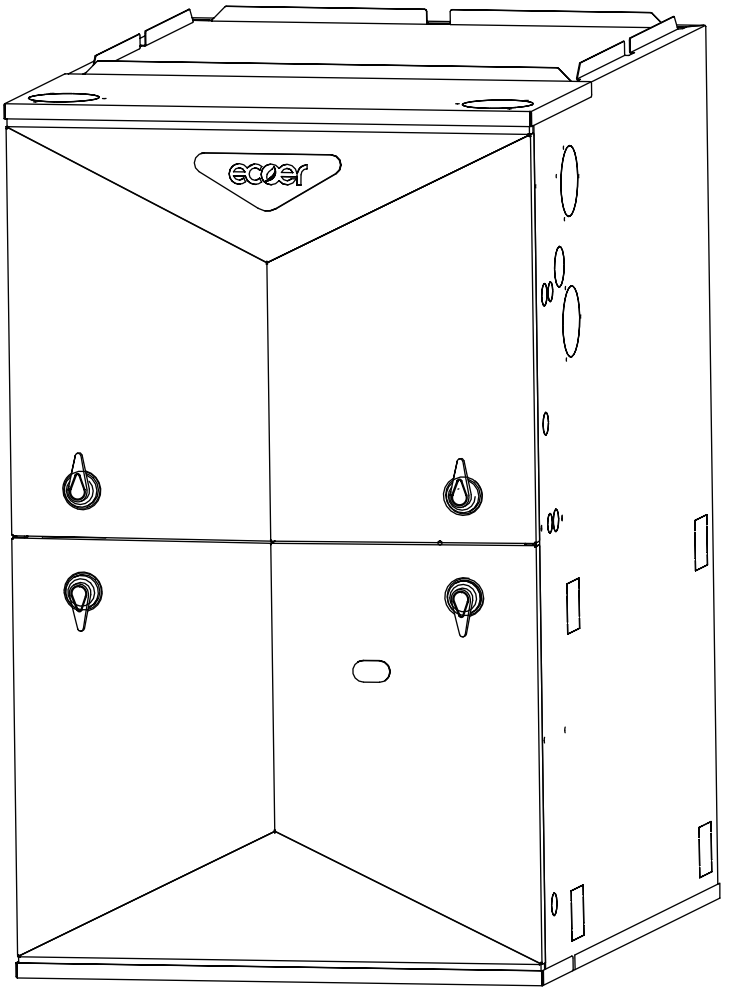
Making your home Green & Smart

Installation and operation instructions

DFi 98% AFUE Gas Furnace



CERTIFIED

DESIGN CERTIFIED

AHRI CERTIFIED
www.ahridirectory.org
Residential Furnaces
DOE 10 CFR Part 430

THIS BOOKLET CONTAINS IMPORTANT INFORMATION

INSTALLER: USE THE INFORMATION IN THIS BOOKLET TO INSTALL THE APPLIANCE AND AFFIX THIS BOOKLET ADJACENT TO THE APPLIANCE AFTER INSTALLATION.

USER: KEEP THIS BOOKLET OF INFORMATION FOR FUTURE REFERENCE.

SERVICER: USE THE INFORMATION IN THIS BOOKLET TO SERVICE THE APPLIANCE AND AFFIX THE BOOKLET ADJACENT TO THE APPLIANCE AFTER SERVICING.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

- Failure to follow the safety warnings exactly could result in 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 neighbor's phone. 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.

These furnaces conform to the American National Standard / National Standard of Canada ANSI Z21.47/CSA-2.3 for Gas Fired Central Furnaces.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

The furnace is designed and approved for use with natural gas and (LP) propane gas ONLY. DO NOT BURN ANY LIQUID FUEL OR SOLID FUEL IN THIS FURNACE.

Burning any unapproved fuel will result in damage to the furnace heat exchanger, which could result in fire, personal injury, and/or property damage.

Installation, Start--up, Operating and Service and Maintenance Instructions

CONTENTS

1. SAFETY CONSIDERATIONS 4
2. INTRODUCTION 8
3. CODES AND STANDARDS 8
4.ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE 9
5. LOCATION 10
6. INSTALLATION 11
6.1 Up flow installation 11
6.2 Horizontal installation 12
6.3 Downflow installation 13
6.4 Filter arrangement 19
6.5 Air duct 23
7. COMBUSTION AIR AND VENTILATION 26
7.1 Direct vent (2-pipe) applications 26
7.2 Ventilated combustion air applications 26
7.3 Combustion air/vent pipe sizing 28
7.4 Combustion air and vent piping assembly 31
7.5 Ventilated combustion air and vent termination clearance 31
7.6 Vent system 33
7.7 For upflow installation 36
7.8 For horizontal installations 37
7.9 For downflow installations 39
8.CONDENSATE LINE AND CONDENSATE TRAP 40
8.1 For up flow-condensate line and condensate TRAP installation 41
8.2 For horizontal -condensate line and condensate TRAP installation 42
8.3 For downflow -condensate line and condensate TRAP installation 44
9. HIGH ALTITUDE DERATE 46
10. PROPANE GAS CONVERSION 47
11. GAS SUPPLY AND PIPING 49
12. ELECTRICAL CONNECTIONS 51
12.1 115V wiring 51
12.2 24V wiring 54
12.3 Accessories (Field supplied) 55
12.4 Grounding 55
13. START-UP, ADJUSTMENT, AND SAFETY CHECK 57
13.1 General 57
13.2 Setup switches 57
13.3 Prime condensate TRAP with water 59
13.4 Purge gas lines 60
13.5 Adjustments 60
13.6 Check safety control 63
14. FUNCTIONAL BUTTON OPERATIONS 66
15. WIRING DIAGRAMS 73
16. Fault Code. 74

1. SAFETY CONSIDERATIONS

⚠WARNING

FIRE, EXPLOSION, ELECTRICAL SHOCK, AND CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in dangerous operation, serious injury, death,or property damage.
Improper installation,adjustment,alteration,service,maintenance,or use could cause carbon monoxide poisoning,explosion, fire,electrical shock,or other conditions which maycause personal injury or property damage. Consult a qualified service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified service agency must use only factory-authorized and listed kits or accessories when modifying this product.

⚠CAUTION

FURNACE RELIABILITY HAZARD

Improper installation or misapplication of furnace may require excessive servicing or cause premature component failure.
Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rated air temperature rise, unit leveling, and unit sizing.

⚠CAUTION

CUT HAZARD

Failure to follow this caution may result in personal injury. Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts and servicing furnaces.

Improper installation, adjustment, alteration, service, maintenance, or use can cause explosion, fire, electrical shock, or other conditions which may cause death, personal injury, or property damage. Consult a qualified installer, service agency, or your distributor or branch for information or assistance. The qualified installer or agency must use factory-authorized kits or accessories when modifying this product. Refer to the individual instructions packaged with the kits or accessories when installing.

Follow all safety codes. Wear safety glasses, protective clothing, and work gloves. Have a fire extinguisher available. Read these instructions thoroughly and Follow all warnings or cautions included in literature and attached to the unit. Consult local building codes,the
current editions of the National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the National Electrical Code (NEC) NFPA 70.

In Canada, refer to the current editions of the National Standards of Canada CAN/CSA-BI49.1 and .2 Natural Gas and Propane Installation Codes, and Canadian Electrical Code CSA C22.1.

Recognize safety information. This is the safety-alert symbol ⚠When you see this symbol on the unit and in instructions or manuals, be alert to the potential for personal injury. Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety-alert symbol.

Understand the signal words DANGER, WARNING, and CAUTION. These words are used with the safety–alert symbol.

·**DANGER** identifies the most serious hazards which will result in severe personal injury or death.

·**WARNING** signifies a hazard which could result in personal injury or death.

·**CAUTION** is used to identify hazards which may result in minor personal injury or product and property damage.

·**NOTE** and **NOTICE** are used to highlight suggestions which will result in enhanced installation,reliability, or operation.

01. Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
02. Install this furnace only in a location and position as specified in the “Location” section of these instructions.
03. Provide adequate combustion and ventilation air to the furnace space as specified in “Air for Combustion and Ventilation” section.
04. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in the “Venting” section of these instructions.
05. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections, as specified in the “Gas Piping” section.
06. Always install furnace to operate within the furnace’s intended temperature–rise range with a duct system which has an external static pressure within the allowable range, as specified in the “Start–Up, Adjustments, and Safety Check”section. See furnace rating plate.

07. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. See “Air Ducts” section.

08. A gas–fired furnace for installation in a residential garage must be installed as specified in the warning box in the “Location” section.

09. The furnace may be used for construction heat provided that the furnace installation and operation comply with the first CAUTION in the **LOCATION** section of these instructions.

10. These Multipoise Gas–Fired Furnaces are CSA design–certified for use with natural and propane gases (see furnace rating plate) and for installation in alcoves, attics, basements, closets, utility rooms, crawlspaces, and garages. The furnace is factory–shipped for use with natural gas. A CSA (A.G.A. and C.G.A.) listed accessory gas conversion kit isrequired to convert furnace for use with propane gas.

11. See Table 1 for required clearances to combustible construction.

12. Maintain a 1–in. (25 mm) clearance from combustible materials to supply air ductwork for a distance of 36 in. (914 mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.

13. These furnaces **SHALL NOT** be installed directly on carpeting, combustible tile, or any other combustible material other than wood flooring.

14. Follow the instruction of lighting/ shutdown operations. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting of the electrical supply.

15. Before heating season begins, examine the furnace to determine that:

    a. All flue gas carrying areas external to the furnace (i.e. chimney, vent connector) are clear and free of obstructions.
    b. The vent connector is in place, slopes upward and is physically sound without holes or excessive corrosion.
    c. The Return air duct connections are physically connected, sealed to the furnace casing, and terminate externally to the space containing the furnace.
    d. The physical support of the furnace is sound without sagging, cracks, gaps, etc. around the base so as to provide a seal between the support and the base.
    e. There are no obvious signs of deterioration of the furnace.
    f. The burner flames are in good adjustment (by comparison with pictorial sketches of the main burner flame (see Fig 1).

16. Furnace operation needs air for combustion andventilation. Do not block or obstruct air openings on furnace or clearances around furnace required for supplying sufficient combustion air and ventilation.

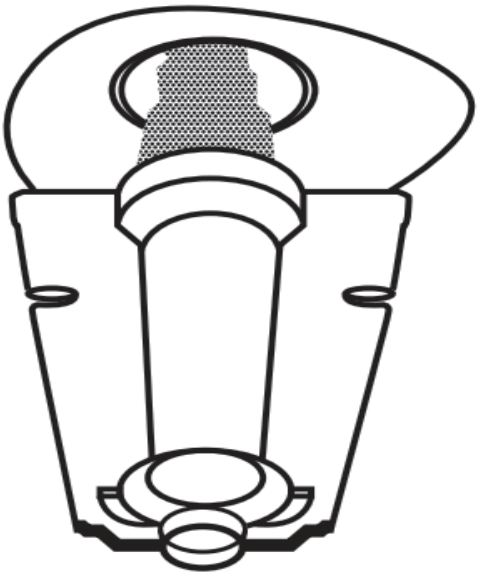


Fig. 1 Burner Flame

Check the burner flames to ensure:

01. Proper adjustment.
02. They are stable, soft, and blue.
03. There is no curling, floating, or liftingoff.

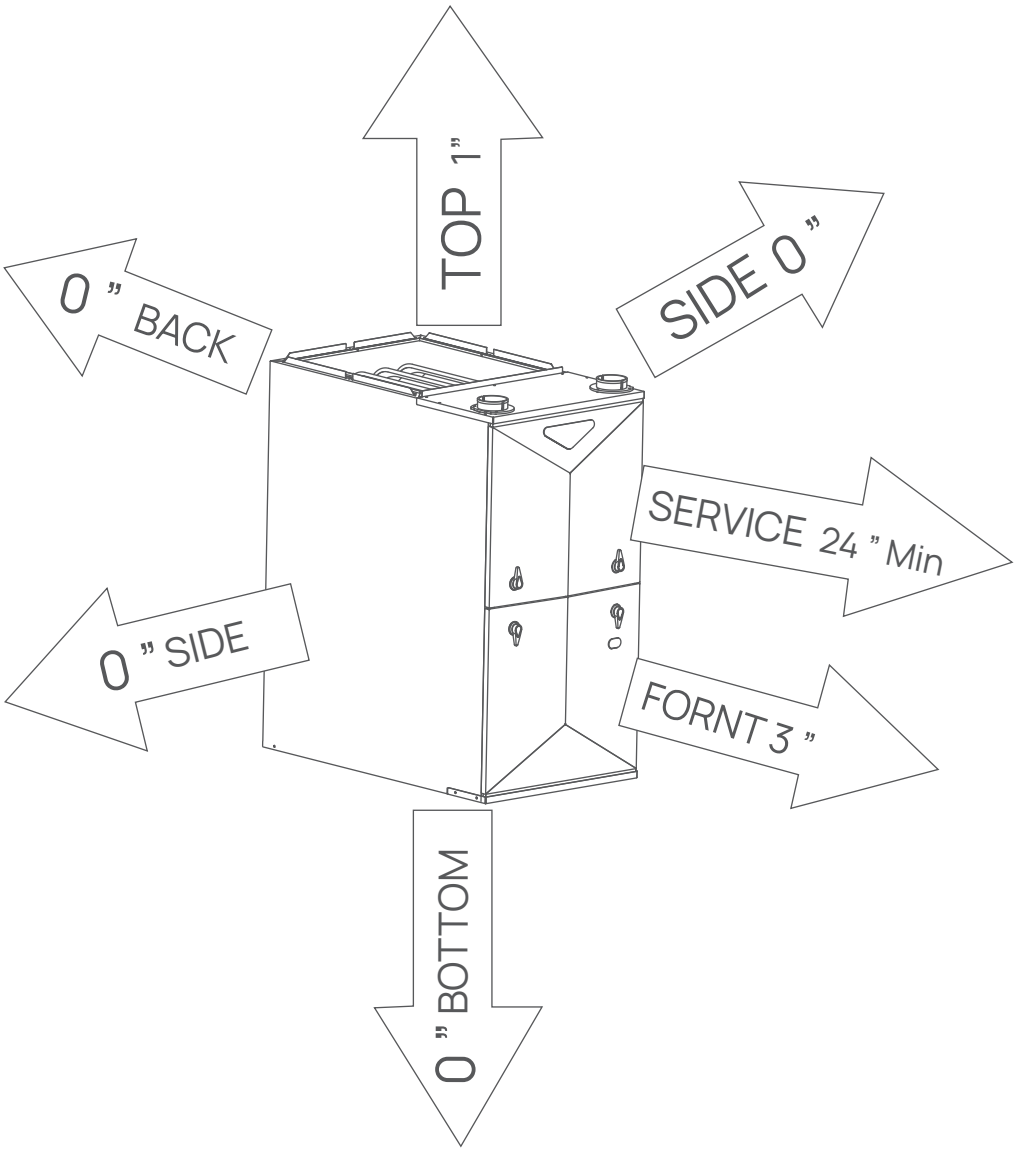


Table 1 Minimum Clearances to Combustible Materials for All Units

POSITION	CLEARANCE
Rear	0 (0 mm)
Front (Combustion air openings in furnace and in structure)	3 in. (25 mm)
Required for service	24 in. (610 mm)
All Sides of Supply Plenum	1 in. (25 mm)
Sides	0 (0 mm)
Vent	0 (0 mm)
Top of Furnace	1 in. (25 mm)

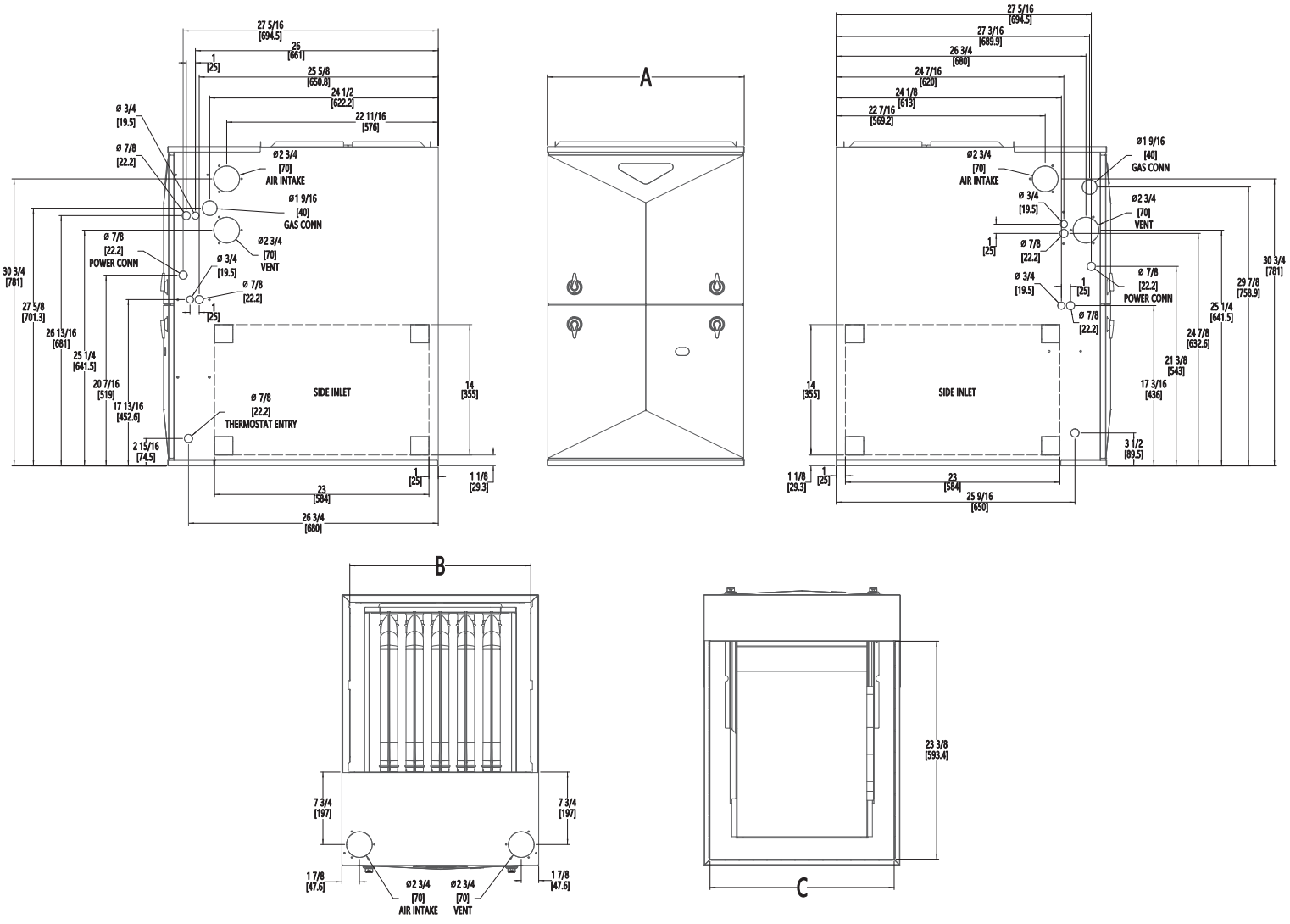


Fig. 2 – Dimensional Drawing

Size	A inch	B inch	C inch	NET WT. LB (KG)	SHIP WT. LB (KG)
	CABINET WIDTH	OUTLET WIDTH	BOTTOM INLET WIDTH		
80B	17.5	15.9	16.4	150(68)	182(83)
100C	21	19.4	19.9	173(78.5)	208(94)

2. INTRODUCTION

The 4-way multipoise Category IV condensing furnace is CSA design-certified for both direct-vent (2-pipe) and ventilated combustion air venting installations. See Fig. 2. The furnace is factory-shipped for use with natural gas. The furnace can be converted in the field for use with propane gas when a factory-supplied conversion kit is used. Refer to the propane gas conversion instructions for details.

This furnace is not approved for installation in mobile homes, recreational vehicles, or outdoors.

This furnace is designed for minimum continuous return-air temperature of 60℉(16℃)db or intermittent operation down to 55 ℉(13 ℃)db such as when used with a night setback thermostat. Return-air temperature must not exceed 85 ℉ (29℃)db. Failure to follow these return-air temperature limits may result in equipment protection shutdown or affect reliability of heat exchangers, motors, and controls. See Fig.3.

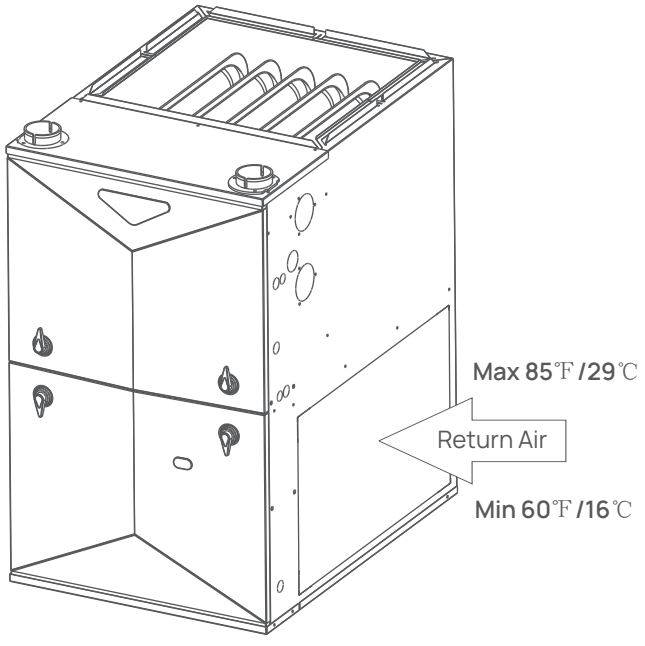


Fig. 3 - Return Air Temperature

The furnace should be sized to provide 100 percent of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. None of the furnace model sizes can be used if the heating load is 20,000 BTU or lower. Use Air Conditioning Contractors of America (Manual J and S); American Society of Heating, Refrigerating, and Air-Conditioning Engineers; or other approved engineering method to calculate heating load estimates and select the furnace.

Excessive oversizing of the furnace may cause the furnace and/or vent to fail prematurely, customer discomfort and/or vent freezing.Failure to follow these guidelines is considered faulty installation and/or misapplication of the furnace; and resulting failure, damage, or repairs may impact warranty coverage.For accessory installation details, refer to the applicable instruction literature.

NOTE: Remove all shipping materials, loose parts bag, and literature before operating the furnace.

3. CODES AND STANDARDS

Follow all national and local codes and standards in addition to these instructions. The installation must comply with regulations of the serving gas supplier, local building, heating, plumbing, and other codes. In absence of local codes, the installation must comply with the national codes listed below and all authorities having jurisdiction.
In the United States and Canada, follow all codes and standards for the following:

3.1 Safety

- US: National Fuel Gas Code (NFGC) NFPA 54/ANSI Z223.1 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B.
- CANADA: National Standard of Canada Natural Gas and Propane Installation Codes (CAN/CSA-B149.1-05)

3.2 General Installation

- US: Current edition of the NFGC and the NFPA 90B. For copies, contact the National Fire Protection Association Inc., Battery march Park, Quincy, MA 02269; or for only the NFGC, contact the American Gas Association, 400 N.Capitol Street, N.W., Washington, DC 20001.
- CANADA: NSCNGPIC. For a copy, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke (Toronto), Ontario, M9W 1R3 Canada.

3.3 Combustion and Ventilation Air

- US: Section 9.3 of the NFGC, NFPA 54/ANSI Z223.1 Air for Combustion and Ventilation.
- CANADA: Part 8 of CAN/CSA-B149.1-05, Venting Systems and Air Supply for Appliances.

3.4 Duct Systems

- US and CANADA: Air Conditioning Contractors Association (ACCA) Manual D, Sheet Metal and Air Conditioning Contractors National Association (SMACNA), or American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) 2001 Fundamentals Handbook Chapter 34.
- CANADA: National Standard of Canada Natural Gas and Propane Installation Codes (CAN/CSA-B149.1-05)

3.5 Acoustical Lining and Fibrous Glass Duct

- US and CANADA: current edition of SMACNA and NFPA 90B as tested by UL Standard 181 for Class I Rigid Air Ducts.

3.6 Gas Piping and Gas Pipe Pressure Testing

- US: NFPA 54/ANSI Z223.1 Chapters 5, 6, 7, and 8 and National Plumbing Codes.
- CANADA: CAN/CSA-B149.1-05 Parts 4, 5, and 6 and Appendices A, B, E, and H.

3.7 Electrical Connections

- US: National Electrical Code (NEC) ANSI/NFPA 70.
- CANADA: Canadian Electrical Code CSA C22.I.

3.8 Electrical power supply

- Voltage: ANSI C84.1 (104-127 volts)

3.9 Condensate Drain Connection

- US: National Standard Plumbing Code 2009, Section 8.7.
- Canada: National Plumbing Code of Canada 2010 in Canada.

3.10 Venting

- US: NFGC NFPA 54/ANSI Z223.1-2006 ; chapters 12 and 13.
- CANADA: CAN/CSA-B149.1-05 Part 8 and Appendix C.

4. ELECTROSTATIC DICHARGE (ESD) PRECAUTIONS PROCEDURE

⚠ WARNING

FURNACE RELIABILITY HAZARD

Improper installation or service of furnace may cause premature furnace component failure. Electrostatic discharge can affect electronic components. Follow the Electrostatic Discharge Precautions Procedure listed below during furnace installation and servicing to protect the furnace electronic control. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure. These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, and the person at the same electrostatic potential.

4.1 Disconnect all power to the furnace. Multiple disconnects may be required. **DO NOT TOUCH THE CONTROL OR ANY WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.**

4.2 Firmly touch the clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.

4.3 After touching the chassis, you may proceed to service the control or connecting wires as long as you do nothing to recharge your body with static electricity(for example; DO NOT move or shuffle your feet, do not touch ungrounded objects, etc.).

4.4 If you touch ungrounded objects (and recharge your body with static electricity), firmly touch a clean, unpainted metal surface of the furnace again before touching control or wires.

4.5 Use this procedure for installed and uninstalled (ungrounded) furnaces.

4.6 Before removing a new control from its container, discharge your body's electrostatic charge to ground to protect the control from damage. If the control is to be installed in a furnace, follow items 1 through 4 before bringing the control or yourself in contact with the furnace. Put all used and new controls into containers before touching ungrounded objects.

5. LOCATION

5.1 General

This multipoise furnace is shipped in packaged configuration. Some assembly and modifications are required when used in any of the four applications . This furnace must:

- Be installed such that the electrical components are protected from water.
- Not be installed directly on any combustible material other than wood flooring (refer to **SAFETY CONSIDERATIONS**).
- Be located as close to the chimney or vent and attached to an air distribution system. Refer to Air Ducts section.
- Be provided ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown on the furnace clearance to combustible label.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death, and unit component damage. Corrosive or contaminated air may cause failure of parts containing flue gas, which could leak into the living space. Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products. Do not install urnace in a corrosive or contaminated atmosphere. Ensure all combustion and circulating air requirements are met, and comply with local codes and ordinances.

The following types of furnace installations may require OUTDOOR AIR for combustion air due to chemical exposure:

- Commercial buildings
- Buildings with indoor pools
- Laundry rooms
- Hobby or craft rooms
- Chemical storage areas

If the combustion air contains the following substances, it should not be used for combustion air, and outdoor air may be required for combustion:

- Permanent wave solutions
- Chlorinated waxes and cleaners
- Chlorine based swimming pool chemicals
- Water softening chemicals
- De–icing salts or chemicals
- Carbon tetrachloride
- Halogen type refrigerants
- Cleaning solvents (such as perchloroethylene)
- Printing inks, paint removers, varnishes, etc.
- Hydrochloric acid
- Cements and glues
- Antistatic fabric softeners for clothes dryers
- Masonry acid washing materials

⚠ WARNING

FIRE, INJURY OR DEATH HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage. When the furnace is installed in a residential garage, the burners and ignition sources must be located at least 18 inches (457 mm) above the floor. The furnace must be located or protected to avoid damage by vehicles. When the furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, the furnace must be installed in accordance with the NFGC or CAN/CSA - B149 .1-05. (See Fig. 4).

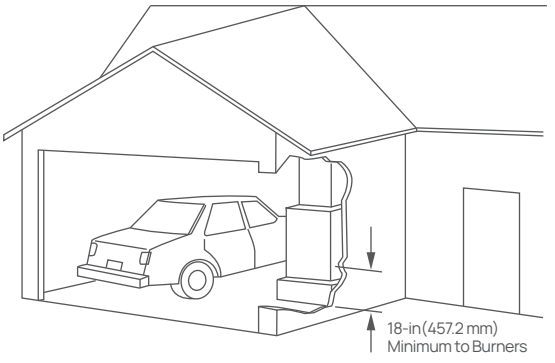


Fig. 3 - Return Air Temperature

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.Do not install the furnace on its back or hang furnace with control compartment facing downward. Safety control operation will be adversely affected. Never connect return–air ducts to the back of the furnace. See Fig. 8.

Location Relative to Cooling Equipment

The cooling coil must be installed parallel with, or on the downstream side of the unit to avoid condensation in the heat exchangers. When installed parallel with the furnace, dampers or other flow control must prevent chilled air from entering the furnace. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full–heat or full–cool position.

6. INSTALLATION

NOTE: Air leakage less than 2% of design airflow rate in accordance with ASHRAE 193.

⚠ CAUTION

FIRE HAZARD

DO NOT install the furnace in a corrosive or contaminated atmosphere.

IMPORTANT:

The furnace must be installed level. The only allowable variation would be slightly to the right and/or forward in up flow installations or slightly toward the front in horizontal installations. This is necessary for proper condensate drainage.(see Fig. 7)

This furnace may be installed in an up flow position or downflow position or horizontal on either the left or right side panel. Do not install this furnace on its back. (see Fig. 8).

6.1 Up flow Installation

NOTE: The furnace must be pitched as shown in Fig. 9 for proper condensate drainage.

Return Air Connections

⚠ WARNING

FIRE HAZARD

A failure to follow this warning could cause personal injury, death and/or property damage.

Never connect return-air ducts to the back of the furnace. Follow instructions below.

The return-air duct must be connected to bottom, sides(left or right), or a combination of bottom and side(s) of main furnace casing. Bypass humidifier may be attached into unused return air side of the furnace casing. See Fig.10.

· Bottom Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

① Tilt or raise furnace and remove the screw holding bottom filler panel. (See Fig. 5.)

② Remove bottom closure panel.

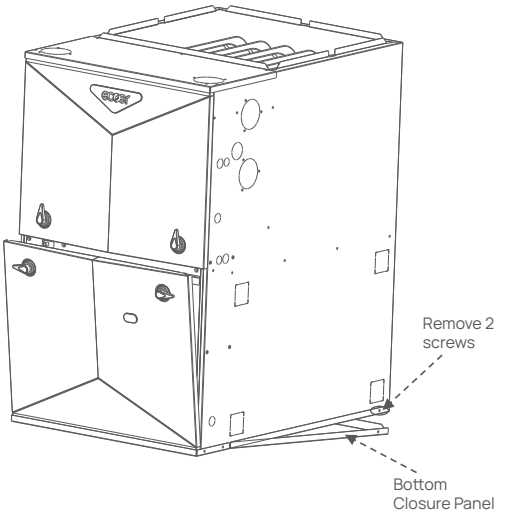


Fig. 5 – Removing Bottom Closure Panel

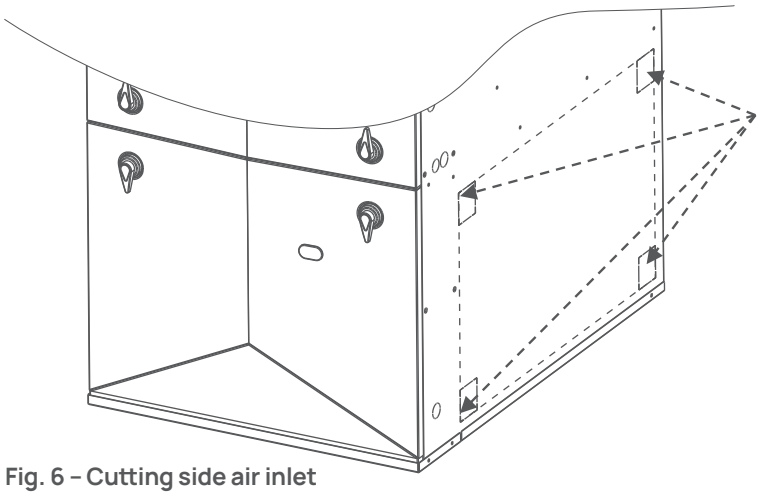


Fig. 6 – Cutting side air inlet

· Side Return Air Inlet

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. This panel MUST be in place when only side return air is used.

Cut open according to the existing 4 imprints on the side panel, and use them as side return air vents.

NOTE: Side return-air openings can be used in UPFLOW and some HORIZONTAL configurations. Do not use side return-air openings in DOWNFLOW configuration. See Fig. 11.

Supply Air Connections

For a furnace not equipped with a cooling coil, the outlet duct shall be provided with a removable access panel. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for possible openings using light assistance or a probe can be inserted for sampling the air stream. The cover attachment shall prevent leaks.

Connect the supply-air duct to the flanges on the furnace's supply-air outlet. The supply-air duct must be connected to **ONLY** the furnace supply–outlet–air duct flanges or air conditioning coil casing(when used). **DO NOT** cut main furnace casing side to attach relocation condensate **TRAP.**

supply air duct, humidifier, or other accessories. All supply–side accessories **MUST** be connected to duct external to furnace main casing.

6.2 Horizontal Installation

⚠ WARNING

FIRE, EXPLOSION, AND CARBON MONOXIDE POISONING HAZARD

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

Do not install the furnace on its back or hang furnace with control compartment facing downward. Safety control operation will be adversely affected. Never connect return-air ducts to the back of the furnace.

The furnace can be installed horizontally in an attic or crawl space, either on the bottom or on the left-hand (LH) or right-hand (RH) side. The furnace can be hung from floor joists, rafters or trusses or installed on a non-combustible platform, blocks, bricks or pad.

Platform Furnace Support

Construct working platform at location where all required furnace clearances are met. See Fig. 13) For furnaces with 1–in. (25 mm) clearance requirement on side, set furnace onnon-combustible blocks, bricks or angle iron. For crawlspace installations, if the furnace is not suspended from the floor joists, the ground underneath furnace must be level and the furnace set on blocks or bricks.

Suspended Furnace Support

The furnace must be supported under the entire length of the furnace with threaded rod and angle iron. See Fig. 14. Secure angle iron to bottom of furnace as shown.

Return Air Connections

The return–air duct may be connected to bottom of the furnace.

The side of casing that faces downward may also be used for return air connection. A combination of the bottom and downward facing side may also be used. The upward facing side of the casing cannot be used as a return air connection. See Fig. 12.

- **Bottom Return Air Inlet**

These furnaces are shipped with bottom closure panel installed in bottom return-air opening. Remove and discard this panel when bottom return air is used. To remove bottom closure panel, perform the following:

①Tilt or raise furnace and remove the screw holding bottom filler panel. (See Fig. 5.)

②Remove bottom closure panel.

- **Side Return Air Inlet**

These furnaces are shipped with bottom closure panel installed in bottom return–air opening. This panel MUST be in place when side return air inlet(s) are used without a bottom return air inlet.

Not all horizontal furnaces are approved for side return air connections. See Fig. 12.

Supply Air Connections

For a furnace not equipped with a cooling coil, the outlet duct shall be provided with a removable access panel. This opening shall be accessible when the furnace is installed and shall be of such a size that the heat exchanger can be viewed for possible openings using light assistance or a probe can be inserted for sampling the air stream. The cover attachment shall prevent leaks.

Connect supply–air duct to flanges on furnace supply–air outlet. The supply–air duct must be connected to ONLY the furnace supply–outlet–air duct flanges or air conditioning coil casing(when used). DO NOT cut main furnace casing side to attach supply air duct, humidifier, or other accessories. All accessoriesMUST be connected to duct external to furnace main casing.

6.3 Downflow Installation

NOTE: The furnace must be pitched as shown in Fig. 9 for proper condensate drainage.

Return Air Connections

⚠ WARNING

FIRE HAZARD

A failure to follow this warning could cause personal injury, death and / or property damage.

Never connect return–air ducts to the back of the furnace. Follow instructions below.

The return–air duct must be connected to return–air opening(bottom inlet). DO NOT cut into casing sides (left or right).

Bypass humidifier connections should be made at ductwork or coil casing sides exterior to furnace. See Fig. 11.

- **Bottom Return Air Inlet**

These furnaces are shipped with bottom closure panel installed in bottom return–air opening. Remove and discard this panel when bottom return air is used in downflow applications. To remove bottom closure panel, perform the following:

1. Tilt or raise furnace and remove 2 screws holding bottom plate. See Fig. 5.
2. Remove bottom closure panel.

Supply Air Connections

NOTE: For downflow applications, this furnace is approved for use on combustible flooring.
when any one of the following 3 accessories are used:

① Special Base, KGASB
② Cased Coil Assembly Part No. CNPV, CNRV, CAP, or CAR
③ Coil Box Part No. KCAKC

1. Determine application being installed from Table 2
2. Construct hole in floor per Table 2 and Fig. 15.
3. Construct plenum to dimensions specified in Table 2 and Fig. 15.
4. Install special base coil assembly or coil box as shown in Fig. 15

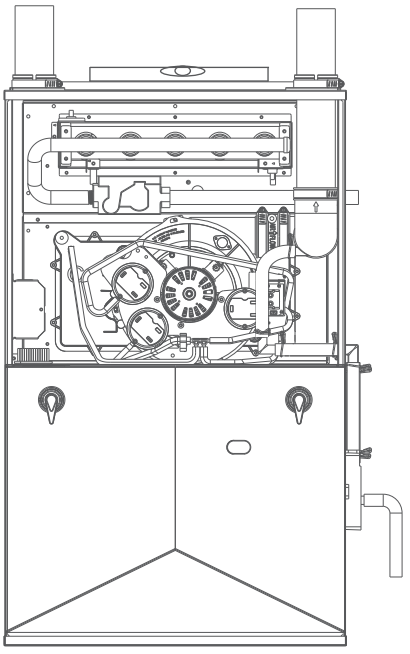
⚠ CAUTION

CUT HAZARD

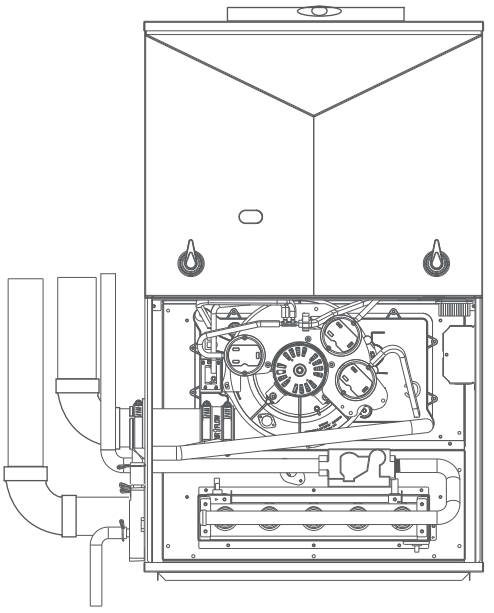
Failure to follow this caution may result in personal injury.

Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

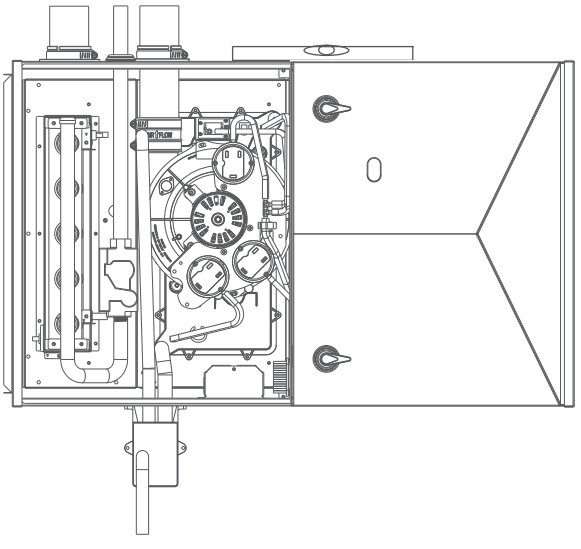
Connect supply–air duct to supply–air outlet on furnace. The supply–air duct must be connected to ONLY the furnace supply outlet or air conditioning coil casing (when used). When installed on combustible material, supply–air duct must be connected to ONLY the factory–approved accessory subbase, or a factory–approved air conditioning coil casing. DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All supply–side accessories MUST be connected to duct external to furnace casing.

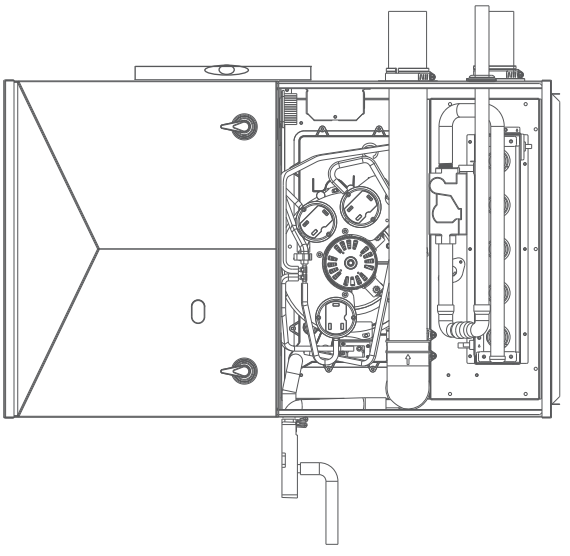


Upflow Installation



Downflow Installation





Horizontal Installation

Fig. 7 – Installations

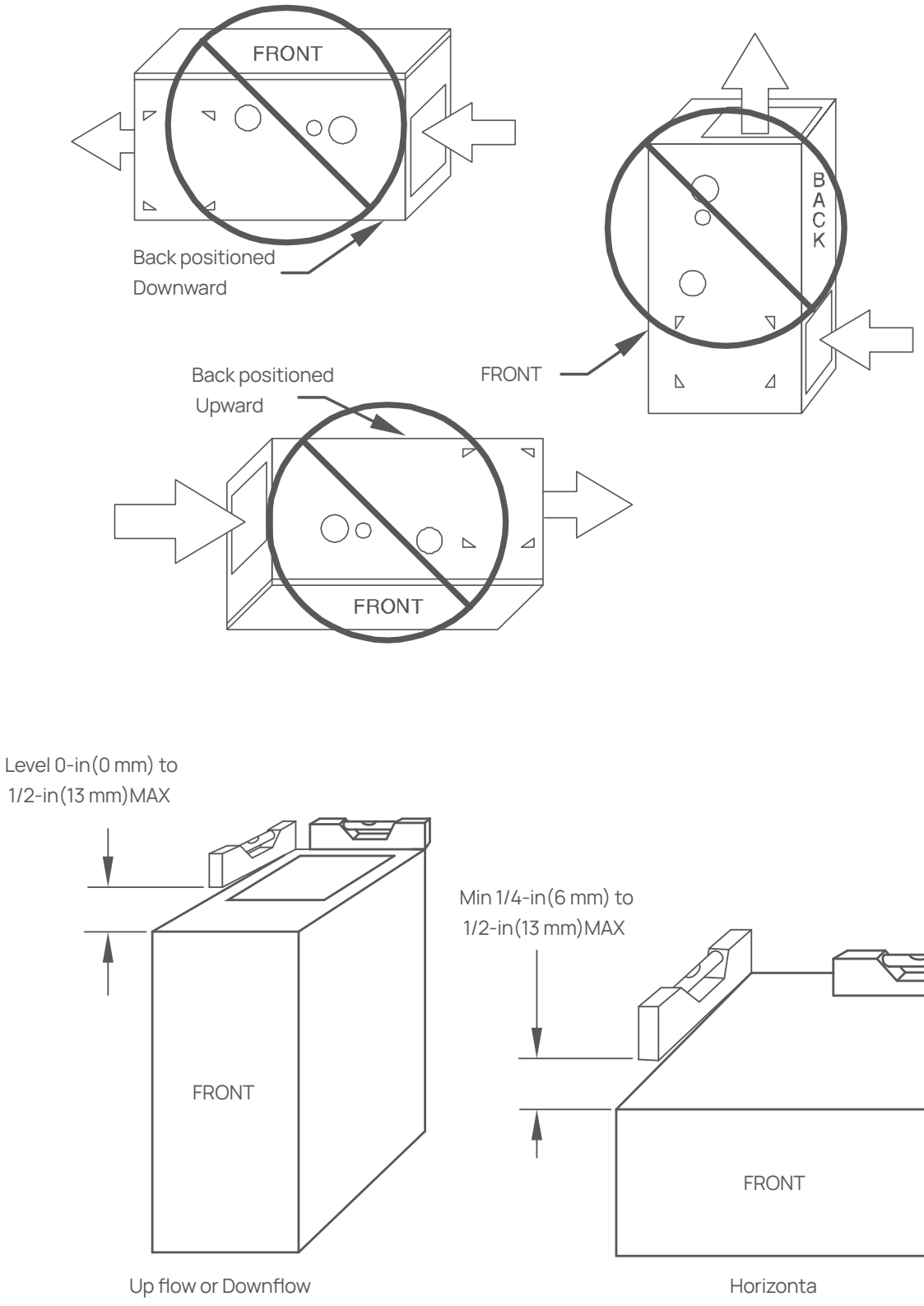


Fig. 9 – Installations

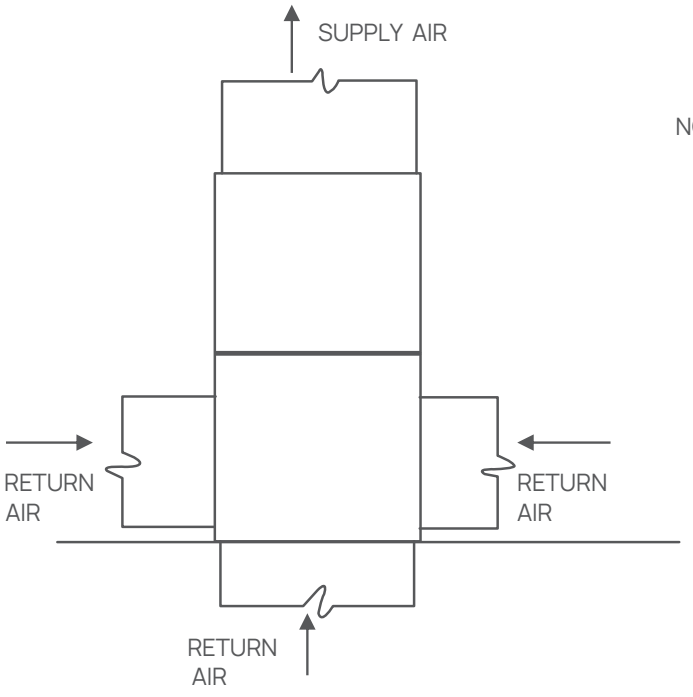


Fig.10 –Up flow Installations

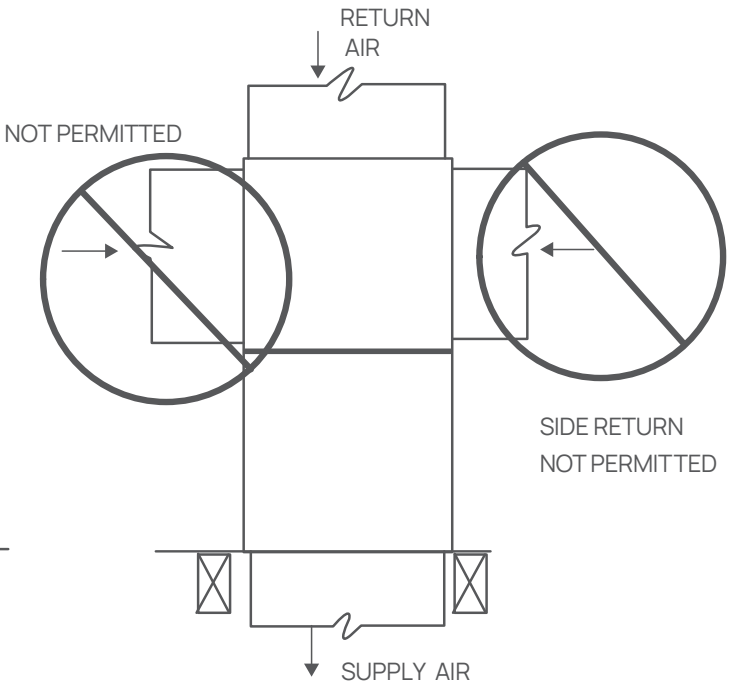


Fig.11 - Downflow Installations

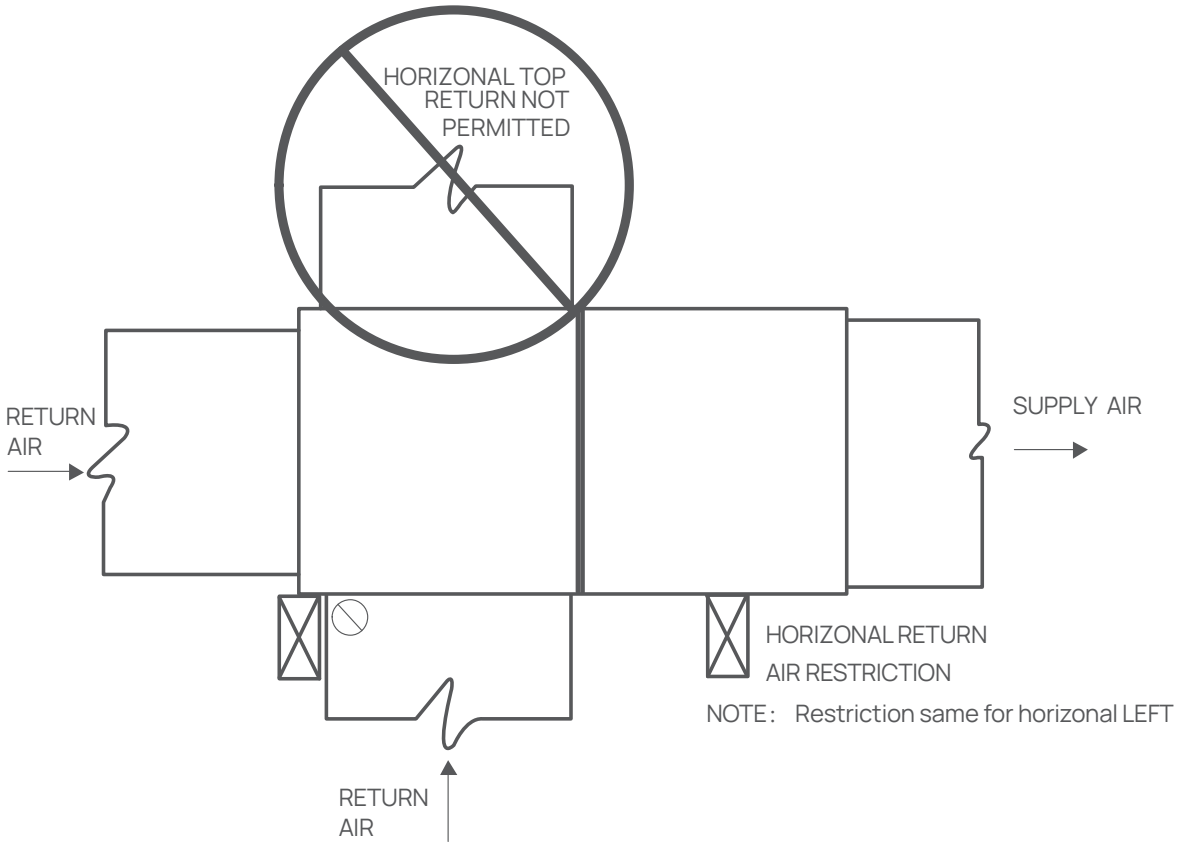


Fig.12 –Horizontal Installation

Return Air Configurations and Restrictions

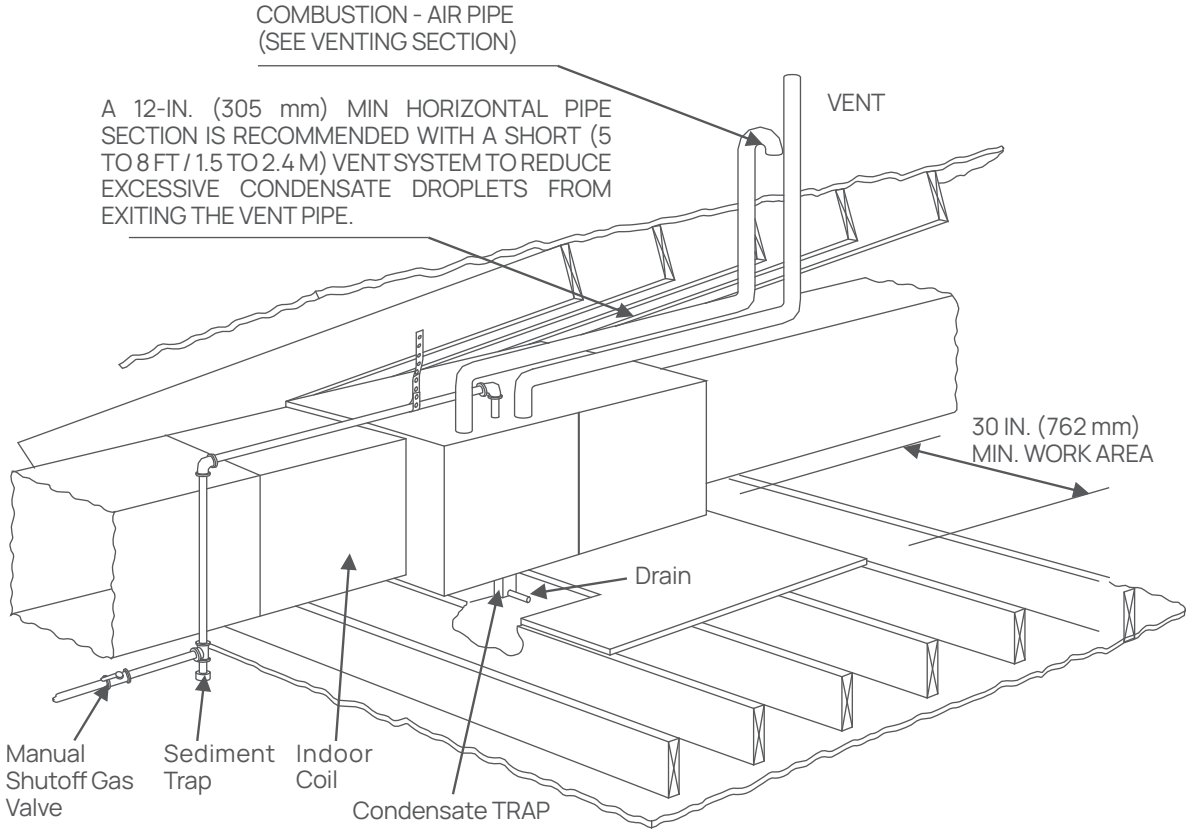
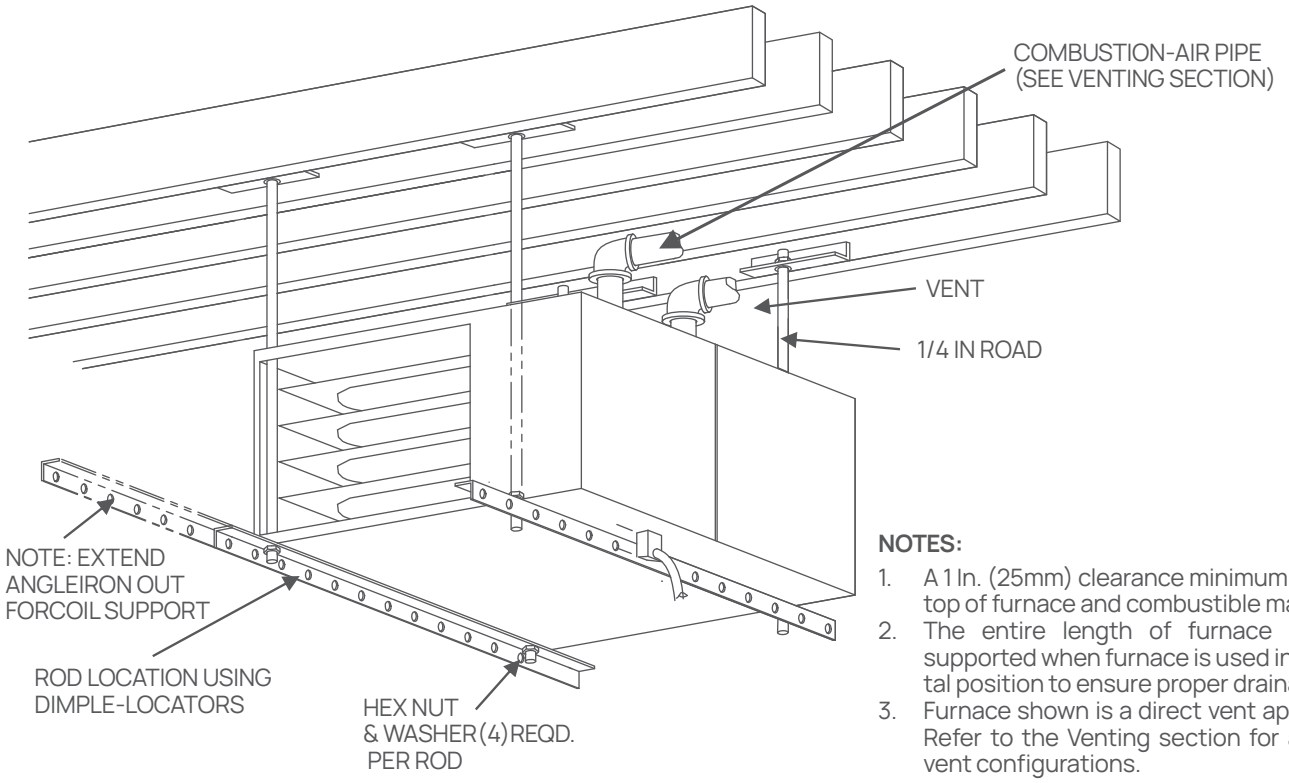


Fig.12 –Horizontal Installation



NOTES:

1. A 1 In. (25mm) clearance minimum between top of furnace and combustible material
2. The entire length of furnace must be supported when furnace is used in horizontal position to ensure proper drainage.
3. Furnace shown is a direct vent application. Refer to the Venting section for allowable vent configurations.

Fig. 14 -Suspended Furnace Installation

Return Air Configurations and Restrictions

Required floor opening:

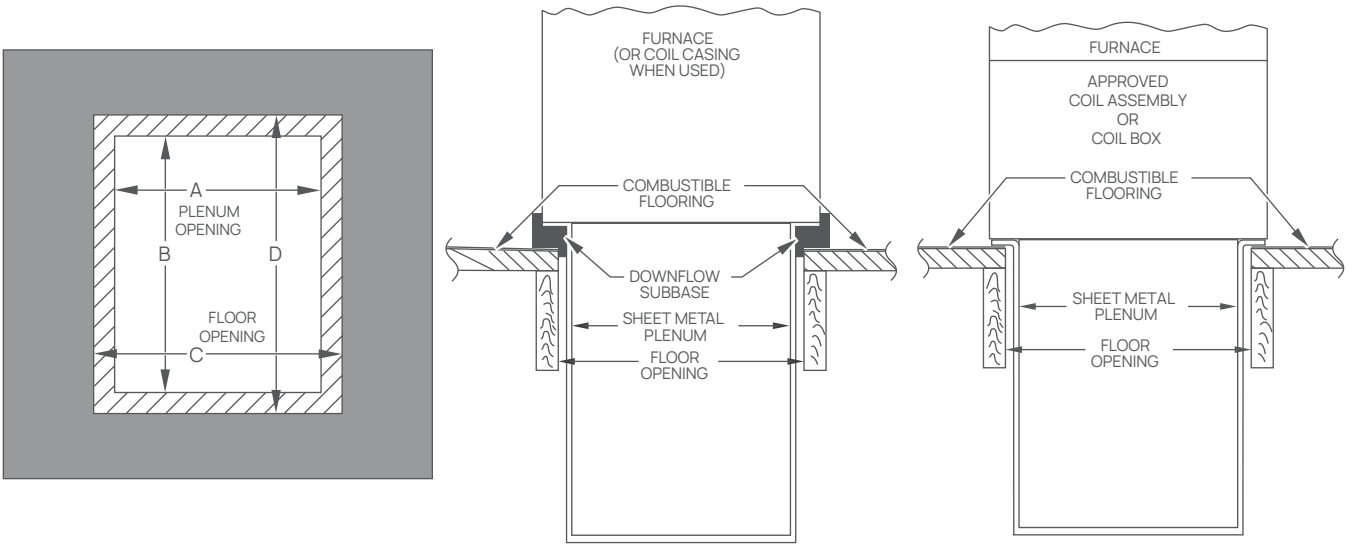


Fig. 15 – Installation on Combustible Flooring

Table 2 Opening Dimensions – In. (mm)

CABINET WIDTH	APPLICATION	PLENUM OPENING		FLOOR OPENING	
		"A"	"B"	"C"	"D"
17-1/2"	Up flow Applications on Combustible or Noncombustible Flooring	16 (406)	21-5/8 (549)	16-5/8 (422)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring	15-7/8 (403)	19 (483)	16-1/2 (419)	19-5/8 (498)
	Downflow applications on combustible flooring	15-1/8 (384)	19 (483)	16-3/4 (425)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with coil box	15-1/2 (394)	19 (483)	16-1/2 (419)	20 (508)
21"	Up flow Applications on Combustible or Noncombustible Flooring	19-1/2 (495)	21-5/8 (549)	20-1/8 (511)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring	19-3/8 (492)	19 (483)	20 (508)	19-5/8 (498)
	Downflow applications on combustible flooring	18-5/8 (473)	19 (483)	20-1/4 (514)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with coil box	19 (483)	19 (483)	20 (508)	20 (508)
24-1/2"	Up flow Applications on Combustible or Noncombustible Flooring	23 (584)	21-1/8 (537)	23-5/8 (600)	22-1/4 (565)
	Downflow Applications on Noncombustible Flooring	22-7/8 (581)	19 (483)	23-1/2 (597)	19-5/8 (498)
	Downflow applications on combustible flooring	22-1/8 (562)	19 (483)	23-3/4 (603)	20-5/8 (600)
	Downflow Applications on Combustible Flooring with coil box	22-1/2 (572)	19 (483)	23-1/2 (597)	20 (508)

6.4 Filter Arrangement

⚠ WARNING

CARBON MONOXIDE AND POISONING HAZARD

Failure to follow this warning could result in personal injury, or death. Never operate a furnace without a filter or with filter access door removed.

There are no provisions for an internal filter rack in these furnaces.
An external filter is required.

All applications require the use of a field installed filter. All filters and mounting provision must be field supplied.
Filters must be installed external to the furnace cabinet. **DO NOT** attempt to install filters inside the furnace.

NOTE: Single side return above 1800 CFM is approved as long as the filter velocity does not exceed filter manufacturer's recommendation and a transition is used to allow use on a 20x25 filter.

For downflow applications, the Media Cabinet (or field supplied accessory air cleaner) must only be connected to the bottom opening on the furnace. See Fig. 11 and 16.

For horizontal applications, the Media Cabinet (or field supplied accessory air cleaner) for all models can be connected to the bottom opening on the furnace. For side return use in the horizontal position, refer to Fig. 12. If both side and bottom openings are used in Fig.12, each opening used will require a filter.
The media cabinet (or field supplied accessory air cleaner) can also be installed in the common return duct prior to entering the return air opening in any orientation.

See Table 5 for filter size details.

Filter and Return Duct Sizing

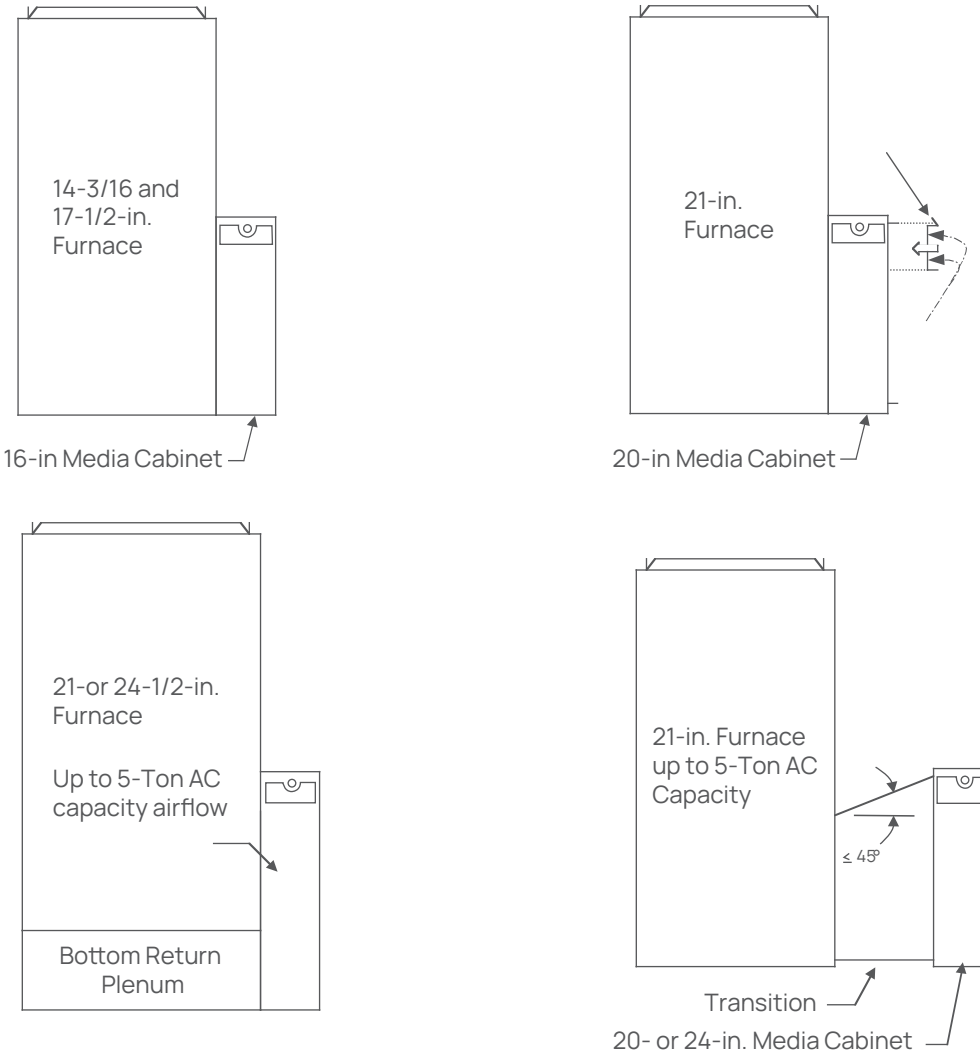
Pressure drop must be taken into account when sizing filters, filter racks, IAQ devices, and associated system ductwork. See Table 3 for a comparison of Pressure Drop (initial/clean resistance to airflow) versus Airflow for a variety of filter media types and sizes.
These are representative numbers. Consult the filter or IAQ device manufacturers' specification sheet for performance data for a particular filter media or IAQ device.
Design the filter and associated ductwork for the best match of pressure drop versus filter size. Best practice usually chooses filter systems with pressure drops under 0.2 in. W.C. (50 Pa), with the best blower electrical efficiency and system airflow performance occurring with filter pressure drops under 0.1 in. W.C. (25 Pa).

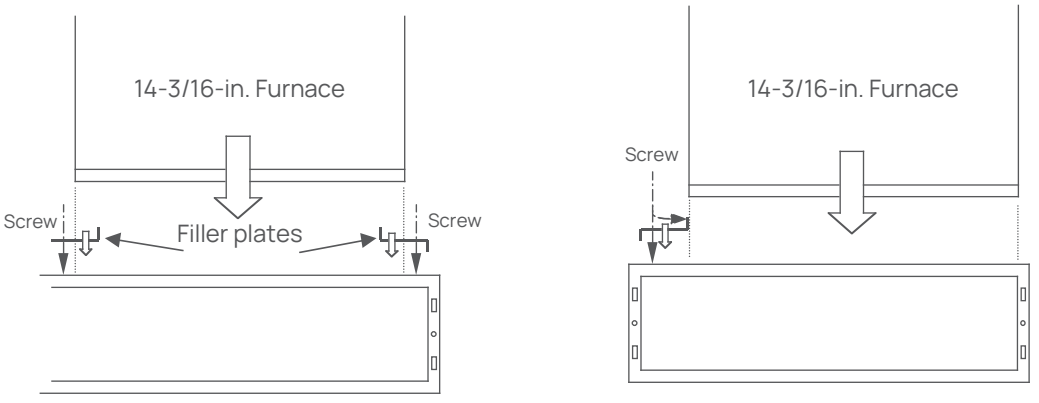
NOTICE

CUT HAZARD

Design the duct system FIRST to determine how much pressure drop may be allowed in the filter system. See he Air
Ducts section. Excessive filter pressure drop often compromises system airflow and duct performance, causes inadequate airflow to the furthest ends of the duct system, as well as causes excess noise and higher than anticipated electrical consumption.

Provide duct transitions, as required, to smoothly transition airflow from the return duct system to the filter (or IAQ device) to the furnace when the dimensions of the ductwork or furnace return air opening do not match the required filter or IAQ device dimensions. See Fig.16.





14–3/16-in. Furnace with Filler Plates, Centered

14–3/16-in. Furnace with Filler Plates, Off–Set to Right

Fig. 16 Media Filter

Table 3 – Filter Media Pressure Drop (Clean) Versus Airflow – In. W.C. (Pa)

16 x 25 Filter (406 x 635 mm)		Factory-Accessory Washable		Factory-Accessory Media*		Representative After-Market Filter Media*							
						Fiberglass*				Pleated*			
CFM	L/s	(1-in. / 2.5 cm)		(4-in. / 10 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)	
600	283	0.04	10	0.05	13	0.06	15	0.09	23	0.2	51	0.13	33
800	377	0.05	13	0.07	18	0.08	20	0.13	33	0.29	74	0.2	51
1000	472	0.06	15	0.11	28	0.11	28	0.17	43	––	––	0.27	69
1200	566	0.07	18	0.15	38	0.14	36	0.22	56	––	––	––	––
1400	660	0.08	20	0.19	48	0.18	46	0.28	71	––	––	––	––
1600	755	0.09	23	0.24	61	0.21	53	––	––	––	––	––	––
1800	849	0.10	25	––	––	0.26	66	––	––	––	––	––	––

20 x 25 Filter (508 x 635 mm)		Factory-Accessory Washable		Factory-Accessory Media*		Representative After-Market Filter Media*							
						Fiberglass*				Pleated*			
CFM	L/s	(1-in. / 2.5 cm)		(4-in. / 10 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)	
800	377	0.04	10	0.05	13	0.06	15	0.09	23	0.22	56	0.15	38
1000	472	0.05	13	0.07	18	0.08	20	0.13	33	0.29	74	0.20	51
1200	566	0.06	15	0.09	23	0.11	28	0.16	41	––	––	0.25	64
1400	660	0.07	18	0.12	30	0.13	33	0.20	51	––	––	0.31	79
1600	755	0.08	20	0.15	38	0.16	41	0.24	61	––	––	––	––
1800	849	0.08	20	0.18	46	0.18	46	0.29	74	––	––	––	––
2000	943	0.09	23	0.22	56	0.21	53	––	––	––	––	––	––

25 x 25 Filter (635 x 635 mm)		Factory-Accessory Washable		Factory-Accessory Media*		Representative After-Market Filter Media*							
						Fiberglass*				Pleated*			
CFM	L/s	(1-in. / 2.5 cm)		(4-in. / 10 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)	
800	377	0.03	8	0.03	8	0.05	13	0.07	18	0.17	43	0.11	28
1000	472	0.04	10	0.05	13	0.06	15	0.09	23	0.22	56	0.15	38
1200	566	0.05	13	0.07	18	0.08	20	0.12	30	0.27	69	0.18	46
1400	660	0.06	15	0.09	23	0.1	25	0.15	38	––	––	0.23	58
1600	755	0.06	15	0.12	30	0.11	28	0.18	46	––	––	0.28	71
1800	849	0.07	18	0.14	36	0.13	33	0.21	53	––	––	––	––
2000	943	0.08	20	0.16	41	0.16	41	0.24	61	––	––	––	––

The following equations relate Face Velocity (FPM), Filter Area and Airflow (CFM):

Filter Face Velocity = Airflow / Filter Area

Minimum Filter Area = Rated System Airflow / Maximum Filter Face Velocity

* Filters with a side return --air may have a different filter size. Measure the filter to obtain the correct size.

* Recommended to maintain air filter face velocity. See Product Data for part number.

If the filter size that you are looking for is not contained in Table 5, refer to Table 6 for a comparison of Pressure Drop (initial/clean resistance to airflow) versus Face Velocity for a variety of filter media types.

Table 4 – Filter Media Pressure Drop (Clean) Versus Face Velocity– In. W.C. (Pa)

Face Velocity		Factory-Accessory Washable		Representative After-Market Filter Media							
				Fiberglass				Pleated			
FPM	(m/s)	(1-in. / 2.5 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)		(1-in. / 2.5 cm)		(2-in. / 5 cm)	
200	1.0	0.04	10	0.05	13	0.08	20	0.18	46	0.12	30
300	1.5	0.05	13	0.09	23	0.13	33	0.3	76	0.21	53
400	2.0	0.07	18	0.13	33	0.2	51	-	-	0.31	79
500	2.5	0.08	20	0.18	46	0.27	69	-	-	-	-
600	3.0	0.09	23	0.23	-	-	-	-	-	-	-
700	3.6	0.1	25	0.29	-	-	-	-	-	-	-

Table 5 – Air Filter Selection and Duct Sizing – In. (mm)

CABINET WIDTH	FILTER SIZE		FILTER TYPE
	SIDE RETURN	BOTTOM RETURN	
B-17-1/2"	16 x 25 x 3/4 (406 x 635 x 19)	16 x 25 x 3/4 (406 x 635 x 19)	Washable*
C-21"	16 x 25 x 3/4 (406 x 635 x 19)	20 x 25 x 3/4 (508 x 635 x 19)	Washable*
D-24-1/2"	16 x 25 x 3/4 (406 x 635 x 19)	24 x 25 x 3/4 (610 x 635 x 19)	Washable*
*Recommended to maintain air filter face velocity. See Product Data for part number.			

1. Air velocity through throwaway type filters may not exceed 300 feet per minute (91.4 m/min). All velocities over this require the use of high velocity filters.
2. Do not exceed 1800 CFM using a single side return and a 16x25 filter. For CFM greater than 1800, you may use two side returns or one side and the bottom or one side return with a transition to allow use of a 20x25 filter.

6.5 Air Ducts

General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by: Air Conditioning Contractors Association (ACCA Manual D) , Sheet Metal and Air Conditioning Contractors National.
Association (SMACNA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) or consult The Air Systems Design Guidelines reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design external static pressure.
Secure ductwork with proper fasteners for type of ductwork used. Seal supply- and return-duct connections to furnace with code approved tape or duct sealer.

NOTE: Flexible connections should be used between ductwork and furnace to prevent transmission of vibration.
Ductwork passing through unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapor barrier is recommended.
Maintain a 1-in. (25 mm) clearance from combustible materials to supply air ductwork for a distance of 36-in. (914 mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.

Return Duct Sizing

Refer to the Filter Selection and Duct Sizing section for information on the proper selection of filter sizes and the associated ductwork and duct transitions. Improperly designed filtering systems and return ductwork are the most common causes of airflow and/or noise complaints in HVAC systems.

Ductwork Acoustical Treatment

NOTE: Metal duct systems that do not have a 90 degree elbow and 10 ft. (3 M) of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.

Table 6 – Heating Air Delivery – CFM (Bottom Return Without Filter)

Model	Speed		External Static Pressure (ESP)									
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
80B	Maximum Heat	CFM	1298	1295	1300	1300	1305	1304	1301	1309	1209	-
		Temp Rise	51.5	51.6	51.4	51.4	51.2	51.3	51.4	51.1	55.3	-
	Intermediate Heat	CFM	994	998	1001	1002	1005	1004	1010	1008	1013	1015
		Temp Rise	47.1	46.9	46.8	46.7	46.6	46.6	46.3	46.4	46.2	46.1
	Minimum Heat	CFM	651	652	650	649	651	648	654	653	655	658
		Temp Rise	35.9	35.9	36.0	36.1	35.9	36.1	35.8	35.8	35.7	35.6
100C	Maximum Heat	CFM	1501	1495	1500	1498	1502	1501	1495	1503	1505	1510
		Temp Rise	55.7	55.9	55.7	55.8	55.6	55.7	55.9	55.6	55.5	55.3
	Intermediate Heat	CFM	1152	1157	1155	1157	1157	1153	1155	1153	1161	1158
		Temp Rise	50.8	50.6	50.6	50.6	50.6	50.7	50.6	50.7	50.4	50.5
	Minimum Heat	CFM	745	749	750	746	750	751	753	751	755	762
		Temp Rise	39.3	39.1	39.0	39.2	39.0	38.9	38.8	38.9	38.7	38.4

1. A filter is required for each return -air Inlet. Airflow performance Included 3/4-In. (19 mm) washable filter media such as contained In factory-authorized accessory filter rack. To determine airflow performance with this filter, assume an additional 0.1 in. wc available external static pressure.
2. The airflows in the above table is based on bottom return or both bottom and side return air.
3. All airflows are 5% less on side return only installations.

Table 7 – Cooling Air Delivery – CFM (Bottom Return Without Filter)

Unit Size	CF Switch Settings			External Static Pressure (ESP)									
	SW2-1	SW2-2	SW2-3	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
Cabinet B/A	ON	OFF	OFF	548	549	546	548	550	546	550	547	550	549
	ON	OFF	ON	640	642	641	645	650	644	644	648	650	648
	ON	ON	OFF	743	745	744	748	750	747	748	756	750	751
	ON	ON	ON	842	844	843	848	850	847	848	857	850	851
	OFF	OFF	OFF	941	942	947	944	950	944	945	947	950	941
	*OFF	OFF	ON	1041	1042	1047	1043	1050	1043	1044	1047	1050	1041
	OFF	ON	OFF	1119	1119	1125	1121	1120	1121	1122	1125	1120	1081
	OFF	ON	ON	1190	1191	1197	1193	1200	1193	1194	1197	1200	1142
Cabinet C/D	ON	OFF	OFF	994	997	997	995	1000	995	996	995	1000	996
	ON	OFF	ON	1099	1095	1097	1100	1100	1099	1095	1102	1100	1101
	ON	ON	OFF	1199	1195	1197	1200	1200	1199	1195	1202	1200	1201
	ON	ON	ON	1299	1294	1297	1300	1300	1299	1294	1302	1300	1301
	OFF	OFF	OFF	1399	1394	1397	1400	1400	1399	1394	1403	1400	1401
	*OFF	OFF	ON	1499	1494	1496	1500	1500	1499	1494	1503	1500	1501
	OFF	ON	OFF	1602	1596	1599	1603	1600	1602	1596	1599	1600	1604
	OFF	ON	ON	1699	1693	1696	1700	1700	1699	1693	1703	1700	1701

* Factory default settings.

Through different dialing settings, 8 optional air volumes can be set.

#"Speed model" has three modes (standard/high speed/Low speed), which can be set through "press bottom" or Internet app. If not, the factory default standard model will be used.

1. A filter is required for each return -air Inlet. Airflow performance Included 3/4-In. (19 mm) washable filter media such as contained In factory-authorized accessory filter rack. To determine airflow performance with this filter, assume an additional 0.1 in. wc available external static pressure.
2. The airflows in the above table is based on bottom return or both bottom and side return air.
3. All airflows are 5% less on side return only installations.

NOTE: To set these setup switches for the appropriate requirement

1. Remove blower door.
2. Locate setup switches on furnace control.
3. Configure the set-up switches as necessary for the application.
4. Replace blower door.

7. Combustion Air and Ventilation

7.1 Direct Vent (2–pipe) Applications

When the furnace is installed as a direct vent (2-pipe) furnace, no special provisions for air for combustion are required. However, other gas appliances installed in the space with the furnace may require outside air for combustion. Follow the guidelines below to ensure that other gas appliances have sufficient air for combustion.

7.2 Ventilated Combustion Air Applications

When the furnace is installed using the ventilated combustion air option, the attic or crawlspace must freely communicate with the outdoors to provide sufficient air for combustion. The combustion aair pipe must not be terminated in attics or crawlspaces that use ventilation fans designed to operate during the heating season. If ventilation fans are present in these areas, the combustion air pipe must terminate outdoors as a Direct Vent/ 2-Pipe system.

All air for combustion is piped directly to the furnace from a space that is well ventilated with outdoor air (such as an attic, crawl space, or equipment closet) and the space is well isolated from the living space or garage. In addition, other gas appliances installed in the space with the furnace may require outside air for
combustion. Follow the guidelines below to insure that the roof or crawlspace walls have sufficient free area to provide sufficient air for combustion and ventilation for the furnaces. The guidelines below can be used to insure that other gas appliances have sufficient air for combustion.

Provisions for adequate combustion, ventilation, and dilution air must be provided in accordance with:

- U.S.A. Installations: Section 9.3 of the NFPA 54/ANSI Z223.1–2012 , Air for Combustion and Ventilation and applicable provisions of the local building codes.
- Canada: Part 8 of the CAN/CSA–B149.1–2010, Venting Systems and Air Supply for Appliances.

⚠ CAUTION

FURNACE CORROSION HAZARD

Failure to follow this caution may result in furnace damage or unsafe operation.
Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow this warning could result in personal injury or death.
The operation of exhaust fans, kitchen ventilation fans, clothes dryers, attic exhaust fans or fireplaces could create a NEGATIVE PRESSURE CONDITION at the furnace.
Make–up air MUST be provided for the ventilation devices, in addition to that required by the furnace. Refer to the Carbon Monoxide Poisoning Hazard warning in the venting section of these instructions to determine if an adequate amount of make–up air is available.

Outdoor Combustion Air Method

Furnace locations may be in a “confined space” or an “unconfined space” .
Unconfined space is defined in Figure 17. These spaces may have adequate air by infiltration to provide air for combustion and ventilation. Buildings with tight construction (for example, weather stripping, heavily insulated, caulked, vapor barrier, etc.), may need additional air provided as described for confined space.
Confined spaces are installations with less than 50 cu. ft. of space per 1000 BTU/hr input from all
equipment installed, as in Figure 18. Air for combustion and ventilation requirements can be supplied from inside the building as in Figure
19 or from the outdoors, as in Figure 20.

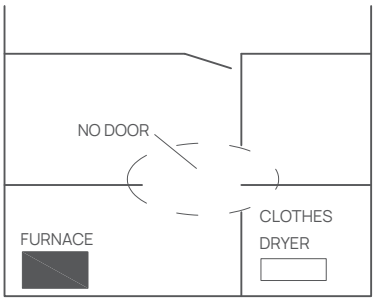


Fig. 17 UNCONFINED

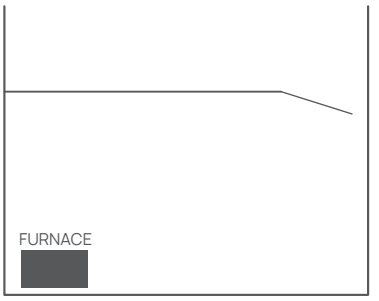


Fig. 18 CONFINED SPACE

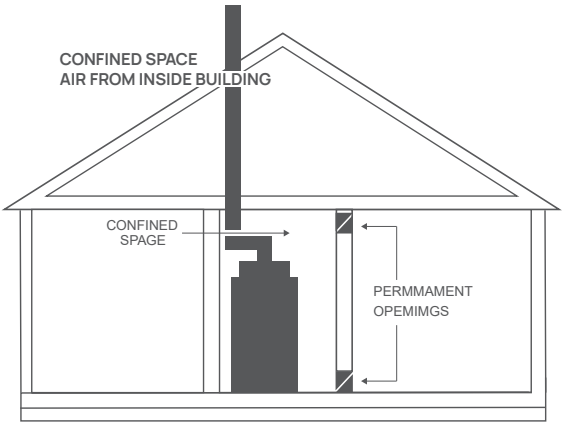


Fig. 19

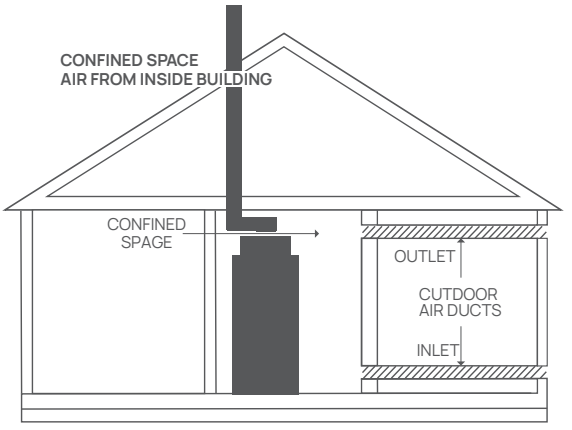


Fig. 20

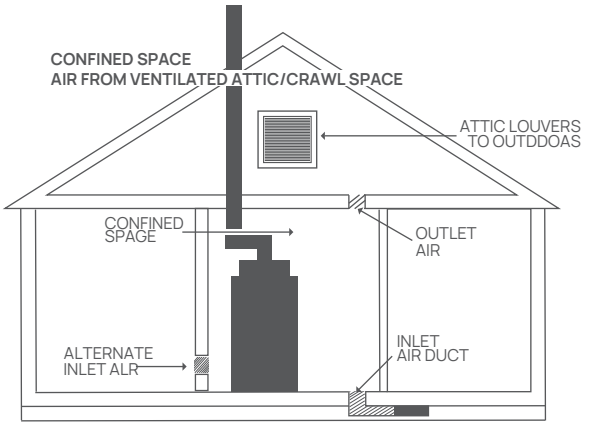


Fig. 21

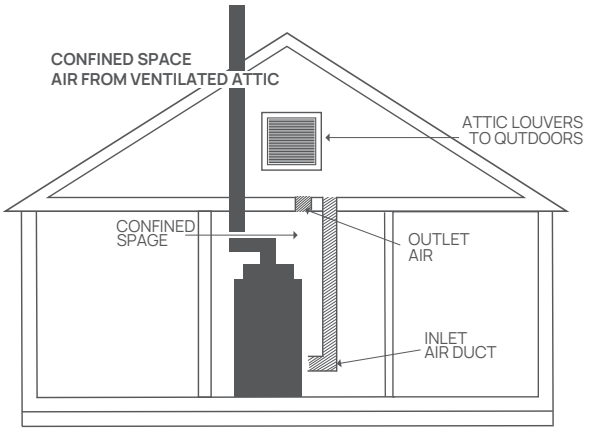


Fig. 22

1. All air from inside the building as in Figure 22: The confined space shall be provided with two permanent openings communicating directly with an additional room(s) of sufficient volume so that the combined volume of all spaces meets the criteria for an unconfined space. The total input of all gas utilization equipment installed in the combined space shall be considered in making this determination. Refer to Table 8 for minimum open areas requirements.
2. All air from outdoors as in Figure 20: The confined space shall be provided with two permanent openings, one commencing within 12 inches of the top and one commencing within 12 inches of the bottom of the enclosure. The openings shall communicate directly, or by ducts, with the outdoors or spaces (crawl or attic) that freely communicate with the outdoors. Refer to Table 8, for minimum open areas requirements.

Table 8 Minimum area of unconfined space installations (square feet)

INPUT (BTUH)	With 8 FT ceiling minimum area of unconfined space
80000	500
100000	625

7.3 Combustion Air/Vent Pipe Sizing

The size of pipe required will be determined by the furnace model, the total length of pipe required and the number of elbows required.Table 9,"Maximum Equivalent Pipe Length" lists the maximum equivalent length of pipe allowed for each model of furnace. The equivalent length of elbows is shown in Table 10, "Equivalent Length of Fittings".
The equivalent length of the vent system is the total length of straight pipe PLUS the equivalent length of all of the elbows.

The following rules must also be followed:

1. Long radius or Medium Radius elbows are recommended. Mitered elbows may be used, but since they have a longer equivalent length, they will reduce the total length of pipe that will be allowed. The standard dimensions and equivalent lengths of acceptable elbows are shown in Table 10.
2. The maximum equivalent length listed in Table 9, "Maximum Equivalent Pipe Length" is for the vent piping and the air intakepiping separately. For example, if the table allows 60 equivalent feet for a particular model, then the vent can have 60 equivalent feet of pipe, AND the combustion air intake can have another 60 equivalent feet of pipe.
3. Three vent terminal elbows (two for the vent and one for the combustion air intake) are already accounted for and need not be included in the equivalent length calculation.
4. All combustion air and vent pipes and fittings must conform to American National Standards Institute (ANSI) and American Society for Testing and Materials (ASTM) standards, D1785 (Schedule 40 PVC, including IPEX System 1738 Schedule 40 PVC), F441 (Schedule 40 CPVC), D2665 (PVC-DWV), F891 (PVC-DWV Cellular Core), D2661 (ABS-DWV) or D1527 (Schedule 40 ABS). Pipe cement and primer must conform to ASTM Standard D2564 (PVC), F493 (CPVC) or D2235 (ABS). If ABS pipe is to be used, any joint where ABS pipe is joined to PVC pipe must be glued with cement that is approved for use with BOTH materials. As an alternate, use all purpose cement, to bond ABS, PVC, or CPVC pipe when using fittings and pipe made of the same materials. Metallic materials must not be used for venting or air intake.
5. If a flexible connector is used in the vent system, it must be made of a material that is resistant to acidic exposure and to at least 225° F temperature. Flexible connectors are also allowed in the combustion air pipe.
6. All models are supplied with 2" vent connections. When the pipe must be increased to 3" diameter, the transition from 2" to 3" must be done as close to the furnace as possible. For upflow models, the transition from 2" to 3" should be done immediately above the furnace. For downflow or horizontal models, the transition from 2" to 3" pipe should be done immediately after exiting the furnace.
7. In Canada, vents shall be certified to ULC S636, standard for Type BH Gas Venting Systems. IPEX System 636 PVC is certified to this standard.
8. In Canada, the first three feet (900 mm) of the vent must be readily accessible for inspection.

NOTE: Maximum Equivalent Vent Length (MEVL) includes standard and concentric vent termination and does NOT include elbows.
Use Table 10 — Deductions from Maximum Equivalent Vent Length to determine allowable vent length for each application.

NOTE: For single pipe systems it is recommended to install the combustion air coupling provided and install approximately 18" of PVC pipe on the furnace.In addition to the vent/-flue pipe, a single 90 ° elbow should be secured to the combustion air intake to prevent inadvertent blockage.

IMPORTANT

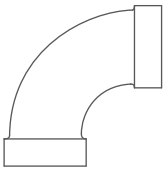
Furnace vent pipe connections are sized for 2" (5.1 cm). pipe. Any pipe size change must be made outside the furnace casing in a vertical pipe section to allow proper drainage of condensate. An offset using two 45° (degree) elbows will be required for plenum clearance when the vent is increased to 3" (7.6 cm).

Venting System Length Calculations

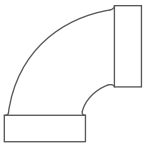
The Total Equivalent Vent Length (TEVL) for EACH combustion air or vent pipe equals the length of the venting system, plus the equivalent length of elbows used in the venting system from Table 10.
Standard vent terminations or factory accessory concentric vent terminations count for zero deduction.
See vent system manufacturer' s data for equivalent lengths of flexible vent pipe or other termination systems. DO NOT ASSUME that one foot of flexible vent pipe equals one foot of straight PVC/ABS DWV vent pipe.
Compare the Total Equivalent Vent Length to the Maximum Equivalent Vent Lengths in Table 9.

Table 9 Maximum Equivalent Pipe Length

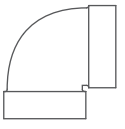
Altitude (feet)	Pipe Dia. (in)	Unit Size	
		80	100
0-2000	2"	100(30)	50(15m)
	3"	172(53)	150(46m)
2001-3000	2"	90	45
	3"	170	145
3001-4000	2"	85	45
	3"	155	140
4001-5000	2"	80	40
	3"	150	130
5001-6000	2"	70	35
	3"	140	125
6001-7000	2"	65	30
	3"	130	120
7001-8000	2"	55	30
	3"	120	115
8001-9000	2"	50	25
	3"	110	105
9001-10000	2"	40	20
	3"	100	100



Long



Medium



Mitered

Table 10 – Equivalent Length of Fittings – Ft. (M)

Pipe Diameter (in):	2		2-1/2		3	
	in	m	in	m	in	m
Long Radius 90° Elbow	3	0.9	3	0.9	3	0.9
Medium Radius 90° Elbow	5	1.5	5	1.5	5	1.5
Mitered 90° Elbow	8	2.4	8	2.4	8	2.4
Long Radius 45° Elbow	1.5	0.5	1.5	0.5	1.5	0.5
Medium Radius 45° Elbow	2.5	0.8	2.5	0.8	2.5	0.8
Mitered 45° Elbow	4	1.2	4	1.2	4	1.2

Example

An 70,000 BTUH furnace requires 60 feet of pipe and eight 90° elbows.

Using 2" pipe and Mitered 90° Elbow, the total equivalent length will be:

60 feet of 2" pipe = 60 equivalent feet
8 - Mitered 90° Elbow = (8x8) = 64 equivalent feet

Total = 124 equivalent feet of 2" pipe

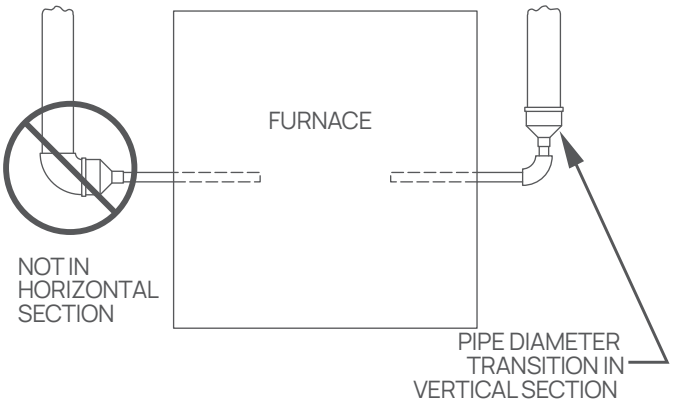
This is exceeds the 100 feet maximum equivalent length of 2" pipe allowed for that model(see table 9) and is thus not acceptable.

Alternatively, using 2" pipe and Medium Radius 90° elbows, the total equivalent length will be:

60 feet of 2" pipe = 60 equivalent feet
8 - Medium Radius 90° elbows = 40 equivalent feet

Total = 100 equivalent feet of 2" pipe

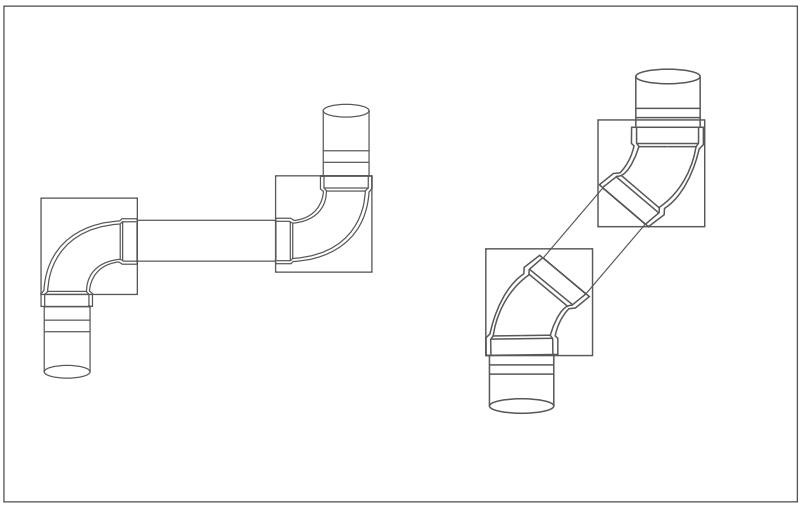
This is equal to the 100 feet maximum equivalent length of 2" pipe allowed for that model(see table 9) and is thus acceptable.



Near Furnace Vent Connections and Vent Pipe Diameter Transition Location and Elbow Configuration

The following rules must also be followed:

1. Avoid short horizontal offsets with 90 deg. Elbows. Short offsets can be difficult to slope and may trap condensate.
2. Use 45 deg. Elbows where possible, to ensure condensate drainage.
3. **PIPE DIAMETER TRANSITION IN VERTICAL SECTION**



7.4 Combustion Air And Vent Piping Assembly

The final assembly procedure for the combustion air and vent piping is as follows:

1. Cut piping to the proper length beginning at the furnace.
2. Deburr the piping inside and outside.
3. Chamfer (bevel) the outer edges of the piping.
4. Dry-fit the vent piping assembly from the furnace to the outside termination checking for proper fit support and slope.
5. Dry-fit the combustion air piping assembly checking for proper fit, support and slope on the

following systems:

a. Sealed combustion air systems from the furnace to the outside termination.
b. Ventilated combustion air systems from the furnace to the attic or crawl space termination.

6. Disassemble the combustion air and vent piping, apply cement primer and the cement per the manufactures instructions. Primer and cement must conform to ASTM
7. D2564 for PVC, or ASTM D2235 for ABS piping.
   All joints must provide a permanent airtight and watertight seal.
8. Support the combustion air and vent piping such that it is angled a minimum of 1/4" per foot (21 mm/m) so that condensate will flow back towards the furnace. Piping should be supported with pipe hangers to prevent sagging.
9. Seal around the openings where the combustion air and / or vent piping pass through the roof or sidewalls.

7.5 Ventilated Combustion Air and Vent Termination Clearance

IMPORTANT

The vent must be installed with the minimum required clearances, and must comply with local codes and requirements.

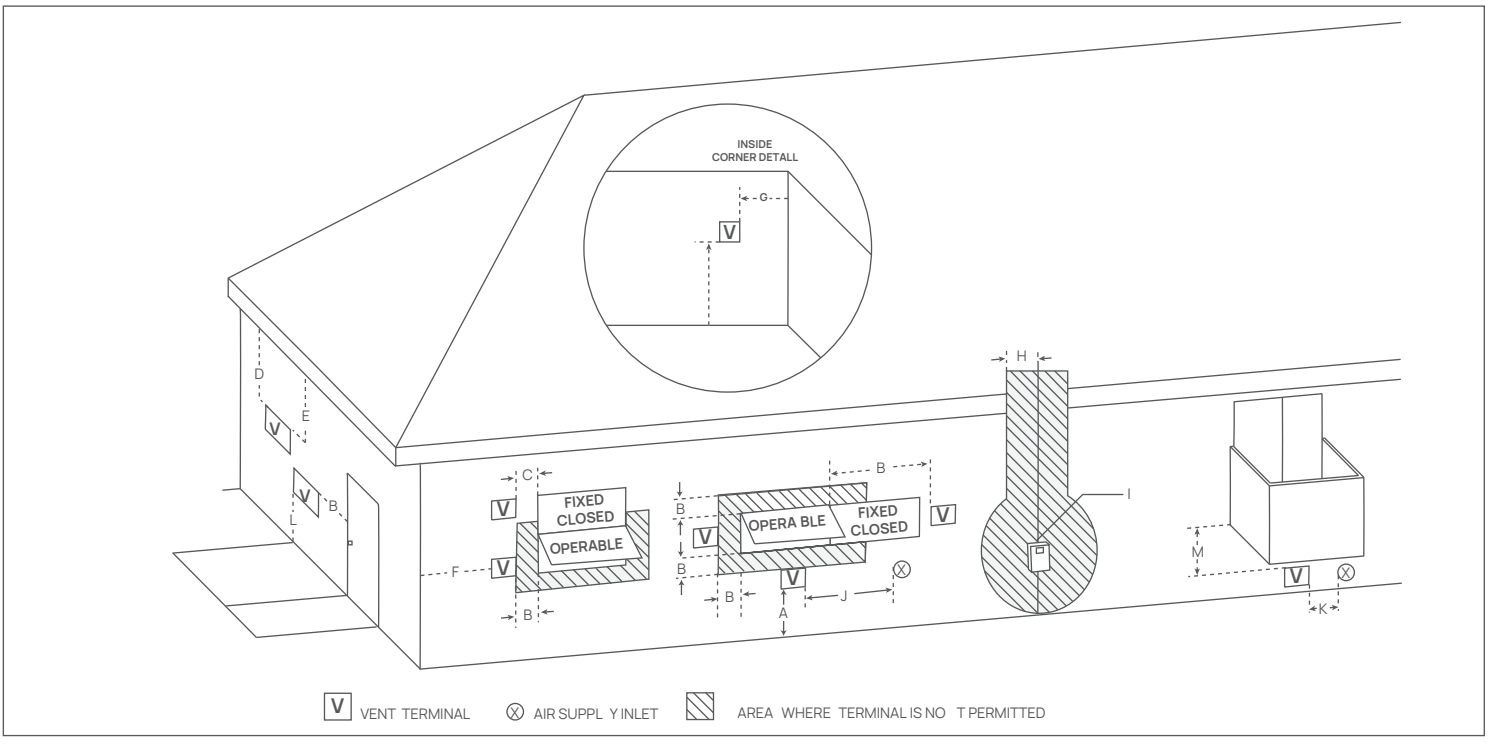


Fig. 23 Vent terminal clearances (See Table 11)

NOTE: The following is based upon National codes for gas appliances and is provided as a reference.
Refer to local codes which may supersede these standards and/or recommendations.

Table 11-See Fig.23

Direct Vent Terminal Clearances		Canadian Installations	US Installation
A	Clearance above grade, veranda, porch, deck, or balcony	12" (30.5 cm)	12" (30.5 cm)
B	Clearance to window or door that may be opened	12" (30.5 cm) for appliances≤100,000 BTUH (30kW), 36" (91 cm) for appliances›100,000 BTUH (30kW).	Two-pipe (direct vent) applications: 9" (23 cm) for appliances≤50,000 BTUH (15 kW), 12" (30.5 cm) for appliances ›50,000 BTUH (15 kW). †† Single-pipe applications: 4 feet (1.2 m).
C	Clearance to permanently closed window	12" (30.5 cm)	12" (30.5 cm)
D	Vertical clearance to ventilated soffit located above the terminal within a horizontal distance of 2 feet (61 cm) from the center line of the terminal	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
E	Clearance to unventilated soffit	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
F	Clearance to outside corner	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.
G	Clearance to inside corner	36" (91.4 cm)	36" (91.4 cm)
H	Clearance to each side of center line extended above meter/regulator assembly	Above a meter/regulator assembly within 36" (91.4 cm) horizontally of the vertical center-line of the regulator vent outlet to a maximum vertical distance of 15 feet (4.5 m) above the meter/regulator assembly.	Above a meter/regulator assembly within 36" (91.4 cm) horizontally of the vertical center-line of the regulator vent outlet to a maximum vertical distance of 15 feet (4.5 m) above the meter/regulator assembly.
I	Clearance to service regulator vent outlet	36" (91.4 cm)	36" (91.4 cm) or in accordance with local installation codes and the requirements of the gas supplier.
J	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	12" (30.5 cm) for appliances≤100,000 BTUH (30kW), 36" (91 cm) for appliances›100,000 BTUH (30kW).	Two-pipe (direct vent) applications: 9" (23 cm) for appliances≤50,000 BTUH (15 kW), 12" (30.5 cm) for appliances ›50,000 BTUH (15 kW). †† Single-pipe applications: 4 feet (1.2 m).
K	Clearance to a mechanical supply inlet	6 feet (1.83 m)	3 feet (91.4 cm) above if within 10 feet (3 m)horizontally
L	Clearance above paved sidewalk or paved driveway located on public property	7 feet (2.13 m)†	7 feet (2.13 m) or in accordance with local installation codes and the requirements of the gas supplier.
M	Clearance under veranda, porch, deck, or balcony	12" (30.5 cm)‡	12" (30.5 cm) or in accordance with local installation codes and the requirements of the gas supplier.

1. In accordance with the current CSA B149.1-00, Natural Gas and Propane Installation Code.
2. In accordance with the current ANSI Z223.1 / NFPA 54, National Gas Code.
3. In accordance with the current ANSI Z21.47 * CSA 2.3 American National Standard.

- A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.
- 12" (30.5 cm) up from the bottom edge of the structure for Two-pipe (direct vent) applications per ANSI Z223.1 / NFPA 54, National Gas Code.
- Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor and the distance between the top of the vent termination and the underside of the veranda, porch, or deck is greater than 12" (30.5 cm) as specified in CSA B149.1-00.

A vent shall not terminate less than 12" (30.5 cm) above a grade level.
Any fresh air or make up inlet for dryer or furnace area is considered to be forced air inlet.
Avoid areas where condensate drip page may cause problems such as above planters, patios, or adjacent to windows where steam may cause fogging.
A terminus of a vent shall be fitted with a cap in accordance with the vent manufacturer's installation instructions, or in accordance with the installation instructions for a special venting system.
Responsibility for the provision of proper adequate venting and air supply for application shall rest with the installer.
Vent shall extend high enough above building, or a neighboring obstruction, so that wind from any direction will not create a positive pressure in the vicinity of the vent.

IMPORTANT

Consideration must be given for degradation of building materials by flue gases. Sidewall termination may require sealing or shielding of building surfaces with a corrosion resistant material to protect against combustion product corrosion. Consideration must be given to wind direction in order to prevent flue products and/or condensate from being blown against the building surfaces. If a metal shield is used it must be a stainless steel material at a minimum dimension of 20 inches (51 cm). It is recommended that a retaining type collar be used that is attached to the building surface to prevent movement of the vent pipe.

7.6 Vent System

This furnace is certified to be installed with one of two possible vent configurations.

1. Horizontal vent system. This vent system can be installed completely horizontal or combinations of horizontal, vertical, or offset using elbows.
2. Vertical vent system. This vent system can be installed completely vertical or a combination of horizontal, vertical, or offset using elbows.

Vent Applications And Termination

When selecting the location for a horizontal combustion air / vent termination, the following should be considered:

1. Observe all clearances listed in vent clearances in these instructions.
2. Termination should be positioned where vent vapors will not damage plants or shrubs or air conditioning equipment.
3. Termination should be located where it will not be affected by wind gusts, light snow, airborne leaves or allow recirculation of flue gases.
4. Termination should be located where it will not be damaged or exposed to flying stones, balls, etc.
5. Termination should be positioned where vent vapors are not objectionable.
6. Horizontal portions of the vent system must slope upwards and be supported to prevent sagging.
7. Direct vent systems must be installed so the vent and the combustion air pipes terminate in the same atmospheric zone. Refer to Figures 24.

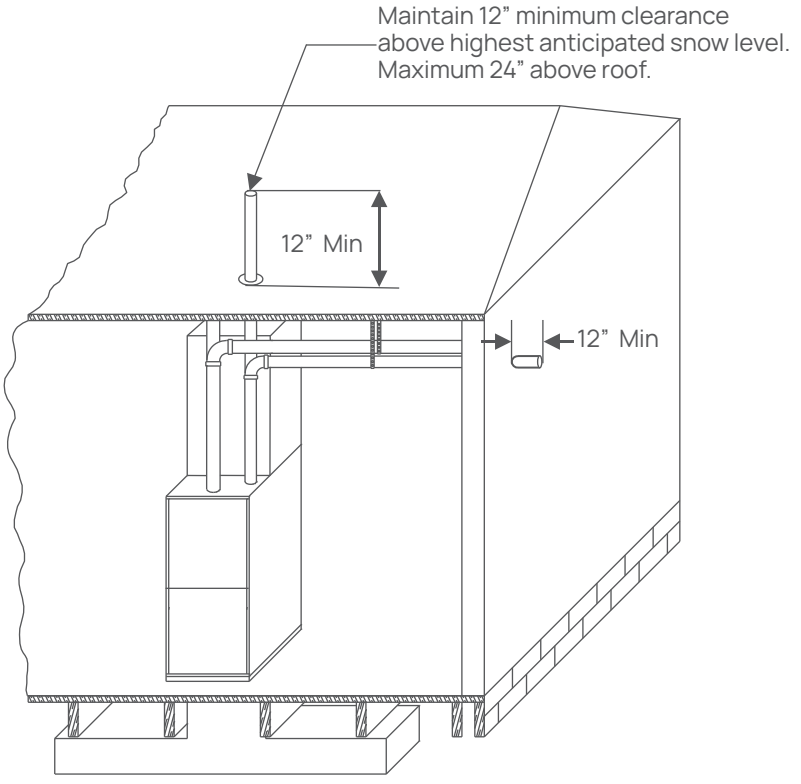


Fig. 24 Termination Configuration - 1 Pipe

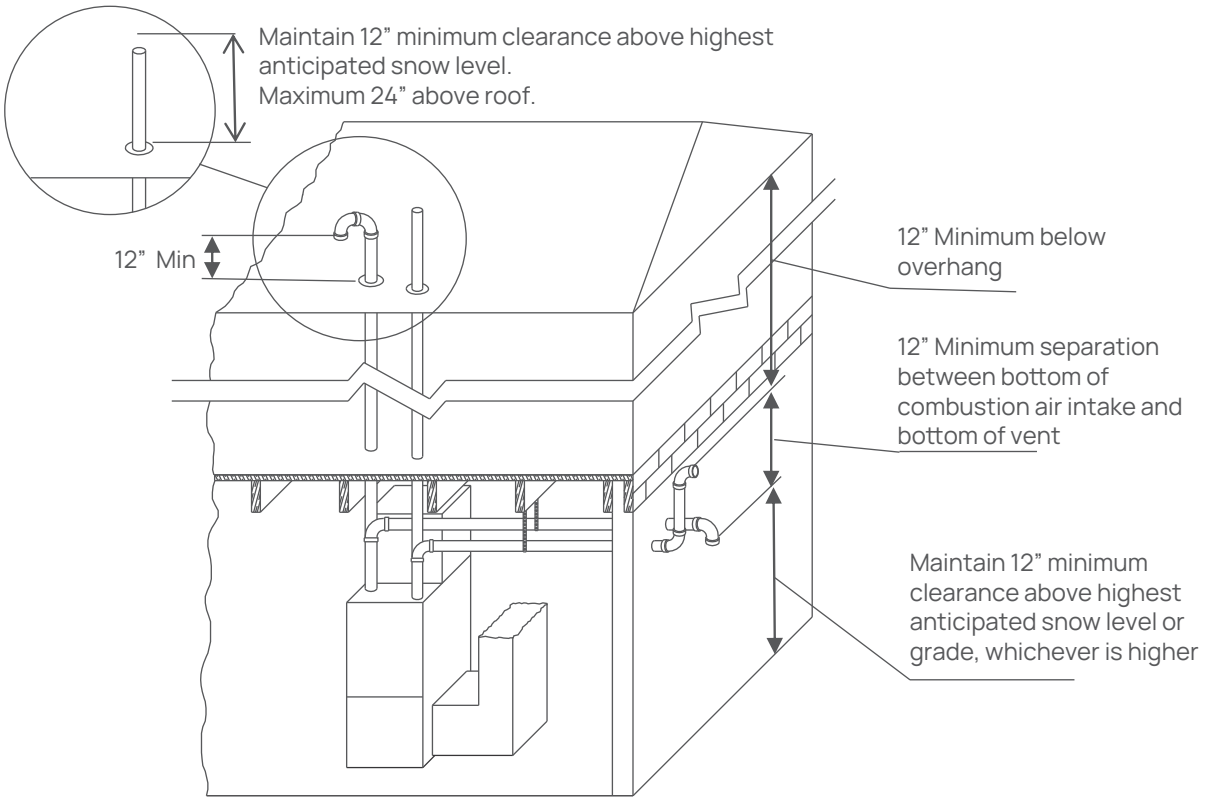


Fig. 25 Termination Configuration - 2 Pipe

Venting Multiple Units

Multiple units can be installed in a space or structure as either a single pipe configuration or a two-pipe configuration.

The combustion air side of the single pipe configuration shown in Figure 20 is referred to in these instructions as ambient combustion air supply. Follow the instructions for ambient combustion air installations, paying particular attention to the section on air source from inside the building. The vent for a single pipe system must be installed as specified in the venting section of these instructions with the vent terminating as shown in Figure 20. Each furnace must have a separate vent pipe. Under NO in Figure 24 Figure 25 . Each furnace must have a separate vent pipe. Under NO circumstances can the two vent pipes be tied together.

The combustion air side of the two-pipe configuration shown in Figure 24 Figure 25 can be installed so the combustion air pipe terminates as described in outdoor combustion air or ventilated combustion air sections in these instructions. Follow the instructions for outdoor combustion air or ventilated combustion air and the instructions for installing the vent system with the vent terminating as shown in Figures 26 or 27. The two-pipe system must have a separate combustion air pipe and a separate vent pipe for each furnace.

Under NO circumstances can the two combustions air or vent pipes be tied together. The combustion air and vent pipes must terminate in the same atmospheric zone.

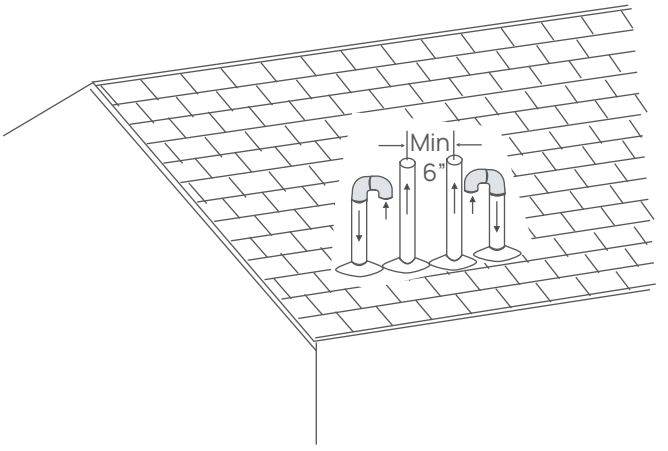


Fig. 27 Double Vertical Combustion Air Intake and Vent Termination

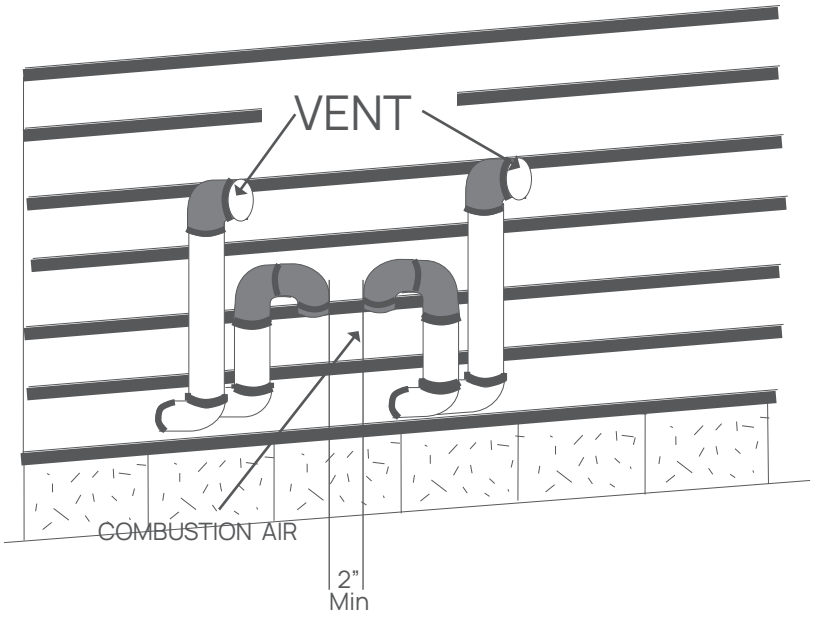


Fig. 26 Double Horizontal Combustion Air Intake and Vent Termination

Knockout Removal

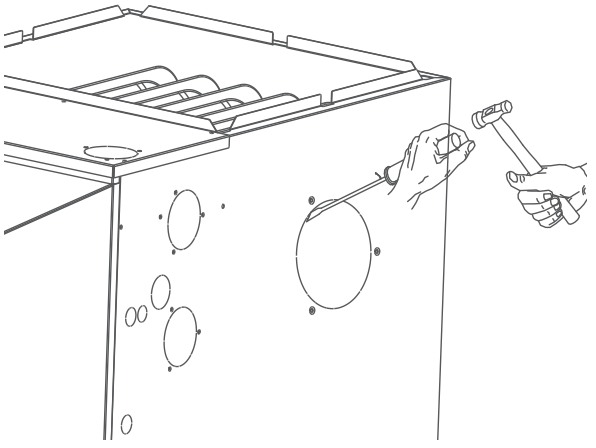


Fig. 28 Knockout Removal

⚠CAUTION

CUT HAZARD

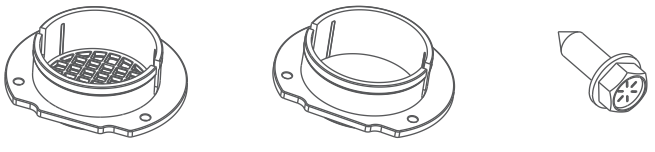
Failure to follow this caution may result in personal injury.
Sheet metal parts may have sharp edges or burrs. Use care and wear appropriate protective clothing, safety glasses and gloves when handling parts, and servicing furnaces.

When connecting vent pipes, gas pipes, drainage pipes, power lines, and control signal lines, according to the needs of different installation position, knock open the knock off holes on the corresponding side of the housing plate (see Fig.28).

Note: Do not knock off holes on surfaces that do not require threading or threading, otherwise the sealing of the casing will not be maintained.

7.7 For Up flow Installation

1. Top venting



① ② ③

① intake coupler; ② outlet coupler; ③ tapping screw

Fig. 29 List of venting pipe accessories

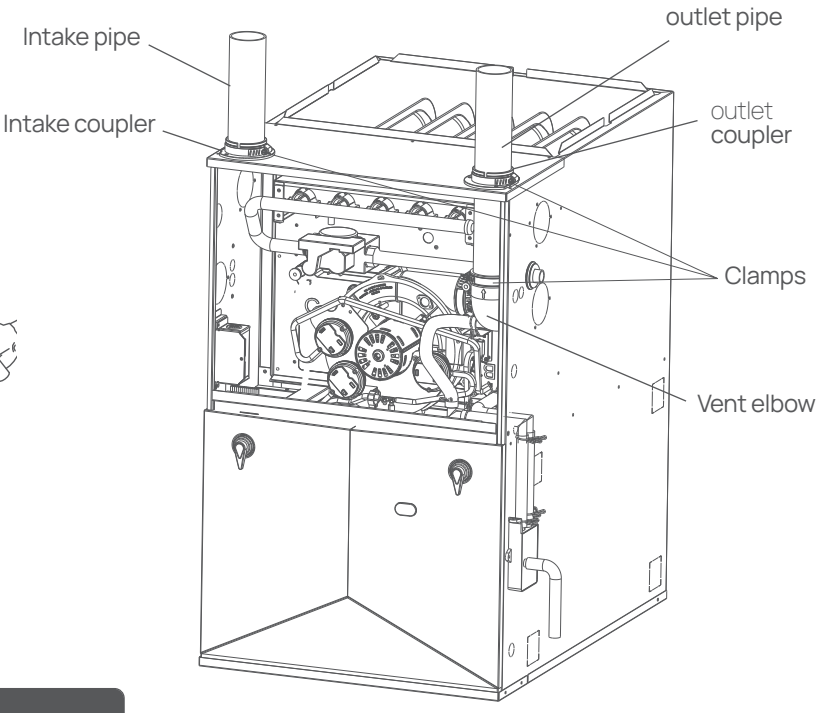


Fig. 30 Up-flow Installation, Top Venting

1. Install the intake and outlet couplers (refer to Fig. 29 ① and ②) into the knock-out holes for intake and outlet on the top panel, and secure them with three self-tapping screws provided in the accessories.
2. Insert the intake pipe into the intake coupler and tighten the clamp on the intake coupler;
3. Insert the outlet pipe through the top outlet hole into Vent elbow, and tighten the clamps on the elbow and coupler;
4. Use street 2 to 3" transition for 3" pipe if necessary.

7.8 For Horizontal Installations

1. Horizontal right side air outlet

① Knock open the intake and outlet holes on the left side panel;

② Install the intake and outlet couplers (refer to Fig. 29 ① and ②) into the knock-out holes for intake and outlet on the left side panel, and secure them with three self-tapping screws provided in the accessories.

③ As described in the "Vent Pipe Elbow Rotation" procedure, rotate the vent pipe elbow counterclockwise 90 degrees, and tighten the clamp again after reaching the angle;

Note: The vent elbow is made of flexible material. Prolonged compression may cause it to fuse/adhere to adjacent elbows. Therefore, even after loosening the clamp, moderate force is still required to rotate it.

④ Reinstall the vent elbow assembly back onto the inducer outlet and tighten the clamp;

⑤ Insert the 2 "vent pipe through the coupler on the left side panel into vent elbow ① , and tighten all clamps on the couplers and vent elbows;

⑥ Insert the intake pipe into the intake coupler and tighten the clamp on the coupler ;

⑦ Use street 2 to 3" transition for 3" pipe if necessary.

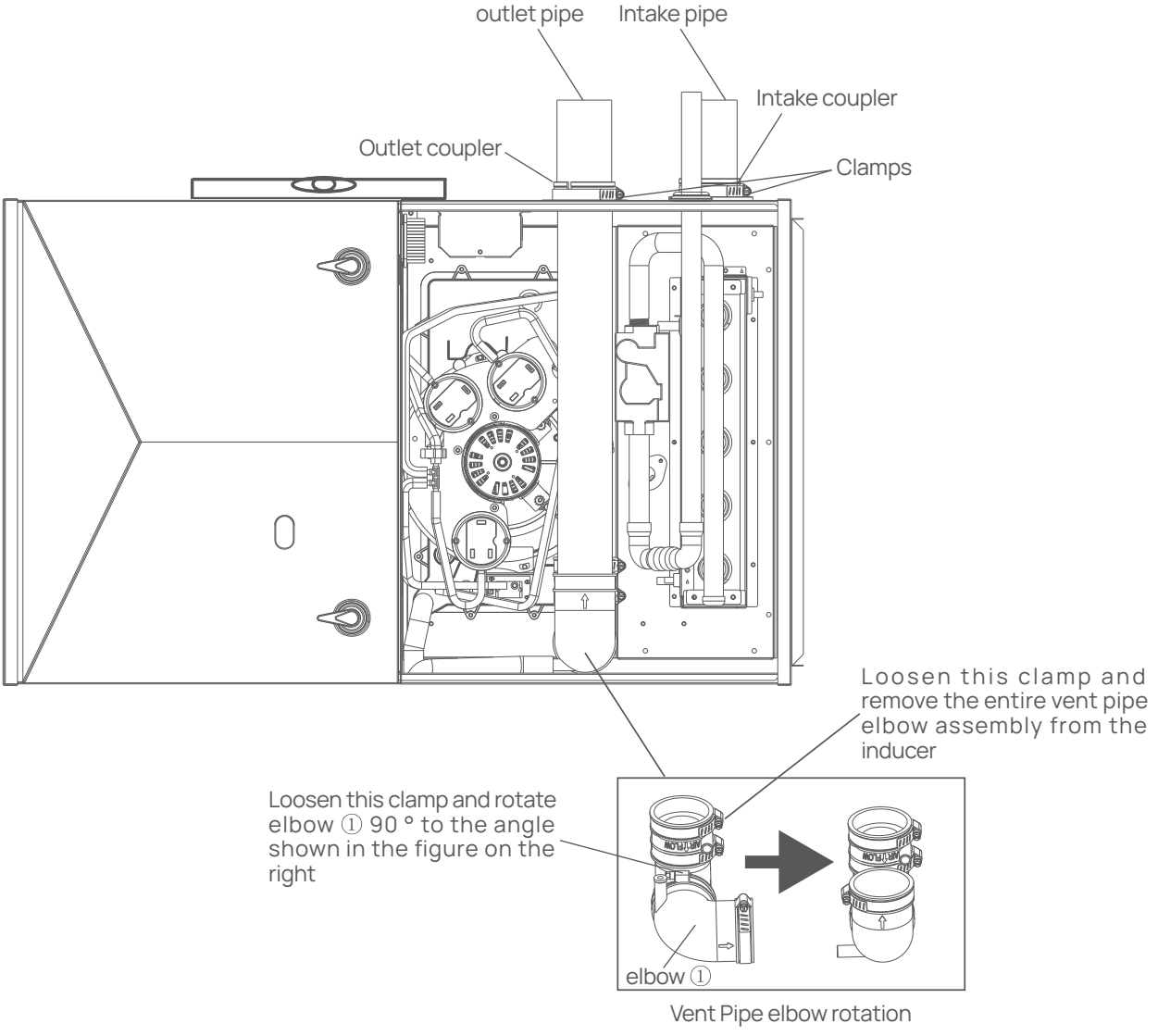


Fig. 32 Horizontal right Side Installation

1. Horizontal right side air outlet

① Knock open the intake and outlet holes on the left side panel;

② Install the intake and outlet couplers into the knock-out holes for intake and outlet on the right side panel, and secure them with three self-tapping screws provided in the accessories.

③ Loosen the clamp of the vent pipe elbow, and remove elbows ② and ① together;

④ Insert a 2 "vent tube through the coupler on the right side panel into the flexible coupler on the inducer air outlet, and tighten the clamp of the coupler and the flexible connector;

⑤ Insert the intake pipe into the intake coupler and tighten the clamp on the coupler ;

⑥ Use street 2 to 3" transition for 3" pipe if necessary.

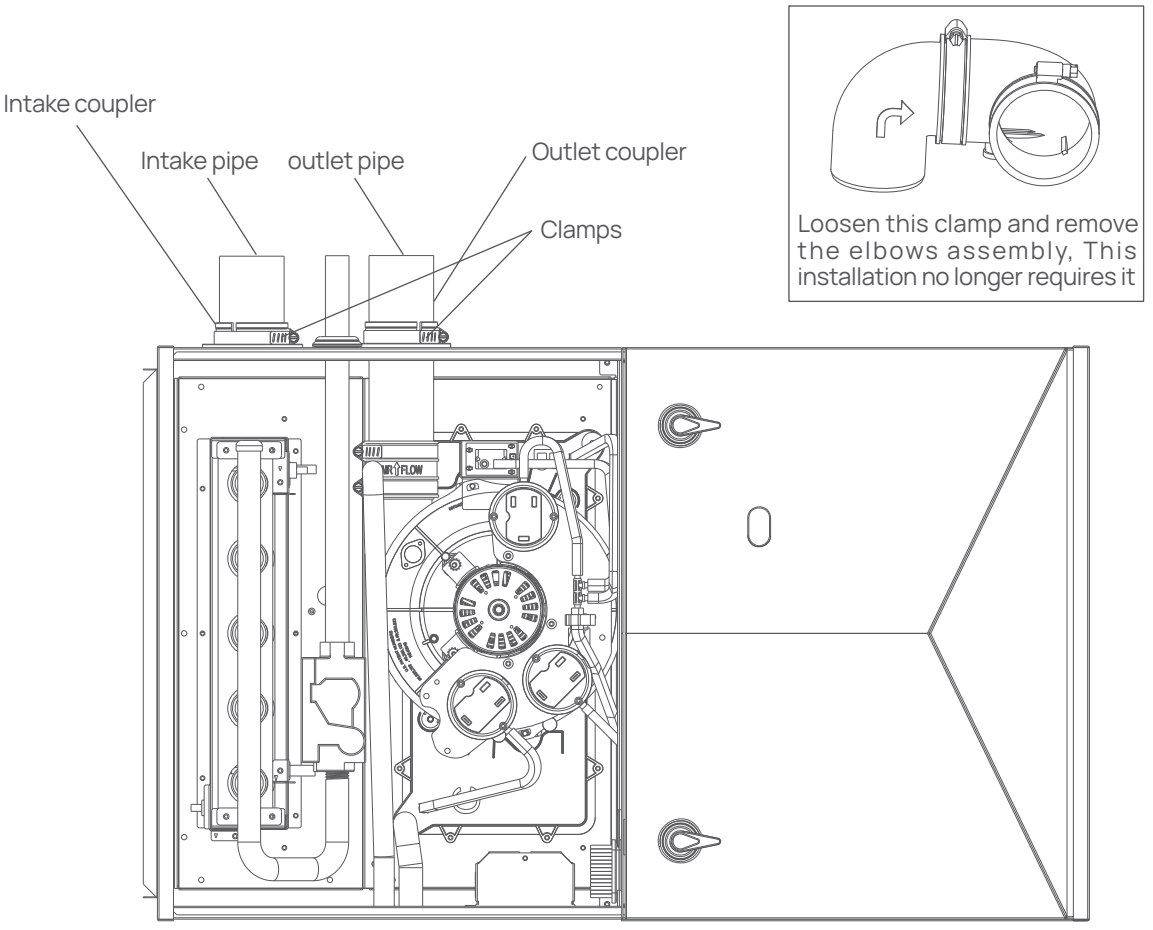


Fig. 33 Horizontal left Side Installation

7.9 For Downflow Installations (see Fig. 34)

① Knock open the intake and outlet holes on the side panel;

② Install the intake and outlet couplers into the knock-out holes for intake and outlet on the side panel, and secure them with three self-tapping screws provided in the accessories.

③ Loosen the clamp of the cigarette pipe elbow, and remove elbows ② and ① together;

④ Insert a 2 "vent tube through the outlet coupler into the flexible coupler on the inducer air outlet, and tighten the clamp of the coupler and the flexible connector;

⑤ Insert the intake pipe into the intake coupler and tighten the clamp on the coupler ;

⑥ Use street 2 to 3" transition for 3" pipe if necessary.

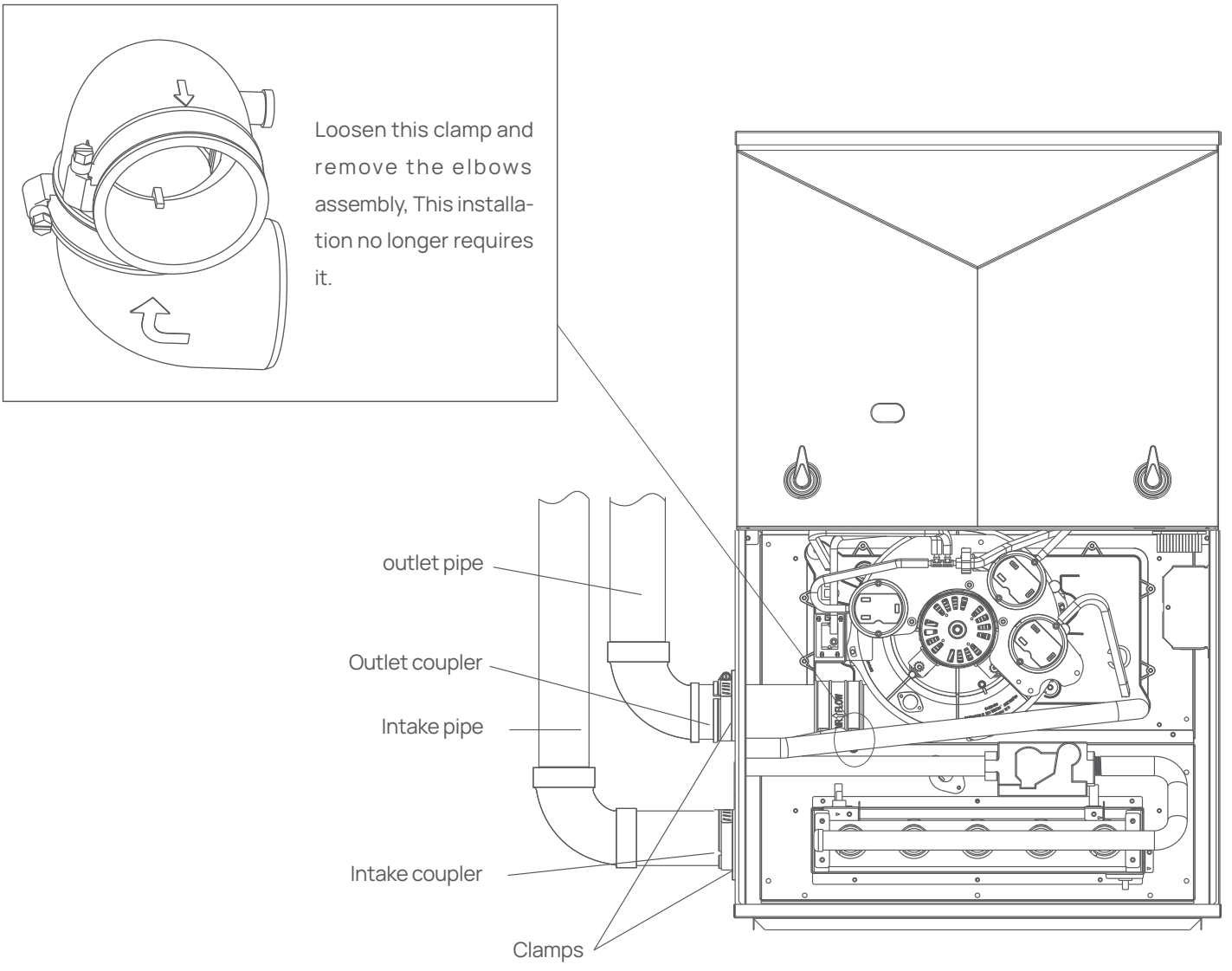


Fig. 34 Downflow Installation, Left Side Venting

8. Condensate Line and Condensate TRAP

To achieve higher energy efficiency than non-condensing furnace, condensing furnace will generate significant amount of condensate water from combustion to recover latent heat in flue. Condensate generated from flue must be collected and discharged to drain line.
For some of venting directions and furnace installations, reroute condensate and/or overflow pressure switch hoses may be required. Follow the instructions in Figure 36-40 for each installation:
Follow the bullets listed below when installing the drain system. Refer to the following sections for specific details concerning furnace drain TRAP installation and drain hose hook ups.

- The drain TRAP supplied with the furnace must be used.
- The drain line between furnace and drain location must be constructed of 3/4" PVC or CPVC.
- The drain line between furnace and drain location must maintain a 1/4 inch per foot downward slope toward the drain.
- Do not trap the drain line in any other location than at the drain trap supplied with the furnace.
- Do not route the drain line outside where it may freeze.
- If the drain line is routed through an area which may see temperatures near or below freezing, precautions must be taken to prevent condensate from freezing within the drain line.
- If an air conditioning coil is installed with the furnace, a common drain may be used. An open tee must be installed in the drain line, near the cooling coil, to relieve positive air pressure from the coil' s plenum. This is necessary to prohibit any interference with the function of the furnace' s drain trap.

All installations positions require the use of the drain trap, hoses, tubes, and clamps. The following quantity of hoses, tubes, and hose clamps are provided with the unit.

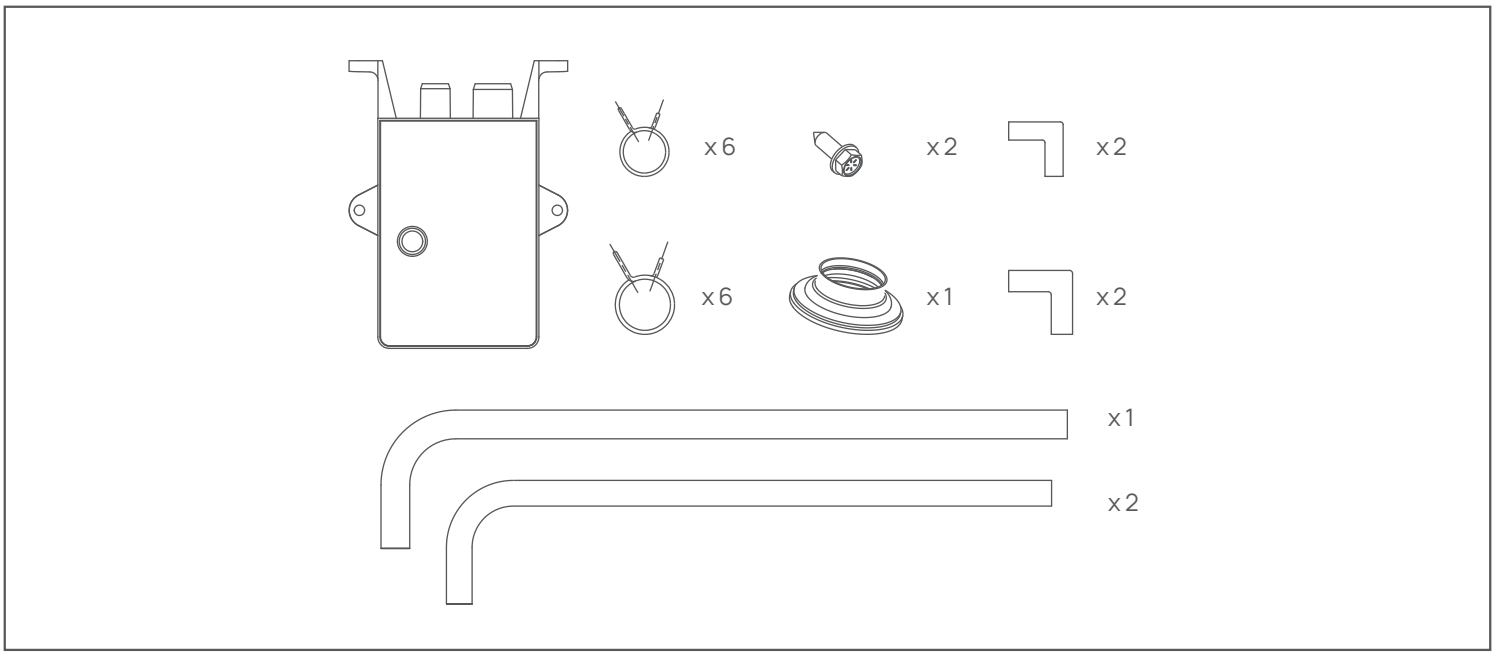


Fig. 35 List of accessories for condensate pipe installation

8.1 For Up flow-Condensate Line and Condensate TRAP Installation

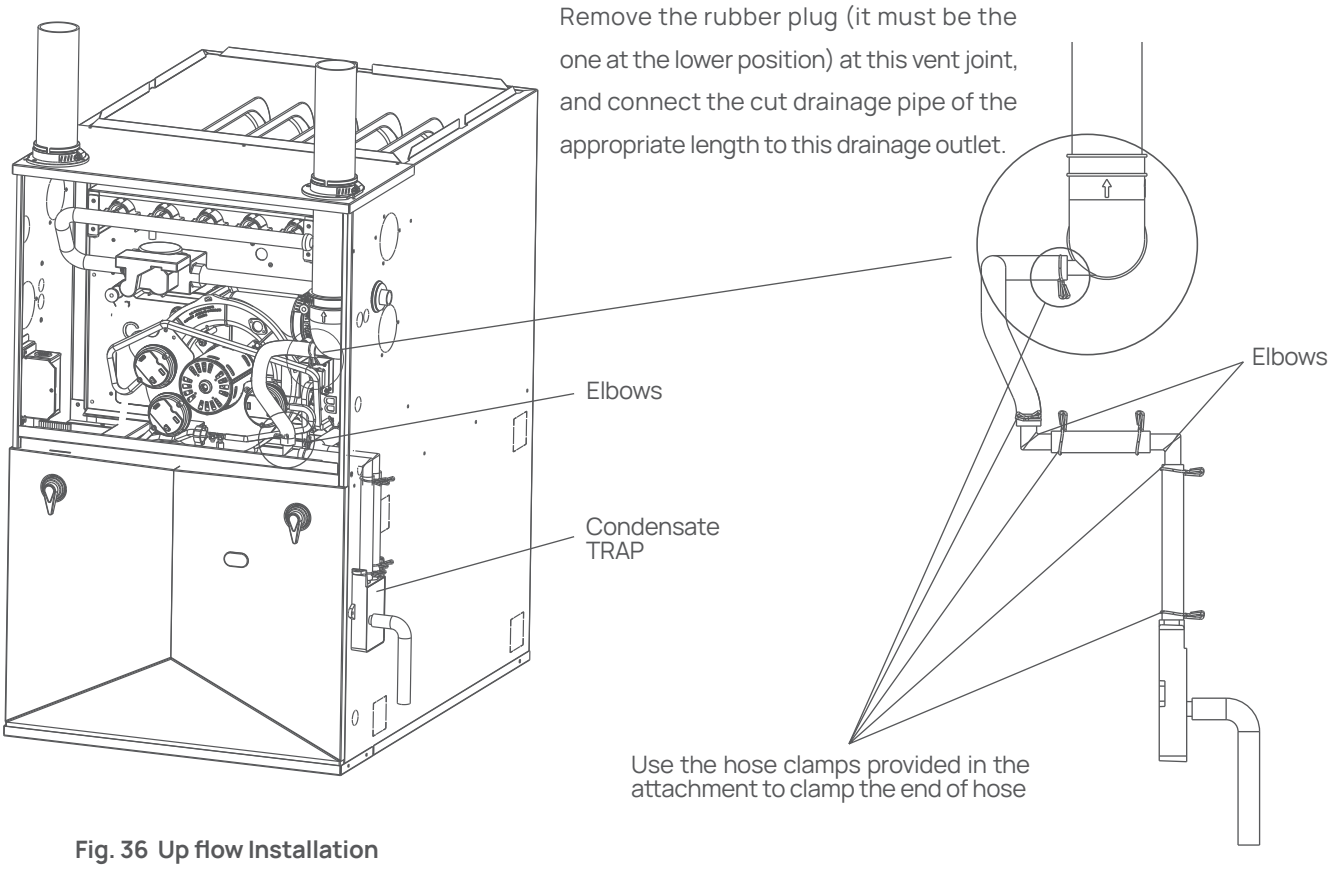
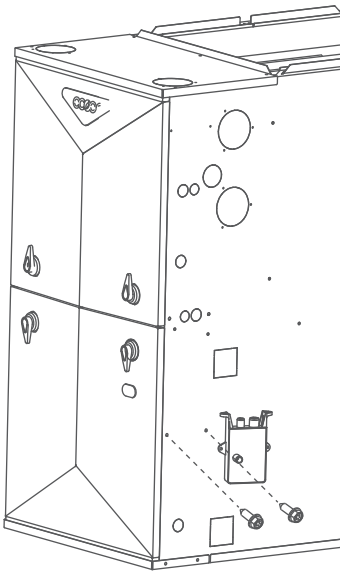


Fig. 36 Up flow Installation



In up flow installing , the drainage line is discharged from the right side, and the condensate TRAP needs to be installed on the right side panel, as shown in Fig.36;

① Knock open the corresponding drainage hole on the right side panel using the method shown in Fig.28.

② Remove the rubber plugs on the bottom right corner of the Condensate collector and the vent joint;

③ Cut out drainage pipes of appropriate length (with 2 diameters, connecting the drainage outlet of the collection box and the drainage outlet of the inducer joint), pass them through the drainage holes on the side panel, connect them to the corresponding inlet of the Condensate TRAP, and tighten them with the clamps provided by the factory accessories.

④ Align the Condensate TRAP with the positioning point on the side panel and fix it with the 2 self tapping screws provided in the attachment;

⑤ Connect the other end of the drainage pipes to the drainage outlet of the water collection box and the drainage outlet of the vent pipe, which have already removed the rubber plug, and clamp the hose head with a clamp provided by the factory accessory;

8.2 For Horizontal -Condensate Line and Condensate TRAP Installation
1) Horizontal right side

In Horizontal right side installing , the drainage line is discharged from the right side, and the condensate TRAP needs to be installed on the right side panel, as shown in Fig.37;

① Knock open the corresponding drainage hole on the right side panel using the method shown in Fig.28.

② Remove the rubber plugs on rubber plugs of the Condensate collector and the vent joint; see Fig.37

③ Cut out drainage pipes of appropriate length (with 2 diameters, connecting the drainage outlet of the collection box and the drainage outlet of the inducer joint), pass them through the drainage holes on the side panel, connect them to the corresponding inlet of the Condensate TRAP, and tighten them with the clamps provided by the factory accessories.

④ Align the two inlets of the Condensate TRAP with the drainage outlet of the side panel, and fix them on the side panel with the two self supplied screws provided by the factory accessories; See Figure 37

⑤ Connect the other end of the drainage pipes to the drainage outlet of the water collection box and the drainage outlet of the vent pipe, which have already removed the rubber plug, and clamp the hose head with a clamp provided by the factory accessory;

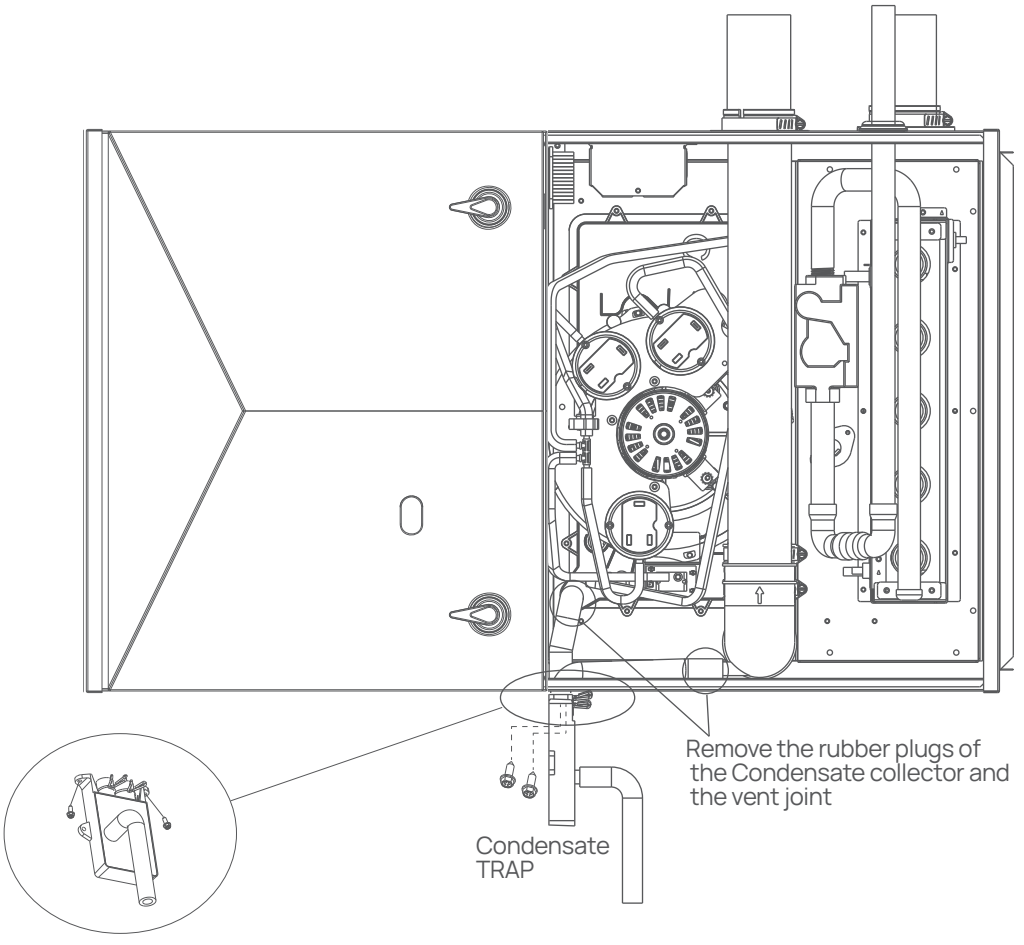


Fig. 37 Horizontal Right Side Installation

2) Horizontal left side

In Horizontal left side installing , the drainage line is discharged from the left side, and the condensate TRAP needs to be installed on the left side panel, as shown in Fig.38;

① Knock open the corresponding drainage hole on the left side panel using the method shown in Fig.28.

② Remove the rubber plugs on rubber plugs of the Condensate collector and the vent joint; see Fig.38

③ Cut out drainage pipes of appropriate length (with 2 diameters, connecting the drainage outlet of the collection box and the drainage outlet of the inducer joint), pass them through the drainage holes on the side panel, connect them to the corresponding inlet of the Condensate TRAP, and tighten them with the clamps provided by the factory accessories.

④ Align the two inlets of the Condensate TRAP with the drainage outlet of the side panel, and fix them on the side panel with the two self supplied screws provided by the factory accessories; See Figure 38

⑤ Connect the other end of the drainage pipes to the drainage outlet of the water collection box and the drainage outlet of the vent pipe, which have already removed the rubber plug, and clamp the hose head with a clamp provided by the factory accessory;

CAUTION: The connection port for the pressure measuring hose of the air pressure switch: LPS is connected to pressure measuring port ① (see Fig.40) at the factory. LPS must be connected to the pressure measuring port at a lower position of the water collection box in order to detect the water level of condensed water. Therefore, when installing the left and lower air outlets, the LPS pressure measuring hose needs to be pulled out from pressure measuring port ① and transferred to pressure measuring port ②. The pressure measuring hose originally connected to pressure measuring port ② needs to be pulled out and transferred to pressure measuring port ①.
Connecting incorrectly will result in failure to protect condensate overflow.

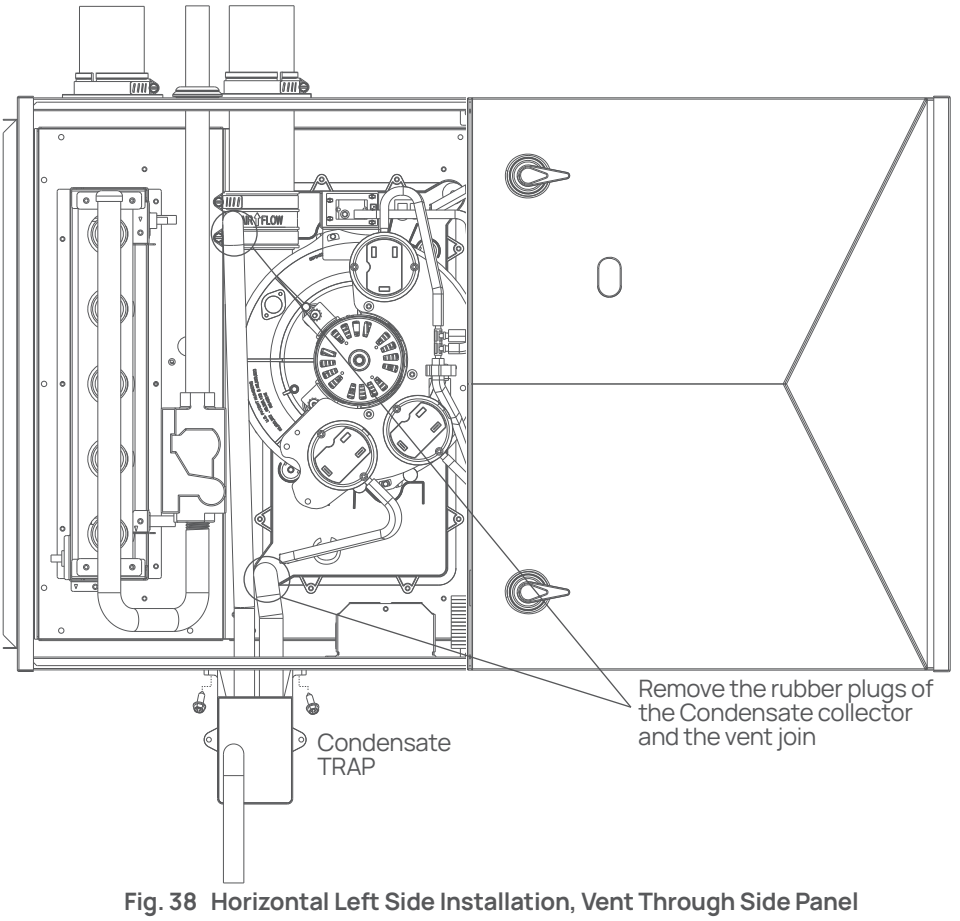


Fig. 38 Horizontal Left Side Installation, Vent Through Side Panel

8.3 For Downflow--Condensate Line and Condensate TRAP Installation

In Horizontal left side installing , the drainage line is discharged from the left side, and the condensate TRAP needs to be installed on the left side panel, as shown in Fig.39;

① Knock open the corresponding drainage hole on the left side panel using the method shown in Fig.28.

② Remove the rubber plugs on rubber plugs of the Condensate collector and the vent joint; see Fig.39

③ Cut out drainage pipes of appropriate length (with 2 diameters, connecting the drainage outlet of the collection box and the drainage outlet of the inducer joint), pass them through the drainage holes on the side panel, connect them to the corresponding inlet of the Condensate TRAP, and tighten them with the clamps provided by the factory accessories.

④ Align the two inlets of the Condensate TRAP with the drainage outlet of the side panel, and fix them on the side panel with the two self supplied screws provided by the factory accessories; See Figure 39

⑤ Connect the other end of the drainage pipes to the drainage outlet of the water collection box and the drainage outlet of the vent pipe, which have already removed the rubber plug, and clamp the hose head with a clamp provided by the factory accessory;

CAUTION: The connection port for the pressure measuring hose of the air pressure switch: LPS is connected to pressure measuring port ① (see Fig.40) at the factory. LPS must be connected to the pressure measuring port at a lower position of the water collection box in order to detect the water level of condensed water. Therefore, when installing the left and lower air outlets, the LPS pressure measuring hose needs to be pulled out from pressure measuring port ① and transferred to pressure measuring port ②. The pressure measuring hose originally connected to pressure measuring port ② needs to be pulled out and transferred to pressure measuring port ①.
Connecting incorrectly will result in failure to protect condensate overflow.

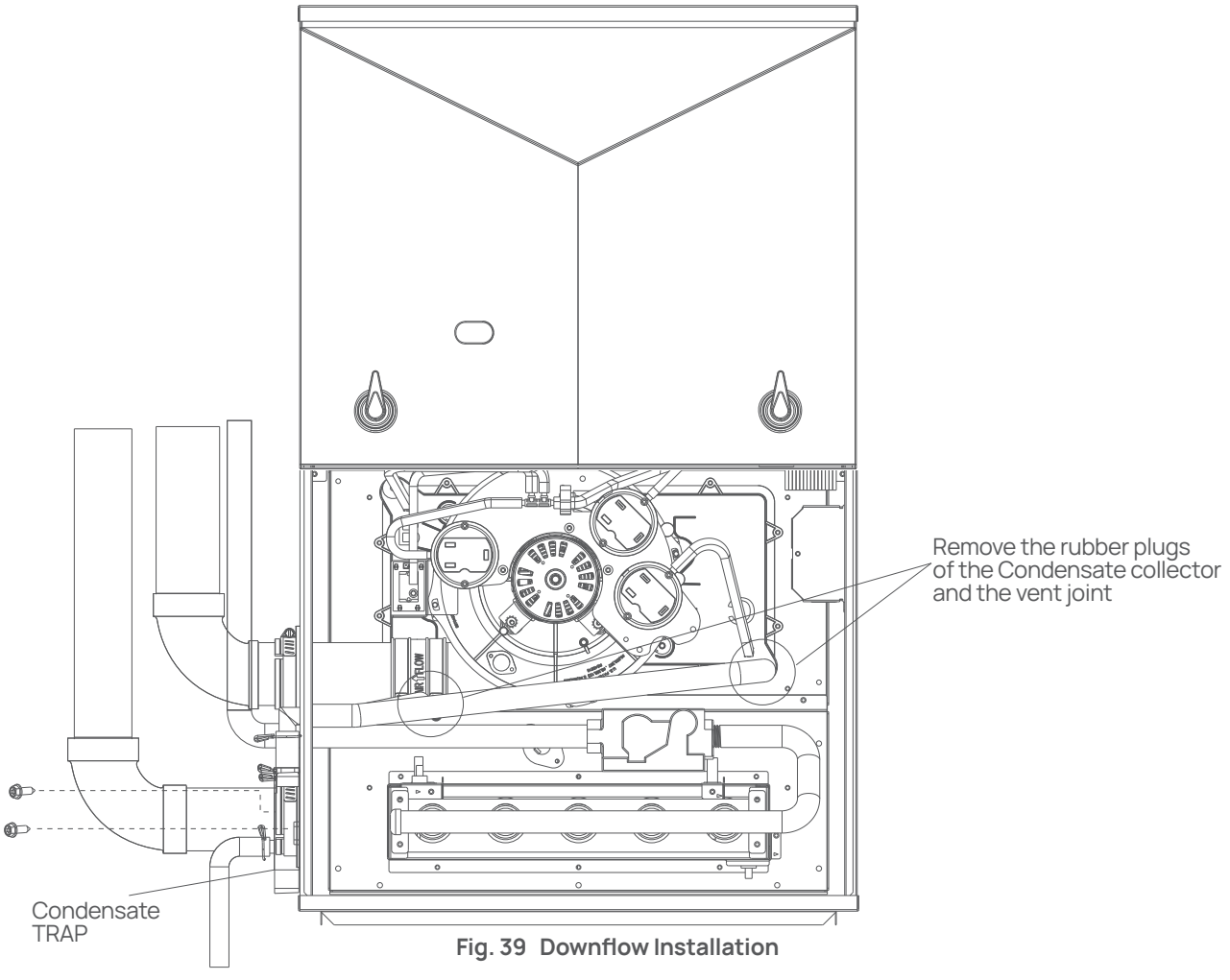
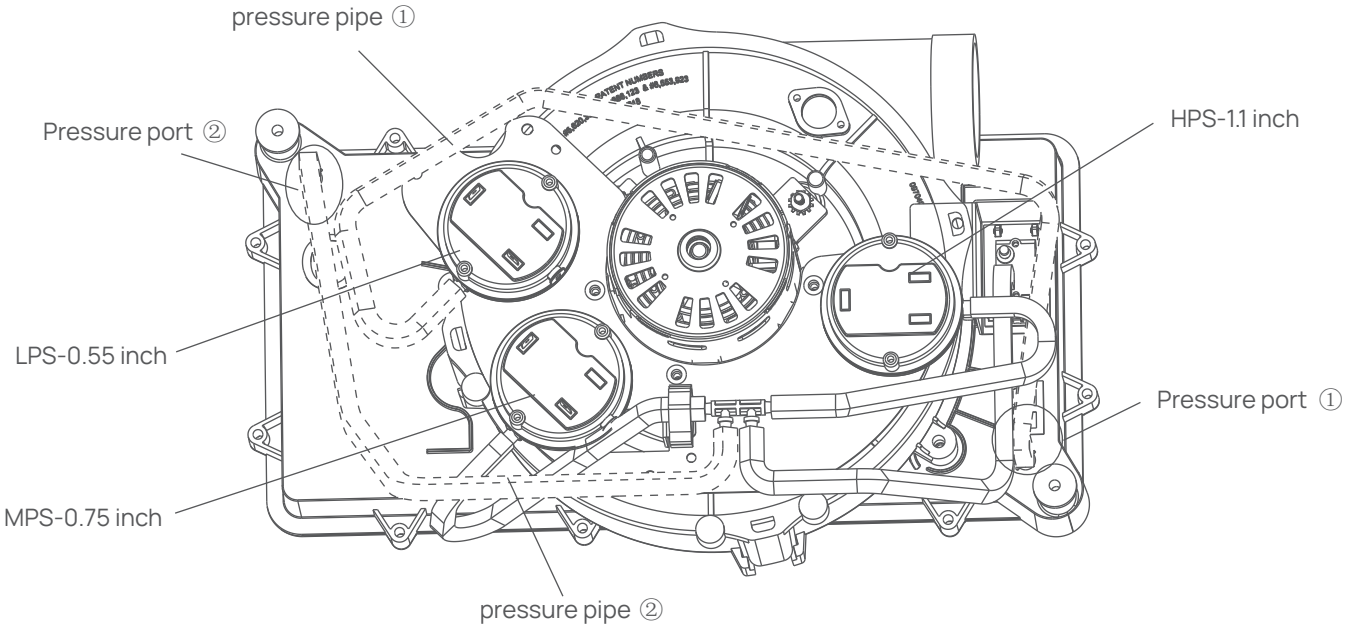


Fig. 39 Downflow Installation



Changing the position of the pressure connection pipe at the Horizontal left side and downflow positions

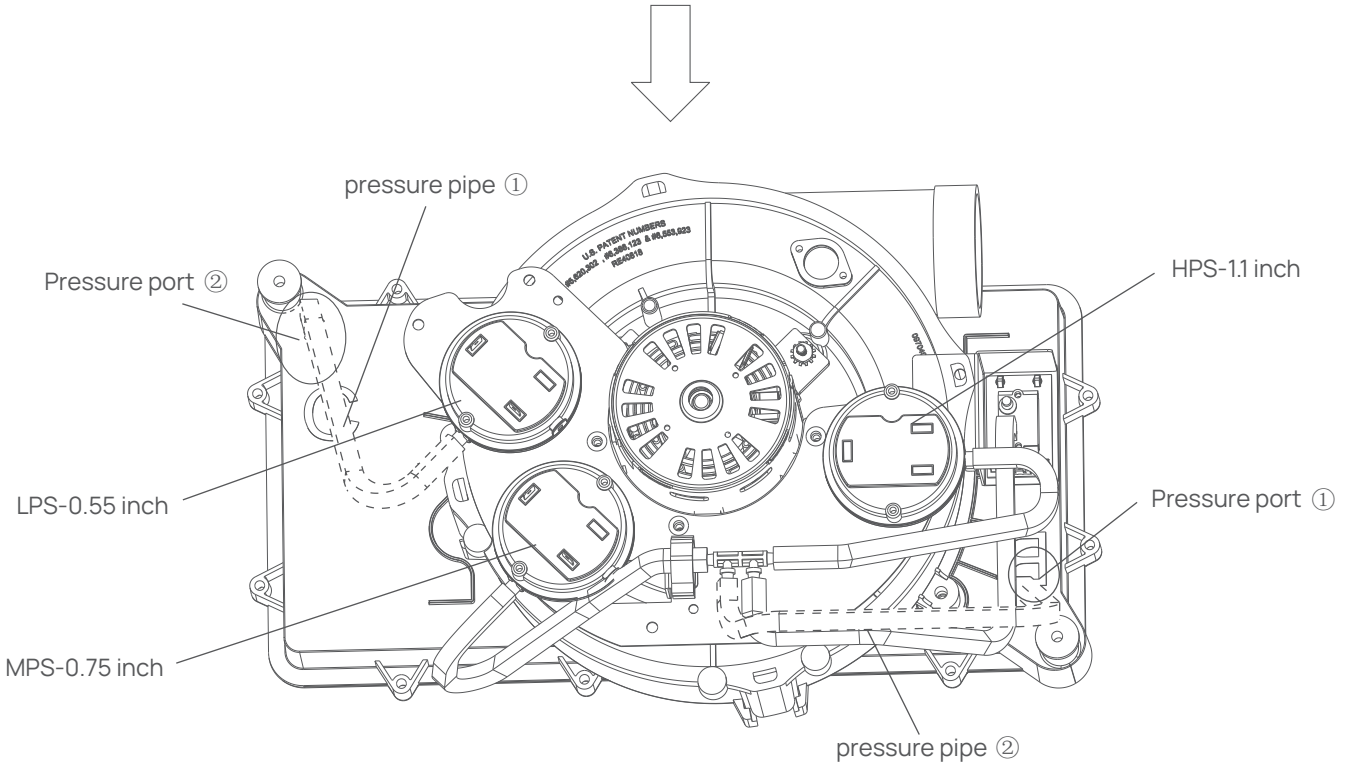


Fig. 40 Pressure Switch Position

9. High Altitude Derate

Input ratings (BTUH) of these furnaces are based on sea level operation and should not be changed at elevations up to 2,000 ft.
If the installation is 2,000 ft. or above, the furnace input rate (BTUH) shall be reduced 4% for each 1,000 ft. above sea level. The furnace input rate should be checked by multiplying the gas flow rate (CFH) obtained from the local utility supplier at the installation height by the calorific value of the gas transported at the installation height. The change in input rate can be achieved by adjusting the manifold pressure (3.2~3.8 in. W.C. - natural gas; 8.0~ 9.0 in. W.C. - propane gas) or setting the corresponding altitude (altitude may not always be required). If the change in manifold pressure cannot reach the required input rate, the altitude setting must be changed.

If you need to set the altitude, please refer to Chapter 14 for instructions on how to set n14 to correspond to different altitudes. After completing the altitude setting, the furnace input rate and temperature rise should be checked again to determine the appropriate rate for the altitude.

Symbol	Faction	Item	Description
f13	Altitude setting	0(factory)	2000(0-2000)ft
		1	3000(2001-3000)ft
		2	4000(3001-4000)ft
		3	5000(4001-5000)ft
		4	6000(5001-6000)ft
		5	7000(6001-7000)ft
		6	8000(7001-8000)ft
		7	9000(8001-9000)ft
		8	10000(9001-10000)ft
		9	11000(10001-11000)ft

10 Propane Gas Conversion

⚠WARNING

Possible property damage, personal injury or death may occur if the correct conversion kits are not installed. the appropriate kits must be applied to insure safe and proper furnace operation. all conversions must be performed by a qualified installer or service agency.

⚠NOTICE

NOTICE

If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.

This unit is configured for natural gas. The appropriate manufacturer's propane gas conversion kit , must be applied for propane gas installations. High Altitude Installations refer to the "High Altitude Derate" section for details.

Contact your distributor for a tabular listing of appropriate manufacturer's kits for propane gas and/or high altitude installations.

The indicated kits must be used to insure safe and proper furnace operation. All conversions must be performed by a qualified installer, or service agency.

The gas supply shall be shut off prior to disconnecting the electrical power before proceeding with conversion

1. Make sure all utilities (gas and electricity) are turned off
2. Remove the furnace front panel
3. Disconnect the gas line from the gas valve
4. Disconnect the wires at gas control.

To Replace Orifices with LP Orifices From Gas Manifold:

1. Disconnect all control wires
2. Remove 4 screws holding gas manifold to supporting burner assembly bracket.
3. Slide the manifold (with valve and orifices) out of burners. Be careful not to damage the assembly.
4. Replace the natural gas orifices with the LP orifices or set the high altitude (refer to Section High Altitude Installation)
5. Re-assemble the gas manifold and re-connect all wires.

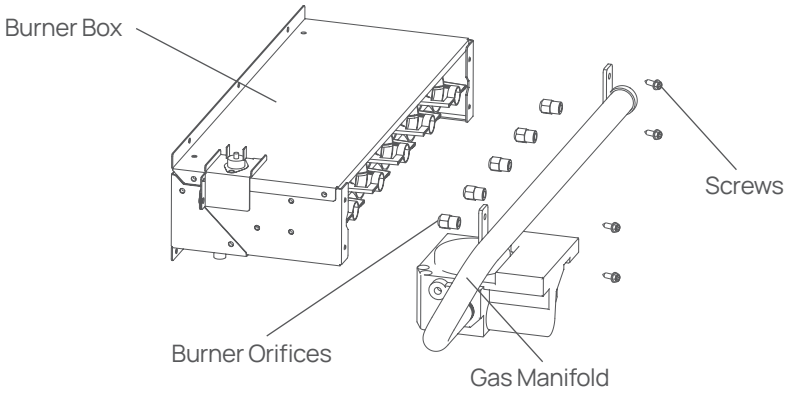


Fig. 41 Gas Manifold Blow-up

To Convert From Natural to LP Gas on Gas Valve

1. Move the switch located on the gas valve to the “OFF” position.
2. Remove the “NAT. GAS” label from the top of the gas valve;
3. Using a pair of tweezers or needle nose pliers, place the jumper (supplied with the F92-1021 of “ L.P. Gas Conversion Kit”) on the receptacle located beneath the label that was removed in step 1. Use care to make sure that both prongs of receptacle engage the jumper.
4. Place the “LP” label (supplied with the F92-1021 of “ L.P. Gas Conversion Kit”) on the gas valve over the opening to the jumper.
5. Attach the “WARNING” label (supplied with the F92-1021 of “ L.P. Gas Conversion Kit”) to the gas valve where it can readily be seen.
6. Move the switch located on gas valve back to the “ON” position.

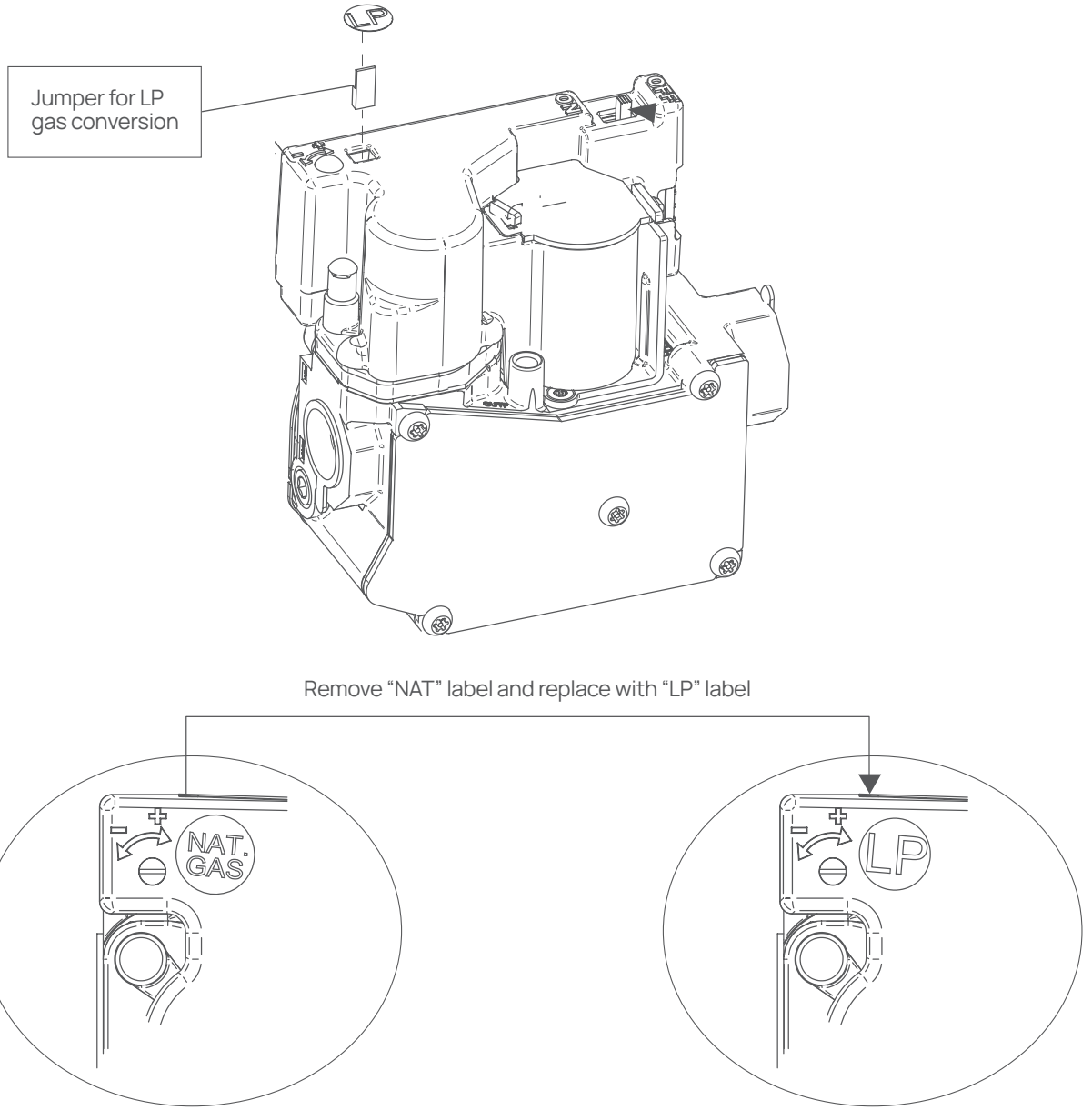


Fig. 42 Gas valve conversion to “LP”

11. GAS SUPPLY AND PIPING

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.
Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.
Use proper length of pipe to avoid stress on gas control manifold and gas valve.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.
Gas valve inlet and/or inlet pipe must remain capped until gas supply line is permanently installed to protect the valve from moisture and debris. Also, install a sediment trap in the gas supply piping at the inlet to the gas valve.

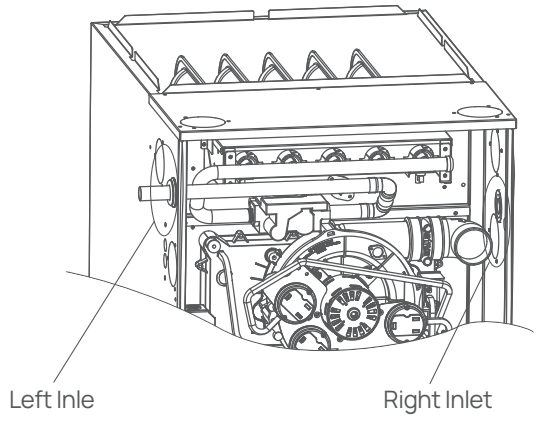


Fig. 43 Gas Entry

Gas piping must be installed in accordance with national and local codes. Refer to current edition of NFGC in the U.S.A. Refer to current edition of NSCNGPIC in Canada.
Installations must be made in accordance with all authorities having jurisdiction. If possible, the gas supply line should be a separate line running directly from meter to furnace.

Refer to Table 12 for recommended gas pipe sizing. Risers must be used to connect to furnace and to meter. Support all gas piping with appropriate straps, hangers, etc. Use a minimum of one hanger every 6 ft. (2 M). Joint compound (pipe dope) should be applied sparingly and only to male threads of joints. Pipe dope must be resistant to the action of propane gas.

Table 12 – Maximum Capacity of Pipe

NOMINAL IRON PIPE SIZE IN. (MM)	LENGTH OF PIPE -- FT (M)				
	10	20	30	40	50
	(3)	(6)	(9)	(12)	(15)
1/2(13)	175	120	97	82	73
3/4(19)	360	250	200	170	151
1(25)	680	465	375	320	285
1-1/4(32)	1400	950	770	660	580
1-1/2(39)	2100	1460	1180	990	900

Pressure 0.5 psi or less and pressure drop of 0.3" W.C.;
Based on 0.60 Specific Gravity Gas.

$$\text{CFH} = \frac{\text{BTUH Funace input}}{\text{Heating Value of Gas (BTU/Cubic Foot)}}$$

To connect the furnace to the building's gas piping, the installer must supply a ground joint union, drip leg, manual shutoff valve, and line and fittings to connect to gas valve. In some cases, the installer may also need to supply a transition piece from 1/2" pipe to a larger pipe size.

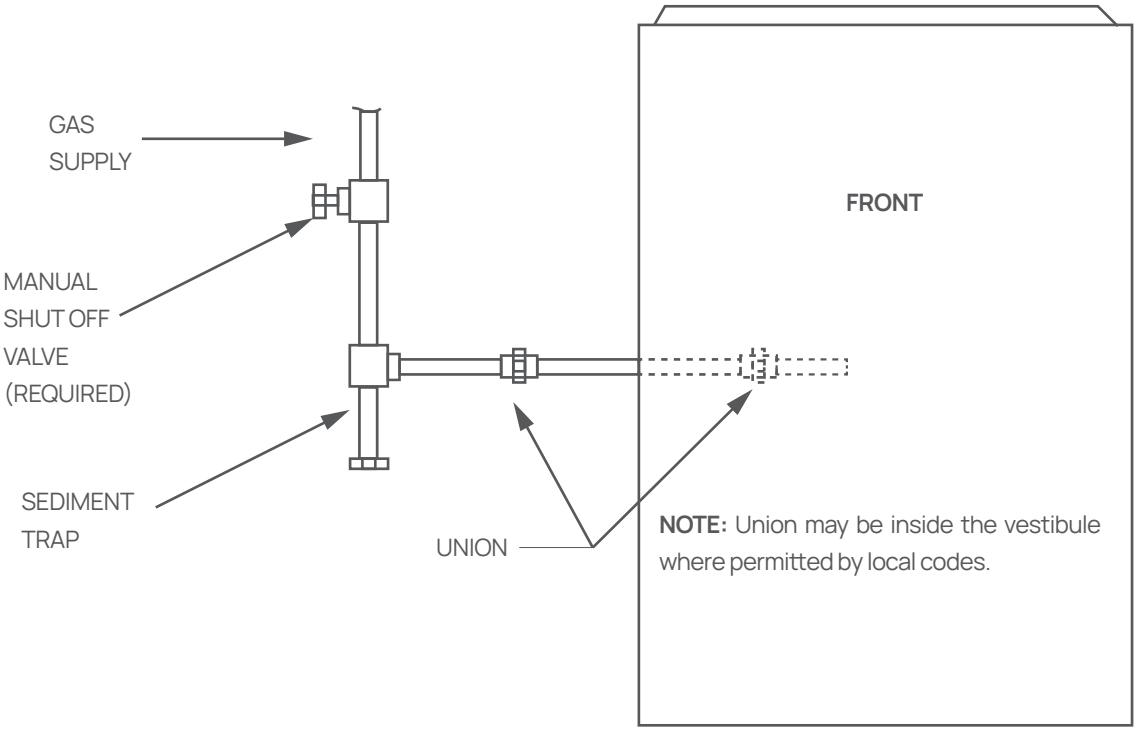


Fig. 44 – Typical Gas Pipe Arrangement

12. ELECTRICAL CONNECTIONS

⚠ WARNING

ELECTRICAL SHOCK, FIRE OR EXPLOSION HAZARD

Failure to follow safety warnings exactly could result in dangerous operation, serious injury, death or property damage.
Improper servicing could result in dangerous operation, serious injury, death or property damage.
– Before servicing, disconnect all electrical power to furnace.
– When servicing controls, label all wires prior to disconnection. Reconnect wires correctly.
– Verify proper operation after servicing.

⚠ WARNING

ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury or death.
Blower door switch opens 115–v power to control. No component operation can occur. Do not bypass or close switch with blower door removed.

⚠ WARNING

ELECTRICAL SHOCK AND FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.
The cabinet MUST have an uninterrupted or unbroken ground according to NEC NFPA 70–2011 or local codes to minimize personal injury if an electrical fault should occur.
In Canada, refer to Canadian Electrical Code CSA C22.1.
This may consist of electrical wire, conduit approved for electrical ground or a listed, grounded power cord (where permitted by local code) when installed in accordance with existing electrical codes. Refer to the power cord manufacturer's ratings for proper wire gauge. Do not use gas piping as an electrical ground.

⚠ CAUTION

FURNACE MAY NOT OPERATE HAZARD

Failure to follow this caution may result in intermittent furnace operation.
Furnace control must be grounded for proper operation or else control will lock out. Control must remain grounded throu green/yellow wire routed to gas valve and manifold bracket screw.

See Fig. 45 for field wiring diagram showing typical field 115–v wiring.
Check all factory and field electrical connections for tightness.
Field–supplied wiring shall conform with the limitations of 63_F (33_C) rise.

12. 1 115–V Wiring

Furnace must have a 115-v power supply properly connected and grounded.

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, the display will repor fault code "E4" and furnace will NOT operate.Verify that the voltage, frequency, and phase correspond to that specified on unit rating plate. Also, check to be sure that service provided by utility is sufficient to handle load imposed by this equipment. Refer to rating plate or Table 13 for equipment electrical specifications.

U.S.A. Installations: Make all electrical connections in accordance with the current edition of the National Electrical Code (NEC) NFPA 70 and any local codes or ordinances that might apply.

Canada Installations: Make all electrical connections in accordance with the current edition of the Canadian Electrical Code CSA C22.1 and any local codes or ordinances that might apply.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.
Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire. See Fig. 47.
and manifold bracket screw.

Use a separate, fused branch electrical circuit with a properly sized fuse or circuit breaker for this furnace. See Table 13 for wire size and fuse specifications. A readily accessible means of electrical disconnect must be located within sight of the furnace.

Power Cord Installation in Furnace J–Box

⚠ WARNING

FIRE OR ELECTRICAL SHOCK HAZARD

Failure to follow this warning could result in personal injury, death, or property damage.
If field–supplied manual disconnect switch is to be mounted on furnace casing side, select a location where a drill or fastener cannot damage electrical or gas components.

NOTE: Power cords must be able to handle the electrical requirements listed in Table 13. Refer to power cord manufacturer's listings.

Table 13 – Electrical Data

UNIT SIZE	VOLTS - HERTZ - PHASE	OPERATING VOLTAGE RANGE*		MAXIMUM UNIT AMPS	MINIMUM WIRE SIZE AWG	MAXIMUM WIRE LENGTH FT (M)	MAXIMUM FUSE OR CKT BKR AMPS
		Maximum*	Minimum*				
80B	115 - 60 - 1	127	104	8	14	29	15
100C	115 - 60 - 1	127	104	14	12	30	20

* Permissible limits of the voltage range at which the unit operates satisfactorily.

Unit ampacity = 125 percent of largest operating component' s full load amps plus 100 percent of all other potential operating components' (EAC, humidifier, etc.) full load amps.

Length shown is as measured one way along wire path between furnace and service panel for maximum 2 percent voltage drop.

The J-Box is used when field line voltage electrical connections are made to the furnace wiring harness inside the furnace casing. The J-Box is not required if a field-supplied electrical box is attached to the outside of the furnace casing and the box is grounded to the green ground wire of the main wiring harness and the earth ground of the field electrical supply.

Note: This furnace junction box design does not require changing the position, and all installation directions can use the factory default position.

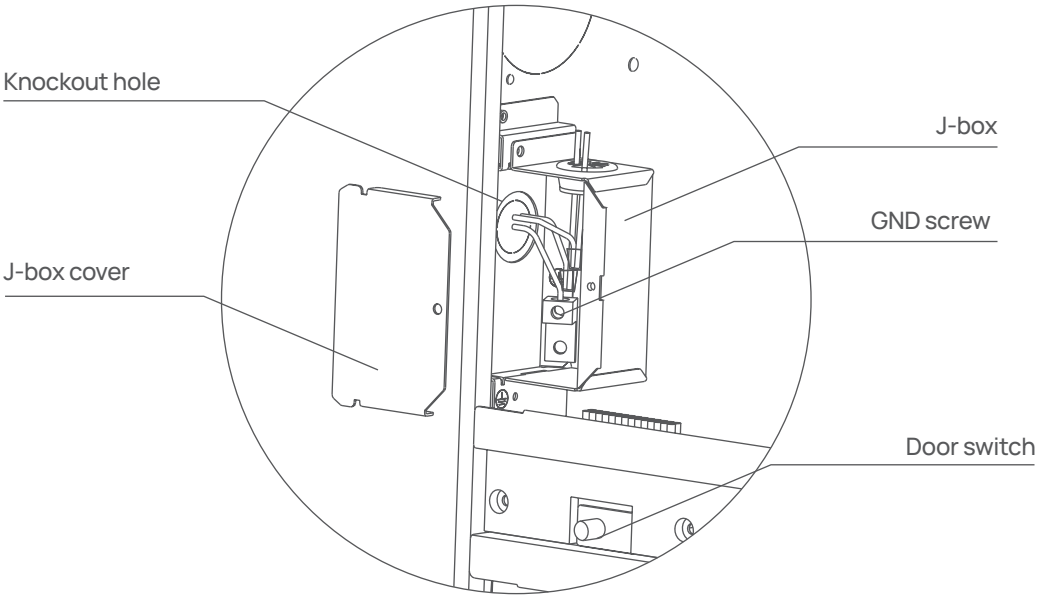


Fig. 45 – Field–Supplied Electrical Box on Furnace Casing

1. Remove cover from furnace J-Box and Keep 1 removed screws.
2. Route listed power cord through 7/8–in. (22 mm) diameter hole in casing and J–Box bracket.
3. Secure power cord to the wiring hole on the side panel with a strain relief bushing or a connector approved for the type of cord used.
4. Pull furnace power wires through 1/2–in. (12 mm) diameter hole in J–Box.
5. As shown in Fig.45, connect the on-site grounding wire to the green grounding copper joint inside the J-Box
6. Connect power cord power and neutral leads to furnace power leads as shown in Fig. 45.
7. Reinstall cover to J-Box with the 1 screws saved in step 1. Do not pinch wires between cover and bracket. See Fig. 45.

Electrical Box on Furnace Casing Side

NOTE: Check that duct on side of furnace will not interfere with installed electrical box.

1. Fasten a field-supplied external electrical box to the outside of the casing by driving two field-supplied screws into casing. See Fig. 46.
2. Route field power wiring into external electrical box.
3. Pull furnace power wires through 1/2-in. (12 mm) diameter hole in J-Box. If necessary, loosen power wires from strain relief wire-tie on furnace wiring harness.
4. Connect any code required external disconnect(s) to field power wiring.
5. Route external field power wires through holes in electrical box and casing.
6. Connect field ground wire and factory ground wire to green ground screw on J–Box mounting bracket as shown in Fig.46.
7. Connect field power and neutral leads to furnace power leads as shown in Fig. 46.
8. Attach furnace J-Box cover to mounting bracket with screws supplied in loose parts bag. Do not pinch wires between cover and bracket.
9. Complete external disconnect wiring and installation. Connect line voltage leads as shown in Fig. 46. Use best practices (NEC in U.S.A. for wire bushings, strain relief, etc., CANADA: Canadian Electrical Code CSA C22.1)

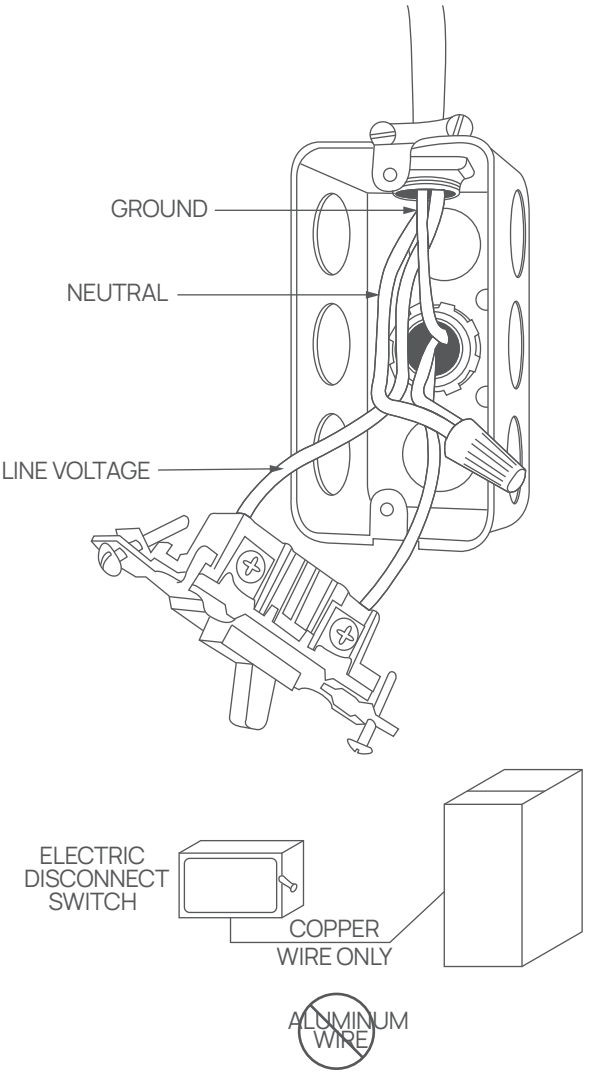


Fig. 46 – Field–Supplied Electrical Box on Furnace Casing

Bx Cable Installation In Furnace J-box

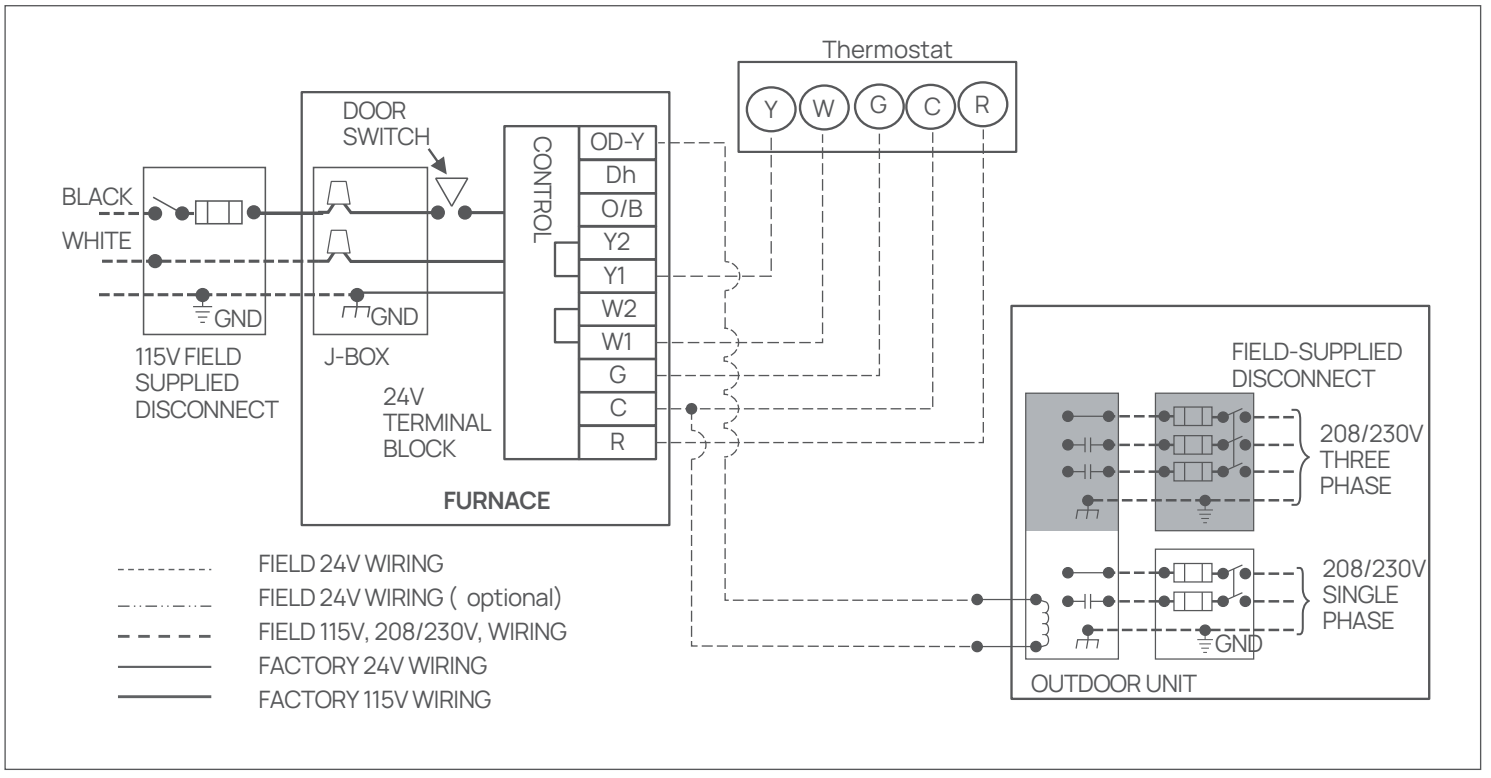
1. Remove cover from furnace J-Box and Keep 1 removed screws. See Fig. 45.
2. Route BX connector through 7/8–in. (22 mm) diameter hole in casing and J–Box bracket.
3. Secure BX cable to J–Box bracket with connectors ap proved for the type of cable used.
4. Connect field ground wire and factory ground wire to green ground screw on J–Box mounting bracket as shown in Fig.45.
5. Connect field power and neutral leads to furnace power leads. as shown in Fig. 45.
6. Reinstall cover to J-Box whit the 1 screws saved in step 1. Do not pinch wires between cover and bracket. See Fig. 45.

12.2 24V Wiring

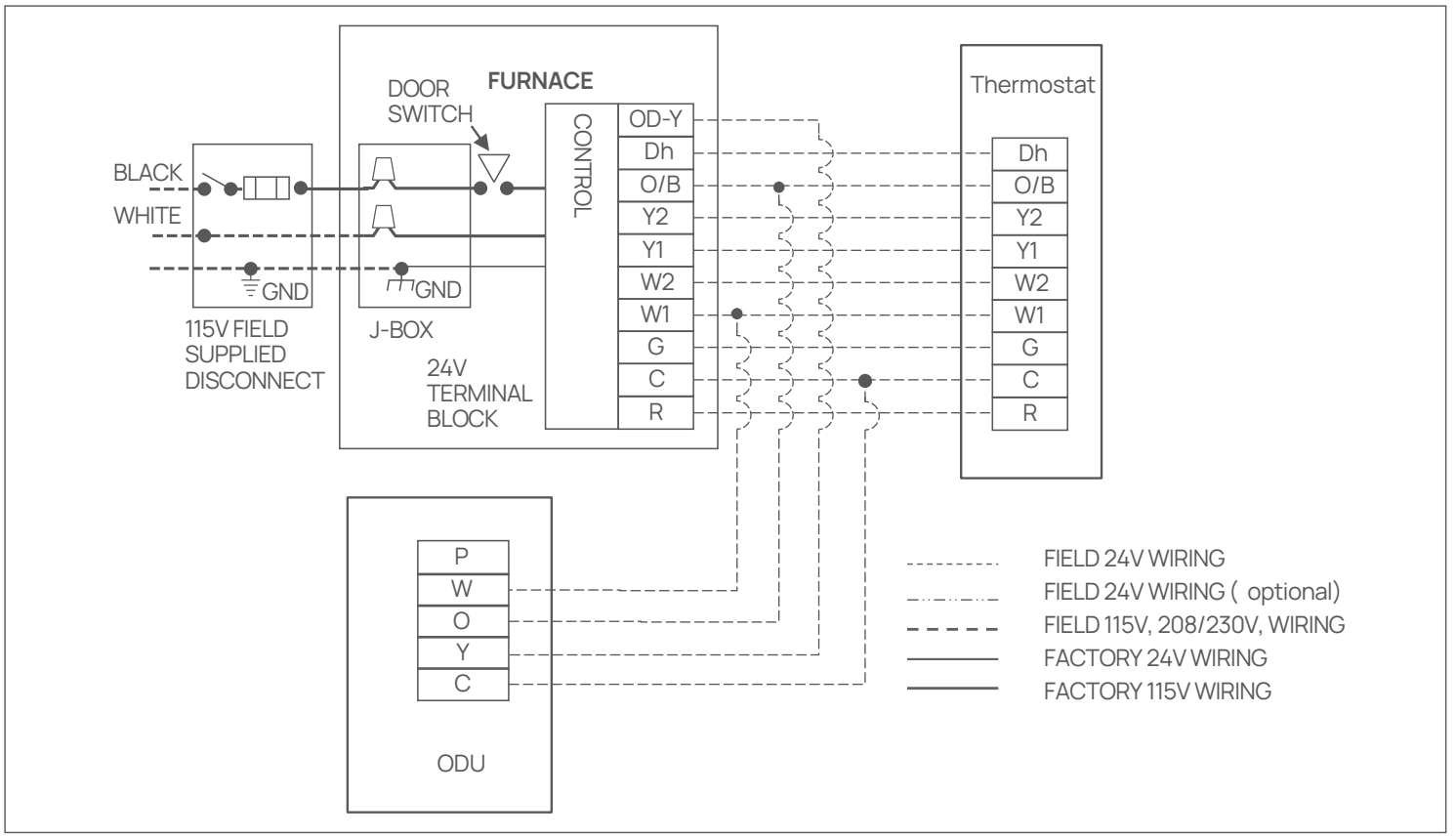
Connect terminal Y1, Y2 and W1,W2 as shown in Fig. 47 for proper cooling operation or heating operation. Use only AWG No. 18, color-coded, copper thermostat wire.

1) Typical Field Wiring Diagram

Fig. 47 Heating and Cooling Application Wiring Diagram



2)Match with ECOER thermostat



3) Match with ECOER Air Conditioner (Including ECOER thermostat and control box)

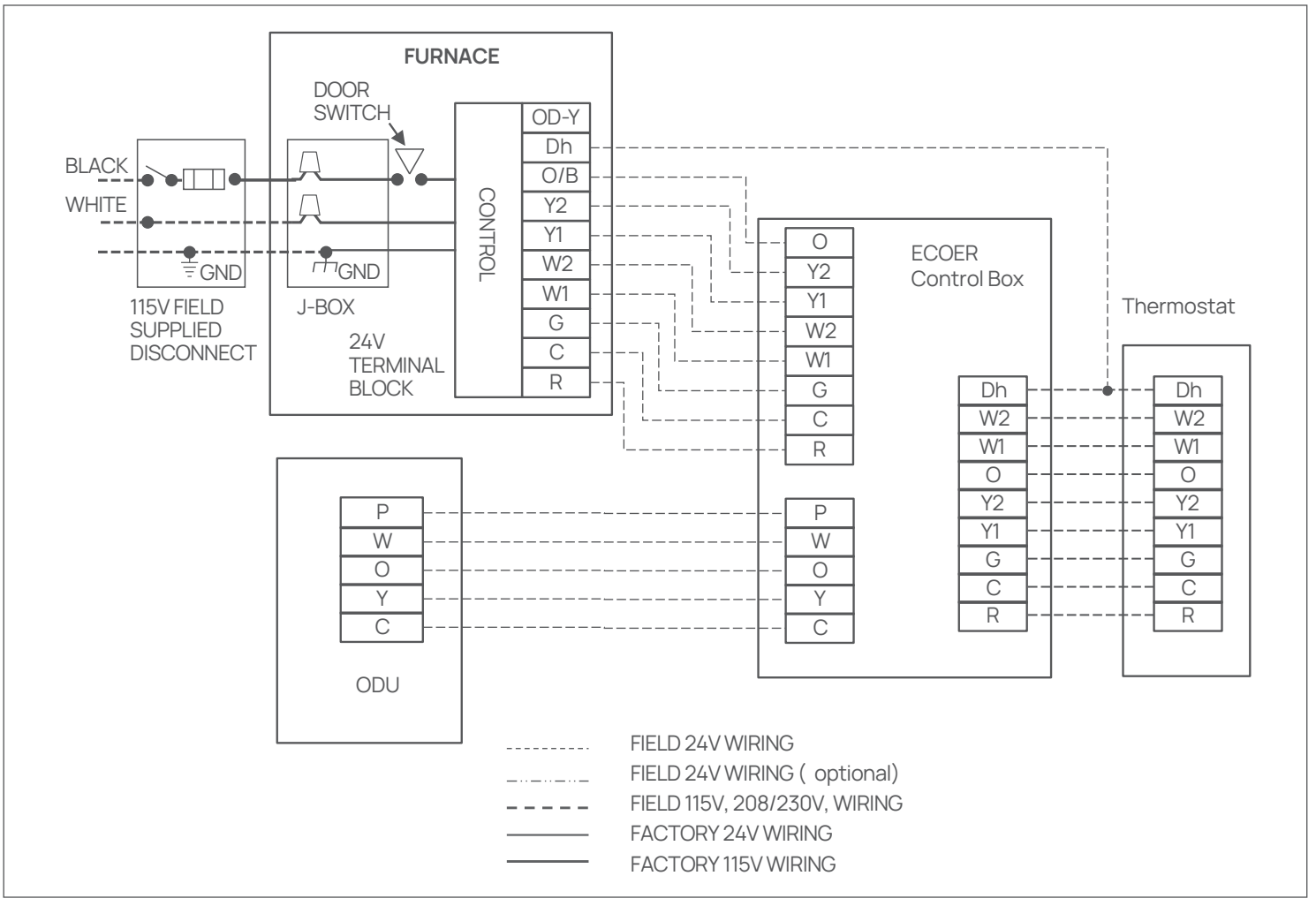


Fig. 47 Heating and Cooling Application Wiring Diagram

NOTE: Use AWG No. 18 color-coded copper thermostat wire for lengths up to 100 ft. (31 M). For wire lengths over 100 ft., use AWG No. 16 wire.

The 24-v circuit contains a resettable-type, 2-amp. fuse located on the control. Any direct shorts during installation, service, or maintenance could cause this fuse to trigger protection. No need to replace the fuse, it will automatically restart after the short circuit is eliminated.

12.3 Accessories (Field Supplied)

1. Electronic Air Cleaner (EAC) Connect an accessory Electronic Air Cleaner (if used) using l/4-in female quick connect terminals to the two male 1/4-in quick-con nect terminals on the control board marked CLANERS. The terminals are rated for 115V AC, 1.5 amps maximum and are energized during blower motor operation. (See Fig. 48)
2. Humidifier (HUM) Connect an accessory 115V AC, 1.5 amp. maximum humidifier (if used) to the 1/4-in male quick-connect HUM-H terminals terminal is energized when gas valve relay is energized. (See Fig.48)

12.4 Grounding

The furnace 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, Part 1, if an external electrical source is utilized.

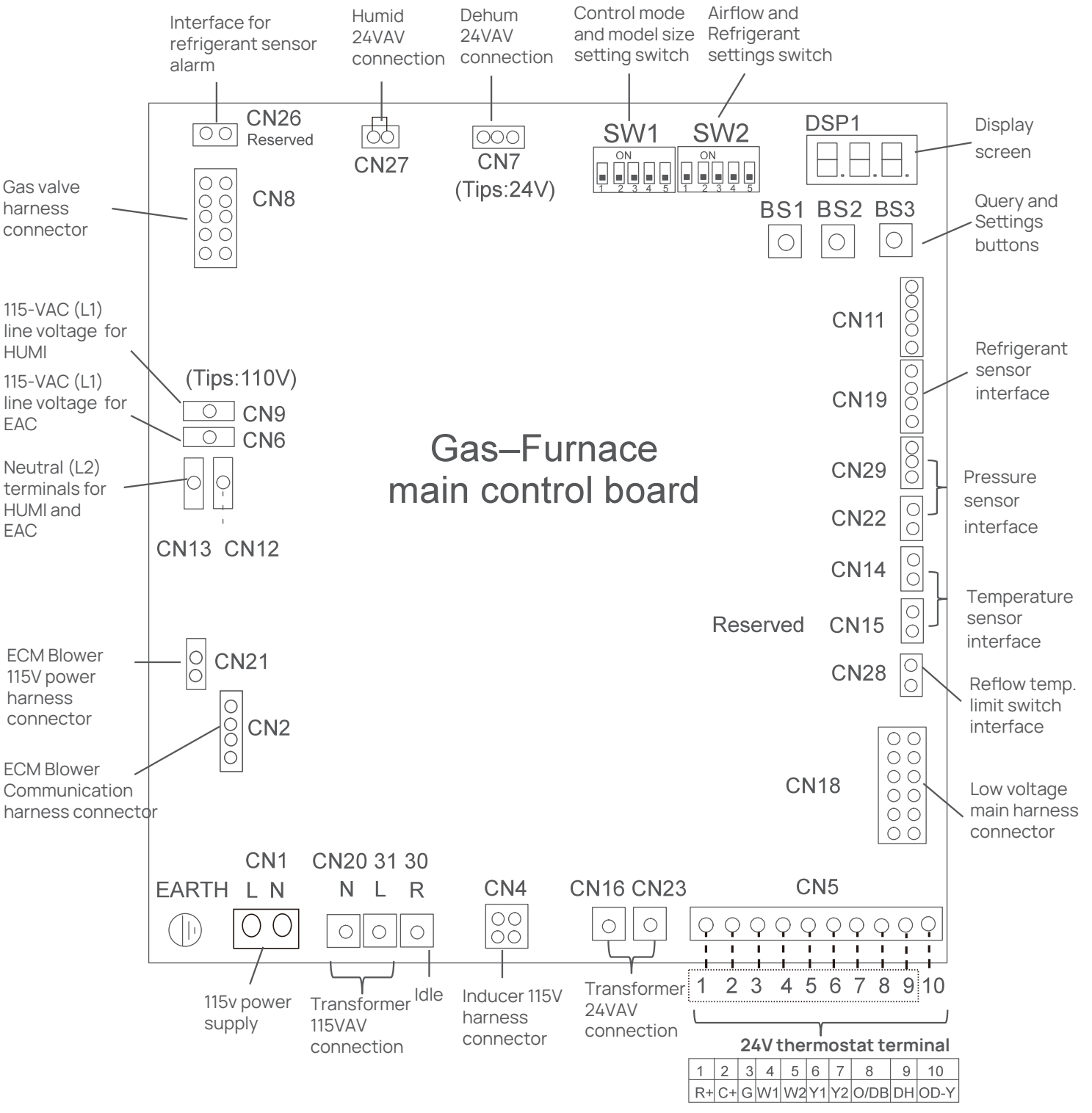


Fig. 48 – Example of Modulating Furnace Control

13.START-UP, ADJUSTMENT, AND SAFETY CHECK

13.1 General

1. Maintain 115V wiring and ground. Improper polarity will result "E4" fault and no furnace operation. (See Fig. 45)
2. Make thermostat wire connections at the 24-V terminal block on the furnace control. Failure to make proper connections will result in improper operation. (See Fig. 47)
3. Gas supply pressure to the furnace must be greater than 4.5-in. wc (0.16 psig) but not exceed 14-in. we (0.5 psig).
4. Check all manual-reset switches for continuity.
5. Install blower compartment door. Door must be in place to operate furnace.

Before operating furnace, check flame rollout manual reset switch for continuity. If necessary, press button to reset switch.

EAC-1 terminal is energized whenever blower operates, HUM terminal is only energized when blower is energized in heating.

⚠NOTICE

Important Installation and Start-up Procedures

Failure to follow this procedure may result in a nuisance smoke or odor complaint.

The manifold pressure, gas rate (by meter timing), temperature rise, and proper operation must be checked after installation. A minor amount of smoke and odor may be noticeable during the initial operation of the furnace, which is normal for the manufacturing process.

Some occupants are more sensitive to this minor smoke and odor. It is recommended that doors and windows be open during the first heat cycle.

13.2 Setup Switches

There are 2 sets of setup switches on the furnace control board.

These switches configure the furnace for correct application requirement.

They also select the airflow settings for Air Conditioning and Continuous Fan airflows.

The Setup Switch locations are shown and described on Table 14.

The setup switches are also shown on the unit wiring label.

Table 14 Furnace Setup Switch setting

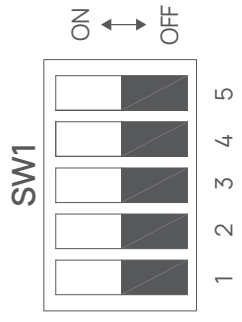
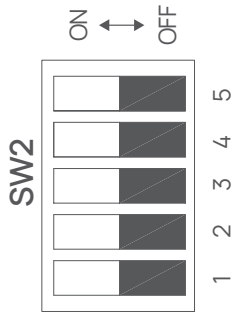
SWITCHS	Furnace Setup Switch Description			
	SETUP SWITCH	SWITCH NAME	Options	Default POSITION
	SW1-1	Control mode setting	OFF-variable	OFF
			ON-two stage	
	SW1-2	Cabinet setting	OFF-Cabinet B/D	OFF
			ON-Cabinet A/C	
	SW1-3	Reserve	Reserve	Reserve
	SW1-4			
	SW1-5			

Table 14 Furnace Setup Switch setting

SWITCHS	Furnace Setup Switch Description				
	SETUP SWITCH	SWITCH NAME	Options	Default POSITION	DESCRIPTION OF USE
	SW2-1	Cooling CFM setting	OFF/ON	OFF	See Table 15 Rated Cooling&heatpump air volume
	SW2-2		OFF/ON	OFF	
	SW2-3		OFF/ON	OFF	
	SW2-4	O/B model setting	OFF-with O-cooling, with O-heating	OFF	O/B signal control during operation of heat pump
			ON-with B-cooling, without B-heating		
	SW2-5	RLF leak	OFF Common	Selection of refrigerant	Common:No mandatory requirement for refrigerant sensor signal access; Combustible:Paired with combustible refrigerant, refrigerant sensors are mandatory.
			ON Combustible		

13.3 Prime Condensate TRAP with Water

⚠ WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow these warnings could result in personal injury or death.
Failure to use a properly configured trap or NOT water–priming trap before operating furnace may allow positive pressure vent gases to enter the structure through drain tube. Vent gases contain carbon monoxide which is tasteless and odorless.

1. Before installing the condensate TRAP, the interior should be filled with water first.
2. Connect field-supplied tube with attached funnel to the trap inlet. See Fig. 49.
3. Pour an appropriate amount of water into funnel/tube. Water should overfill condensate TRAP, and flow into open field drain.
4. Remove funnel, Connect the trap to the drainage pipe and secure it in the desired position.

Fig. 49 – Priming Condensate TRAP (Appearance May Vary)

13.4 Purge Gas Lines

If not previously done, purge the lines after all connections have been made and check for leaks.

⚠ WARNING

FIRE OR EXPLOSION HAZARD

Failure to follow this warning could result in personal injury, death, and/or property damage.
Never purge a gas line into a combustion chamber. Never test for gas leaks with an open flame. Use a commercially available soap solution made specifically for the detection of leaks to check all connections. A fire or explosion may result causing property damage, personal injury or loss of life.

13.5 Adjustments

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution could result in reduced furnace life.
DO NOT push or force gas valve adjusting screw. This can result in damage to the adjustment screw resulting in incorrect manifold pressure, which can result in a no heat situation or shorten the life of the heat exchangers.

⚠ WARNING

FIRE HAZARD

Failure to follow this warning could result in personal injury, death and/or property damage.
DO NOT push or force gas valve adjusting screw. This can result in damage to the adjustment screw resulting in incorrect manifold pressure, which can result in a no heat situation or shorten the life of the heat exchangers

⚠ CAUTION

FURNACE DAMAGE HAZARD

Failure to follow this caution may result in reduced furnace life.
DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of heat exchangers, causing failures

Rating Input

To adjust manifold pressure to obtain the proper input rate, first, determine if the furnace has the correct orifice installed. Tables have been provided in the furnace installation instructions to match the required orifice to the manifold pressure to the heat content and specific gravity of the gas.
For proper operation and long term reliability, the Furnace input rate must be within +/−2 percent of input rate on furnace rating plate or as adjusted for altitude.
The gas input rate on rating plate is for installations at altitudes 0-2000 ft. (609.6M).
Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate are shown in Table 16.

Check Inlet Gas Pressure

The inlet gas pressure must be checked with the furnace operating in maximum heat. This is necessary to make sure the inlet gas pressure does not fall below the minimum pressure of 4.5 in. w.c. for natural gas. The maximum inlet gas pressure is 13.5 in. of water column. If the inlet pressure is too low, you will not be able to adjust the manifold pressure to obtain the proper input rate. To check the inlet gas pressure:

1. Make sure the gas supply is turned off to the furnace and at the electric switch on the gas valve.
2. Remove the 3/32" HEX HEAD plug from the inlet pressure tap on the gas valve.
3. Connect a manometer to the inlet pressure tap on gas valve.
4. Turn on furnace power supply.
5. Turn gas supply manual shutoff valve to ON position.
6. Turn furnace gas valve switch to ON position.
7. Jumper the R to W/W1 and W2 thermostat connections at the furnace control board.
8. When main burners ignite, confirm inlet gas pressure is Between 4.5 in. w.c. and 13.5 in. w.c.
9. Remove jumper across thermostat connections to terminate call for heat. Wait until the blower off delay is completed.
10. Turn furnace gas valve electric switch to OFF position.
11. Turn gas supply manual shutoff valve to OFF position.
12. Turn off furnace power supply.
13. Remove manometer from the inlet pressure tap of the gas valve.
14. Re−install the 3/32" HEX HEAD plug removed in the step 2 to its original position.

Adjust Manifold Pressure

For proper operation and long term reliability, the manifold pressure must be adjusted within ±2 percent of input rate on furnace rating plate.
This furnace is a modulating furnace manifold pressure is set at only the Maximum Heat. Intermediate Heat manifold pressure and the Minimum Heat manifold pressure will automatically adjust according to the percentage of maximum heating pressure.

NOTICE: Set Maximum Heat manifold pressure Within the range of 3.5-3.8 in. w.c.

To adjust manifold pressure to obtain input rate for Maximum Heat:

1. Turn SW1-1 to ON.
2. Make sure the gas supply is turned off to the furnace and at the electric switch on the gas valve.
3. Remove the 3/32" HEX HEAD plug from the outlet pressure tap on the gas valve.
4. Connect a manometer to the outlet pressure tap on gas valve.
5. Turn on furnace power supply.
6. Turn gas supply manual shutoff valve to ON position.
7. Turn furnace gas valve switch to ON position.
8. Jumper the R to W/W1 and W2 thermostat connections at the furnace control board.
9. After the main burners ignite and the blower starts, confirm Maximum Heat manifold pressure is correct, based on the manifold pressure tables in the installation instructions.
10. To adjust the manifold pressure for Maximum Heat, slowly turn the adjustment screw clockwise to increase the pressure or counterclockwise to decrease it. Do not turn the screw by more than one click at a time, pausing between adjustments until the required pressure is achieved. See Fig. 50.
11. Main burner flame should be clear blue, almost transparent.
12. After adjusting the Maximum Heat manifold pressure, remove jumpers across thermostat connections to terminate the call for heat.
13. Wait for blower off-delay to finish then reset 115–v power to furnace.
14. Reinstall manifold pressure tap plug in gas valve to prevent gas leak.
15. Turn SW1-1 back to Factory setting-OFF.

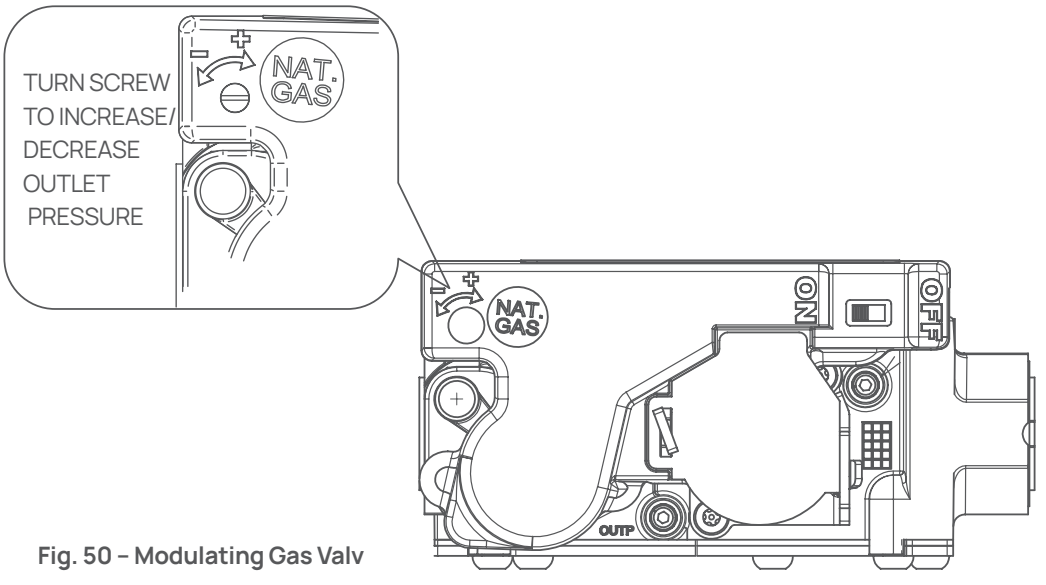


Fig. 50 – Modulating Gas Valv

⚠WARNING

FIRE HAZARD

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

Reinstall manifold pressure tap plug in gas valve to prevent gas leak.

⚠NOTICE

After completing the manifold pressure adjustment, SW1-1 must be returned to the OFF position.

Unless you do not want a modulating controlled furnace.

Combustion analysis

After completing the input-rate adjustment for maximum heat, operate the furnace under rated conditions for a minimum of 10 minutes to ensure stable combustion. Use a calibrated combustion analyzer to measure the flue-gas constituents at the flue outlet.

The flue-gas composition must fall within the acceptable ranges listed in the table below. All measurements must be taken with the unit operating at steady state.

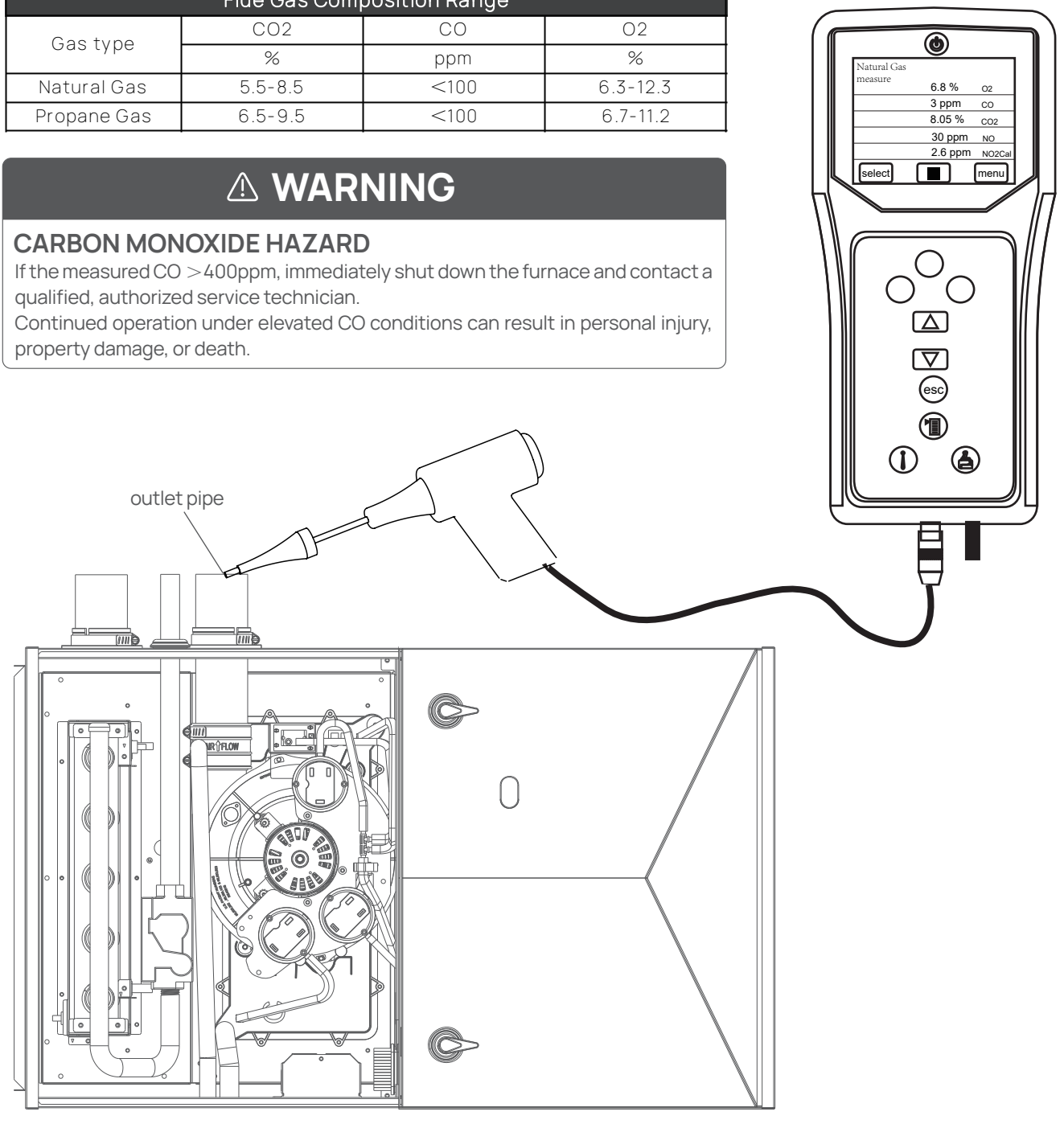
Flue Gas Composition Range			
Gas type	CO2	CO	O2
	%	ppm	%
Natural Gas	5.5-8.5	<100	6.3-12.3
Propane Gas	6.5-9.5	<100	6.7-11.2

⚠ WARNING

CARBON MONOXIDE HAZARD

If the measured CO >400ppm, immediately shut down the furnace and contact a qualified, authorized service technician.

Continued operation under elevated CO conditions can result in personal injury, property damage, or death.



13.6 Check Safety Controls

The flame sensor, gas valve, and pressure switch were all checked in the Start-up procedure section as part of normal operation.

Check Main Limit Switch

This control shuts off combustion system and energizes air-circulating blower motor, if furnace overheats. By using this method to check limit control, it can be established that limit is functioning properly and will operate if there is a restricted return-air supply or motor failure. If limit control does not function during this test, cause must be determined and corrected.

a. Run furnace for at least 5 minutes.
b. Gradually block off return air with a piece of cardboard or sheet metal until the limit trips.
c. Unblock return air to permit normal circulation.
d. Burners will re-light when furnace cools down.

Check Pressure Switch(es)

This control proves operation of the draft inducer blower.

a. Turn off 115-v power to furnace.
b. Disconnect inducer motor lead wires from wire harness.
c. Turn on 115-v power to furnace.
d. Set thermostat to "call for heat" and wait 1 minute. When pressure switch is functioning properly, hot surface igniter should NOT glow and control diagnostic light flashes a status code 32. If hot surface igniter glows when inducer motor is disconnected, shut down furnace immediately.
e. Determine reason pressure switch did not function properly and correct condition.
f. Turn off 115-v power to furnace.
g. Reconnect inducer motor wires, replace blower door, and turn on 115-v power.
h. Draft inducer blower will run for 15 seconds before igniter glow.
i. Furnace should ignite normally.

TABLE 16 Orifice Size and Manifold Pressure (In. W.C.) for Gas Input Rate

MODEL	INPUT RATING BTUH	NUMBER OF BURNERS	ORIFICE SIZE		Manifold Pressure	
			NAT. GAS	LP GAS	NAT. GAS	LP GAS
80B	80000	4	44#	54#	3.8	9.0
100C	100000	5	44#	54#	3.8	9.0

Table 17 – Gas Rate (CU ft./hr)

SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL		
	1 Cu Ft.	2 Cu Ft.	5 Cu Ft.		1 Cu Ft.	2 Cu Ft.	5 Cu Ft.		1 Cu Ft.	2 Cu Ft.	5 Cu Ft.
30	120	240	600	**61**	59	118	295	**92**	39	78	196
31	116	232	581	**62**	58	116	290	**93**	39	77	194
32	113	225	563	**63**	57	114	286	**94**	38	77	191
33	109	218	545	**64**	56	113	281	**95**	38	76	189
34	106	212	529	**65**	55	111	277	**96**	38	75	188
35	103	206	514	**66**	55	109	273	**97**	37	74	186
36	100	200	500	**67**	54	107	269	**98**	37	73	184
37	97	195	486	**68**	53	106	265	**99**	36	73	182
38	95	189	474	**69**	52	104	261	**100**	36	72	180
39	92	185	462	**70**	51	103	257	**101**	36	71	178
40	90	180	450	**71**	51	101	254	**102**	35	71	176
41	88	176	439	**72**	50	100	250	**103**	35	70	175
42	86	171	429	**73**	49	99	247	**104**	35	69	173
43	84	167	419	**74**	49	97	243	**105**	34	69	171
44	82	164	409	**75**	48	96	240	**106**	34	68	170
45	80	160	400	**76**	47	95	237	**107**	34	67	168
46	78	157	391	**77**	47	94	234	**108**	33	67	167
47	77	153	383	**78**	46	92	231	**109**	33	66	165
48	75	150	375	**79**	46	91	228	**110**	33	65	164
49	73	147	367	**80**	45	90	225	**111**	32	65	162
50	72	144	360	**81**	44	89	222	**112**	32	64	161
51	71	141	353	**82**	44	88	220	**113**	32	64	159
52	69	138	346	**83**	43	87	217	**114**	32	63	158
53	68	136	340	**84**	43	86	214	**115**	31	63	157
54	67	133	333	**85**	42	85	212	**116**	31	62	155
55	65	131	327	**86**	42	84	209	**117**	31	62	154
56	64	129	321	**87**	41	83	207	**118**	31	61	153
57	63	126	316	**88**	41	82	205	**119**	30	61	151
58	62	124	310	**89**	40	81	202		30	60	150
59	61	122	305	**90**	40	80	200				
60	60	120	300	**91**	40	79	198				

LIGHTING INSTRUCTIONS

NOTICE: Important Installation and Start-up Procedures

Failure to follow this procedure may result in a nuisance smoke or odor complaint.
The manifold pressure, gas rate (by meter timing), temperature rise, and proper operation must be checked after installation. Minor smoke and odor may be present temporarily after start-up from the manufacturing process. Some occupants are more sensitive to this minor smoke and odor. It is recommended that doors and windows be open during the first heat cycle.

FOR YOUR SAFETY READ BEFORE OPERATING

⚠WARNING Ifyou do not follow these instructions exactly, a fre or explosion may result, causing property damage, personal injury or loss of life.

A. This appliance does not have a pilot. It is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.

B. BEFORE OPERATING smell all around the appliance area for gas. Be sure to smell next to the floor because some qas is heavierthan air and will settle on the floor.

FORYOUR SAFETY
"WHAT TO DO IFYOU SMELL GAS"

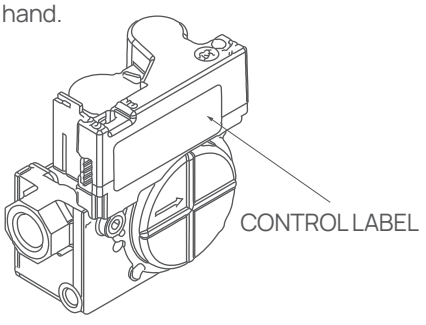
- Do not try to light any appliance.
- Do not touch any electrical switch; do not use any phone in your building.
- Immediately call your gas supplier from a neighbor's phone. Follow the gas supplier's instructions.
- Ifyou cannot reach your gas supplier, call the fre department.

C. Use only your hand to move the gas controlswitch. **Never use tools.** If the switch will not move by hand, don't try to repair it, call a qualifed service technician. Force orattempted repair may result in a fre or explosion.

D. Do not use this appliance if any part has been underwater.Immediately call a qualifed service technician to inspect the appliance and to replace any part of the control system and any gas control which has been under water.

OPERATING INSTRUCTIONS

1. **STOP!** Read the safety information above on this label.
2. Set the thermostat to lowest setting.
3. Turn off all electric power to the appliance.
4. **HSI MODELS**: This appliance is equipped with an ignition device which automatically lights the burner. Do not try to light the burner by hand.



5. PROVEN/INTERMITTENT PILOTMODELS:This appliance is
6. equipped with an ignition device which automatically lights
7. the pilot. Do not try to light the burner by hand.
8. Remove control access panel.
   Wait five (5) minutes to clear out any gas. If you then smell gas, STop! Follow "B" in the safety information above on this label. If you don't smell gas, go to the next step.
   Push gas control switch to "ON."NOTE: Do not force.
9. Replace control access panel
10. Turn on all electric power to the appliance
11. Set thermostat to desired setting.
12. If the appliance will not operate, follow the instructions "ToTurn OffGas To Appliance"and call your service technician or gas supplier.

TO TURN OFF GAS TO APPLIANCE

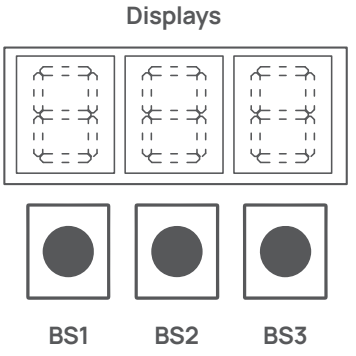
1. Set the thermostat to lowest setting.
2. Turn off all electric power to the appliance if service is to be performed.
3. Remove control access panel.
4. Push qas control switch to **"OFF." Do not force.**
5. Replace control access panel.

14. Fumctional Button 0perations

0perate the three buttons(BS1,B82,B83)on the control board to:

- Query Historical Faults ;
- Access Hardware Information and Settings;
- Query Software Settings ;
- Configure Software Settings;

Detailed operating methods are described below.



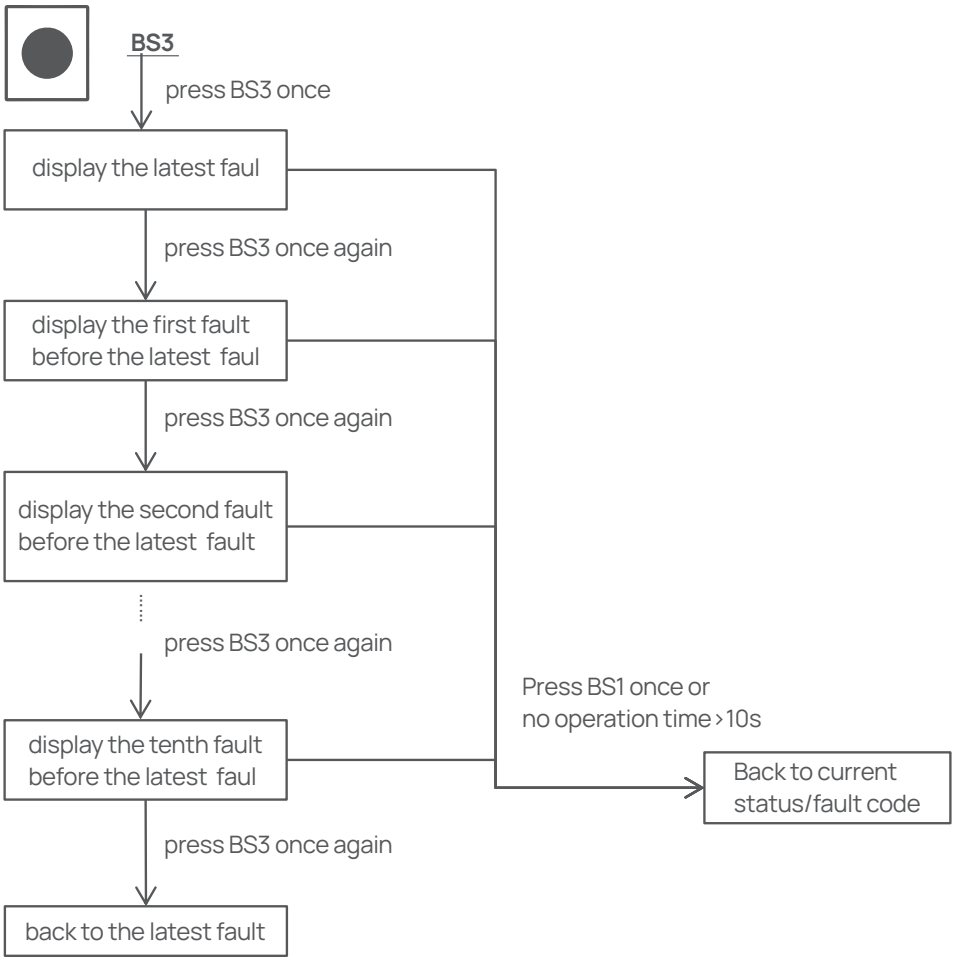
BS1: Enter Menu and back button

BS2: Selection

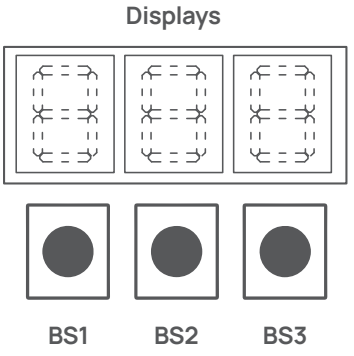
BS3: Spot check and confirm button

"Query Historical fault" Operating instructions:

Query Historical fault



14. Fumctional Button Operations



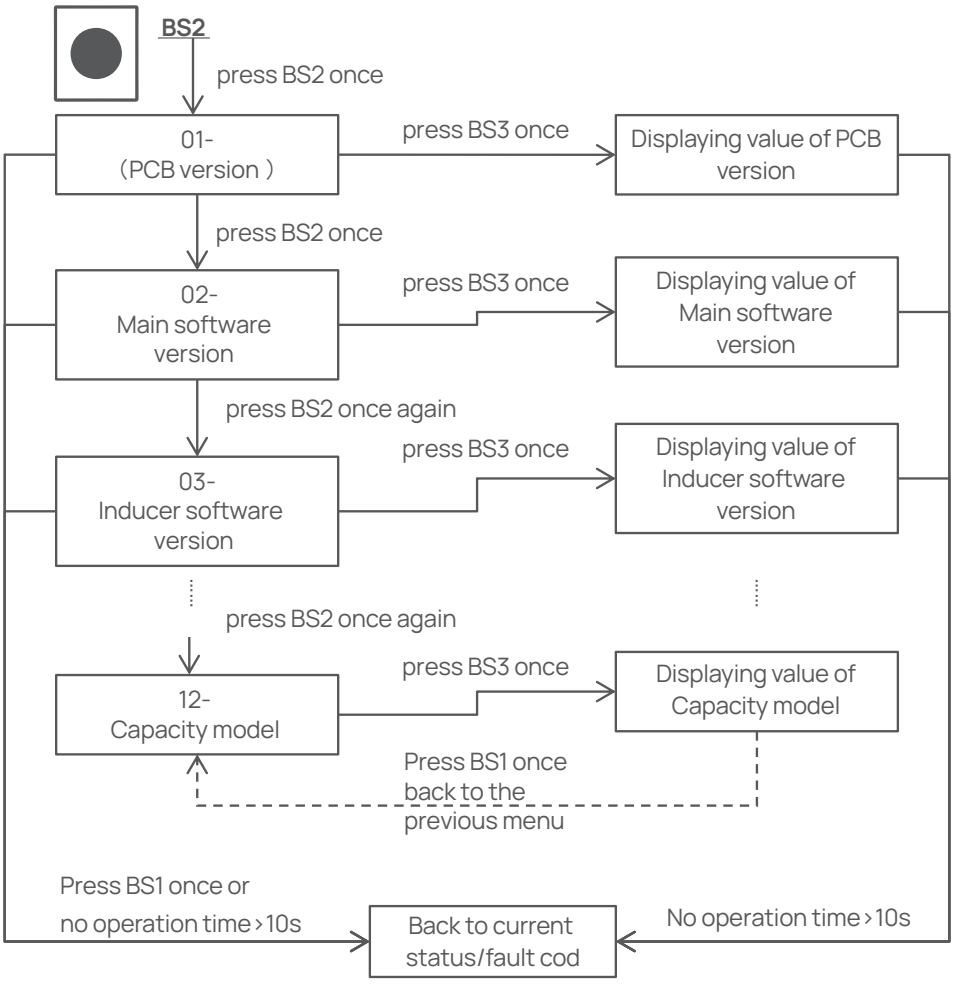
BS1: Enter Menu and back button

BS2: Selection

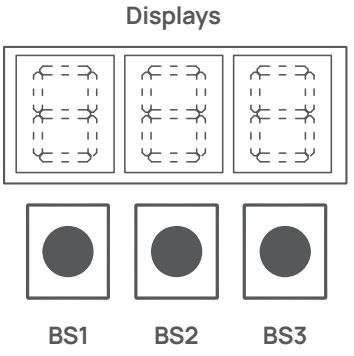
BS3: Spot check and confirm button

"Query hardware information and settings" Operating instructions:

Query of hardware information and settings



14. Fumctional Button Operations



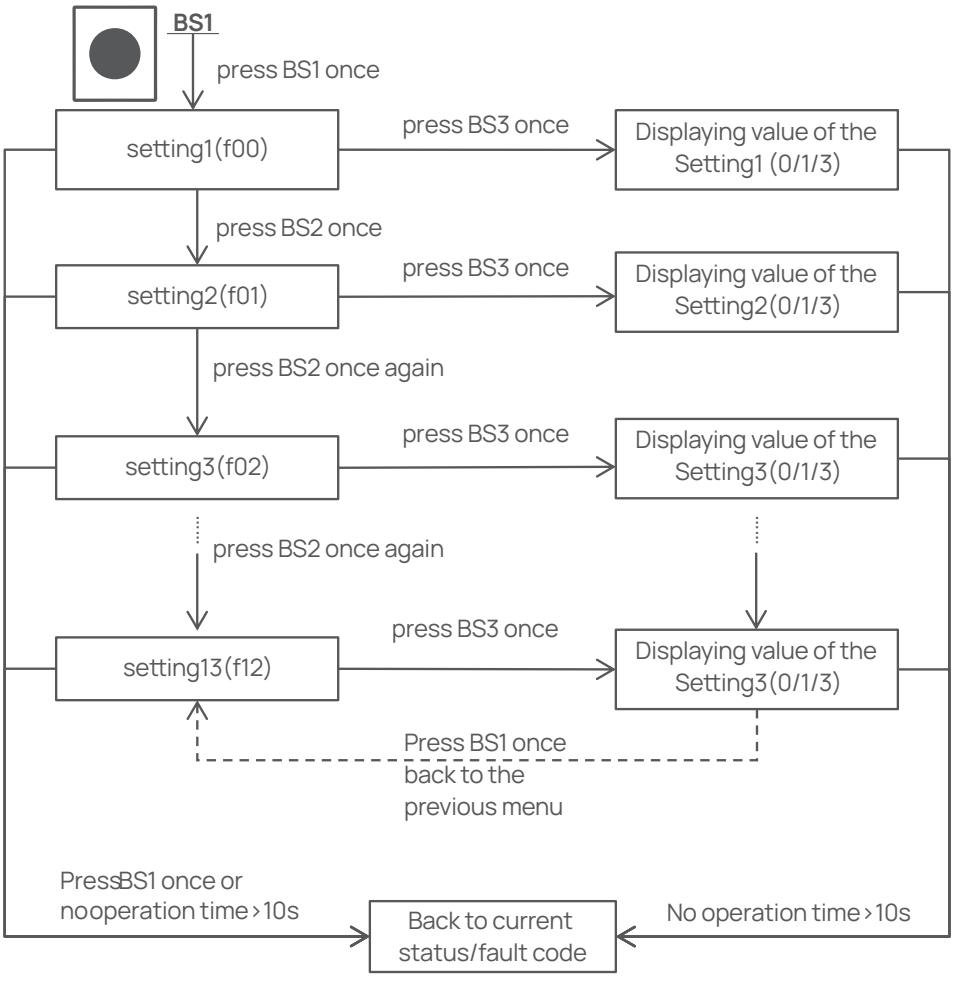
BS1: Enter Menu and back button

BS2: Selection

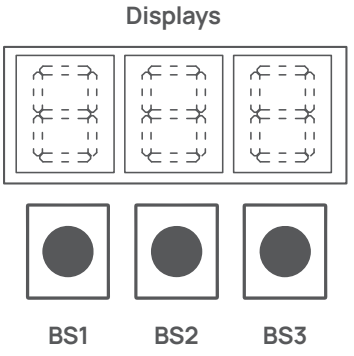
BS3: Spot check and confirm button

"Query software settings" Operating instructions:

Query software settings



14. Fumctional Button Operations



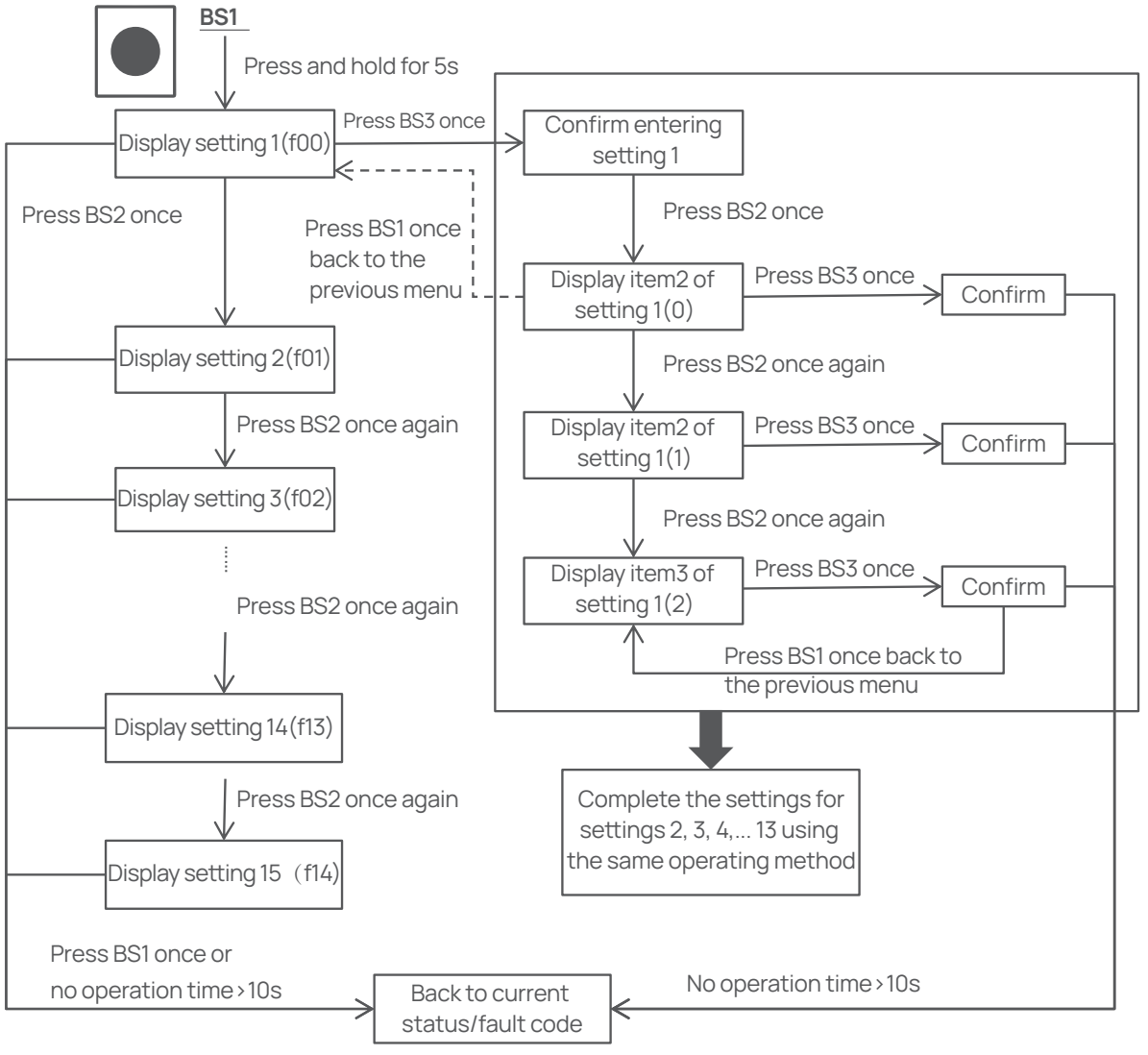
BS1: Enter Menu and back button

BS2: Selection

BS3: Spot check and confirm button

"Software settings" Operating instructions:

Software settings

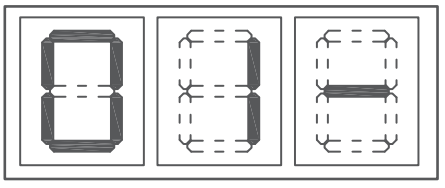


Spot check

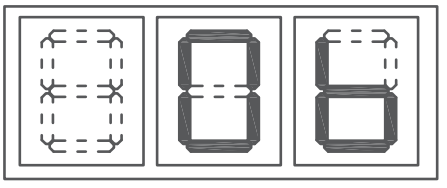
System states can be showed on the 7 segments dispaly.

Press BS3 with an interval of more than 1s but less than 10s to get the fault codes;
press BS2 with an interval of one second to view current hardware information and settings.
press BS2 with an interval of one second to view current software settings.

Example: Code number



Detailed information



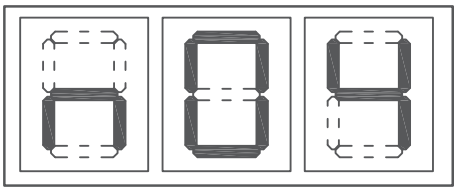
Query menu of hardware information and settings

NO.	Number content	Example	Description
Default	Current operating mode/ fault code	H1	H:heat, C:Cooling,Cr:circulate 1: 1st stage; 2: 2nd stage; U: variable, "———" : idle
01-	PCB version	06	06 version
02-	Main software version	55	55 version
03-	Inducer software version	03	03 version
04-	Return air temperature （T1 sensor）	68	68℉
05-	Setting temperature	75	75 ℉
06-	Evaporator temperature （T2 sensor）	41	41 ℉
07-	Blower CFM	170	1700cfm
08-	Inducer pressure （Air-P sensor）	250	250pa
09-	Gas valve output	70	70%
10-	Control mode	0	0 : variable ; 1 : two-stage
11-	Cabinet size	0	0 :Large ; 1 : small

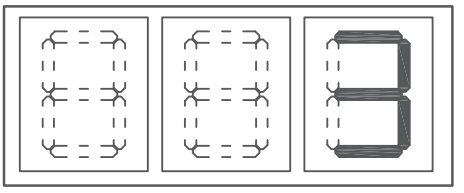
Setting model

Press and hold BS1 for 5 seconds to enter the setting mode.
The latest setting will be taken as the final one.

Example: Symbol



Item



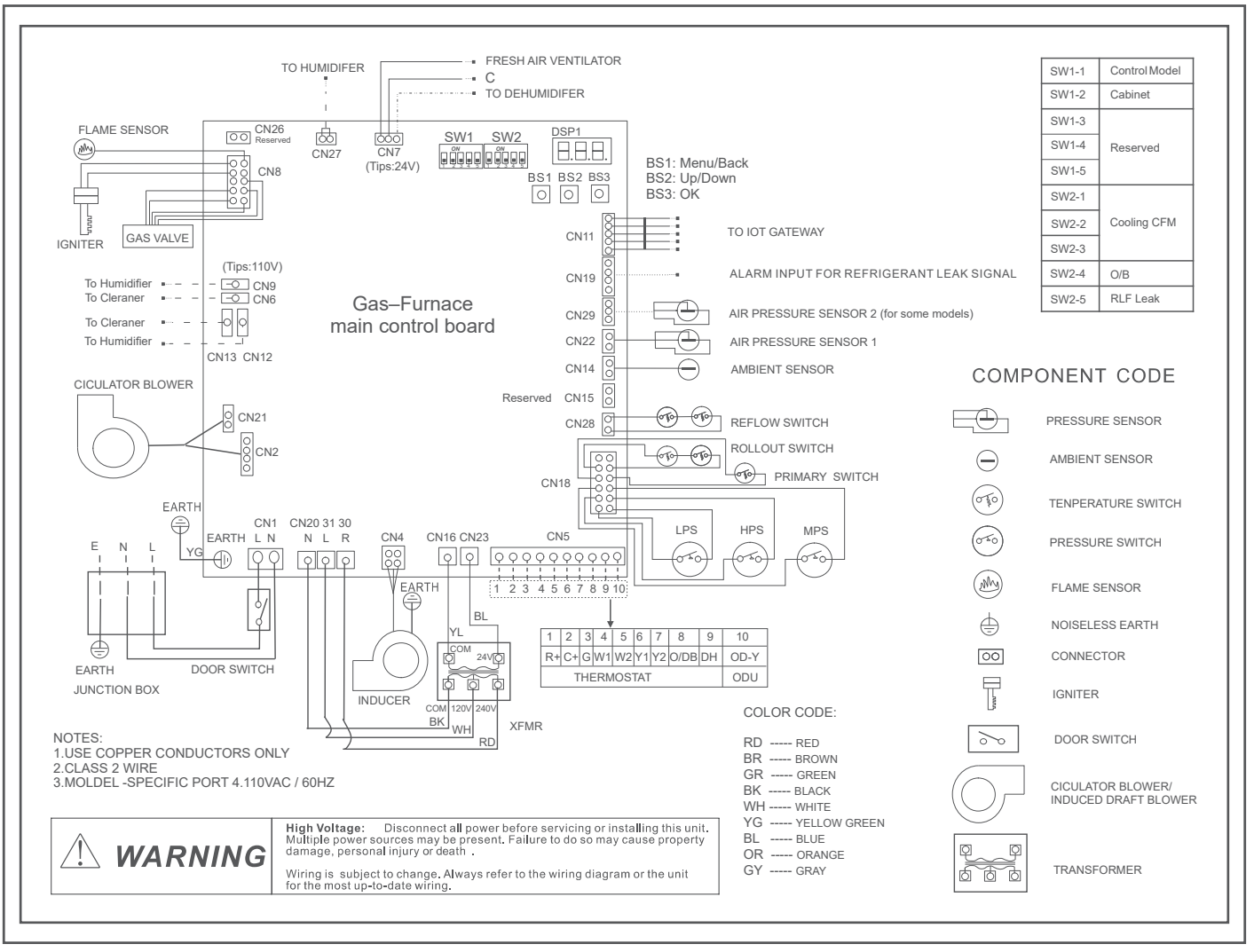
Setting menu of software

Symbol	Faction	Item	Description
f00	Blower speed Mode setting	0(factory)	Standard
		1	Low speed
		2	High speed
f01	Capacity Mode setting	0(factory)	Standard
		1	Low capacity
		2	High capacity
f02	“heat-on delay” setting	0(factory)	15s
		1	30s
		2	45s
f03	“heat-off delay” setting	0(factory)	90s
		1	120s
		2	150s
		3	180s
		4	60s
f04	“cool-on delay” setting	0(factory)	0s
		1	30s
		2	45s
		3	60s
f05	“cool-off delay” setting	0(factory)	90s
		1	120s
		2	150s
		3	180s
		4	60s

continued

Symbol	Faction	Item	Description
f06	“Pre-purge” setting	0(factory)	15s
		1	30s
		2	45s
f07	“Post-purge” setting	0(factory)	15s
		1	30s
		2	45s
f08	“Inter-purge” setting	0(factory)	15s
		1	30s
		2	45s
		3	60s
f09	“Igniter Warm-up Time” setting	0(factory)	17s
		1	12s
		2	22s
f10	Silent Mode setting	0(factory)	None silent mode
		1	Silent mode
		2	Night silent mode
f11	Night silent mode-start time setting	0(factory)	18:00
		1	19:00
		2	20:00
		3	21:00
f12	Night silent mode-end time setting	0(factory)	6:00
		1	7:00
		2	8:00
		3	9:00
f13	Altitude setting	0(factory)	2000(0-2000)ft
		1	3000(2001-3000)ft
		2	4000(3001-4000)ft
		3	5000(4001-5000)ft
		4	6000(5001-6000)ft
		5	7000(6001-7000)ft
		6	8000(7001-8000)ft
		7	9000(8001-9000)ft
		8	10000(9001-10000)ft
		9	11000(10001-11000)ft
f14	Gas type setting	0(factory)	Natural Gas
		1	Propane Gas

15. WIRING DIAGRAMS



SW1-1	Control Model
SW1-2	Cabinet
SW1-3	Reserved
SW1-4	
SW1-5	
SW2-1	Cooling CFM
SW2-2	
SW2-3	
SW2-4	O/B
SW2-5	RLF Leak

COMPONENT CODE

- PRESSURE SENSOR
- AMBIENT SENSOR
- TENPERATURE SWITCH
- PRESSURE SWITCH
- FLAME SENSOR
- NOISELESS EARTH
- CONNECTOR
- IGNITER
- DOOR SWITCH
- CICULATOR BLOWER/ INDUCED DRAFT BLOWER
- TRANSFORMER

COLOR CODE:

RD ----- RED
BR ----- BROWN
GR ----- GREEN
BK ----- BLACK
WH ----- WHITE
YG ----- YELLOW GREEN
BL ----- BLUE
OR ----- ORANGE
GY ----- GRAY

NOTES:
1.USE COPPER CONDUCTORS ONLY
2.CLASS 2 WIRE
3.MOLDEL -SPECIFIC PORT 4.110VAC / 60HZ

WARNING

High Voltage: Disconnect all power before servicing or installing this unit. Multiple power sources may be present. Failure to do so may cause property damage, personal injury or death .

Wiring is subject to change. Always refer to the wiring diagram or the unit for the most up-to-date wiring.

16. Fault Code

Code	Error	Code	Error
E1	Internal error	F1	Pressure sensor fault
E2	Normally closed error of pressure switch	F2	Refrigerant leakage fault
P6	LPS error	F3	T1 sensor fault
P7	MPS error	F4	T1 restricted operation
P8	HPS error	E5	Blower failure fault
E6	LPS locked	P3	Voltage protection
E7	MPS locked	PC	Reflow Temp. limit switch protection
E8	HPS locked	EC	Reflow Temp. limit switch locked
E9	The INDUCER fault	E3	Power polarity error/Ground wire error
EA	Ignition failure	E4	Fuse error
EB	Flame loss error	P1	Signal error
PD	Primary Temp. limit switch protection	P2	Signal error
ED	Primary Temp. limit switch locked	F5	INDUCER Comm Failure
EE	Rollout Temp. limit switch protection	F6	GasValve Comm Failure
		F7	P2 Limit operation

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