cold drafts and hot discharge air streams do not affect its performance. Do not mount the thermostat on the casing on the unit, as it will be affected by radiated and conducted heat. Refer to the instructions furnished with the thermostat for further details.

Temperature controllers, limit controllers, remote selector switches, door switches or any other auxiliary electrical items must be connected to the terminals provided and shown on the wiring diagram. The installation is to be adjusted to obtain a temperature rise within the range specified on the unit heater rating plate.

For units shipped in two or more sections, electrical connections between sections are to be made by installer in the field.

Field wiring to be done by the installer is denoted by dotted lines on the wiring diagram. Solid lines on the wiring diagram indicate factory wiring by the manufacturer.

NOTE: If the optional low temperature limit was not furnished with the heater, a low temperature limit control should be installed by the installing contractor in regions where freeze protection is needed in the event of burner shutdown. The low temperature limit should be set @ 45 Deg F and the bypass timer @ 3 minutes.

NOTE: For furnace only sections, it is the responsibility of the installing contractor to ensure the furnace is interlocked to a blower, and that proper design airflow is circulating prior to energizing burner section. When equipment is furnished with direct digital control (DDC) interface it is the responsibility of the installing contractor and control contractor to provide interlock and ensure proper airflow is present to operate burner. Additionally, that the burner is never operated outside of design operating temperature parameters.

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

GAS PIPING

All gas piping must be in accordance with the requirements outlined in the National Fuel Gas Code –ANSI Z223.1 and the regulations of local authorities having jurisdiction. It is necessary to have a ground union installed next to the unit manifold for easy servicing. A drip leg and filter should be provided upstream of the unit's inlet gas connection. An additional shut-off must be located external to the unit's enclosure when required by local code.

For Canadian Units: All gas piping should be in accordance with CAN/CSA/1-B149 and the regulations of local authorities having jurisdiction. Emergency manual shut down valve should be provided upstream of piping to unit and should be labeled for quick identification. Color-coding of gas piping is also recommended.

Warning: To avoid damage or potential personal injury, do not connect gas piping to this unit until a supply line pressure test has been conducted. Connecting the unit prior to leak test may damage the unit gas valve and/or regulator and result in a fire hazard.

Carefully check the unit rating plate for fuel type and supply pressure.

- *The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of the system at pressures in excess of ½ psi (3.5 kPa). The appliance must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply system at test pressures equal to or less than ½ psi (3.5 kPa).
- *A minimum 1/8 inch NPT plugged tapping, accessible for test gauge connection, must be installed immediately upstream of the gas supply connection to the appliance.
- *Locate the high-pressure regulator, if required, at least five feet from the unit.
- *Gas lines must not be located in such a way as to hinder access to the unit
- *A tee shall be installed in the supply line at the same elevation as the gas inlet connection. The tee must be equipped with a nipple and pipe cap to serve as a condensate collector.
- *Test for tightness of gas connections after installation. The safety check valves shall be leaked tested at least once a year as described in the Initial Start up and Adjustment section on Page 19 of this manual.
- *The gas line pressure must be as shown on unit rating plate when unit is operating at full input.

GAS VENTS

High gas pressure regulator (if required), low pressure regulator, pilot pressure regulator, gas pressure switch (if supplied), and normally open vent valve (if supplied) must be vented outside of building for an indoor unit. (Check with authorities having jurisdiction). Periodic cleaning of the screens for the vent terminals must be conducted.

GENERAL OPERATING INSTRUCTIONS

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

GAS-FIRED UNITS

Refer to the rating plate for fuel input and supply pressures.

DO NOT ATTEMPT TO START THE BURNER IF THE UNIT IS FULL OF VAPOR OR GAS, OR IF THE COMBUSTION CHAMBER IS VERY HOT.

DO NOT USE THIS UNIT TO BURN GARBAGE OR PAPER.

DO NOT LEAVE COMBUSTIBLE MATERIALS NEAR THE UNIT.

SHUT OFF THE MANUAL FUEL SUPPLY VALVE IF THE BURNER IS SHUT DOWN FOR AN EXTENDED PERIOD OF TIME.

ENSURE CLEAN-OUT DOORS ARE IN PLACE BEFORE STARTING THE BURNER.

DO NOT START THE BURNER UNLESS THE BLOWER ACCESS DOORS ARE SECURELY IN PLACE.

START-UP PROCEDURES

PRECAUTIONS

1. Ensure the main disconnect switch is in the “off” position.
2. Ensure the burner on-off switch is in the “off” position.
3. Check all electrical connections and tighten if necessary.
4. Check main fans (by rotating fan shaft by hand), bearing setscrews, exhauster wheel, and pulley set screws.
5. Lubricate (if necessary) the burner, induced draft fan and main fan motors. The specifications on the motors for grease and oil shall be adhered to.
6. Check heater outlets and exhauster, or induced draft discharge for obstructions.
7. Check fan-limit control. Setting should be as follows:

MODEL	CONFIGURATION	MAIN		AUXILIARY	
		LIMIT	FAN*	LIMIT	FAN*
C	Horizontal Suspended	200	120	NA	NA
D	Vertical Upflow Floor set	180	80	NA	NA
R	Vertical Down flow Floor set	180	80	165	100
M	Horizontal Floor set	200	120	NA	NA
AEB	Vertical Upflow Floor set	180	80	NA	NA

*Fan “ON” settings, set differential for Fan “OFF” 15-20 degrees below fan setting.

8. Ensure that the flue is in place and providing proper over fire draft as noted in previous section on “Connecting the Flue”.
9. The induced draft-proving switch (power vented units only) is factory set and must not be tampered with. This switch will not allow unit operation if over fire draft is outside of the acceptable operating range.
10. Check all fuse blocks to determine that all fusing is installed.
11. Set the operating controls (eg. thermostat, remote panel switches) so as to allow heating operation of the unit when the burner section is powered up in initial start –up and adjustment section on page 19 of this manual. Note: At this time keep the burner section on/off switch off, so the burner is still locked out.

12. Reset the primary flame safeguard by pushing the reset button or lever.
13. Reset motor starter by pushing the reset button, if so equipped.
14. Check building system gas supply and be sure all lines are purged of air.
15. Check building system gas supply pressure.
CAUTION - GAS UNITS
At maximum input the gas pressure must fall within the range specified on the unit rating plate.
Optional high and low gas pressure switches (if supplied) must be reset.
16. Check all piping for tightness and correct any signs of leaks.

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

START-UP

1. Refer to factory test report for correct settings that are to be checked on the unit.
2. Check the supply fan motor thermal overload setting against the rating plate figure.
3. **Ensure burner on-off switch is “off”.** (On heating units using a fan plenum switch, jumper the fan switch).
4. Put the main disconnect switch in the “on” position, thus activating the supply fan. Check for correct direction of rotation.
5. Check supply fan motor load against rating plate figure. If actual figure is significantly different than the rating plate value, take corrective actions with respect to duct work and accessories external to the unit
6. The thermal overloads must be left set appropriate to the motor performance after all adjustments have been made.
7. Repeat steps 2 through 6 for the induced draft fan motor (power vented units only).
8. Remove jumper from fan switch if installed in step 4 above.

FOR INITIAL START-UP & ADJUSTMENT REFER TO PAGE 19 to 21 OF THIS MANUAL BEFORE PROCEEDING WITH START UP OF BURNER SECTION.

9. Ensure all manual fuel valves are open.
10. Turn on-off switch on burner to “on” position.
11. Check direction of rotation of burner fan.
12. Set thermostat to temperature desired.
13. After a pre-purge period (30 seconds high purge units or up to 90 seconds on fixed low purge units) the pilot will light and main burner will energize. Check for good clean flame and smooth light-off conditions.
14. Check unit performance as described on the factory test report. (Include items such as stack temperature, CO-2 level, flame signals, etc.). Readings obtained in the field should not deviate significantly from those obtained at the factory.

SHUT DOWN

EMERGENCY SHUT DOWN

1. Set disconnect switch to “off” position.
2. Close the manual main fuel valve.
3. Set the burner on-off switch to “off” position.

SERVICE SHUT DOWN

1. Set the burner toggle switch to “off” position.
2. Close the manual main fuel valve.
3. Set the operating controls (eg. thermostat, remote panel switches) so as to prevent heating operation.

TROUBLE SHOOTING GUIDE

WARNING: Fire or explosion hazard can cause property damage, severe injury, or death. Check for gas leaks with rich soap and water solution or electronic gas detector any time that work is done on a gas line. NEVER use an open flame to detect gas leaks.

The equipment has been electrically and fire tested prior to shipment. However, during transit, miss adjustment of controls and loose wires could develop. Do not assume a control is defective until it and its associated wiring is checked.

This equipment has many items supplied to us by outside vendors. This manual is accompanied by information sheets on most of the major items which should be referred to for detailed service information.

The following is an obvious list of items that could cause field problems; however, it does not cover all problems encountered and is meant to be used as a guide only.

1. EXHAUSTER* AND/OR BURNER MOTORS FAIL TO RUN. CONTROL RELAY DOES NOT FUNCTION.
 - A) Blown fuses, or circuit breaker tripped. Main disconnect is open.
 - B) Control relay off on flame failure. Push reset button on control.
 - C) Thermostat or duct stat not calling for start-up. Defective control.
 - D) Loose wire or low voltage.
 - E) Motor overcurrent protector tripped in open position or defective.
 - F) Controls in limit circuit defective or tripped in open position.
 - G) Control transformer defective.
2. EXHAUSTER* AND/OR BURNER MOTORS RUN, NO IGNITION OR MAIN FLAME. PRIMARY RELAY WILL NOT INDICATE FLAME FAILURE.
 - A) Exhauster* and/or burner motors running backwards.
 - B) Misadjusted draft.
 - C) Misadjusted or defective exhauster draft switch*.
 - D) Main safety gas valve proof of closure switch and/or low fire proving switch (on modulating burners only) not made.
 - E) High or low gas pressure switch tripped.
3. EXHAUSTER* AND/OR BURNER MOTORS RUN, NO IGNITION OR MAIN FLAME. PRIMARY RELAY LOCKS OUT ON FLAME FAILURE.

- A) Fuel valve manually closed.
- B) Ignition transformer or pilot defective. Defective or improperly gapped ignition electrodes. Cracked porcelain.
- C) Broken or loose wire in fuel circuit.
- D) Gas nozzles obstructed or plugged.
- E) Gas pilot valve defective. Main fuel valve defective.
- F) Insufficient fuel at supply. Air in system.

4. BURNER SHORT CYCLES.

- A) High limit switch misadjusted or defective.
- B) Draft switch* misadjusted or defective.
- C) Various duct stats defective or settings improper.

5. EXHAUSTER* AND/OR BURNER MOTORS RUN, IGNITION AND MAIN FLAME. MAIN FAN MOTOR FAILS TO OPERATE.

- A) Automatic fan switch not set properly or defective.
- B) Blown fan fuses.
- C) Motor overcurrent protector tripped open or defective.

6. UNABLE TO ADJUST FIRE TO BURN CLEANLY.

- A) Insufficient exhauster* draft.
- B) Insufficient or too much fuel at supply.
- C) Incorrect adjustment of air shutters at burner.
- D) Insufficient combustion air available.
- E) Burner blower wheel running backwards.

7. INSUFFICIENT HEAT BEING DISCHARGED INTO AREA.

- A) Main fan blowers running backwards.
- B) High limit switch setting too low or defective.
- C) Burner locked in low fire position.
- D) Duct stat setting improper or defective.
- E) Field mounted thermostat and/or duct stats improperly wired.

*APPLIES TO POWER VENTED UNIT ONLY.

MAINTENANCE

Regular maintenance is necessary to ensure the efficient operation and long life of this unit. This maintenance should be performed by, or supervised by, qualified service personnel. A maintenance schedule should be prepared for the unit based on its application and location.

RECOMMENDED MONTHLY MAINTENANCE

1. Check for loose connections in the wiring.
2. Check the voltage at the unit while it is in operation.
3. Check motor amperage draws against rating plate values.
4. Inspect all contactors to ensure that they are clean and making good contact.
5. Check all fittings, valves and lines for leaks.
6. Check the burner; clean and adjust if necessary.
7. Check the flame sensor; clean if necessary.
8. Check the fuel supply pressure to the unit.
9. On gas fired units, check the manifold pressure.
10. Clean or replace air filters if necessary. Replace filters only with type equivalent to those supplied with the unit by the factory.
11. Check all damper, linkages and damper actuators; adjust and tighten as required.
12. Check all belts; adjust or replace as necessary.
13. Check operation of all safety controls.

RECOMMENDED YEARLY MAINTENANCE

1. Perform the monthly maintenance recommended.
2. Inspect blower wheels and housing; clean if necessary.
3. Inspect all set screws on blower wheels and pulleys to ensure that they are secured to their respective shafts.
4. Check ignition spark and adjust gap if necessary.
5. Inspect and clean ignition electrodes and pilot assembly.
6. Check flame supervisor relay.
7. Inspect all operating and safety controls; clean and replace if necessary.
8. Inspect the header box and secondary tubes through the access panels provided. Check for carbon deposits, soot, scale, or rust; clean as required. Check condition of flue pipe.
9. Clean the primary combustion chamber.
10. Check the unit vent pipe and flue termination to ensure unblocked and clean as necessary.
11. Clean the burner and clean off the combustion wheel of any dust or debris.

NOTE: Refer to manufacturer literature provided for maintenance requirements of optional equipment.

BEARING INSTALLATION AND MAINTENANCE

NOTE: To prevent premature failure – please ensure greasing instructions below are applied. As well, tighten bearing set screws, collars, and wheel lugs every four to six months.

ENGINEERING – BALL & ROLLER BEARINGS LUBRICATION

For bearings that are equipped with a hydraulic grease fitting threaded into the housing for ease of lubrication, the proper amount of lubricant in the bearing is important. Both excessive and inadequate lubrication may cause failure. The bearings should be re-lubricated while they are rotating (if it is safe to do so, only a qualified service technician should perform this task); the grease should be pumped in slowly until a slight bead forms around the seals. The bead in addition to acting as an indicator of adequate re-lubrication provides additional protection against the entry of foreign matter and helps flush out contaminants in the bearing.

By the time the slight bead is formed, it will be noticed that the bearing temperature will rise. It is not uncommon for the temperature to rise as much as 30 degrees Fahrenheit after re-lubrication. If necessary to re-lubricate while the bearing is idle, refer to the recommended re-lubrication grease chart tables on the following page for various sizes of the bearings.

Lubricant-Standard Bearings:

All bearing units are pre-lubricated at the factory with a lithium soap grease, which is compatible with multi-purpose grease readily available from local suppliers. The lubricant selected for factory lubrication uses a highly refined mineral oil with a high viscosity index, thickened with lithium soap to conform to NLGI grade 2 consistency. A suitable additive package is added to protect the highly polished rolling contact surfaces from corrosion and oxidation of the lubricant. The lubricant is satisfactory for an operating temperature range of –30 F to +250 F.

Select standard industrial grade greases that conform to the following specification for optimum bearing performance:

General Duty Ball & Roller;
58-75 SUS @ 210 F
450-750 SUS @ 100 F

Premium Duty Ball & Roller;
68-75 SUS @ 210 F
600-750 SUS @ 100 F

Heavy Duty Roller Bearing;
82 SUS @ 210 F
886 SUS @ 100 F

NOTE: For heavy loaded roller bearing applications, grease with EP additives are often recommended for optimum performance.

Table 1. Recommended Lubrication

Ball Bearings		Roller Bearings	
Shaft Size (inches)	Grease Charge (ounces)	Shaft Size (inches)	Grease Charge (ounces)
1/4 to 3/16	0.03	1-3/16 to 1-1/4	0.1
1/2 to 3/4	0.1	1-3/8 to 1-7/16	0.22
1-1/4 to 1-1/2	0.15	1-1/2 to 1-11/16	0.32
1-11/16 to 1-15/16	0.2	1-3/4 to 2	0.5
2 to 2-7/16	0.3	2 to 2-3/16	0.55
2-1/2 to 2-15/16	0.5	2-1/4 to 2-1/2	0.65
3 to 3-7/16	0.85	2-11/16 to 3	0.85
3-1/2 to 4	1.5	3-3/16 to 3-1/2	1.25
-	-	3-15/16 to 4	2.5
-	-	4-7/16 to 4-1/2	3.1

Frequency of re-lubrication depends upon operating conditions. The bearing operating temperature is the best index for determining a re-lubrication schedule. The following chart gives the frequency of re-lubrication based upon continuous operation for various operating temperatures and can be used as a satisfactory guide for determining when bearings should be re-lubricated.

Table 2. Lubrication Frequency

Speed	Temperature	Cleanliness	Greasing Interval
100 RPM	Up to 120 F	Clean	5 months
500 RPM	Up to 130 F	Clean	2 months
1000 RPM	Up to 210 F	Clean	2 weeks
1500 RPM	Over 150 F	Clean	Weekly
Any speed	Up to 150 F	Dirty	1 week to 1 month
Any speed	Over 150 F	Dirty	Daily to 1 week
Any speed	Any temperature	Very dirty	Daily to 1 week
Any speed	Any temperature	Extreme conditions	Daily to 1 week

TENSIONING V-BELT DRIVES

1. Ideal tension is the lowest tension at which the belt will not slip under peak load conditions.
2. Check tension frequently during the first 24-48 hours of operation.
3. Over-tensioning shortens the belt and bearing life.
4. Keep belts free from foreign material that may cause slip.
5. Make V-drive inspection on a periodic basis. Tension when slipping. Never apply belt dressing as this will damage the belt and cause early failure.

Check and tighten belt tension. The following procedure is recommended for tightening belts:

- a) Measure span "X" shown in Figure A.
- b) At the center of span length "X", apply a force perpendicular to the span and large enough to deflect belt 1/64" for each inch of span length. Example- the required deflection for a 40" span would be 40/64" or 5/8".

- c) Compare the force applied with the values given in Table III. If force is between the minimum and maximum range shown, the drive tension should be satisfactory. A force below the minimum value indicates an under tightened belt and force that exceeds the maximum value indicates an over tightened belt.

FIGURE A

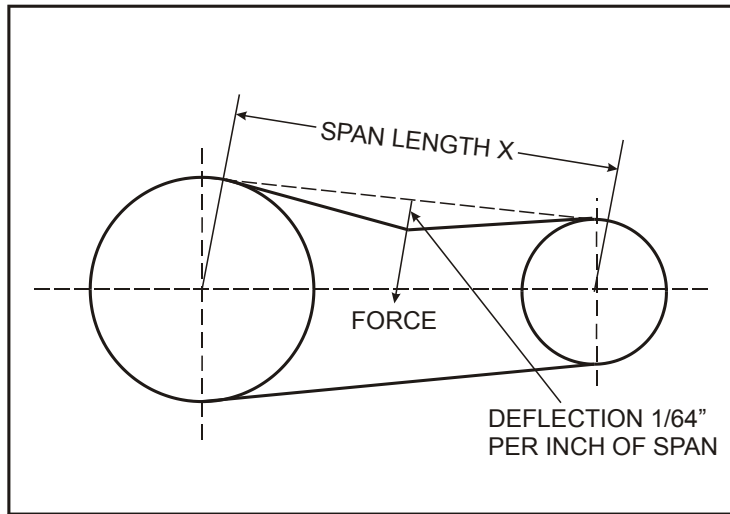
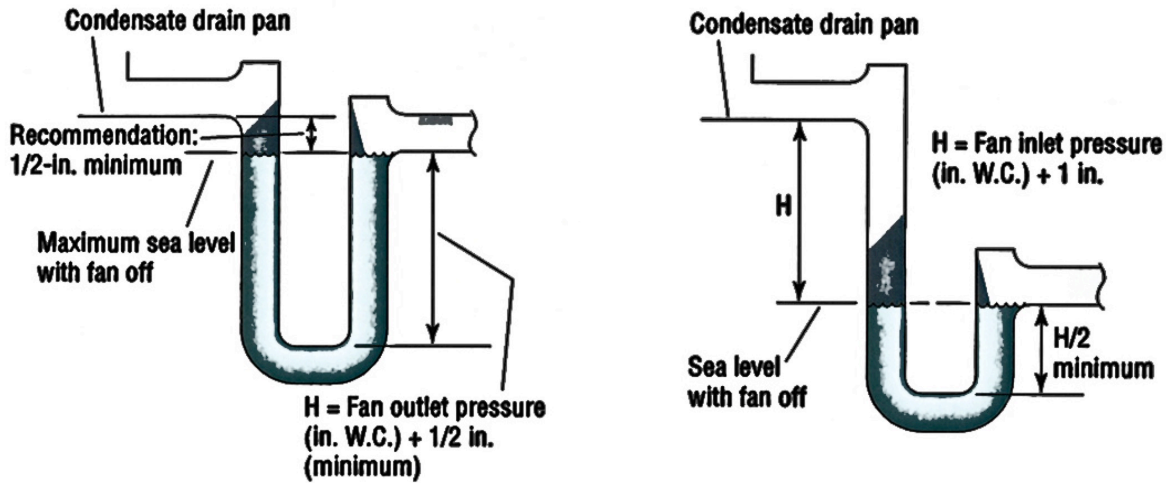


TABLE III

BELT CROSS SECTION (Marked on Belt)	MOTOR PULLEY PITCH DIAMETER	DEFLECTION FORCE	
		MINIMUM	MAXIMUM
A	3.0" - 3.6"	2.62lbs.	3.25lbs.
	3.8" - 4.8"	3.0lbs.	4.0lbs.
	5.0" - 7.0'	3.25lbs.	5.0lbs.
B	3.4" - 4.2"	3.0lbs.	5.0lbs.
	4.4" - 5.6'	4.0lbs.	5.87lbs.
	5.8" - 8.6"	5.25lbs.	7.87lbs.

DRAINS AND TRAPS

CHILLED WATER AND DIRECT EXPANSION COOLING COILS



Blow through coil arrangement

Draw through coil arrangement

Some units are equipped with cooling coils and have condensate drain connections. Coils may be supplied before or after the heat exchanger depending on the application. When the coil is supplied after the heat exchanger the arrangement is a blow through type. If the cooling coil is upstream of the blower it is a draw through arrangement. Make sure the proper type and size of condensate P-trap is installed, otherwise unit may leak condensate out of the casings. On start-up it may be necessary to prime the P-trap manually after the unit is operating properly a small amount of water will be held in the trap and prevent air from bypassing the trap and preventing it from working properly.

A chilled water coil must be drained before freezing conditions are present. The cooling coil drain pans and condensate lines must also be thoroughly drained to prevent freezing of the pipes. The cooling coil collects dirt over the months and years of service. A Clean filter prevents the cooling coil from soiling quickly. In time, however, the cooling coil will still collect dirt. This dirt reduces airflow and insulates the coil reducing its ability to absorb heat. To avoid this problem, check your cooling coil every year and clean as necessary. Occasionally pass a stiff wire brush through the unit's drain connection and clean out the P-trap. Periodically the cooling coil, drain pan and condensate drain line need to be cleaned to prevent microbiological growth. The coil should be professionally inspected, cleaned and disinfected yearly.

HEAT EXCHANGER CONDENSATE LINES

On some furnace models, when high turndown modulating burners are provided, the heat exchanger and exhauster may have condensate drains provided. Condensate from the heat exchanger is acidic and may contain chemical compounds requiring special drainage. Typically the condensate drain is composed of PVC or steel pipe. The drain must be installed in accordance with all plumbing codes. When a condensate neutralizer is used, the overflow shall be provided such that the condensate will be directed to the drain in the event that the neutralizer becomes plugged. Indoor units typically require a condensate trap to be installed to prevent combustion gases from entering the space. Outdoor units may require installing heat trace or special attention to drains to prevent freezing and clogging up of the drain line. Avoid long runs of drain piping, always slope piping down a minimum of 1/8 of an inch per foot in the direction of the flow.

Power Flame JR and CR Burners and GP Combustion C Burners.

INITIAL START UP AND ADJUSTMENT

CAUTION: Only qualified service personnel should attempt initial start-up.

1. Study these instructions, the wiring diagrams and flame safeguard instructions. Locate and identify all of the burner components.
2. Have on hand: CO and CO₂ tester, stack thermometer, 0" to 30" W.C. gas pressure gauge, U-Tube manometer and DC volt meter.
3. Make the proper setting on all limit controls and set the operating control to call for heat. Make sure burner power switch is off and manual main and pilot valves are closed.
4. Check the piping for leaks. Check gas tightness of main and pilot safety shut off valves by connecting a pressure gauge to the pressure tap located between the safety shut-off valve and the test firing valve. When the test firing valves are closed and the manual shut-off valves are opened, no pressure rise should show on the pressure gauge. Additionally another check is to turn off main shut-off valve and pilot valve (refer to as built manifold diagram), then turn on the gas pressure to the gas supply line and observe the meter test dial. There should be no movement of the dial hand for at least five minutes on a half-foot dial (proportionally longer on larger dials). All other gas appliances must, of course, be completely shut off during this test. If a leak is detected it should be located with a soap suds test and corrected. If air or inert gas (do not use oxygen) under pressure is used for leak detection, do not subject the main and pilot valves or regulators to pressure readings exceeding ½ PSI (disconnect piping to prevent damage during high pressure leak testing).
5. Purge the gas supply line up to the main and pilot manual valves. **DO NOT** purge into the combustion chamber.
6. **Make sure that the MAIN and PILOT MANUAL gas valves are closed and that the burner line switch is off. (refer to as built manifold piping diagram and unit control diagram).**
7. The pilot gas pressure regulator is set for 3 ½ " W.C. outlet pressure which is suitable for natural gas and average draft conditions. If propane gas is to be used, adjust the regulator to its minimum outlet pressure setting.
8. Firmly push in the flame safeguard manual reset button (refer to as built control wiring diagram) and the **Power Flame** motor manual overload reset.
9. Check that all blower motors are rotating freely.
10. Turn line switch on momentarily and check for proper blower wheel rotation. Check for proper rotation of all blowers including burner, exhauster (if equipped) and main supply blower. Re-confirm that the pilot and main automatic shutoff valves are closed at this time.
11. Open pilot manual valve, **keep the main manual test-firing valve closed at this time.** (refer to as built manifold diagram).
12. Trial for pilot ignition. Turn switch to winter operation. If power vented, burner will be powered when air switch contacts close. Flame safeguard is powered, motor relay (refer to control wiring diagram) pulls in. As motor reaches operating speed, the blower interlock switch "makes" to initiate a pre purge period as factory set on the flame safeguard system. After pre purge the load relay (refer to control wiring diagram) pulls in to energize the pilot solenoid and ignition transformer and the pilot should light. Observe the ignition spark for proper location and firmness.
13. If the pilot fails to light during the 10 second trial, it is probably due to air in the pilot line. Wait one minute and push flame safeguard reset button to restart, (Power Flame burner motor will stop approximately 15 seconds after solenoid valve closes).
14. Observe the pilot flame. If it is weak, screw in the pilot regulator adjustment. If it is excessively rich and large or floating from the pilot tip, back off the regulator adjustment. Set the pilot to a stable blue flame which burns firmly within the pilot tip. Check flame current with a DC volt meter. It should show a steady 15-17 volts (Fireye) or 3-5 VDC (Honeywell). Operate air shutter throughout range to check pilot stability. Adjust pilot regulator slowly to obtain highest reading possible, try several relights. Once the pilot flame is established and registered by the flame safeguard relay the main gas automatic valves will open. At this time confirm proper flame safeguard lockout function. Close the pilot manual valve and unit should turn off on flame failure and will lock out after approximately 10 seconds. If the unit shuts off properly, restart the flame safeguard system with the pilot manual valve open and after timed pre purge reestablish pilot flame. Repeat the ignition cycle a few times to ensure a fast ignition and stable pilot flame.
15. Set the shutter to match the intended input, i.e. full open for maximum, closed for minimum or partially open for mid-range.

16. **Slowly open main manual valve** until the main flame ignites. Set the high/low limit switch and the modulating controller so that after establishing a main flame, the burner will travel to high fire. Continue to open valve, adjusting air shutter if necessary, if the manual valve is fully opened before input is reached, screw in regulator adjustment. Set regulator to desired manifold pressure, marked on the rating plate.

NOTE: Do not screw the adjusting nut in past the point where no further increase in manifold pressure is noted. If the specified pressure cannot be reached, check for proper inlet pressure at the inlet of the main manual valve with the burner running.

Take a gas combustion analyzer reading and readjust manifold gas pressure if necessary. Take a CO₂ or O₂ and a CO reading. CO₂ should be between 8-1/2 and 9-1/2 % and O₂ should not be more than 5%, both with a maximum CO reading of .04%. Readjust air damper accordingly.

17. The air damper has been factory set approximately during factory test firing, if need to adjust see linkage set up sheet provided on page 23 & 24 of this manual. Readjust the air damper if main flame is to lean or too rich. Re-adjust the main air shutter to provide a quiet soft flame-blue at the burner nozzle with well defined orange tips for natural gas or with well defined yellow tips for propane.
18. The primary air adjustment, which affects the flame length, has been set wide open for average conditions. Decrease the primary air if a longer, softer flame is desired. With high/low and modulating burners, mark the high air damper position and set the high/low limit control or modulating control so that the burner travels to low position. Visually adjust the input adjuster on the main gas shut-off valve actuator if low fire is too rich or too lean. Take gas meter reading and readjust the input adjuster according to the required low fire input, but not less than indicated in the specifications table. In order to keep the high fire setting unchanged when adjusting the low fire air damper position, drive the burner to high fire, change the positioning of the linkage as indicated in diagram for low fire adjustment, drive the burner back to low fire and check the CO₂ or O₂ readings. Repeat this procedure until a satisfactory setting is obtained.
19. Cycle the burner on and off several times to check its operation.
20. Check the operation of the limit and operating controls.
21. Check the flue gas temperature ahead of the diverter. It should be above 300°F. Excessive flue temperatures will result in low efficiencies. Low flue temperatures may cause excessive condensation. Reset gas input if necessary to adjust stack temperature.
22. Make the final setting of the air shutter by checking the flue gases with an "Orsat" or other similar combustion testing instrument. There should be no carbon monoxide and the carbon dioxide content should be within limits prescribed by the local gas company. Make sure that the main air shutter is locked securely in place.
23. Recheck pilot to make sure that its operation has not deteriorated because of main shutter adjustment. If necessary, readjust pressure regulator.
24. Modulation operation: see wiring diagram and modulating instruction sheets supplied with this unit for correct set up.
25. If linkage between butterfly valve and burner (gravity unit only) and venter fan if power vented needs to be adjusted from factory setting, (see below on Figure IV and V on page 23 & 24). Make sure all linkage connections are tight and check the readings in high and low fire again. The motor is allowed to over run with the spring linkage. Set the travel on the Johnson motor to ensure it does not go too far, or damage to the motor could occur. Reset controller and limits to their desired settings. Complete the burner safety check on Page 28 & 29 of this manual.

PCD LINKAGE SET-UP WITH POWER VENTS

1. Install a manometer on suction at test port in pressure relief door. Ensure there is a negative pressure at that point on low fire through to high fire. (- .50 to - .75" W.C.) low fire and (-.01 to -.10 on high fire).
2. On units equipped with high turndown and automatic exhaust adjustment (as shown on Figure IV page 24). To increase exhaust move drive rod toward damper pin (decrease the distance between drive rod and center pin). On standard units equipped with fixed exhaust, open the manual quadrant damper more to increase exhaust flow.
3. To increase combustion air move drive rod towards center pin (decrease the distance between drive rod and center pin).
4. To ensure a negative pressure throughout full modulation range, you may have to speed up exhaust flow and/or burner damper supply to match gas flow to the burner. Proper balance and timing of damper crankshafts is necessary to provide consistent flame combustion throughout stroke. Moving drive rod closer to the drive pin on the butterfly valve will reduce the movement of the burner damper.

5. Adjust low and high fire on the stop screws on the butterfly valve. Do not set low fire too low or condensate will form in the flue, unless high turndown furnace is provided and equipped with heat exchanger and exhauster condensate drain connections.

NOTE: The motor is allowed to over run with the spring linkage, set the travel on the Penn Johnson motor to ensure it does not go too far, or damage to the motor could occur.

MINIMUM EQUIPMENT TO START-UP AND SET-UP PCD GAS BURNER

1. CO and CO₂ tester.
2. Stack thermometer.
3. 0" to 10" W.C. gas pressure gauge or magnehelic 0" to 10" W.C.
4. U-tube manometer or -5" to +5" magnehelic gauge.
5. DC volt meter.

ADJUSTING BURNER FIRING RATE

FOR GRAVITY VENTED UNITS (no induced draft blower).

Add manifold pressure and over fire draft reading at pressure relief door to obtain correct manifold pressure setting. For example if gas manifold pressure is 2.6 in w.c. and over fire draft is +0.35 in w.c. The correct total pressure at the gas manifold test port (actual firing rate as shown on the unit rating plate) would be 2.95 in w.c.

FOR POWER VENTED UNITS (with induced draft blower).

Subtract over fire draft from the manifold pressure reading to obtain the correct pressure reading. For example if manifold reading is 3.4 in w.c. and over fire draft is -0.1 in w.c. then the actual manifold pressure would be $3.4 + (-0.1) = 3.5$ in w.c. (actual firing rate as shown on the unit rating plate).

WARNING

DO NOT ADJUST FLAME VISIBLY. INSTRUMENTS ARE THE ONLY SAFE AND RELIABLE MEANS TO DETERMINE THE PROPER ADJUSTMENTS.

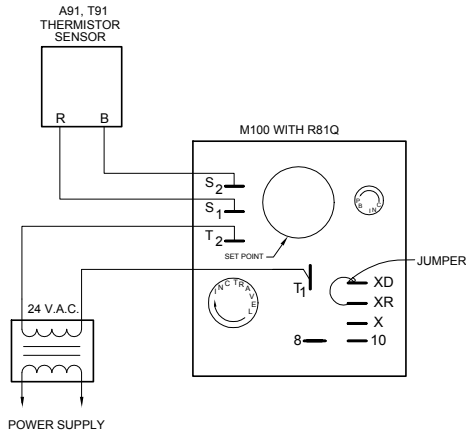


FIG. 4 - TYPICAL WIRING HOOKUP FOR THE R81QAA INSTALLED IN AN M100 SERIES MOTOR ACTUATOR.

PROPORTIONAL BAND

THE PROPORTIONAL BAND ADJUSTMENT, LOCATED ON THE TERMINAL BOARD, IS ADJUSTABLE BETWEEN 2 AND 30°F (1.1 TO 16.7°C). FIELD ADJUSTMENTS ARE MADE WITH THE SYSTEM IN OPERATION. TURN THE PROPORTIONAL BAND ADJUSTMENT UNTIL THE SYSTEM STABILIZES AND THE MOTOR ACTUATOR NO LONGER OSCILLATES.

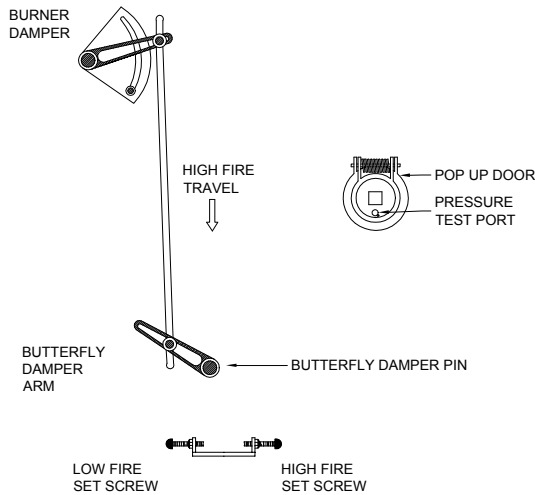
ADJUSTMENT

SET POINT

THE SET POINT FOR THE REMOTE SENSOR IS LOCATED ON THE R81'S TERMINAL BOARD AND HAS A CALIBRATED DIAL THAT IS ADJUSTABLE BETWEEN 40 AND 90°F (5 AND 30°C).

NOTE:

STANDARD PENN JOHNSON MODULATION SYSTEM WITH DISCHARGE AIR SENSOR AND SELECTION ON MOTOR ELECTRONIC BOARD.



PCD - LINKAGE SET-UP

LINKAGE OPERATION (GRAVITY VENT)

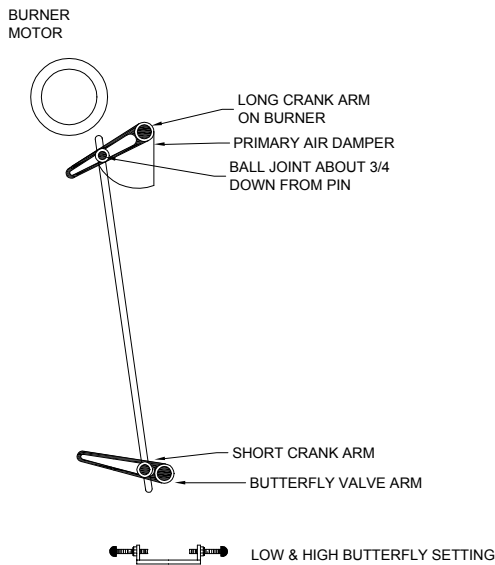
1. INSTALL A MANOMETER ON POSITIVE AT TEST PORT IN POP-UP DOOR.
 - A) INSURE THERE IS A PRESSURE AT THAT POINT ON LOW FIRE THROUGH TO HIGH FIRE. MAXIMUM 1.50" W.C.
2. TO INCREASE EXHAUST MOVE DRIVE ROD TOWARD DAMPER PIN (DECREASE THE DISTANCE BETWEEN DRIVE ROD AND CENTER PIN.)
3. TO INCREASE COMBUSTION AIR MOVE DRIVE ROD TOWARDS CENTER PIN (DECREASE THE DISTANCE BETWEEN DRIVE ROD AND CENTER PIN).
4. TO INSURE A POSITIVE PRESSURE THROUGHOUT FULL MODULATION RANGE, YOU MAY HAVE TO SPEED UP EXHAUST AND OR BURNER DAMPER TO MATCH GAS FLOW TO THE BURNER.

MOVE DRIVE ROD CLOSER TO THE DRIVE PIN ON THE BUTTERFLY VALVE. (THIS WILL REDUCE THE MOVEMENT OF THE BURNER DAMPER)
5. ADJUST LOW AND HIGH FIRE ON THE STOP SCREWS ON THE BUTTERFLY VALVE.

NOTE:

THE MOTOR IS ALLOWED TO OVER RUN WITH THE SPRINGS LINKAGE SET THE TRAVEL ON THE PENN JOHNSON MOTOR TO INSURE IT DOES NOT GO TO FAR OR DAMAGE TO THE MOTOR COULD OCCUR.

				TITLE PCD GRAVITY VENTED LINKAGE OPERATION			
Rev	By	Revision Description		Date			
PCD SERIES				DRAWN BY JV	ISSUED BY	SCALE 1:1	DRW. NO. FIG. V
				CHK. BY	DATE JULY 1/98	JOB NO.	REV -



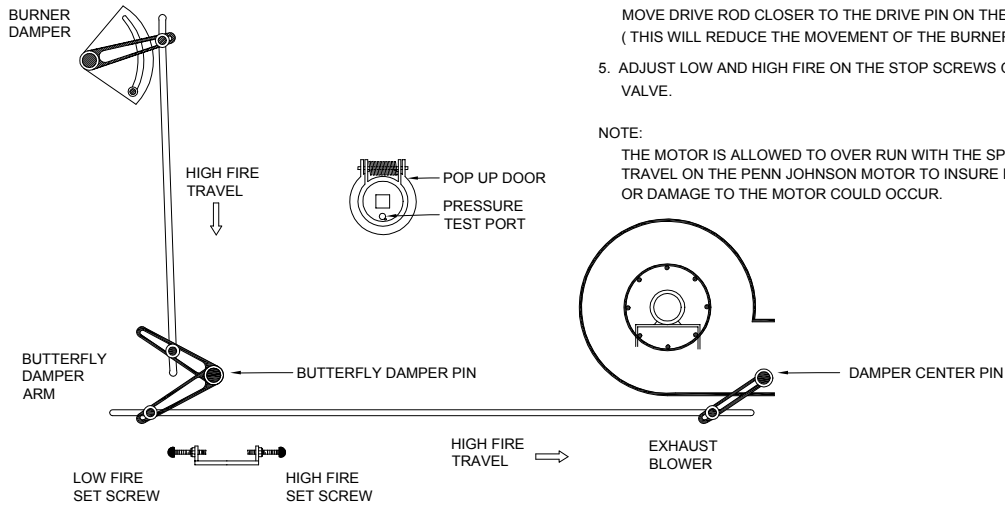
1. THE ABOVE SETTING IS IN LOW FIRE POSITION.
2. THE PRIMARY AIR ON BURNER TO BE ONLY 1/2-1 TURN OPEN AT SET SCREW.
3. TO DECREASE PRIMARY AIR ON HIGH FIRE MOVE BUTTERFLY CRANK ARM DOWN CLOSER TO HORIZONTAL POSITION.

LINKAGE OPERATION (POWER VENT)

1. INSTALL A MANOMETER ON SUCTION AT TEST PORT IN POP-UP DOOR.
 - A) INSURE THERE IS A NEGATIVE PRESSURE AT THAT POINT ON LOW FIRE THROUGH TO HIGH FIRE. -.50 TO -.75 W.C. LOW FIRE AND -.01 TO -.10 ON HIGH FIRE.
2. TO INCREASE EXHAUST MOVE DRIVE ROD TOWARD DAMPER PIN (DECREASE THE DISTANCE BETWEEN DRIVE ROD AND CENTER PIN.)
3. TO INCREASE COMBUSTION AIR MOVE DRIVE ROD TOWARDS CENTER PIN (DECREASE THE DISTANCE BETWEEN DRIVE ROD AND CENTER PIN).
4. TO INSURE A NEGATIVE PRESSURE THROUGHOUT FULL MODULATION RANGE, YOU MAY HAVE TO SPEED UP EXHAUST AND OR BURNER DAMPER TO MATCH GAS FLOW TO THE BURNER.

MOVE DRIVE ROD CLOSER TO THE DRIVE PIN ON THE BUTTERFLY VALVE. (THIS WILL REDUCE THE MOVEMENT OF THE BURNER DAMPER)
5. ADJUST LOW AND HIGH FIRE ON THE STOP SCREWS ON THE BUTTERFLY VALVE.

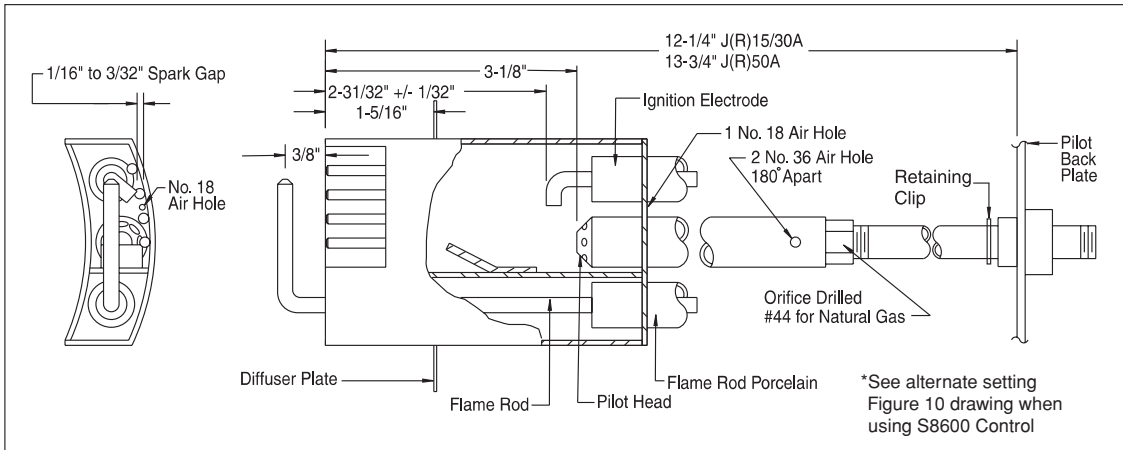
NOTE:
THE MOTOR IS ALLOWED TO OVER RUN WITH THE SPRINGS LINKAGE SET THE TRAVEL ON THE PENN JOHNSON MOTOR TO INSURE IT DOES NOT GO TO FAR OR DAMAGE TO THE MOTOR COULD OCCUR.



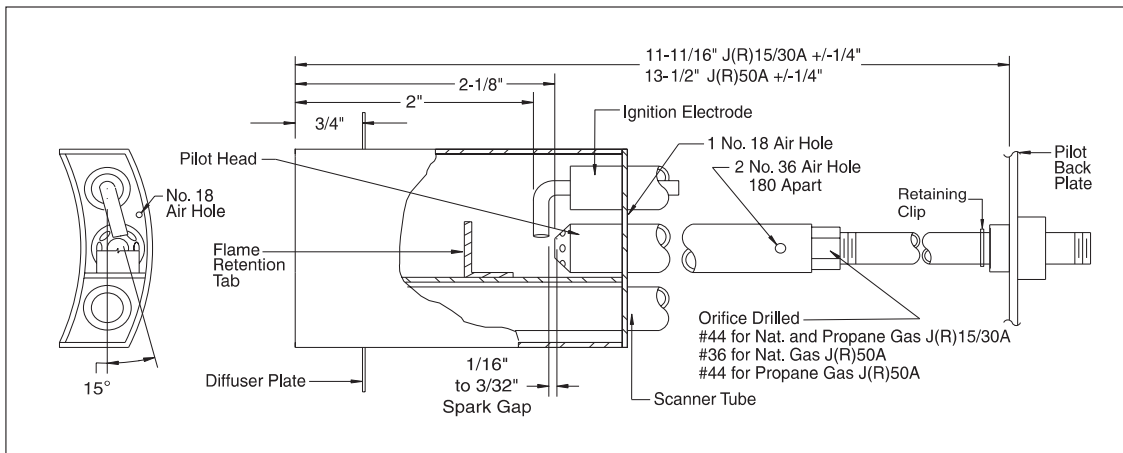
PCD - LINKAGE SET-UP WITH POWER VENT

				TITLE			
				PCD GRAVITY VENTED LINKAGE OPERATION AND POWER VENT LINKAGE SET-UP			
Rev	By	Revision Description	Date	DRAWN BY	ISSUED BY	SCALE	DRW. NO.
				JV		1:1	FIG. IV
PCD SERIES				CHK. BY	DATE	JOB NO.	REV
					JULY 1/98		-

Power Flame JR Pilot Assembly Flame Rod Type Natural Gas Only (Do Not use with Propane)

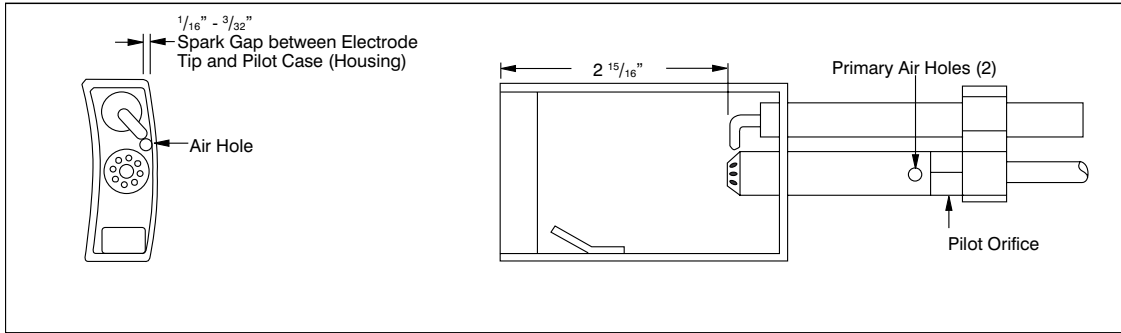


Power Flame JR Pilot Assembly UV Scanner Type (Natural Gas or Propane)

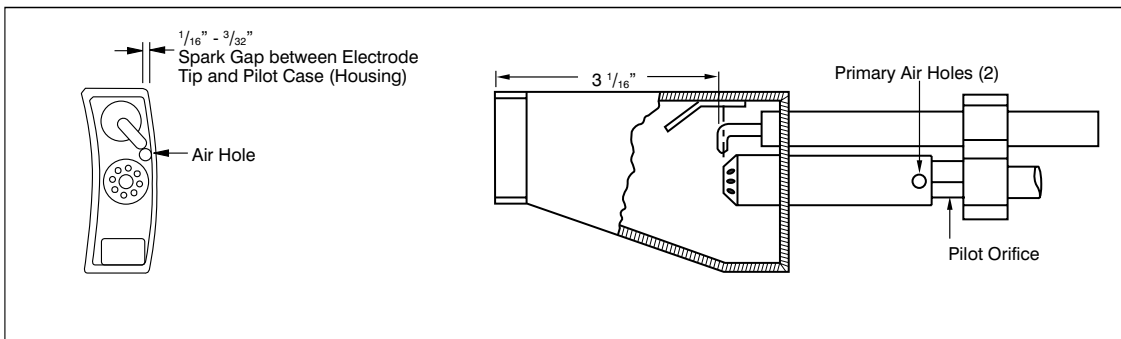


				TITLE			
				INDIRECT FIRED POWER FLAME			
				MODEL JR PILOT ASSEMBLY			
Rev	By	Revision Description	Date	PCD SERIES			
				DRAWN BY	ISSUED BY	SCALE	DRW. NO.
				JV		1:1	FIG.VI
				CHK. BY	DATE	JOB NO.	REV
					MAY 19/98		-

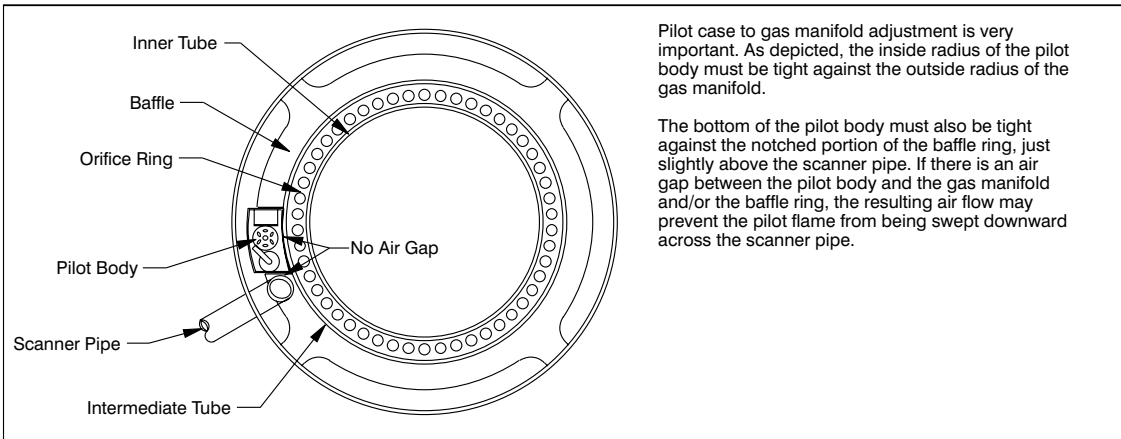
POWER FLAME CR1 & CR2 IGNITION ELECTRODE ADJUSTMENT



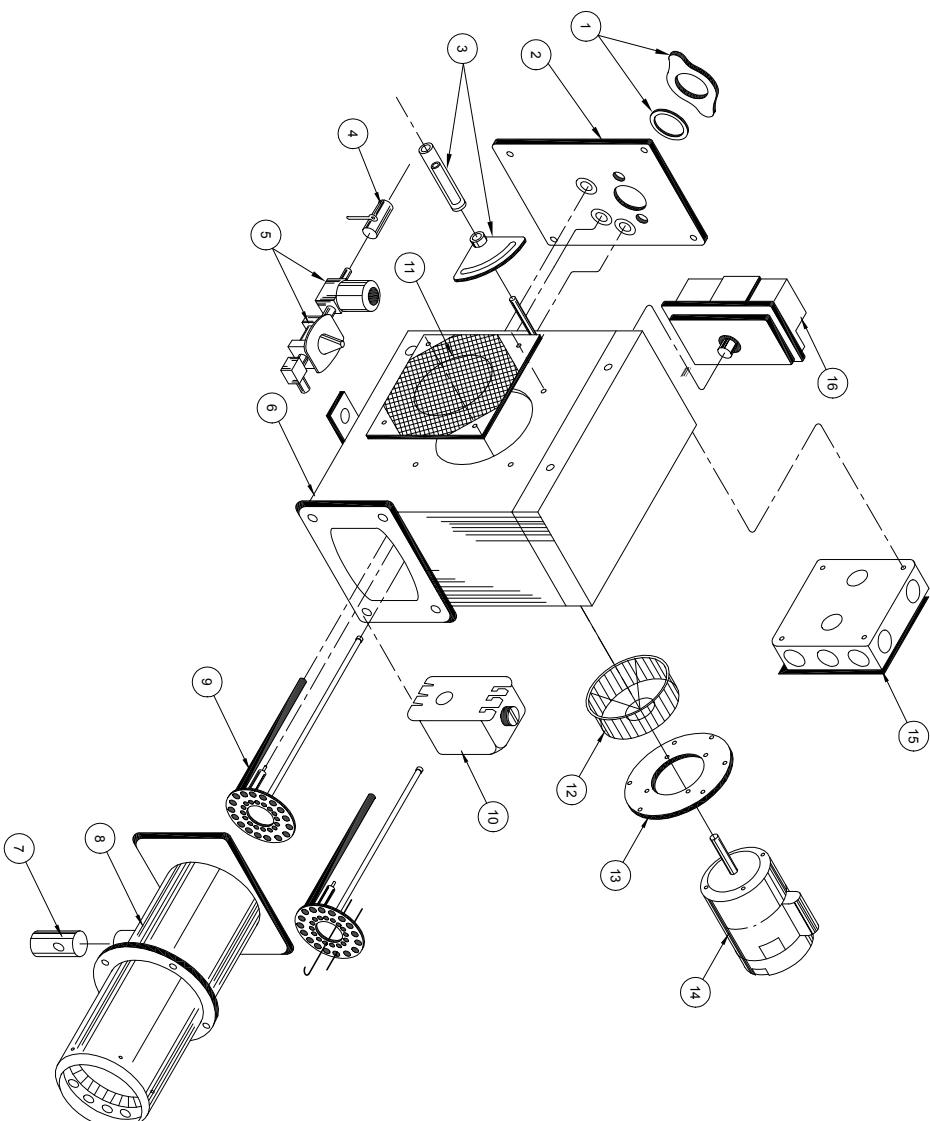
POWER FLAME CR 3, CR 4 IGNITION ELECTRODE ADJUSTMENT



POWER FLAME CASE TO GAS MANIFOLD ADJUSTMENT



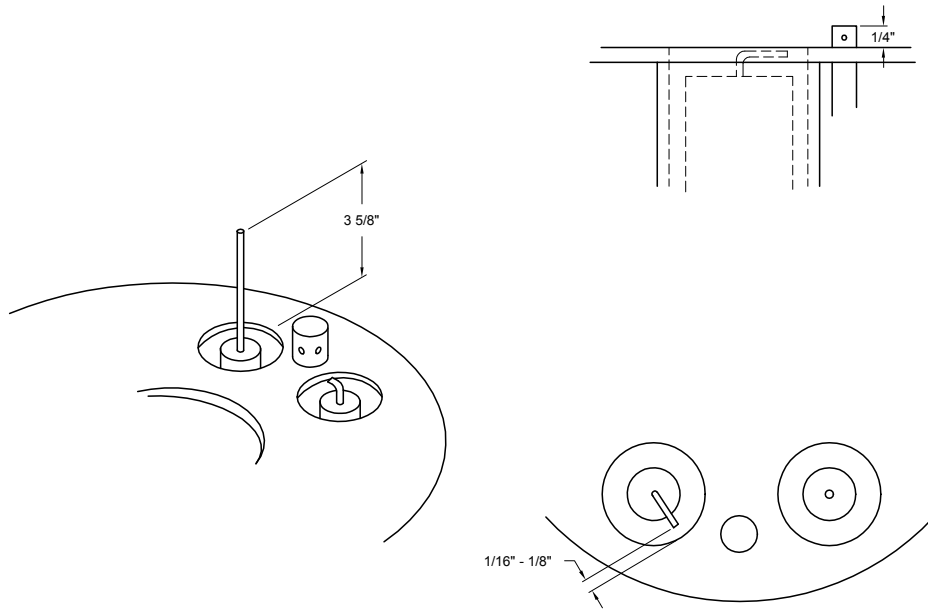
				TITLE			
				INDIRECT FIRED POWER FLAME MODEL CR IGNITON AND PILOT ASSEMBLY			
Rev	By	Revision Description	Date	DRAWN BY	ISSUED BY	SCALE	DRW. NO.
				JV		1:1	FIG.VII
PCD SERIES				CHK. BY	DATE	JOB NO.	REV
					MAY 19/98		-



- 1 SIGHT GLASS & SEAL
- 2 REAR COVER PLAT
- 3 DAMPER CONTROL
- 4 PILOT SHUT OFF VALVE
- 5 PILOT REGULATOR & SOLENOID
- 6 FAN BOX
- 7 GAS LINE IN/ORIFICE LOCATION
- 8 FIRING TUBE
- 9 PILOT, IGNITOR AND SENSOR ASSEMBLY
- 10 IGNITION TRANSFORMER
- 11 MESH SHIELD AND INLET ORAFICE
- 12 BLOWER WHEEL
- 13 MOTOR MOUNTING PLATE
- 14 MOTOR
- 15 ELECTRICAL BOX
- 16 AIR PROVING SWITCH

Rev. By	Revision Description	Date	PCD SERIES			
TITLE			DRAWN BY VC CHK BY	ISSUED BY DATE 7/21/98	SCALE 1'-1' DRW. NO. FIG IX JOB NO.	REV
TYPE C TURBO RING FORCED DRAFT BURNER						

POSITION OF THE IGNITION ELECTRODE FOR STRAIGHT GAS BURNERS, USING A FLAT DIFFUSER PLATE.



IGNITION ELECTRODE:

THE IGNITION ELECTRODE IS POSITIONED AS SHOWN, WITH THE HORIZONTAL PART OF THE ELECTRODE FLUSH WITH THE DIFFUSER PLATE, LEAVING A GAP OF 1/16" TO 1/8" WIDE. THE POINTING DIRECTION OF THE ELECTRODE IS AS SHOWN, BUT IS NOT CRITICAL.

FLAME SENSOR:

THE FLAME SENSOR SHOWN IS A RECTIFICATION- OR FLAME ROD. A UV SCANNER CAN BE USED INSTEAD. IN THAT CASE THE SCANNER TUBE IS POSITIONED IN THE SAME HOLDER AS THE FLAME ROD.

				TITLE GP COMBUSTION MODEL C BURNER POSITIONING OF THE IGNITION ELECTRODE FOR STRAIGHT GAS BURNER, USING A FLAT DIFFUSER PLATE.				
Rev	By	Revision Description	Date					
			PCD SERIES		DRAWN BY JV	ISSUED BY	SCALE 1:1	DRW. NO. FIG. X
				CHK. BY	DATE JULY 13/98	JOB NO.		REV -

BURNER SAFETY CHECK

1. Start and stop burner several times to ensure proper operation.
2. Check operation of combustion safeguard control by simulating a flame failure, making certain the burner locks out on safety within the proper time.

3. Check operation of the air flow switch, making certain fuel valve closes when the air flow diaphragm switch opens.
4. Bypass discharge controller and check to ensure high limit will shut down burner on temperature increase. If changed reset as per factory setting.
5. Reset operating control to desired temperature. Permit burner to run until it is shut off by the operating control. Adjust operating control, if necessary, until it causes burner to stop and start within desired range.
6. With the burner running, check hi and low gas pressure switch if on manifold (Typical settings are 1.0 w.c. on low gas switch and manifold pressure + 125% for high gas switch). The burner should shut off immediately.
7. Conduct minimum, pilot turn down test, reduce gas pressure to pilot with manual shut off cock to the point pilot flame is extinguished or fails to prove. Increase gas flow slightly. Main flame must be ignited with this pilot flame.
8. Verify that the temperature rise of the heater is within the range as specified on the unit rating plate. The air throughput should also be within the range as indicated on the unit rating plate.
9. The following readings should be taken and recorded after final adjustments have been made.
 - A) Gas pressure at inlet with burner off
 - B) Gas pressure at train inlet Low Fire & High Fire
 - C) Verify Gas manifold pressure Low Fire & High Fire (as indicated on the unit rating plate).
 - D) Burner input (CFH gas).
 - E) Percent CO₂ and O₂.
 - F) CO indication. Low Fire & High Fire
 - G) Stack temperature. Low Fire & High Fire
 - H) Firebox pressure. Low Fire & High Fire
 - I) Voltage to burner. Full load amps to main blower, burner and exhaustor if equipped.
 - J) Flame Signal Readings Pilot, Low Fire & High Fire
 - K) Combustion Efficiency (%) Low Fire & High Fire
 - L) NO_x Measured Low Fire & High Fire
9. Give instruction to owner (operator).

WARNING: SHOULD OVERHEATING OCCUR

1. Shut off the manual gas control (s) to the burner.
2. Do not shut off the control switch to the blower.

PCD/AEB INDUSTRIAL HEATER - WARRANTY

I.C.E. (US) INC. WARRANTS THAT IT WILL SUPPLY TO OR REPAIR FOR THE PURCHASER OF THIS PACKAGE UNIT HEATER THE HEAT EXCHANGER FREE OF CHARGE F.O.B. FACTORY IF SAID HEAT EXCHANGER WEARS OUT OR FAILS UNDER NORMAL USE AND SERVICE DUE TO A DEFECT IN MATERIAL AND/OR WORKMANSHIP DURING FIVE (5) YEARS FROM DATE OF SHIPMENT FROM THE FACTORY PROVIDED AN ALL STAINLESS HEAT EXCHANGER WAS FURNISHED. COMBINATION STAINLESS STEEL WITH MILD STEEL SECONDARY HEAT EXCHANGERS ARE WARRANTED FOR ONE (1) YEAR.

ALL MECHANICAL COMPONENTS, MOTORS, BLOWERS, VALVES, AND CONTROLS ARE COVERED BY A ONE (1)YEAR LIMITED WARRANTY.

THIS WARRANTY DOES NOT INCLUDE ANY FREIGHT, LABOR, OR SALES TAXES THAT MAY BE INCURRED BY THE PURCHASERS AND IS SUBJECT TO THE FOLLOWING CONDITIONS.

- 1) THE UNIT SHALL HAVE BEEN INSTALLED BY A QUALIFIED HEATING CONTRACTOR IN ACCORDANCE WITH THE PROVISIONS OF THE SERVICE MANUAL.
- 2) THE UNIT SHALL HAVE BEEN INSTALLED IN ACCORDANCE WITH ALL STATE, PROVINCIAL AND LOCAL CODES.
- 3) THE UNIT SHALL HAVE BEEN SUBJECT TO ONLY NORMAL USE IN SERVICE AND SHALL NOT HAVE BEEN MISUSED, NEGLECTED, ALTERED OR OTHERWISE DAMAGED.
- 4) THE UNIT SHALL HAVE BEEN OPERATED WITHIN ITS PUBLISHED CAPACITY AND WITH THE PRESCRIBED FUEL.
- 5) ALL AUTOMATIC CONTROLS SHALL HAVE BEEN OPERATIVE AT ALL TIMES.
- 6) THE UNIT HAS NOT BEEN ALLOWED TO EXCEED IT'S PROPER TEMPERATURE LIMITS DUE TO CONTROL MALFUNCTION OR INADEQUATE AIR CIRCULATION.
- 7) THERE IS NO EVIDENCE OF TAMPERING OR DELIBERATE DESTRUCTION.
- 8) THE UNIT HEATER HAS NOT BEEN SUBJECT TO AIR FOR COMBUSTION CONTAMINATED WITH FLUORIDES, DRY CLEANING FLUID VAPORS HAIRDRESSING FLUID VAPORS, (OR ANY VAPORS FOUND TO HAVE ADVERSE EFFECT ON METALS).

NO REPRESENTATIVE OF ICE (US), INC NOR ANY OF ITS DISTRIBUTORS OR DEALERS, ARE AUTHORIZED TO ASSUME FOR ICE (US), INC ANY OTHER OBLIGATIONS OR LIABILITY IN CONNECTION WITH THIS PRODUCT, NOR ALTER THE TERMS OF THIS WARRANTY IN ANY WAY. THIS WARRANTY IS LIMITED TO THE EXPRESS PROVISIONS CONTAINED HEREIN AND DOES NOT EXTEND TO LIABILITY FOR LABOR COSTS INCURRED IN REPLACING DEFECTIVE PARTS.

AUTHORIZATION TO RETURN ANY ALLEGED DEFECTIVE PARTS MUST BE OBTAINED FROM THE FACTORY BEFORE THE PART IS TRANSPORTED. TRANSPORTATION CHARGES FOR ANY ALLEGED DEFECTIVE PART(S) SHALL BE PREPAID BY THE OWNER. ICE (US), INC WILL NOT ACCEPT CHARGES FOR PARTS PURCHASED UNLESS THE CONDITIONS OF THIS WARRANTY HAVE BEEN SATISFIED.

THE EXPRESS WARRANTIES HEREIN CONTAINED ARE IN LIEU OF ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING THE WARRANTY OF MERCHANTABILITY AND OF FITNESS FOR ANY PARTICULAR PURPOSE. ICE (US), INC SHALL NOT BE LIABLE FOR DAMAGES, INCLUDING SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES ARISING OUT OF, OR IN CONNECTION WITH THE PERFORMANCE OF THE GIDM/DIDM SERIES UNIT HEATER OR IT'S USE BY THE OWNER. ICE (US), INC LIABILITY IS LIMITED EXCLUSIVELY TO REPAIR AND OR REPLACEMENT OF THE DEFECTIVE PART. PARTS CAN BE OBTAINED FROM ICE (US), INC. BOLIVAR, TN ON THE BASIS THAT CREDIT WILL BE ISSUED IF THE DEFECTIVE PARTS ARE RETURNED. THE DEFECTIVE PARTS MUST QUALIFY FOR REPLACEMENT PURSUANT TO THE TERMS AND CONDITIONS OF THIS WARRANTY.