

# Oil Furnaces

# PMP-098 MULTI-POSITION

**KEEP THESE INSTRUCTIONS WITH FURNACE FOR FUTURE REFERENCE.**

## Furnace Manual

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### Hazard definitions



Hazards that **will cause severe** personal injury, death, or substantial property damage.



Hazards that **will or can cause minor** personal injury or property damage.



Hazards that **can cause severe** personal injury, death, or substantial property damage.



Special instructions on installation, operation or maintenance that are important but not related to personal injury or property damage.



**INSTALLER** – Read all instructions before installing. **Read page 2 first.** Follow all instructions in proper order to prevent personal injury or death.

- Consider ducting, fuel supply, venting and installation when determining furnace location.
- Any claims for damage or shortage in shipment must be filed immediately against the transportation company by the consignee.



**USER** – Please read the following. Failure to comply could result in severe personal injury, death or substantial property damage.

- **This manual is for the sole use by your qualified heating installer / service technician.**
- Please see the **Owner's information** only, on the back page of this manual.
- Have the furnace serviced by a qualified service technician, at least once a year.



Do not store or use gasoline or other flammable liquids or vapors near this furnace or any other appliance.



This manual must only be used by a **qualified heating installer / service technician**. Furnace and burner must be installed and serviced only by a qualified heating installer / service technician. Failure to comply could result in severe personal injury, death, or substantial property damage.



Ventilate house while operating furnace for the first time. Odors may be emitted for a brief period.



Do not alter this furnace in any way. The manufacturer will not be liable for any damage resulting from changes made in the field to the furnace or its components or from improper installation. Failure to comply could result in severe personal injury, death, or substantial property damage.



When calling or writing about the furnace – Please indicate furnace model number and serial number from rating label. You may list the serial number and model number in the space provided on the "Installation and service certificate" found on page 17.



If your furnace is shut down during the cold weather season, water pipes may freeze, burst and cause serious water damage. Turn off the water supply and bleed the pipes

If the heater is left unattended during the cold weather season, take the following precautions:

Close the main water valve in the house and purge the pipes if possible. Open all the faucets in the house;

Ask someone to frequently check the house during the cold weather season to make sure that there is sufficient heat to prevent the pipes from freezing. Tell this person to call an emergency number if required

## READ THIS FIRST!

**⚠ WARNING** Failure to adhere to the guidelines below can result in severe personal injury, death or substantial property damage.

### Service and maintenance –

1. To avoid electric shock, disconnect electrical supply before performing maintenance.
2. To avoid severe burns, allow furnace to cool before performing maintenance.
3. Perform service and maintenance as described in this manual and the burner manual.
4. Do not attempt to make adjustments to the blower or motor while the furnace is in operation. Disconnect power to the furnace and be sure all parts have stopped moving before attempting adjustments or maintenance.
5. The burner must be set up and adjusted using combustion test instruments. Visual examination of the flame alone cannot determine combustion performance.
15. Do not operate furnace if temperature rise through heat exchanger exceeds 85°F.
16. Inspect, clean, and replace (if necessary) return air filter regularly.
17. Do not obstruct return air grills or supply air outlets.
18. Supply only with #2 fuel oil to the burner. Never attempt to use gasoline, a mixture of gasoline and oil, waste fuel, reused or any other substance in the burner of furnace.

### Operation -

6. Do not use the furnace as a construction heater.
7. Do not operate any furnace if the heat exchanger is damaged, corroded or pitted. Toxic flue products could enter the air stream.
8. Do not jumper, attempt to by-pass or override any limit control.
9. Do not block flow of combustion or ventilation air to furnace. Do not block or obstruct the air openings in the furnace casing.
10. Do not store or use combustible materials, gasoline, or other flammable liquids or vapors in the furnace area.
11. Do not operate the furnace if the furnace area will be exposed to air contaminants as described on page 7
12. Should overheating occur, do not turn off or disconnect electrical supply to furnace. Instead, shut off the oil supply at a location external to the appliance, if possible.
13. Do not use this furnace if any part of it has been under water. Call a qualified service technician immediately, to inspect the furnace and to replace any part of the furnace, control system or burner that was submerged in water.
14. Do not stack items or boxing within the required clearances to combustible materials specified in Table 1.
19. Do not block flow of combustion or ventilation air to furnace. Do not block or obstruct the air openings in the furnace casing.
20. Connect furnace only to a functional vent system in good condition. Place the furnace to allow proper venting, with the shortest possible venting and minimum number of elbows.
21. Always connect and seal a return air duct to the furnace unless the furnace is located in a large space, such as an unpartitioned basement. Route the return air duct to an adjacent room if no return air manifold is used.
22. Install furnace maintaining minimum clearances for service and separation from combustible surfaces described in this manual.
23. Install, start-up, service and maintain burner per instructions in this manual and the burner manual.
24. Verify burner is properly inserted through the combustion chamber opening.
25. Furnace must be installed so that burner and control system components are protected from dripping, spraying water or rain during operation or service.
26. If installing an air conditioning evaporator coil, install the coil downstream of, or in parallel with, the furnace to prevent condensation on the furnace heat exchanger. If the coil is in parallel, provide means to prevent flow of chilled air into the furnace, including an interlock to prevent simultaneous operation of heating and air conditioning.

### Installation -

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**NOTICE** Apply the following suggestions to prevent unsatisfactory operation of the furnace.

### Installation –

1. Be sure to level the furnace, using a spirit level on the front and one side. If the furnace is not level, oil can drip into the combustion chamber after burner cycling and contaminate the heat exchanger and the burner head.
2. Make sure all legs are in contact with the floor to distribute the load and prevent the possibility of undue noise or vibration.
3. Avoid locating return grills in rooms that may contain undesirable odors.
4. Never locate a return air grill closer than approximately 20 feet from the furnace.
5. Locate the furnace near the center of the supply and return duct systems.
6. Always check the size of the ducts on a replacement installation, particularly if adding air conditioning.

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**NOTICE** 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, agency approved carbon monoxide detectors should be installed in your residence and properly maintained to warn of dangerously high carbon monoxide levels. There are several sources of possible smoke and flames in a residence. Smoke and flames can cause bodily harm or death. For this reason, agency approved smoke detectors should be installed in your residence and 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 the optional Blocked Vent Shut-off Device.

# 1. INSTALLATION

This furnace is a true multi-position unit, in that it will function in an upflow, downflow or horizontal configuration to the left or the right. Only a few modifications are required during installation to change from one position to another. The unit is shipped in the upflow configuration and instructions as to how to change to the other positions are included in this manual.

The unit is shipped with a burner and its controls. It requires a 115VAC power supply to the control panel and thermostat hook-up as shown on the wiring diagram, one or more oil line connections, suitable ductwork, and connection to a properly sized vent.

All local and national code requirements governing the installation of oil burning equipment, wiring and the flue connection MUST be followed. Some of the codes that may apply are:

- CSA B139: **Installation code for oil burning equipment.**
  - ANSI/NFPA 31: **Installation of oil burning equipment.**
  - ANSI/NFPA 90B: **Warm air heating and air conditioning systems.**
  - ANSI/NFPA 211: **Chimneys, Fireplaces, Vents and solid fuel burning appliances.**
  - ANSI/NFPA 70: **National Electrical Code.**
  - CSA C22.1: **Canadian Electrical Code.**
  - or CSA C22.10:
- Only the latest issues of these codes may be used.

## 1.1. POSITIONING THE FURNACE



**Fire and explosion hazard.**  
The furnace must be installed in a level position, never where it will slope toward the front.

Do not store or use gasoline or any other flammable substances near the furnace.

Non-observance of these instructions will potentially result in death, bodily injury and/or property damage.



This furnace is not watertight and is not designed for outdoor installation. It must be installed in such a manner as to protect its electrical components from water. Outdoor installation will lead to a hazardous electrical condition and to premature failure of the equipment.

The minimum clearances from combustible material for each of the positions are specified in Table 1.

If the furnace is installed in a basement or on a dirt floor, in a crawl space for example, it is recommended to install the unit on a cement base 2.5 cm to 5.0 cm (1" to 2") thick.

The unit must be installed in an area where the ambient and return air temperatures are above 15°C (60°F). In addition, the furnace should be installed as closely as possible to the vent, so that the connections are direct and kept to a minimum. The furnace should also be located close to the center of the air distribution system.

### 1.1.1. Installation in an enclosure

The unit can be installed in an enclosure such as a closet. However, 2 ventilation openings are required for combustion air. The openings should be in front of the furnace approximately 15 cm (6") above the floor and 15 cm (6") below the ceiling. Figure 1 indicates the minimum dimensions required and the location of the openings.

Figure 1: Location and dimensions of ventilation air openings in a closet door

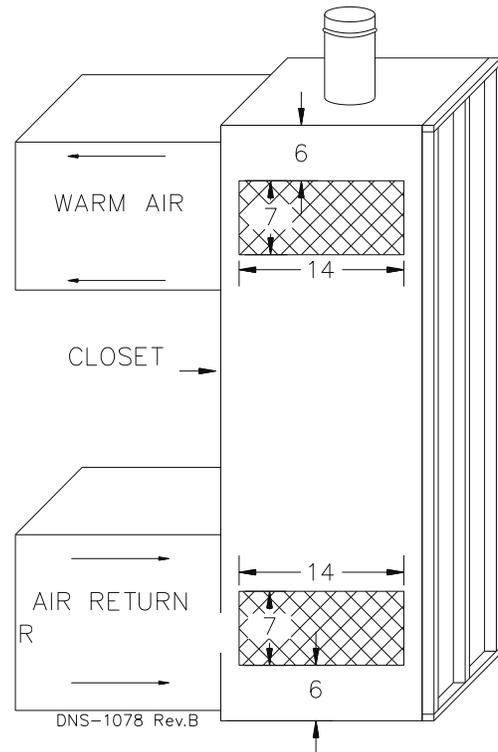


Table 1: Minimum clearances from combustible materials

LOCATION		UPFLOW	HORIZONTAL	DOWNFLOW
SIDES	FURNACE <sup>1</sup>	2.54 cm (1")	N/A	2.54 cm (1")
	PLENUM AND WARM-AIR DUCT WITHIN 6 ft. OF FURNACE <sup>1</sup>	5.08 cm (2")	2.54 cm (1")	5.08 cm (2")
BOTTOM	FURNACE <sup>2</sup>	∅	2.54 cm (1") <sup>3</sup>	5.08 cm (2") <sup>4</sup>
BACK	FURNACE (OPPOSITE SIDE OF THE BURNER) <sup>1</sup>	7.62 cm (3")	2.54 cm (1")	7.62 cm (3")
TOP	PLENUM OR HORIZONTAL WARM-AIR DUCT WITHIN 6 ft. OF FURNACE <sup>2</sup>	5.08 cm (2")	5.08 cm (2")	5.08 cm (2")
	FURNACE <sup>2</sup>	N/A	5.08 cm (2")	N/A
FLUE PIPE	AROUND FLUE PIPE	22.86 cm (9")	22.86 cm (9")	22.86 cm (9")
FRONT	FURNACE (BURNER SIDE) <sup>1</sup>	45.72 cm (18")	45.72 cm (18")	45.72 cm (18")

<sup>1</sup> These are horizontal dimensions

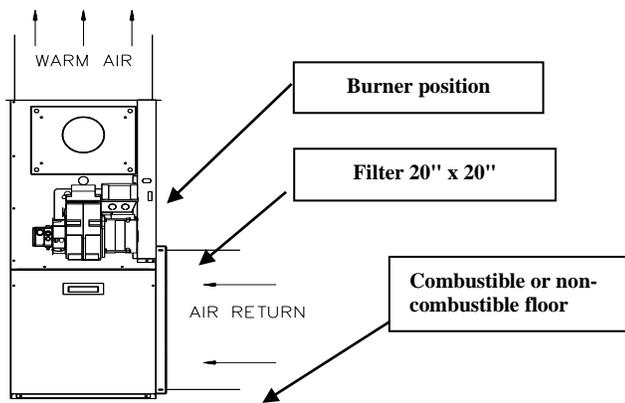
<sup>2</sup> These are vertical dimensions

## 1.2. CONFIGURATIONS

### 1.2.1. Up flow Installation

The return air opening may be located on either side of the furnace. Care should be taken not to damage the wires inside, while cutting the opening. Install the filter rack supplied with the unit according to the instructions provided with it. It is also recommended to install the blower door before handling or moving the unit. Refer to figure 2 for additional details.

Figure 2: Up flow installation



### 1.2.2. Downflow Installation

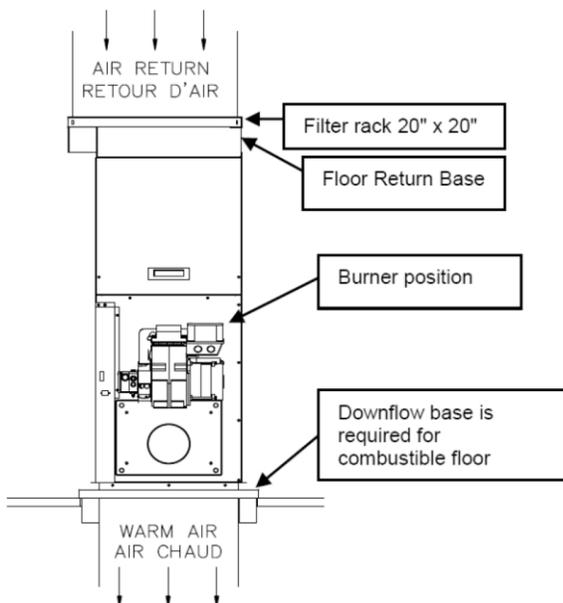
When the furnace is installed in the downflow position on a combustible floor, the clearances from combustibles must be adhered to. The downflow base DFB-102 can be used to ensure these clearances. Refer to Figure 3 and the installation instructions provided with the base.

In cases where the return air enters through the floor, the floor return base FRB-101 must be used.

The burner must always be installed in the same manner, regardless of the discharge position of the furnace. Refer to Figure 3 for additional details.

The protection plate (B03789) must be installed on the plastic cover of the Beckett NX burner to protect it from vent.

Figure 3: Downflow installation

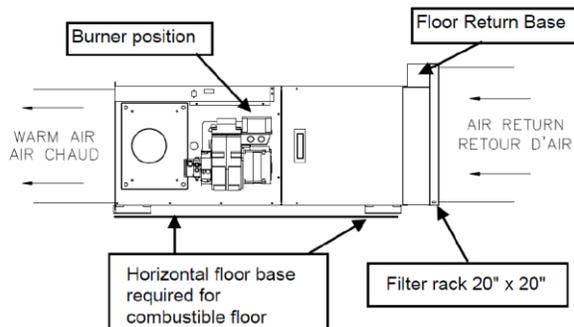


### 1.2.3. Horizontal Installation

When the furnace is installed in the horizontal position, either suspended or on a combustible floor with a choice of right or left discharge, the clearances from combustible material must be adhered to. If the unit is installed on a combustible floor, the horizontal floor base HFB-101 can be used to ensure these clearances. Refer to the instructions supplied with the base. In cases where the return air enters through the floor, the floor return base FRB-101 or KLARB0101DET can be installed as per the supplied instructions.

The burner must always be installed in the same manner, regardless of the discharge position of the furnace. Refer to Figure 4 for additional details.

Figure 4: Horizontal installation



## 1.3. ELECTRICAL SYSTEM

**CAUTION** The exterior of the unit must have an uninterrupted ground to minimize the risk of bodily harm, if ever an electrical problem develops. A green ground screw is supplied with the control box for that purpose.

The appliance must be installed in accordance with the current ANSI/NFPA 70 National Electrical Code, CSA C22.1 Canadian Electrical Code Part 1 and/or local codes.

The control system depends on the correct polarity of the power supply. Connect "HOT" wire (H) and "NEUTRAL" wire (N) as shown in figures 10 and 11.

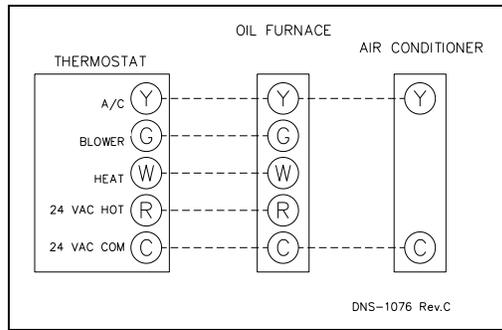
A separate line voltage supply should be used, with fused disconnect switch or circuit breaker, between the main power panel and the unit.

Only copper wire may be used for the 115V circuit on this unit. If wires need to be changed, the replacements must have the same temperature resistance as the originals.

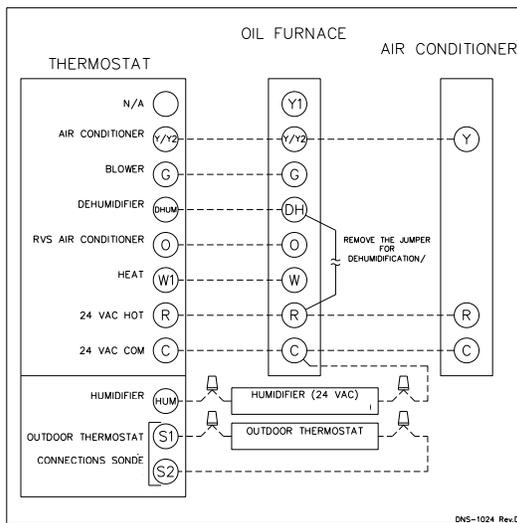
## 1.4. INSTALLATION OF THE THERMOSTAT

A thermostat must be installed to control the temperature of the area to be heated. Follow the instructions supplied with the thermostat. Also refer to the wiring diagrams provided with the heating/air conditioning unit. The connections must be made as indicated on the following diagrams and the wiring diagrams, figures 10 and 11.

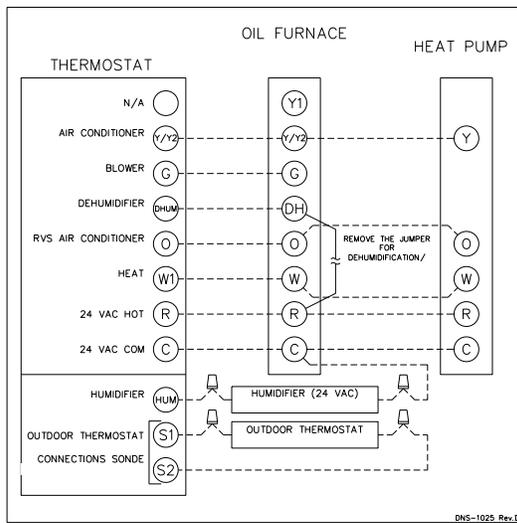
**Figure 5: Thermostat wiring, heating and air conditioning with 4-speed motor**



**Figure 6: Thermostat wiring heating and air conditioning with ECM variable speed motor**



**Figure 7: Thermostat wiring, heating and air cond. heat pump with ECM v. speed motor**



**Note:** On units with 2 stage cooling or heat pump, terminal Y1 must be used. When Y1 on the electronic control receives a 24 VAC signal, the air flow is reduced by 20%. Do not use terminal Y1 with a single stage cooling or heat pump.

## 1.5. INSTALLATION OF THE BURNER

Refer to the burner manufacturer's instructions. Also, the burner must be installed always in the same way independently of the furnace orientation.

1. Position the mounting gasket between the mounting flange and the burner mounting plate. Align the holes in the burner mounting plate with the studs on the mounting flange and bolt securely in place.
2. Remove the burner drawer assembly or the air tube assembly.
3. Install the nozzle, refer to Burner data Table 11.
4. Check the electrode settings.
5. Make the electrical connections.
6. Complete oil line connections.

### 1.5.1. Nozzles

The burner comes equipped with an appropriate nozzle. However, if another size or a replacement nozzle is required, use the manufacturer's recommended spray angle and type as shown in Table 11 and pump pressure as specified.

Always select nozzle sizes by working back from the desired flow rate at operating pressure and not the nozzle marking.

### 1.5.2. Air and Turbulator Settings

Before starting the burner for the first time, adjust the air and turbulator settings to those listed in this manual, Table 11. Once the burner becomes operational, final adjustments will be required. Refer to section 2 of this manual.

### 1.5.3. Post purge delay adjustment

The post purge delay on the oil-fired burners is factory set to zero second. This delay is applicable for all installations with chimney venting. For heating units installed with side wall venting and a burner equipped with this feature, the post purge delay must be set to 15 seconds (For configuration use the Beckett Contractor's Tool "52082U"). No delay is required for Riello burners. Refer to the burner control instruction manual and markings for proper adjustment of the post purge delay.

## 1.6. VENTING

**WARNING** Poisonous carbon monoxide gas, fire, and explosion hazard.

Read and follow all instructions in this section.

Failure to properly vent this furnace can result in death, bodily injury and/or property damage.

To ensure the safe and proper functioning of an oil furnace, it must always be connected to a flue with sufficient draft or to an approved sidewall venting system. In addition, it is strongly recommended to perform a complete inspection of all the existing venting systems.

**WARNING** Poisonous carbon monoxide gas hazard. Never install a hand operated damper in the vent pipe. However, any Underwriters Laboratories listed, electrically operated automatic type vent damper may be installed if desired. Be sure to follow the instructions provided with vent damper. Also, read and follow all instructions in this section of the manual.

Failure to properly vent this furnace or other appliances can result in death, bodily injury and/or property damage.

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### 1.6.1. Masonry chimney

This furnace can be vented into an existing masonry chimney. However, the unit must not be vented into a chimney into which a solid fuel burning furnace is already being vented.

Before venting this furnace into a chimney, its condition must be checked and repairs made, if necessary. Also, the chimney lining and dimensions must conform to local and national codes.

### 1.6.2. Factory Built Chimneys

Oil fired furnaces are approved for use with "L" type vents. The unit may also be used with an approved chimney of proper dimensions and temperature ratings as specified in the installation code. Refer to chimney manufacturer's instructions for proper installation.

### 1.6.3. Draft Regulator

It is recommended that a draft regulator be installed in cases where the draft is either high or variable due to external conditions. Follow the instructions provided with the regulator.

### 1.6.4. Sidewall Venting and Mobile Homes / Recreational Vehicles

The heating unit is approved for sidewall venting. This system is comprised of a model VTK-54 sidewall venter and a 4" insulated vent pipe, model IFV-420. Refer to the installation instructions provided with the venting system.

Side-wall venting is required for mobile home and recreational vehicles applications. For such applications, combustion air shall not be drawn from occupied spaces.

When the furnace is installed in a movable mobile home or in a recreational vehicle, it shall be fixed on the floor or on the wall by means of steel angles screwed at the bottom of each sides of the furnace and the floor (or the wall). When moving, the furnace and the burner shall be shut down and oil line valve closed.

### 1.7. BLOCKED VENT SHUT-OFF DEVICE (BVSO) FOR CHIMNEY VENTING - OPTIONAL

**CAUTION** It is imperative that this device be installed by a qualified service technician.

A positive pressure venting system (Sealed Combustion System or Direct Vent) must NOT use the BVSO. Follow the instructions supplied with the venting system.

This device is designed to detect the insufficient evacuation of combustion gases in the event of a vent blockage. In such a case the thermal switch will shut down the oil burner. The device will then need to be re-armed MANUALLY.

Refer to the detailed instructions and wiring diagrams supplied with the BVSO for the installation and wiring procedures. The length of wires supplied with the unit is such that the safety device must be installed between the flue outlet of the appliance and the draft regulator, as indicated in the instructions.

It is also essential that the BVSO be maintained annually. For more details refer to the instructions supplied with the device itself, as well as Section 2 of this Manual.

#### 1.7.1. BVSO Performance Test (If installed)

The purpose of the following test is to check that the electrical outlet on the furnace, designated to the BVSO, is functional.

1. Start up the burner.
2. Disconnect one wire of the BVSO.
3. The burner must shut-off immediately, while the blower continues to run to the end of the cool-down cycle.

If the test is not in line with the above, call a QUALIFIED SERVICE TECHNICIAN.

Figure 8: BVSO mounting installation: Up flow with vertical exhaust (OPTIONAL)

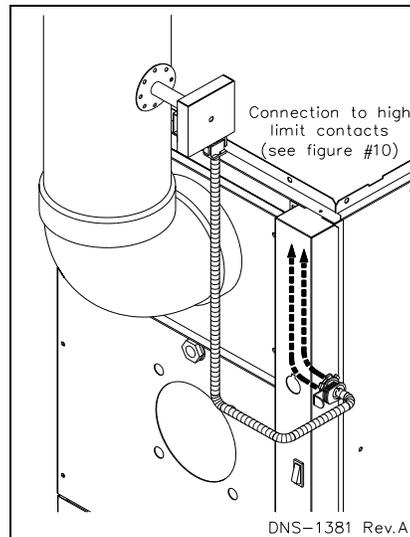


Figure 9: BVSO mounting installation: Up flow with horizontal exhaust (OPTIONAL)

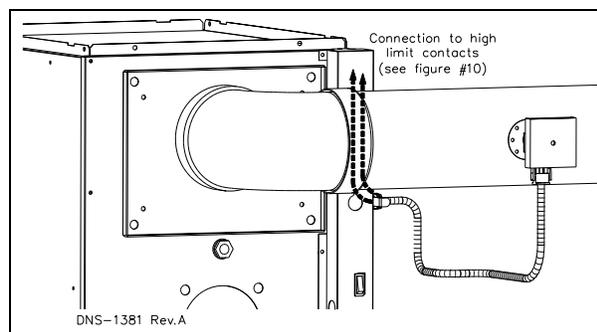
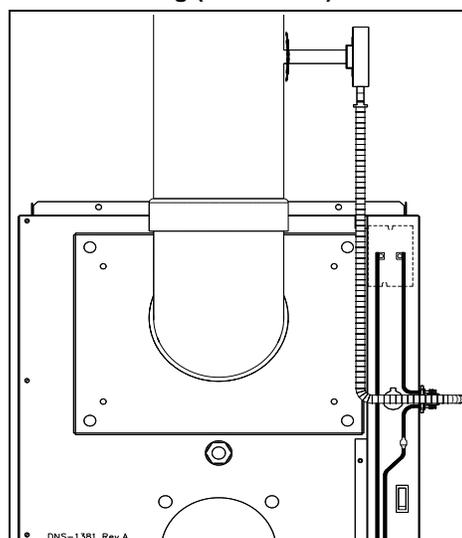


Figure 10: BVSO Wiring (OPTIONAL)



## 1.8. COMBUSTION AIR SUPPLY AND VENTILATION

**⚠ WARNING** Poisonous carbon monoxide gas hazard.

Comply with NFPA 31 (U.S.) and CSA B139 (Canada) standards for the installation of Oil Burning Equipment and applicable provisions of local building codes to provide combustion and ventilation air.

Failure to provide adequate combustion and ventilation air can result in death, bodily injury and/or property damage.

Oil furnaces must have an adequate supply of combustion air. It is common practice to assume that older homes have sufficient infiltration to accommodate the combustion air requirement for the furnace. However, home improvements such as new windows, doors, and weather stripping have drastically reduced the volume of air infiltration into the home.

Refer to oil furnace installation codes relative to combustion and ventilation air requirements. Consult Section 1.1.1 in this manual, specifically for units installed in an enclosed space.

Home air exhausters are common. Bathroom and kitchen fans, power vented clothes dryers and water heaters all tend to create a negative pressure condition in the home. Should this occur the chimney becomes less and less effective and can easily downdraft. In certain cases, mechanically supplied air, by way of a blower, interlocked with the unit, is necessary. It is the installer's responsibility to verify that.

### 1.8.1. Contaminated Combustion Air

Installations in certain areas or types of structures will increase the exposure to chemicals or halogens that may harm the furnace. These conditions will require that only outside air be used for combustion.

The following areas or types of structures may contain or be exposed to certain substances, potentially requiring outside air for combustion:

- Commercial buildings.
- Buildings with indoor pools.
- Furnaces installed near chemical storage areas.

Exposure to the following substances:

- Permanent wave chemicals for hair.
- 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.
- Solvent based glue.
- Antistatic fabric softeners for clothes dryers.
- Acid based masonry cleaning materials.

### 1.8.2. Burner with Outdoor Combustion Air Kit

Some burners are designed to function with combustion air taken directly from the outside. Follow the instructions provided with the burner, the fresh-air supply kit or the sidewall venting kit.

## 1.9. OIL TANK

**⚠ WARNING** Fire and explosion hazard. Use only approved heating type oil in this furnace. DO NOT USE waste oil, used motor oil, gasoline or kerosene.

**⚠ CAUTION** Use of these will result in death, bodily injury and/or property damage. When a 0.75 USGPH or smaller nozzle is used, a 10 micron or finer filter, must be installed on the oil supply line to the furnace inside the building where the unit is located. This is a requirement for the heat exchanger warranty to remain in force.

Check your local codes for the installation of the oil tank and accessories.

At the beginning of each heating season or once a year, check the complete oil distribution system for leaks.

Ensure that the tank is full of clean oil. Use No.1 or No.2 Heating Oil (ASTM D396 U.S.) or in Canada, use No.1 or No.2 Furnace Oil.

A manual shut-off valve and an oil filter shall be installed in sequence from tank to burner. Be sure that the oil line is clean before connecting to the burner. The oil line should be protected to eliminate any possible damage. Installations where the oil tank is below the burner level must employ a two-pipe fuel supply system with an appropriate fuel pump. A rise of 2.4 m (8') and more requires a two-stage pump and a rise greater than 4.9 m (16') an auxiliary pump. Follow the pump instructions to determine the size of pipe needed in relation to the rise or to the horizontal distance.

## 1.10. CONNECT SUPPLY AND RETURN DUCTS

### 1.10.1. Duct sizing

#### 1.10.1.1. Determine airflow CFM

The temperature rise through the furnace must not exceed 85°F but should be at least 55°F for comfort. When calculating airflow, assume a temperature rise of 70°F.

The noticeable temperature change for cooling would be approximately 27 - 30°F. Actual temperature change will be approximately 18 - 21°F due to humidity of the air.

To calculate noticeable heat temperature change ( $\Delta T$ ), you can use the formula:

$$\Delta T = \text{BTU/h} / (1.1 \times \text{CFM}) \quad \text{Eq. 3 - 1}$$

To calculate air flow when you know temperature change ( $\Delta T$ ), you can use:

$$\text{CFM} = \text{BTU/h} / (1.1 \times \Delta T) \quad \text{Eq. 3 - 2}$$

You can estimate air flow using the following rules of thumb:

Heating:	<b>14 CFM per 1,000 BTU/h output</b>	Eq. 3 - 3
Cooling:	<b>400 CFM per ton air conditioning</b>	Eq. 3 - 4

Determine the required airflow based on whichever is larger: heating mode or air conditioning mode.

Examples:

- What would the temperature rise be for a 100,000 BTU/h output furnace with an airflow rate of 1200 CFM?

Use Equation 3 - 1 since you know CFM and BTU/h:

$$\Delta T = 100,000 / (1.1 \times 1200) = 76^\circ\text{F}$$

- The temperature rise would be 76°F.
- If the air enters the furnace at 70°F, it will leave the furnace at 70°F + 76°F = 146°F.

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2. What would the airflow be to obtain a 70°F rise through a 120,000 BTU/h output furnace?

Use equation 3 - 2 since you know  $\Delta T$  and BTU/h:

$$\text{CFM} = 120,000 / (1.1 \times 70) = 1558 \text{ CFM}$$

- The air flow would have to be 1558 CFM to obtain a temperature rise of 70°F.

3. Estimate the required airflow for a 75,000 BTU/h output furnace installed with a 2-ton air conditioning evaporator coil.

Heating mode air flow (use Equation 3 - 3):

$$\text{CFM} = 75 \times 14 = 1050 \text{ CFM}$$

Cooling mode air flow (use Equation 3 - 4):

$$\text{CFM} = 2 \times 400 = 800 \text{ CFM}$$

- The larger number is 1050 CFM (heating), so the duct system should be sized for 1050 CFM.
- The supply duct would need to be 16" round or a rectangular equivalent such as 8" x 25" or 12" x 18", using Table 3.

4. Estimate the required airflow for the same furnace installed with a 4-ton air conditioning evaporator coil.

Heating mode airflow is still 1050 CFM.

Cooling mode air flow (use Equation 3 - 4):

$$\text{CFM} = 4 \times 400 = 1600 \text{ CFM}$$

- The larger number is 1600 CFM (cooling), so the duct system should be sized for 1600 CFM.
- The supply duct would need to be 18" round or a rectangular equivalent such as 8" x 36" or 12" x 23", using Table 3.

### **CAUTION**

Always check the size of existing ducts, particularly if you are adding air conditioning. The air pressure loss through the cooling evaporator coil reduces available airflow. If the ducts are too small as well, the system may not work satisfactorily on either heating or cooling.

### 1.10.1.2. Determine duct dimensions

Tables 3 and 4, provide typical round and rectangular duct sizes for rectangular and flat oval galvanized ducts. Do not apply these tables to size ductwork if the total equivalent length of the duct exceeds approximately 100 feet. For longer systems or for duct board, fiberglass-lined or flexible duct sizing, use the ACCA Manual D or the ACCA duct sizing slide rule. These tables are based on pressure loss of approximately 0.10" water column per 100 feet equivalent length of duct.

Use Table 2 beside to size or check sizing of take-offs to supply registers or return grills.

Verify the size and type of registers, diffusers, and grills from the manufacturer's ratings. Do not exceed the recommended flow rate. The pressure drop allowance for each should not exceed approximately 0.05" water column.

Install a return air filter, sized per specifications in Section 5.

Use only a return air filter mounted to the furnace. Do not add additional filters unless the duct system is carefully sized to allow for the additional pressure drop.

**Table 2: Suggested maximum flow to runouts**

TAKE-OFF SIZE (Inches)	CFM	
	SUPPLY	RETURN
<b>Sheet metal or ductboard</b>		
5 Round	60	45
6 Round	100	75
7 Round	140	110
8 Round	210	160
3 ¼ x 8 Stack	70	55
3 ¼ x 10 Stack	100	75
3 ¼ x 14 Stack	140	110
2 ¼ x 12 Stack	70	55
2 ¼ x 14 Stack	90	70
<b>Flexible duct (keep bends to minimum)</b>		
6 Round	55	40
8 Round	120	90
10 Round	200	160
12 Round	320	250
14 Round	480	375
16 Round	660	530
18 Round	880	680
20 Round	1200	900

**1.10. CONNECT SUPPLY AND RETURN DUCTS (continued)**

**1.10.1. Duct sizing (continued)**

Table 3: Typical duct sizing for systems not over 100 feet equivalent length – round or rectangular galvanized

Typical duct sizing																		
(For approximately 0.10 inch w.c. in a typical residential installation of galvanized metal duct)																		
CFM	Round duct diameter (inches)	Rectangular duct equivalent sizes																
		Minimum width (inches) for duct heights (inches) of :																
		4 x	5 x	6 x	7 x	8 x	9 x	10 x	12 x	14 x	16 x	18 x	20 x	22 x	24 x	26 x	28 x	30 x
45	4	4	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
65	5	6	5	4	4	-	-	-	-	-	-	-	-	-	-	-	-	-
100	6	8	6	5	5	4	4	-	-	-	-	-	-	-	-	-	-	-
150	7	12	9	7	6	5	5	5	4	4	-	-	-	-	-	-	-	-
200	8	14	11	9	8	7	6	6	5	4	4	-	-	-	-	-	-	-
250	9	18	13	10	9	8	7	6	6	5	5	4	4	-	-	-	-	-
300	9	20	15	12	10	9	8	7	6	6	5	5	4	4	-	-	-	-
400	10	26	19	15	13	11	10	9	8	7	6	6	5	5	5	4	4	-
500	12	32	23	18	15	13	12	11	9	8	7	6	6	6	5	5	5	5
600	12	38	28	22	18	15	13	12	10	9	8	7	7	6	6	6	5	5
700	12	46	32	25	20	17	15	14	11	10	9	8	7	7	7	6	6	6
800	14	52	36	28	23	19	17	15	13	11	10	9	8	8	7	7	6	6
900	14	58	41	31	25	21	19	17	14	12	11	10	9	8	8	7	7	7
1000	16	64	45	34	28	23	20	18	15	13	11	10	9	9	8	8	7	7
1100	16	72	49	38	30	25	22	19	16	14	12	11	10	9	9	8	8	7
1200	16	-	54	41	33	27	24	21	17	15	13	12	11	10	9	9	8	8
1300	16	-	58	44	35	29	25	22	18	16	14	12	11	10	10	9	9	8
1400	18	-	63	47	38	31	27	24	19	16	14	13	12	11	10	10	9	9
1500	18	-	68	51	40	34	29	25	20	17	15	14	12	12	11	10	10	9
1600	18	-	72	54	43	36	30	27	21	18	16	14	13	12	11	11	10	9
1700	18	-	-	58	45	38	32	28	23	19	17	15	14	13	12	11	10	10
1800	18	-	-	61	48	40	34	29	24	20	17	16	14	13	12	11	11	10
1900	20	-	-	64	51	42	35	31	25	21	18	16	15	14	13	12	11	11
2000	20	-	-	68	53	44	37	32	26	22	19	17	15	14	13	12	12	11
2200	20	-	-	-	59	48	41	35	28	23	20	18	16	15	14	13	12	12
2400	22	-	-	-	64	52	44	38	30	25	22	19	17	16	15	14	13	12
2600	22	-	-	-	69	56	47	41	32	27	23	21	19	17	16	15	14	13
2800	22	-	-	-	-	61	51	44	34	29	25	22	20	18	17	15	15	14
3000	22	-	-	-	-	65	54	47	37	30	26	23	21	19	17	16	15	14
3500	24	-	-	-	-	-	63	54	42	34	29	26	23	21	19	18	17	16
4000	26	-	-	-	-	-	72	61	47	39	33	29	26	23	21	20	19	18



Do not apply this table for duct systems over approximately 100 equivalent feet length. For longer systems or systems using other duct materials, refer to ACCA Manual D. Incorrectly sizing duct systems can result in unsafe or uncomfortable operation.

**1.10. CONNECT SUPPLY AND RETURN DUCTS (continued)**

**1.10.1. Duct sizing (continued)**

Table 4: Typical duct sizing for systems not over 100 feet equivalent length – round or flat oval galvanized

Typical duct sizing														
(For approximately 0.10 inch w.c. in a typical residential installation of galvanized metal duct)														
CFM	Round duct diameter (inches)	Flat oval duct equivalent sizes												
		Minimum width (inches) for duct heights (inches) of :												
		3 x	4 x	5 x	6 x	7 x	8 x	9 x	10 x	12 x	14 x	16 x	18 x	20 x
45	4	6	5	-	-	-	-	-	-	-	-	-	-	-
65	5	8	6	-	-	-	-	-	-	-	-	-	-	-
100	6	11	8	7	-	-	-	-	-	-	-	-	-	-
150	7	16	11	9	8	-	-	-	-	-	-	-	-	-
200	8	21	15	11	10	8	-	-	-	-	-	-	-	-
250	9	26	18	14	11	10	9	-	-	-	-	-	-	-
300	9	30	20	16	13	11	10	-	-	-	-	-	-	-
400	10	40	26	20	16	14	12	11	-	-	-	-	-	-
500	12	49	32	24	19	16	14	13	12	-	-	-	-	-
600	12	59	38	28	22	19	16	15	13	-	-	-	-	-
700	12	69	44	32	25	21	18	16	15	13	-	-	-	-
800	14	-	50	36	29	24	20	18	16	14	-	-	-	-
900	14	-	56	41	32	26	22	20	18	15	-	-	-	-
1000	16	-	63	45	35	29	24	22	19	17	15	-	-	-
1100	16	-	69	49	38	31	26	23	21	18	16	-	-	-
1200	16	-	75	53	41	33	28	25	22	19	17	-	-	-
1300	16	-	-	58	44	36	30	26	24	20	18	-	-	-
1400	18	-	-	62	47	38	32	28	25	21	18	17	-	-
1500	18	-	-	66	50	41	34	30	26	22	19	18	-	-
1600	18	-	-	71	54	43	36	31	28	23	20	18	-	-
1700	18	-	-	-	57	46	38	33	29	24	21	19	-	-
1800	18	-	-	-	60	48	40	35	31	25	22	20	-	-
1900	20	-	-	-	63	50	42	36	32	26	23	21	19	-
2000	20	-	-	-	67	53	44	38	33	27	24	21	20	-
2200	20	-	-	-	73	58	48	41	36	29	25	23	21	-
2400	22	-	-	-	-	63	52	44	39	32	27	24	22	21
2600	22	-	-	-	-	68	56	48	42	34	29	25	23	22
2800	22	-	-	-	-	-	60	51	44	36	30	27	24	23
3000	22	-	-	-	-	-	64	54	47	38	32	28	26	24
3500	24	-	-	-	-	-	-	63	54	43	36	32	28	26
4000	26	-	-	-	-	-	-	71	61	48	40	35	31	29

**⚠ WARNING** Do not apply this table for duct systems over approximately 100 equivalent feet length. For longer systems or systems using other duct materials, refer to ACCA Manual D. Incorrectly sizing duct systems can result in unsafe or uncomfortable operation.

### 1.10.2. Ducting

**WARNING** Poisonous carbon monoxide gas hazard. DO NOT draw return air from inside a closet or utility room. Return air MUST be sealed to the furnace casing. Failure to properly seal ducts can result in death, bodily injury and/or property damage.

The ducting must be designed and installed according to approved methods, local and national codes as well as good trade practices.

When ducting supplies air to a space other than where the furnace is located, the return air must be sealed and be directed to the space other than where the furnace is located.

### 1.10.3. Air filter

A properly sized air filter must be installed on the return air side of the unit. Refer to Table 10, for the correct dimensions. Also refer to the instructions supplied with the filter.

### 1.11. SUPPLY AIR ADJUSTMENTS (4 SPEED MOTORS)

On units equipped with 4-speed blower motor, the supply air must be adjusted based on heating/air conditioning output and the static pressure of the duct system. For the desired airflow refer to the following table as well as the air flow tables based on static pressure in the table 12 of this manual.

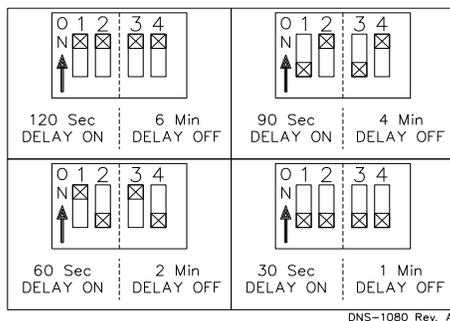
Table 5: Blower speed adjustments (4-speed motors)

FURNACE APPLICATION	HEATING OR A/C OUTPUT	RECOMMENDED BLOWER SPEED
HEATING	0.50 USGPH	MED-LOW
	0.60 USGPH	MED-HIGH
	0.70 USGPH	HIGH
A/C	2.0 TONS	MED-LOW
	2.5 TONS	MED-HIGH
	3.0 TONS	HIGH

To make the adjustment, the RED (for heating) and BLUE (for cooling and heat pump) wires can be changed on the motor. Also, refer to the position of the wires on the electronic board of the unit and consult the wiring diagrams. If the heating and air conditioning speeds are the same, the RED wire must be moved to "UNUSED LEADS" on the electronic board and the jumper provided with the BLUE wire must be used between the "HEAT" and "COOL" terminals.

The blower start/stop delays can be adjusted by positioning the DIP switches on the electronic board as shown in the following figures. The recommended blower ON delay is 60 seconds and the blower OFF delay is 2 minutes.

Figure 11: Blower start/stop delays Board # 1158



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### 1.12. SUPPLY AIR ADJUSTMENTS (ECM VARIABLE SPEED MOTORS)

On units equipped with ECM variable speed blower motors, the air supply must be adjusted based on heating/air conditioning output. The start/stop delays of the blower must also be adjusted by positioning the DIP switches on the electronic board. Refer to the following tables, airflow table 13 and the wiring diagram, figure 13 in this manual for the proper settings:

Table 6: Supply air adjustments, ECM variable speed motors, heating mode

SW1 – HEAT			Input USGPH
DIP Switch Positions			
1	2	POSITION	
OFF	OFF	A	0.70
ON	OFF	B	0.60
OFF	ON	C	0.50
ON	ON	D	ALL

Table 7: Supply air adjustments, ECM variable speed motors, air conditioning mode

SW2 – COOL			Output Tons
DIP Switch Positions			
1	2	POSITION	
OFF	OFF	A	3.0
ON	OFF	B	2.5
OFF	ON	C	2.0
ON	ON	D	1.5

Table 8: CFM adjustments, all modes

SW3 – ADJ (Adjustment)			CFM HTG. % increase or decrease	CFM A/C % increase or decrease
DIP Switch Positions				
1	2	POSITION		
OFF	OFF	A	0%	0%
ON	OFF	B	10%	10%
OFF	ON	C	-10%	-10%
ON	ON	D	0%	0%

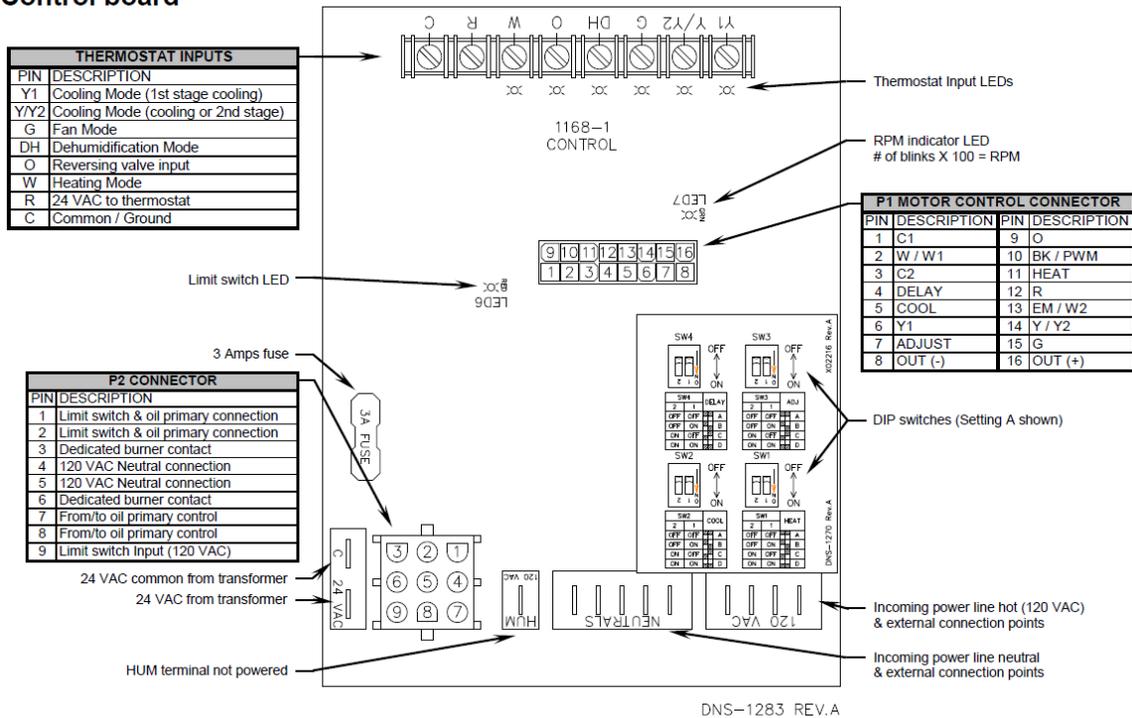
Table 9: Delay adjustments - heating mode

SW1 – HEAT			Input USGPH
DIP Switch Positions			
1	2	POSITION	
OFF	OFF	A	0.70
ON	OFF	B	0.60
OFF	ON	C	0.50
ON	ON	D	ALL

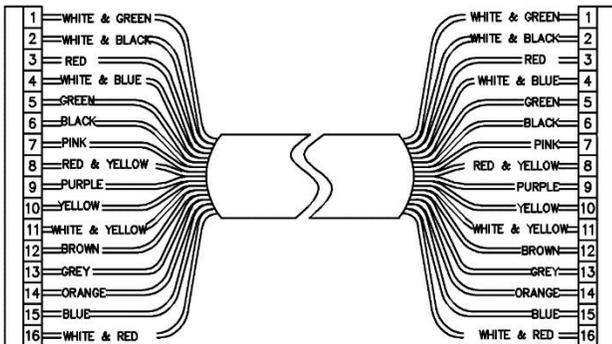
**BOARD**

**1.13. ECM VARIABLE SPEED MOTORS CONTROL**

**Control board**



**Motor control wires**



Also refer to the instructions supplied with the accessory.

**1.14.2. Electronic Air Cleaner (EAC)**

The EAC terminal on the electronic board supplies 120 VAC when the blower is operating in the heating or air conditioning mode. This signal can be used to activate an electronic air cleaner that is not equipped with an air flow switch. If the cleaner is equipped with an air flow switch, the S terminal on the electronic board or one of the 120 VAC terminals on the ECM electronic card can be used to provide a constant supply of 120 VAC.

Also refer to the instructions supplied with the accessory.

**1.14.3. Air Conditioner (or Heat Pump)**

An air conditioning coil may be installed on the supply air side ONLY.

**WARNING** Poisonous carbon monoxide gas hazard. Install the evaporator coil on the supply side of the furnace ducting ONLY.

An evaporator coil installed on the return air side of the ducting can cause condensation to form inside the heat exchanger, resulting in heat exchanger failure. This in turn, can result in death, bodily injury and/or property damage.

A clearance of 15 cm (6") is required between the bottom of the coil drain pan and the top of the heat exchanger. If a heat pump is installed, a "dual-energy" thermostat, or other control is recommended, to prevent the simultaneous operation of the furnace and the heat pump. It also prevents a direct transition from heating by way of the heat pump to heating with oil. Refer to the thermostat instructions or those of another control used for the proper wiring.

**1.14. INSTALLATION OF ACCESSORIES**

**WARNING** Electrical shock hazard.

Turn OFF electrical power at the fuse box or service panel before making any electrical connections and ensure a proper ground connection is made before connecting line voltage.

Failure to do so can result in death or bodily injury.

**1.14.1. Humidifier**

The 120 VAC HUM terminal on the electronic board of the blower is tied directly to terminal 8 of the 9-terminal connector of the electronic board. It supplies 120 VAC electric power when the burner is in operation.

A 24 VAC signal can also be supplied from the W and C terminals on the blower electronic board to activate a switching relay.

## 2. OPERATION

### 2.1. START-UP

**CAUTION** DO NOT START THE BURNER UNLESS THE BLOWER ACCESS DOOR IS SECURED IN PLACE.

Before starting up the unit, be sure to check that the following items are complying:

1. The electrical installation, the oil supply system, the venting system, combustion air supply and ventilation.
2. The blower access door is in place and the blower rail locking screws are well tightened.
3. The Blocked Vent Shut-Off (BVSO) is installed according to instructions (for chimney venting).
4. The oil supply valve is open.
5. The burner "Reset" button is well pushed in or re-armed.
6. The preliminary air adjustments on the burner comply with the technical specifications in this manual.
7. The blower speed adjustments for heating and air conditioning are appropriate and according to the specifications in this manual.
8. The blower start/stop delays are satisfactory.
9. The thermostat of the room is in the heating mode and is set higher than the ambient temperature.

To start the unit, turn the main electrical switch on.

### 2.2. OPERATING SEQUENCE OIL HEATING MODE

1. The W-R contact closes.
2. The burner motor starts up to pre-purge the combustion chamber for a period of 10 to 15 seconds. During that time a spark is established on the electrodes.
3. The solenoid valve opens, and a flame is established. Shortly after, the electrodes cease to spark.
4. Then the blower runs up to full speed. The delay depends on the adjustments that were made on the electronic board, which controls the blower motor. Refer to Sections 1.11. and 1.12., as well as the CFM tables 12 and 13 for more details.
5. When the call for heat is satisfied, the solenoid valve closes, the flame goes out and the burner motor stops (after post purge delay, if applicable).
6. The blower stops shortly after the burner. The delay depends on the adjustments that were made on the electronic board that controls the blower. Refer to Sections 1.11. and 1.12., as well as the CFM tables 12 and 13 for more details.

**Note:** A detailed operating sequence of the oil burner is outlined in the instructions provided with the burner.

### 2.3. CHECKS AND ADJUSTMENTS

#### 2.3.1. Purging the oil line

Open the bleed port screw and start the burner. Allow the oil to drain into a container for at least 10 seconds. The oil should flow absolutely free of white streaks or air bubbles to indicate that no air is being drawn into the suction side of the oil piping and pump. Slowly close and tighten the bleed screw. Once closed, the flame will light up.

#### 2.3.2. Pressure adjustment

The oil pressure must be adjusted according to Table 11 of this manual. An adjustment screw and a connection for a pressure gauge are located on the oil pump for that purpose. Also refer to the burner instruction manual.

#### 2.3.3. Combustion Check

**CAUTION** The heat exchanger metal surfaces may have oil and the baffle insulation also contains binders. These products will burn or evaporate when the unit operates for the first time. Because of that, the smoke reading may be skewed during the first minutes of operation. Therefore, the unit must operate during at least 60 minutes before taking any readings to adjust the combustion quality. Let the unit cool down before making any adjustments.

**NOTICE** The combustion check verification **MUST** be performed after the nozzle replacement or the burner cleaning. After these manipulations, the combustion parameters are necessarily modified. Refer also to the burner instruction manual.

1. Pierce a test hole in the flue pipe, approximately 18 inches from the furnace breach. Insert the smoke test probe into the hole. For installation using a sidewall venting, use the orifice provided on the breach plate.
2. From a cold start, let the unit operate for about 5 minutes.
3. Set the burner air setting until you have between 0 and 1 on the Bacharach Scale (or a "trace");
4. Take a CO<sub>2</sub> sample at the same test location where the #1 smoke reading was taken and make note of it. Example: 13.8% of CO<sub>2</sub> or 2.5% of O<sub>2</sub>.
5. Adjust the burner air setting to obtain a CO<sub>2</sub> reading 1.5% lower (or an O<sub>2</sub> reading 2.0% higher) than the reading associated with the "trace" of smoke. Example: 12.3% of CO<sub>2</sub> or 4.5% of O<sub>2</sub>.
6. This method of adjusting the burner will result in clean combustion (Bacharach smoke scale between 0 and a "trace") and ensure the proper functioning of the system. The optimum CO<sub>2</sub> level is around 12% to 13% (or 3.5% to 5.0% of O<sub>2</sub>).

#### 2.3.4. Draft Regulator adjustment

On chimney installations only, a barometric draft regulator (supplied with the furnace) must be installed, to ensure proper draft through the furnace. The barometric damper must be mounted with the hinge pins in a horizontal position and the face of the damper vertical for proper functioning (see instructions included with the damper.) After the furnace has been firing for at least five minutes, the draft regulator should be set to between -0.025" and -0.060" W.C.

#### 2.3.5. Overfire pressure test

The overfire draft that is taken through the observation port, located above the burner, is a measurement necessary to determine if there is a blockage in the heat exchanger or the flue pipe. The overfire pressure should be set between -0.035" to +0.010" W.C. for chimney installation and +0.03" to +0.15" W.C. for direct vent installation. A high-pressure condition may be caused by excessive combustion air, due to the air band being too wide open, or a lack of flue draft (chimney effect) or some other blockage, such as soot in the secondary section of the heat exchanger or the use of an oversize nozzle input or high-pressure pump.

### 2.3.6. Vent Temperature Test

1. After having adjusted the burner combustion, insert a thermometer into the test hole in the breech pipe.

**⚠ CAUTION** Low flue gas temperatures increase the risk of condensation. Adjust the total temperature at or higher than 204°C (400°F) in order for the heat exchanger warranty to remain in force.

2. The total vent temperature should be between 204 and 302°C (400 and 575°F). If not, check for improper air temperature rise, pump pressure, nozzle size or a badly soothed heat exchanger.

### 2.3.7. Supply Air Temperature Rise Test

1. Operate the burner for at least 10 minutes.
2. Measure the air temperature in the return air plenum.
3. Measuring the air temperature in the largest trunk coming off the supply air plenum, just outside the range of radiant heat from the heat exchanger. 0.3 m (12") from the plenum of the main take-off is usually sufficient.
4. The temperature rise is calculated by subtracting the return air temperature from the supply air temperature.
5. If the temperature rise is lower or exceeds the temperature specified in Table 10, change to the next lower or higher blower speed tap, until the temperature rise falls to the target. If the excessive temperature rise cannot be increased or reduced by changing fan speed, investigate for ductwork obstructions, dirty or improper air filter, improper firing caused by improper pump pressure or nozzle sizing.

### 2.3.8. Limit Control Check

After operating the furnace for at least 15 minutes, restrict the return air supply by blocking the filters or the return air register and allow the furnace to shut off on High Limit. The burner will shut off, but the blower will continue to run.

Remove the obstruction and the burner should restart after a few minutes. The time required for the restart also depends on the adjustment of the blower "OFF" delay.

### 2.3.9. Restart after Burner Failure

1. Set the thermostat lower than room temperature.
2. Press the reset button on the burner primary control (relay);
3. Set the thermostat higher than room temperature.
4. If the burner motor does not start or ignition fails, turn off the disconnect switch and CALL A QUALIFIED SERVICE TECHNICIAN.

**⚠ CAUTION** Do not attempt to start the burner when excess oil has accumulated, when the furnace is full of vapor or when the combustion chamber is hot.

### 3. MAINTENANCE

**⚠WARNING** Electrical shocks hazard. Turn OFF power and fuel to the furnace before any disassembly or servicing. Failure to do so can result in death, bodily injury and/or property damage.

Preventive maintenance is the best way to avoid unnecessary expense and inconvenience. Have your heating system and burner inspected by a qualified service technician at regular intervals.

To maintain the reliability and optimal performance of the furnace, have a complete combustion check done after the annual maintenance call. Do not attempt to repair the furnace or its controls. Call a qualified service technician.

Before calling for repair service check the following points:

1. Check the oil tank gauge and make sure the valve is open.
2. Check fuses and the circuit breaker.
3. Check if the main disconnect switch is ON.
4. Set the thermostat above room temperature.
5. If ignition does not occur, turn off the disconnect switch and call a qualified service technician.

When ordering replacement parts, please specify the complete furnace model number and serial number, see page 17.

#### 3.1 CLEANING THE HEAT EXCHANGER

It is not generally necessary to clean the heat exchanger or flue pipe every year, but it is advisable to have the oil burner service technician check the unit before each heating season to determine whether the cleaning or replacement of parts is necessary.

If a cleaning is necessary, the following steps should be performed:

1. Turn OFF all utilities upstream from the furnace.
2. Disconnect the flue pipe.
3. Remove the flue collar panel located at the front of the furnace.
4. Remove the heat exchanger baffles.
5. Disconnect the oil line and remove the oil burner.
6. Clean the secondary tubes and the primary cylinder with a stiff brush and a vacuum cleaner.
7. Before re-assembling the unit, the heat exchanger and combustion chamber should be inspected to determine if replacement is required.
8. After the cleaning replace the heat exchanger baffles, flue collar plate and oil burner.
9. Readjust the burner for proper operation.

#### 3.2 CLEANING THE BLOCKED VENT SHUT-OFF DEVICE (BVSO) (IF INSTALLED)

For continuous safe operation, the Blocked Vent Shut-off device (BVSO) must be inspected and maintained annually by a qualified service technician.

1. Disconnect power to the appliance.
2. Remove the two screws holding on the BVSO assembly cover and remove the cover.

3. Remove the two screws holding the control box to the heat transfer tube assembly. Sliding the control box in the appropriate direction will unlock it from the heat transfer tube assembly.
4. Carefully remove any build-up from the thermal switch surface.

**⚠CAUTION** Do not dent or scratch the surface of the thermal switch. If the thermal switch is damaged it MUST be replaced.

5. Clean and remove any build-up or obstruction inside the heat transfer tube.
6. Re-mount, lock and fasten the control box with the 2 screws removed in step 4.
7. Re-attach the assembly cover with the screws removed in step 2.
8. Re-establish power to the unit.

#### 3.3 CLEANING OF THE BURNER HEAD

Once annually, remove the retention head and electrodes from the drawer assembly and remove all foreign matter, if necessary. Also clean the extremity of the burner tube, if necessary.

#### 3.4 CHANGING THE NOZZLE

Change the nozzle once a year with the one specified in Table 10.

#### 3.5 CHANGING THE OIL FILTER

##### Tank Filter

The tank filter should be changed as required. Follow the manufacturer's instructions.

##### Secondary Filter

The 10 microns, or finer, filter cartridge should be changed annually. Follow the manufacturer's instructions.

#### 3.6 CHANGING THE AIR FILTER

Dirty filters have an impact on the efficiency of the furnace and increase fuel consumption. Air filters should be changed at least once a year. Very dusty conditions, the presence of animal hair and the like will require more frequent changing or cleaning.

## 4. CHECKOUT PROCEDURE

### Furnace selection

- ..1. Heat loss ..... BTU/h at ..... °F outdoor design temperature.
- ..2. Furnace model .....  
Output ..... BTU/h.
- ..3. Burner model .....  
Nozzle: ..... GPH ..... ° type .....
- ..4. Burner pump pressure ..... psig.

### Furnace installation

- ..5. Is the furnace level and are all legs in contact with the floor?
- ..6. Are return and supply ducts securely attached to furnace?
- ..7. Are the fuel filter and fuel lines installed and inspected as per the burner manual?
- ..8. Are furnace and burner wired as per the wiring diagram?
- ..9. 120 VAC wiring: type ..... size ..... AWG.

### Vent and combustion air

- ..10. Was the existing chimney / vent system inspected and found in proper condition?
- ..11. Was new vent piping installed and sealed as required?
- ..12. Was the vent sizing checked against furnace manual and codes?

### Ductwork

- ..13. Was the duct sizing checked against furnace manual and / or ACCA Manual D?
- ..14. Were the supply and return registers checked for size based on airflow?
- ..15. Were balancing dampers installed as needed?
- ..16. Was the ductwork sealed and insulated as needed?

### Furnace operation

- ..17. Is a / are clean air filter(s) in place?
- ..18. Was the temperature rise through furnace checked (not to exceed 85°F) and the blower speed adjusted if necessary?
- ..19. Was the thermostat heat anticipator set per wiring diagram?

### Furnace operation (continued)

- ..20. Was the burner started and tested per burner manual?
- ..21. Is there proper draft and burner flame? Were final adjustments made with combustion test equipment?
- ..22. Was air purged from oil piping and piping checked for leaks?
- ..23. Was burner sealed to furnace and nuts tightened? Was burner harness securely plugged in?



Obtain gas-tight seals at burner flange, cleanout plates and/or flue collector box to prevent possible flue gas leakage and carbon monoxide emissions, leading to severe personal injury or death.

- ..24. Was limit control tested as per the section 2.3.8. in this manual?
- ..25. Was furnace cycled with thermostat? Rise to highest setting and verify furnace goes through normal start up cycle. Lower to lowest setting and verify furnace shuts off.
- ..26. Were several operating cycles observed for proper operation?
- ..27. Were room thermostat(s) set to desired room temperatures?

### After installation

- ..28. Was "Installation and service certificate" (below) filled out?
- ..29. Was Owner's information in this manual reviewed with owner or maintenance person and the person instructed to keep the manual for future reference?
- ..30. Were all instruction manuals placed near the furnace for future reference?

**4. CHECKOUT PROCEDURE (continued)**

**Installation and service certificate**

Furnace model \_\_\_\_\_ Series \_\_\_\_\_

Serial number \_\_\_\_\_ Date installed \_\_\_\_\_

- Installation instructions have been followed.
- Checkout sequence has been performed.
- Above information is certified to be correct.
- Information received and left with owner/maintenance person.

Installer \_\_\_\_\_  
(Company) (Address) (Phone)

\_\_\_\_\_  
(Installer's signature)

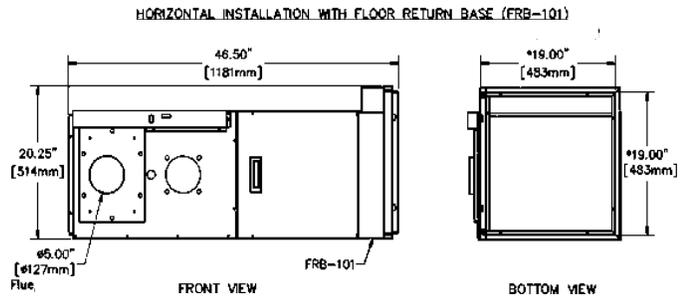
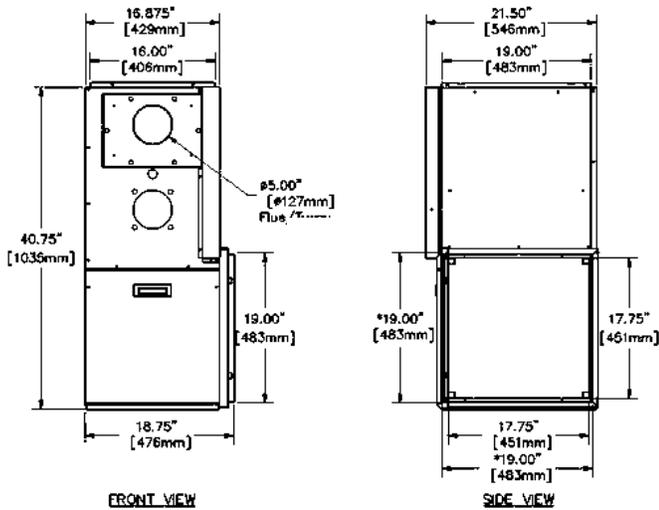
## 5. DIMENSIONS AND RATINGS

Table 10: Model PMP-098-DD & PMP-098-VV Dimensional data – ALL DIMENSIONS IN INCHES

Model	Furnace casing			Warm air supply (top)		Return air supply (side)		Flue pipe diam.
	Width	Depth	Height	Width	Depth	Width	Depth	
PMP-098-DD	16 7/8"	20 1/8"	40 3/4"	16"	19"	19"	19"	5"
PMP-098-VS	16 7/8"	20 1/8"	40 3/4"	16"	19"	19"	19"	5"

Model	Maximum heating temperature rise (°F)	Filter quantity and size	Volt - Hertz - Phase	Electrical load (amps)	Minimum ampacity for wiring sizing	Maximum fuse size (amps)	Ship weight (pounds)
PMP-098-DD	55° - 85°	1 X 20" x 20"	115 - 60 - 1	12.2	13.7	15	125
PMP-098-VS	55° - 85°	1 X 20" x 20"	115 - 60 - 1	10.3	12.2	15	125

Model	Input (BTU/h)	Firing rate (GPH)	Installed Nozzle	Blower size	Blower motor HP	Blower motor Speed adjustment		Maximum cooling capacity (tons)	Blower CFM	
						@ 0,25"W.C.	@ 0,50"W.C.		@ 0,25"W.C.	@ 0,50"W.C.
PMP-098-DD	70 000	0.50		10" x 8"	1/3 HP 4 speeds	MED-LOW	MED-LOW	2.5	860	795
	84 000	0.60	✓			MED-HIGH	MED-HIGH		1030	925
	98 000	0.70				HIGH	HIGH		1170	1050
PMP-098-VS	70 000	0.50		10" x 8"	1/2 HP ECM	X		3.0	See Table 13	
	84 000	0.60	✓							



\* DUCT OPENING

DNS-1097 Rev.C

## 5. DIMENSIONS AND RATINGS (continued)

Table 11: Model PMP-098 Burner data

BECKET BURNER; MODEL AFG (Chimney)

Model	Input BTU/h (*)	Output BTU/h (*)	Firing rate USGPH (*)	AFUE (***)	Nozzle (Delavan) (**)	Pump pressure (PSIG) (*)	Head	Low firing rate baffle	Burner tube insertion length (Inch)	Static disc	ATC	Head/Air setting
PMP-098-DD	70 000	58 000	0.50	85.2%	0.40 - 60A	175	2 - Slot L2	Yes (5880)	1 3/4"	3 3/8 U	AFG70MQSS	4/0
	84 000	69 000	0.60	85.1%	<b>0.50 - 60A</b>	150		Yes (5880)				8/0
	98 000	80 000	0.70	83.9%	0.60 - 60B	140		No				5/0
PMP-098-VS	70 000	58 000	0.50	<b>85.2% ‡</b>	0.40 - 60A	175	2 - Slot L2	Yes (5880)	1 3/4"	3 3/8 U	AFG70MQSS	4/0
	84 000	69 000	0.60	<b>85.1% ‡</b>	<b>0.50 - 60A</b>	150		Yes (5880)				8/0

BECKET BURNER; MODEL NX (Chimney or DV)

Model	Input BTU/h (*)	Output BTU/h (*)	Firing rate USGPH (*)	AFUE (***)	Nozzle (Delavan) (**)	Pump pressure (PSIG) (*)	Head	Low firing rate baffle	Burner tube insertion length (Inch)	ATC	Head/Air setting
PMP-098-DD	70 000	59 000	0.50	86.1%	0.40 - 60W	155	6 - Slot LQ	Yes (32229)	1 3/4"	NX56LQ	2.0
	84 000	70 000	0.60	85.4%	<b>0.50 - 60W</b>	145		Yes (32229)			2.5
	98 000	81 000	0.70	84.5%	0.60 - 60W	135		No			2.5
PMP-098-VS	70 000	59 000	0.50	<b>86.1% ‡</b>	0.40 - 60W	155	6 - Slot LQ	Yes (32229)	1 3/4"	NX56LQ	2.0
	84 000	70 000	0.60	<b>85.4% ‡</b>	<b>0.50 - 60W</b>	145		Yes (32229)			2.5

**\* INPUT & OUTPUT ADJUSTMENT**

- Pump pressure can be adjusted to maintain proper firing rate.
- Increase pump pressure if flue gases temperature is under 400°F.
- Adjust the total flue gas temperature between 400°F and 575°F (330°F and 505°F net approximately)

\*\* Default Installed Nozzle in bold characters

\*\*\* AFUE values established after minimum 20 hours of operation.



**NOTICE**

PMP furnaces are CSA design certified for installation on combustible flooring.

‡=



## 5. DIMENSIONS AND RATINGS (continued)

Table 11: Model PMP-098 Burner data (continued)

RIELLO BURNER; MODEL 40-F3 (Chimney)								
Model	Input BTU/h (*)	Output BTU/h (*)	Firing rate USGPH (*)	AFUE (***)	Nozzle (Delavan) (**)	Pump pressure (PSIG) (*)	Burner tube insertion length (Inch)	Combustion air adjustment (Turbulator /Damper)
PMP-098-DD	70 000	59 000	0.50	86.4%	0.40 - 70A	155	2 3/4"	0 / 1,5
	84 000	70 000	0.60	85.9%	<b>0.50 - 70A</b>	145		0 / 2,5
	98 000	81 000	0.70	84.5%	0.60 - 70A	135		1 / 3,5
PMP-098-VS	70 000	59 000	0.50	<b>86.4% ‡</b>	0.40 - 70A	155	2 3/4"	0 / 1,5
	84 000	70 000	0.60	<b>85.9% ‡</b>	<b>0.50 - 70A</b>	145		0 / 2,5

CARLIN BURNER; MODEL EZ-LF (Chimney)								
Model	Input BTU/h (*)	Output BTU/h (*)	Firing rate USGPH (*)	AFUE (***)	Nozzle (Danfoss) (**)	Pump pressure (PSIG) (*)	Burner tube insertion length (Inch)	Combustion air adjustment (Head/Air)
PMP-098-DD	70 000	58 000	0.50	86.2%	0.50 - 60H	100	1 3/4"	0,50 - 13%
	84 000	69 000	0.60	85.4%	<b>0.50 - 60H</b>	150		0,50 - 23%
	98 000	79 000	0.70	83.8%	0.55 - 60H	165		,60/65 - 30%
PMP-098-VS	70 000	58 000	0.50	<b>86.2% ‡</b>	0.50 - 60H	100	1 3/4"	0,50 - 13%
	84 000	69 000	0.60	<b>85.4% ‡</b>	<b>0.50 - 60H</b>	150		0,50 - 23%

**\* INPUT & OUTPUT ADJUSTMENT**

- Pump pressure can be adjusted to maintain proper firing rate.
- Increase pump pressure if flue gases temperature is under 400°F.
- Adjust the total flue gas temperature between 400°F and 575°F (330°F and 505°F net approximately)

\*\* Default Installed Nozzle in bold characters

\*\*\* AFUE values established after minimum 20 hours of operation.



**NOTICE**

PMP furnaces are CSA design certified for installation on combustible flooring.

‡=



## 5. DIMENSIONS AND RATINGS (continued)

Table 12: Airflow Data, Models with 1/3 HP PSC Motors

Speed	External Static Pressure ("W.C.)								
	0.1" (W.C.)	0.2" (W.C.)	0.3" (W.C.)	0.4" (W.C.)	0.5" (W.C.)	0.6" (W.C.)	0.7" (W.C.)	0.8" (W.C.)	0.9" (W.C.)
<b>HIGH</b>	1230	1185	1150	1095	1050	990	920	810	595
<b>MED-HIGH</b>	1090	1055	1005	970	925	875	810	700	550
<b>MED-LOW</b>	865	860	860	845	795	740	695	600	460
<b>LOW</b>	675	680	690	680	665	640	565	480	390

Table 13: Airflow Data, Models with 1/2 HP ECM Motors

OIL HEATING MODE				
24 VAC input (R) on W only				
SW1- HEAT DIP switch position	HEAT INPUT (USGPH)	CFM with SW3-ADJ DIP switch position A	CFM with SW3-ADJ DIP switch position B	CFM with SW3-ADJ DIP switch position C
A (1=OFF, 2=OFF)	0.70	1100	1210	990
B (1=ON, 2=OFF)	0.60	980	1080	885
C (1=OFF, 2=ON)*	0.50	815	900	735
D (1=ON, 2=ON)*	Same value as DIP switch position A			

\*Alternate adjustment in oil-fired heating mode with high temperature rise.

CONTINUOUS FAN				
24 VAC input (R) on G only				
SW2- COOL DIP switch position	A/C size (TON)	CFM with SW3-ADJ DIP switch position A	CFM with SW3-ADJ DIP switch position B	CFM with SW3-ADJ DIP switch position C
A (1=OFF, 2=OFF)	3.0	900	1035	765
B (1=ON, 2=OFF)	2.5	750	860	635
C (1=OFF, 2=ON)	2.0	600	690	510
D (1=ON, 2=ON)	1.5	450	515	380

COOLING OR HEAT PUMP HEATING MODE				
24 VAC input (R) to G, Y/Y2 and O (for cooling)				
SW2- COOL DIP switch position	A/C size (TON)	CFM with SW3-ADJ DIP switch position A	CFM with SW3-ADJ DIP switch position B	CFM with SW3-ADJ DIP switch position C
A (1=OFF, 2=OFF)	3.0	1200	1320	1080
B (1=ON, 2=OFF)	2.5	1000	1100	900
C (1=OFF, 2=ON)	2.0	800	880	720
D (1=ON, 2=ON)	1.5	600	660	540

In Cooling - Dehumidification mode, with no 24 VAC input to DH, the CFMs are reduced by 15%.

The CFMs shown are reduced by 20% if there is 24 VAC input to Y1 (first stage of 2-stage cooling unit)

DELAY PROFILE FOR OIL HEATING MODE				
SW4- DELAY DIP switch position	HEAT INPUT (USGPH)	PreRun On-Delay CFM Level - Time	ShortRun On-Delay CFM Level - Time	Off-Delay CFM Level - Time
A (1=OFF, 2=OFF)	0.75	13% - 45 sec.	19% - 45 sec	38% - 3 min.
B (1=ON, 2=OFF)	0.65	13% - 45 sec.	19% - 60 sec	38% - 3 min.
C (1=OFF, 2=ON)	0.50	13% - 60 sec.	13% - 60 sec	38% - 3 min.
D (1=ON, 2=ON)	All	13% - 30 sec.	100% - 30 sec	100% - 2 min.

PreRun and ShortRun are the periods of time when the blower starts at very low CFM to minimize the distribution of cool air in the system and then runs up to normal speed.

Off Delay is the time required to cool down the heat exchanger with low CFMs, to minimize cool draft in the air distribution system.

DELAY PROFILE FOR COOLING OR HEAT PUMP HEATING MODE				
No adjustment required	A/C size	PreRun On-Delay CFM Level - Time	ShortRun On-Delay CFM Level - Time	Off-Delay CFM Level - Time
-	All	No delay	No delay	100% - 90 sec.

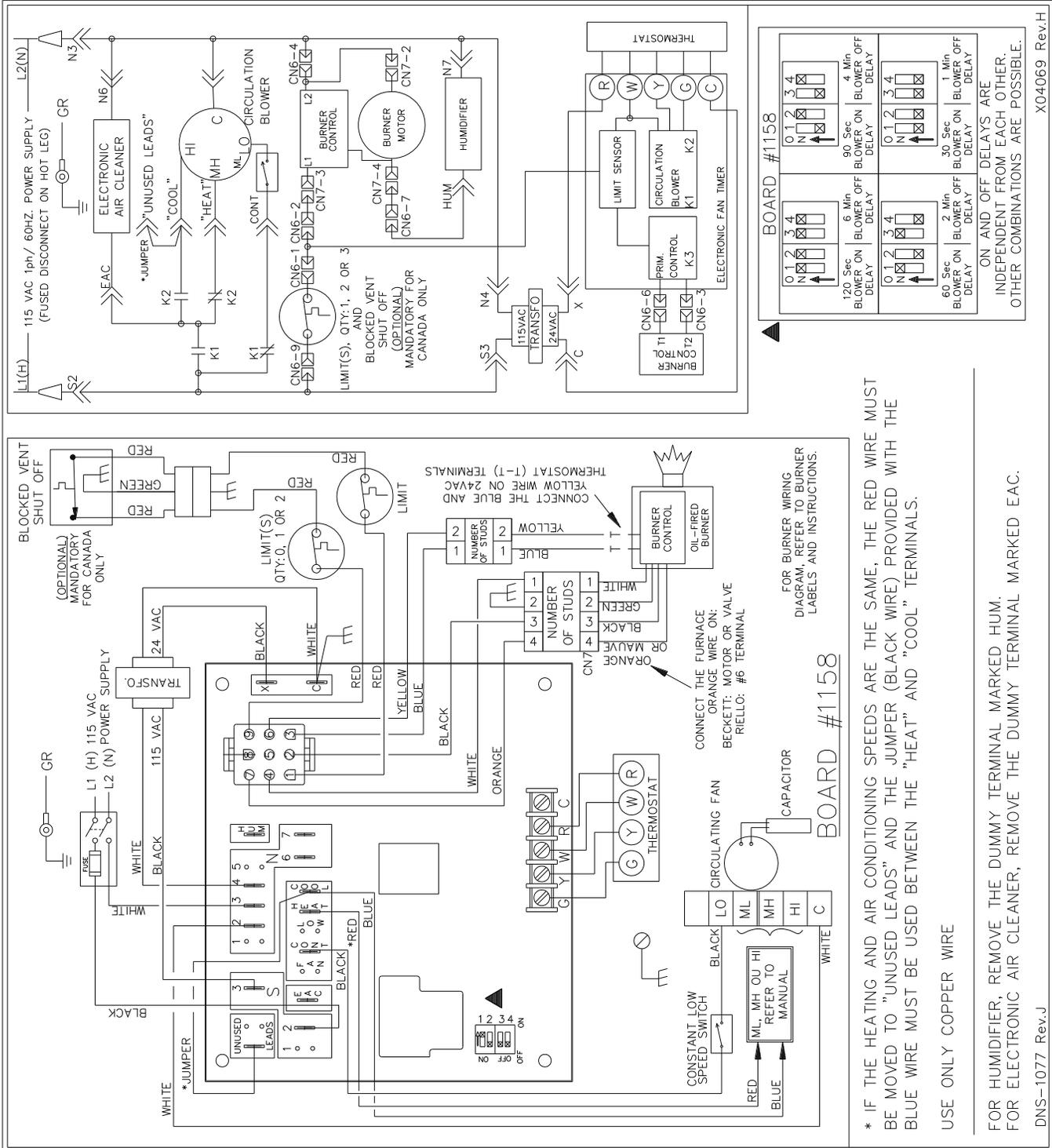
PreRun and ShortRun are the periods of time when the blower starts at very low CFM to minimize the distribution of cool air in the system and then runs up to normal speed.

Off Delay is the time required to cool down the coil (heating mode) with low CFMs, to minimize cool draft in the air distribution system.

**NOTE:** disconnect main power to unit prior to changing DIP switch settings

## 5. DIMENSIONS AND RATINGS (continued)

Figure 12: Wiring diagram, 4-speed motor (PSC)







## 6. COMPONENTS AND REPLACEMENT PARTS (continued)

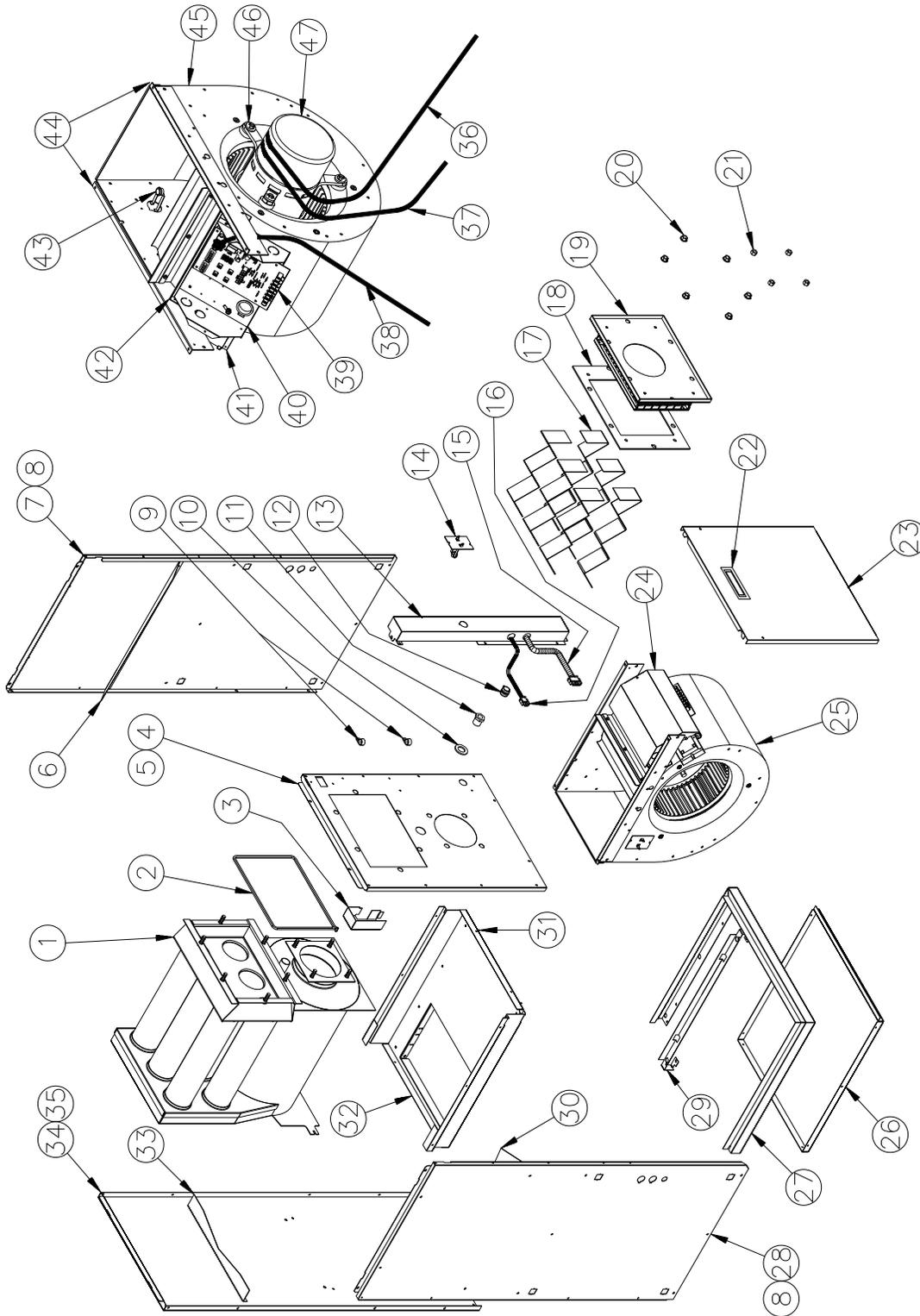
Table 14: Parts list with 4-speed motor (PSC)

ITEM	PART #	DESCRIPTION	COMMENTS
1	B03409	HEAT EXCHANGER	Heat exchanger only
2	J06L002	SEAL STRIP, 1/4 x 1/8 x 25'	
3	B03429	WIRE CHANNEL, INT.	
4	B03420-02	FRONT PANEL ASSEMBLY	Panel, insulation, and labels included
5	B03444	FRONT PANEL INSULATION	
6	B03450-01	BAFFLE, LATERAL	
7	B03426-03	SIDE PANEL ASSEMBLY (RIGHT)	Panel, insulation, and baffle included
8	B03473	SIDE PANEL INSULATION	
9	L04J001	CABLE CLAMP, 9/16" WHITE	
10	F06F015	WASHER, ZINC 1 7/16"	
11	Z99F061	OBSERVATION PORT	
12	L04I013	STRAIN RELIEF BUSHING	
13	B03445-01	WIRE CHANNEL (SWITCH)	
14	L07F003	ROCKER SWITCH, SPST	
15	R02R006	HIGH LIMIT 36T01B7 150-20F, 7"	
16	B03454	ELECTRICAL KIT, BURNER	
17	B03453	ELECTRICAL KIT, TT	
18	B03630-01	BAFFLE	One baffle included
19	B03428	SMOKE OUTLET GASKET	
20	B03416-01	RADIATOR BAFFLE	Item # 19 included
21	F07O001	FLANGE NUT, HEXAGONAL 3/8-16NC BRASS	
22	F07F011	HEX NUT 3/8-16NC ZINC	
23	Z99F050	HANDLE, RECESSED BLACK	
24	B03419-11	BLOWER DOOR ASSEMBLY	Door and labels included
25	B03439	COVER, ELECTRICAL BOX	
26	B03535-01	REPLACEMENT BLOWER ASSEMBLY	Blower, motor, and capacitor included
27	B03470	FLOOR	
28	B03298-01	FILTER RACK FRAME	
29	B03426-04	SIDE PANEL ASSEMBLY (LEFT)	Panel, insulation, and baffle included
30	B03299-01	FILTER RACK ACCESS	
31	B03450-02	LATERAL BAFFLE	
32	B30513	BLOWER SLIDE	One slide included
33	B03441	BLOWER DIVIDER	
34	B03451	REAR BAFFLE	
35	B03427-01	REAR PANEL ASSEMBLY	Panel, insulation, and baffles included
36	B03471	REAR PANEL INSULATION	
37	B03457-01	ELECTRICAL KIT, BLOWER	
38	L01I001	CAPACITOR 5MF	
39	B01024	CAPACITOR HOLDER	
40	B03456	ELECTRICAL KIT, BOARD	
41	R99G004	ELECTRONIC BOARD, UTEC 1158-110	
42	B03440	ELECTRICAL BOX	
43	L01F009	TRANSFORMER, 120-24Volt, 40VA	
44	B03438	SUPPORT, ELECTRONICS BOX	
45	R02R007	HIGH LIMIT, 120-20F, 1.75"	
46	B03437	BLOWER SLIDE	One slide included
47	B03720-02	BLOWER, 100-8R DD 0,50 PP	Housing, wheel, and label only
48	B01888	MOTOR SUPPORT ASSEMBLY	Legs, band, and hardware included
49	B01890-01	MOTOR ASSEMBLY, 1/3 HP	Complete with legs
50	L01G009	CONTROL CARD FUSE - 3 AMPS	
<b>ACCESSORIES</b>			
DFB-102		DOWNFLOW BASE	B03464-01
HFB-101		HORIZONTAL FLOW BASE	B00488-01
FRB-101		FLOOR RETURN BASE	B03482-01
VTK-54		VENT TERMINAL KIT 4"	For sealed combustion
IFV-420		4" INSULATED FLEX VENT 20ft	For sealed combustion
B03789		PROTECTION PLATE BURNER BECKETT NX	For downflow installation only

B50122B

## 6. COMPONENTS AND REPLACEMENT PARTS (continued)

Figure 15: Parts list with variable speed motor (ECM)



B50123A

## 6. COMPONENTS AND REPLACEMENT PARTS (continued)

Table 15: Parts list with variable speed motor (ECM)

ITEM	PART #	DESCRIPTION	COMMENTS
1	B03409	HEAT EXCHANGER	Heat exchanger only
2	J06L002	SEAL STRIP, 1/4 x 1/8 x 25'	
3	B03429	WIRE CHANNEL, INT.	
4	B03420-02	FRONT PANEL ASSEMBLY	Panel, insulation, and labels included
5	B03444	FRONT PANEL INSULATION	
6	B03450-01	BAFFLE, LATERAL	
7	B03426-03	SIDE PANEL ASSEMBLY (RIGHT)	Panel, insulation, and baffle included
8	B03473	SIDE PANEL INSULATION	
9	L04J001	CABLE CLAMP, 9/16" WHITE	
10	F06F015	WASHER, ZINC 1 7/16"	
11	Z99F061	OBSERVATION PORT	
12	L04I013	STRAIN RELIEF BUSHING	
13	B03446-01	WIRE CHANNEL	
14	R02R006	HIGH LIMIT 36T01B7 150-20F, 7"	
15	B03454	ELECTRICAL KIT, BURNER	
16	B03453	ELECTRICAL KIT, TT	
17	B03630-01	BAFFLE	One baffle included
18	B03428	SMOKE OUTLET GASKET	
19	B03416-01	RADIATOR BAFFLE	Item #18 included
20	F07O001	FLANGE NUT, HEXAGONAL 3/8-16NC BRASS	
21	F07F011	HEX NUT 3/8-16NC ZINC	
22	Z99F050	HANDLE, RECESSED BLACK	
23	B03419-11	BLOWER DOOR ASSEMBLY	Door and labels included
24	B03439	COVER, ELECTRICAL BOX	
25	B03535-02	REPLACEMENT BLOWER ASSEMBLY	Blower, motor, and capacitor included
26	B03470	FLOOR	
27	B03298-01	FILTER RACK FRAME	
28	B03426-02	SIDE PANEL ASSEMBLY (LEFT)	Panel, insulation, and baffle included
29	B03299-01	FILTER RACK ACCESS	
30	B03450-02	LATERAL BAFFLE	
31	B30513	BLOWER SLIDE	One slide included
32	B03441	BLOWER DIVIDER	
33	B03451	REAR BAFFLE	
34	B03427-01	REAR PANEL ASSEMBLY	Panel, insulation, and baffle included
35	B03471	REAR PANEL INSULATION	
36	B03242	ELECTRONIC KIT, BLOWER	
37	B03243	ELECTRICAL KIT, BLOWER	
38	B03456	ELECTRICAL KIT, BOARD	
39	R99G003	ELECTRONIC BOARD, UTEC 1168	
40	B03440	ELECTRICAL BOX	
41	L01F009	TRANSFORMER, 120-24Volt, 40VA	
42	B03438	SUPPORT, ELECTRONICS BOX	
43	R02R007	HIGH LIMIT, 120-20F, 1.75"	
44	B03437	BLOWER SLIDE	One slide included
45	B03720-02	BLOWER ASSEMBLY WITH LABEL	Housing, wheel, and label included
46	B01888	MOTOR MOUNT ASSEMBLY	Legs, band, and hardware included
47	B3811-14	MOTOR, 1/2 HP ECM EON	
48	L01G009	CONTROL CARD FUSE - 3 AMPS	
<b>ACCESSORIES</b>			
	DFB-102	DOWNFLOW BASE	B03464-01
	HFB-101	HORIZONTAL FLOW BASE	B00488-01
	FRB-101	FLOOR RETURN BASE	B03482-01
	VTK-54	VENT TERMINAL KIT 4"	For sealed combustion
	IFV-420	4" INSULATED FLEX VENT 20ft	For sealed combustion
	B03789	PROTECTION PLATE BURNER NX	For downflow installation only

B50123B

## **7. OWNER'S INFORMATION**

---

**The furnace must be inspected and started ANNUALLY, at the beginning of the heating season, only by a qualified service technician.** The service technician must perform annual service and maintenance on the furnace to ensure reliable operation. Failure to service and maintain the furnace and system could result in equipment failure, causing severe personal injury, death, or substantial property damage.

As the owner, you must be aware of the following requirements. You must inspect and clean or replace the furnace filter monthly, as described below, and perform the other inspection procedures as well. Failure to maintain a clean filter will result in cycling of the furnace and could lead to a no-heat condition. Failure to perform this maintenance could result in substantial property damage.

Follow all the procedures below. Failure to comply could result in severe personal injury, death, or substantial property damage.

---

### **Operating the furnace**

1. The furnace should operate automatically on call for heat from the room thermostat.
2. If the furnace oil burner should shut down on flame failure, the burner primary control will lock out. Ask your service technician to show you the correct procedure to reset the primary control button. NEVER push the button more than once in an attempt to start the burner after lockout. Continued lockout of the control means something is wrong with the burner, controls, or oil system. The condition must be corrected by a qualified service technician.

---

### **Daily inspection**

1. Verify there are no combustible materials in the furnace room or near the furnace.
2. Verify the air openings to the furnace room are not obstructed in any way.
3. Verify the furnace seems to be operating normally. Notify your service technician immediately if you notice any abnormal behavior.

---

### **Monthly – inspect and clean/replace filter**

1. Ask your service technician to show you the correct way to remove and clean your furnace filter. Replace the filter if you are unable to thoroughly clean it.
- 

### **To shut down furnace**

1. Set the room thermostat to its lowest setting.
2. Turn off the disconnect switch in the 120-VAC power line to the furnace.
3. If the burner will be shut down for an extended time, tightly close all oil valves.
4. Refer to burner manual for any additional instructions.

W-T Manufacturing  
N93 W14635 Whittaker Way, Menomonee Falls, WI 53051