

EngA®

ENGINEERED AIR®

**INSTALLATION, OPERATION
AND MAINTENANCE MANUAL
FOR
RUVG SERIES
INDOOR INDIRECT GAS FIRED HEATER**



UNIT MODEL NO. _____
UNIT SERIAL NO. _____
SERVICED BY: _____
TEL. NO: _____

**CANADIAN
HEAD OFFICE
AND FACTORY**

1401 HASTINGS CRES. SE
CALGARY, ALBERTA
T2G 4C8
Ph: (403) 287-2590
Fx: (403) 243-5059
Parts Fax: 888-364-2727

**USA
HEAD OFFICE
AND FACTORY**

32050 W. 83rd STREET
DESOTO, KANSAS
66018
Ph: (913) 583-3181
Fx: (913) 583-1406

**CANADIAN
EASTERN FACTORY**

1175 TWINNEY DRIVE
NEWMARKET, ONTARIO
L3Y 5V7
Ph: (905) 898-1114
Fx: (905) 898-7244
Parts Fax: 905-898-1664

SALES OFFICES ACROSS CANADA AND USA

Retain instructions with unit and maintain in a legible condition.
Please give model number and serial number when contacting
factory for information and/or parts.

www.engineeredair.com

June 14

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YOU HAVE RESPONSIBILITIES TOO

This installation, operation and maintenance manual cannot cover every possibility, situation or eventuality. Regular service, cleaning and maintaining the equipment is necessary. If you are not capable of performing these tasks, hire a qualified service specialist. **Failure to perform these duties can cause property damage and/or harm to the building occupants and will void the manufacturers' warranty.**

INTRODUCTION

Engineered Air units are high quality products designed and manufactured to provide many years of trouble-free operation. We recommend that this manual be read thoroughly to ensure proper installation, efficient operation and proper maintenance of this equipment. The submittal record is considered to be part of the Installation, Operation and Maintenance Manual. Please report any omissions to the national service manager.

SAFETY PRECAUTIONS

Read, understand and follow the complete manual before beginning the installation, including all safety precautions and warnings.



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 damage.

— **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 your 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.**

— **Installation and service must be performed by a qualified installer, service agency or the gas supplier.**

Warning: Pool, laundry and common cleaning products often contain fluorine or chlorine compounds. When these chemicals pass through the heater, they can form strong acids. The acid can eat through the heat exchanger wall, causing serious damage and presenting a possible threat of flue gas spillage into the building.



Warning: This unit is connected to high voltages. Electrical shock or death could occur if instructions are not followed. This equipment contains moving parts that can start unexpectedly. Injury or death could occur if instructions are not followed. All work should be performed by a qualified technician. Always disconnect and lock out power before servicing. **DO NOT** bypass any interlock or safety switches under any circumstances.



WARRANTY

LIMITED WARRANTY ENGINEERED AIR will furnish without charge, F.O.B. factory, freight collect, replacement parts for, or repairs to products covered herein which prove defective in material or workmanship under normal and proper use for a period of twelve (12) months from the initial start-up or eighteen (18) months from the date of shipment, whichever expires sooner, provided the customer gives ENGINEERED AIR written notice of such defects within such time periods and provided that inspection by ENGINEERED AIR establishes the validity of the claim and all pertinent invoices have been paid in full. The repairs or replacements will be made only when the complete product(s) or part(s) claimed to be defective are returned to ENGINEERED AIR or a depot designated by ENGINEERED AIR, transportation charges prepaid. Repairs or replacements as provided for by this paragraph shall constitute fulfillment of all ENGINEERED AIR's obligations with respect to this warranty. The refrigerant charge is not included in any part of this warranty. This warranty does not apply to any products or parts thereof that have been subject to accident, misuse or unauthorized alterations, or where ENGINEERED AIR's installation and service requirements have not been met.


The foregoing warranty is in lieu of all other warranties, express or implied. ENGINEERED AIR specifically disclaims any implied warranty of merchantability and/or fitness for purpose. Under no circumstances shall ENGINEERED AIR be liable to, nor be required to indemnify, Buyer or any third parties for any claims, losses, labour, expenses or damages (including special, indirect, incidental, or consequential damages) of any kind, resulting from the performance (or lack thereof) of this Agreement or the use of, or inability to use the goods sold hereunder, including, but not limited to, damages for delay, temporary heating/cooling costs, loss of goodwill, loss of profits or loss of use. Furthermore, the parties agree that the Buyer's sole remedy under this Agreement shall be limited to the limited warranty set forth in the preceding paragraph relating to the repair or replacement of any defective goods. Under no circumstances shall any claim or award against ENGINEERED AIR exceed the original contract price whether awarded through arbitration, litigation or otherwise.

ENGINEERED AIR Warranty is void if:

1. The unit is not installed in accordance with this manual.
2. The start-up and operation of the unit is not performed in accordance with this manual.
3. The unit is operated in an atmosphere containing corrosive substances.
4. The unit is allowed to operate during building construction.
5. The unit is allowed to operate in atmospheres where chlorine or chlorine compounds are present or which contain any contaminant (silicone, aluminum oxide etc.) that adheres to the spark ignition flame sensing probe.

PARTS

Warning: Any replacement part must be of equivalent listing or certification and be functionally equivalent. The replacement part must meet the original's specification in terms of functionality including certifications, timing, input and output range, accuracy and operation.

 Failure to replace parts or components with equivalent parts can cause property damage, injury or death.

1. Motors:
Motor manufacturers have service centers that will repair or replace motors as required.
2. Parts Other Than Motors:
Contact the nearest Engineered Air sales office or factory. Be sure to include Model Number, Serial Number, date of installation and nature of failure along with the description of the parts required. Some parts may not be stocked items that must be made or ordered.

RECEIVING

Refer to the back of the packing slip for receiving unit instructions.

On receipt of the unit, check for damage. Inspect protective covers for punctures or other signs that there may be internal damage. Remove protective covers and check for internal damage. Replace covers if the unit is not being assembled or installed at this time. Open access doors and check for internal damage. Close access doors when the inspection is complete.

All units are pre-tested at the factory immediately prior to shipping and are ensured to be in good operating condition at that time. If damage is found follow the instructions on the packing slip.

On receipt of the unit, check electrical characteristics (see rating plate) to make sure the unit voltage is compatible with that available for the unit. All parts for field installation are listed on the shipping order form.

TEMPORARY STORAGE

If a unit is to be stored prior to installation the following precautions are required:

- Store in a well drained area that will not accumulate surface water.
- Store in an area where the unit will not get damaged.
- All protective coverings that were provided for shipping must be in place.
- Protect indoor units from rain and snow.

INSTALLATION

Warning:

This unit is not rated for hazardous locations and cannot be installed in areas requiring any hazardous location rating.

Caution:

All wiring, piping and fuel line installation must be completed by qualified persons in accordance with all federal, state, provincial and/or local codes.

Note: Installation shall be in accordance with this manual and all other associated component and control Installation, Operation and Maintenance Manuals.

CODES

In Canada:

1. The installation of this unit shall be in accordance with the latest edition of the Canadian Electrical Code, Part 1 – C.S.A. Standard C22.1, Provincial and Local Codes, and in accordance with the local authorities having jurisdiction.
2. This unit shall be electrically grounded in accordance with the latest edition of the Canadian Electrical Code, Part 1 – C.S.A. Standard C22.1, Provincial and Local Codes, and in accordance with the local authorities having jurisdiction.
3. The installation of this unit shall be in accordance with the latest edition of the Canadian Natural Gas and Propane Installation Code, C.S.A. Standard B149.1, Provincial and Local Codes, and in accordance with the local authorities having jurisdiction.
4. In accordance with local authorities having jurisdiction or CSA. Standard B149.1 a readily accessible approved manual shut-off valve shall be installed in either the drop or riser as close as possible to the valve train (gas manifold).
5. The installation of this unit shall be in accordance with the latest edition of the National Plumbing Code of Canada, Provincial and Local Codes, and in accordance with the local authorities having jurisdiction.
6. The installation of this unit shall be in accordance with all other National, Provincial and Local Codes, and in accordance with the local authorities having jurisdiction.

In USA:

1. The installation of this unit shall be in accordance with the latest edition of the National Electrical Code (ANSI/NFPA 70), State and Local Codes and in accordance with the local authorities having jurisdiction.
2. This unit shall be electrically grounded in accordance with the latest edition of the National Electrical Code (ANSI/NFPA 70), State and Local Codes and in accordance with the local authorities having jurisdiction.
3. If the unit has not been provided with an electric disconnect switch, one of adequate ampacity shall be installed in accordance with Article 430 of the National Electrical Code (ANSI/NFPA 70).
4. The installation of this unit shall be in accordance with the latest edition of the National Fuel Gas Code ANSI/Z223.1/NFPA 54, State and Local Codes and in accordance with the local authorities having jurisdiction.
5. In accordance with local authorities having jurisdiction or NFPA 54 an accessible approved manual shutoff valve shall be installed within 6 ft (1.8 m) of the valve train (gas manifold).
6. The installation of this unit shall be in accordance with the latest edition of the National Standard Plumbing Code (NSPC), State and Local Codes and in accordance with the local authorities having jurisdiction.
7. The installation of this unit shall be in accordance with all other National, State and Local Codes, and in accordance with the local authorities having jurisdiction.

MINIMUM CLEARANCE TO COMBUSTIBLES AND FOR SERVICE IN INCHES (mm)

MODEL	COMBUSTIBLE CLEARANCE						SERVICE CLEARANCE		
	TOP	FRONT	BACK	SIDE	BOTTOM	FLUE	OPPOSITE BURNER SIDE	SERVICE/BURNER SIDE	CONTROL PANEL †
RUVG INDIRECT FIRED GAS HEAT Category I	0	0	0	0	0	9" (229)	NA	24" (610)	42" (1067)
RUVG INDIRECT FIRED GAS HEAT Co-axial Category III	0	0	0	0	0	0	NA	24" (610)	42" (1067)
RUVG INDIRECT FIRED GAS HEAT Parallel Category III	0	0	0	0	0	6" (152)	NA	24" (610)	42" (1067)
FLUID COILS & RECOVERY DEVICES	0	0	0	0	0	NA	NA	UNIT WIDTH	42" (1067)
ELECTRIC HEAT	0	0	0	0	0	NA	NA	UNIT WIDTH + 10" (254)	42" (1067)


† - As required by the Canadian Electrical Code or the National Electrical Code.

For Safety and Service, the minimum clearances must be observed. Minimum clearances also provide adequate combustion air supply.

LIFTING

Engineered Air units are constructed on a structural steel base frame. The unit base frame is equipped with lifting lugs specifically located to facilitate proper lifting of the unit. Spreader bars must be used to keep rigging away from the unit cabinetry. All lifting lugs must be used. If using a lift truck, ONLY lift using the perimeter structural frame. **DO NOT** allow forks to lift on cabinet or unit floor.

Note: There may be bottom mounted components, such as drain piping, that can be easily damaged.

Warning:	 Injury or death can result from improper rigging and lifting. Rigging and lifting of equipment must be performed by qualified personnel with proper equipment using appropriate and approved safety precautions.
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MOUNTING

Units must be mounted level. Failure to do so can cause water to be trapped in drain pans or operational problems that can void warranty. Failure to do so can result in injury or death, damage the equipment and/or building and can be a cause of poor indoor air quality.

Equipment must be installed so that sufficient working clearance and component access is provided. Some units are designed for cantilevered installation. Consult the Submittal Record for specific unit mounting.

SHIPPING MATERIALS

Remove shipping materials. Shipping materials may include, but are not limited to:

- Protective covers over openings, inlets, condenser coils etc.
- Protective covers over split sections if provided.
- Tie-down bolts, straps and blocks on fan and compressor vibration isolators.
- Tie-down bolts, straps and blocks on tilt equipped heat pipes and enthalpy/desiccant wheels if supplied.
- Indirect fired heat exchangers may be supported with wood for shipping. Remove.

PIPING, ELECTRICAL OR CONTROL SERVICE CONNECTIONS

DO NOT install anything that will interfere with equipment access or the rating plate.

Engineered Air equipment is constructed with cabinet and floors designed to prevent water from entering the building through the installed unit. When ordered, factory installed pipe chases and/or electrical chases are built into the unit floor. Factory chases are provided with covers that need to be replaced and sealed after piping and electrical connections are made.

THE FLOOR OF THE UNIT HAS BEEN MADE WATER-RESISTANT. DO NOT CUT OR DRILL HOLES IN THE FLOOR OR USE PENETRATING FASTENERS.

All penetrations through the unit walls must be caulked and sealed to prevent air and/or water from entering the unit.

NATURAL GAS AND PROPANE INSTALLATION:

1. Installation must be made in accordance with the requirements of the authorities having jurisdiction.
2. Check the unit rating plate and confirm fuel type, supply pressure, input rating and temperature rise.
3. Refer to the heater rating plate for determining the minimum gas supply pressure for obtaining the maximum gas capacity for which this heater is specified.
4. Gas supply pressure higher than the unit rating plate requires an additional field supplied gas regulator.
5. Install an approved appliance shutoff valve on the gas supply in accordance with the requirements of the authorities having jurisdiction.
6. Gas lines shall not interfere with unit access. The gas line connection at the heater shall have an approved drip leg with screwed cap.
7. 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 unit.
8. On indoor units any control device (regulator, diaphragm valve, high and low pressure switch, etc.) that requires a bleed or vent line, must be vented in accordance with applicable codes.

GAS LINE TESTING (EXTERNAL TO THE UNIT)

The appliance and its individual shutoff valve must be disconnected from the gas supply piping system during any testing of that system at test pressures in excess of 0.5 psi (3.5 kPa).

The appliance must be isolated from the gas supply system by closing its individual shutoff valve during any testing of that system at test pressure equal to or less than 0.5 psi (3.5 kPa).

VENTING PRODUCTS OF COMBUSTION

Installation shall be in accordance with the requirements of authorities having jurisdiction and ANSI Z2231/NFPA 54 or CSA B149.1. Heaters must be provided with sufficient combustion air and shall not be located in an area where a negative pressure will be created that will starve the burner of combustion air. Flue outlet pressure must not exceed maximum over fire pressure shown on the nameplate.

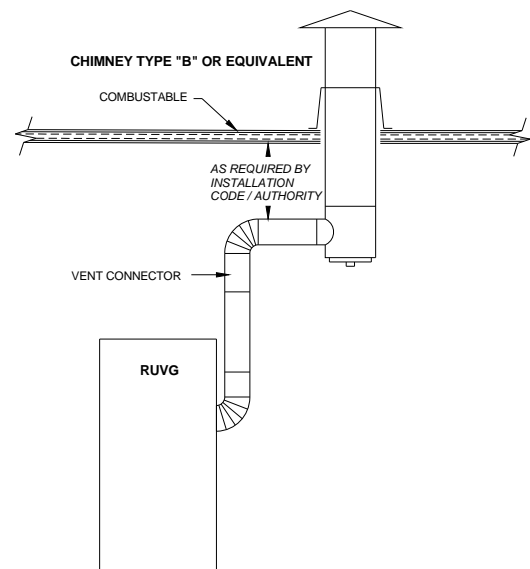
Do not connect the vent to any portion of mechanical draft systems that are under positive pressure. Do not install dampers or other restrictive devices in the flue vent pipe. Vent terminations shall be in accordance with the requirements of the authorities having jurisdiction.

The vent shall be installed in such a manner that access to the appliance or unit rating plate is not obstructed.

Indoor Category I Vertical Venting

Vent systems must be sized and installed in accordance with ANSI Z2231/NFPA 54 or CSA B149.1. Proper venting of the heating units is the responsibility of the installer.

- Use single wall or double wall "B" vent.
- Maximize the height of the vertical run of vent pipe. A minimum of five (5) feet (1.5m) of vertical pipe is required.
- An approved weatherproof vent cap shall be installed.



SEPARATED COMBUSTION

Warning:

Separated combustion equipment is not designed or approved for use in atmospheres containing flammable or chlorine vapors.

Warning:

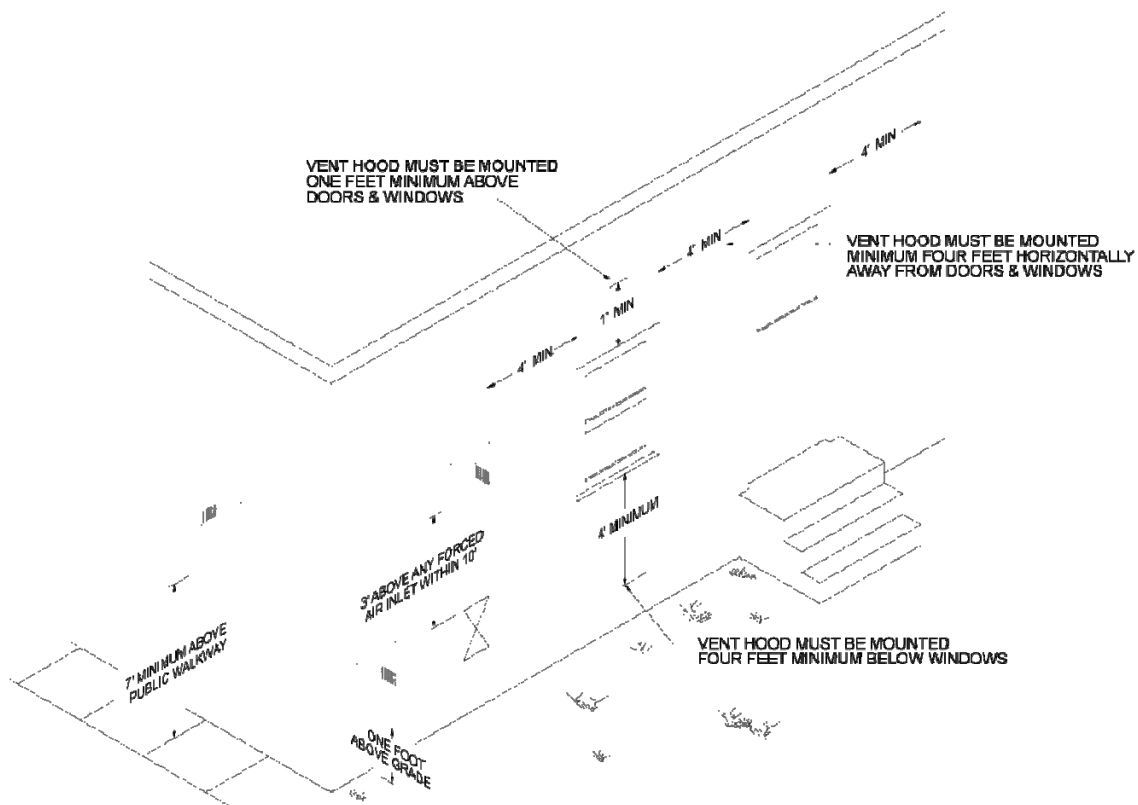
The installation of separated combustion systems must be completed by qualified persons in accordance with all federal, state, provincial and/or local codes.

Warning:

Do not operate this heater without all combustion air and flue gas piping installed.

The heater shall not be connected to a venting system serving any other gas, liquid or solid fuel fired appliance. Installation shall be in accordance with the requirements of authorities having jurisdiction and ANSI Z2231/NFPA 54 or CSA B149.1. The vent shall be installed in such a manner that access to the appliance or unit rating plate is not obstructed.

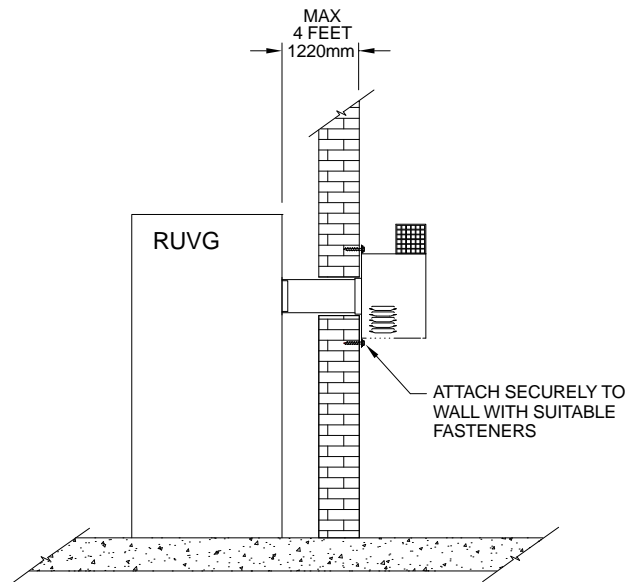
If as side wall termination is used, locate the termination as shown below.



COAXIAL VENTING-COMBUSTION

Indoor Category III Horizontal Venting

- Pressures in Category III venting systems are positive and therefore care must be taken to avoid flue products entering any occupied space. Use only vent materials and components provided.
- The venting and combustion air are integrated as a coaxial system with the vent pipe at the center and combustion air surrounding the vent pipe.
- The total length of vent pipe must not exceed 4 ft. (1220mm). No elbows shall be used.
- Use the combination Vent Cap / Combustion Air intake provided. Mount level.
- The vent terminal must be located at least 1 ft. (305mm) above grade, or in snow areas, at least 3 ft. (1m) above snow line to prevent blockage. The vent terminal must be installed with a minimum horizontal clearance of 4 ft. (1.2m) from electric meters, gas meters, regulators or relief equipment (see following drawing).



PARALLEL VENTING-COMBUSTION

The following table indicates the maximum equivalent length of the various sizes of vent and combustion air for each furnace model. Equivalent length equals the total length of straight pipe, plus 10 ft (3m) for each 90° elbow and 5 ft (1.5m) for each 45° elbow.

Maximum Equivalent Feet

Btuh	Vent Diameter		Combustion Air Diameter	
	3"	4"	4"	5"
50,000	100	-	100	-
60,000	100	-	100	-
70,000	100	-	100	-
80,000	-	100	-	100
90,000	-	100	-	100
100,000	-	100	-	100
120,000	-	100	-	100
140,000	-	100	-	100
160,000	-	100	-	100

This manual describes two options for separated combustion systems:

- Side Wall Vent
- Vertical Vent

COMBUSTION AIR DUCT

- Each separated combustion XE heater shall be equipped with its own combustion air supply. It must not connect to any other air intake systems.
- Use single wall pipe constructed of minimum 24ga galvanized steel or a material of equal durability and corrosion resistance.
- Single wall combustion air duct may be externally insulated, as required.
- Each slip joint shall be secured with corrosion resistant screws or rivets, and sealed with an adhesive silicon sealant and/or aluminum tape.
- For horizontal combustion air systems longer than 5 ft (1.5m) the piping must be supported every 3 ft (1m).

VENTING

- Each heater must have its own vent system, and must not be connected to other venting systems or chimney.
- Use 'C' Vent. All joints must be secured with corrosion resistant screws or rivet, and sealed with sealant and/or aluminum tape rated to 500°F (290°C).

Warning:

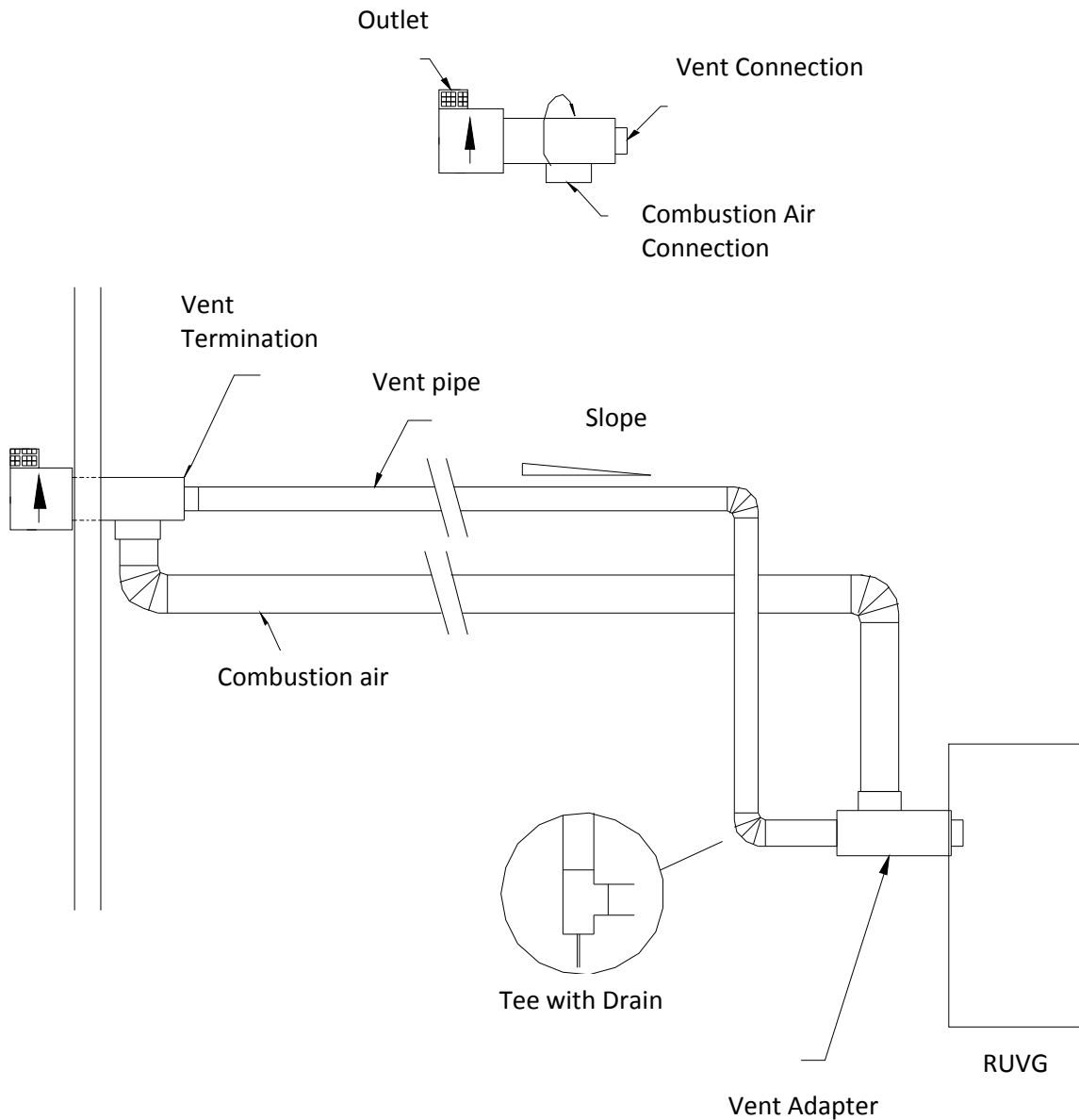
Do not use PVC, ABS or any other non-metallic pipe for venting.

- Any run of single wall vent pipe passing through an unheated space should be insulated with insulation rated for at least 550°F (280°C) to prevent condensing. In cases where condensing is expected, install a Tee at the bottom of the vertical section, with a drain for condensate.
- Horizontal lengths of the vent system must be installed and sloped (2%) to prevent the accumulation of condensate.
- Maintain a minimum of 6" (150mm) clearance from any combustible material.
- Do not install dampers or other restrictive devices in the flue vent pipe.

Side Wall Vent

Only Engineered Air supplied concentric vent terminations are approved for use with RUVG furnace models.

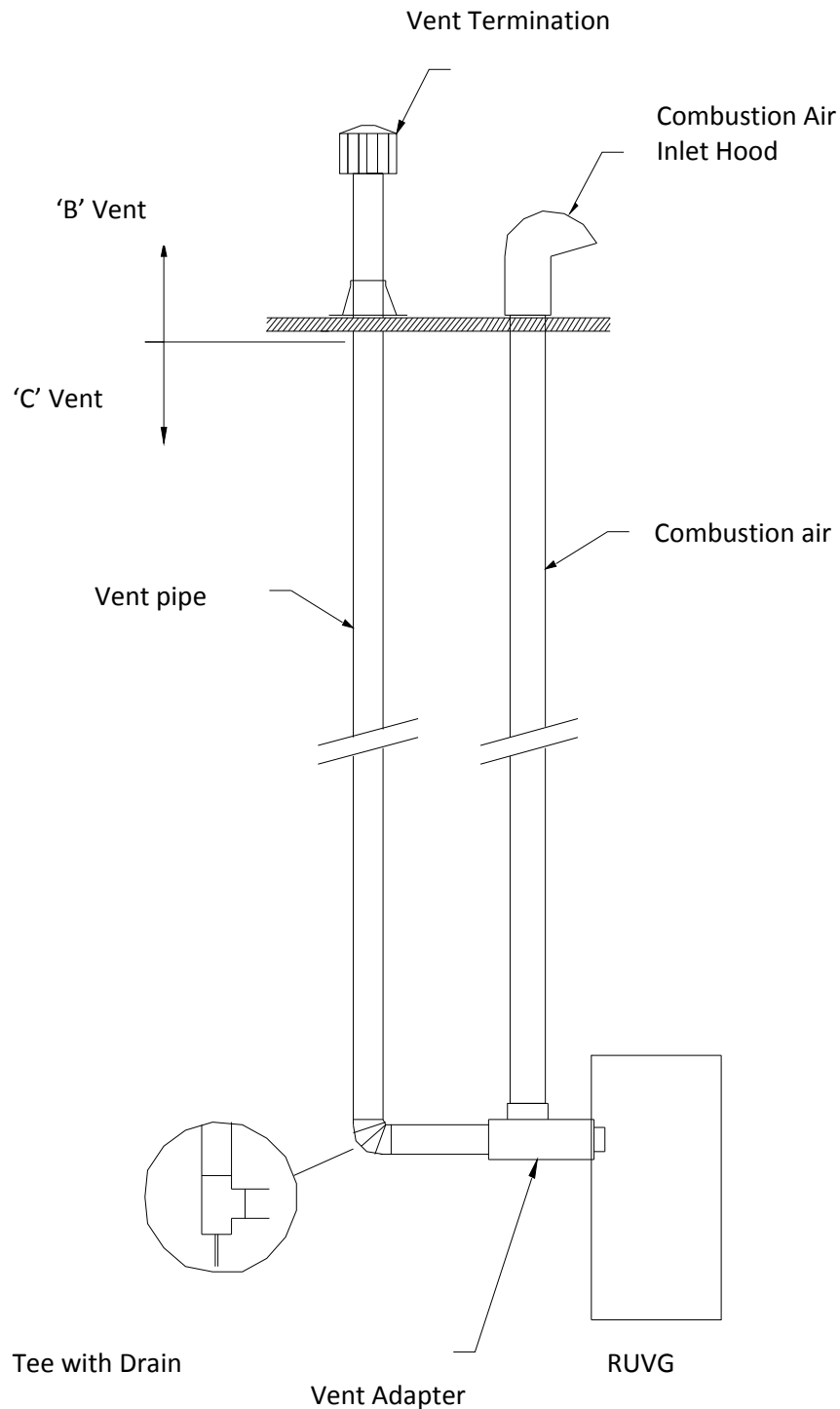
Refer to the sketch below.



Vertical Vent

An approved vent cap (eg. Breidert), furnished by the customer, must be installed at the termination point of the vertical vent system. The vent in this arrangement is category 1. 'B' Vent is acceptable. Installer may seal joints as required.

Refer to the sketch below.



PIPING, ELECTRICAL OR CONTROL SERVICE CONNECTIONS

DO NOT install anything that will interfere with equipment access or the rating plate.

Engineered Air equipment is constructed with cabinet and floors designed to prevent water from entering the building through the installed unit. When ordered, factory installed pipe chases and/or electrical chases are built into the unit floor. Factory chases are provided with covers that need to be replaced and sealed after piping and electrical connections are made.


THE FLOOR OF THE UNIT HAS BEEN MADE WATER-RESISTANT. DO NOT CUT OR DRILL HOLES IN THE FLOOR OR USE PENETRATING FASTENERS.


All penetrations through the unit walls must be caulked and sealed to prevent air and/or water from entering the unit.

ELECTRICAL INSTALLATION

DO NOT install anything that will interfere with equipment access or the rating plate.

The unit must be electrically grounded and all wiring must be installed in accordance with the National Electrical Code, ANSI/NFPA 70, and/or the Canadian Electric Code CSA 22-1 and to the approval of the authorities having jurisdiction. **THE FLOOR OF THE UNIT HAS BEEN MADE WATER-RESISTANT. DO NOT CUT OR DRILL HOLES IN THE FLOOR OR USE PENETRATING FASTENERS.** Field wiring diagrams, internal wiring diagrams and operating functions are included in the control cabinet. The power requirements are indicated on the rating plate. Where field wiring of control circuits is required, take care to size the field wiring for a maximum 10% voltage drop. The control circuit ampacity is noted on the field wiring diagram. See the field wiring diagram for requirements for shielded or twisted pair wire for solid state devices.

Caution: 	Temporary Power Generation The warranty will be void if the voltage being fed from any temporary generator is not within 10% of the nominal rated nameplate voltage and voltage imbalance shall be limited to 2%. A power monitor shall be installed by others to properly monitor power quality and conditions. All generator sets shall be provided with overcurrent and earth-fault protection. The protective apparatus should be capable of interrupting, without damage, any short-circuit current that may occur.
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Warning: 	No unspecified external load shall be added to the control transformer circuit(s) or to the main power circuit(s).
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Recommended 24V Field Wiring Size:

Copper conductors only

Circuit Load (Amps) (1)	Maximum Total Length of Run									
	< 50 Ft (~ 15 m)	< 100 Ft (~ 30 m)	< 150 Ft (~ 45 m)	< 200 Ft (~ 60 m)	< 250 Ft (~ 75 m)	< 300 Ft (~ 90 m)	< 350 Ft (~ 105 m)	< 400 Ft (~ 120 m)	< 450 Ft (~ 135 m)	< 500 Ft (~ 150 m)
1	16 AWG	16 AWG	16 AWG	16 AWG	16 AWG	16 AWG	14 AWG	14 AWG	14 AWG	12 AWG
2	16 AWG	16 AWG	16 AWG	14 AWG	12 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG
3	16 AWG	16 AWG	14 AWG	12 AWG	12 AWG	10 AWG	10 AWG	10 AWG		
4	16 AWG	14 AWG	12 AWG	10 AWG	10 AWG	10 AWG				
5	16 AWG	12 AWG	12 AWG	10 AWG						
6	16 AWG	12 AWG	10 AWG	10 AWG						
7	14 AWG	12 AWG	10 AWG							
8	14 AWG	10 AWG	10 AWG							
9	14 AWG	10 AWG								
10	12 AWG	10 AWG								
11	12 AWG	10 AWG								
12	12 AWG	10 AWG								
13	12 AWG									
14	12 AWG									
15	12 AWG									

Notes:

- 1) The field wiring load depends on the actual load on a particular control circuit the field wiring is connected to. Refer to the internal wiring diagram of the unit.
- 2) The table above is based on a maximum 10% voltage drop on a 24V control circuit. Wire size was calculated using the following formula:

$$CM = (25 \times I \times L) / V$$

Where **CM** is circular mils of conductor for a constant load of **I** amps, wire length **L** in feet from the unit to the field device and back, and voltage drop **V**.

When connecting to a three phase power supply, check for the correct rotation of all motors and fans. If the rotation is incorrect, reverse the rotation at the incoming power only. All electrical conduit outlets in the control panel must be sealed to prevent moist building air from migrating to the control panel.

All penetrations through the unit walls must be caulked and sealed to prevent air and/or water from entering the unit.

COIL CONNECTIONS

This equipment may require field connection of water, steam or refrigerant coils. For proper operation airflow must be counterflow to the flow of the fluid. The inlet water connection is normally at the bottom of one header and the outlet water connection at the top of the other header. The steam connection is at the middle of the supply header and the condensate is at the bottom of the other header.

Caution:

Use a backup wrench on threaded coil connections when installing piping.

For refrigerant coils, all piping is to be installed by a qualified refrigeration mechanic. All refrigeration specialties shall be installed using good refrigeration installation and design practices.

Recovery, reuse, recycling, reclamation, and safe disposal of refrigerant is the only acceptable practice today. Venting of refrigerant into the atmosphere during installation or servicing is unacceptable. To avoid damage, use an accepted refrigerant recovery system whenever removing refrigerant. When working with refrigerants you must comply with all local government safety and environmental laws.

DRAIN TRAPS

Each drain connection requires a separate drain trap supplied and installed by the contractor. For a trap to work properly, it must be primed. During freezing periods, primed traps may need to be heat traced or drain and plug the trap when not in use. If a drain connection has a smaller pipe inside, connect to the outer pipe only. Ensure that the trap is of adequate depth to operate against a static that includes the extra pressure drop for dirty filters.

Warning:

Failure to properly trap each connection can result in drain pan flooding, standing water in unit, building damage, injury or death, cause poor air quality or other problems.

In some applications (e.g. heat recovery units) there may be additional drain connections inside the curb intended to be connected to the building drainage system. These drains must be connected and properly trapped.

Cooling coil drain pans may have multiple drain connections extending outside the unit casing. Multiple drains may be connected to a common drain providing that each drain is individually trapped and vented to avoid problems from drains in different pressure zones. The drain must be properly sized and sloped.

Size drain trap with the following minimum requirements:

a) Units With Draw Through Drain Pans:

$$H1 = \text{Negative Static}^\dagger \times 1.5 + 3.5''$$

(89mm)

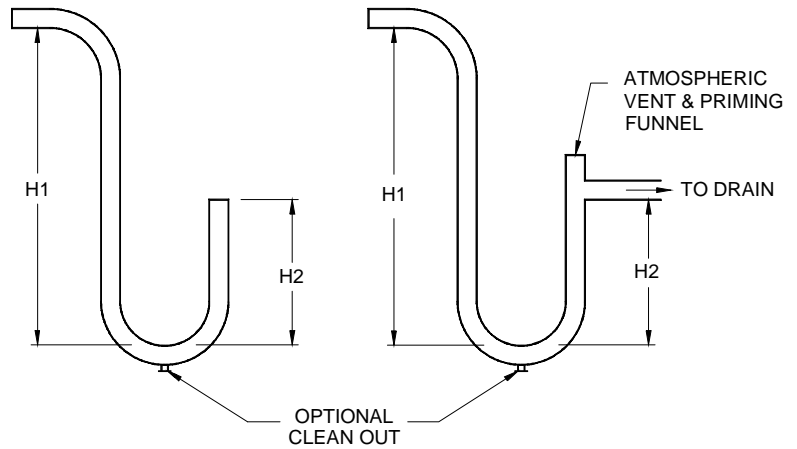
$$H2 = \text{Negative Static}^\dagger \times 0.75 + 2.5''$$

(64mm)

b) Units With Blow Through Drain Pans:

$$H2 = \text{Maximum Positive Static}^\dagger \times 1.5$$

$$H1 = H2 + 0.5'' \text{ (13mm)}$$



† Static Water Column (WC) in inches or mm including fully loaded filters.

Ensure adequate clearance for properly sized drain traps.

FLUSHING AND DEGREASING OF WATER AND GLYCOL COILS

Coil tubing may contain material or residue from manufacturing, transportation or storage. To prevent possible damage to other components in the system, the coils must be flushed and degreased. Consult a qualified water treatment specialist.

HEAT TRANSFER FLUIDS

The coil(s) provided have been selected for use with a specific heat transfer fluid as shown on the Submittal Record. Use of other fluids will result in different performance and can damage the coil(s).

It is imperative to properly select and apply heat transfer fluids used in heating and cooling systems. Untreated, improperly treated or improper use of fluids or use of fluids not approved for use in commercial heating and cooling systems can damage coils and system components. For selection and application of heat transfer fluids, always follow the manufacturers' recommendations including treatment, mixing and filling. Warranty will be void if coil damage results from misapplication or improper treatment of the heat transfer fluid.

Some systems may use CPVC piping. Do not use propylene glycol with CPVC.

8. Purge all the air from the gas lines. Refer to the Canadian Natural Gas and Propane Installation Code, C.S.A. Standard B149.1 or the National Fuel Gas Code ANSI/Z223.1/NFPA 54 for proper method. Check all connections for leaks and correct. Ensure that the inlet pressure agrees with the approval label.
9. Enable heating and/or cooling; refer to unit function for correct sequence and operation.
10. Confirm field wiring voltage drop is less than 10% when equipment is operating.
11. For the unit to operate properly a system air balance must be performed to ensure correct air flow. Failure to do so can damage the equipment and/or building and can be a cause of poor indoor air quality.
12. Damper sections:
 - a. Flat mixing dampers:
Both the fresh air and return air dampers are fully open when the dampers are at a 45° angle when fully stroked. This provides optimum mixing of the air streams for this damper arrangement.
 - b. Angle mixing damper:
Angle mixing section dampers open to an angle of 90° when fully stroked. This provides optimum mixing of the air streams for this damper arrangement.
13. Some units are equipped with an adjustable coil air bypass. This must be field adjusted during the system air balance to ensure proper air flow across the coil. Adjust the bypass to achieve coil pressure drop as stated on the submittal and/or the unit function sheet.
14. Check setting of fan limit control(s). Adjust high limit to value indicated below unless wiring diagram shows a different value.

High Limit		180°F	(82°C)
Fan Switch	ON	125°F	(52°C)
	OFF	90°F	(32°C)
15. **Set all controls to the settings indicated on the wiring diagram.**
16. Re-install all access panels.
17. Remove any packing material or debris and dispose appropriately.

OPERATION

Warning:

This unit is connected to high voltages. Electrical shock or death could occur if instructions are not followed. This equipment contains moving parts that can start unexpectedly. Injury or death could occur if instructions are not followed. All work should be performed by a qualified technician. Always disconnect and lock out power before servicing. DO NOT bypass any interlock or safety switches under any circumstances.

Warning:

Proper commissioning and start-up of the air handling system is the responsibility of the installing contractor. It is recommended that an air balance be completed by a certified air balancing contractor to insure the air volume being delivered matches the unit rating plate. Failure to perform a proper air balance can cause injury or death, damage to the equipment, property damage, system operational problems, or be a cause of poor air quality. Moisture carry over can result from improper air flow.

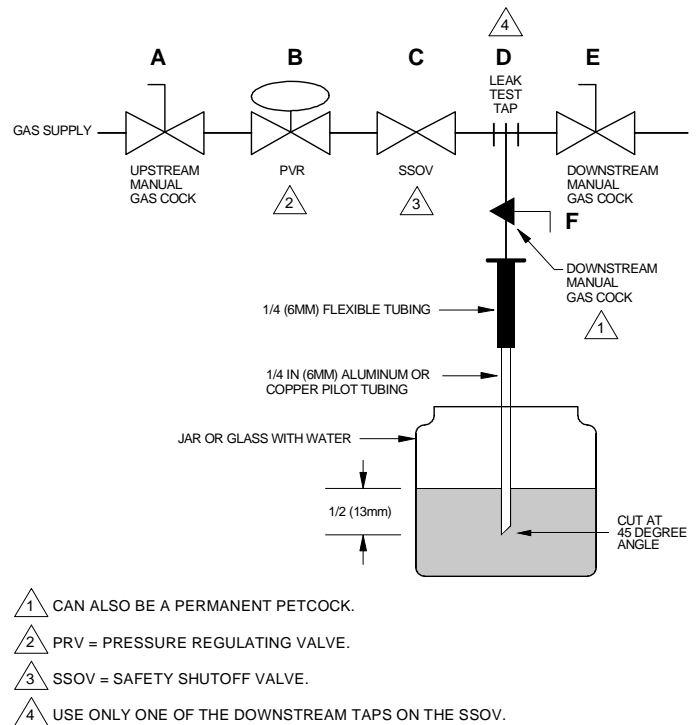
This unit may incorporate one or more functions and a variety of controls and options to suit individual requirements. A description of the unit functions and options is shown on the Electrical Data Sheet and unit wiring diagram. Carefully check your wiring diagram to verify that all remote controls are properly located and correctly field wired.

Some equipment may contain programmable unitary controllers or programmable logic controllers (PLC). Additional information can be obtained from the specific programmable control manufacturer. Often this information is available from the control manufacturer's website.

SAFETY SHUTOFF VALVE LEAK TEST:

Safety shutoff valves require a qualified technician to perform a leak (bubble) test to determine tightness of closure on a least an annual basis. A very small amount of leakage is normal. Valve leakage rates exceeding those noted in the table below require repair or valve replacement. For more detailed valve leak test instructions, refer to the valve manufacturer’s instructions.

1. De-energize the control system.
2. Close the upstream manual gas valve.
3. Connect a ¼” (6mm) tube to the outlet pressure tap on the safety shutoff valve.
4. Immerse the opposite end of the ¼” (6mm) tube (cut to a 45° angle) vertically ½” (13mm) into a clear container of water.
5. Count the number of bubbles appearing during a 10 second period.
6. If the bubble rate is greater than that noted in the table repair or replace the valve.
7. If bubble rate is less than noted in the table, remove the ¼” (6mm) tube, reconnect the outlet pressure tap plug.
8. Energize the control system and open upstream manual gas valve.
9. After testing check all piping connections and plugs for external leakage.



The maximum leakage rate (bubbles/10sec.) is 6.

GAS MANIFOLD

It is recommended that at least once each year the safety devices should be checked. Follow operational check at detailed in this manual.

The Safety Shut Off Valves must be tested on at least an annual basis or as per the manufacturer’s recommendations which ever is less.

Regulators with vent terminals must have yearly cleaning of the screen.

OPERATIONAL CHECK FOR GAS FIRED RUVG UNITS

The unit has been tested at the factory, gas consumption clocked, and all safety controls checked to ensure they operate. Field testing will confirm all components are operating properly after shipping and installation.

1. Read all of this section before proceeding. It may be necessary to refer to another control manual to perform some of the operation test procedure and then return to this document to complete the safety checks.
2. Purge all the air from the gas lines. Refer to the Canadian Natural Gas and Propane Installation Code, C.S.A. Standard B149.1 or the National Fuel Gas Code ANSI/Z223.1/NFPA 54 for proper method. Check all connections for leaks and correct. Ensure that the inlet pressure agrees with the approval label.
3. Adjust airflow through the unit to obtain the rating plate specified airflow. Operation with airflow less than specified can damage the heat exchanger.
4. Do not re-start burner when the heat exchanger is:
 - a. very hot
 - b. full of gas
5. Do not start burner unless the supply fan blower access door is secured in place and the burner access cover is firmly attached.
6. Open door and remove access panel to the gas heater enclosure. Note: The access panel must be in place except when servicing.
7. Turn the gas on for the unit. Check for leaking gas piping to the unit and check the manifold piping up to the safety shutoff valves.
8. Check the main and safety shut off valves and pilot valve for leakage following the valve manufacture's recommendations.
9. Move gas control knob to "Off" position.
10. Install a tapped fitting for attachment to a manometer, or other gauge suitable for 14.0" w.c., in the inlet pressure tap, and for 10.0" w.c., in the manifold pressure tap.
11. Wait 5 minutes for any gas to clear out. If you smell gas, see Step 4 above and correct leak. If you don't smell gas or have corrected any leaks, go to the next step.
12. Turn gas control knob to "On" position

13. Open all manual gas valves
14. Turn power on at disconnect switch
15. Set thermostat or controller to its highest position to initiate call for heat and maintain operation of unit.
16. Draft inducer will run for a 15 second pre-purge period.
17. At the end of the pre-purge the direct spark will be energized and gas safety shutoff valve will open and if provided the flow ratio valve will move to the light off position.
18. There is up to a 10 second trial for ignition to light the burner. During this time the direct spark is energized and the gas valve is open.
19. Confirm the burner has ignited. Check the appearance of the main burner flame. The burner flame should be mostly blue in color and well defined and centered at the tube. A distorted flame, yellow tipping of natural gas flame or a long yellow flame on propane may be caused by lint and dirt accumulation inside burner or at burner ports.
20. When the sensing probe proves the flame, it de-energizes the spark igniter. See the internal wiring diagram for the type of flame ignition control used.
21. On the initial start-up the first ignition trial may be unsuccessful due to need to purge air from manifold at start-up. If the gas fails to ignite or the flame is not sensed the ignition control will lock out. To clear the lockout turn the service switch off for 5 minutes then retry.
22. Confirm gas inlet pressure matches unit rating plate at high fire. The appliance regulator shall be adjusted to provide the manifold pressure specified on the rating plate.
23. Once the heat call is satisfied:
 - a. Ignition controller is de-energized.
 - b. Main gas valve is de-energized.
 - c. Make sure flame is out.
24. After the combustion has been checked, bring the unit to high fire and check entire manifold for gas leaks.
25. When the main flame is established, check the gas manifold pressure at the test point nearest the burner with the unit operating at high fire. Check the name plate for the correct manifold pressure and adjust the appliance regulator if necessary. The unit inlet gas pressure should not go below the minimum pressure shown on the nameplate when at high fire. Ensure that the temperature rise does not exceed nameplate.
26. Do a final check of the main and safety shutoff valves and pilot valve for leakage following the valve

manufacturer's recommendations.

27. Replace access panel to the gas heater enclosure and close door. Note: The access panel must be in place except when servicing.
28. Return thermostat or controller to the normal operating set point.

COMBUSTION AND FINAL UNIT CHECK

The heater has been test fired in the factory for firing rate and combustion. Field conditions may require small adjustments to be made. These checks should be done by a qualified service person.

1. Prior to completing the start-up, check the appearance of the main burner flame. The burner flame should be mostly blue in color and well defined and centered at the tube. A distorted flame, yellow tipping of natural gas flame or a long yellow flame on propane may be caused by lint and dirt accumulation inside burner or at burner ports. Accumulations may also be at the air inlet between burner and manifold pipe, or due to debris in the main burner orifice. Clean burners, heat exchanger, draft inducer and vent ducts with a soft brush or vacuum affected areas
2. Poorly defined, substantially yellow flames, or flames that appear lazy, indicate poor air supply to burners or excessive burner input. Verify gas supply type and manifold pressure with rating plate.
3. Poor air supply can be caused by obstructions or blockage in heat exchanger tubes or vent discharge pipe. Inspect and clean as necessary to eliminate blockage. Remove any dirt or loose debris. Clean heat exchanger tubes with stiff brush. Poor flame characteristics can also be caused by undersized combustion air openings or flue gas recirculation into combustion air supply. Increase air opening size or re-direct flue products to prevent re-circulation.
4. Reduced air delivery can also be the result of fan blade slippage, dirt accumulation in the fan blade or low voltage to draft inducer motor. Inspect draft fan assembly and be sure fan blade is secure to motor shaft. Check line voltage to heater.
5. When the unit start up is complete, re-check the amperage draw of each motor (i.e., after an air balance).
6. Ensure that the safety controls are operative, i.e., flame ignition control, high limit, etc. (See specification sheets on all controls). Recheck setting of all limits and temperature controls.

IGNITION CONTROL

1. Draft inducer will run for a 15 second pre-purge period.
2. At the end of the pre-purge the direct spark will be energized and gas safety shutoff valve will open and if provided the flow ratio valve will move to the light off position.
3. There is up to a 10 second trial for ignition to light the burner. During this time the direct spark is energized and the gas valve is open.
4. If ignition does not occur on the first trial, the gas and spark are shut-off by the ignition control and the control enters an inter-purge period of 15 seconds, during which the draft inducer continues to run.
5. At the end of the inter-purge period, another trial for ignition will be initiated.
6. Control will initiate up to three ignition trials on a call for heat before lockout of control occurs.
7. On the initial start-up, or after unit has been off long periods of time, the first ignition trial may be unsuccessful due to need to purge air from manifold at start-up.
8. If the ignition control has locked out., clear the lockout by turning the service switch off for 5 minutes then retry.

UNIT SHUT-DOWN INSTRUCTIONS

Service Shut Down

1. Set the thermostat in the "OFF" position.
2. Close the manual firing valve in the manifold on gas fired heaters.
3. If the unit was firing at the time of shut down allow the main blower to run for a sufficient period to cool off the heat exchanger.
4. Set the unit "ON-OFF" toggle switch to the "OFF" position.
5. Set the main power disconnect switch to the "OFF" position.



CAUTION: If the unit is to be off for an extended period of time, close the manual shut off valve.

Emergency Shut Down

1. Set the electrical disconnect switch to the "OFF" position.
2. Close the main manual firing valve in the manifold on gas fired heaters.

Start-Up After Extended Shut-Down Period

When unit is shut down for an extended period of time the same start-up procedures, as outlined in previous sections, should be followed.

MAINTENANCE

Warning:

This unit is connected to high voltages. Electrical shock or death could occur if instructions are not followed. This equipment contains moving parts that can start unexpectedly. Injury or death could occur if instructions are not followed. All work should be performed by a qualified technician. Always disconnect and lock out power before servicing. **DO NOT** bypass any interlock or safety switches under any circumstances.

Warning:

Follow the cleaning instructions and recommended inspection schedule to reduce the risk of mold or other bacterial growth. Property damage or personal injury claims may result from mold or biological growth arising from improper installation, inadequate maintenance, or failure to inspect. Engineered Air has no responsibility for and makes no express or implied warranties regarding mold or bacterial growth or any other indoor air quality issues. If mold or biological growth is present, determine and fix the cause. Properly remove and dispose of the contamination. Properly clean and sanitize the affected area using only approved sanitizers suitable for HVAC equipment.

To provide a maintenance history, it is recommended that the owner have a maintenance file for each unit. **The following maintenance instructions are to be carried out each spring and fall or as otherwise indicated by qualified service personnel.**

Caution:

Label all wires prior to removal when servicing controls or critical components. Wiring errors can cause improper and dangerous operation.



Verify proper operation after servicing.

ELECTRICAL

1. Check all wiring for loose connections.
2. Check voltage at unit (while in operation).
3. Check amperage draw against unit rating plate.
4. Where possible, all contactors should be inspected to ensure that contacts are clean and are making good contact. If contacts are abnormally pitted or burned badly, replace contactor. Single phasing and motor burnouts can result from bad contacts.

GAS MANIFOLD

It is recommended that at least once each year the safety devices should be checked. Follow operational check as detailed in this manual.

The Safety Shut Off Valves must be tested on at least an annual basis or as per the manufacturer's recommendations, whichever is less.

Regulators with vent terminals must have yearly cleaning of the screen.

GAS HEATER

Warning:

This unit is connected to high voltages. Electrical shock or death could occur if instructions are not followed. This equipment contains moving parts that can start unexpectedly. Injury or death could occur if instructions are not followed. All work should be performed by a qualified technician. Always disconnect and lock out power before servicing. DO NOT bypass any interlock or safety switches under any circumstances.

1. The furnace should be inspected annually by a qualified service personnel. The condition of the burners, heat exchanger, draft inducer, vent system, operating controls and wiring should be determined. Check for obvious signs of deterioration, accumulation of dirt and debris and any heat or water related damage. Any damaged or deteriorated parts should be replaced before the unit is put back into service.
2. Clean burners, heat exchanger, draft inducer and vent ducts with a soft brush or vacuum affected areas.
3. Check Heat Exchanger for cracks. If any are present, replace heat exchanger before putting unit back into service.
4. Check the attachment point of the ducts to verify that they are air tight.
5. Check the automatic gas valve to insure that the gas valve seat is not leaking.

Operation Check

1. Turn on power to the unit and set thermostat or heat controller to call for heat, allowing furnace module to operate.
2. Check for proper start-up and ignition as outlined in "Operational Check" on page 27.
3. Return thermostat or heat controller to normal setting.

VENT TERMINALS

The vent terminal should be checked and cleaned every fall. If the terminal is found to have accumulations of leaves or other debris, clean more often as necessary.

FILTERS

Filter-changing intervals can be based on the pressure drop across the filter or by calendar scheduling or visual inspection. Scheduled intervals should be between one and six months, depending on the pollutant loading from indoor and outdoor air. More-frequent changes may be required during the economizer season.

Units that operate with high levels of outside air should have filters removed (or moved to winter filter location if available) during the winter months in areas that have heavy frost or snow.

Plugged or excessively dirty filters can cause damage to the equipment. See submittal record for filter quantities, sizes and types. Use same size and type for replacement.

- A. High Velocity Permanent:
It is important that the filters be checked and cleaned regularly during the period immediately following installation, in order to determine the best service interval. To clean, rinse with water. Shake off excess water and re-install. These filters do not require an oil adhesive.
- B. Pleated Throwaway and/or Replaceable Media (Cartridge, Bag):
Replacement filters can be obtained from any Engineered Air representative.

In some applications the used filters/media may contain chemical or biological hazards. All local, regional and national regulations for safety and disposal should always be followed.

CONTROLS

Annually clean and recalibrate all controls, check for proper operation, and repair or replace any faulty controls. Check all damper hardware settings every three months. Replace blown fuses with equivalent size and type fuse. Failure to do so can result in damage to the unit.

CONTROL ENCLOSURE VENTILATION

Control enclosures are often ventilated in summer to provide component cooling. A manually adjustable slide damper is provided for adjustment and seasonal shut off. The slide damper should be closed for winter operation and opened for summer operation.

OUTDOOR AIR INTAKES, MIXING SECTIONS AND DAMPERS

Outdoor air intakes, screens, and adjacent areas shall be checked semi-annually for cleanliness, integrity and proper operation. Adjust dampers where required.

COILS

Inspect coils and drain pans for cleanliness and biological growth once per year during the cooling season or more often as required.

Warning:

Dirty coils can be a cause of poor air quality. Failure to maintain clean coils can cause injury or death, damage to the equipment, property damage or system operational problems. Moisture carry over can result from dirty coils.

The external surface of finned coils can be cleaned using a low pressure water spray and a brush. Coil fins are easily damaged. Do not use high pressure steam or water to clean coils; it will permanently damage the coil. When using cleaning additives or solutions they must be compatible with the coil materials or coatings. Use a fin comb to straighten any damaged or bent fins.

Coil Winterization:

Water coils that are not in use must be protected from freezing. Coils should be drained and blown out with compressed air and then filled and drained several times with appropriate strength pre-mixed inhibited HVAC glycol or other suitable fluid. Do not use propylene glycol with CPVC piping.

