Installation Guide and Owner's Manual

MODELS:

C15-M-V & C15-M-S
C30-M-V & C30-M-S
C45-M-V & C45-M-S
C60-M-V
C75-M-V
C90-M-V
C105-M-V
C120-M-V

Chinook

High efficiency

modulating and multiposition

CONDENSING GAS FURNACE

IMPORTANT: The furnace must be installed with the Modulating Touch-Screen Thermostat R02P030 (#1F95M). If the furnace is to be installed with the modulating cooling option, use the Communicating Thermostat R02P029 (#1F991292).

ATTENTION: Do not tamper with the unit or its controls. Call a qualified service technician.

INSTALLER / SERVICE TECHNICIAN: Use the information in this manual for the installation / servicing of the furnace and keep the document near the unit for future reference.

Gas furnaces manufactured on or after May 1, 2017 are not permitted to be used in Canada for heating of buildings or structures under construction.

These instructions must be read and understood completely before attempting installation.

HOMEOWNER: PLEASE Keep this manual near the furnace for future reference.

Manufactured by:
Industries Dettson Inc.
Sherbrooke (Québec) Canada
www.dettson.ca

2016-09-19 X40225 Rev.O

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Required notice for Massachusetts installations
Important

The Commonwealth of Massachusetts requires compliance with regulation 248 CMR as follows:

5.08: Modifications to NFPA-54, Chapter 10. Revise 10.8.3 by adding the following additional requirements:

For all side wall horizontally vented gas fueled equipment installed in every dwelling, building or structure used in whole or in part for residential purposes, including those owned or operated by the commonwealth and where the side wall exhaust vent termination is less than seven (7) feet above finished grade in the area of the venting, including but not limited to decks and porches, the following requirements shall be satisfied:

Installation of Carbon Monoxide Detectors
At the time of installation of the side wall horizontal vented gas fueled equipment, the installing plumber or gas fitter shall observe that a hard wired carbon monoxide detector with an alarm and battery backup is installed on the floor level where the gas equipment is to be installed. In addition, the installing plumber or gas fitter shall observe that a battery operated or hard wired carbon monoxide detector with an alarm is installed on each additional level of the dwelling, building or structure served by the side wall horizontal vented gas fueled equipment. It shall be the responsibility of the property owner to secure the services of qualified license professionals for the installation of hard wired carbon monoxide detectors.

In the event that the side wall horizontally vented gas fueled equipment is installed in a crawl space or an attic, the hard wired carbon monoxide detector with alarm and battery backup may be installed on the next adjacent floor level.

In the event that the requirements of this subdivision cannot be met at the time of completion of installation, the owner shall have a period of thirty (30) days to comply with the above requirement; provided, however, that during said thirty (30) day period, a battery operated carbon monoxide detector with an alarm shall be installed.

APPROVED CARBON MONOXIDE DETECTORS: Each carbon monoxide detector as required in accordance with the above provision shall comply with NFPA 720 and be ANSI/UL 2034 listed and IAS certified.

SIGNAGE: A metal or plastic identification plate shall be permanently mounted to the exterior of the building at a minimum height of eight (8) feet above grade directly in line with the exhaust vent terminal for the horizontally vented gas fueled heating appliance or equipment. The sign shall read, in print size no less than in-half (1/2) inch in size, “gas vent directly below. Keep clear of all obstruction”.

INSPECTION: the state of local gas inspector of the side wall horizontally vented gas fueled equipment shall not approve the installation unless, upon inspection, the inspector observes carbon monoxide detectors and signage installed in accordance with the provisions of 248 CMR 5.08 (2) (a) 1 through 4:

EXEMPTION: the following equipment is exempt from 248 CMR 5.08(2) (a) 1 through 4:

The equipment listed in Chapter 10 entitled “equipment not required to be vented “in the most current edition of NFPA 54 as adopted by the board; and

Product approved side wall horizontally vented gas fueled equipment installed in a room or structure separate from the dwelling, building or structure in whole or in part for residential purposes.

MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM PROVIDED
When the manufacturer of product approved side wall horizontally vented gas equipment provides a venting system design or venting system component with the equipment, the instructions provided by the manufacturer for installation of the equipment and the venting system shall include:

Detailed instructions for the installation of the venting system design or the venting system components; and a complete parts list for the venting system design or venting system.

MANUFACTURER REQUIREMENTS – GAS EQUIPMENT VENTING SYSTEM PROVIDED
When the manufacturer of product approved side wall horizontally vented gas fueled equipment does not provide the parts or venting the flue gases, but identifies “special venting system”, the following requirements shall be satisfied by the manufacturer:

The referenced “special venting system” shall be product approved by the board, and the instruction for that system shall include a parts list and detailed installation instructions.

A copy of all installation instructions for all product, approved side wall horizontally vented gas fueled equipment, all venting instructions, all part s lists for venting instructions, and/or all venting design instructions shall remain with the appliance or equipment at the completion of the installation.

For questions regarding these requirements, please contact the Commonwealth of Massachusetts board of State Examiners of Plumbers and Gas Fitters, 239 Causeway Street, Boston, MA, 02114, tel.: 617 727-9952.

1- SAFETY REGULATION

1.1- Safety labeling and warning signs

The words DANGER and WARNING are used to identify the levels of seriousness of certain hazards. It is important that you understand their meaning. You will notice these words in the manual as follows:

DANGER

Immediate hazards that **WILL** result in death, serious bodily injury and/or property damage

WARNING

Hazards or unsafe practices that **CAN** result in death, bodily injury and/or property damage.

NOTE: is used to highlight suggestions which will result in enhanced installation, reliability or operation.

1.2- Important information

DANGER

Non-observance of the safety regulations outlined in this manual will potentially lead to consequences resulting in death, serious bodily injury and/or property damage.

⇒ It is the homeowner's responsibility to engage a qualified technician for the installation and subsequent servicing of this furnace;

⇒ Before calling for service, be sure to have the information page of your manual (last page of your manual) close by in order to be able to provide the contractor with the required information, such as the model and serial numbers of the furnace.

WARNING

Installations and repairs performed by unqualified persons can result in hazards to them and to others. Installations must conform to local codes or, in the absence of same, to codes of the country having jurisdiction.

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

1.3- Detection systems

It is recommended that carbon monoxide detectors be installed wherever oil or gas fired heaters are used. Carbon monoxide can cause bodily harm or death. For this reason, approved carbon monoxide detectors shall be installed in your residence and properly maintained to warn of dangerously high carbon monoxide levels.

Fire can cause bodily harm or death. For this reason, approved smoke detectors should be installed in your residence and be properly maintained, to warn early on, of a potentially dangerous fire. Also, the house should be equipped with approved and properly maintained fire extinguishers.

Your unit is equipped with safety devices that can prevent it from functioning when anomalies are detected such as a blocked venting system.

WARNING

CARBON MONOXIDE POISONING/COMPONENT DAMAGE 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 furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are met, in addition to all local codes and ordinances.

WARNING

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

Failure to follow this warning could result in dangerous operation, personal injury, death, or property damage. Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause 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.

WARNING

FIRE, EXPLOSION, AND CARBON MONOXIDE POISONING HAZARD

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

Never operate a furnace without a filter or filtration device installed. Never operate a furnace with filter or filtration device access doors removed.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in literature, on tags, and on labels attached to or shipped with furnace and other safety precautions that may apply.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.

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.

CAUTION

INJURY HAZARD

Ignoring this warning could 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

1. Use only with type of gas approved for this furnace. Refer to the furnace rating plate.
2. Install this furnace only in a location and position as specified in section 2.3-Location.
3. Provide adequate combustion and ventilation air to the furnace as specified in section 8-Venting and combustion air piping
4. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only as specified in section 8.4.2-Exhaust vent piping.
5. 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 section 6-Gas piping.
6. 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 section 5-Duct installation. See furnace rating label.
7. 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 section 5.3-Return air connections.
8. A gas fired furnace for installation in a residential garage must be installed as specified in the WARNING box below:

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 ignitions sources must be located at least 18 in. (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 NFPA 54/ANSI Z223.1-2009 or CAN/CSA B149.2-2010.

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 duct to the back of the furnace.

9. The furnace is factory shipped for use with natural gas. A CSA (A.G.A. and C.G.A.) listed accessory gas conversion kit is required to convert furnace for use with propane gas.
10. See Table 1 Minimum clearance to combustible material for all units for required clearances to combustible construction.
11. Maintain a 1" (25 mm) clearance from combustible materials to supply air ductwork for a distance of 36" (914 mm) horizontally from the furnace. See NFPA 90B or local code for further requirements.
12. These furnaces SHALL NOT be installed directly on carpeting, tile, or any other combustible material other than wood flooring.
13. Gas furnace manufactured on or after May 1, 2017 are not permitted to be used in Canada for heating of buildings or structures under construction.

CAUTION

FROZEN AND BURST WATER PIPE HAZARD

Failure to protect against the risk of freezing may result in property damage. Special precautions MUST be made if installing furnace in an area which may drop below freezing. This can cause improper operation or damage to equipment. If furnace environment has the potential of freezing, the drain trap and drain line must be protected

CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in burst water pipes and/or property damage. If a condensate pump is installed, a clogged condensate drain or a failed pump may cause the furnace to shut down. Do not leave the home unattended during freezing weather without turning off water supply and draining water pipes or otherwise protecting against the risk of frozen pipes.

Ensure all condensate drain connections are secured and liquid tight. Use the furnished tube clamps and verify tightness

CAUTION

FURNACE CORROSION HAZARD

Failure to follow this caution may result in furnace damage. Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodine. These elements can corrode heat exchangers and shorten furnace life. Air contaminants are found in aerosol spray, 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.

WARNING

CARBON MONOXIDE POISONING HAZARD

Failure to follow the steps outlined below for each appliance connected to the venting system being placed into operation could result in carbon monoxide poisoning or death. The following steps shall be followed for each appliance connected to the venting system being placed into operation, while all other appliances connected to the venting system are not in operation:

1. Seal any unused openings in venting system;
2. Inspect the venting system for proper size and horizontal pitch, as required in the National Fuel Gas Code, NFPA 54/ANSI Z223.1-2009 and these instructions. In Canada, refer to CAN/CSA-B149.1-2010. Determine that there is no blockage or restriction, leakage, corrosion and other deficiencies, which could cause an unsafe condition
3. As far as practical, close all building doors and windows and all doors between the space in which the appliance(s) connected to the venting system are located and other spaces of the building.
4. Close fireplace dampers.
5. Turn on clothes dryers and any appliance not connected to the venting system. Turn on any exhaust fans, such as range hoods and bathroom exhausts, so they are operating at maximum speed. Do not operate a summer exhaust fan.
6. Follow the lighting instructions. Place the appliance being inspected into operation. Adjust the thermostat so appliance is operating continuously.
7. Test for spillage from draft hood equipped appliances at the draft hood relief opening after 5 minutes of main burner operation. Use the flame of a match or candle.
8. If improper venting is observed during any of the above tests, the venting system must be corrected in accordance with the National Fuel Gas Code, NFPA 54/ANSI Z223.1-2009. In Canada, refer to CAN/ CSA-B149.1-2010.
9. After it has been determined that each appliance connected to the venting system properly vents when tested as outlined above, return doors, windows, exhaust fans, fireplace dampers and any other gas-fired burning appliance to their previous conditions of use.

Failure to follow the instructions outlined in Locating the Vent Termination for each appliance being placed into operation could result in carbon monoxide poisoning or death. For all venting configurations for this appliance and other gas appliances placed into operation for the structure, provisions for adequate combustion, ventilation, and dilution air must be provided in accordance with:

U.S.A. Installations: Section 9.3 NFPA 54/ANSI Z223.1 1−2009, Air for Combustion and Ventilation and applicable provisions of the local building codes.

Canadian Installations: Part 8 of CAN/CSA−B149.1−10. Venting Systems and Air Supply for Appliances and all authorities having jurisdiction.

2- INTRODUCTION

This 4-way multi-positioning and modulating Category IV condensing furnace is CSA design certified as a direct vent (2 pipes) or non-direct vent (1 pipe). 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 furnace rating plate for conversion kit information.

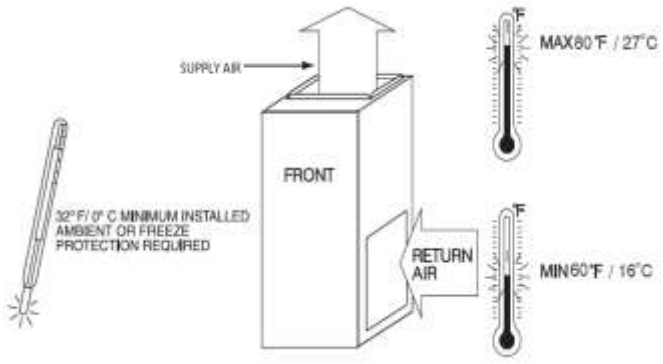
This Category IV furnace is approved for installation in Manufactured/Mobile housing. The furnace must be installed in accordance with the instruction provided in this manual. A manufactured home installation must conform with the *Manufactured Home Construction and Safety Standard, Title 24 CFR, Part 3280,* or when this Standard is not applicable, *The Standard for Manufactured Home Installations (Manufactured Home Sites, Communities and Set-Ups), ANSI/NCS A225.1, and/or MH Series Mobile Homes, CAN/CSA-Z240.* **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.

This furnace is designed for minimum continuous return air temperature of 60 °F (16 °C) or intermittent operation down to 55 °F (13 °C) such as when used with a night setback thermostat. Return air temperature must not exceed 80 °F (27 °C). Failure to follow these return air temperature limits may affect reliability of heat exchangers, motors, and controls (Figure 1 Freeze protection and return air temp.).

The furnace should be sized to provide 100 % of the design heating load requirement plus any margin that occurs because of furnace model size capacity increments. Heating load estimates can be made using approved methods available from Air Conditioning Contractors of America (Manual J); American Society of Heating, Refrigerating, and Air Conditioning Engineers; or other approved engineering methods. Excessive over sizing of the furnace could cause the furnace and/or vent to fail prematurely.

2.1- Codes and standards

Figure 1 Freeze protection and return air temp.



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:

2.1.1- Safety

USA: National Fuel Gas Code (NFGC) NFPA 54-2009/ANSI Z223.1-2009 and the Installation Standards, Warm Air Heating and Air Conditioning Systems ANSI/NFPA 90B

CANADA: National Standard of Canada, Natural Gas and Propane Installation Code (NSCNGPIC) CAN/CSA B149.1-2010

2.1.2- General installation

USA: 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, N.W.,Washington DC 20001

CANADA: NSCNGPIC. For a copy, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke (Toronto), Ontario, M9W 1R3, Canada

2.1.3- Combustion and air ventilation

USA: Section 9.3 of the NFPA54/ANSI Z223.1-2009 Air for Combustion and Ventilation

CANADA: Part 8 of the CAN/CSA B149.1-2010, Venting Systems and Air Supply for Appliances

2.1.4- Duct systems

USA 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).

2.1.5- Acoustical lining and fibrous glass duct

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

2.1.6- Gas piping and pipe pressure testing

USA: NFPA 54/ANSI Z223.1-2009 NFGC; Chapters 5, 6, 7, and 8 and national plumbing codes.

CANADA: CAN/CSA-B149.1-2010, Part 6

IN THE STATE OF MASSACHUSETTS:

- ⇒ This product must be installed by a licensed plumber or gas fitter.
- ⇒ When flexible connectors are used, the maximum length shall not exceed 36 in. (914 mm).
- ⇒ When lever type gas shutoffs are used they shall be "T" handle type.
- ⇒ The use of copper tubing for gas piping is not approved by the state of Massachusetts.

2.1.7- Electrical connections

USA: National Electrical Code (NEC) ANSI/NFPA 70-2011

CANADA: Canadian Electrical Code

2.2- Electrostatic discharge

CAUTION

FURNACE RELIABILITY HAZARD

Failure to follow this caution may result in unit component damage. Electrostatic discharge can affect electronic components. Take precautions 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.

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.
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.
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) 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.
5) Use this procedure for installed and uninstalled (ungrounded) furnaces.
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.
7) An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

2.3- Location

2.3.1- General

These furnaces are shipped with materials to assist in proper furnace installation. These materials are shipped in the main blower compartment. See Table 2 Furnished parts list. This furnace must:

- ⇒ Be installed so the electrical components are protected from water;
- ⇒ Not be installed directly on any combustible material other than wood flooring;
- ⇒ Be located close to the chimney or vent and attached to an air distribution system. Refer to section 5-Duct installation;
- ⇒ Be provided ample space for servicing and cleaning. Always comply with minimum fire protection clearances shown in Table 1 Minimum clearance to combustible material for all units or on the furnace rating label.
- ⇒ Install de furnace with a correct slope if installed in other position than upflow. If installed upflow, make sure the furnace is leveled to ensure proper drainage of condensate.

Table 1 Minimum clearance to combustible material for all units*

Position	Clearance in (mm)
Rear	0
Front	0
Required for service	*24" (610)
All sides of supply plenum	*1"(25)
Sides	0
Vent	0
Top of furnace	1"

*See local building codes.

Table 2 Furnished parts list

Quantity	Description
1	Plastic cap 5/8"
6	Plastic cap 1/2"
10	Screw TEKS HEX WSH #8-18 x ½
1	2" PVC pipe (Length = 1.5" OR 6.75")
1	Drain trap
1	Drain trap gasket
2	Gasket wall pipe flange
2	Wall pipe flange
1	Clear PVC tube 5/8" ID x 24"
1	Clear PVC tube 1/2" ID x 24"
1	Square PVC tube 3/16'' ID x 8"
1	Brown wire (Only used in Downflow and horizontal configuration)

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

⇒ Commercial buildings
⇒ Buildings with indoor pools
⇒ Laundry rooms
⇒ Hobby or craft rooms, and
⇒ Chemical storage areas

If air is exposed to the following substances, it should not be used for combustion air. Outdoor air may be required for combustion:

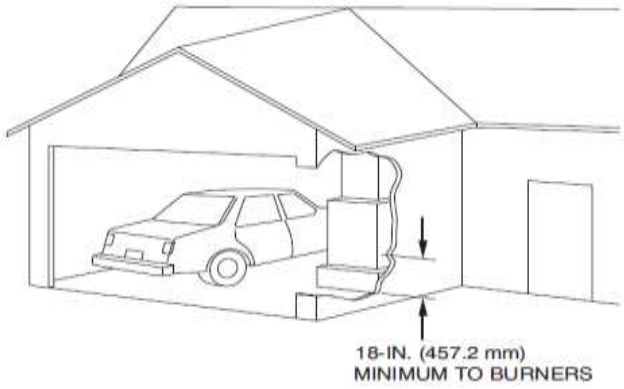
⇒ Permanent wave solutions
⇒ Chlorinated waxes and cleaners
⇒ Chlorine based swimming pool chemicals
⇒ Water softening chemicals
⇒ De-icing salts or chemicals
⇒ Carbon tetrachloride Halogen type refrigerants
⇒ Cleaning solvents (such as perchloroethylene)
⇒ Printing inks, paint removers, varnishes, etc.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

All fuel burning equipment must be supplied with air for fuel combustion. Sufficient air must be provided to avoid negative pressure in the equipment room or space. A positive seal must be made between the furnace cabinet and the return air duct to prevent pulling air from the burner area.

Place the unit so that proper venting can be achieved, with a minimum number of elbows, in accordance with the instructions in this manual. The furnace should be located as close to the chimney (vertical venting) or to the outside vent wall (horizontal venting) as possible.

When installing the furnace, provisions must be made to ensure the supply of adequate combustion and ventilation air in accordance with the “air for combustion and ventilation” section of the National Fuel Gas Code, NFPA 5/ANSI Z223.1-2002, or latest edition, or applicable provisions of the local building code.

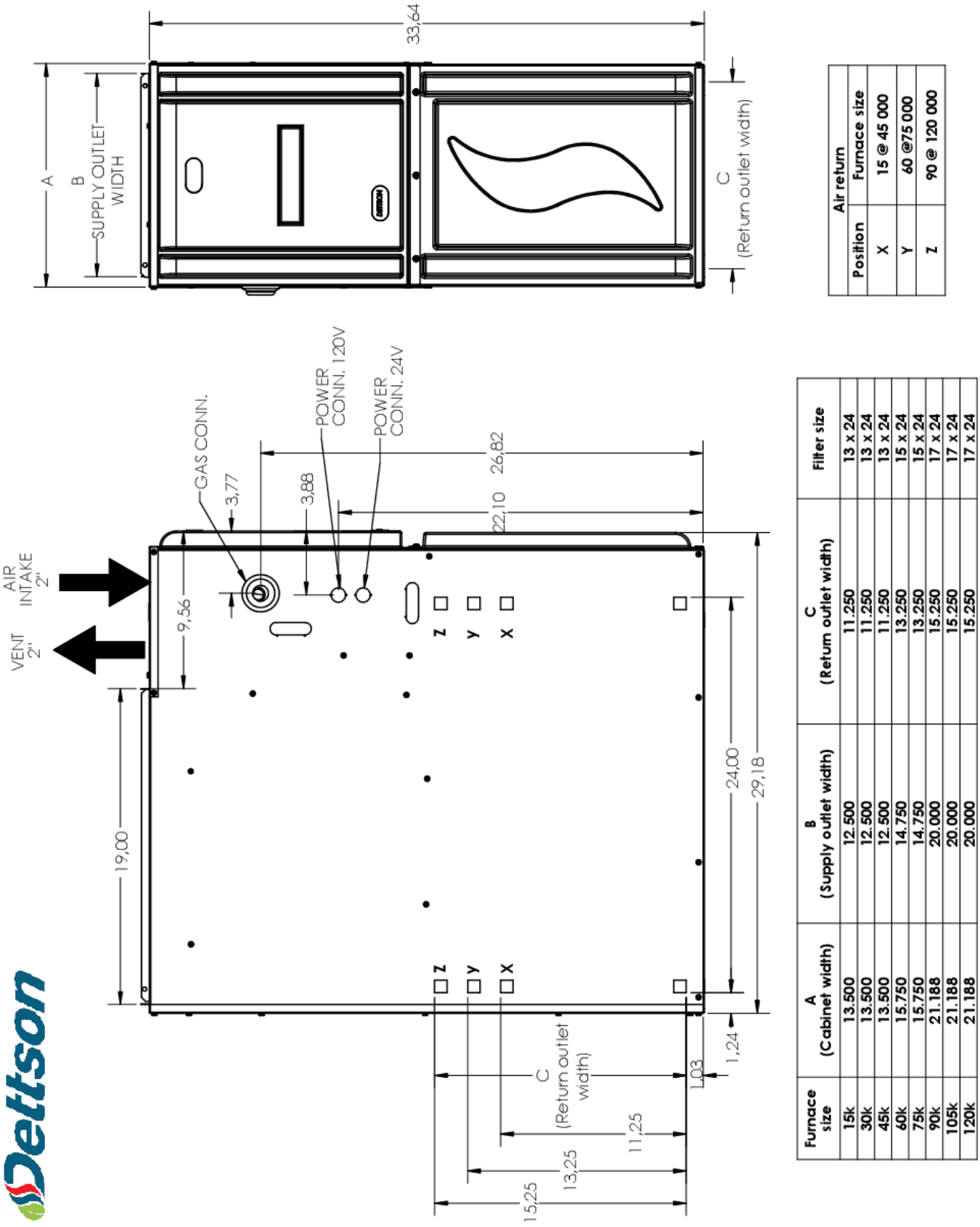
Figure 2: Installation in a garage



2.3.2- Location relative to cooling equipment

The cooling coil can either be installed in the supply air duct or in the return air duct. If the cooling coil is installed in the supply air duct, it must be at a minimum of 6” over the furnace heat exchanger.

Figure 3 Dimensional drawing



Air return	
Position	Furnace size
X	15 @ 45 000
Y	60 @75 000
Z	90 @ 120 000

Furnace size	A (Cabinet width)	B (Supply outlet width)	C (Return outlet width)	Filter size
15k	13.500	12.500	11.250	13 x 24
30k	13.500	12.500	11.250	13 x 24
45k	13.500	12.500	11.250	13 x 24
60k	15.750	14.750	13.250	15 x 24
75k	15.750	14.750	13.250	15 x 24
90k	21.188	20.000	15.250	17 x 24
105k	21.188	20.000	15.250	17 x 24
120k	21.188	20.000	15.250	17 x 24

3- ALIZÉ COOLING UNIT

To optimize your HVAC experience, Dettson offers a cooling system called the Alizé.

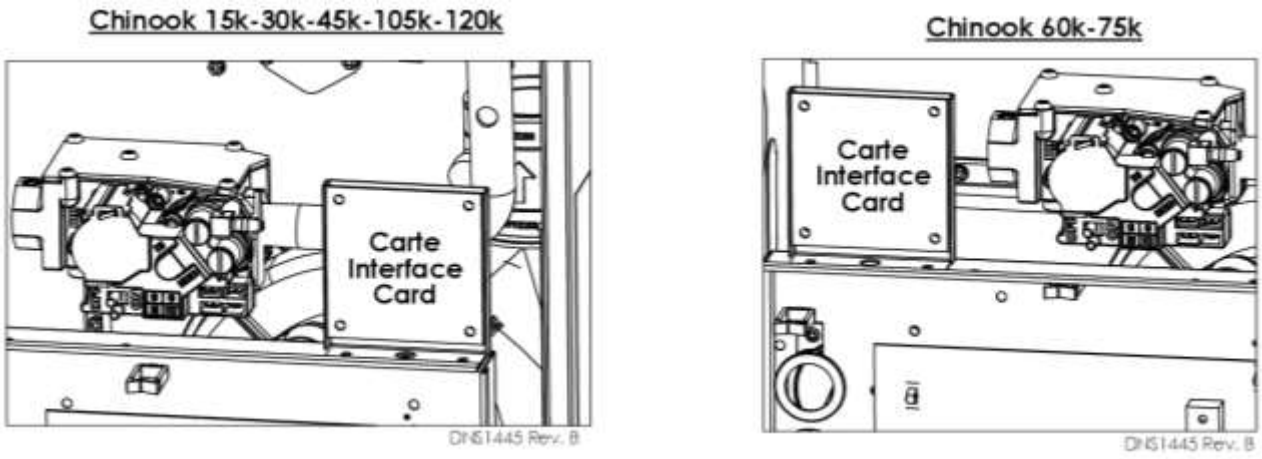
3.1- Thermostat using Alizé system

When using the Alizé cooling unit, the communicating thermostat must be used (R02P029). The interface card (K03069) will be able to gather information from the outdoor unit, the furnace and the thermostat, making this integrated system easy to install. The indoor blower speed will be determined by various factors including outdoor temperature, compressor speed and demand from the thermostat. The balance point (temperature at which the unit will switch from heat pump heating to auxiliary heat, in this case gas) will be adjustable through the thermostat. If this unit is destined to be used as a cooling system only, the heat pump can also be disable from the communicating thermostat, by using emergency heat. For more details refer to the manual provided with the thermostat.

3.2- Position of the interface board

Provision has been made on the main control board support in the furnace to locate the interface board (K03069). Refer to Figure 4 Interface card position.

Figure 4 Interface card position



3.3- Wires connections with interface board

Figure 5 Interface board wires connection

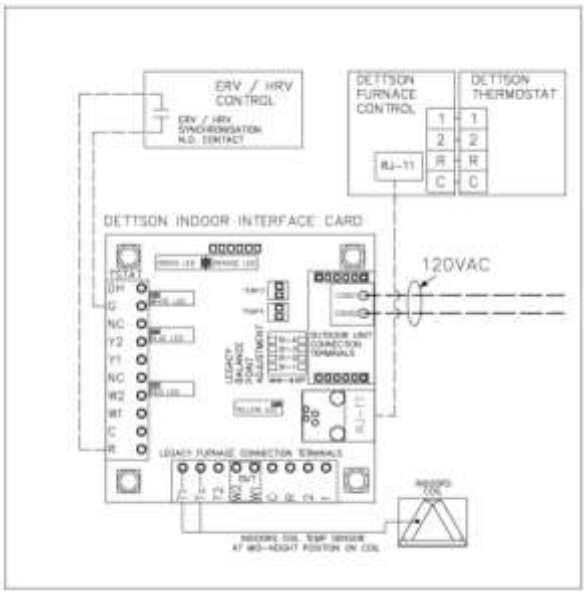


Figure 5 Interface board wires connection, explains how to properly wire the interface board to the ERV/HRV and main furnace control. For the complete wire connection, please refer to the Alizé manual. The interface board allows the ERV/HRV to be interlocked with the furnace, giving a smooth and quiet operation of the whole system.

4- INSTALLATION

The furnace is factory built for upflow position. In this position, the drain trap can be installed on right or left side depending on air return duct. When installing the furnace in the upflow position, make sure it is leveled.

To ensure proper drainage of the condensate when installed in position other than upflow, tilt the furnace from level position to a minimum slope of ½" higher at back to front.

When installing the furnace in other orientation than the upflow position, simply configure the condensate tubing accordingly with the instructions provided in this section of the manual.

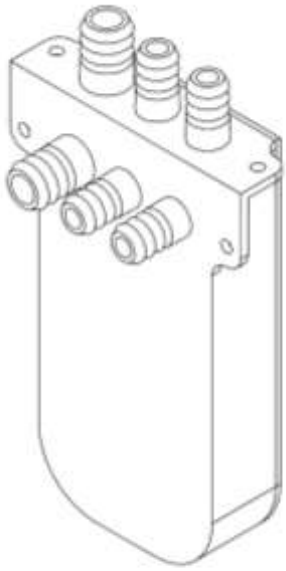
CAUTION

PROPERTY DAMAGE HAZARD

Failure to follow this caution may result in water spillage and/or property damage.

For any position other than upflow, the multiposition pressure switch must be connected pneumatically to the condensate box and electrically to the control to allow the furnace to stop in the event of drain blockage.

Figure 6 Drain trap



4.1- Upflow orientation

In the upflow orientation, the drain trap (Figure 6 Drain trap) can be installed to the right or to the left of the furnace. The condensate drain hoses must be routed from the trap through the furnace casing. Remove the knock out parts of metal and install the hoses to the drain trap. The condensate hoses can be routed through the left or right.

Figure 7 Left side condensate drain connection

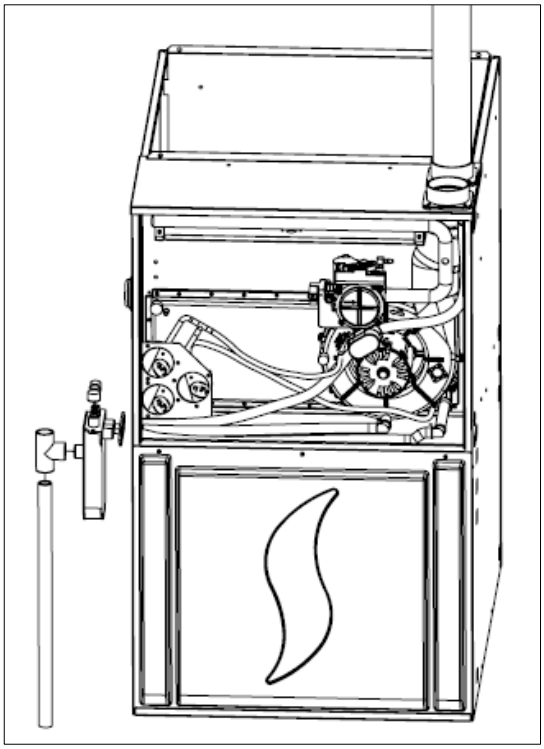
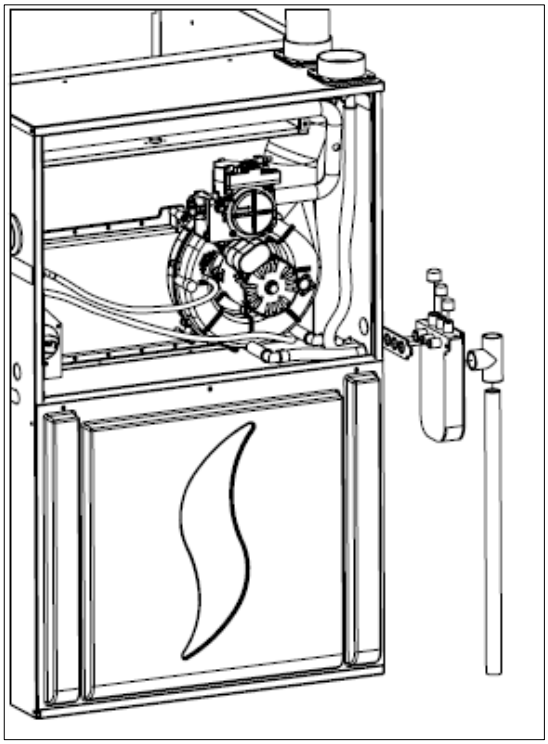


Figure 8 Right side condensate drain connection



4.1.1- Right side condensate drain trap connection

1. Remove the oblong knock-out from the right side of the casing.

2. Place the drain trap gasket on drain trap, in a way that the holes are aligned.
3. Install the drain trap on the right side, the three outlet stub of the drain trap toward the interior of the furnace. The three outward stubs ends are now inside the furnace.
4. Screw in place the drain trap with two head tapping screws on the right side of the furnace.
5. Connect the outlet drain from the drain trap to an additional condensate piping using a ½'' tee for an adequate drainage of the condensate. **DO NOT vent using the remaining 3 outlet stubs.** Such a drain shall be in compliance with local building codes or to a condensate pump approved for the use with acidic furnace condensate.
6. Prime the drain trap with water. This will ensure proper furnace drainage at startup and will avoid any recirculation of flue gas.
7. On the remaining 3 outlet stub, connect black vinyl cap (1x5/8'' and 2x1/2"). Those cap are furnished in the loose part bag.

4.1.2- Left side condensate drain trap connection

1. Remove the oblong knock-out from the left side of the casing.
2. Place the drain trap gasket on drain trap.
3. Install the drain trap on the side, the three outlet stubs of the drain trap toward the interior of the furnace. The three outward stubs are now inside the furnace.
4. Connect each of condensate tubes to a stubs. Use de furnished ½'' and 5/8'' hoses to cut the appropriate length to get to the drain trap. The condensate hose from the condensate box is 5/8'' and it must be connected to the 5/8'' stub of the drain trap. The condensate hoses from the ID blower and the vent flange are ½" and are connected to the ½" stubs of the drain trap.
5. Ensure the hoses are adequately connected to the stubs.
6. Screw in place the drain trap with two head tapping screws on the side of the furnace.
7. Connect the outlet drain from the drain trap to an additional condensate piping using a ½'' tee for an adequate drainage of the condensate. **DO NOT vent using the remaining three outlet stubs.** Such a drain shall be in compliance with local building codes or to a condensate pump approved for the use with acidic furnace condensate.
8. Prime the drain trap with water. This will ensure proper furnace drainage at startup and will avoid any recirculation of flue gas.
9. On the remaining 3 outlet stub, connect black vinyl cap (1x5/8'' and 2x1/2"). Those cap are furnished in the part bag.

4.2- Down flow orientation

To install the furnace in down flow position, the following steps are required for proper operation.

NOTE: It is STRONGLY RECOMMENDED to use the optional downflow base to ensure the 1'' clearance around the supply duct going through the floor and the proper slope of the furnace for condensate drainage. Also, the base allows sufficient spacing for the venting and the drain trap.

4.2.1- Down flow condensate drain trap connection

1. Remove all PVC tubes from the ID blower, condensate box and vent collector and block the stub openings with furnished 5/8'' & 1/2'' black caps.
2. Remove the knock-out from the bottom left side of the casing.
3. Place the drain trap gasket on drain trap.
4. Install the drain trap on the bottom left side, the three outlet stubs ends of the drain trap directed toward the interior of the furnace. The three outward stubs ends now penetrate inside the furnace.
5. Screw in place the drain trap with 2 Tek tapping screws to the side of the furnace.
6. Install two 1/2'' black plastic caps on the 1/2" stub of the drain trap. See Figure 9 Unused stub on drain trap.
7. Cut the required length of furnished 5/8'' clear PVC tube and connect one end on the port on the lower right side of the condensate box.(Figure 10 Condensate box)
8. Connect the other end to 5/8'' stub of the drain trap and secure the hose on the gas manifold with a tie wrap.
9. Connect the outlet from the drain trap to the condensate drain piping with a tee. **DO NOT vent using the remaining 3 outlet stubs.** Such a drain shall be in compliance with local building codes or to a condensate pump approved for the use with acidic furnace condensate.
10. The venting should be drained using a PVC 636 tee. Connect this tee to a P-trap and connect it to your condensate drain. Commercially available condensate trap exist for use with IPEX system 636.
11. Make sure the unused stub ends of the drain trap are plugged with furnished plastic caps.

Figure 9 Unused stub on drain trap

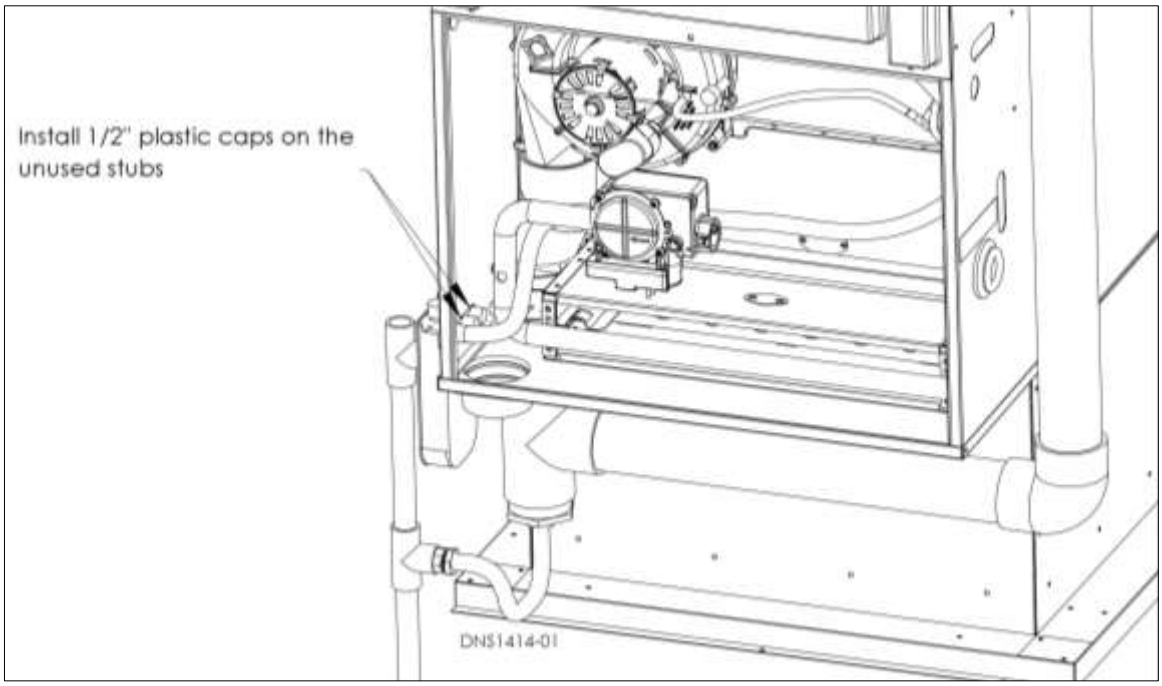


Figure 10 Condensate box

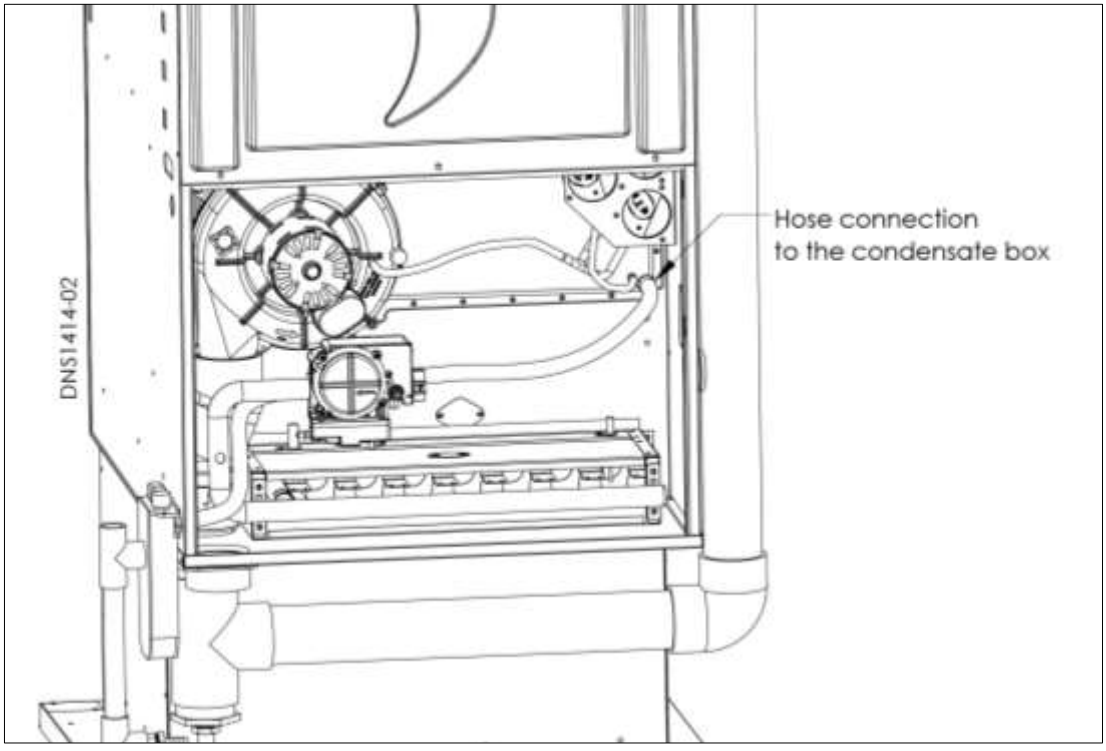
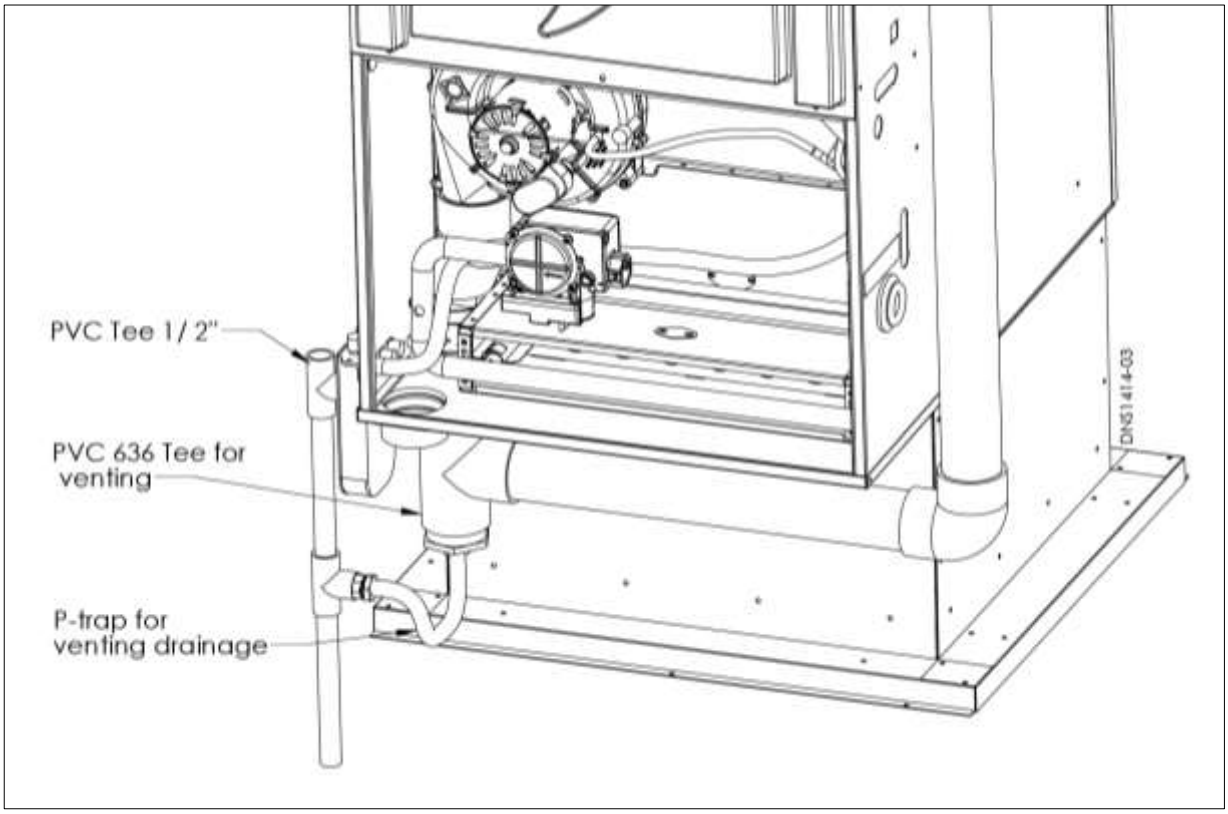


Figure 11 Down flow orientation



4.2.2- Downflow venting drainage

All furnaces with horizontal exhaust vent piping must have a PVC 636 drain tee assembly and trap installed in the exhaust pipe as close to the furnace as possible. See Figure 11 Down flow orientation. Commercially available condensate trap exist for use with IPEX system 636.

4.2.3- Multiposition pressure switch connection downflow

The 3/16 stub just beside the drain of the condensate box **must be drilled or cut open**. The black squared PVC tubing of the pressure switch (-0.2 in w.c.) must be connected to this stub. This tubing is furnished with the furnace. See Figure 12 Condensate pressure switch.

The pressure switch must now be electrically connected in series with the low fire pressure switch (top) with the brown jumper. See Figure 16 Pressure switch assembly and wiring diagrams.

4.3- Horizontal right orientation

4.3.1- Horizontal right condensate drain connection

1. Remove all PVC tubes from the ID blower, condensate box and vent collector and block the stub openings with furnished 5/8'' & 1/2'' black caps.
2. Remove the knock-outs from the bottom middle side of the casing.
3. Place the drain trap gasket on the drain trap.
4. Screw in place the drain trap with 2 Tek tapping screws to the side of the furnace.
5. Install two 1/2" black plastic caps on the unused stub openings on the drain trap inside the furnace. See Figure 13 Unused stub in the horizontal right position
6. Connect a piece of 5/8'' PVC tube to the bottom left of the condensate box and route with an elbow to the drain trap. See Figure 14 Horizontal Right Drain connection of the condensation box.
7. Connect the outlet from the drain trap to the condensate drain piping using a ½'' PVC tee. **DO NOT vent using the remaining 3 outlet stubs.** Such a drain shall be in compliance with local building codes or to a condensate pump approved for use with acidic furnace condensate.
8. Make sure the unused stubs ends of the drain trap are plugged with furnished plastic caps.

NOTE : The drain trap must be vertical.

4.3.2- Horizontal right vent drainage

All furnaces with horizontal exhaust vent piping must have a PVC 636 drain tee assembly and trap installed in the exhaust pipe as close to the furnace as possible. See Figure 15 Horizontal right drain trap position

4.3.3- Multiposition pressure switch connection horizontal

The 3/16 stub just beside the drain of the condensate box **must be drilled or cut open**. The tubing of the pressure switch (-0.2 nearest to the ID blower) must be connected to this stub.

The pressure switch must now be electrically connected in series with the low fire pressure switch (top) with the brown jumper. See Figure 16 Pressure switch assembly and wiring diagrams.

4.4- Horizontal left orientation

4.4.1- Horizontal left condensate drain connection

1. Remove the knock-outs from the bottom middle side of the casing.

2. Drill open the new bottom stub of the ID blower (if not already open). Be sure to remove all debris.
3. Reroute the ID blower drain tube from the bottom of the ID blower casing to one of the 1/2" stub. **Do not screw the drain trap to the furnace casing.**
4. Block the other open ID blower drain with a 1/2'' black cap.
5. Reroute the condensate box drain tube from the bottom of the condensate box through the casing.
6. Block the other opening of the condensate box with a 5/8'' black cap.
7. Reroute the vent collector drain tube to one of the 1/2" stubs.
8. Apply the neoprene gasket around the 5/8'' and 1/2" tubes at the point where they cross the furnace casing to seal the passage.
9. Plug the 5/8'' and 1/2" tubes to the drain trap. The drain trap must be vertical.
10. Connect the outlet from the drain trap to the condensate drain piping using a ½'' PVC tee. Such a drain shall be in compliance with local building codes or to a condensate pump approved for use with acidic furnace condensate.
11. Make sure the unused stub ends of the drain trap are plugged with furnished plastic caps.

4.4.2- Multiposition pressure switch connection horizontal

The 3/16" stub just beside the drain of the condensate box must be drilled or cut open. The tubing of the pressure switch (-0.2 nearest to the ID blower) must be connected to this stub.

The pressure switch must now be electrically connected in series with the low fire pressure switch (top) with the brown jumper. See Figure 16 Pressure switch assembly and wiring diagrams.

Figure 12 Condensate pressure switch

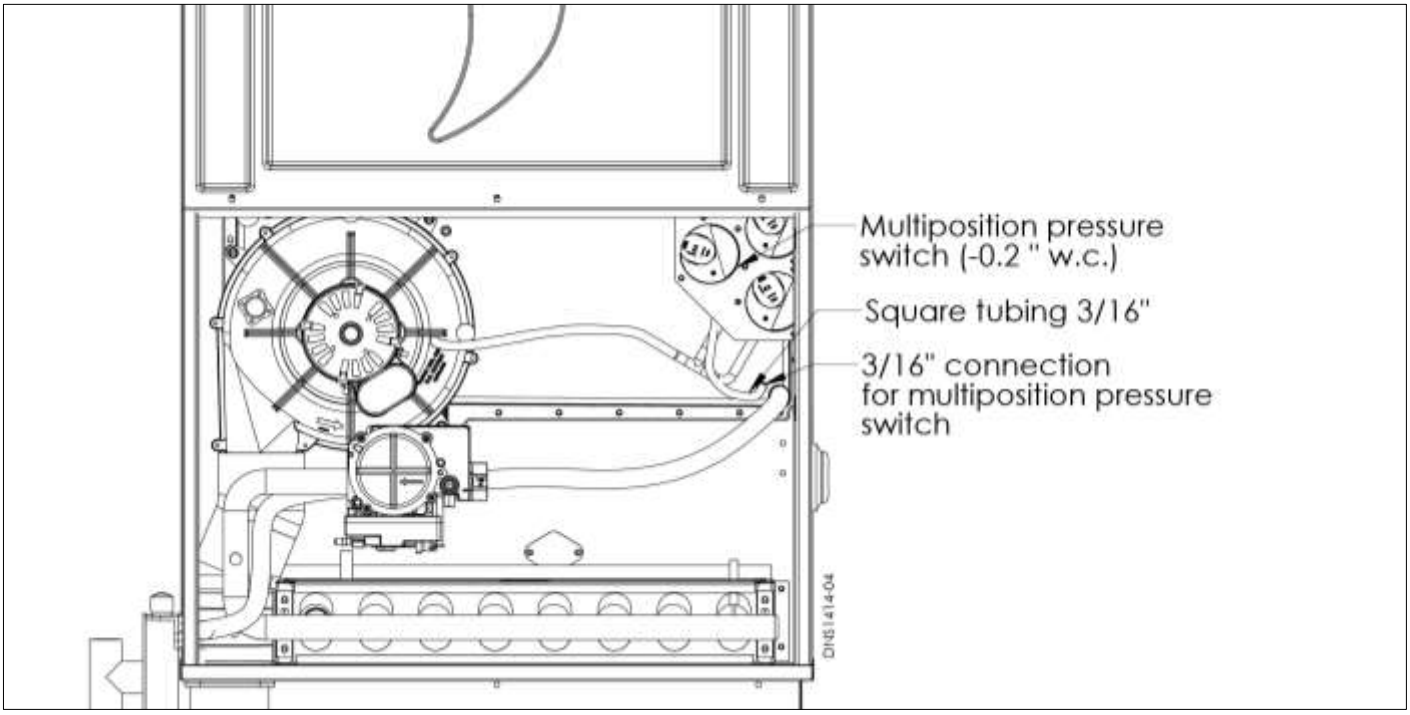


Figure 13 Unused stub in the horizontal right position

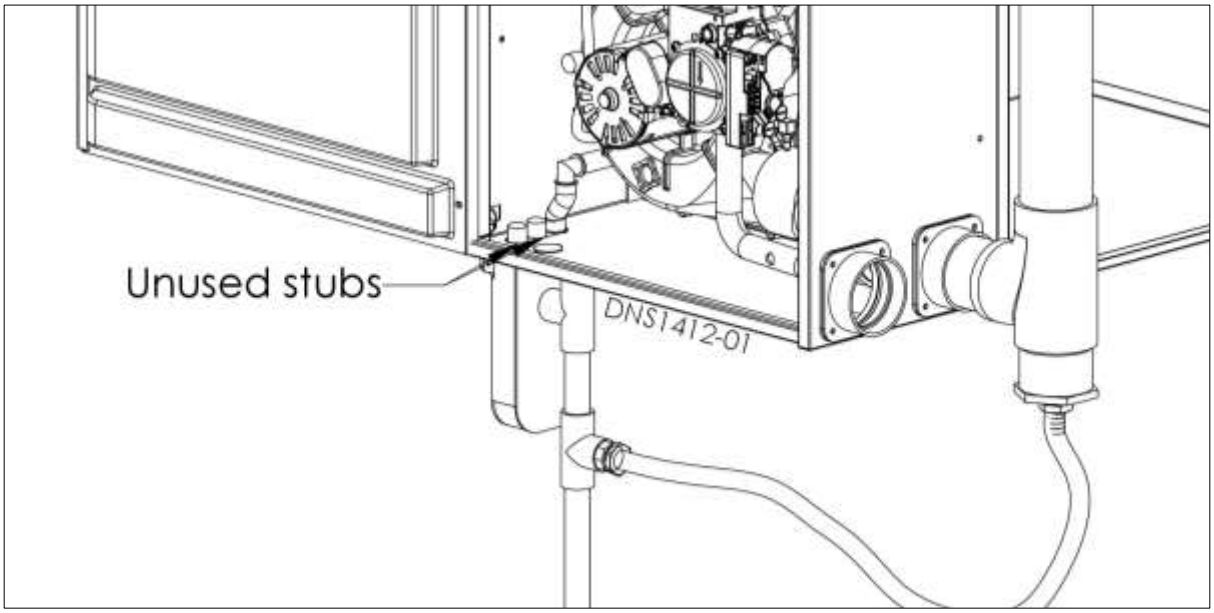


Figure 14 Horizontal Right Drain connection of the condensation box

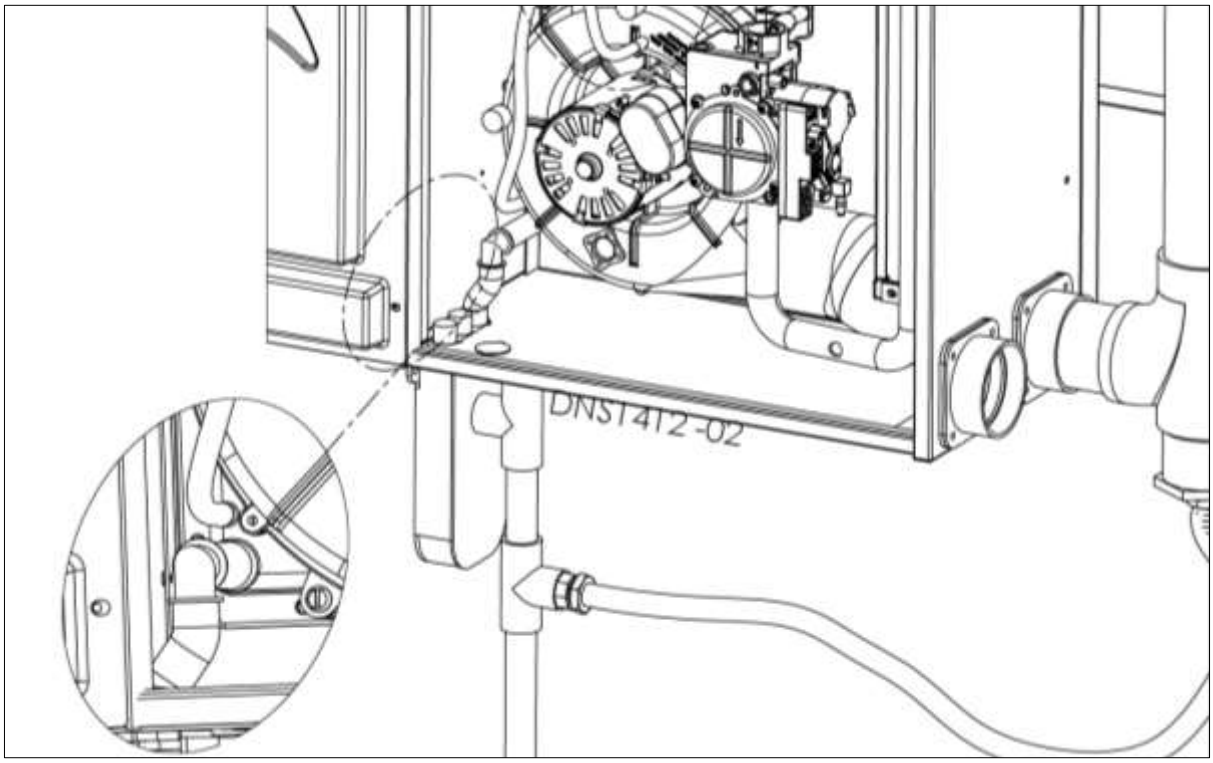


Figure 15 Horizontal right drain trap position

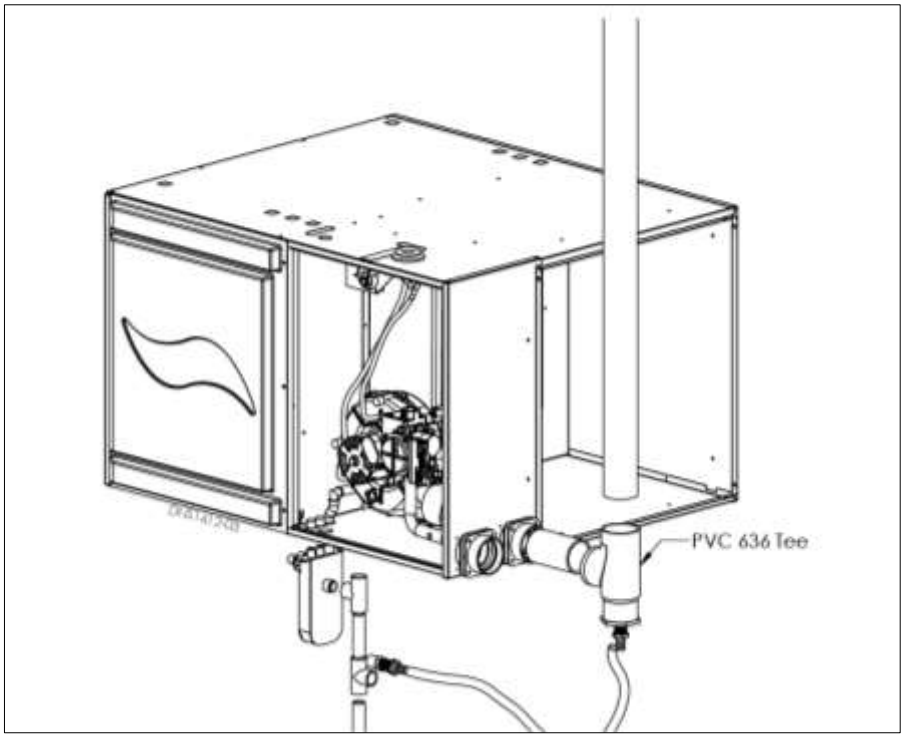


Figure 16 Pressure switch assembly

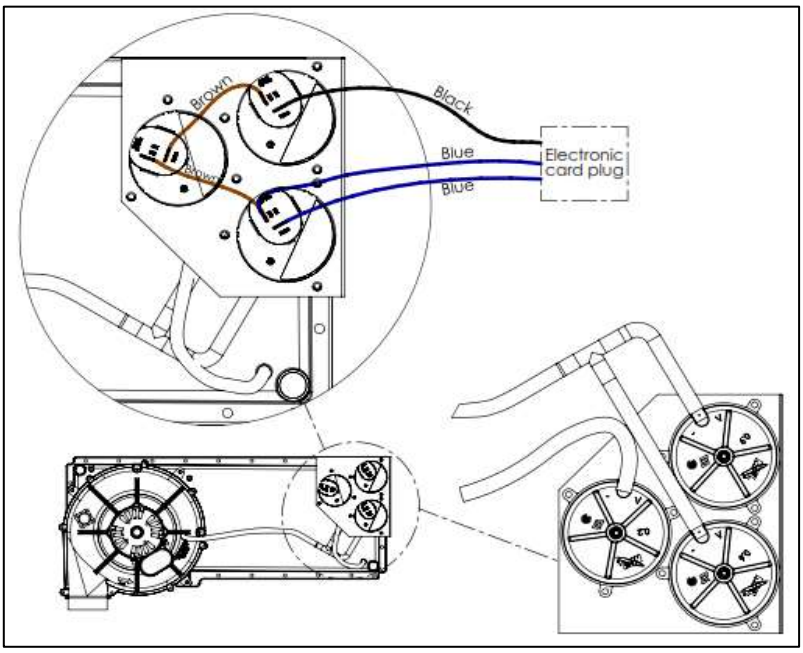


Figure 17 Horizontal left condensate drain connection (1)

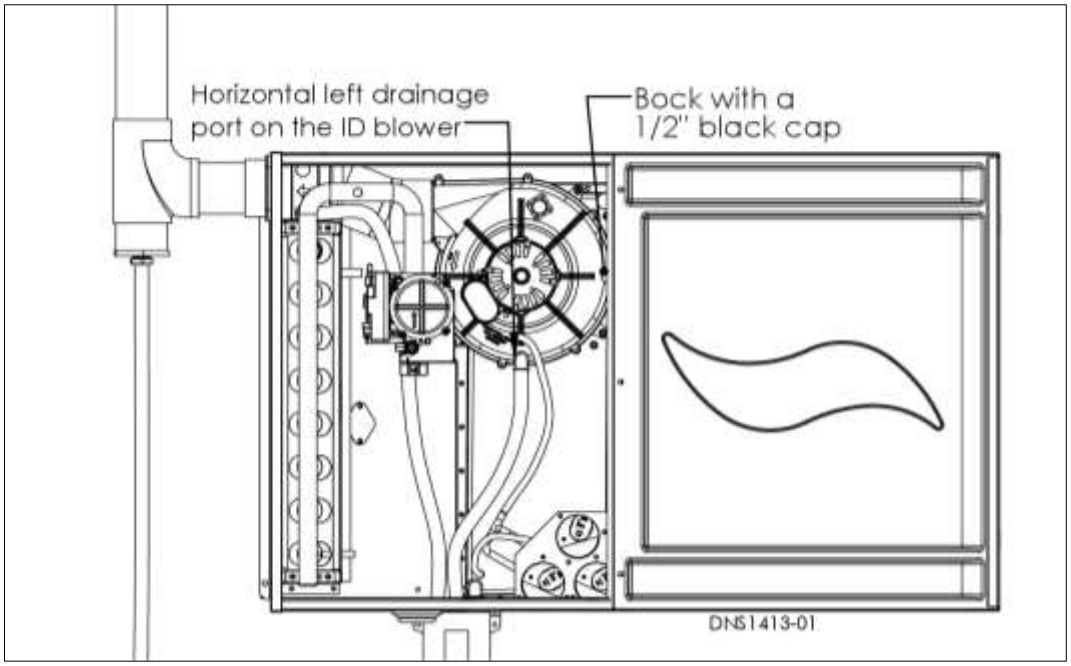
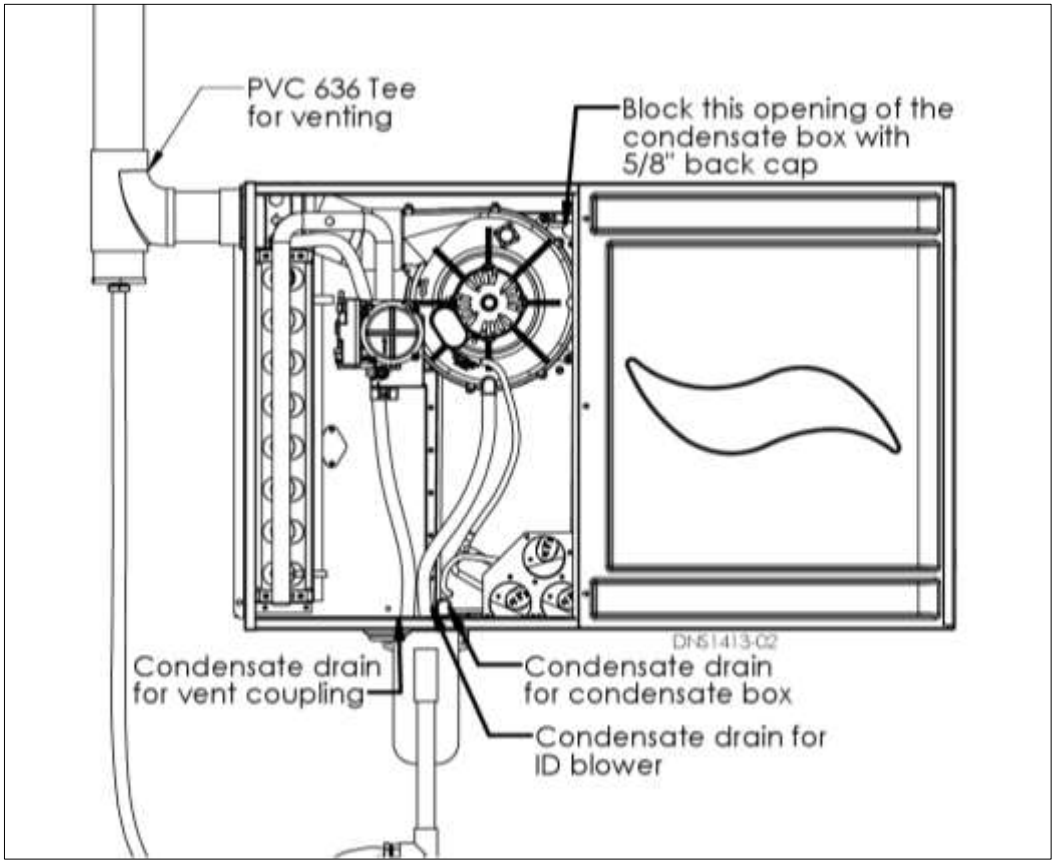


Figure 18 Horizontal left condensate drain connection (2)



5- DUCT INSTALLATION

5.1- 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), 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. The furnace airflow rates are provided at the end of this manual. When a furnace is installed so that the 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.

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.

Ductwork passing through an unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapour 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.

NOTE: Flexible connections can be used between ductwork and furnace to prevent transmission of vibration.

Proper airflow is necessary for the correct operation of this furnace. If ductwork is not sized properly, the furnace can operate erratically.
Installer should size the ducts according to industry standards and methods. The total static pressure drop of the supply and return ducts should not exceed 0.3'' w.c. if this furnace is installed with traditional ductwork.

CFM Tables are provided at the end of this manual to help installer size the ducts.

5.2- Smart Duct System

Dettson Industries also offers Smart Duct System. Please refer to the Smart Duct Manual (X40240) for proper installation of this system.

5.3- Return air connections

The return air duct must be connected to the bottom, left side or right side. If necessary (depending on your filter restriction), provision should be made for a double return.

NOTE: In downflow configuration, side return air is not permitted, it must be connected to bottom.

5.3.1- Bottom return air inlet

In Upflow orientation, for the bottom inlet, installer can use a return air base. This base allows the connection of the duct on the side with a bottom inlet. See Table 45 Part list – Modulating – ECM 3.0. Options for the part number corresponding to your furnace.

Cut a rectangular opening on the bottom plate of the furnace. To know what dimension to be used, refer to the input of the furnace as showed on Figure 3 Dimensional drawing. Install the return air inlet as per local codes.

5.3.2- Side return air inlet

Remove 4 knock-outs on the side of the furnace of the 8 knock-outs available. Use the knock-outs related to the furnace size as shown on Figure 3 Dimensional drawing. Install the return air inlet as per local codes.

5.4- Filter arrangement

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

Dettson doesn't provide any air filter or filter rack.

5.5- Supply air ducts

The supply air duct must be connected ONLY to 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 accessories MUST be connected to the supply or return ductwork external to furnace main casing.

NOTE: Many states, provinces and localities are considering or have implemented standards and/or restrictions on duct sizing practices, ductwork leakage, and/or ductwork thermal, airflow and electrical efficiencies. CONSULT LOCAL CODE OFFICIALS for ductwork design and performance requirement in your area.

5.5.1- Duct work acoustical treatment

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.

6- GAS PIPING

6.1- General

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 CAN/CSA B149.1 in Canada.

Installations must be made in accordance with all authorities having jurisdiction.

NOTE: Use a back-up wrench on the inlet of the gas valve when connecting the gas line to the gas valve.

In the state of Massachusetts:

1. Gas supply connections MUST be performed by a licensed plumber or gas fitter.
2. When flexible connectors are used, the maximum length shall not exceed 36 in. (915 mm).
3. When lever handle type manual equipment shutoff valves are used, they shall be "T" handle valves.
4. The use of copper tubing for gas piping is NOT approved by the state of Massachusetts.

Report to Table 3 Maximum capacity of pipe for recommended gas pipe sizing. Support all gas piping with appropriate straps, hangers, etc. Use a minimum of 1 hanger every 6 ft (1.8 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.

An accessible manual equipment shut off valve **MUST** be installed external to furnace casing.

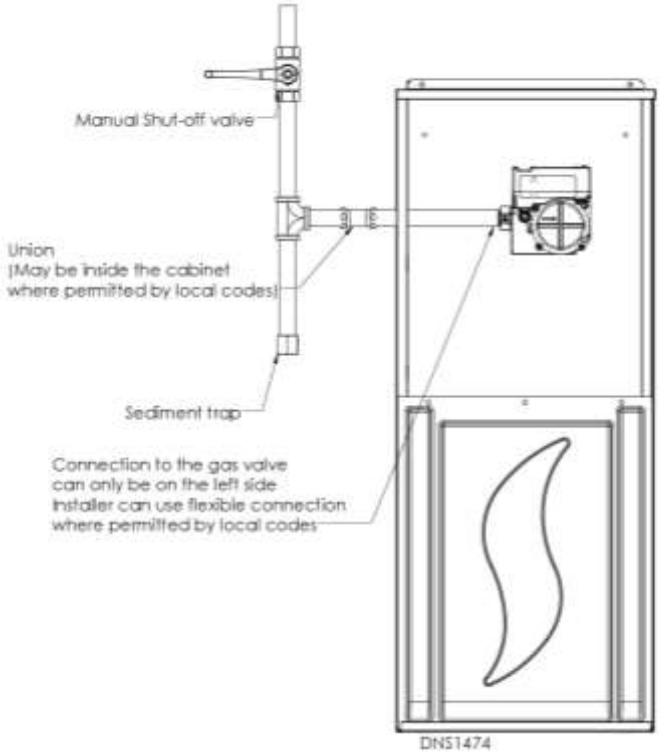
Install a sediment trap in riser leading to furnace as shown in Figure 19 Typical gas pipe arrangement. Connect a capped nipple into lower end of tee. Capped nipple should extend below level of furnace gas controls. Place a ground joint union between furnace gas control valve and exterior manual equipment gas shutoff valve (for ridged black pipe).

Table 3 Maximum capacity of pipe in Ft³ of gas/hr

Nominal Iron pipe size in. (mm)	Internal dia. in. (mm)	Length of pipe - FT (M)				
		10 (3.0)	20 (6.0)	30 (9.1)	40 (12.1)	50 (15.2)
1/2 (13)	0.622 (158)	175	120	97	82	73
3/4 (19)	0.824 (20.9)	360	250	200	170	151
1 (25)	1.049 (26.6)	680	465	375	320	285
1-1/4 (32)	1.380 (35.0)	1400	950	770	660	580
1-1/2 (39)	1.610 (40.9)	2100	1460	1180	990	900

* Cubic feet of gas per hr for gas pressures of 0.5 psig (14 in. w.c)
(Based on a 0.60 specific gravity gas)
Ref: Table 6.2 of NFPA54/ANSI Z223.1-2009

Figure 19 Typical gas pipe arrangement



Piping should be pressure and leak tested in accordance with the current edition of the NFGC in the United States, local, and national plumbing and gas codes before the furnace has been connected. Refer to current edition of NSCNGPIC in Canada. After all connections have been made, purge lines and check for leakage at furnace prior to operating furnace.

NOTE: The furnace gas valve inlet pressure tap connection is suitable to use as test gauge connection providing test pressure.

Table 4 Inlet Gas pressure

Gas Pressure in w.c. (psig)	Natural gas	Propane
Maximum	10.5 (0.38)	13.0 (0.47)
Minimum	4.5 (0.16)	11.0 (0.40)

If pressure exceeds 0.38 psig (10.5 in. W.C.), gas supply pipe must be disconnected from furnace and capped before and during supply pipe pressure test. If test pressure is equal to or less than 0.38 psig (10.5 in. W.C.), turn off electric shutoff switch located on furnace gas control valve and accessible manual equipment shutoff valve before and during supply pipe pressure test. After all connections have been made, purge lines and check for leakage prior to operating furnace.

The gas supply pressure shall be within the maximum and minimum inlet supply pressures marked on the rating plate and in Table 4 Inlet Gas pressure.

6.2- Gas valve and propane conversion kit

To convert from natural to L.P. gas, installer should use the appropriate conversion kit. Please refer to Table 45 Part list – Modulating – ECM 3.0 at the end of this manual.

The conversion kit consist of orifices, jumper and stickers to clearly identify conversion on the gas valve.

1. Move the switch located on the 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) on the receptacle located beneath the label that was removed in step 2. Use care to make sure that both prongs of receptacle engage the jumper.
4. Place the «LP» label (supplied with the kit) on the gas valve over the opening to the jumper.
5. Attach the "WARNING" label (supplied with this kit) to the gas valve where it can readily be seen.
6. Move the switch located on gas valve back to the "ON" position.
7. Unscrew the manifold.
8. Replace the natural gas burner orifices with the LP orifice (#56) supplied with the kit.
9. Replace the manifold and make sure it's properly aligned with the burners.
10. Make sure the gas valve outlet pressure (measured on the outlet pressure tap) is compliant with the outlet pressure. Outlet pressure is specified on the nameplate of the furnace.

6.3- Gas pipe grommet

For direct vent (2 pipe) applications, the hole for the gas pipe on the cabinet must be sealed to prevent air leakage. Install the grommet in the hole, then insert the gas pipe and apply fillet paste.

7- ELECTRICAL CONNECTIONS

WARNING

FIRE HAZARD

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

Do not connect aluminium wire between disconnect switch and furnace. Use only copper wire.

Check all factory and field electrical connections for tightness.

Supplied field wiring shall conform to the limitations of 63°F (33°C) rise.

7.1- 120 V wiring

Furnace must have a 120 V power supply properly connected and grounded.

NOTE: Proper polarity must be maintained for 120 V wiring. If polarity is incorrect, control LED status indicator light will flash rapidly 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 5 Electrical data for equipment electrical specifications.

U.S.A. Installations:

Make all electrical connections in accordance with the current edition of the National Electrical Code (NEC) ANSI/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.

Use a separate fused branch electrical circuit with a properly sized fuse or circuit breaker for this furnace. See Table 5 Electrical data for fuse specifications. A readily accessible means of electrical disconnect must be located within sight of the furnace.

Table 5 Electrical data

Unit size	Volts-Hertz-Phase	Operating voltage range		Maximum unit amps	Units ampacity	Maximum fuse or CKT BRK amp
		Max.	Min.			
15,000	120-60-1	127	104	10.7	12.6	15
30,000	120-60-1	127	104	10.7	12.6	15
45 000	120-60-1	127	104	10.7	12.6	15
60,000	120-60-1	127	104	13.1	15.6	20
75,000	120-60-1	127	104	13.1	15.6	20
105,000	120-60-1	127	104	15.8	19	20
120,000	120-60-1	127	104	15.8	19	20

7.2- 24 V wiring

Make field 24 V connections at the 24 V terminal strip. Use only AWG No. 18 minimum, color-coded, copper thermostat wire.

NOTE: Use AWG No. 18 color coded copper thermostat wire for lengths up to 100ft. (30.5m). For wire lengths over 100 ft., use AWG No 16 wire.

The 24 V circuit contains an automotive type, 3-amp fuse located on the control board. Any 24v direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use **ONLY** a 3 amp fuse. Refer to Figure 20 Wiring diagram for the location of the fuse.

7.3- Thermostats

The furnace must be installed with the Modulating Touch-Screen Thermostat R02P030 (#1F95M). If the furnace is to be installed with the modulating cooling option, use the Communicating Thermostat R02P029 (#1F991292).

Consult the thermostat installation instruction for specific information about configuring the thermostat.

To know exactly what thermostat should be used with your system (cooling, ERV/HRV), please refer to the table below:

Table 6 Thermostat choice vs system

Heating system	Cooling system	Thermostat	HRV interlock at low CFM	Interface board needed	Smart duct Compliant
Modulating Chinook	Alizé	Communicating R02P029	Yes	Yes	Yes
	1 stage Non-Alizé Cooling Unit	Communicating R02P029	Yes	Yes	No
	1 & 2 Stage Non Alizé Cooling/Heat pump	Modulating R02P030	No	No	No

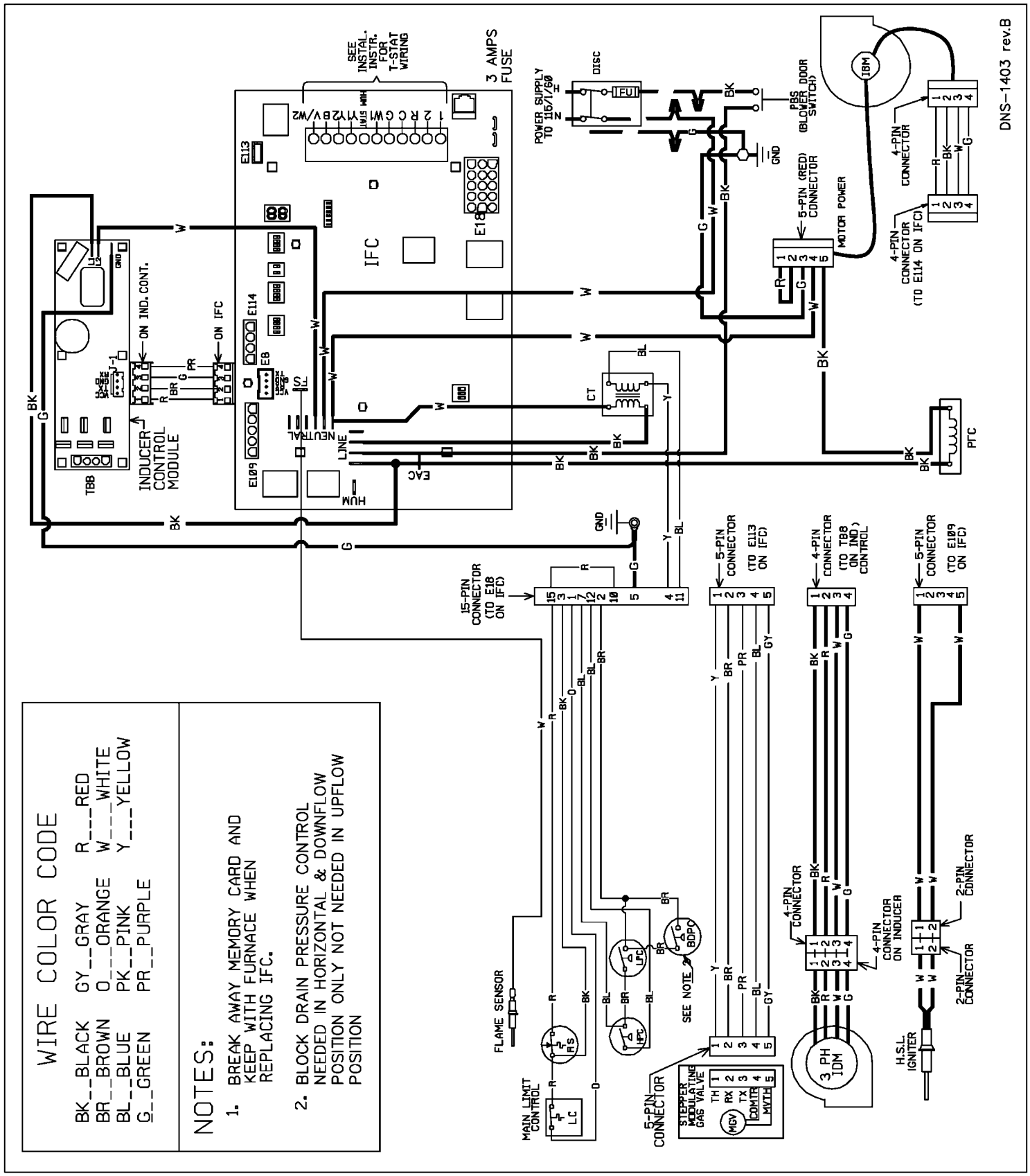
7.4- Alternate power supply

The furnace is designed to operate on utility generated power which has a smooth sinusoidal waveform. If the furnace is to be operated on a generator or other alternate power supply, it must produce a smooth sinusoidal waveform for compatibility with furnace electronics. The alternate power supply must generate the same voltage, phase, and frequency (Hz) as shown in Table 5 Electrical data or the furnace rating plate.

Power from an alternate power supply that is non-sinusoidal may damage the furnace electronics or cause erratic operation.

Contact the alternate power supply manufacturer for specifications and details.

Figure 20 Wiring diagram



8- VENTING AND COMBUSTION AIR PIPING

8.1- Introduction

8.1.1- Direct vent (2 pipe applications)

When this 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 insure that other gas appliances have sufficient air for combustion.

Direct vent installations require a dedicated combustion air and venting system. All air for combustion is taken from outside and all combustion products are discharged to the outdoors.

Therefore, no ventilation or combustion air openings are required.

In Canada, refer to manufacturer's instructions for supporting ULC S636 venting.

In a direct vent (2 pipes) system, all air for combustion is taken directly from outdoor atmosphere, and all flue products are discharged to outdoor atmosphere. Combustion air and vent pipes must terminate either through the roof or sidewall. See Figure 22 Direct venting for references to clearances required by National code authorities.

TERMINATION REQUIREMENTS FOR THE PROVINCE OF ALBERTA AND SASKATCHEWAN:

The Provinces of Alberta and Saskatchewan require a minimum unobstructed distance of 4 ft. (1.2 M) from the foundation to the property line of the adjacent lot for vent termination of any appliance with an input over 35,000 BTU/h. If there is less than 4 ft. (1.2 M) of unobstructed distance to the property line of the adjacent lot, no type of vent termination is permitted for appliances with inputs greater than 35,000 BTU/h. There are no additional restrictions on unobstructed distances greater than 8 ft. (2.4 M).

All single, two pipe and concentric vents may be used, providing all other Codes and manufacturer’s requirements in these instructions are adhered to.

If the unobstructed distance from the foundation to the property line of the adjacent lot is no less than 4 ft. (1.2 M) and no greater than 8 ft. (2.4 M), it will be necessary to re-direct the flue gas. In this situation, a concentric vent kit cannot be used.

A 2 pipe system (or single pipe system when permitted) that redirects the flue gas away by use of an elbow or tee, certified to ULC S636 from the adjacent property line must be used.

8.1.2- Non direct vent (1 pipe) applications

When the furnace is installed as a non-direct vent (1 pipe) furnace, it will be necessary to ensure there is adequate air for combustion. Other gas appliances installed with the furnace may also require air for combustion and ventilation in addition to the amount of combustion air and ventilation required for the furnace.

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 air pipe cannot be terminated in attics or crawlspaces that uses ventilation fans designed to operate during the heating season. If ventilation fans are present in these areas, the combustion 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, crawlspace 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.

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

U.S.A. Installations: Section 5.3 of the NFPA 54/ANSI Z223.1-2009, 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.

8.2- Special venting requirements for installations in Canada

The special vent fittings and accessory concentric vent termination kits and accessory external drain trap have been certified to ULC S636 for use with Royal Pipe, IPEX PVC and CPVC vent components.

In Canada, S636 certified primers and cements must be used and be of the same manufacturer of the S636 venting system- **do not mix primers and cements from one manufacturer with a vent system from a different manufacturer.** Follow the manufacturer's instructions in the use of primer and cement and never use primer or cement beyond its expiration date.

Safe operation, as defined by ULC S636, of the vent system is based on following the vent system manufacturer installation instructions, and proper use of required primers and cements.

All fire stop and roof flashing used with this system must be UL listed material.

Acceptability under Canadian standard CAN/CSA B149 requires full compliance with all installation instructions.

The authority having jurisdiction (gas inspection authority, municipal building department, fire department, etc.) should be consulted before installation to determine the need to obtain a permit.

8.3- General

If this furnace replaces a furnace that was connected to a vent system or chimney, the vent or vent connectors of other remaining appliances may need to be re-sized. Vent systems or vent connectors of other appliance must be sized to the minimum size allowable.

An abandoned masonry chimney may be used as a raceway for properly insulated and supported combustion-air (when applicable) and vent pipes. Each furnace must have its own set of combustion air and vent pipes and be terminated individually.

A furnace shall not be connected to a chimney flue serving a separate appliance designed to burn solid fuel.

Other gas appliances with their own venting system may also use the abandoned chimney as a raceway providing it is permitted by local code, the current edition of the National Fuel Gas Code, and the vent or liner manufacturer’s installation instructions. Care must be taken to prevent the exhaust gases from one appliance from contaminating the combustion air of other gas appliances.

8.4- Connecting to furnace

Do not common vent with any other appliance. Do not install in the same chase or chimney with a metal or high temperature plastic pipe from another gas or fuel-burning appliance unless the required minimum clearances to combustibles are maintained between the approved PVC pipe and other pipes. Clean and deburr all pipe cuts. The shavings must not allowed to block the exhaust, inlet or condensate drain pipes.

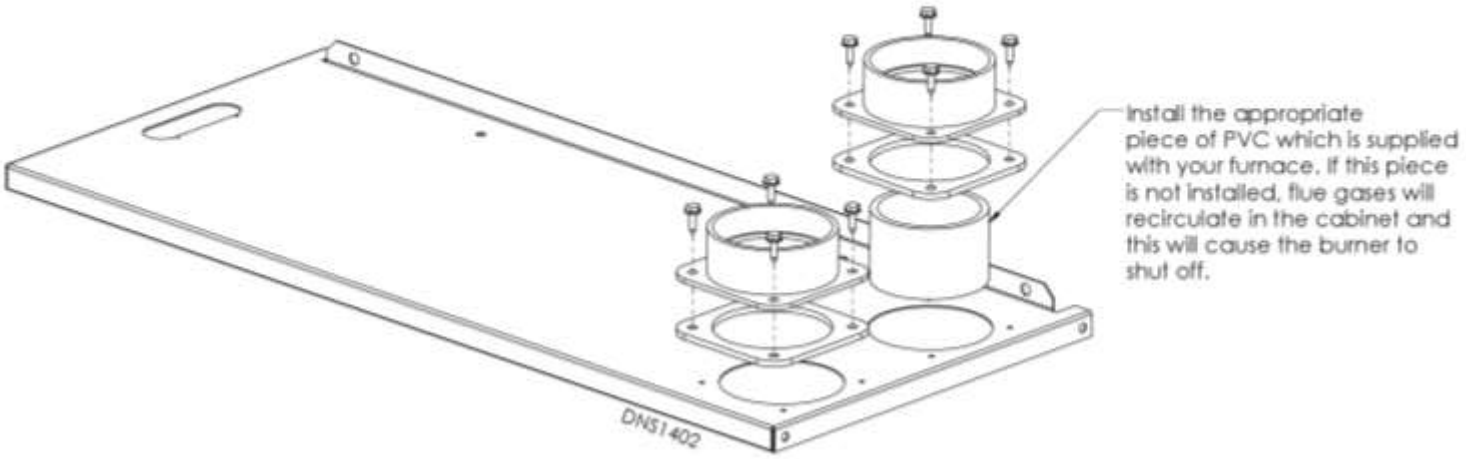
A 2” diameter PVC pipe is supplied with your furnace. Depending of your cabinet size, this pipe length is either 1.5” or 6.75”. Connect this piece of PVC to the rubber coupling over the induce draft blower. If this piece is not installed properly, flue gases will circulate in the cabinet and cause burner to shut off.

The exhaust pipe connection is a 2” female PVC pipe fitting extending through the back right side of the furnace top plate. (See Figure 21 Vent coupling and adapter with gasket). When 2” pipe is used, connect it directly to this fitting. When 3” pipe is used, connect a 2” to 3” coupling to this fitting with a short piece of 2” PVC pipe. The inlet combustion air connection is at the front right side of the top plate.

All exhaust piping must be installed in compliance with Part 7, “Venting of Equipment,” of the latest edition of the National Fuel Gas Code NPFA 54, 90A and 90B ANSI Z223.1-, local codes or ordinances and these instructions:

1. Provide the space with sufficient air for proper combustion, ventilation, and dilution of flue gases using permanent horizontal or vertical duct(s) or opening(s) directly communicating with the outdoors or spaces that freely communicate with the outdoors.
2. Insulate all vent runs through unconditioned spaces where below freezing temperatures are expected with 1" thick medium density, foil faced fiberglass or equivalent Rubatex/Armaflex insulation. (In Canada per the vent manufacturer’s instructions)
3. For runs where condensate could collect and freeze, wrap the vent pipe with self-regulating, 3 or 5 Watt heat tape. The heat tape must be U.L./CSA. listed and installed per the manufacturer’s instructions.
4. All piping between the furnace and the roof or outside wall penetration is either 2" or 3".

Figure 21 Vent coupling and adapter with gasket



8.4.1- Combustion air piping

Use a 90° elbow or two medium-radius sweep elbows to keep the inlet downward and prevent the entry of rain. The inlet opening of the combustion air termination must be a minimum of 12” above the anticipated level of snow accumulation.

Install termination as follow:

1. Install a 2" coupling to the combustion air pipe at the outside wall to prevent the termination from being pushed inward.
2. Cut the needed length of 2" PVC pipe and connect this to the coupling.
3. Attach the termination in the final length of 2” PVC pipe in the vertical position with PVC cement.

NOTE: Furnaces may have a drain tee assembly and trap installed in the combustion air pipe as close to the furnace as possible. This is to drain any water that may enter the combustion air pipe to prevent it from entering the furnace vestibule area.

8.4.2- Exhaust vent piping

The rubber coupling that attaches to the vent pipe adapter must be used. The adapter seals the vent pipe to the casing and reduces the strain the inducer and the elbow (when present).

It is necessary to properly seal on either side of the adapter with an appropriate adhesive. This is to prevent any condensate leakage.

The exhaust vent must terminate **at least 12” above** the combustion air termination inlet. The maximum length of the exposed vent pipe above the roof is 30".

NOTE: The combustion air and exhaust terminations must be at least 12” above grade. Use alternate horizontal terminations when termination locations are limited and higher snow levels are anticipated.

NOTE: Ensure the location of the combustion air inlet with respect to the exhaust vent terminal complies with Figure 22 Direct venting.

8.5- Materials

USA: Combustion air and vent pipe, fittings, primers, and solvents must conform to American National Standards Institute (ANSI) standards and American Society for Testing and Materials (ASTM) standards. See Table 9 Approved combustion air and vent pipe, fitting and cement materials (U.S.A. Installation) - (In Canada all vent material s shall comply to ULC S636) for approved materials for use in the U.S.A.)

CANADA: Special Venting Requirements for Installations in Canada must conform to the requirements of CAN/CSA B149 code. PVC and CPVC vent systems **must** be composed of pipe, fittings, cements, and primers listed to ULC S636.

8.6- Size of the vent and combustion air pipes

Furnace combustion air and vent pipe connections are sized for 2” pipe. Any pipe diameter change should be made outside furnace casing in

vertical pipe. Any change in diameter to the pipe must be made as close to the furnace as reasonably possible.

When installing vent systems of short pipe lengths use the smallest allowable pipe diameter.

The Maximum Vent Length for the vent and combustion air pipe (when used) is determined from Table 7 Maximum equivalent vent length (ft.) minus the number of fittings multiplied by the deduction for each type of fitting used. The measured length of pipe used in a single or 2 pipes termination is included in the total vent length. Include a deduction for a Tee when used for Alberta and Saskatchewan terminations.

1. Measure the linear pipe distance from the furnace to the termination for each pipe.
2. Select a Maximum Equivalent Vent Length (MEVL) longer than the measured distance of the individual vent and combustion air connections to the vent termination.
3. Count the number of elbows for each pipe.
4. For each pipe, multiply the number of elbows by the equivalent length for the type of elbow used. Record the equivalent length of all the elbows for each pipe.
5. If a Tee is used on the termination, record the equivalent length of the Tee used (Table 8 Deduction for fitting). Record the equivalent length of the termination to be used.
6. Subtract the equivalent lengths of the fittings and terminations from the Maximum Equivalent Vent Length.
7. If the Maximum Vent Length calculated is shorter than the individual measured length of either the vent pipe or the combustion air pipe, then the diameter of pipe selected may be used.
8. If the Maximum Vent Length calculated is longer than the individual measured length of either the vent pipe or the combustion air pipe, recalculate the Maximum Vent Length using the next larger diameter pipe.

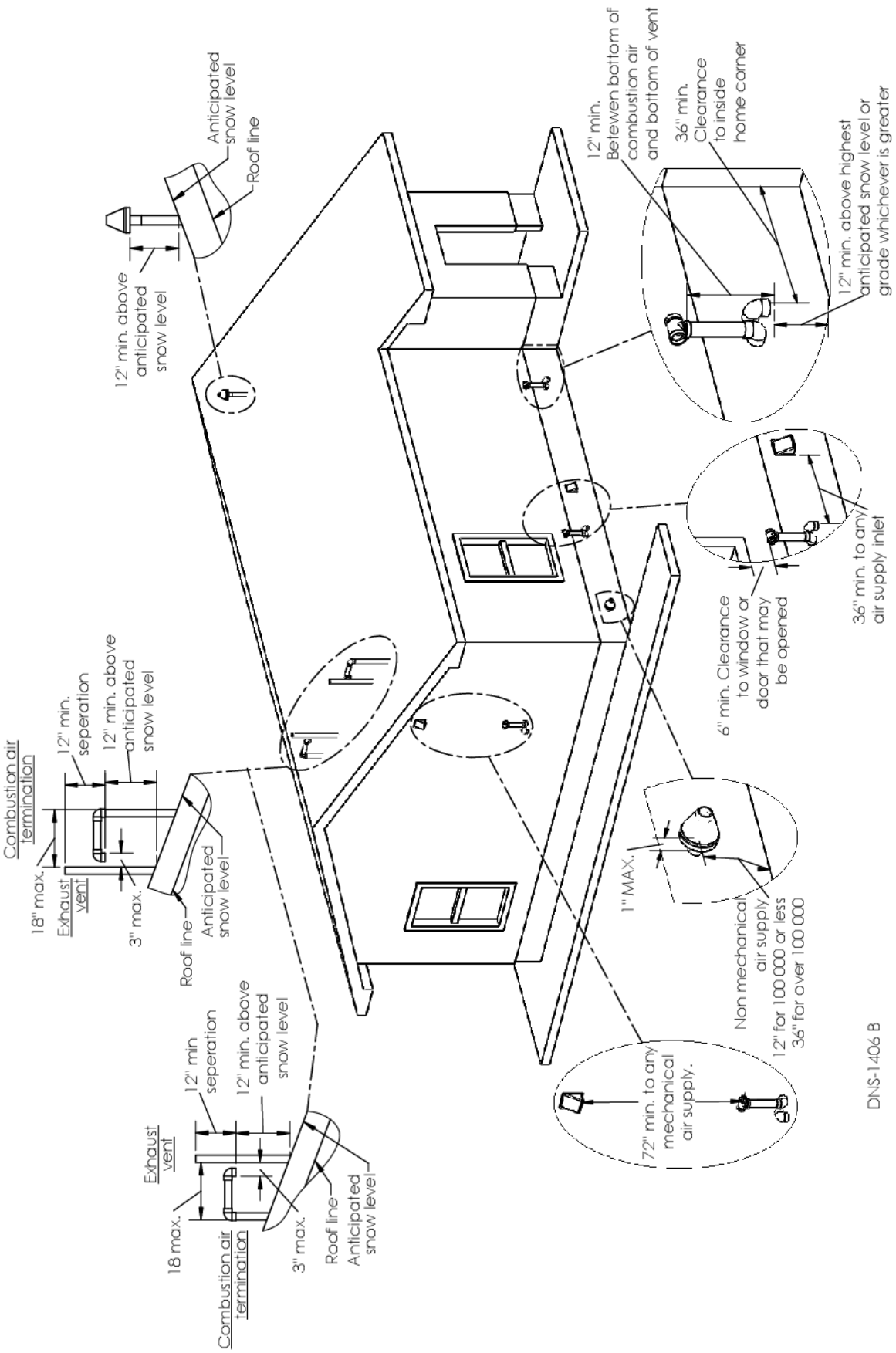
NOTE: The vent pipe and combustion air pipe must be the same diameter.

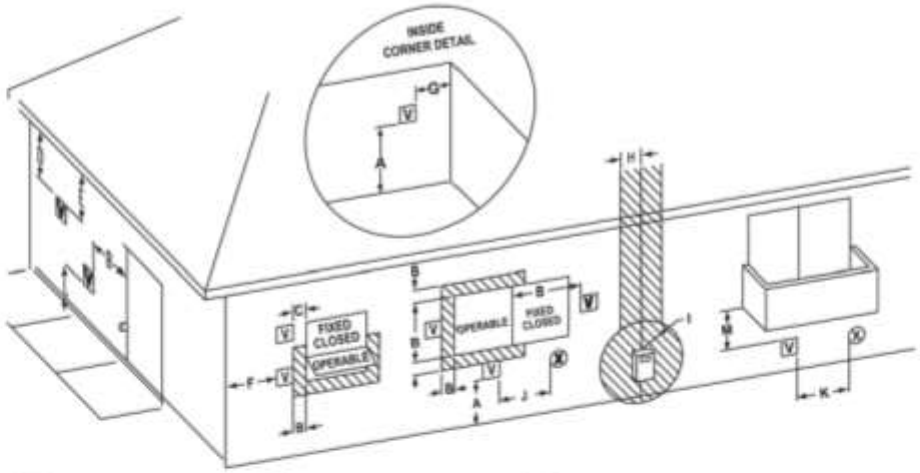
NOTE: If the Maximum Vent Length for diameter of the pipe selected is longer than the measured length and the equivalent length of all the fitting and terminations, recalculate using the next smaller diameter. If the recalculated Maximum Vent Length is longer than the measured length of the vent pipe and combustion air pipe, then that diameter of pipe selected may be used.

NOTE: Slope horizontal vent piping upward a minimum of 1/4" per foot of run so that condensate drains toward the furnace.

NOTE: Support horizontal vent piping at least every five feet. No sags or dips are permitted

Figure 22 Direct venting





V VENT TERMINAL ⊗ AIR SUPPLY INLET AREA WHERE TERMINAL IS NOT PERMITTED

		Canadian Installations[1]	US Installations[2]
A=	Clearance above grade, veranda, porch, deck, or balcony (See 1.24.6-i(9)b.)	12 inches (30 cm)	12 inches (30 cm)
B=	Clearance to window or door that may be opened	6 inches (15 cm) for appliances 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and 100,000 Btuh (30 kW), 36 inches (91 cm) for appliances >100,000 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (300 m) above opening
C=	Clearance to permanently closed window	*	*
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	*	*
E=	Clearance to unventilated soffit	*	*
F=	Clearance to outside corner	*	*
G=	Clearance to inside corner	*	*
H=	Clearance to each side of center line extended above meter/regulator assembly	3 feet (91 cm) within a height 15 feet (4.5 m) above the meter/regulator assembly	*
I=	Clearance to service regulator vent outlet	3 feet (91 cm)	*
J=	Clearance to nonmechanical air supply inlet to building or the combustion air inlet to any other appliance	6 inches (15 cm) for appliances 10,000 Btuh (3 kW), 12 inches (30 cm) for appliances > 10,000 Btuh (3 kW) and 100,000 Btuh (30 kW), 36 inches (91 cm) for appliances >100,000 Btuh (30 kW)	4 feet (1.2 m) below or to side of opening; 1 foot (30 cm) above opening
K=	Clearance to a mechanical air supply inlet	6 feet (1.83 m)	3 feet (91 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)
M=	Clearance under veranda, porch deck, or balcony	12 inches (30 cm) ‡	*

1 In accordance with the current *CSA B149.1, Natural Gas and Propane Installation Code*

2 In accordance with the current *ANSI Z223.1/NFPA 54, National Fuel Gas Code*

† A vent shall not terminate directly above a sidewalk or paved driveway that is located between two single family dwellings and serves both dwellings.

‡ Permitted only if veranda, porch, deck, or balcony is fully open on a minimum of two sides beneath the floor.

* For clearances not specified in *ANSI Z223.1/NFPA 54* or *CSA B149.1*, the following statement shall be included:

"Clearance in accordance with local installation codes and the requirements of the gas supplier and the manufacturer's installation instructions."

Figure 23 Other than direct vent clearance

Table 7 Maximum equivalent vent length (ft.)

Altitude (ft)	Unit size (Btu/hr)*	Vent pipe diameter (in.)	
		2"	3" and 4"
0 to 4500 ft	**15,000**	300	N/A
	30,000	180	N/A
	45,000	70	90
	60,000	70	90
	75,000	70	90
	105,000	15	80
	120,000	10	40

Table 8 Deduction for fitting

Type of elbow	Equivalent Length (ft.)
45° Standard	5
45° Long sweap	2½
90° Standard	10
90° Long sweap	5
Tee	1.5

Table 9 Approved combustion air and vent pipe, fitting and cement materials (U.S.A. Installation) - (In Canada all vent material s shall comply to ULC S636)

ASTM SPECIFICATION (MARKED ON MATERIAL)	MATERIAL	PIPE	FITTINGS	SOLVENT CEMENT AND PRIMERS	DESCRIPTION
D1527	ABS	PIPE	-	-	Schedule-40
D1765	PVC	PIPE	-	-	Schedule-40
D2235	For ABS	-	-	Solvent Cement	For ABS
D2241	PVC	PIPE	-	-	SDR-21 & SDR-26
D2466	PVC	-	Fittings	-	Schedule-40
D2468	ABS	-	Fittings	-	Schedule-40
D2564	For ABS	-	-	Solvent Cement	For PVC
D2661	ABS	PIPE	Fittings	-	DWV at Schedule-40 IPS Sizes
D2665	PVC	PIPE	Fittings	-	DWV at Schedule-40 IPS Sizes
F438	CPVC	-	Fittings	-	Schedule-40
F441	CPVC	PIPE	-	-	Schedule-40
F442	CPVC	PIPE	-	-	SDR
F493	For CPVC	-	-	Solvent Cement	For CPVC
F628	ABS	PIPE	-	-	Cellulare Core DWV at Schedule-40 IPS sizes
F656	For PVC	-	-	Primer	For PVC
F891	PVC	PIPE	-	-	Cellulare Core Schedule-40 & DWV

8.7- Combustion air and vent piping insulation guidelines

The vent pipe may pass through unconditioned areas.

1. Using winter design temperature (used in load calculations), find appropriate temperature for your application and furnace model.
2. Determine the amount of total and exposed vent pipe.
3. Determine required insulation thickness for exposed pipe length(s).
4. When combustion air inlet piping is installed above a suspended ceiling, the pipe **MUST** be insulated with moisture resistant insulation such as Armaflex™ or other equivalent type of insulation.
5. Insulate all vent runs through unconditioned spaces where below freezing temperatures are expected with 1" thick medium density, foil faced fiberglass or equivalent Rubatex/Armaflex insulation.
6. For horizontal runs where water may collect, wrap the vent pipe with self-regulating, 3 or 5 Watt heat tape. The heat tape must be U.L./CSA. listed and installed per the manufacturer's instructions.
7. Insulate combustion air inlet piping when run in warm, humid spaces.
8. Install the insulation per the insulation manufacturer's installation instructions.

NOTE: Pipe length specified for maximum pipe lengths located in unconditioned spaces cannot exceed total allowable pipe length as calculated from Table 7 and Table 8.

9. Apply the wall pipe flange gaskets to the vent wall pipe and combustion air wall pipe flanges.

NOTE: The vent wall pipe flange and the combustion air wall pipe flange have the same ID.

10. **For the exhaust vent, place the wall pipe flange over the 2" diameter pipe provided. Take good care to glue the piece of PVC to the wall pipe flange to avoid any condensate leakage.**
11. **Align the pipe on the rubber coupling with drain and tighten the clamp around the rubber coupling.**
12. Align the screw holes in the plastic wall pipe flange with the dimples in the casing.
13. Pilot drill the screw holes for the flange in the casing and attach the vent wall pipe flange to the furnace with sheet metal screws
14. Repeat step 12 and 13 for the air combustion wall pipe flange and secure to the top casing.
15. Install the remaining vent and combustion air pipes. It is recommended that all pipes be cut, prepared, and preassembled before permanently cementing any joint.
16. Working from furnace to outside, cut pipe to required length(s).
17. Deburr inside and outside of pipe.
18. Chamfer outside edge of pipe for better distribution of primer and cement.
19. Clean and dry all surfaces to be joined.
20. Check dry fit of pipe and mark insertion depth on pipe.
21. Insert the combustion air pipe into the adapter.
22. Seal around the combustion air pipe with silicone or foil tape.
23. After pipes have been cut and preassembled, apply generous layer of cement primer to pipe fitting socket and end of pipe to insertion mark. Quickly apply approved cement to end of pipe and fitting socket (over primer). Apply cement in a light, uniform coat on inside of socket to prevent build-up of excess cement. Apply second coat.
24. While cement is still wet, twist pipe into socket with 1/4" turn. Be sure pipe is fully inserted into fitting socket.
25. Wipe excess cement from joint. A continuous bead of cement will be visible around perimeter of a properly made joint.
26. Handle pipe joints carefully until cement sets.
27. Horizontal portions of the venting system shall be supported to prevent sagging. Support combustion air piping and vent piping a minimum of every 5 ft. (1.5 M) [3 ft. (.91 M) for SDR-21 or -26 PVC] using perforated metal hanging strap or commercially available hangars designed to support plastic pipe.
28. Prevent condensate from accumulating in the pipes by sloping the combustion air piping and vent piping downward towards furnace a minimum of 1/4" per linear ft. with no sags between hangers.
29. Complete the vent and combustion air pipe installation by installing the required termination elbows. See Figure 22 Direct venting.
30. Use appropriate methods to seal openings where combustion air pipe and vent pipe pass through roof or sidewall.

8.8- Installing the vent termination

A roof termination of any type will require a 4" (102 mm) flashing for a 2" (51 mm) concentric vent or a 5" diameter (127 mm) flashing for a 3" (76 mm) concentric vent kit. For two-pipe or single pipe vent systems, a flashing for each pipe of the required diameter will be necessary. It is recommended that the flashing be installed by a roofer or competent professional prior to installing the concentric vent. The terminations can be installed on a flat or pitched roof.

8.8.1- Concentric vent

Single or multiple concentric vent must be installed as shown in Figure 22 Direct venting. Maintain the required separation distance between vents or pairs of vents and all clearances.

Cut one 4" (102 mm) diameter hole for 2" (51 mm) kit, or one 5" (127 mm) diameter hole for 3" (76 mm) kit in the desired location. Loosely assemble concentric vent/combustion air termination components together using instructions in kit. Slide assembled kit with rain shield REMOVED through hole in wall or roof flashing.

NOTE: Do not allow insulation or other materials to accumulate inside of pipe assembly when installing it through hole. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.

8.8.2- Two pipe termination

Two pipe vent must be installed as shown in Figure 22 Direct venting. Maintain the required separation distance between vents or pairs of vents and all clearance. Cut the required number of holes in the roof or sidewall for vent and combustion air pipes. Sidewall holes for two pipes vent terminations should be side-by-side, allowing space between the pipes for the elbows to fit on the pipes. Holes in the roof for two pipe terminations should be spaced no more than 18" (457 mm) apart. Termination elbows will be installed after the vent and combustion air pipe is installed.

8.8.3- Sidewall termination

Determine an appropriate location for termination kit using Figure 22 and Figure 23

1. Cut one 4" diameter hole for 2" kit, or one 5" diameter hole for 3" kit.
2. Loosely assemble vent/combustion air termination components together using instructions in kit.
3. Slide assembled kit with rain shield REMOVED through hole (**NOTE:** Do not allow insulation or other materials to accumulate inside of pipe assembly when installing it through hole).
4. Locate assembly through sidewall with rain shield positioned no more than 1" (25 mm) from wall.
5. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.
6. Cut 2 holes, 1 for each pipe, of appropriate size for pipe size being used.
7. Loosely install elbow in bracket and place assembly on combustion-air pipe.
8. Disassemble loose pipe fittings. Clean and cement using same procedures as used for system piping.

9- START UP, ADJUSTMENT AND SAFETY CHECK

1. Furnace must have a 120 V power supply properly connected and grounded (**NOTE**: Proper polarity must be maintained for 120 V wiring. Control status indicator light flashes rapidly and furnace does not operate if polarity is incorrect.)
2. If the modulating thermostat is used, thermostat wire connections at terminals R, W/W1, G, Y/Y2, etc. must be made at 24 V terminal block on furnace control
3. Natural gas service pressure must not exceed 0.38 psig (10.5 in. w.c.), but must be no less than 0.16 psig (4.5-in. w.c.). Propane service pressure must not exceed 0.47 psig (13 in. w.c.) but must be no less than 0.40 psig (11 in. w.c.)
4. Blower door must be in place to complete 120 V electrical circuit to furnace.

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

9.1- To start the furnace

9.1.1- Lighting instructions

This appliance is equipped with a hot surface ignition device. This device lights the main burners each time the room thermostat calls for heat. See the lighting instructions on the furnace.

During initial start-up, it is not unusual for odour or smoke to come out of any room registers. To ensure proper ventilation, it is recommended to open windows and doors before initial firing.

The furnace has negative pressure switches that are a safety during a call for heat. The induced draft blower must pull a negative pressure on the heat exchanger to close the negative pressure switch. The induced draft blower must maintain at least the negative pressure switch set point for the furnace to operate. If the induced draft blower fails to close or maintain the closing of the negative pressure switch, an error code would result.

1. Remove the burner compartment control access door.
2. **IMPORTANT:** Be sure that the manual gas control has been in the “OFF” position for at least five minutes. Do not attempt to manually light the main burners.
3. Set the room thermostat to its lowest setting and turn off the furnace electrical power.
4. Turn the gas control knob to the “ON” position.

WARNING

Replace the burner compartment control access door.

Failure to replace the burner door can cause products of combustion to be released into the conditioned area resulting in personal injury or death.

5. Turn on the manual gas control.
6. Turn on the furnace electrical power.
7. Put thermostat to “Heat” mode and set the room thermostat at least 10°F above room temperature to light the main burners.
8. After the burners are lit, set the room thermostat to a desired temperature.**Unit operation hazard**

These furnaces are equipped with a manual reset limit switch in burner assembly. This switch opens and shuts off power to the gas valve if an overheat condition (flame rollout) occurs in burner assembly. Correct inadequate combustion-air supply or improper venting condition before resetting switch. **DO NOT jumper this switch.**

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

9.3- Setup switches

The furnace control has setup switches that may be set to meet the application requirements. To set these setup switches for the appropriate requirement:

1. Turn off electrical power.
2. Remove upper door.
3. Locate setup switches on furnace control.
4. Configure the set-up switches as necessary for the application.
5. Replace upper door and turn on electrical power.

These switches are ignored on communicating system (using the Alizé and the communicating T-stat).

See Table 10 Dipswitch S1 - Air flow adjustment - Dip switch setting to Table 14 Dipswitch S5 – Dehumidification and 1st stage cooling for more details.

Table 10 Dipswitch S1 - Air flow adjustment - Dip switch setting

	S1-1	S1-2	S1-3	S1-4	DESCRIPTION
FACTORY DEFAULT	OFF	OFF	OFF	OFF	NO ADJUSTMENT
LOW HEAT ADJUSTMENT ONLY (40%)	OFF	ON	OFF	OFF	-7.5% AIR FLOW AT LOW HEAT
	OFF	ON	OFF	ON	-15% AIR FLOW AT LOW HEAT
	OFF	ON	ON	OFF	+7.5% AIRLFOW AT LOW HEAT
	OFF	ON	ON	ON	+15% AIRFLOW AT LOW HEAT
HIGH HEAT ADJUSTMENT ONLY (100%)	ON	OFF	OFF	OFF	-7.5% AIR FLOW AT HIGH HEAT
	ON	OFF	OFF	ON	-15% AIR FLOW AT HIGH HEAT
	ON	OFF	ON	OFF	+7.5% AIR FLOW AT HIGH HEAT
	ON	OFF	ON	ON	+15% AIR FLOW AT HIGH HEAT
ADJUSMENT TO ALL RISE RATE	ON	ON	OFF	OFF	-7.5% AIR FLOW
	ON	ON	OFF	ON	-15% AIR FLOW
	ON	ON	ON	OFF	+7.5% AIR FLOW
	ON	ON	ON	ON	+15% AIR FLOW

Table 11 Dipswitch S3 - Cooling airflow select for non-communicating condenser

S3-1	S3-2	½ HP	1/3 HP	1 HP
OFF	OFF	1200	1600	2000
ON	OFF	1000	1200	1600
OFF	ON	800	1000	1400
ON	ON	600	800	1200

Table 12 Dipswitch S3 - Cooling/heat pump airflow adjustment for non-communicating system

S3-3	S3-4	ALL MOTORS
OFF	OFF	NO ADJUST
ON	OFF	+10%
OFF	ON	-10%
ON	ON	+10%

Table 13 Dipswitch S4 - Heat rise – test mode – continuous fan selection

	S4-1	S4-2	S4-3	S4-4	DESCRIPTION
HEAT RISE	OFF				55°F
	ON				60-65°F
TEST MODE AND T-STAT		OFF	OFF		MODULATING OR 1 STAGE T-STAT
		ON	OFF		40% TEST MODE
		OFF	ON		100% TEST MODE
		ON	ON		2-STAGE OPERATION (WITH 2 STAGE T-STAT)
CONTINUOUS FAN				OFF	NORMAL CFM
				ON	HIGHER CFM

Table 14 Dipswitch S5 – Dehumidification and 1st stage cooling

S5-1	S5-2	Description
OFF		No On demand dehumidification
ON		On demand dehumidification based on HUM STAT terminal (Humidistat required)
	OFF	Normal 1st stage cooling airflow (approx. 70-80% of 2nd stage cooling airflow)
	ON	1st stage cooling airflow is 50% of 2nd stage cooling airflow

Table 15 Dipswitch S3 and S5 – Setting cooling airflow demand

Motor Hp	S5-2	S5-1	CFM			
			S3-1	S3-2	Y1	Y1 + Y2
1HP AND ¾ HP	ON	OFF	OFF	OFF	1400	1800
			OFF	ON	1200	1600
			ON	OFF	1050	1400
			ON	ON	900	1200
		ON	OFF	OFF	1080	1460
			OFF	ON	960	1280
			ON	OFF	840	1120
			ON	ON	720	960
½ HP		OFF	OFF	OFF	900	1200
			OFF	ON	750	1000
			ON	OFF	600	800
			ON	ON	450	600
		ON	OFF	OFF	720	960
			OFF	ON	600	800
			ON	OFF	480	675
			ON	ON	360	480
ALL	OFF	OFF	OFF	OFF	Please refer to tech CFM table in the annex at the end of the manual	
			OFF	ON		
			ON	OFF		
			ON	ON		
		ON	OFF	OFF		
			OFF	ON		
			ON	OFF		
			ON	ON		

9.4- Fault code reset

To clear the fault code memory, push and hold the Fault Recall Button for more than 5 seconds and less than 10 seconds. The right-most Seven-Segment display will energize horizontal upper and lower segments for four seconds. This will clear faults in the buffer displayed at power-up.

9.5- Diagnostic features

The control continuously monitors its own operation and the operation of the system. If the failure is internal to the control, the light will stay on. In this case, the entire control should be replaced, as the control is not field repairable.

If the sensed failure is in the system (external to control), the dual 7 segment red LED will flash error codes.

Refer to Table 17 Fault code for diagnostic.

9.6- Normal operation codes

Refer to Table 16 Normal operation codes/messages.

9.7- Sequence of operation

9.7.1- Heating cycle initiation

The heating cycle is always initiated by a 24 volt signal on W of the thermostat. When the controller senses 24 volts on W or the communicated message for heat call, the following sequence occurs:

⇒ High and low pressure switches are checked to insure contacts are open.

⇒ Inducer is powered on high speed for a thirty (30) second pre-purge.

⇒ Pre-Purge:

There are two different types of pre-purge; a normal pre-purge and a learning-sequence pre-purge. During a learning-sequence pre-purge, the inducer motor will incrementally increase in RPM (stepping) until the low and high pressure switches are both closed. After both switches are sensed to be closed, the inducer motor will continue to run for an additional 30 seconds before the ignition trial.

A learning sequence pre-purge will be initiated under the following conditions:

⇒ First heat call after power reset.

⇒ Every 25th heat call.

⇒ Next heat attempt after a failed pre-purge (pressure switch (es) does not close).

⇒ Next heat attempt after a pressure switch has opened unexpectedly during normal heating operation.

A normal pre-purge will not go through the incremental stepping process of the inducer motor and should be much quicker. The inducer will start at a pre-determined RPM (determined during learning-sequence pre-purge) and this should close both pressure switches quickly. Once both pressure switches are sensed to be closed, the inducer will run for 25 seconds before the ignition trial starts.

⇒ Hot-surface igniter is energized during the pre-purge period.

⇒ The modulating gas valve is set to the highest possible rate (no flow yet).

⇒ The main solenoids on the gas valve are energized allowing gas to flow to the burners.

⇒ When flame is proven, the ignition control is de-energized - 8 second maximum trial times.

⇒ The gas valve maintains 90% rate through the warm-up period - 20 seconds (aka «Blower On Delay»).

9.7.2- Heating cycle response

MODULATING FUNCTION:

(“W” and “V” signal inputs)

After the warm-up period, the furnace will respond to the thermostat demand by adjusting the gas valve pressure and blower speed anywhere between 40 % to 100 % heating capacity.

HEATING CYCLE TERMINATION:

(“W” signal only)

When the 24 volt signal is removed from W1, the heating cycle will end and the furnace will shut down and return to the proper off cycle operation.

9.7.3- Setting input rate

Checking furnace input is important to prevent over firing beyond its design-rated input. **NEVER SET INPUT ABOVE THAT SHOWN ON THE RATING PLATE**. Prior to checking the furnace input, make certain that all other gas appliances are shut off, with the exception of pilot burners. Time the meter with only the furnace in operation. Start the furnace, in Furnace Test Mode (see Table 13 Dipswitch S4 - Heat rise – test mode – continuous fan selection), 100% rate, and measure the time required to burn one cubic foot of gas.

The furnace is shipped from the factory with #48 orifices. They are sized for natural gas having a heating value of 1075 BTU/cu. ft. and a specific gravity of .60.

Since heating values vary geographically, the manifold pressure may need to be changed to adjust the furnace to its nameplate input. Consult the local gas utility to obtain the yearly average heating value.

10- THERMOSTAT

WARNING

Do not apply 24Vac to V/W2 at the furnace control (this is sometimes done during setup, troubleshooting and/or while diagnosing problems). Doing so will damage the thermostat.

10.1- Non-communicating modulating thermostats

The furnace must be installed with the Modulating Touch-Screen Thermostat R02P030 (#1F95M).

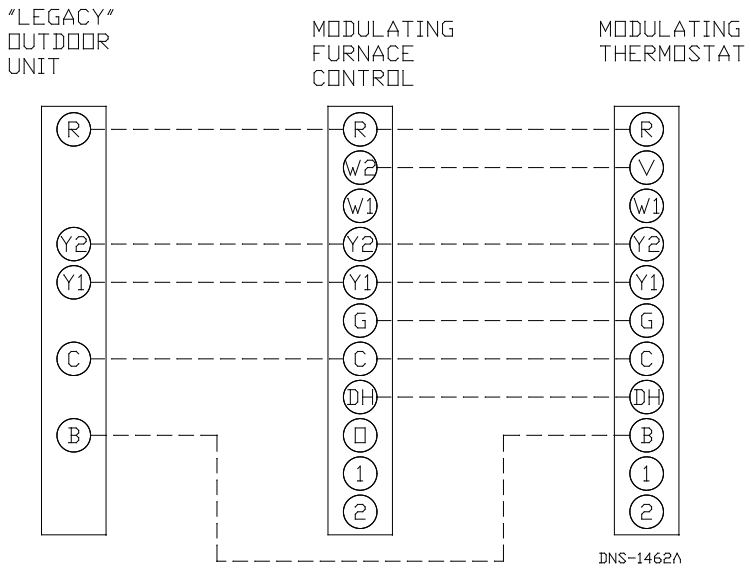
NOTE: Do not use 24 volt control wire smaller than No. 18 AWG.

Wire all non-communicating thermostats to the 24V connections on the integrated furnace control. Figure 24 Wiring diagram for modulating heat (no dual fuel) (non-communicating).

NOTE: A larger wire gage may be required for longer lengths of thermostat wire.

Operations with a non-communicating modulating thermostat are fully modulating between 40% and 100% of furnace capacity. The firing rate is first determined by the thermostat and then sent to the furnace. This is the optimum mode of operation and will give the best temperature control with minimal temperature variation from the desired set point.

Figure 24 Wiring diagram for modulating heat (no dual fuel) (non-communicating)



10.2- 24 VAC thermostat (TSTAT) INPUT (J4 & J6)

These connections are used with any traditional 24 V AC modulating non-communicating, thermostat specified for this modulating furnace. **W1, Y1, Y2, G, C and R** are the traditional thermostat inputs used in nearly all HVAC equipment. Installation of the thermostat to these connections is straight- forward and simple.

HUM STAT – This terminal is used to connect the output of a humidistat to the furnace control to control humidification and/or dehumidification. Optional equipment is required for these features.

V/W2 – This terminal is used to connect the modulating signal (V) from a non-communicating, fully modulating thermostat specified for use with this furnace. It is used to transmit the firing rate (determined by the thermostat) to the furnace control.

NOTE: Do not apply 24 VAC to the V/W2 terminal (as with a jumper to R for diagnostic purposes) with a non-communicating, modulating thermostat.

B - This terminal is used to pass a reversing valve signal to a condenser. It is only a holding place for connecting a wire from the thermostat and a wire from the condenser. It does not change the airflow of the cool/heat commands.

10.3- Fuse (F1)

A three-amp automotive-style (ATC blade type) fuse is supplied on the furnace control board. This fuse should provide protection from short-circuits on the control board and associated 24 VAC wiring.

Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use **ONLY** a 3 amp. It is located on the control board. Refer to Figure 20 Wiring diagram for the location of the fuse.

10.4- 120 VAC terminals

These terminals supply 120 VAC to the furnace control. Additionally, spare terminals are provided for use with electronic air cleaners and other accessories as needed (Check the voltage rating of your equipment.)

10.5- INDUCED DRAFT MOTOR (INDUCER) CONTROL OUTPUT (E8)

This four-pin connector is white and provides control command to both the high and low speed inducer outputs.

Pin 1 to Inducer 12V

Pin 2 to Inducer Rx

Pin 3 to inducer GND

Pin 4 to inducer Tx

10.6- Electronic air cleaner (E.A.C.) output (E-103)

This output is used to energize an electronic air cleaner. The output will provide 1.0 amp at 120 VAC. This output is energized any time the blower motor is above 40% of maximum airflow capacity. Airflow below this value is not considered to be enough for a typical electronic air cleaner to perform properly.

For ½ HP and ¾ HP motors – Electronic air cleaner is energized any time the blower is above 320 CFM

For 1 HP motors - Electronic air cleaner is energized any time the blower is above 800 CFM

10.7- Stepper gas valve control

The furnaces is equipped with a stepper modulating gas valve. A five-pin connector is used to control and sense the gas valve. The valve uses a PWM (Pulse Width Modulated) signal to control the firing rate. The duty cycle of this signal is five percent less than the expected firing rate. For example, if the firing rate is 90%, the PWM to (and from) the valve will be 85% duty cycle. The connector also provides the 24 VAC signal to energize the main valve solenoid. For troubleshooting purposes, follow the wiring diagram in this manual and on the inside of the furnace blower door. Additionally, the pin designations for the connector are specified below:

Pin 1 to stepper modulating gas valve connector Pin 1 (TH)

Pin 2 to stepper modulating gas valve connector Pin 2 (RX)

Pin 3 to stepper modulating gas valve connector Pin 3 (TX)

Pin 4 to stepper modulating gas valve connector Pin 4 (COMMON)

Pin 5 to stepper modulating gas valve connector Pin 5 (MVTH)

10.8- Pin Mate-V-Lok connector (J1)

The 15-pin connector provides connections for a variety of inputs and outputs to the furnace control. The flame sense, pressure switches sense and limits sense (Main Limit, MRLC and HALC) are connected to the I.F.C. through this connector. Reference the wiring diagram for the furnace printed in this document or on the inside of the furnace blower door for pin assignments for troubleshooting.

For troubleshooting purposes, follow the wiring diagram in this manual and on the inside of the furnace blower door.

Additionally, the pin designations for the connector are specified below:

See Figure 25 15-Pin connector; J1 with pin designations.

Pin 1. HLI HIGH LIMIT INPUT

Pin 2. PS1 LOW PRESSURE SWITCH OUTPUT

Pin 3. RLI ROLL OUT SWITCH INPUT

Pin 4. TH 24V HOT

Pin 5. GND GROUND

Pin 6. NOT USED

Pin 7.PSO PRESSURE SWITCH OUTPUT

Pin 8.MVC MAIN VALVE COMMON

Pin 9.ILI INDUCER LIMIT INPUT

Pin 10.HLO HIGH LIMIT OUTPUT

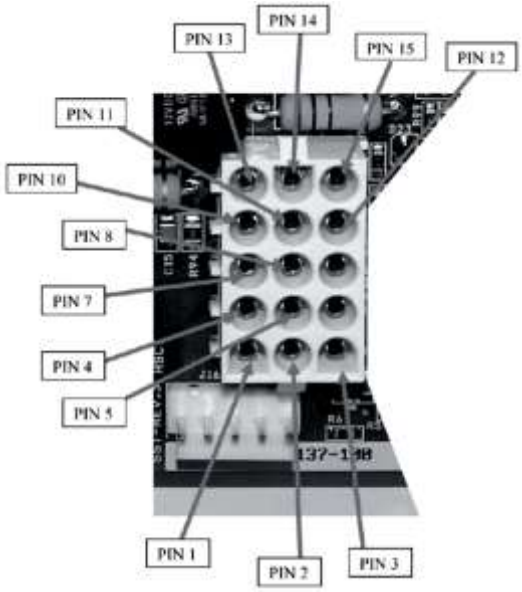
Pin 11.TR 24V RETURN

Pin 12.PS2 SECOND PRESSURE SWITCH OUTPUT

Pin 13.MVL MAIN VALVE LOW

Pin 14.MVH MAIN VALVE HIGH

Figure 25 15-Pin connector; J1 with pin designations



10.9- Communicating ECM motor communications (control) connection (E114)

This connector sends and receives messages to and from the blower motor through a single peer-to-peer network. The blower motor does not communicate on the same communications buss as the furnace, condenser and thermostat. Further, a different communications protocol is used.

For troubleshooting purposes, follow the wiring diagram supplied in this manual and on the inside of the furnace blower door. Additionally, the pin designations for the connector are specified below:

Pin 1 to communicating blower motor connector Pin 1 (+V)

Pin 2 to communicating blower motor connector Pin 2 (TX)

Pin 3 to communicating blower motor connector Pin 3 (RX)

Pin 4 to communicating blower motor connector Pin 4 (C)

10.10- Communications L.E.D.'s (Light emitting diodes)

"RX" (Green) L.E.D. – This L.E.D. indicates that communications is being sensed to or from (i.e.: something on the network is trying to communicate) other components (e.g. a condenser) on the network. This L.E.D. will blink randomly any time a message is received by the furnace control. If no blinking is seen within five minutes, it can be assumed that there is not valid communications established. Check wiring to make sure that all points are connected properly.

Further, if this L.E.D. is on continuously, it is an indication that mis-wiring has occurred.

"STAT" (STATUS) (Red) L.E.D. – This L.E.D. blinks twice slowly (¼ second ON, ¾ second OFF) upon power-up.

Pressing the learn button for two seconds will cause the green "RX" L.E.D. to blink rapidly (for a short period) to indicate an attempt at communications. If the L.E.D. does not blink, communications cannot be established.

10.11- Memory card

A memory card is defined as an electronic card that carries a copy of the furnace shared data.

RULES FOR WRITING, DISTRIBUTION AND ARBITRATION OF MULTIPLE COPIES OF FURNACE SHARED DATA FOR COMMUNICATING - CAPABLE FURNACES

Furnace shared data is defined as data specific to a given furnace that is critical for proper furnace operation. More specifically, it is data which defines the operation of the furnace and is unique to a given furnace platform and model. The most critical of these data are the coefficients that control the blower operation (i.e. define the blower speed-torque operation). Because of this, each furnace control is programmed with furnace shared data for that model furnace only. The furnace shared data from any given furnace can NOT be transferred to another furnace for any reason. Doing so can adversely affect operation of the furnace. Further, if no furnace shared data is present, the furnace will not operate in any mode and a fault will be displayed.

Valid Furnace Shared Data is defined as furnace shared data for the furnace series in question with the correct motor horsepower. However, it is impossible for the furnace control to determine if the furnace shared data is matched to the furnace input BTU's if the motor horsepower is correct. This means, for example, furnace shared data for a 120K BTU upflow furnace could be installed and recognized as valid furnace shared data in a 105KBTU downflow furnace. VALID FURNACE SHARED DATA simply means that there is no motor horsepower conflict and that the furnace shared data is for the series of furnace in question. VALID FURNACE SHARED DATA is data that will be used by the furnace control with no fault reported. VALID FURNACE SHARED DATA may not necessarily mean that the furnace shared data is correct for the furnace in question. The input BTU's could still be incorrect and this is why it is important to **never exchange memory cards from one furnace to another.**

Furnace shared data is programmed into the furnace control microprocessor and attached memory card at the factory. The attached memory card cannot be programmed in the field but furnace shared data inside the furnace IFC microprocessor may be written or rewritten in the field through the network depending on the circumstances.

WARNING

Do not replace the furnace control or memory card of the furnace with a furnace control or memory card of another furnace or another component (e.g. a memory card from a condenser or air handler). The wrong furnace control or memory card may specify parameters which will make the furnace run at undesired conditions including (but not limited to) reduced airflow during heating causing excessive undesired operation of the main limit control. Further, the memory card is specific to the model number and BTU input rating for a specific furnace and this information should not be transported from one furnace (or component) to another.

The memory card is the default memory location to be used first when there is any conflict. If the memory card has been replaced with a card that has data for another furnace, the furnace will assume the identity of the "other" furnace. In all cases, the memory card has the final say about the data to use. It is only when the memory card is not present, is corrupt or specifies a motor larger or smaller than what is found in the furnace that the furnace control will use the data stored in the microprocessor (a mirror of the most recent memory card with blower size matching that found in the furnace). The hierarchy of data to be used in the event of a lost card or conflict is listed in order of importance below.

If no memory card present:

A. Furnace shared data from the "network" is used. Furnace network shared data is defined as a redundant copy (or copies) of the critical furnace shared data stored at various places and components on the communicating network. The "network" can be defined as follows:

   i. The "network" can be the furnace control itself if it was programmed at the factory and the memory card has been removed for some reason.

   ii. The "network" can be a furnace control which has had a valid card previously (either attached or inserted) and removed for some reason.

   iii. The "network" can be a furnace control attached to a communicating condenser and/or thermostat which has copies of the furnace shared data that can be retrieved by the furnace control.

B. A furnace control sent as a replacement part will have no furnace shared data either in the microprocessor or on the memory card. The replacement control does not include a valid memory card. The furnace shared data can be added by:

   i. Inserting a valid memory card (e.g. the original memory card sent with the original furnace control or a valid replacement memory card)

OR

   ii. By attaching the furnace control to a communicating network (e.g. a condenser and thermostat) which was previously connected to (and operating with) a valid furnace control with valid furnace shared data.

Regardless, the memory card of a replacement control cannot be programmed or reprogrammed in the field with furnace shared data and will always remain blank. In fact, this card does not even contain the electronic components necessary to turn it into a valid memory card.

C. In the event that the original memory card is lost, the original furnace control has been replaced and there is no furnace shared data on the network, the replacement memory card must be ordered and installed into the connector at E117 to give the furnace valid furnace shared data. The furnace will not operate properly without the correct furnace shared data. When no furnace shared data is present (either at the memory card or on the network) a "d1" (NO SHARED DATA) fault code will be displayed at the furnace control (I.F.C.) seven-segment displays.

If the original memory card is lost, it should be replaced even if there is valid furnace shared data on the network. The valid furnace shared data

on the network should only be considered as a backup to the memory card.

D. If valid furnace shared data is available from the network and no memory card is present, a “d4” (MEM CARD INVALID) fault is displayed at the furnace seven-segment displays when in standby mode only (see fault code table).

If furnace shared data from the memory card is not valid or is not present and shared data from network can be used, the appropriate fault (d4, d5, d6, d7 or d8 – see fault codes in this manual) is displayed at the furnace seven-segment displays during standby mode only.

If memory card present:

Furnace shared data from the memory card (if valid) will be used to write (or rewrite) the network furnace shared data and furnace shared data from card will be used. If the data on that card is not valid:

A. If furnace shared data on the memory card

i. is corrupt or invalid (“d4”–MEM CARD INVALID”),

and/or

ii. is for another component or different furnace series (“d5”–CARD-HARD CNFLCT),

and/or

iii. does not match the horsepower of the attached motor (“d6”-BLWR HP CNFLCT),

and/or

iv. does not support the motor manufacturer of the motor present (“d7”-BLWR MFG CNFLCT),

and/or

v. is from an older furnace and is missing critical newer furnace shared data (“d8”-OLD SHARED DATA), furnace shared data from the network (if valid) is used to control the furnace (see description of “network” under “If no memory card present” (item i above). Furnace shared data on the network will not be written or rewritten from the memory card. If the furnace shared data on the network is valid, the appropriate fault for the memory card will be displayed at the furnace seven-segment displays when in standby mode only

B. If neither the furnace shared data on the memory card is valid nor the furnace shared data on the network is valid, the fault code status is elevated. The fault code d1 (NO VALID SHARED DATA) is displayed at the furnace seven-segment displays provided a higher priority fault is not also present (in which case the higher priority fault is displayed).

C. If no furnace shared data is available on either the memory card or the network, the fault code “d1” (NO SHARED DATA) is displayed at the furnace seven-segment displays.

10.12- Replacing the furnace control

In the event that the furnace control must be replaced, the memory card must be detached from the original furnace control and retained with the furnace. Failure to save and connect the memory card properly to the replacement control may result in no operation or undesired operation of the furnace.

When replacing the furnace control, be sure to match the dipswitch settings of the original control on the replacement.

NEVER USE A CONTROL BOARD TAKEN FROM ANOTHER FURNACE AS A REPLACEMENT CONTROL FOR THIS FURNACE. FURNACE CONTROLS TAKEN FROM OTHER FURNACES MAY CONTAMINATE THE NETWORK WITH THE WRONG SHARED DATA WHICH CAN ONLY BE FIXED BY REPLACING THE MEMORY CARD WITH THE ORIGINAL MEMORY CARD FROM YOUR FURNACE OR A REPLACEMENT MEMORY CARD DESIGNED FOR YOUR FURNACE.

10.13- Dipswitch

NOTE: The integrated furnace control does not recognize switch setting changes while energized.

Dipswitches are ignored on communicating system.

10.13.1- S1 – Heat air flow adjustment

Dipswitch bank S1 is used to fine-tune the airflow in the heating mode. The switches of bank S1 can be set to adjust either the minimum heat rate airflow or the maximum heat rate airflow or both. Also, every firing rate in between these points will be adjusted accordingly.

NOTE: All dip switches on S1 will be shipped in the “OFF” position. See Table 10 Dipswitch S1 - Air flow adjustment - Dip switch setting for Heating Adjustment Selections.

10.13.2- S3-1 and S3-2 – Cooling airflow select

These dipswitches are used to select the appropriate cooling airflow based on the amount required. The switch settings do not affect cooling airflow when installed with a fully communicating condenser. In that case, the condenser supplies the information for cooling airflow which is pre-set at the factory and not adjustable.

The target cooling airflow will be determined by the adjustments of S3-1 and S3-2. Furnaces with ½ HP motors will have a maximum target airflow setting of 800 CFM. Furnace with 1 HP motors will have a maximum target airflow setting of 2,000 CFM. The airflow achieved may be less than the target depending of the static pressure in the supply air duct.

See Table 11 Dipswitch S3 - Cooling airflow select for non-communicating condenser. Cooling airflow is also affected by the settings of dipswitch position S5-2. This switch will determine the appropriate amount of airflow to be used for the low stage (1st stage) of cooling.

Target airflow settings and adjustments are based on the positions of the dipswitches S3-1, S3-2, S3-3, S3-4 and S5-2.

10.13.3- S3-3 and S3-4 – Cooling and heat pump air flow adjustment

Cooling airflow can be adjusted approximately +/- 10% by using the cool trim adjustment dipswitches; S3-3 and S3-4. See Table 12 Dipswitch S3 - Cooling/heat pump airflow adjustment for non-communicating system.

These dipswitches are used to adjust the cooling and heat-pump airflow slightly based on the user’s preference.

10.13.4- S4 – Heat rise adjust

S4-1 HEAT RISE ADJUST – This dipswitch is used to select desired temperature rise in the heating mode. The heat rise will always be closer to the target if the supply air sensor is properly installed.

“OFF” will yield the minimum heat rise. (Target heat rise is 55°F or 65°F but this value may vary between low and high fire.)

“ON” will decrease the airflow to yield the maximum heat rise. (Target heat rise is 60°F - 65°F but this value may vary between low and high fire.)

S4-4 FAN SPEED SELECT – This dipswitch is used to select the continuous fan speed. **This switch is ignored on a communicating system.**

S4-2 and S4-3 - FURNACE TEST and OPERATING MODES

The Test Switches will place the IFC into a test mode, operating the furnace at continuous input rates of either 100% of full rate (maximum fire) or 40% of full rate (minimum fire). This is accomplished by setting the Test Switches. See Table 13 Dipswitch S4 - Heat rise – test mode – continuous fan selection.

To enter the Furnace Test Mode, proceed as follows:

1. Switch the 120 volt power to the furnace OFF. Do not change settings with control energized.
2. Position Test Switches for the desired test mode.

3. Switch the 120 volt power to the furnace ON.
4. Set the thermostat mode to HEAT; adjust the set point at least 4°F above room temperature to demand a call for heating.

The furnace will operate at the fixed Test mode until one of the following conditions:

A. The thermostat is satisfied and the call for heat is removed.

B. The furnace has been in test mode continuously for sixty minutes, at which time the furnace control (IFC) will exit the test mode and proceed to normal heating operation as configured. Test mode cannot be activated again unless line voltage power to the furnace is cycled off and back on. This is true even if the dipswitches remain configured to the test settings

To set the furnace for normal operation:

1. Set the thermostat mode to OFF.
2. Always allow furnace to complete the cool down cycle.
3. Switch the 120 volt power to the furnace OFF. **Do not change settings with control energized.**
4. Position dipswitches for modulating/single-stage mode.
5. Switch the 120 volt power to the furnace ON.
6. Set the thermostat.

10.13.5- S5 – Cooling

S5-1 - ODD "ON" or "OFF" select:

This switch will ignore the input from the 24 volt terminal labeled "HUM STAT" during cooling when in the "OFF" position. However, the "HUM STAT" input is always read in the heating mode to turn on and off the humidifier relay.

S5-2:

Placing S5-2 in the "ON" position will establish the low (Y1) cooling airflow at half of the max cool (Y2) airflow. This setting will be useful with cooling systems where two compressors are used to control two cooling stages (one compressor for first stage and two compressors for second stage)

11- USER'S INFORMATION MANUAL

Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance. Installation and service must be performed by a qualified installer, service agency, or the gas supplier.

Read all instructions in this manual and retain this and all additional instructions for future reference.

To keep your operating costs low and to eliminate unnecessary service calls, we have provided a few guidelines. These guidelines will help you understand how your gas furnace operates and how to maintain it so you can get years of safe and dependable service. Read all the instructions in this manual, and keep all manuals for future reference.

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. Follow the gas supplier's instructions.
⇒ If you cannot reach the gas supplier, call the fire department.

For your safety, read the following before operating your furnace:

1. The furnace area must be kept clear and free of combustible materials, gasoline, and other flammable vapors and liquids.
2. Insulating materials may be combustible. A furnace installed in an attic or other insulated space must be kept free and clear of insulating materials. Examine the furnace when it is installed and also any time insulation is added.
3. For proper safe operation, the furnace needs air for combustion and ventilation. Do not block or obstruct air openings to the area in which the furnace is installed, and the spacing around the furnace.
4. This furnace is equipped with an ignition device which automatically lights the burners. See OPERATING YOUR FURNACE for information on lighting and shutting down the furnace.
5. Should the gas supply fail to shut off or if overheating occurs, shut off the gas valve to the furnace before shutting off the electrical supply.
6. Do not use the furnace if any part has been under water. A flood damaged furnace is extremely dangerous. Attempts to use the furnace can result in fire or explosion. A qualified service agency should be contacted to inspect the furnace and to replace all gas controls, control system parts, electrical parts that have been wet, or the entire furnace if deemed necessary.
7. Examine the furnace installation to determine that:
   a) All flue gas carrying areas external to the furnace, such as the chimney and vent connector, are clear and free of obstructions.
   b) Vent connector is in place, slopes upward, and is physically sound without holes or excessive corrosion.
   c) Return air duct connection(s) is physically sound, sealed to the furnace casing, and terminates outside the space containing the furnace.
   d) Physical support of the furnace is sound without sagging, cracks, gaps, etc. around the base as to provide a seal between the support and the base.
   e) There are no obvious signs of deterioration of the furnace.
   f) Burner flames are in good adjustment.
8. It is important that you conduct a physical inspection of the furnace at least twice a year. It is also recommended that the furnace should be inspected by a qualified service agent at least once per year.

11.1- Operating your furnace

These furnaces are equipped with an ignition device which automatically lights the burners. **Do not try to light the burners by hand.**

Before operating, smell around furnace area for gas. Be sure to smell near floor because some gas is heavier than air and will settle to the lowest point. See **WHAT TO DO IF YOU SMELL GAS** under User's information manual if the odour of gas is present. Use only your hand to turn the gas control knob; **never use tools.** If the knob will not turn by hand, don't try to repair it. Call a qualified service technician. **Force or attempted repair may result in a fire or explosion.**

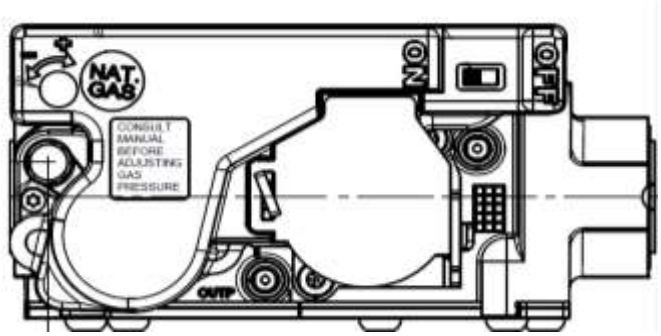
11.2- Lighting instructions

1. **STOP!** Read the previous safety information.
2. Set the thermostat to the lowest setting.
3. Turn off all electric power to the furnace.
4. Remove the burner compartment access panel.
5. This appliance is equipped with an automatic ignition device.

Do not try to light the burners by hand.

Move the gas control switch to “OFF” (see Figure 26 Control switch modulating valve).

Figure 26 Control switch modulating valve



6. Wait 5 minutes to clear out any gas, then smell for gas (including at the bottom of the unit near the ground). If you smell gas, stop and follow the directions in **WHAT TO DO IF YOU SMELL GAS**. If you don’t smell gas, continue to next step.
7. Move the gas control knob or switch to “ON”.
8. Replace the burner compartment access panel.
9. Turn on all electric power to the furnace.
10. Set the thermostat to the desired setting.
11. If the furnace will not operate, follow the instructions found below in to turn off Gas to Furnace and call your service technician or gas supplier.

11.3- Shutting down the furnace

To shut down the furnace, set the thermostat to the “OFF” position.

11.4- To turn off gas to the furnace

1. Set the thermostat to the lowest setting.
2. Turn off all electric power to the furnace if service is to be performed.
3. Remove the burner compartment access panel.
4. Move the gas control knob or switch to “OFF” (see Figure 26 Control switch modulating valve). Do not force.

11.5- Maintenance of your furnace

WARNING

ELECTRICAL SHOCK, FIRE,OR EXPLOSION HAZARD

Failure to follow the 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 disconnecting. Reconnect wires correctly.
- ⇒ Verify proper operation after servicing.

There are routine maintenance steps you should take to keep your furnace operating efficiently. This maintenance will assure longer life, lower operating costs, and fewer service calls.

In addition to the maintenance procedures listed in this manual, there are also other service and maintenance procedures that require the skills of a service person that has specialized tools and training. **Personal injury can result if you are not qualified to do this work.** Please call your dealer when service is needed.

Your gas furnace is designed to give many years of efficient, satisfactory service. However, the varied air pollutants commonly found in most areas can affect longevity and safety. Chemicals contained in everyday household items such as laundry detergents, cleaning sprays, hair sprays, deodorizers, and other products which produce airborne residuals may have an adverse effect upon the metals used to construct your appliance. The cabinet of the furnace can be cleaned with soap and water. Grease spots can be removed with a household cleaning agent.

It is important that you conduct periodic physical inspections of your appliance, paying special attention to the gas burner and the flue outlet from the furnace. These components are located at the front of the unit. A flashlight will be useful for these inspections. Make one inspection prior to the beginning of the heating season and another during the middle.

Should you observe unusual amounts of any of the following conditions, it is important that you call your authorized dealer at once to obtain a qualified service inspection:

- ⇒ Rust, flakes, or other deposits
- ⇒ Coatings
- ⇒ Corrosion

Even if no unusual rust or other conditions are observed, it is recommended that the furnace be inspected and serviced at least once per year by a qualified service technician. Regular inspections and planned maintenance will assure many years of economic performance from your gas furnace.

11.6- Combustion and ventilation air

Adequate air supply in single pipe application must be provided to furnaces located in a closet, alcove, or utility room by means of a grilles in the lower part of the door, or by the introduction of outside air, or both, in accordance with the National Fuel Gas Code, ANSI Z223.1/ NFPA 54 (latest edition) or the CSA B149.1, Natural Gas and Propane Installation Codes, and local codes.

Adequate combustion and ventilation air must reach the furnace to provide for proper and safe operation. Air openings in front of furnace must be kept free of obstructions. Any obstruction may cause improper operation that can result in a fire hazard or carbon monoxide injury.

Venting of this furnace must comply with the unit Installation Instructions. Be sure the installer has followed these requirements. If not, you should request the installer to comply.

For your safety, please note the following:

1. Condensing furnaces must not be vented with any other appliance. The flue (vent) system is under positive pressure from the power venter. Connection of any other appliance to the furnace flue may create a hazardous condition that could cause either appliance to malfunction.
2. This furnace is not designed for use with a vent damper. Use of such a device will not improve the efficiency of this furnace. The vent from your furnace may rise vertically and terminate above the roof. The vent may also be run horizontally through an exterior wall. Make sure all flue product materials external to the furnace are clear and free of any obstruction, slope upward, and have no holes or leaks. For proper venting terminations, see Figure 22 Direct venting. If this furnace is a direct vent (2 pipe) installation, it requires that all the air necessary for combustion be supplied from outside the dwelling through an air intake pipe. You should inspect the air intake and flue product carrying areas external to the furnace to determine they are clear and free of obstructions. You should also check to see that the vent air intake system is in place, physically sound, sealed to the furnace casing, and terminating outside the space containing the furnace.

Check to see that the furnace cabinet is sound and firmly supported, without sagging. There should be no cracks or gaps between the furnace and the base or floor, which would permit entry of unfiltered air.

It is important that the outside area where the vent terminates is kept clear of any obstructions which might block or impede the venting of the furnace. Should venting become blocked at any time, your furnace is equipped with a special safety control to prevent operation of the furnace until the condition has been corrected. Contact your dealer if you desire more information about this important safety feature.

NOTE: After any heavy snow, ice or frozen fog event the furnace vent pipes may become restricted. Always check the vent system and remove any snow or ice that may be obstructing the intake or exhaust plastic pipes.

Should any unusual conditions be observed during your inspections, call an authorized service dealer immediately.

11.7- Return air

All return air duct connections must be tight and sealed to furnace cabinet and all return air grilles or registers must be located outside the space containing the furnace.

11.8- Filter location

The filter on your furnace will be located in one of two different locations:

⇒ On one side of the furnace

⇒ On the bottom of the furnace

11.8.1- Cleaning/replacing the filter

It is very important to clean or replace the air filter regularly.

Dirty filters are the most common cause of inadequate heating or cooling performance and can sharply increase the operational costs of your unit. In some cases, they can double the cost. **The air filter should be inspected at least every 6 weeks and cleaned or replaced as required.**

Your furnace may use either a disposable filter or a cleanable filter. The type of filter may be indicated on a label attached to the filter. If a disposable filter is used, replace with the same type and size. To remove excess dirt from a cleanable filter, shake filter and/or use a vacuum cleaner. Wash filter in soap or detergent water and replace after filter is dry.

Cleanable filters do not need to be oiled after washing. Cleanable filters may be replaced with disposable filters.

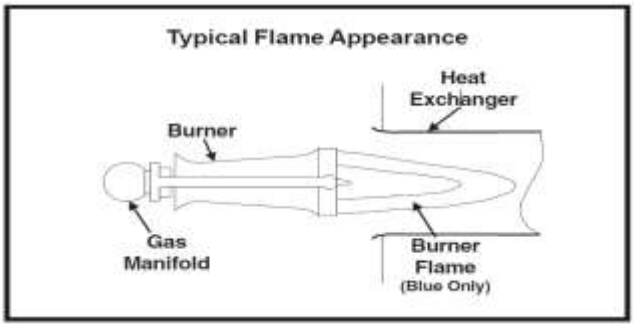
11.9- Lubrication

Lubrication of the bearings in the circulating air blower motor and the combustion blower motor **is not** recommended. These motor are permanently lubricated.

11.10- Burner flame

While the furnace is in operation, observe the burner flames. Compare these observations to Figure 27 Typical flame appearance to determine if proper flame adjustment is present. If your observations indicate improper flame adjustment, call your authorized service dealer for service. **Do not attempt to adjust flame!** Your service representative will perform this adjustment correctly.

Figure 27 Typical flame appearance



11.11- Condensate collection and disposal system

The condensate system must not be exposed to temperatures under 32°F.

Make sure the condensate drain line does not become blocked or plugged. Visual inspection of condensate flow can easily be made while the furnace is operating. Use a flashlight to illuminate the discharge end of the condensate drain that is placed in the sewer opening. The furnace will not operate properly if the condensate drain line becomes blocked or plugged. If this event occurs, have the furnace inspected by a qualified service technician.

11.12- Rollout switch

This unit is equipped with a manual reset high temperature sensor or rollout switch. In the unlikely event of a sustained burner flame rollout, the rollout switch will shut off the flow of gas by closing the gas valve. The switch is located inside the gas burner area. Flame rollout can be caused by blockage of the power vent system, a blocked heat exchanger, or improper gas pressure or adjustment. If this event occurs, the unit will not operate properly. The gas supply to the unit should be shut off and **no attempt should be made to place it in operation.** The system should be inspected by a qualified service technician.

11.13- Safety interlock switch

The blower compartment door on your high efficiency gas furnace is equipped with a safety interlock switch that will automatically shut off your complete system (including blower) once the door is removed. This is for your personal safety. Be sure to check your furnace for proper operation once the door or panel has been replaced. If the system does not operate once the panel has been replaced, try removing and replacing it once again. If the furnace still does not operate, call your dealer for service.

11.14- Repair parts

The repair parts are available from your local distributor. When ordering parts, include the complete furnace model number and serial number, which are printed on the rating plate, located on the furnace.

11.15- Dual seven segment display

The dual seven-segment diagnostic display will either display the status of the system (e.g. “H” for Heat) or a diagnostic error code in the event of an active fault. Fault and status codes and their meanings can be determined from Table 17 Fault code

11.16- Fault code buffer

Upon power reset, the last five fault codes from the furnace will be displayed on the seven-segment display. These will be displayed in chronological order from newest (displayed first) to oldest (displayed last).

NOTE: The following fault codes will not be stored back-to-back in the fault buffer. These will only be stored in the buffer if the previous fault stored was a different fault: 11, 45, 46 & 57.

11.16.1- Clearing diagnostic fault codes from the buffer

To clear the fault codes in the fault buffer, push and hold down the “Fault Recall” button for 3 seconds. When this is done, the right-most seven-segment display will energize the upper and lower horizontal segments for four seconds as confirmation that the fault codes have been cleared from the buffer. Be sure to return the switch to the original position after clearing the faults.

11.17- Active fault codes

Two levels of fault codes exist: (1) Non- critical and (2) Critical. In general a non-critical fault permits all (or nearly all) operations to proceed and a critical fault prevents all (or nearly all) operations from proceeding.

When using communicating thermostat (with the Alize system), active faults of either level will be displayed at the thermostat in the “ACTIVE FAULT” area. To enter the furnace “ACTIVE FAULT” area using a communication thermostat, see the installation and operation instruction provided with the thermostat.

Table 16 Normal operation codes/messages

NORMAL OPERATION CODES / MESSAGES	
CODE DISPLAYED AT FURNACE	**DESCRIPTION**
0	Standby mode - no thermostat calls, no active faults.
c	Low-stage cooling
C	High-stage cooling (displayed during both low and high cooling in comm.
F	Continuous Fan Operation
hp	Low-stage heat-pump operation
HP	High-stage heat-pump operation
H (steady)	Furnace heat with valid modulation signal
h (steady)	Heat call with no valid modulation signal (legacy modes only)

NOTE: The text in the box shows combinations of upper-case and lower-case letters.

Table 17 Fault code

FAULT CODE	**DISPLAYED TEXT CODE AT DUAL 7-SEGMENT DISPLAY OF IFC& FAULT AREA OF COMM. THERMOSTAT**
	STATUS
	DESCRIPTION
	EXPECTED OPERATION
	CAUSE
	SOLUTION

Table 18 D1 - No shared data

Code at dual 7 segment display of I.F.C.:	D1
Status :	This is a critical fault. The furnace will not operate in any mode.
Description :	This code displays anytime there is no shared data at the furnace. The shared data is electronically stored data that is used to define (among other things) blower operation. Without the shared data, the furnace cannot function. Note that shared data may be available even if there is no card attached to the furnace control. A missing memory card will display fault code ''D4'' if shared data is available to the network.
Expected operation	No operation (including thermostat) will be permitted without the shared data. The shared data defines the IBM (Indoor blower motor) speed-torque curve. Without this information, the IBM cannot operate.
Cause :	Typically, the memory card will be missing from the furnace. In most cases, the cause of this fault will be the loss or disconnection of the original memory card from the furnace contral (or I.F.C) . When the furnace control (I.F.C.) is replaced, the memory card must be broken away, saved and installed int the replacement control. This is explained in details in the section of this book titled “Replacing the furnace control”.
Solution :	Replace the missing memory card into the connector labelled J15 on the furnace control (I.F.C.). If the original card cannot be found, a replacement card can be ordered. Be sure to order the correct memory card for the furnace. **NOTE** : Furnace power must be cycled off and then on again after replacing the card or the shared data will not be read.

Table 19 D4 - Memory card

Code at dual 7 segment display of I.F.C.:	D4
Status :	This is non-critical fault. The furnace should operate in any mode.
Description :	The memory card inserted into the slot at position E117 of the furnace control is corrupt OR there is no memory card installed at all. However, a valid copy of shared data for the furnace can be retrieved from the network.
Expected operation	Shared data from the memory card cannot be used because it is invalid. During the first (up to) five minutes of operation after power reset, the furnace may not respond to the thermostat calls and/or fan calls (from either the thermostat or the condenser) while the furnace is searching the network for valid shared data. Until valid shared data is found, no operation will take place. Once valid network shared data has been found, operation should proceed as normal with this fault (d4) only being displayed during the standby mode. If no valid network shared data is found, the d4 fault will be replaced by d1 fault (see d1) and no operation will take place until the issue is repaired.
Cause :	This fault is displayed when there is no information on the memory card (blank) or the memory card has corrupted and cannot be properly used.
Solution :	Remove the memory card and replace with the original memory card from the furnace or the correct replacement memory card. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger. If the original memory card for the furnace control is available and working, it must be used.** A correct replacement memory card can be ordered. Be sure to have the furnace model and serial number available when ordering.

Table 20 D5 - Card hardware conflict

Code at dual 7 segment display of I.F.C.:	D5
Status :	This is a non-critical fault. The furnace should operate in any mode.
Description :	The memory card inserted into the slot at position E117 of the furnace control is not correct for the furnace application.
Expected operation	Shared data from the memory card cannot be used because it is invalid. During the first (up to) five minutes of operation after power reset, the furnace may not respond to thermostat calls and/or fan calls (from either the thermostat or the condenser) while the furnace is searching the network for valid shared data. Until valid shared data is found, no operation will take place. Once valid network shared data has been found, operation should proceed as normal with this fault (d5) only being displayed during the standby mode. If no valid network shared data is found, the d5 fault will be replaced by a d1 fault (see d1) and no operation will take place until the issue is repaired.
Cause :	There are a couple of reasons that this fault might be displayed: (1) The memory card inserted is from a different type of furnace (e.g.: from a two stages furnace). (2) The memory card inserted is from another invalid unit.
Solution :	Remove the memory card and replace with the original memory card from the furnace or the correct replacement memory card. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger. If the original memory card for the furnace control is available and working, it must be used.** A correct replacement memory card can be ordered. Be sure to have the furnace model and serial number available when ordering.

Table 21 D6 - Blower horsepower conflict

Code at dual 7 segment display of I.F.C.:	D6
Status :	This is a non-critical fault. The furnace should operate in any mode.
Description :	The horsepower reported by the motor does not match the horsepower stored in memory in the shared data of the memory card or furnace control.
Expected operation	Shared data from the memory card cannot be used because it is invalid during the first (up to five minutes of operation after power reset, the furnace may not respond to thermostat calls and/or fan calls from either the thermostat or the condenser) while the furnace is searching the network for valid shared data. Until valid shared data is found, no operation will take place. Once valid network shared data has been found, operation should proceed as normal with this fault (D5) only being displayed during the standby mode. If no valid network shared data is found, the D5 fault will be replaced by a D1 fault (see D1) and no operation will take place until the issue is repaired.
Cause :	A motor manufactured by a non-supported OEM at the time of production of the furnace control and/or an invalid memory card is used to replace the blower motor.
Solution :	Either (1) replace the blower motor with a supported motor or (2) replace the memory card and/or furnace control with a newer updated version that supports the newer motor. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger**.

Table 22 D7 - Blower manufacturer conflict

Code at dual 7 segment display of I.F.C.:	D7
Status :	This is a non-critical fault. The furnace should operate in any mode.
Description :	This fault code is displayed any time the blower motor attached is able to communicate with the furnace control but is not recognized by the furnace control. If the motor attached is from a new manufacturer which was not supported at the time of production of the furnace control or memory card. The furnace control will not recognize the newer motor. For example, the motor available to be used in production at the time of this writing was Regal Beloit (RB) (formerly GE) and Emerson. If a Panasonic motor were added in the future, the Panasonic motor would not be recognize by the production control board and memory card made today. The d7 fault code would be displayed. Refer to the section of this manual titled “INTEGRATED FURNACE CONTROL” under the subsection titled “MEMORY CARD” for details on the hierarchy to use of multiple copies of shared data and distribution (among other details) of shared data.
Expected operation	Shared data from the memory card cannot be used because it is invalid. During the first (up to) five minutes of operation after power reset, the furnace may not respond to thermostat calls and/or fan calls. (from) either the thermostat or the condenser) while the furnace is searching the network for valid shared data. Until valid shared data is found, no operation will take place. Once valid network shared data has been found, operation should proceed as normal with this fault (d7) only being displayed during the standby mode. If no valid network shared data is found, the d7 fault will be replaced by a d1 fault (see d1) and no operation will take place until the issue is repaired.
Cause :	A motor manufactured by a non-supported OEM at the time of production of the furnace control and/or memory card is used to replace the blower motor.
Solution :	Either (1) replace the blower motor with a supported motor or (2) replace the memory Card and/or furnace control with a newer updated version that supports the newer motor. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger.**

Table 23 D8 - old shared data

Code at dual 7 segment display of I.F.C.:	D8
Status :	This is a non-critical fault. The furnace should operate in any mode.
Description :	This message is intended for future applications where the shared data of a newer furnace has been replaced with shared data from an older furnace. If, in the future, a new parameter is added to the shared data, an older memory card in this hypothetical furnace will force this fault to be displayed. If the new shared data parameter is critical to furnace operation, the furnace will use shared data from the network if available.
Expected operation	Shared data from the memory card cannot be used because it is invalid. During the first (up to) five minutes of operation after power reset, the furnace may not respond to thermostat calls and/or fan calls. (from) either the thermostat or the condenser) while the furnace is searching the network for valid shared data. Until valid shared data is found, no operation will take place. Once valid network shared data has been found, operation should proceed as normal with this fault (d8) only being displayed during the standby mode. If no valid network shared data is found, the d8 fault will be replaced by a d1 fault (see d1) and no operation will take place until the issue is repaired.
Cause :	The incorrect memory card has been used with the furnace control. Specifically, an older memory card has been used with a newer furnace and some operation (perhaps critical) cannot be performed by the furnace.
Solution :	Replace the older memory card with a newer card. If the original memory card for the furnace is available, it must be used. **Never replace the memory card of a furnace with a memory card from another furnace or component (e.g. condenser or air handler). Doing so could result in improper operation of the blower which may cause damage to the heat exchanger. If the original memory card for the furnace control is available and working, it must be used.** A correct replacement memory can be ordered. Be sure to have the furnace model and serial number available when ordering.

Table 24 h – NO V

Code at dual 7 segment display of I.F.C.:	h
Status :	This message is displayed only when using a 24v non modulating thermostat. The status is low-level and is not critical to furnace operation. However, the furnace's capacity to function in the best possible manner is slightly compromised. The code will only be displayed at the furnace control (or I.F.C.) dual seven-segment display.
Description :	When the lower-case "h" is displayed at the furnace control (or I.F.C.) dual seven-segment display, it indicates that the furnace is operating in heat mode and providing heat but the modulation function has been compromised. Two stages or even three-stage operation is possible (through a timed algorithm) but full modulation will not be possible.
Expected operation	Operation should proceed as normal with a perceivable difference in heating mode. This operation may either be single or two stage staging operation as defined by the dipswitches at SW2-2 and SW2-3 and may be as expected if neither a fully communicating thermostat nor non-communicating, fully modulating thermostat is used and indicates that the "V" signal is not present as it should be. If this is the case, operation will be compromised and (most likely) only low-stage heat will be delivered. The thermostat may not satisfy properly and it will seem as if the furnace will not be able to deliver enough heat to "keep-up".
Cause :	The modulating "V" signal cannot be sensed by the furnace control. This may be OK if either a traditional single stage or two stages, non-communicating thermostat is used with a modulating furnace. If this is the case, the lower case "h" is normally displayed during heating operation and does not indicate abnormal operation. However, if a fully modulating, non-communicating thermostat is used and this message is displayed. It indicates the furnace control is not sensing the modulating "V" signal from the thermostat. A lower-case "h" should never be displayed during any operation with a fully communicating thermostat.
Solution :	If a single stage or two stage, non-communicating thermostat is used, this operation is normal and no action needs to be taken. However, if the thermostat is fully modulating and non-communicating, the "V" signal is not being sensed by the furnace control (or I.F.C.) microprocessor. The connection (including wiring, wire nuts and etc.) should be checked first. If the connection is correct and OK, check the thermostat and then the furnace control (or I.F.C.).

Table 25 10 - Ignition 1 hour retry

Code at dual 7 segment display of I.F.C.:	10
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) the furnace control (or I.F.C.) will attempt to light three more times before displaying "10" again and entering the second one-hour lockout. This cycle will repeat indefinitely until gas heat is established or the heat call has ended.
Description :	This fault is displayed after four failed ignition attempts. After four attempts to ignite without success, the furnace control (or I.F.C.) goes into a lockout mode and will not attempt ignition again for one hour.
Expected operation	After four failed ignition attempts (see fault code "11"), the furnace control (I.F.C.) will display "10" and will wait one hour before removing the "10" from the display and attempting the next ignition cycle provided the heat call is still present. If the first attempt at ignition after the one hour lockout is unsuccessful, the furnace control (I.F.C.) will attempt to light three more times before displaying "10" again and entering the second one-hour lockout. This cycle will repeat indefinitely until gas heat is established or the heat call has ended.
Cause :	1. Is unable to sense flame. It may need cleaning or may not be properly connected. 2. The igniter is not working properly. It may not be properly connected or the spark location may not be correct. 3. The furnace control may not be working properly and may need to be replaced. 4. The flame may not be properly spreading from the first burner to the last.
Solution :	The solution will depend on the cause. Solutions to noted causes (1), (2), (3) and (4) Above are: 1. Clean or replace the flame sense rod or check all connections and wire between the rod and the gas furnace control (or I.F.C.). 2. Replace or reposition the igniter or check all connections and wire between the igniter and the furnace control (or I.F.C.) 3. Replace the furnace control. 4. Check the manifold pressure during ignition. For natural gas it should be approx. 3.5" w.c. and for LP gas it should be 11" w.c. If manifold pressure is good, watch the burner during ignition. If the first burner lights, but the second, third and so on do not light, the burner may need to be replaced.

Table 26 11 - Failed ignition

Code at dual 7 segment display of I.F.C.:	11
Status :	Up to three failed ignitions will not constitute a critical condition. Critical condition (with no heating operation) is only noted when the furnace has failed to ignite four or more ties in a row. After four failed ignition attempts, the fault code will change from “11” to “10” and will read as described under the description for fault code “10”.
Description :	The fault is displayed at the furnace control after the first failed ignition attempt. It continues to be displayed until successful ignition or the furnace control has failed to ignite four consecutive times. After four attempts, the status of the fault is elevated to “10” and the furnace control (or I.F.C.) reacts as described under description for the fault code “10”.
Expected operation	After the first failed ignition attempt, the fault (“11”) is displayed and the inducer will complete a 20 second post-purge followed by a second ignition attempts. This cycle will be repeat until gas heat is established or until the fourth ignition attempt. After the fourth attempt, the furnace control (I.F.C.) will proceed to one-hour lockout as described under the fault code “10”.
Cause :	There can be several causes for a failed ignition attempt(s). The most common are: 1. The flame sense rod is unable to sense flame. It may need cleaning or may not be properly connected. 2. The gas valve may be turned off. 3. The igniter is not working properly. It may not be properly connected or the spark location may not be correct. 4. The furnace control may not be working properly and may need to be replaced. 5. The flame may not be properly spreading from the first burner to the last.
Solution :	The solutions depend on the cause. Solutions to noted causes (1) to (5) above are: 1. Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.) Make sure furnace ground is properly connected. 2. Turn the valve on. 3. Replace or reposition the igniter or check all connections and wire between the igniter and the furnace control (or I.F.C.). 4. Replace the furnace control. 5. Check the manifold pressure during ignition. For natural gas it should be approx. 3.5” W.C. and for LP gas it should be 11” W.C. If manifold pressure is good, watch the burner during ignition. If the first burner lights, but the second, third and so on do not light, the burner may need to be replaced.

Table 27 12 - Low flame sense

Code at dual 7 segment display of I.F.C.:	12
Status :	The status of this fault is non-critical and furnace operation will continue as normal in heating (and all other) mode(s). If flame sense is low, the furnace control (or I.F.C.) may soon no longer be able to properly sense the flame and status of the problem may be elevated to the level of fault code “13” or fault “11” (if flame cannot be sensed at all).
Description :	The flame sense current from the flame sense rod at the furnace control (or I.F.C.) is weak or marginal at best.
Expected operation	All operation (including gas heat) will proceed as normal with only the fault code (“12”) displayed at the furnace control (or I.F.C.) and “LOW FLAME SENSE” displayed in the fault area of a communicating thermostat.
Cause :	1. The most common cause for low flames sense during heat operation is that the flame sense rod may need cleaning or may not be properly connected or wiring between the rod and the furnace control may be shorted or opened. 2. Another cause for low flame may be an improperly mounted or poorly grounded flame sensor.
Solution :	1. Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.). 2. Reinstall or replace flame sensor and check wiring and connections. Also make sure the furnace is properly grounded.

Table 28 13 - Flame lost

Code at dual 7 segment display of I.F.C.:	13
Status :	Flame lost is not a critical fault. Subsequent ignition attempts will follow and normal operation should resume. However, a lost flame can often be followed by failed ignition attempts then a one-hour lockout. Once the status has reached one-hour lockout, the fault condition is critical (although attempts at ignition will be made again after the 1 hour lockout) and furnace operation will proceed as described under "10" ("IGN 1 HR RTRY").
Description :	After a successful ignition trial, the flame (which was properly sensed) is no longer sensed. This can happen any time after successful ignition while a valid heat call is present.
Expected operation	When flame is lost, the fault code ("13") is immediately displayed at the IFC SSD's. The IBM (Indoor Blower Motor) is energized (if it was not already) at the correct speed (based on the demand from the thermostat) and completes a 90 second blower off delay. The IDM (Induced Draft Motor) remains energized at the most recent speed (based on the demand from the thermostat or as required for ignition cycle) for a 20 second post-purge. After both the post-purge and blower off delay are complete, the fault code ("13") is removed and a new attempt at ignition is made. Often, the new ignition attempt will fail and operation will proceed as though a failed ignition has occurred from that point (see fault code "11"). Note: This fault will not be displayed to the homeowner on communicating systems unless it occurs at least three times within a single heat call. It will not be displayed to the homeowner after the first or even second failure. However, it will be displayed in the active fault screen of thermostat immediately after the first failure (and all subsequent failures) during a single heat call. Further, this fault (13) will only be logged into the fault buffer one time. It will not log more than once in the buffer."
Cause :	1. The most common cause for low flame sense during heat operation is that the flame sense rod may need cleaning or may not be properly connected or wiring between the rod and the furnace control may be shorted or opened. 2. Another cause for low flame may be an improperly mounted or poorly grounded flame sensor. 3. Flame pattern may be unsafe.
Solution :	1. Clean or replace the flame sense rod or check all connections and wire between the rod and the furnace control (or I.F.C.). 2. Reinstall or replace flame sensor and check wiring and connections. Also **make** sure the furnace is properly grounded. 3. Check that all burner assembly components are properly installed. Check for good seals between the burner and blower compartments. Insure that the combustion door gasket is in place and the door is properly installed and sealed.

Table 29 16 - Igniter fail

Code at dual 7 segment display of I.F.C.:	16
Status :	This is a critical fault. The furnace will not operate in any mode.
Description :	This code is displayed anytime there is an igniter failure. It may also be displayed if the furnace control relay for the igniter is not closing or cannot be sensed indicating a faulty control board. The fault may also be displayed if there is improper grounding of the control board.
Expected operation	Heating operation will not be permitted.
Cause :	The control cannot sense the igniter. The igniter may be out of spec, the control may be faulty or there may be a large potential difference between ground and neutral to the furnace control.
Solution :	Check the igniter and the connections between the igniter and the control board. If these are OK, check ground potential between neutral and ground. There should be no more than 5 volts difference. If this is OK, check the furnace control. Replace if necessary.

Table 30 14 - Unexpected flame

Code at dual 7 segment display of I.F.C.:	**14**
Status :	This is an extremely critical fault and should rarely (if ever) be seen in the field. The furnace will not operate with this fault present.
Description :	This fault indicates flame is present when it should not be. Flame is seen to be present when the gas valve is supposed to be off.
Expected operation	When unexpected flame is sensed, the IBM (Indoor Blower Motor) is energized at maximum. Response to any thermostat call is not permitted until the fault is cleared, the IDM will complete a 20 second post-purge and the IBM will complete a 90 second blower off-delay. **Note** that the gas valve circuit should not have been energized at high speed. Both will remain energized until the fault is cleared.
Cause :	1. Field miswiring of 24VAC to the gas valve main solenoid. 2. Faulty gas valve stuck in the “OPEN” position. 3. Faulty furnace control (signal improperly sensed when it should not be sensed at all).
Solution :	1. Wire properly. 2. Replace gas valve. 3. Replace furnace control.

Table 31 22 - Main limit open

Code at dual 7 segment display of I.F.C.:	22
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function.
Description :	The main limit has opened or is sensed to be opened. This normally means that the temperature inside the heat exchanger area has gone above a certain predetermined critical value and heating operation is not permitted until the limit cools to within normal parameters.
Expected operation	When the main limit opens, the IBM (Indoor Blower Motor) will be energized at maximum heat speed. The gas valve circuit is de-energized
Cause :	1. Insufficient airflow. 2. Faulty limit control. 3. Loose or faulty wiring. 4. Input too high.
Solution :	1. Check for proper blower operation. Is the blower turning during heat (or any other) mode? If not, a blower motor fault should also be present. Check the wiring to the motor then check the motor. It may need replacing. 2. Check ductwork and filters. Determine the static pressure and make sure it is not above the published values for the furnace. Check the rate and outlet air temperature at high and low-fire heat (use the test mode dipswitches SW2-2 and SW2-3) and compare to the nameplate maximum values. 3. Replace the limit control. 4. Check wiring and connections. Replace and/or repair as necessary. 5. Insure properly sized burner orifices are installed. Check the manifold pressure at high fire and compare to the nameplate values. Adjust as needed.

Table 32 26 - Line neutral reverse

Code at dual 7 segment display of I.F.C.:	26
Status :	This is a critical fault. The furnace will not operate in gas heat or any other modes.
Description :	This fault code is an indication that line voltage and neutral are reversed to the furnace control. No operation is allowed to proceed until the problem is corrected.
Expected operation	No heating or cooling operation will take place.
Cause :	1. Line and neutral to the furnace have been interchanged at the furnace. 2. Line voltage and neutral have been interchanged at the disconnect or at the breaker box.
Solution :	1. Check voltage with meter and reverse line and neutral if necessary. 2. Check voltage with meter and reverse line and neutral if necessary.

Table 33 33 - MRLC (Manually Reset Limit Control) OPEN

Code at dual 7 segment display of I.F.C.:	**33**
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function.
Description :	The Manually Reset Limit Control (M.R.L.C.) is also known by the name “Rollout Limit”. There can be several on any given furnace. When one or more of these limits open, they must be manually pushed back to open (hence the name; Manually Reset) to force the acknowledgement of a critical fault. This fault will occur when flames have rolled out of the normal area in the heat exchanger and into the burner compartment. This fault should rarely (if ever) be seen in the field and indicates a very serious problem that must be fixed before furnace operation can continue.
Expected operation	When the MRLC (Manually Reset Limit Control) circuit has been opened, the IBM (Indoor Blower Motor) is energized at maximum heating speed. The gas valve circuit is de-energized (if it was energized) and the IDM (Induced Draft Motor) is energized at high speed. Response to thermostat cooling calls will take place as normal with IBM energizing at the higher of the two blower speeds (high heat or cool). When the fault is cleared, the IDM will remain energized for a 20 second post-purge and the IBM will remain energized for the 90 second blower off-delay period.
Cause :	1. Insufficient venting through either the inlet or exhaust. 2. Loose or faulty wiring. 3. Unstable flame pattern.
Solution :	1. Check that the pressure switch (es) have not been welded closed or bypassed. Check that the inducer is operating at the proper rpm. Ensure that the venting does not exceed the maximum specified lengths. Check for obstructions in combustion venting. Check that all gaskets between the inducer and center panel/heat exchanger are properly installed and sealed. 2. Check wiring and connections. Replace and/or repair as necessary. 3. Check that all burner assembly components are properly installed. Check that all seals between the burner and blower compartments are tight. Ensure that the door seals are in place and that the burner door is properly installed and does not leak. Check to make sure that the heat exchanger has not been damaged; i.e.: crushed tubes, breached collector box and etc.

Table 34 44 - LPC (low pressure control (switch)) Closed

Code at dual 7 segment display of I.F.C.:	**44**
Status :	This is a critical fault. The furnace will not operate in gas heat mode but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode).
Description :	The low pressure control (or switch) should not be closed when the inducer is not running. If it is, this is a sign of a serious condition. The switch may be welded closed or purposely bypassed in the field. Before any heat cycle can begin, the pressure switch is tested to make sure that it is opened. The switch is ignored except in gas heating modes.
Expected operation	There will be no other operation than displaying of the fault code and diagnostic messages to the homeowner and technician. The fault code is only present during a heat call before pre-purge begins.
Cause :	1. Faulty switch. 2. Pressure switch physically bypassed in the field. 3. Loose or faulty wiring. 4. Abnormally high negative pressure present on vent system without inducer running.
Solution :	1. Replace low pressure control (switch). 2. Remove bypass and restore correct operation. Determine reason for bypass (e.g. vent length too long) and correct issue. Notify homeowner and proper authorities of illegal tampering if necessary. 3. Check wiring and connections. Replace and/or repair as necessary. 4. Check for proper venting and terminations as defined in the furnace installation instruction.

Table 35 46 - LPC (low pressure control (switch)) Open

Code at dual 7 segment display of I.F.C.:	**46**
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode).
Description :	This fault indicates that the low pressure switch is open when the inducer is energized at low speed. The switch must close after the inducer is energized and before the ignition sequence can begin. The switch is ignored except in heating modes.
Expected operation	1. DISPLAYED BEFORE HEAT IS ESTABLISHED: The IBM (Indoor Blower Motor) will not be energized. The fault code will not be displayed until the IDM (Induced Draft Motor) has been energized for a minimum five minutes after the beginning of the pre-purge attempt. After five minutes, the IDM is de-energized and second pressure switch closes or the heat call is lost. 2. DISPLAYED AFTER HEAT IS ESTABLISHED: If this fault is displayed after heat is established, the gas valve will be de-energized, the IBM will be energized (if not already energized) at the correct heat speed (determined by the firing rate required by the thermostat) and the IDM will remain energized at high speed. The IBM will complete a 90 second blower off-delay and the IDM will complete a 20 second post-purge (at high speed). After these delays, a new attempt at ignition will be made provided the call for heat is still present.
Cause :	1. Blockage or improper termination in either the inlet or exhaust vents. 2. The flue vent length and/or number of elbows exceed the maximum number specified. 3. Faulty or disconnected inducer. 4. Faulty control board (inducer relay). 5. Loose or faulty wiring. 6. Disconnected, blocked, split or cut pressure switch hoses. 7. Wind gusts (sporadic). 8. Faulty pressure switch.
Solution :	1. Check the vent system for blockage and proper termination and repair as necessary. 2. Check the specification sheets and/or installation instructions. Remove excess venting. 3. Repair or replace inducer and/or inducer wiring and/or electrical connections. 4. Replace control board. 5. Check wiring and connections. Replace and/or repair as necessary. 6. Replace hoses as necessary. 7. Insure proper termination. 8. Replace the pressure switch.

Table 36 55 - HPC (High Pressure Control (switch)) CLOSED

Code at dual 7 segment display of I.F.C.:	**55**
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode).
Description :	The high pressure control (or switch) should not be closed when the inducer is not running. If it is, this is a sign of a serious condition. The switch may be welded closed or purposely bypassed in the field. Before any heat cycle can begin, the pressure switch is tested to make sure that it is opened. The switch is ignored except in gas heating modes.
Expected operation	There will be no other operation than displaying of the fault code and diagnostic messages to the homeowner and technician. The fault code is only present during a heat call before pre-purge begins.
Cause :	1. Faulty switch. 2. Pressure switch physically bypassed in the field. 3. Loose or faulty wiring. 4. Abnormally high negative pressure present on vent system without inducer running.
Solution :	1. Replace high pressure control (switch). 2. Remove bypass and restore correct operation. Determine reason for bypass (e.g. vent length too long) and correct issue. Notify homeowner and proper authorities of illegal tampering if necessary. 3. Check wiring and connections. Replace and/or repair as necessary. 4. Check for proper venting and terminations as defined in the furnace installation instructions.

Table 37 57 - HPC (High Pressure Control (switch)) OPEN

Code at dual 7 segment display of I.F.C.:	**57**
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function if present simultaneously with a heating call (e.g. defrost call in dual-fuel mode). if this is experienced during high heat operation (above 50% rate) and the low pressure switch remains engaged, the furnace will switch to low fire heat and continue to run (if possible) to try to satisfy the thermostat.
Description :	This fault indicates that the high pressure switch is open when the inducer is energized at high speed. This fault can be displayed any time during the heat call except during low heat call and only after the pre-purge and blower on delays are complete.
Expected operation	1. DISPLAYED BEFORE HEAT IS ESTABLISHED: The IBM (Indoor Blower Motor) will not be energized. The fault code will not be displayed until the IDM (Induced Draft Motor) has been energized for a minimum of ten seconds. The IDM will remain energized at the high speed (high speed is default pre-purge speed) for a period of five minutes after the beginning of the pre-purge attempt. After five minutes, the IDM is de-energized and second attempt at pre-purge is made (as long as the heat call is still present). This cycle is repeated indefinitely until either the pressure switch closes or the heat call is lost. 2. DISPLAYED AFTER HEAT IS ESTABLISHED: if this fault is displayed after heat is established, the IDM will remain energized at high speed and the firing rate will drop to low (40%) provided the low pressure switch remains closed. The IBM will energize at, or switch to, the low-fire rate (also provided the low pressure switch remains closed). Low heat is provided until the heat call ends or the high pressure switch closes. If the high pressure switch closes, the heat rate and blower speed will be adjusted to the correct (higher) rate required by the thermostat and the IDM will remain energized at high speed. If the low pressure switch also will not remain closed, operation will be as described under fault code # 46 (“LPC OPEN”) above.
Cause :	1. Blockage or improper termination in either the inlet or exhaust vents. 2. The flue vent length and/or number of elbows exceed the maximum number specified. 3. Faulty or disconnected inducer. 4. Faulty control board (inducer relay). 5. Loose or faulty wiring. 6. Disconnected, blocked, split or cut pressure switch hoses. 7. Wind gusts (sporadic). 8. Faulty pressure switch.
Solution :	1. Check the vent system for blockage and proper termination and repair as necessary. 2. Check the specification sheets and/or installation instructions. Remove excess venting. 3. Repair or replace inducer and/or inducer wiring and/or electrical connections. 4. Replace control board. 5. Check wiring and connections. Replace and/or repair as necessary. 6. Replace hoses as necessary. 7. Insure proper termination. 8. Replace the pressure switch.

Table 38 60 - Blower fault - running

Code at dual 7 segment display of I.F.C.:	60
Status :	This is a non-critical fault experienced by the furnace. All operations (including thermostat calls) should continue as normal with no perceivable difference in operation.
Description :	A blower fault which is non-critical allows the blower to continue to run but at less than optimal conditions.
Expected operation	All (including thermostat) operation should continue as normal. Blower operation may be slightly compromised but will continue.
Cause :	The blower has hit the maximum speed or torque limit specified by the manufacturer or is running at the temperature limit because the static pressure is too high.
Solution :	The static pressure is too high because the ductwork is improperly designed or is restricted for some other reason or the filter needs cleaning or replacing. Remove the obstruction or repair the duct so that static pressure does not exceed published values in the specification sheets or installation instructions.

Table 39 61 - Blower fault – not running

Code at dual 7 segment display of I.F.C.:	61
Status :	This is a critical fault. The furnace will not operate in any mode.
Description :	The blower has failed critically or there is a critical motor fault – such as thermal limit trip that prevents the blower motor from running.
Expected operation	If the furnace was in heating operation when this fault occurred, blower operation will immediately stop and the furnace will shut down normally with post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared.
Cause :	1. The motor has tripped on thermal limit because of a restriction or bearing failure. 2. The motor Power Factor Correction (P.F.C.) choke is faulty and needs replacing. 3. The furnace shared data is faulty or corrupted. 4. Wiring to the motor and/or P.F.C. has become compromised. 5. The motor has failed catastrophically.
Solution :	1. Remove obstruction or replace motor. 2. Replace the Power Factor Correction choke. 3. Replace the furnace memory card with the correct replacement part. 4. Inspect and replace or repair wiring and/or connectors to the motor and/or P.F.C. as necessary. 5. Replace the motor.

Table 40 66 - Blower overspeed

Code at dual 7 segment display of I.F.C.:	66
Status :	This is a non-critical fault experienced by the furnace. All operations (including thermostat calls) should continue as normal with no perceivable difference in operation.
Description :	The blower motor is operating at the highest rpm or torque that specifications allow but the application requires more torque or speed in order to get the desired airflow under the current static pressure conditions. The motor will continue to operate because internal software will prevent operation above the permitted range. However, a fault is sent to the furnace control (or I.F.C.) from the motor. **Note**: this fault will not be displayed after the first hour of blower operation after power reset. Further, this fault will not be logged in the fault buffer or fault history after the first hour of operation and will only be logged into the fault buffer a maximum of one time. This code (66) indication is intended as a tool to notify the installer of inadequate airflow due to excessive static pressure in the duct of the system. The code is not intended to be a fault code. It is merely an operating indicator.
Expected operation	All (including thermostat) operation should continue as normal. Blower operation may be slightly compromised but will continue.
Cause :	The blower has hit the maximum speed or torque limit specified by the manufacturer because the static pressure is too high.
Solution :	The static pressure is too high because the ductwork is improperly designed or is restricted for some other reason or the filter needs cleaning or replacing. Remove the obstruction or repair the duct so that static pressure does not exceed published values in the specification sheets or installation instructions for the furnace.

Table 41 68 - No blower communication

Code at dual 7 segment display of I.F.C.:	68
Status :	This is a critical fault. The furnace will not operate in any mode.
Description :	The furnace control (I.F.C.) cannot communicate with the blower motor.
Expected operation	If the furnace was in heating operation when this fault occurred, the gas valve will immediately close (flame will be lost), IBM (Indoor Blower Motor) operation will immediately stop and the furnace will shut down normally (except without IBM operation) with IDM (Inducer Draft Motor) post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared.
Cause :	1. The wires between the blower motor have been disconnected or there is a poor connection. 2. There is no line voltage to the motor. 3. The furnace shared data is faulty or corrupted. 4. The motor has failed catastrophically.
Solution :	1. Check wiring, connectors and terminals – repair or replace as necessary. 2. Check line voltage wiring, connectors and terminals to the Power Factor Correction choke and ECM motor. Repair and replace as necessary. 3. Replace the furnace memory card with the correct replacement part. 4. Replace the motor.

Table 42 71 - No inducer communications

Code at dual 7 segment display of I.F.C.:	71
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function.
Description :	When attempting to communicate with the inducer controller module (electronic control board in blower compartment), communications cannot be established or response from the inducer controller module is not as expected.
Expected operation	Upon fault declaration, if currently in steady-state heating mode, the gas valve will be immediately de energized. Commands to operate the inducer at post purge will attempt to be sent but will likely not be received because the communications link has been interrupted. The Air Circulating Blower (A.C.B.) will complete the 90 second blower off delay. Further heating operation will not take place until communications with the inducer controller can be established again. This fault will not affect the furnace during any other operation except heating.
Cause :	The cause can be interrupted wiring between the main furnace control and the inducer controller module or interrupted wiring between the inducer controller module and the inducer itself. Other causes can be a defective inducer controller module or a defective inducer.
Solution :	Check the wiring between the furnace controller (I.F.C.) and the inducer controller module. Check wiring between the inducer controller module and the inducer. Check line voltage to the inducer controller module. If these are ok, replace the inducer controller module and/or inducer.

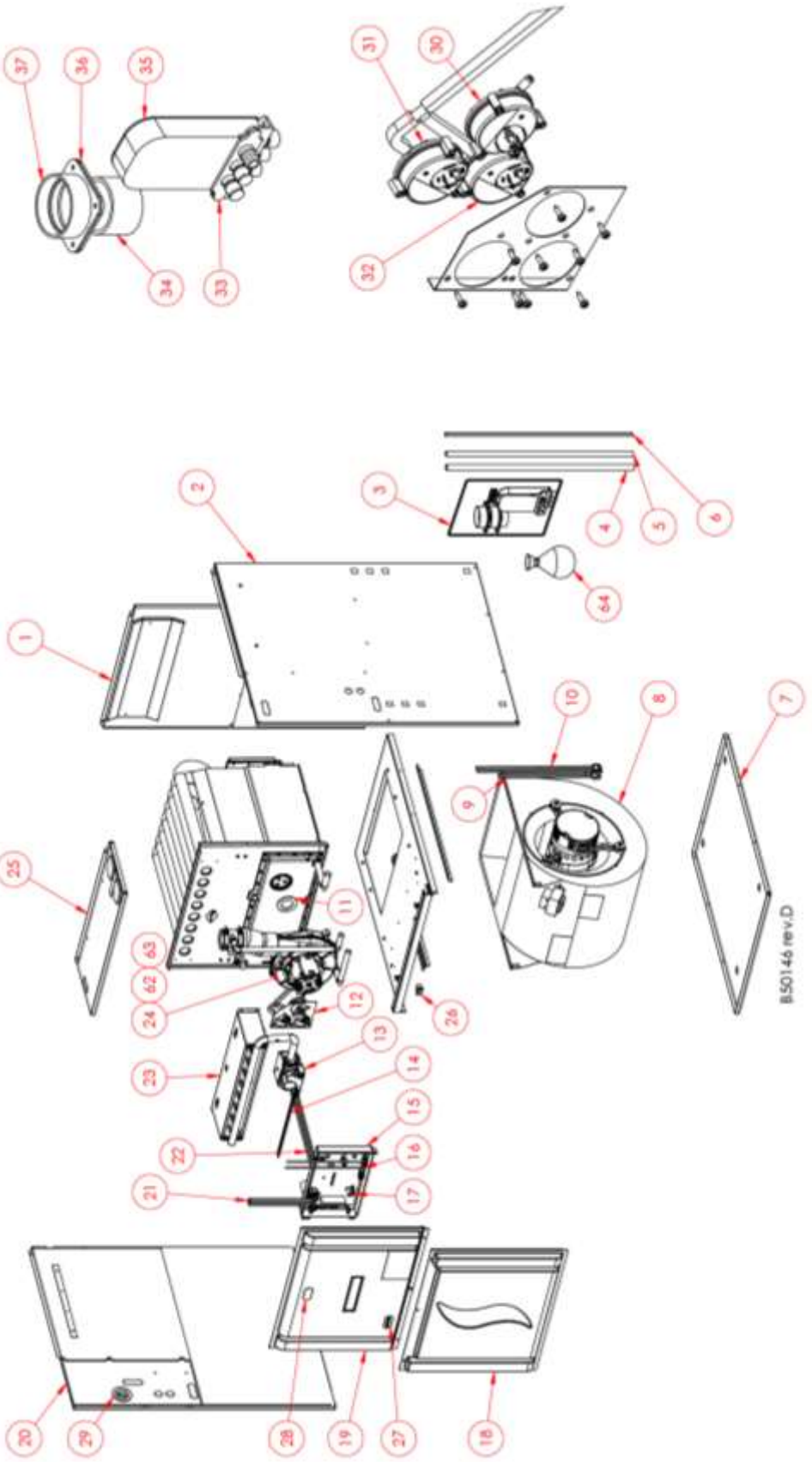
Table 43 77 - No gas valve feedback

Code at dual 7 segment display of I.F.C.:	77
Status :	This is a critical fault. The furnace will not operate in gas heat modes but all other modes (e.g. cooling) should function.
Description :	The furnace control has lost communications with the gas valve.
Expected operation	If the furnace was in heating operation when this fault occurred, the gas valve will immediately close (flame will be lost), IBM (Indoor Blower Motor) operation will immediately stop and the furnace will shut down normally (except without IBM operation) with IDM (Inducer Draft Motor) post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared.
Cause :	1. The wires, connectors or terminals between the furnace control (or I.F.C.) have become disconnected or there is a poor connection. 2. The gas valve is faulty. 3. The furnace control is faulty.
Solution :	1. Check the wires, connectors or terminals between the gas valve and furnace control (or I.F.C.). Replace or repair as necessary. 2. Replace the gas valve. 3. Replace the furnace control.

Table 44 93 - Control fault

Code at dual 7 segment display of I.F.C.:	**93**
Status :	This is a critical fault. The furnace will not operate in any mode of operation.
Description :	This is a severe fault that should rarely (if ever) be discovered in the field. It is an indicator of an internal microprocessor fault on the furnace control (or I.F.C.) or voltage applied to the main gas valve solenoid when there should be none.
Expected operation	If the furnace was in heating operation when this fault occurred, the gas valve will immediately close (flame will be lost), IBM (Indoor Blower Motor) operation will immediately stop and the furnace will shut down normally (except without IBM operation) with IDM (Induced Draft Motor) post-purge at the correct speed. After the post purge (or immediately if no heat call was present), no other operation (including thermostat calls) will occur until this fault is cleared. However, this fault may also indicate an internal microprocessor failure. This may mean that the heat call will not end as expected and that all outputs will be de-energized and gas valve closed immediately when the fault is sensed.
Cause :	1. 24VAC or similar voltage applied to the main gas valve solenoid circuit unexpectedly. 2. Furnace control software test failure – failed furnace control (or I.F.C.).
Solution :	1. Check for miswiring in the furnace. 2. Replace the furnace control (or I.F.C.).

Figure 28 Exploded View – Modulating



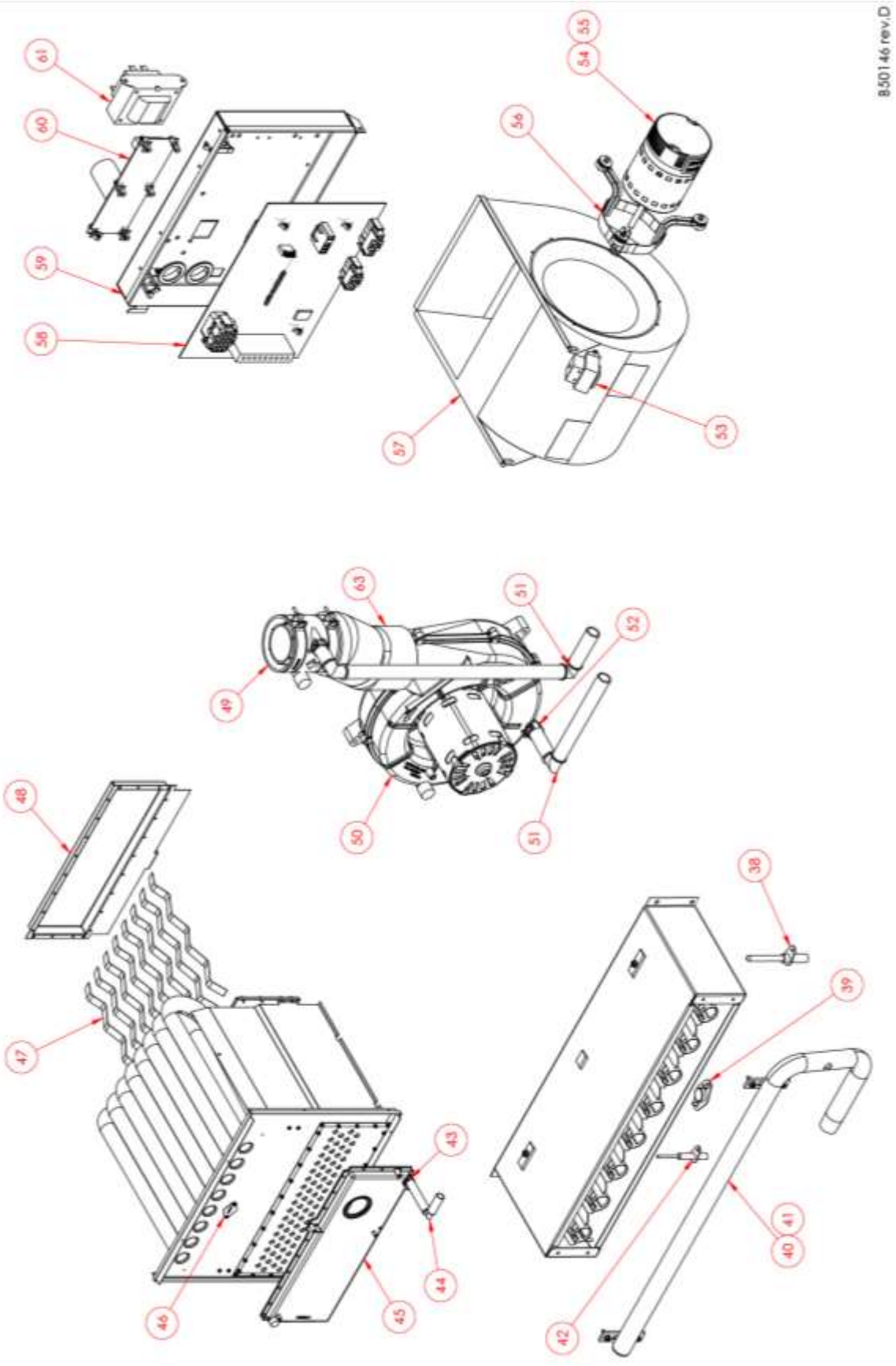

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Table 45 Part list – Modulating – ECM 3.0

#	Description	C15-M-V	C30-M-V	C45-M-V	C60-M-V	C75-M-V	C105-M-V	C120-M-V
1	Heat exchanger ass.	B40511-04	B40511-04	B40511-04	B40511-05	B40511-05	B40511-06	B40511-06
2	Right pannel ass.	B40510-34	B40510-34	B40510-34	B40510-34	B40510-34	B40510-34	B40510-34
3	Loose part bag	B40569-01	B40569-01	B40569-01	B40569-02	B40569-02	B40569-02	B40569-02
4	Hose 5/8	B30157-34	B30157-34	B30157-34	B30157-34	B30157-34	B30157-34	B30157-34
5	Hose 1/2	B30157-38	B30157-38	B30157-38	B30157-38	B30157-38	B30157-38	B30157-38
6	Hose 3/16	B30157-40	B30157-40	B30157-40	B30157-40	B30157-40	B30157-40	B30157-40
7	Floor	B40546-01	B40546-01	B40546-01	B40546-02	B40546-02	B40546-03	B40546-03
8	Blower ass.	B40603-01	B40603-01	B40603-01	B40603-02	B40603-03	B40603-04	B40603-04
9	Electric blower kit	B40581-03	B40581-03	B40581-03	B40581-03	B40581-03	B40581-04	B40581-04
10	Electric blower kit	B40587-01	B40587-01	B40587-01	B40587-01	B40587-01	B40587-02	B40587-02
11	Inducer restrictor	B40563-01	B40699	B40563-07	B40563-04	B40698	B40563-06	B40563-06
12	Pressure switch ass.	B40675-25	B40675-26	B40675-27	B40675-28	B40675-29	B40675-31	B40675-32
13	Gas valve	R01K005	R01K005	R01K005	R01K005	R01K005	R01K005	R01K005
14	Electrical kit gas valve/board	B40582-01	B40582-01	B40582-01	B40582-01	B40582-01	B40582-02	B40582-02
15	Control card assembly	B40516	B40516	B40516	B40516	B40516	B40516	B40516
16	Electrical kit ignitor/board	B40586-01	B40586-01	B40586-01	B40586-01	B40586-01	B40586-02	B40586-02
17	Memory card assembly	B40634-01	B40634-02	B40634-03	B40634-04	B40634-05	B40634-07	B40634-08
18	Lower door assembly	B40570-10	B40570-10	B40570-10	B40570-11	B40570-11	B40570-12	B40570-12
19	Upper door assembly	B40571-01	B40571-01	B40571-01	B40571-02	B40571-02	B40571-03	B40571-03
20	Left pannel ass.	B40509-02	B40508-02	B40509-02	B40509-02	B40509-02	B40509-02	B40509-02
21	Electrical kit main harness	B40588-01	B40588-01	B40588-01	B40588-01	B40588-01	B40588-02	B40588-02
22	Elect. Kit inverter blower	B40585-01	B40585-01	B40585-01	B40585-01	B40585-01	B40585-02	B40585-02
23	Complete gas manifold ass.	B40514-01	B40514-02	B40514-03	B40514-04	B40514-05	B40514-07	B40514-08
24	ID blower ass.	B40578-06	B40578-06	B40578-06	B40578-03	B40578-03	B40578-03	B40578-03
25	Top pannel ass.	B40512-01	B40512-01	B40512-01	B40512-02	B40512-02	B40512-03	B40512-03
26	Door switch	L07H001	L07H001	L07H001	L07H001	L07H001	L07H001	L07H001
27	Dettson observation port	B40565	B40565	B40565	B40565	B40565	B40565	B40565
28	Observation port	L04Z022	L04Z022	L04Z022	L04Z022	L04Z022	L04Z022	L04Z022
29	Grommet	G14F017	G14F017	G14F017	G14F017	G14F017	G14F017	G14F017
30	Pressure switch (condensate box)	R99F035	R99F035	R99F035	R99F035	R99F035	R99F035	R99F035
31	Pressure switch (high fire)	R99F055	R99F048	R99F044	R99F042	R99F049	R99F041	R99F048
32	Pressure switch (low fire)	R99F050	R99F036	R99F050	R99F037	R99F036	R99F036	R99F036
33	Drain trap gasket	B40568	B40568	B40568	B40568	B40568	B40568	B40568
34	PVC pipe	B40573-02	B40573-02	B40573-02	B40573-01	B40573-01	B40573-01	B40573-01
35	Drain trap	B40760	B40760	B40760	B40760	B40760	B40760	B40760
36	Venting flange gasket	B40567	B40567	B40567	B40567	B40567	B40567	B40567

#	Description	C15-M-V	C30-M-V	C45-M-V	C60-M-V	C75-M-V	C105-M-V	C120-M-V
37	Venting flange	B40533	B40533	B40533	B40533	B40533	B40533	B40533
38	Ignitor	R03K005	R03K005	R03K005	R03K005	R03K005	R03K005	R03K005
39	Burner high limit	R02N022	R02N022	R02N022	R02N022	R02N022	R02N022	R02N022
40	Gas manifold	B40576	B40577	B40527	B40528	B40529	B40531	B40532
41	Orifice #48 natural gas	R04I001	R04I001	R04I001	R04I001	R04I001	R04I001	R04I001
42	Flame sensor	R03J004	R03J004	R03J004	R03J004	R03J004	R03J004	R03J004
43	5/8" clamp	G99Z035	G99Z035	G99Z035	G99Z035	G99Z035	G99Z035	G99Z035
44	5/8" elbow	G07J007	G07J007	G07J007	G07J007	G07J007	G07J007	G07J007
45	Condensation box	B40526-01	B40526-01	B40526-01	B40526-02	B40526-02	B40526-03	B40526-04
46	High limit	R02N027	R02N026	R02N026	R02N024	R02N023	R02N024	R02N024
47	Baffles	B40572	B40572	B40572	B40572	B40572	B40572	B40572
48	Smoke box	B40539-01	B40539-01	B40539-01	B40539-02	B40539-02	B40539-03	B40539-04
49	Rubber vent coupling	B40580	B40580	B40580	B40580	B40580	B40580	B40580
50	Induce draft blower	Z01K005	Z01K005	Z01K005	Z01K005	Z01K005	Z01K005	Z01K005
51	1/2" elbow	G07J006	G07J006	G07J006	G07J006	G07J006	G07J006	G07J006
52	1/2" clamp	G99Z034	G99Z034	G99Z034	G99Z034	G99Z034	G99Z034	G99Z034
53	Inducer	B03141-02	B03141-02	B03141-02	B03141-01	B03141-01	B03141	B03141
54	ECM 3.0 motor ass.	B03240-13	B03240-13	B03240-13	B03716-04	B03716-04	B03241-11	B03241-11
55	Motor ECM 3.0	L06H020	L06H020	L06H020	L06I014	L06I014	L06K008	L06K008
56	Belly band ass.	B01889	B01889	B01889	B01889	B01889	B01889	B01889
57	Blower	Z01I033	Z01I033	Z01I033	Z01I035	Z01I036	Z01I038	Z01I038
58	24v control board	R99G014	R99G014	R99G014	R99G014	R99G014	R99G014	R99G014
59	Electrical box	B40559	B40559	B40559	B40559	B40559	B40559	B40559
60	ID blower Control board	R99G017	R99G017	R99G017	R99G017	R99G017	R99G017	R99G017
61	Transformer 120v-24v	L01F009	L01F009	L01F009	L01F009	L01F009	L01F009	L01F009
62	Elbow and ID blower ass.	-	-	-	B40766-03	B40766-03	B40766-03	B40766-03
63	ID blower elbow ass.	-	-	-	B40818	B40818	B40818	B40818
64	Extruded seal	B04435-01	B04435-01	B04435-01	B04435-01	B04435-01	B04435-01	B04435-01

Options	C15-M-V	C30-M-V	C45-M-V	C60-M-V	C75-M-V	C105-M-V	C120-M-V
Bottom return base ass.	B40691-01	B40691-01	B40691-01	B40691-02	B40691-02	B40691-03	B40691-03
Downflow base	B40632-01	B40632-01	B40632-01	B40632-02	B40632-02	B40632-03	B40632-03
Cooling coil base	B40693-01	B40693-01	B40693-01	B40693-02	B40693-02	B40693-02	B40693-03
Propane conversion kit	B40574-03	B40574-06	B40574-09	B40574-12	B40574-15	B40574-21	B40574-24
Orifice #56 for propane	R04I002	R04I002	R04I002	R04I002	R04I002	R04I002	R04I002
Drain trap replacement kit	K01021	K01021	K01021	K01021	K01021	K01021	K01021

Annex 1 - CFM TABLES FOR COOLING AND HEATING

Table 46 Heating CFM C15-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	240	55	238	22
0.2	240	55	238	22
0.3	240	55	238	22
0.4	240	55	238	22
0.5	240	55	238	22
0.6	235	56	235	22
0.7	223	59	221	24
0.8	219	60	223	24
0.9	219	60	221	24
1	226	58	225	23
1.1	221	60	222	24
1.2	218	61	214	25
1.3	200	66	197	27
1.4	200	66	197	27
1.5	200	66	197	27
1.6	200	66	197	27
1.7	200	66	197	27

Table 47 Cooling CFM demand C15-M-V and C15-M-S[1]

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	590	760
		OFF	ON	505	630
		ON	OFF	380	505
		ON	ON	245	320
	OFF	OFF	OFF	675	765
		OFF	ON	550	725
		ON	OFF	420	550
		ON	ON	285	380

[1]CFM can be increase for C15-M-S unit, please refer to **Table 15 Dipswitch S3 and S5 – Setting cooling airflow demand**

Table 48 Heating CFM C15-M-S

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	240	55	238	22
0.2	240	55	238	22
0.3	240	55	238	22
0.4	240	55	238	22
0.5	240	55	238	22
0.6	235	56	235	22
0.7	223	59	221	24
0.8	219	60	223	24
0.9	219	60	221	24
1	226	58	225	23
1.1	221	60	222	24
1.2	218	61	214	25
1.3	200	66	197	27
1.4	200	66	197	27
1.5	200	66	197	27
1.6	200	66	197	27
1.7	200	66	197	27

Table 49 Heating CFM C30-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	408	65	303	35
0.2	408	65	303	35
0.3	408	65	303	35
0.4	408	65	303	35
0.5	408	65	303	35
0.6	408	65	303	35
0.7	408	65	303	35
0.8	408	65	303	35
0.9	408	65	303	35
1.0	408	65	303	35
1.1	408	65	303	35
1.2	408	65	303	35
1.3	408	65	303	35
1.4	408	65	303	35
1.5	354	75	303	35
1.6	354	75	303	35
1.7	354	75	303	35

Table 50 Cooling CFM demand for C30-M-V and C30-M-S[1]

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	600	780
		OFF	ON	335	420
		ON	OFF	430	595
		ON	ON	310	310
	OFF	OFF	OFF	695	900
		OFF	ON	350	460
		ON	OFF	520	695
		ON	ON	315	320

[1]CFM can be increase for C30-M-S unit, please refer to **Table 15 Dipswitch S3 and S5 – Setting cooling airflow demand**

Table 51 Heating CFM for C30-M-S

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	408	65	303	35
0.2	408	65	303	35
0.3	408	65	303	35
0.4	408	65	303	35
0.5	408	65	303	35
0.6	408	65	303	35
0.7	408	65	303	35
0.8	408	65	303	35
0.9	408	65	303	35
1.0	408	65	303	35
1.1	408	65	303	35
1.2	408	65	303	35
1.3	408	65	303	35
1.4	408	65	303	35
1.5	354	75	303	35
1.6	354	75	303	35
1.7	354	75	303	35

Table 52 Heating CFM for C45-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	675	62	325	48
0.2	675	62	325	48
0.3	675	62	355	44
0.4	715	60	360	43
0.5	730	59	360	43
0.6	750	58	365	42
0.7	760	57	360	42
0.8	780	56	365	41
0.9	775	56	360	40
1	780	56	350	41
1.1	780	56	350	41
1.2	775	56	345	41
1.3	770	57	345	41
1.4	755	58	340	42
1.5	735	60	330	42
1.6	715	61	310	45
1.7	690	63	275	51

Table 53 Cooling CFM demand for C45-M-V and C45-M-S[1]

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	530	695
		OFF	ON	420	530
		ON	OFF	315	375
		ON	ON	310	315
	OFF	OFF	OFF	625	810
		OFF	ON	460	625
		ON	OFF	325	435
		ON	ON	315	315

[1]CFM can be increase for C45-M-S unit, please refer to **Table 15 Dipswitch S3 and S5 – Setting cooling airflow demand**

Table 54 Heating CFM for C45-M-S

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	710	57	385	32
0.2	710	57	385	32
0.3	710	57	385	32
0.4	745	56	370	35
0.5	780	54	355	36
0.6	785	53	345	37
0.7	795	53	325	38
0.8	800	53	335	36
0.9	805	53	335	36
1	810	52	330	35
1.1	805	52	325	35
1.2	820	52	320	35
1.3	820	52	320	35
1.4	825	52	315	35
1.5	830	52	295	36
1.6	820	52	275	38
1.7	810	53	250	41

Table 55 CFM in heating for C60-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	850	57	480	56
0.2	900	57	465	56
0.3	950	57	465	56
0.4	975	57	470	57
0.5	985	54	480	60
0.6	990	54	475	69
0.7	1015	54	450	73
0.8	1010	53	410	75
0.9	1020	53	380	80
1	1020	52	375	83
1.1	1025	52	365	83
1.2	1025	53	340	83
1.3	1030	52	330	83
1.4	1020	53	320	83
1.5	1015	53	320	83
1.6	1010	53	310	83
1.7	1000	53	295	83

Table 56 Cooling CFM demand for C60-M-V[1]

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	1245	1475
		OFF	ON	850	1175
		ON	OFF	1025	1460
		ON	ON	520	710
	OFF	OFF	OFF	1475	1475
		OFF	ON	1000	1425
		ON	OFF	1265	1470
		ON	ON	585	825

[1]CFM can be increase, please refer to **Table 15 Dipswitch S3 and S5 – Setting cooling airflow demand**

Table 57 Heating CFM for C75-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	1290	57	512	54
0.2	1290	57	522	56
0.3	1318	56	525	56
0.4	1318	55	543	55
0.5	1336	55	545	55
0.6	1337	55	551	54
0.7	1350	56	556	53
0.8	1346	56	561	53
0.9	1340	56	572	52
1	1335	56	566	52
1.1	1330	57	522	57
1.2	1325	57	493	60
1.3	1289	59	465	64
1.4	1260	61	445	68
1.5	1186	64	431	70
1.6	1113	68	419	72
1.7	1050	71	391	75

Table 58 Cooling CFM demand for C75-M-V

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	1090	1430
		OFF	ON	745	1055
		ON	OFF	640	875
		ON	ON	505	680
	OFF	OFF	OFF	1254	1650
		OFF	ON	925	1270
		ON	OFF	770	1090
		ON	ON	580	800

Table 59 Heating CFM for C105-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	1775	52	685	54
0.2	1775	52	665	56
0.3	1775	52	640	58
0.4	1750	53	640	58
0.5	1735	53	630	59
0.6	1700	54	620	60
0.7	1660	56	610	61
0.8	1630	57	605	61
0.9	1595	58	595	62
1	1580	58	575	64

Table 60 Cooling CFM demand for C105-M-V

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	1265	1700
		OFF	ON	860	1220
		ON	OFF	1020	1375
		ON	ON	710	975
	OFF	OFF	OFF	1590	1750
		OFF	ON	1055	1465
		ON	OFF	1240	1695
		ON	ON	870	1245

Table 591 Heating CFM for C120-M-V

external static pressure	CFM@100%	ΔT (°F)	CFM@40%	ΔT (°F)
0.1	1925	55	700	60
0.2	1925	55	700	60
0.3	1925	55	675	63
0.4	1865	57	660	64
0.5	1835	58	645	65
0.6	1820	58	635	66
0.7	1815	58	625	68
0.8	1800	59	635	66
0.9	1795	59	635	66
1	1775	59	630	67

Table 602 Cooling CFM demand for C120-M-V

Dipswitch				1st stage	2nd stage
S5-2	S5-1	S3-2	S3-1		
OFF	ON	OFF	OFF	1375	1870
		OFF	ON	1070	1500
		ON	OFF	915	1245
		ON	ON	1395	1880
	OFF	OFF	OFF	1645	2040
		OFF	ON	1265	1760
		ON	OFF	1105	1535
		ON	ON	924	1245

Annex 2 - SPECIFICATION SHEET

Model		CC15-M-V	C15-M-S	C15-M-V	C30-M-S	C30-M-V
INPUT	**HIGH**	15000	15000	15000	30000	30000
	LOW	6000	6000	6000	12000	12000
OUTPUT	**HIGH**	14352	14352	14352	28613	28613
	LOW	5741	5741	5741	11445	11445
EFFICIENCY		95.6	95.6	95.6	95.3	95.3
TEMP. RISE		40 - 70°F (22 - 38°C)			50 - 80°F (27 - 44°C)	
AIRFLOW (CFM)	**HEATING HIGH**	240	310	240	410	410
	HEATING LOW	240	310	240	305	305
	MAX*	480	1200	1000	1345	1200
	MAX**	420	860	600	950	720
MAX COOLING CAPACITY		1	3	2.5	3	3
MOTOR HP		1/3	3/4	1/2	3/4	1/2

Model		C45-M-S	C45-M-V	C60-M-V	C75-M-V	C105-M-V	C120-M-V
INPUT	**HIGH**	45000	45000	60000	75000	105000	120000
	LOW	18000	18000	24000	30000	42000	48000
OUTPUT	**HIGH**	43101	43101	57654	71798	101010	15200
	LOW	17240	17240	23062	28605	40427	46080
EFFICIENCY		95.7	95.7	96.0	95.7	96.2	96.0
TEMP. RISE		40 - 70°F (22 - 38°C)					
AIRFLOW (CFM)	**HEATING HIGH**	810	766	970	1200	1735	1835
	HEATING LOW	330	330	388	480	630	645
	MAX*	1400	1285	1680	1700	1961	2138
	MAX**	980	770	1140	1100	N/A	N/A
MAX COOLING CAPACITY		3.5	3	4	4	5	5
MOTOR HP		3/4	1/2	3/4	3/4	1	1

*MAX CFM for ESP of 0.5" w.c.
**MAX CFM for Smart Duct™

INPUT	15K COMPACT	15K	30K	45K	60K	75K	105K	120K
SHIP WEIGHT LB/KG	79/35.8	115/52.2	116/52.6	119/54.0	136/61.7	138/62.6	161/73.0	171/77.6
MAXIMUM CONSUMPTION (Amps/Breaker size)	8.6/10	10.7/15	10.7/15	12.6/15	15.6/20	15.6/20	19.0/20	19.0/20
SUPPLY	115 Volts - 60 Hertz - 1 Phase							

Maximum equivalent straight vent length

Altitude (ft)	Unit size (Btu/hr)	Vent pipe diameter (in.)	
		2"	3"
0 to 4500 ft	**15,000**	300	N/A
	30,000	180	N/A
	45,000	70	90
	60,000	70	90
	75,000	70	90
	105,000	15	80
	120,000	10	40

Deduction for fittings

Type of elbow	Equivalent Length (ft.)
45° Standard	5
45° Long sweap	2½
90° Standard	10
90° Long sweap	5
Tee	1.5

INFORMATION PAGE

MODEL NUMBER	
SERIAL NUMBER	
NATURAL GAS OR PROPRANE?	
IF PROPANE, CONVERSION KIT NUMBER	
GAS SUPPLY PRESSURE	
MANIFOLD PRESSURE	
SUPPLY VOLTAGE	
DUCT STATIC PRESSURE (SUPPLY AND RETURN)	
AIR TEMPERATURE RISE	
DOES THE DRAIN TRAP IS FILLED WITH WATER?	
IS THE DRAIN TRAP VENTED WITH A TEE?	
DOES THE CONDENSATE LINES ARE PROPERLY SLOPED?	
IF THE UNIT IS UPFLOW, IS IT LEVELED?	
IF THE UNIT IS IN POSITION OTHER THAN UPFLOW, IS IT TILTED?	
DIAMETER OF PIPE	
LENGTH OF EQUIVALENT PIPE	
Comments:	