

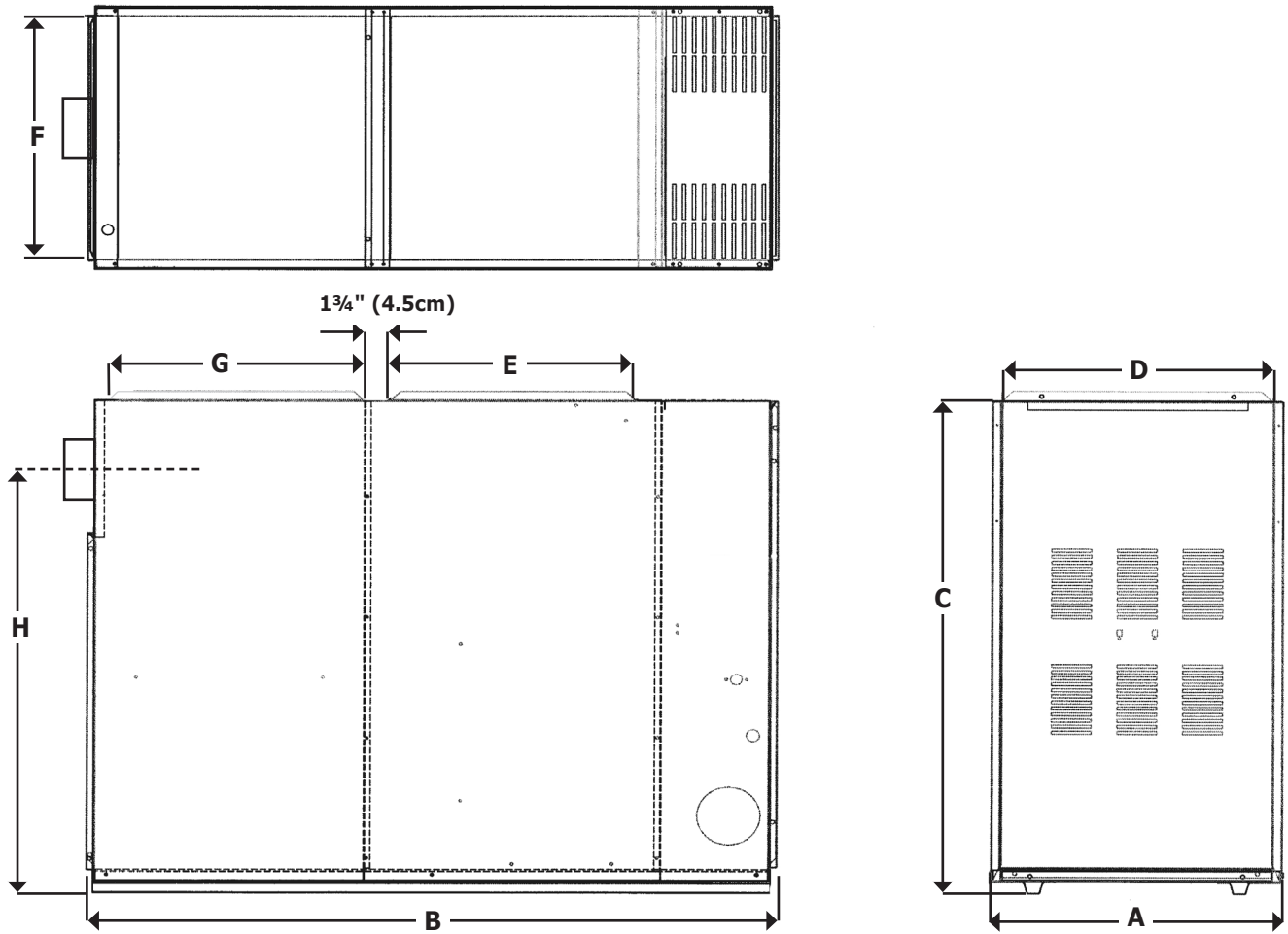


**BML**  
**(Lowboy Model with Direct Drive PSC)**  
**BMLB**  
**(Lowboy Model with Belt Drive Single Speed)**  
**BMLV**  
**(Lowboy Model with ECM)**  
**Series B**  
Oil Fired Warm Air Furnaces

**INSTALLATION, OPERATION & MAINTENANCE MANUAL**



## Dimensions



Furnace Model	Cabinet			Plenum Openings		Flue		Filter (Permanent)	Shipping Weight (LB)
	Width A	Length B	Height C	Supply D x E	Return F x G	Diameter	Height H		
BML	22"	51½"	32"	20½"x 19"	20½"x 18½"	5"	26¼"	20"x 20"x1"	240 LB
BMLB BMLV	55.8 cm	130.8 cm	81.3 cm	52 cm x 49 cm	52.1 cm x 47 cm	12.7 cm	66.7 cm	51cm x 5cm x 2.6cm	108 Kg

1. General .....	4
2. Safety Symbols .....	4
3. Introduction.....	4
5. Locating the Unit .....	5
6. Furnace Used In Conjunction With Air Conditioning .....	5
7. Combustion Air .....	6
8. Chimney Venting .....	6
9. Barometric Damper Control.....	7
10. Optional Side Wall Venting .....	7
11a. Fan Timer Board And Limit Control (BML/BMLB) See Figure 3, page 16 .....	7
11b. Fan Timer Board And Limit Control (BMLV) See Figure 4, page 16 .....	7
12. Electrical Connections.....	7
13. Humidifier.....	8
14. Piping Installation .....	8
15. Oil Filter .....	8
16. Oil Burner Nozzles .....	8
17. Oil Burner Adjustment.....	8
18. Burner Electrodes .....	8
19. Burner Primary (Safety) Control.....	9
20. Combustion Chamber.....	9
21a. Circulating Air Blower (BML/BMLB) .....	9
21b. Circulating Air Blower (BMLV) .....	10
22. Maintenance And Service .....	11
23. Operating Instructions (BML/BMLB).....	12
24. Operating Instructions (BMLV) .....	12
<b>Appendix A: Checkout and Adjustments.....</b>	<b>13</b>
A.1 Oil Burner Air Adjustment.....	14
A.2 Burner Electrodes.....	15
A.3 Start Up.....	15
A.4 Special Instructions For Units Equipped With Riello Burners.....	15
A.5 Final Check Out .....	16
<b>Appendix B: Wiring Diagrams .....</b>	<b>20</b>
Chimney Vent Furnace Wiring Diagram .....	20
Direct Vent Furnace Wiring Diagram .....	21
<b>Appendix C - Sequence of Operation and Troubleshooting .....</b>	<b>22</b>
C.1 Troubleshooting .....	23
C.2 Preliminary Steps.....	23
C.3 Check Oil Primary Control.....	23
<b>Parts Diagram .....</b>	<b>28</b>
<b>Parts Listing: Chimney Vent Models .....</b>	<b>29</b>
<b>Parts Listing: Direct Vent Models .....</b>	<b>31</b>
<b>Appendix D - Homeowner's Reference Table.....</b>	<b>32</b>

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Information and specifications outlined in this manual in effect at the time of printing of this manual. Manufacturer reserves the right to discontinue, change specifications or system design at any time without notice and without incurring any obligation, whatsoever.

## 1. General

Furnace installation shall be completed by qualified agency. See glossary for additional information.

### **WARNING**

Fire, explosion, asphyxiation and electrical shock hazard. Improper installation could result in death or serious injury. Read this manual and understand all requirements before beginning installation.

### **WARNING**

Fire, burn, asphyxiation hazard. Do not use gasoline, crank case oil, or any oil containing gasoline. Failure to follow these instructions could result in death or serious injury.

## 2. Safety Symbols

**Become familiar with symbols identifying potential hazards.**



This is the safety alert symbol. Symbol alerts you to potential personal injury hazards. Obey all safety messages following this symbol to avoid possible injury or death.

### **DANGER**

Indicates a hazardous situation which, if not avoided, WILL result in death or serious injury

### **WARNING**

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

### **CAUTION**

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

### **NOTICE**

Used to address practices not related to personal injury.

## 3. Introduction

Models BML/BMLB/BMLV are oil fired forced air up-flow furnaces with an output capacity range of 59,000 btu/hr to 88,000 btu/hr.

- BML models are equipped with 1/2 HP PSC 4 speed direct drive blower motor.
- BMLB models are equipped with 1/2 HP single speed belt drive blower motor.
- BMLV models are equipped with 1/2 HP ECM variable speed direct drive blower motor.

Furnace models are either factory equipped for chimney venting or factory equipped for direct venting.

Chimney vent models and direct vent models are not field convertible. Direct vent installation instructions are included with the direct vent models.

**Installation shall conform to requirements of authority having jurisdiction or in absence of such requirements:**

- Canada - CAN/CSA - B139, Installation Code for Oil-Burning Equipment.
- United States - National Electrical Code, NFPA31, Standard for the Installation of Oil-Burning Equipment.

**Models are CSA listed, (NRTL/C) for use with No. 1 (Stove) and No. 2 (Furnace) Oil.**

Refer to tables in Appendix A for performance data.

## 4. Heat Loss

Maximum hourly heat loss for each heated space shall be calculated in accordance with the procedures described in the manuals of:

- Canada - The Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI), or by other means prescribed, or approved by the local authority having jurisdiction.
- United States - Manual J. titled, "Load Calculation" published by the Air Conditioning Contractors of America, describes a suitable procedure for calculating maximum hourly heat loss.

## 5. Locating the Unit - [See Table 1]

- Locate furnace so flue connection to chimney is short, direct and consists of as few elbows as possible.
- Centralize furnace location with respect to supply and return air ductwork. Central location minimizes trunk duct sizing.
- All models may be installed on combustible floors.

## 6. Furnace Used In Conjunction With Air Conditioning

- Install furnace in parallel with or upstream from evaporator coil to avoid condensation in heat exchanger.
- When installed in parallel, prevent chilled air from entering furnace by use of dampers or air controlling.
- Manually operated dampers must have a control to prevent operation of either system unless dampers are in full heat or full cool position.
- Air heated by the furnace shall not pass through evaporator coil unless coil is specifically approved for such service.
- Check and adjust blower speed to compensate for pressure drop caused by evaporator coil.
- Maintain required clearance between bottom of coil drain pan and top of heat exchanger as specified by coil manufacturer.
- Cased evaporator coils with cases slightly larger than the furnace cabinet may be used, using field fabricated block off plates to close the gap between furnace cabinet and coil casing.
- Do not use cased evaporator coils with cases smaller than the furnace cabinet as they will restrict airflow.

\*Belt drive models require field modification to the blower assembly to be used in conjunction with Air Conditioners.

**Table 1: Minimum Installation Clearances**

Location	Clearance to Combustibles
	BML / BMLB / BMLV
	Lowboy
Top	1" (26 mm)
Bottom	0"
S/A Plenum	1" (26 mm)
Rear	6"*** (152 mm)
Sides	1"* (26 mm)
Front	1"*** (26 mm)
Flue Pipe	4" (102 mm) measured horizontally or below flue pipe
	8" (204 mm) measured vertically or above flue pipe
Enclosure	Closest
*18 in. (458 mm) Required from 1 side for access to rear	
** 24 in. (610 mm) Service Clearance	

## 7. Combustion Air

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

## 8. Chimney Venting

- Flue pipe should be as short as possible with horizontal pipes sloping upward toward the chimney at a rate of one-quarter inch per foot.
- Flue pipe should not be smaller in cross sectional area than flue collar on the furnace.
- Flue pipe should connect to chimney so the flue pipe extends into, and terminates flush with the inside surface of chimney liner. Seal the joint between pipe and lining.
- Chimney outlet should be at least two feet above highest point of peaked roof.
- All unused chimney openings should be closed.
- Chimneys must conform to local, provincial or state codes, or in the absence of local regulations, to the requirements of the National Building Code.

### NOTICE

This furnace is approved for use with Type L vent or equivalent. Maximum vent temperature for Type L vent is 575°F (300C).

### **⚠ WARNING**

Asphyxiation hazard. Chimney vented versions of furnace must be connected to flue having sufficient draft at all times. Failure to follow these instructions could result in death or serious injury.

Manufacturer recommends over fire draft of -0.02 in. w.c. See figure 2.

Flue pipe must not pass through any floor or ceiling, may pass through a wall where suitable fire protection provisions have been installed.

- Refer to CAN/CSA B-139 for rules governing the installation of oil burning equipment.
- United States, refer to NFPA 31 for regulations governing the installation of oil burning equipment.

See appendix A for burner set-up.

**Figure 2 - Check Over-Fire Draft**



**Over-fire draft access port.**

## 9. Barometric Damper Control

Barometric damper control, also known as draft regulator, is used on conventional chimney venting only. Control automatically maintains constant negative pressure. Ensures proper pressures are not exceeded. If chimney does not develop sufficient draft, draft control does not function properly.

- Install draft regulator in same room or enclosure as furnace. Draft regulator should not interfere with combustion air supplied to the burner.
- Locate control near furnace flue outlet.
- Install per instructions supplied with regulator.
- Set over fire draft, measured at oil burner mounting plate over-fire draft access port, to -0.02 in. w.c. See Figure 2 page 6.

## 10. Optional Side Wall Venting

Certain BML and BMLV furnace models are manufactured as sidewall vented units. Refer to Direct Venting Instructions, PN 240006979 included with Vent Kit for details.

Sidewall Venting (*Direct Venting*) requires use of specific oil burners; Beckett AFII, or Riello 40BF.

Refer to Appendix A, Tables A2, and A4.

## 11a. Fan Timer Board And Limit Control (BML/BMLB) See Figure 3, page 15.

Electronic Fan Timer integrates control of burner and circulator fan operations. Control is central wiring point for most of furnace electrical components.

- United Technologies 1158-120 (BML) has an adjustable fan on time set by selecting dipswitch combination displayed in Chart 1. Fan on delay can be set at 30, 60, 90 or 120 seconds. Provides a delay between burner ignition and blower start-up to eliminate excessive flow of cold air when blower comes on.
- United Technologies 1158-120 (BML) has an adjustable fan off time of 2, 3, 4 or 6 minutes as displayed in Chart 1. Fan off delay time starts when burner motor is de-energized at end of call for heat. Blower shutdown is delayed to remove any residual heat from heat exchanger.
- Electronic fan timer board works in conjunction with snap disc limit controls, performing a safety function, and breaks power to oil burner primary control, shutting off burner if furnace over-heats.
- Limit control is thermally operated and automatically resets. Limit control is factory installed, pre-set and is not adjustable.
- If limit control opens with United Technologies 1158-120 (BML) electronic fan control, circulating fan will energize. When limit closes, fan off timer begins. At the end of fan off time cycle burner is energized, initiating normal burner cycle.

## Chart 1- United Technologies 1158-120 (BML)

Dip Switch Position				Blower Delay Times	
1	2	3	4	On Seconds	Off Minutes
Off	Off			30	
On	Off			60	
Off	On			90	
On	On			120	
		Off	Off		2
		On	Off		3
		Off	On		4
		On	On		6

## 11b. Fan Timer Board And Limit Control (BMLV) [See Figure 4, page 15]

United Technologies 1168-1 ECM (BMLV) tap board has an adjustable fan on/off delay and airflow settings that must be adjusted in accordance with furnace input rating (nozzle size). Refer to Table A-9, page 17 for ECM blower set-up.

## 12. Electrical Connections

- Furnace is listed by Canadian Standards Association under NRTL (North American) Standard.
- All field wiring shall conform to CAN/CSA C22.1 Canadian Electrical Code, Part 1, and by local codes, where they prevail.
- United States, wiring shall conform to National Fire Protection Association NFPA-70, National Electrical Code, and with local codes and regulations.
- Wire furnace to separate dedicated circuit in main electrical panel.
- Suitably located circuit breaker can be used as service switch, separate service switch is advisable.
- Service switch is necessary if circuit breaker is close to the furnace, or furnace is located between circuit breaker and entry to furnace room.
- Clearly mark service switch. Install in accessible area between furnace and furnace room entry. Locate so as to reduce possibility it can be mistaken as light switch or similar device.
- Power requirement for all models is: 115 VAC, 1 Ø, 60 Hz., 12A.
- Accessory equipment such as electronic air cleaners and humidifiers may be included on furnace circuit.
- Accessories requiring 115 VAC power sources such as electronic air cleaners and humidifier transformers may be powered from electronic fan timer board where provisions have been made for connections, but should have their own controls.
- Do not use direct drive motor connections as a power source, there is risk of damaging accessories.

- Thermostat wiring connections are shown in wiring diagrams in Appendix B. Some micro-electronic thermostats require additional controls and wiring. Refer to thermostat manufacturer's instructions.
- Locate thermostat approximately 5 feet above floor, on inside wall, and where thermostat is exposed to average room temperatures. Avoid locations where thermostat is exposed to cold drafts, heat from nearby lamps and appliances, exposure to sunlight, heat from inside wall stacks, etc.
- Adjust thermostat heat anticipator to amperage draw of heating control circuit as measured at "R" and "W" terminals of thermostat. Do not measure current with thermostat connected to the circuit. Measure amperage by connecting ammeter between two wires which connect to thermostat "R" and "W" terminals.

### 13. Humidifier

- Humidifier is optional accessory available through most heating supplies outlets.
- Follow humidifier manufacturer's installation instructions
- Protect furnace heat exchanger from water or water droplets from humidifier.
- Do not use direct drive motor connections as source of power for 115 VAC humidifiers and humidifier transformers.

### 14. Piping Installation

- Install fuel system in accordance with requirements of CAN/CSA B-139, and local regulations.
- United States installation shall conform to NFPA No. 31 and local codes and authorities.
- Use only approved fuel oil tanks, piping, fittings and oil filter.
- Install oil filter as close to burner as possible.
- Refer to instructions and illustrations in oil burner and oil pump instructions shipped with the furnace.

### 15. Oil Filter

Install oil filter between fuel oil storage tank and oil burner. When using oil burner nozzle smaller than 0.65 U.S. Gallons Per Hour, install additional 7 to 10 micron filter as close as possible to oil burner.

### 16. Oil Burner Nozzles

BML and BMLV are certified for multiple firing rates, ranging from 59,000 to 89,000 Btu/h output. Furnace may be fired at ideal rate for wide range of structures by manipulating oil burner nozzle, flame retention head, and temperature rise. Refer to Table A-1 thru A-4, and furnace rating plate to determine proper combinations.

### 17. Oil Burner Adjustment

- Adjust burner air supply to maintain fuel to air ratio to obtain ideal combustion conditions.
- Lack of air causes "soft" and "sooty" flames, resulting in soot build-up throughout heat exchanger passages.
- Excess combustion air causes bright roaring fire and high stack temperatures resulting in poor fuel efficiency.
- BML and BMLV operate most efficiently with No. 1 smoke spot on Bacharach Scale. Dust will eventually build up on air moving components of oil burner assembly resulting in decreased air supply with potential soot build up in flue gas passageways of heat exchanger. Soot behaves as insulator and impairs good heat transfer. Stack temperature increases, and efficiency decreases. To avoid this problem, adjust the air supply to provide no more than trace smoke spot on Bacharach Scale.
- See Venting Instructions included in Vent Kits for set-up details for sidewall vented furnaces.

#### NOTICE

Set up sidewall vented models to deliver zero (0) smoke.

#### NOTICE

Before operating furnace check burner alignment with combustion chamber. End cone of air tube must be centred to accommodating ring of combustion chamber. Adjust as necessary.

### 18. Burner Electrodes

Correct positioning of electrode tips with respect to each other, fuel oil nozzle, and burners is essential for smooth light ups and proper operation.

Refer to oil burner instructions provided with furnace and Appendix A Section A.2 in this manual for electrode specifications.



## NOTICE

Do not tamper with furnace controls they are sensitive. If problems persist, call your service contractor.

### 19. Burner Primary (Safety) Control

Furnace is equipped with primary combustion control, also referred to as burner relay or burner protector relay, which uses a cad cell located in burner housing, to monitor and control combustion.

Dust or combustion residuals can build up on lens of cad cell impairing its response to flame. Check cad cell for cleanliness and proper alignment if primary control frequently shuts down combustion.

### 20. Combustion Chamber

Furnace is equipped with cerafelt combustion chamber, held in place by a retaining bracket.

**Check the alignment of the combustion chamber and oil burner before firing. It is possible for the combustion chamber to shift if subjected to rough handling during transit.**

Inspect combustion chamber for damage or carbon build up whenever oil burner is removed for repairs or routine maintenance.

## ⚠ WARNING

Fire, burn, asphyxiation hazard. Do not start the burner unless blower access door is secured in place. Failure to follow these instructions could result in death or serious injury.

### 21a. CIRCULATING AIR BLOWER (BML/BMLB)

- BML models are equipped with 1/2 HP PSC 4 speed direct drive blower system.
- BMLB models are equipped with 1/2 HP single speed belt drive blower system.

#### Direct Drive Blower Systems

- Direct drive blower speed adjustments are not normally required in properly sized extended plenum duct systems. Motor RPM and air CFM delivery will vary automatically to accommodate conditions within usual range of external static pressures typical of residential duct systems.
- Under-sized duct systems may require higher blower speed to obtain system temperature rise.
- Some older duct systems were not designed to provide static pressure. They typically feature special reducing fittings at each branch run and lack block

ends on the trunk ducts. These systems may require modification to provide some resistance to the airflow to prevent over-amping of direct drive blower motor. Selecting a lower blower speed may correct this problem.

- Direct drive blower speeds are adjusted by changing "hot" wires to motor winding connections. Refer to wiring diagrams in Appendix B or wiring diagram label affixed to furnace.
- **Do not move neutral wire (normally white wire) to adjust blower speed.**
- Single blower speed for both heating and cooling modes may be used. Use a "piggy-back connector" accommodating both wires on a single motor tap.
- It is also acceptable to connect selected motor speed with a pigtail joined to both heating and cooling speed wires with a wire nut.
- Safety precaution against accidental disconnection of wires by vibration, secure wire nut and wires with few wraps of electricians tape.
- **Do not connect power leads between motor speeds. Always connect neutral wire to motor's designated neutral terminal.**
- If joining blower speed wiring is done in furnace junction box, tape off both ends of unused wire.
- **Do not use blower speed wires as source of power to accessories as electronic air cleaners and humidifier transformers. Unused motor taps auto-generate sufficiently high voltages to damage accessory equipment.**

### Belt Drive Blower Systems

## ⚠ WARNING

Improper installation could result in death or serious injury. Belt drive components operate at high speeds and may snag loose clothing resulting in injury or death. Have a trained service professional preform the following instructions. Failure to follow these instructions could result in death or serious injury.

Belt drive blower systems can be modified for speed and air delivery by adjusting variable speed motor pulley and changing blower pulley.

- Adjust variable speed motor pulley by loosening 5/32 allen set screw in outer sheave. Turn outer sheave clockwise to increase blower speed, counter clockwise to reduce speed.
- Verify setscrew is tightened at one of the flat spots, failure to do so will convert the variable speed pulley to a fixed speed pulley by ruining the threads.

- Modify blower speed by changing the blower pulley. Smaller blower pulley will cause the blower to turn faster. Large pulley reduces blower speed.
- Large increases in the blower speed may increase power requirements.
- Check amperage draw of the blower motor after making changes. If amperage draw is greater than the value listed on the motor rating plate, replace with motor of higher horsepower.
- Deflection of 3/4 of an inch to 1 inch fan belt tension is necessary. Less deflection places a strain on the blower bearings and increases start up amperage draw.
- More deflection allows excess slippage and causes premature motor pulley wear.
- Automotive belt dressings are not recommended.
- Bar soap will work as belt dressing to reduce belt squeaks, etc. If using soap apply to the sides of belt only.

## **WARNING**

Electrical shock hazard. Turn OFF electrical power supply at service panel before opening blower access door. Failure to do so could result in death or serious injury.

### **21b. Circulating Air Blower (BMLV)**

BMLV furnace models are equipped with 1/2 HP variable speed direct drive blower systems with electronically commutated motors (ECM).

#### **Setting Blower Speed and "ON" and "OFF" Timings**

Blower speed and on/off time delays are handled by ECM motor programming and are set via dipswitches per Table A-9 on page 17. Heating airflow rate is SW1 and on/off delay is SW4, both are set according to firing rate. Cooling airflow rate is SW2 and if used is set according to installed cooling capacity. SW3 can be used to adjust airflow rate by (+) or (-) 15%. Features of this ECM variable speed motor are that it will deliver a constant airflow within a wide range of external static pressures, and also includes:

- **Soft Start:** ECM will slowly ramp up to required operating speed. In heating cycle allows heat exchanger to reach operating temperature before set heat speed, minimizes noise and increases comfort.
- **Soft Stop:** At end of heating cycle, ECM will slowly ramp down. Allows increased energy efficiency and reduced noise levels.
- **Dehumidification:** Dehumidification feature is programmed into the variable speed motor. At start of each cooling cycle, variable speed motor will run at 82% of rated airflow for 7.5 minutes. After 7.5 minutes has elapsed, motor will increase to 100% of rated airflow. Used to provide dehumidification and improve system efficiency.
- **Continuous Fan Operation:** When thermostat continuous fan (G) switch is on without call for heating or cooling, indoor fan is immediately energized up to 50% of cooling speed. Allows continuous circulation of air between calls for heating or cooling. If call for heat (W) or cool (Y) occurs during continuous fan, blower remains energized.

## 22. Maintenance And Service

### Routine Maintenance By Home Owner

- Arrange for professional servicing of furnace by the service or installation contractor annually.
- Homeowner is to maintain air filter or filters. A dirty filter can cause furnace to over-heat, fail to maintain indoor temperature during cold weather, increase fuel consumption and cause component failure.
- Inspect, clean or replace filter monthly.
- Furnace is supplied with semi-permanent type filter. If filter is damaged, replace with filters of same size and type.
- During monthly filter inspection, inspect general condition of furnace. Watch for signs of oil leaks in vicinity of oil burner, soot forming on any external part of furnace, soot forming around joints in vent pipe, etc. If any of these conditions are present, please advise your service or installation contractor.

### Annual Service By Contractor

#### NOTICE

Combustion chamber (firepot) is fragile. Use care when inspecting and cleaning this area

- Inspect heat exchanger periodically and clean if necessary.

#### WARNING

Electrical shock hazard. Turn OFF electrical power supply at service panel before service or maintenance Failure to do so could result in death or serious injury.

- If cleaning is necessary, shut off oil supply, shut off power to the furnace and remove burner.
- Use stiff brush with wire handle, brush off scale and soot from inside drum and flue pipe.
- Clean radiator, remove clean-out cap screws. Remove caps carefully to avoid tearing gaskets.
- Wire brush can be used to loosen dirt and debris on the inside surfaces of radiator. Clean out all accumulated dirt, soot and debris with a wire handled brush and an industrial vacuum cleaner.
- Before replacing clean-out caps, inspect gaskets. If gaskets are broken, remove remnants and replace with new gaskets.
- Blower motor is factory oiled and permanently sealed. **Do not lubricate.** Excess oil causes premature electric motor failure.
- Inspect blower fan. Clean if necessary.
- Oil Burner Maintenance: Follow oil burner manufacturer instructions.
- Change oil burner nozzle and oil filter annually.
- Clean and inspect venting system for signs of deterioration. Replace pitted or perforated vent pipe and fittings.
- Barometric damper should open and close freely.
- Check electrical connections to ensure tight connections. Safety controls such as the high limit controls should be tested for functionality.
- Check fan control to ensure fan on and off delay function continues to start and stop blower fan at optimal settings.

## **WARNING**

Fire, burn, explosion, asphyxiation hazard.

- Do not start burner when excess oil has accumulated, furnace is full of vapor, or combustion chamber is very hot.
- Do not burn garbage or paper in furnace.
- Do not leave paper or rags around furnace.

Failure to follow these instructions could result in death or serious injury.

### **23. OPERATING INSTRUCTIONS (BML/BMLB)**

#### **Before Lighting**

1. Open all supply and return air registers and grilles.
2. Open all valves in oil pipes.
3. Turn on electric power supply.

#### **To Light Unit**

1. Set thermostat above room temperature to call for heat. Burner should start. It may be necessary to press RESET button on primary combustion control relay.
2. There is a fan on time delay before circulating fan is energized. United Technologies 1158-120 has adjustable fan on time set by selecting dipswitch combination displayed in Chart 1. Fan on delay can be set at 30, 60, 90 or 120 seconds.
3. Set the thermostat below room temperature. Oil burner stops.
4. Air circulation blower continues to operate until time off setting selected on electronic fan timer control times out. United Technologies 1158-120 has adjustable fan off time of 2, 3, 4 or 6 minutes. Fan timer control adjustments may be altered if air at room registers is high upon blower start up or shutdown.
5. Restore thermostat setting to comfortable temperature.

#### **To Shut Down Unit**

1. Set thermostat to lowest possible setting.
2. Set manual switch (if installed) in electrical power supply line to "OFF".

### **24. Operating Instructions (BMLV)**

#### **Before Lighting**

1. Open all supply and return air registers and grilles.
2. Open all valves in oil pipes.
3. Turn on electric power supply.

#### **To Light Unit**

1. Set thermostat above room temperature to call for heat. Burner should start. It may be necessary to press RESET button on primary combustion control relay.
2. There is a fan on time delay before circulating fan is energized. United Technologies 1168-1 has adjustable fan on/off time delay programmed into ECM motor, and is set by selecting SW4 DIP switch combination displayed in Table A-9 page 17. Adjust Fan on/off delay according to input (nozzle size).
3. Set thermostat below room temperature. Oil burner stops.
4. Air circulation blower continues to operate until blower off delay setting programmed into ECM motor times out.
5. Restore thermostat setting to comfortable temperature.

## **NOTICE**

If furnace is to be shut down for extended period of time, close oil supply valve to burner.

**Check out and adjustments**

BML / BMLB / BMLV furnaces may be used with following oil burners.

Beckett AF, and Riello 40F oil burners are for applications using indoor air for combustion only.

Sidewall venting applications utilizing outdoor air for combustion, use Beckett AFII or Riello 40BF (Balanced Flue) oil burners only.

**Table A-1 Beckett AF Oil Burner Set-Up**

<b>Beckett AF Series Oil Burners (For use with chimney vented units only)</b>							
<b>Furnace Model</b>	<b>Output BTU/Hr</b>	<b>Burner Model</b>	<b>Delavan Nozzle</b>	<b>Pump Pressure</b>	<b>Flow Rate</b>	<b>Head <sup>1</sup></b>	<b>Static Plate</b>
BML-60B2 <sup>2</sup> BMLV-60B2 <sup>2</sup>	59,000	AF76BNHS	0.50 / 80°A	100 PSIG	0.50 USGPH	F3	3- 3/8 in.
BML-80B2 BMLB-80B2 BMLV-80B2	76,000	AF76BNHS	0.65 / 80°A	100 PSIG	0.65 USGPH	F3	3- 3/8 in.
BML-90B2 BMLB-90B2 BMLV-90B2	85,000	AF76BNHS	0.75 / 80°A	100 PSIG	0.75 USGPH	F3	3- 3/8 in.

<sup>1</sup> Head is shielded by ceramic insulator.

<sup>2</sup> Low Firing Rate Baffle required when using 0.50-gallon nozzle.

**Table A-2 Beckett AFII Oil Burner Set-Up**

<b>Beckett AFII Series Oil Burners (For use with sidewall vented units with outdoor combustion air, or chimney vented units with indoor air for combustion)</b>						
<b>Furnace Model</b>	<b>Output BTU/Hr</b>	<b>Burner Model</b>	<b>Delavan Nozzle</b>	<b>Pump Pressure</b>	<b>Flow Rate</b>	<b>Head</b>
BML-60BB2U2 BMLV-60BB2U2	59,000	AFII-85	0.50 / 60°A	115 PSIG	0.50 USGPH	FB0
BML-80BB2U2 BMLV-80BB2U2	76,000	AFII-85	0.60 / 60°A	145 PSIG	0.65 USGPH	FB3
BML-90BB2U2 BMLV-90BB2U2	88,000	AFII-85	0.70 / 60°A	145 PSIG	0.75 USGPH	FB3

**Table A-3 Riello 40F Series Oil Burner Set-Up**

Riello 40F Series Oil Burners (For use with chimney vented units)							
Furnace Model	Output BTU/Hr	Burner Model	Delavan Nozzle	Pump Pressure	Flow Rate	Air Gate	Turbulator Setting
BML-60BRF2 BMLV-60BRF2	60,000	40F3	0.50 / 60°W	105 PSIG	0.50 USGPH	2.6	1.0
BML-80BRF2 BMLV-80BRF2	77,000	40F3	0.60 / 60°W	120 PSIG	0.65 USGPH	2.6	1.5
BML-90BRF2 BMLV-90BRF2	87,000	40F3	0.65 / 60°W	135 PSIG	0.75 USGPH	3.6	2.0

**Table A-4 Riello Balanced Flue (40BF) Burner Set-Up**

Riello 40BF Balanced Flue Series Oil Burners (For use with sidewall vented units using outdoor combustion air)						
Furnace Model	Output BTU/Hr	Burner Model	Delavan Nozzle	Pump Pressure	Flow Rate	Turbulator Setting
BML-60BRBU2 BMLV-60BRBU2	60,000	40BF3	0.50 / 60°W	105 PSIG	0.50 USGPH	1.0
BML-80BRBU2 BMLV-80BRBU2	78,000	40BF3	0.60 / 60°W	120 PSIG	0.65 USGPH	1.5
BML-90BRBU2 BMLV-90BRBU2	88,000	40BF3	0.65 / 60°W	135 PSIG	0.75 USGPH	2.0

**NOTE:** Air gate setting may vary for sidewall vented units where air gate must be adjusted to achieve zero smoke.

### A.1 OIL BURNER AIR ADJUSTMENT

Consult oil burner instructions provided in furnace documents envelope for specific information concerning burner adjustments, operation and troubleshooting.

#### Beckett AF Burner (Chimney Vent)

Adjust air shutter by loosening locking screws. Moving air shutter, and if necessary, bulk air band.

#### Beckett AFII Burner (Direct Vent)

Adjust burner air supply. Loosen locking screw located on black dial to right of burner. Turn black dial clockwise to increase combustion air and counter-clockwise to decrease combustion air. Re-tighten locking screw after obtaining proper setting.

#### Riello 40F3 Burner (Chimney Vent)

Combustion air is adjusted by removing burner cover. Loosen screws that secure air adjustment plate. Move adjusting plate to either increase or decrease combustion air. When proper air setting is achieved, retighten fixing screws.

#### Riello 40BF3 Burner (Direct Vent)

Combustion air can be adjusted with burner cover on. Remove plastic cover on top right hand side of burner cover. With phillips head screw driver, turn adjustment screw clockwise to increase combustion air or counter-clockwise to decrease combustion air. When combustion air is set, re-insert plastic cover.

## A.2 Burner Electrodes

Adjustment of electrode tips with respect to each other, nozzle, burner head is very important to ensure smooth start-ups and to permit efficient combustion.

### Beckett AF and AFII Burners

- Electrode gap: 5/32 inch.
- Distance above horizontal center-line: 5/16 inch. Older instruction sheets specify 7/16 inch. Current specification is 5/16 inch.
- Distance ahead of nozzle: 1/16 inch.
- "Z" dimension, distance from front of end cone (head) to face of nozzle should be 1-1/8 inches. If ceramic head is used, distance from end cone to nozzle face is increased to 1-3/8 inches.

### Riello 40F, & BF Burners

- Electrode gap: 5/32 inch.
- Distance above horizontal center-line: 13/64 inch.
- Distance ahead of nozzle: 5/64 to 7/64 inch.

## A.3 Start Up

Use following instructions to set the burner:

1. Shut off electrical power to the furnace.
2. Install oil pressure gauge to pressure port on oil pump. (Refer to oil pump specification sheet included with burner instructions).
3. Restore electrical power to furnace.
4. Start furnace and bleed all air from fuel oil lines.
5. Close purge valve and fire the unit.
6. Allow furnace to warm up to normal operating temperatures. During this time, set pump pressure in accordance with data provided in Appendix A, Table A-1 thru A-4.
7. **Chimney vented units** - Drill 1/4" test port in venting between furnace flue outlet and draft regulator (barometric damper) to take smoke readings.
8. **Sidewall vented units** - Do not drill. Use test port in the supplied appliance connector to take smoke readings.
9. When furnace has reached "steady state" (after approximately 10 minutes). Set combustion air damper to get TRACE of smoke for chimney vented units and ZERO smoke for sidewall vented units.
10. Check system temperature rise. *Temperature rise is the difference between return air temperature measured at a point near return air inlet, and supply air temperature measured near furnace outlet.*  
System temperature rise is listed on furnace rating plate. If temperature rise is too high, airflow must be increased. If temperature rise is too low, slow fan down.
11. After air adjustments have been completed, recheck the over fire draft at test port on burner mounting plate shown in Figure 2. Over fire draft should be adjusted to -0.02 inches w.c.
12. Turn burner off. Observe duct thermometer in supply air stream, note temperature blower fan stops. Fan adjustments can be made by moving dipswitch settings on timer control board for fan off delay.
13. Check operation of limit switch.
  - A. Shut off power to furnace.
  - B. Temporarily remove neutral wire from PSC or belt drive blower motor or remove 5 pin power connector from ECM blower motor. Isolate AC line voltage pins on 5 pin power connector with electrical tape to prevent electric shock hazard.
  - C. Restore electrical power to furnace.
  - D. Set thermostat above room temperature.
  - E. After three or four minutes of burner operation, limit control should turn burner off.
  - F. When limit function test is complete, shut off electrical power to furnace, replace neutral wire to PSC or belt drive blower motor or 5 pin power connector to ECM blower motor. Restore power.
  - G. Blower fan will start up immediately. Once temperature has dropped and limit control has reset, fan will operate until fan off time is reached.
  - H. Oil burner will resume operation and continue until thermostat is satisfied.
  - I. Restore thermostat setting to comfortable temperature.
14. Set heat anticipator adjustment in thermostat (if so equipped), by removing "R" or "W" wire to thermostat. Read amperage draw between the two wires. Failure to remove one of the wires from thermostat while performing this test could burn out heat anticipator. Set heat anticipator to amperage measured.
15. Run furnace through at least three full cycles before leaving the installation, to ensure all controls are operating properly.
16. Check all joints in any positive pressure venting system for leaks before leaving the installation site

## A.4 Special Instructions For Units Equipped With Riello Burners

Riello specifications are listed in Tables A-1 and A-4. Consult Riello Installation Instructions supplied with Burner for specific information concerning burner adjustments, operation, and trouble-shooting.

**A.5 Final Check Out**

Verify all safety devices and electrical components have been set for normal operation.

Verify all electrical connections are tight and wiring is secure.

Verify homeowner is informed and understands:

Where circuit breaker or fuse is located in main electrical panel.

Where furnace switch is located, and switch "on" and "off" positions if not obvious.

Where oil shut-off valve from oil storage tank is located.

Thermostat operation, and other related accessories.

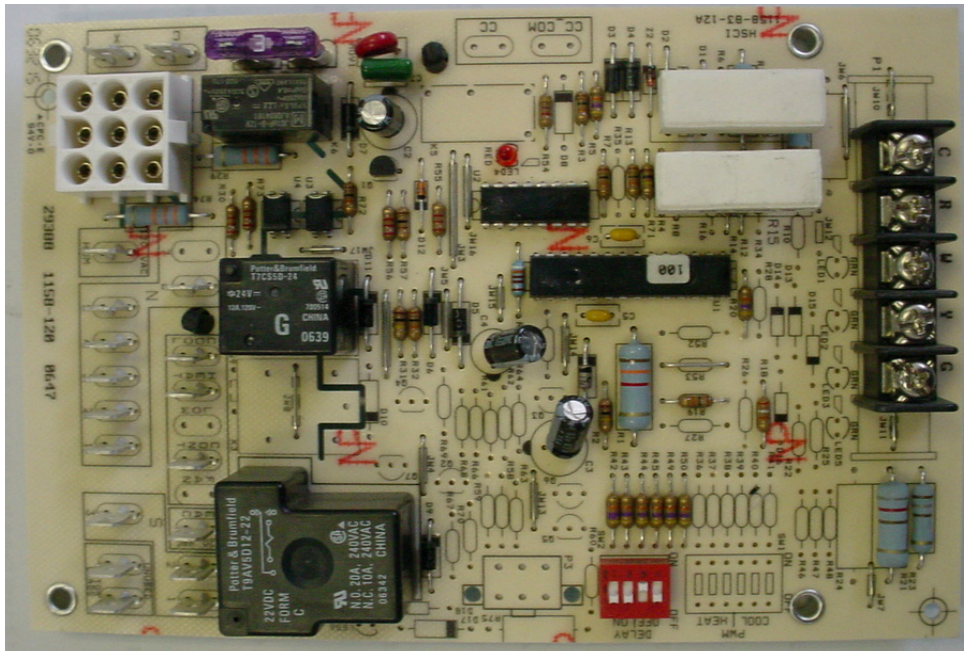
How to operate manual reset button on primary control, and when not to push the reset button.

How and where to visually inspect venting system for leaks or other problems.

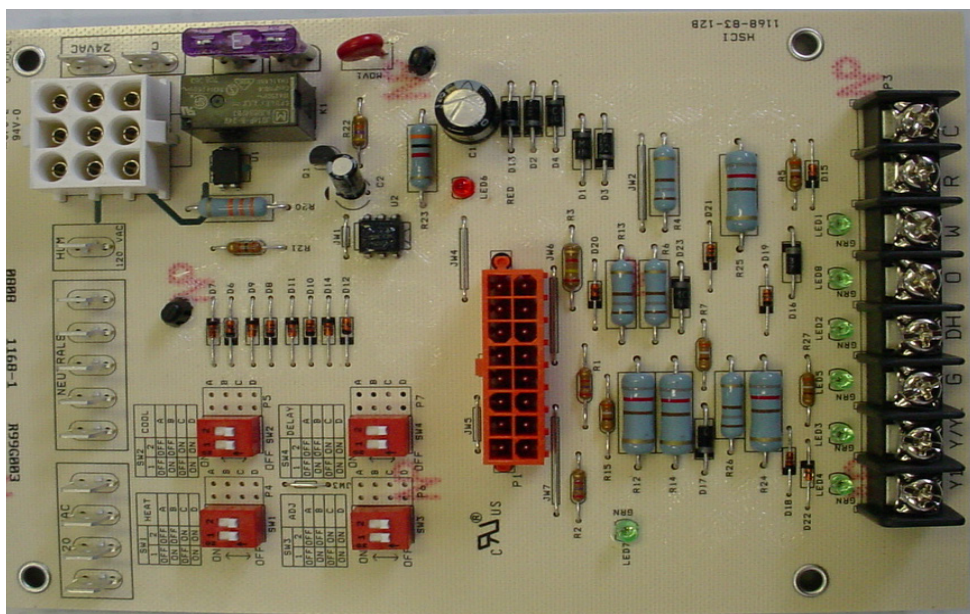
How to inspect, clean and replace air filter, and other homeowner maintenance procedures.

Who to call for emergency service and routine annual service.

**FIGURE 3: UNITED TECHNOLOGIES 1158-120 FAN TIMER BOARD (BML/BMLB)**



**FIGURE 4: UNITED TECHNOLOGIES 1168-1 ECM TAP BOARD (BMLV)**





**Table A-6 Direct Drive Blower Set-Up PSC Motor**

Furnace Model	Blower	Blower Set-Up				Cooling Capacity		
		0.20 in. w.c.		0.50 in. w.c.		Tons	Power	CFM Range
		Speed	Motor	Speed	Motor			
BML-60	100-10T DD	Low	1/2 HP	Med-Low	1/2 HP	3.5	1/2 HP	700-1400
BML-80	100-10T DD	Med-Low	1/2 HP	Med-Low	1/2 HP	3.5	1/2 HP	700-1400
BML-90	100-10T DD	Med-Low	1/2 HP	Med-High	1/2 HP	3.5	1/2 HP	700-1400

**Table A-7 Direct Drive Blower Characteristics PSC Motor**

Furnace Model	Blower	Motor HP	Motor FLA	ΔT	Speed	CFM				
						External Static Pressure – Inches w.c.				
						0.20	0.30	0.40	0.50	0.60
BML 60 – 90	100-10T DD	1/2 HP	7.1	70°F	High	1722	1645	1561	1462	1375
					Med-High	1604	1545	1473	1383	1302
					Med-Low	1147	1133	1106	1063	1013
					Low	747	738	720	702	669

**TIP:**

Formulas will assist with design of duct-work and determination of air flow delivery.

**CFM = Bonnet Output / (1.085 x System Temperature Rise (ΔT))**

**System Temperature Rise (ΔT) = Bonnet Output / (1.085 x CFM)**

**Table A-8 Direct Drive Blower Set-Up - 1/2 HP ECM Variable Speed Constant CFM Motor**

**Dip Switch Adjustment Chart**

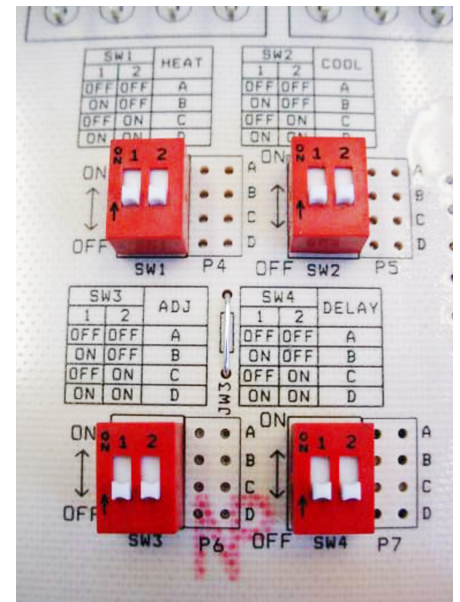
For Input 0.50 USGPH TO 0.75 USGPH

SW1 - HEAT		POS.	INPUT USGPH
DIP Switch Position			
1	2		
OFF	OFF	A	0.65
ON	OFF	B	NA
OFF	ON	C	0.75
ON	ON	D	0.50

SW2 - COOL		POS.	AC Size (TON)
DIP Switch Position			
1	2		
OFF	OFF	A	3
ON	OFF	B	2.5
OFF	ON	C	2
ON	ON	D	1.5

SW3 - ADJUST		POS.	CFM
DIP Switch Position			
1	2		
OFF	OFF	A	0%
ON	OFF	B	(+)15%
OFF	ON	C	(-)15%
ON	ON	D	N/A

SW4 - DELAY		POS.	INPUT USGPH
DIP Switch Position			
1	2		
OFF	OFF	A	0.65
ON	OFF	B	NA
OFF	ON	C	0.75
ON	ON	D	0.50



**NOTE:**

SW1 (HEAT) AND SW4 (DELAY) DIP SWITCHES MUST BOTH BE ADJUSTED ACCORDING TO INPUT (NOZZLE SIZE).

SW2 (COOL): 1 TON is approximately equal to 400 CFM

SW3 (ADJUST): Position B increases CFM. In Heating Mode, this *decreases* temperature rise.

Position C decreases CFM. In Heating Mode, this *increases* temperature rise.

**Table A-9 Direct Drive Blower Characteristics - 1/2 HP ECM Variable Speed Constant CFM Motor**

<b>Furnace Model</b>	<b>Blower</b>	<b>Motor HP</b>	<b>Motor FLA</b>	<b>ΔT</b>
BMLV 60-90	100-10T DD	1/2 HP ECM	7.7	55-85°F
<b>OIL HEATING</b>				
<b>SW1 HEAT DIP SWITCH POSITION</b>	<b>INPUT [USGPH]</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION A</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION B</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION C</b>
A (1=OFF, 2=OFF)	0.65	823	946	700
B (1=ON, 2=OFF)	N/A	1052	1210	894
C (1=OFF, 2=ON)	0.75	923	1061	785
D (1=ON, 2=ON)	0.50	623	716	530
<b>CONTINUOUS FAN</b>				
<b>SW2 COOL DIP SWITCH POSITION</b>	<b>AC SIZE [TONS]</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION A</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION B</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION C</b>
A (1=OFF, 2=OFF)	3	553	636	470
B (1=ON, 2=OFF)	2.5	456	524	388
C (1=OFF, 2=ON)	2	359	413	305
D (1=ON, 2=ON)	1.5	291	335	247
<b>COOLING OR HEAT PUMP HEATING</b>				
<b>SW2 COOL DIP SWITCH POSITION</b>	<b>AC SIZE [TONS]</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION A</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION B</b>	<b>CFM WITH SW3-ADJ DIP SWITCH POSITION C</b>
A (1=OFF, 2=OFF)	3	1105	1271	939
B (1=ON, 2=OFF)	2.5	911	1048	774
C (1=OFF, 2=ON)	2	717	825	609
D (1=ON, 2=ON)	1.5	582	669	495
<b>DELAY PROFILE FOR OIL HEATING</b>				
<b>SW4 DELAY DIP SWITCH POSITION</b>	<b>INPUT [USGPH]</b>	<b>PRE RUN ON DELAY</b>	<b>SHORT RUN ON DELAY</b>	<b>OFF DELAY</b>
		<b>TIME - CFM LEVEL</b>	<b>TIME - CFM LEVEL</b>	<b>TIME - CFM LEVEL</b>
A (1=OFF, 2=OFF)	0.65	90 SECONDS - 0%	90 SECONDS - 50%	5 MINUTES - 63%
B (1=ON, 2=OFF)	N/A	75 SECONDS - 0%	75 SECONDS - 63%	5 MINUTES - 63%
C (1=OFF, 2=ON)	0.75	75 SECONDS - 0%	90 SECONDS - 50%	5 MINUTES - 63%
D (1=ON, 2=ON)	0.50	120 SECONDS - 0%	120 SECONDS - 50 %	5 MINUTES - 63%
<b>DELAY PROFILE FOR COOLING OR HEAT PUMP HEATING</b>				
<b>NO ADJUSTMENT REQUIRED</b>	<b>AC SIZE [TONS]</b>	<b>PRE RUN ON DELAY TIME - CFM LEVEL</b>	<b>SHORT RUN ON DELAY TIME - CFM LEVEL</b>	<b>OFF DELAY TIME - CFM LEVEL</b>
N/A	ALL	7.5 MINUTES - 82%	NONE	NONE

**Table A-10: BMLB Belt Drive Blower Setup \***

Furnace Model	Blower	Motor	Blower Set-Up					
			0.20 in. w.c.			0.50 in. w.c.		
			Pulley		Belt	Pulley		Belt
			Motor	Blower		Motor	Blower	
<b>BMLB-80</b>	100-10T	1/2 HP	3-1/4 x 1/2 (2 T.O.)	7 x 3/4	4L380	3-1/4 x 1/2 (1 T.O.)	6 x 3/4	4L370
<b>BMLB-90</b>	100-10T	1/2 HP	3-1/4 x 1/2 (1 T.O.)	7 x 3/4	4L380	3-1/4 x 1/2 (0 T.O.)	6 x 3/4	4L370

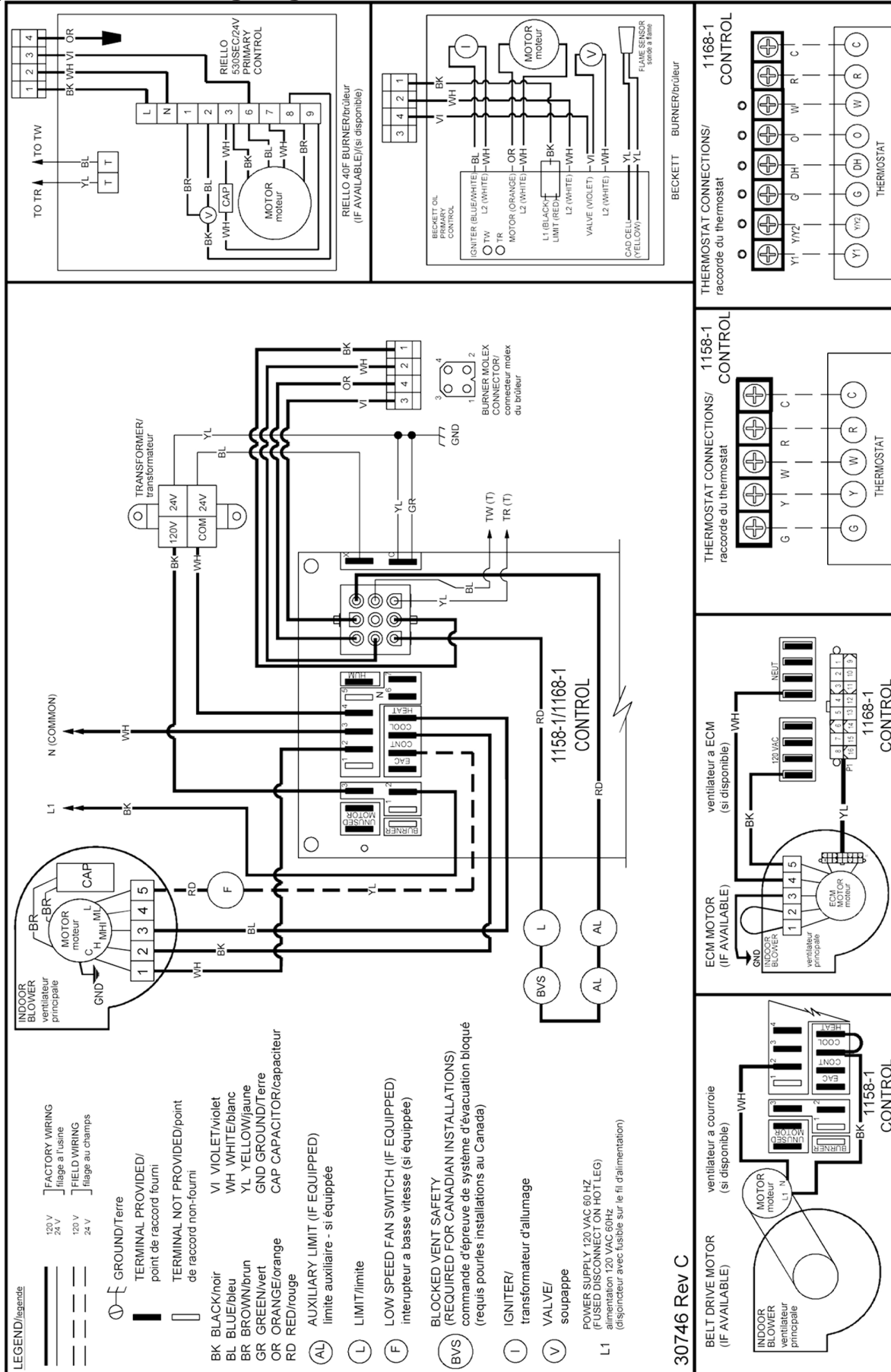
\* BMLB models are factory equipped for operation at up to 0.2 inches w.c. external static pressure. Operation at higher static pressure requires field conversion using aftermarket parts (pulleys and belts as shown in table above) that are not included with the furnace. When an intermediate external static pressure is required (i.e. greater than 0.2 inches w.c. and less than 0.5 inches w.c.) the components specified for the 0.5 inch w.c. static pressure shall be used and adjusted for the rated temperature rise.

**Table A-11 BMLB Airflow Characteristics  
Factory Equipped 0.2 Inch w.c. Belt Drive Blower**

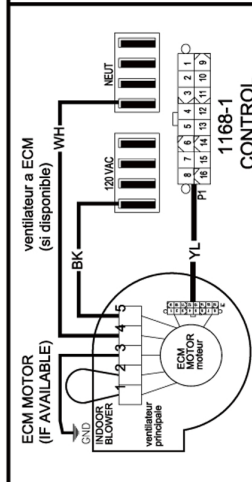
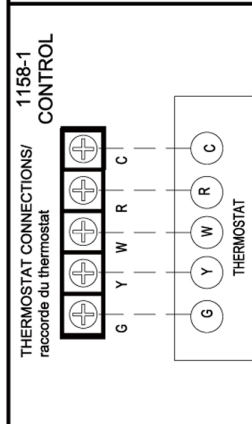
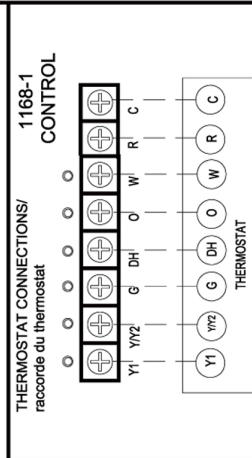
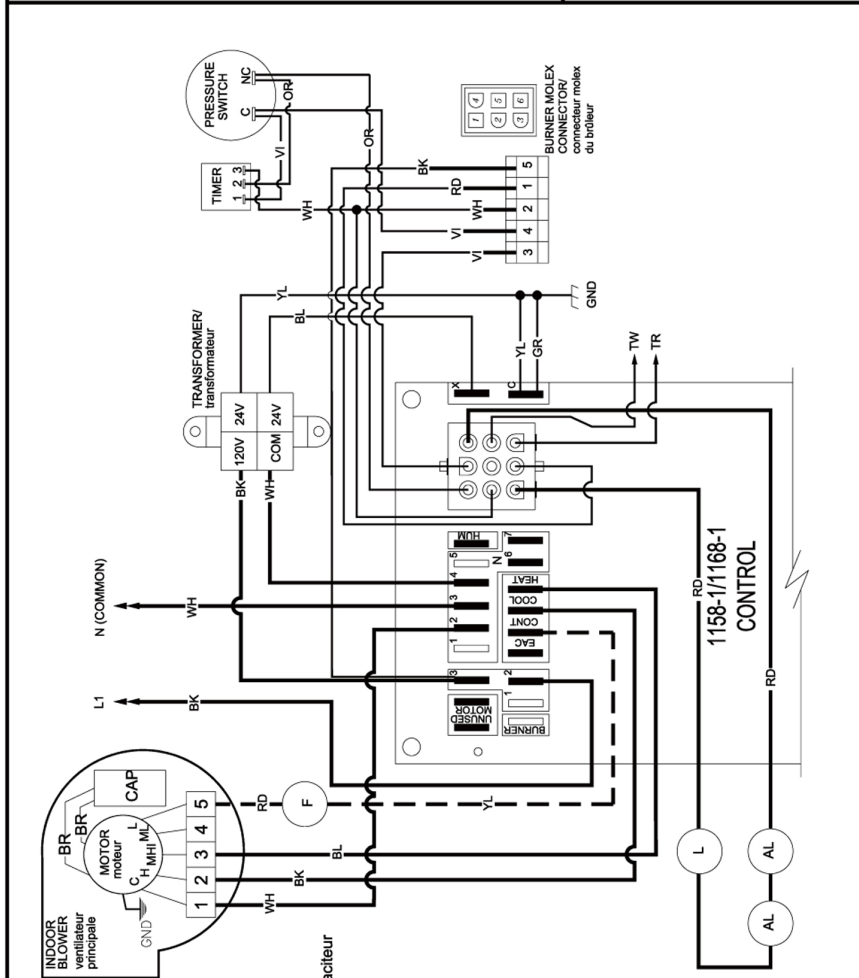
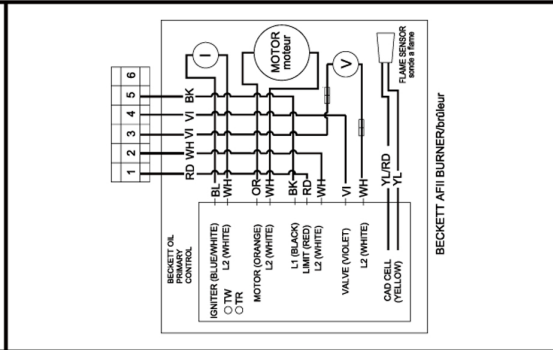
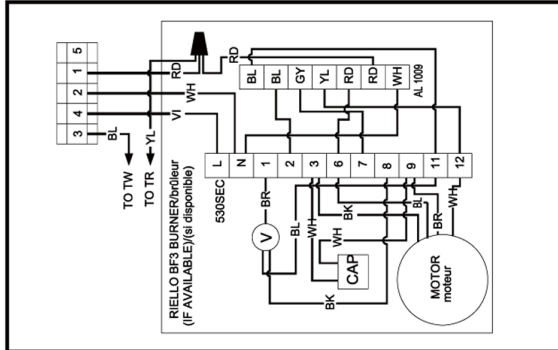
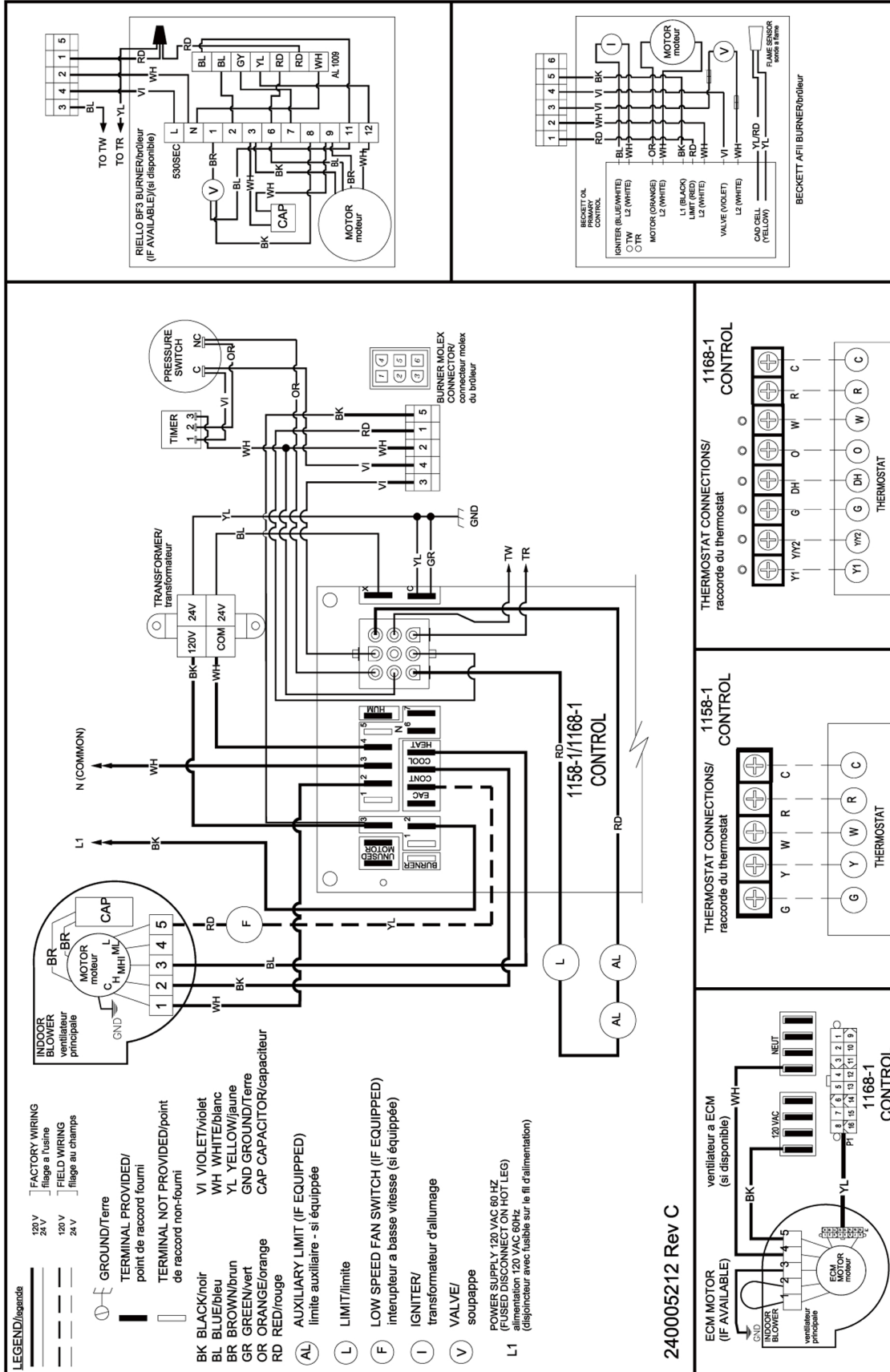
Model	Input	Output	Motor Pulley Turns Out	ESP [in. w.c.]	0.05	0.1	0.15	0.2
<b>BMLB-80</b>	91000	76000	0	cfm	---	---	---	1260
Motor: 1/2 HP Motor FLA: 7.9 Amps Rated Temperature Rise: 70°F Blower: 100-10T Blower Pulley: 7" x 3/4"			1	cfm	---	---	1203	1117
			2	cfm	1274	1187	1089	991
			3	cfm	1175	1066	971	858

Model	Input	Output	Motor Pulley Turns Out	ESP [in. w.c.]	0.05	0.1	0.15	0.2
<b>BMLB-90</b>	105000	85000	0	cfm	---	1403	1334	1260
Motor: 1/2 HP Motor FLA: 7.9 Amps Rated Temperature Rise: 70°F Blower: 100-10T Blower Pulley: 7" x 3/4"			1	cfm	1378	1291	1203	1117
			2	cfm	1274	1187	1089	991
			3	cfm	1175	1066	971	---

Chimney Vent Furnace Wiring Diagram



Direct Vent Furnace Wiring Diagram



**APPENDIX C - SEQUENCE OF OPERATION AND TROUBLESHOOTING**

**Table C-1: 1158-120 Electronic Fan Timer Board (EFT) Detailed Sequence Of Operation (BML)**

<b>Mode</b>	<b>Action</b>	<b>System Response</b>
HEAT	Thermostat calls for heat. ("W" terminal is energized).	EFT closes the oil primary control T - T connections. Ignition system and the oil primary control start the furnace. Oil flows as long as the oil primary control senses flame. Burner motor is energized and heat "fan on" delay timing begins. When timing is complete, the circulator fan is energized at heat speed.
	Thermostat ends call for heat. ("W" terminal is de-energized).	The oil primary control is de-energized, terminating the burner cycle. Heat "fan off" delay timing begins. Length of delay depends on EFT dipswitch settings. When timing is complete, the circulator fan is de-energized. EFT returns to standby mode, (Oil primary control and circulator fan are off, unless continuous fan operation is selected at the thermostat).
	Burner fails to light.	Oil primary control locks out within lockout timing, (15 seconds). Burner motor is de-energized. (Even though thermostat is still calling for heat). If circulator fan has started, it continues through the selected heat "fan off" delay period.
	Established flame fails.	Burner motor is de-energized and oil primary control goes into recycle mode. If the selected heat "fan off" delay timing is longer than the recycle delay timing, the circulator fan continues to run through the next trial for ignition.
COOL	Thermostat begins call for cool. (G and Y terminals are energized).	Cooling contactor is energized immediately. Circulator fan is energized at cool speed.
	Thermostat ends call for cool. (G and Y terminals are de-energized).	Cooling contactor is de-energized immediately. Circulator fan turns off immediately.
FAN	Thermostat begins call for fan. (G terminal is energized).	Circulator fan is energized immediately at cooling speed.
	Thermostat ends call for fan. (G terminal is de-energized).	Circulator fan is de-energized immediately.
LIMIT	Limit switch string opens.	Oil primary control shuts off burner. Circulator fan is energized immediately at heat speed. EFT opens the oil primary control T - T connections. Circulating fan runs as long as limit string stays open. If there is a call for cooling or fan, the circulating fan switches from heating to cooling speed.
	Limit switch string closes (with existing call for heat).	EFT begins heat "fan off" delay sequence. Circulating fan turns off after the selected heat "fan off" timing. EFT re-closes the oil primary control T - T connections. Oil primary control is energized, initiating burner light off.
	Limit switch string closes (without existing call for heat).	Circulator fan turns off when heat "fan off" delay time is complete. Normal operation resumes; EFT control is in standby mode awaiting next thermostat command.
FAN	Continuous circulating fan is connected.	Circulating fan is energized when there is no call for heat, cool, or fan. If fan operation is required by a call for heat, cool, or fan, the EFT switches off the continuous fan speed tap before energizing the other fan speed.
EAC	Electronic Air Cleaner is connected.	Electronic air cleaner (EAC) connections are energized when the heat or cool speed of the circulator fan is energized. EAC connections are not energized when the optional continuous fan terminal is energized.
HUM	Humidity control is connected.	Humidifier connections are energized when the oil burner motor is energized.

**Table C-2: 1168-1 ECM Tap Board Sequence of Operation (BMLV)**

Thermostat Input LEDs (LED 1-5, LED 8)

Six green LEDs are placed behind their respective thermostat connections (Y1, Y/Y2, G, DH, O, W) and illuminate whenever a call is present.

Mode	Action	System Response
HEAT	Thermostat call for heat "W"	The 24 VAC input signal is passed to pin 2 of P1 and will drive the K1 relay that provides dedicated contacts to the T-T input of the oil primary control. Blower runs on heating speed profile.
COOL	Thermostat calls for single stage cooling or second stage of two stage cooling "Y/Y2"	The 24 VAC input signal is passed to pin 14 of P1. Blower runs on cooling speed profile.
	Thermostat calls for first stage of two stage cooling "Y1" while "Y/Y2" is not calling	The 24 VAC input signal is passed to pin 6 of P1. Blower runs on cooling speed profile.
FAN	Thermostat calls for fan "G"	The 24 VAC input signal is passed to pin 15 of P1. Blower runs at continuous low speed profile which is 50% of cooling speed.
DEHUMID	Thermostat calls for Dehumidification "DH"	The 24 VAC input signal is passed to pin 10 of P1. Blower runs according to "Y1" and "Y/Y2" calls as noted above.
REVERSING VALVE	Thermostat calls for reversing valve "O"	The 24 VAC input signal is passed to pin 9 of P1. Blower runs according to "Y1" and "Y/Y2" calls as noted above.

## C.1 Troubleshooting

### **WARNING**

Electrical shock hazard. Only a trained, experienced service technician should perform troubleshooting procedure. Failure to do so could result in death or serious injury.

## C.2 Preliminary Steps:

Consult Beckett or Riello instruction manuals provided with oil burner for specific information regarding oil burner primary control sequence of operation, diagnostics and troubleshooting.

Check diagnostic light for indications of burner condition.

### **NOTICE**

When simulating call for heat at oil primary control, disconnect at least one thermostat lead wire from T - T terminals to prevent damage to thermostat. Neglecting this procedure may burn out heat anticipator of standard 24 vac thermostat, or cause harm to components within micro-electronic thermostat.

Before checking oil primary control, perform these preliminary checks, repair or replace controls as necessary:

- Check power supply, fuse box or breaker, any service switches, all wiring connections, and burner motor reset button (if equipped).
- Check limit switches to ensure switch contacts are closed.
- Check electrode gap and position.
- Check contacts between oil primary control and electrodes.
- Check oil supply (tank gauge).
- Check oil nozzle, oil filter, and oil valves.
- Check piping or tubing to oil tank.
- Check oil pump pressure.

## C.3 Check Oil Primary Control

If the trouble does not appear to be in the burner or ignition hardware, check the oil primary control per manufacturer's instructions included with oil burner.



**⚠ WARNING**

Electrical shock hazard. Only a trained, experienced service technician should perform troubleshooting procedure. Failure to do so could result in death or serious injury.

**Table C2: System and General Troubleshooting**

Problem	Possible Cause	Remedy
Furnace will not start.	Thermostat not calling for heat	Check thermostat and adjust. Check thermostat for accuracy; if mercury switch type, it might be off level.
	No power to furnace	Check furnace switch, main electrical panel furnace fuse or circuit breaker. Look for any other hand operated switch, such as old poorly located furnace switch, which was not removed during furnace replacement.
	Thermostat faulty	Remove thermostat wires from oil primary control terminals T-T. Place a jumper across T-T. If furnace starts, replace thermostat, thermostat sub-base (if equipped), or both.
	Oil primary control faulty	Check reset button on oil primary control. Remove thermostat wires from oil primary control terminals T - T. Check for 24V across T -T. If no voltage is present, check for 115V to oil primary control. If 115V is present, refer to oil primary control documentation provided with oil burner.
	Photo Cell wiring shorted or room light leaking into photo cell compartment	Check photo cell (cad cell) wiring for short circuits. Check for room light leaking into cad cell compartment. Repair light leak if necessary.
	Open safety switch	Check for open limit or auxiliary limit. Check internal wiring connections; loose connectors, etc.
Furnace will not start without first pushing oil primary control reset button. (Happens on frequent basis)	No fuel oil	Check fuel oil supply. Check all hand operated fuel oil valves are in open position. Fill oil storage tank if necessary.
	Clogged nozzle	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Verify erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for signs of oil leaks. Any oil leak is potential source of air or contaminants.
	Defective burner motor	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.

## APPENDIX C - SEQUENCE OF OPERATION AND TROUBLESHOOTING

**Table C-2: System and General Troubleshooting continued**

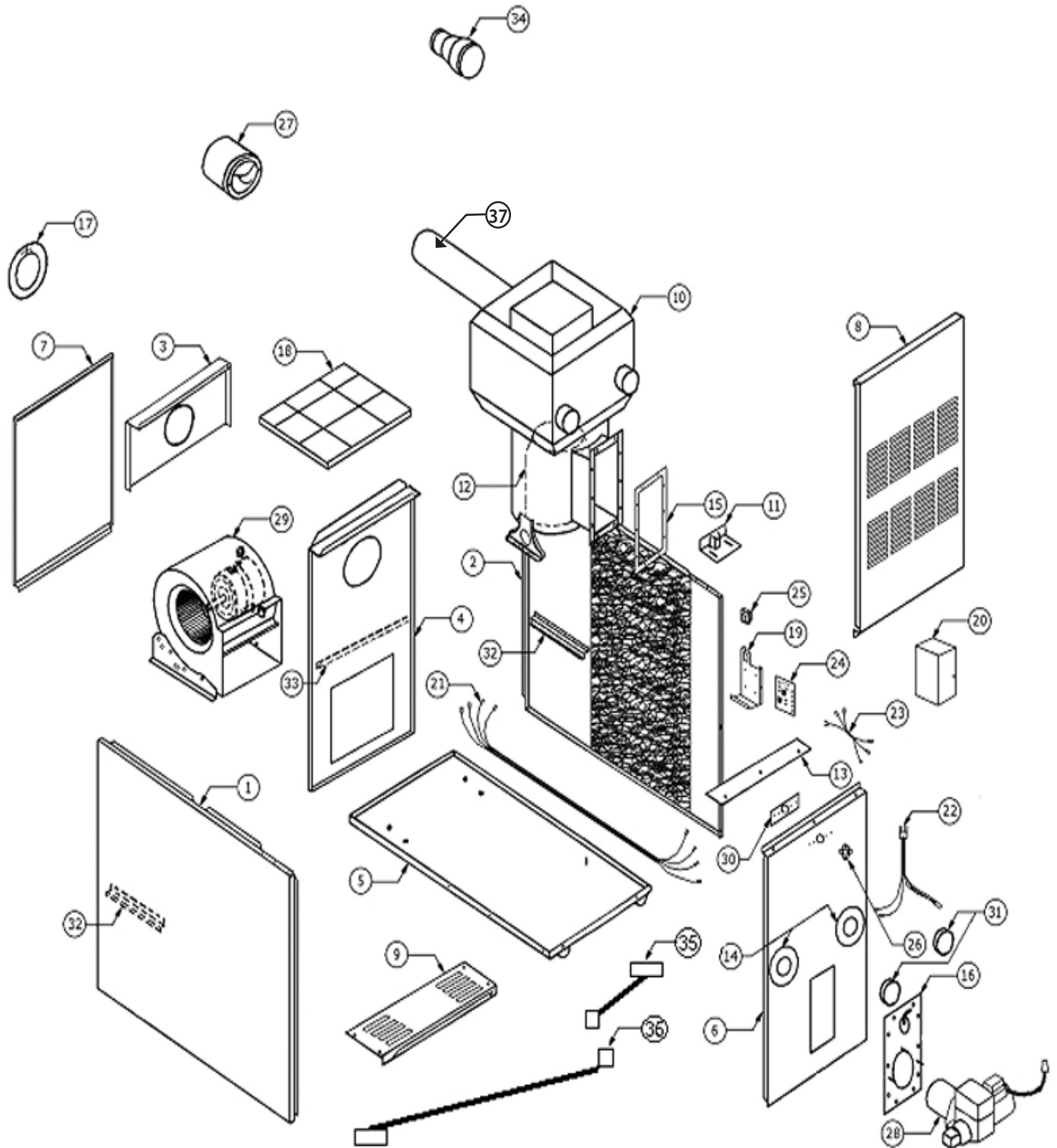
Problem	Possible Cause	Remedy
Furnace starts, but cuts out requiring manually re-setting oil protector reset button.	Photo Cell (Cad Cell) defective.	If cad cell is dirty, clean it. Determine why cad cell is getting dirty. If cad cell is poorly aimed, realign it. NOTE: Photocell should have resistance of 100 K $\Omega$ in absence of light; maximum of 1500 $\Omega$ in presence of light. Verify room light is not leaking into the cad cell compartment. (See diagnostic light section).
Furnace starts, but cuts out requiring manually re-setting oil protector reset button.	No fuel oil.	Check fuel oil supply. Check that all hand operated fuel oil valves are in the open position. Fill oil storage tank if necessary.
	Clogged nozzle.	Replace nozzle with high quality replacement. Use rating plate or Tables in Appendix A as a guide.
	Clogged oil filter.	Replace oil tank filter or in-line filter if used.
	Low oil pump pressure.	Connect pressure gauge to oil pump. Adjust pump pressure, or replace oil pump if necessary. Verify erratic pressure readings are not caused by defective fuel oil line.
	Air getting into fuel oil lines, or fuel oil line dirty, clogged, or in some manner defective.	Check fuel oil lines. Replace any compression fittings found with high quality flared fittings. Check for any signs of oil leaks. Any oil leak is a potential source of air or contaminants.
	Defective burner motor.	Check burner motor. If burner motor is cutting out on over-load, determine why. Replace if necessary.
	Water or contaminants in oil.	Drain fuel oil storage tank; replace fuel oil. (Consult with fuel oil supplier).
	Frozen oil line.	Gently warm oil line. Insulate oil line. (Outdoor piping size may require increased diameter).
Oil burner sputtering at nozzle	Electrodes out of adjustment or defective.	Check electrode settings. Check electrodes for dirt build-up or cracks in porcelain.
	Poor igniter connections or defective igniter.	Check contacts between the igniter and electrodes. If OK, replace the igniter
	Fuel oil filter clogged.	Replace fuel oil storage tank filter and / or fuel oil in-line filter.
	Defective oil pump.	Check burner motor and / or fuel oil pump coupling. Check oil pump pressure. Replace fuel oil pump if necessary.
	Fuel oil line partially clogged or contains air.	Bleed air from oil line. If problem persists, replace oil line.
Excessive fuel oil consumption.	System temperature rise too high.	System temperature rise should not exceed 75°F. Check for clogged air filters. Check blower fan for excess dirt build-up or debris. Speed up blower fan if necessary.
	Poor "fan off" delay timing selection, (fan stops too soon).	Check "fan off" delay timing setting. Use duct thermometer in supply air plenum take-off or first few inches of supply air trunk duct. Fan should shut off at 90° - 100°F. Manipulate dip switch settings to come as close as possible to this "fan off" temperature.
	Fuel oil leak.	Check fuel oil line for leaks. Repair or replace if necessary.
	Stack temperature too high.	Check stack temperature. Stack temperatures will normally range from 400° to 500°F. Check draft regulator. Draft should be set to -0.02 in. w.c.
	Thermostat improperly adjusted or in poor location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to suitable location.

## APPENDIX C - SEQUENCE OF OPERATION AND TROUBLESHOOTING

**Table C-2: System and General Troubleshooting continued**

Problem	Possible Cause	Remedy
Too much smoke.	Insufficient combustion air adjustment at oil burner, or improper draft pressure.	Adjust oil burner combustion air band and draft regulator to gain highest practical CO <sub>2</sub> or lowest practical O <sub>2</sub> content in flue gases. See Burner Set Up.
	Heat exchanger partially clogged.	Check for soot build-up in heat exchanger flue passages, especially in outer radiator.
Soot building up on blast tube (end coning).	Poor alignment between oil burner blast tube and fire pot.	Check alignment. Blast tube should be centered with fire pot burner opening. Oil burner head should be ¼ inch back from inside surface of fire pot.
	Flame impingement caused by incorrect nozzle angle.	Check nozzle size and angle. (See Appendix A). Check distance from head to inside surface of fire pot.
	Defective fire-pot	Check fire-pot. Repair or replace.
Furnace will not warm home to desired temperature.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Thermostat adjustments or location.	Check thermostat heat anticipator setting against measured amperage draw. Increase heat anticipator setting if necessary. If thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to suitable location.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
	Defective high limit control.	Test high limit function of all limit switches. Use duct thermometer to verify accuracy of limit control. Check for obstructions to airflow around limit switch bimetal elements. Replace control if necessary.
	Under-sized nozzle.	Check nozzle. If problem is not caused by air flow problems, use larger nozzle, if permitted by rating plate.
	Blower fan motor stopping intermittently on overload.	Check blower fan motor amperage draw. Check motor ventilation ports, clean if necessary. Replace motor if necessary.
	Burner motor stopping intermittently on overload.	Check burner motor. Replace if necessary.
Home does not heat evenly	Improper distribution of heat.	This is not likely to be a furnace problem. Balance duct system.
Supply air temperature too hot.	Airflow blocked or dirty air filter.	Clean or replace air filter.
	Insufficient airflow.	Check all dampers. Open closed dampers including registers in unused rooms. Check system temperature rise. If temperature rise is too high, speed up blower fan.
Supply air temperature too cool.	Excess airflow.	Check system temperature rise. Slow down blower fan if necessary.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.
Supply air temperature too cool during first moments of furnace cycle.	Fan control "fan on" setting too low.	Increase "fan on" dipswitch settings on EFT if control has this option. Register air deflectors may help.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.

**Model BML / BMLB / BMLV Diagram**  
**Direct Drive Model Shown**



**PARTS LISTING**

**Parts Listing: Chimney Vent Models BML80(B2,BRF2) and BMLV80(B2,BRF2) and BMLB80B2**

Ref. No.	Description	Part No.
1	Left Side Panel Assembly	29631AD
2	Right Side Panel Assembly	29630AD
3	Rear Panel	29638AD
4	Blower Division Assembly	29676
5	Base Panel Assembly	28459
6	Inner Front Panel	30154
7	Blower Access Panel	27367AD
8	Front Door Panel	30157AD
	Logo Bezel	28479
	Logo Label	28563
9	Top Front Panel	26017AD
10	Heat Exchanger Assembly	550001635
11	Firepot Bracket Assembly	27068
12	Replacement Combustion Chamber	27000WP
13	Baffle	30152
14	Clean-out Gasket Retainer (2 per unit)	29161
	Clean-out Gasket (2 per unit)	29163
15	Pouch Gasket	2080175
16	Oil Burner Mounting Plate Assembly	109007674
	Oil Burner Mounting Plate	109007675
	Sight Glass Cover Plate	29850
	Sight Glass Gasket (2 per unit)	29870
	Sight Glass	29876
17	Flue Pipe Collar	27476
18	Air Filter - 20 x 20 x 1 (Permanent)	2180032
19	Control Panel	30010
20	Control Panel Cover	29654
21	Wire Harness Blower Motor Direct Drive	29690
	Wire Harness Blower Motor Belt Drive	29691
22	Wire Harness Fan Timer Board Chimney Vent	29364
23	Wire Harness Transformer and Supply	29751
24	Fan Timer Control 1158-120 UTEC	29388
	Fan Timer Control 1168-1 ECM UTEC	240007048
25	Transformer, 120/24V, 40a	240005330
26	Limit Control 60T11 (L260°F) BOF (Black Oxide Finish)	30153
27	Draft Regulator	27494
28	Beckett AF Oil Burner Assembly, Beckett AF76BNHS	30067
	Burner Motor 1/7 HP 3450 RPM PSC	29689
	Oil Pump, Clean-Cut A2EA6520	29688
	Solid State Ignitor	29522
	Oil Primary Combustion Control 7505P1515	240008818
	Flame Retention Head	1050002
	Low Fire Kit	29880
	Low Firing Rate Baffle	25521101
Oil Burner, Riello 40F3	29568	

**PARTS LISTING**

**Parts Listing: Chimney Vent Models BML80(B2,BRF2) and BMLV80(B2,BRF2) and BMLB80B2**

Ref. No.	Description	Part No.
29	Blower Assembly, Complete, Direct Drive, 1/2 HP, 4-Speed	29668
	Blower Assembly, Complete, Direct Drive, 1/2 HP, ECM	109007377
	Blower Housing and Wheel, 100-10T Direct Drive	30626
	Blower Motor, 1/2 HP, 4-Speed	102000131
	Blower Motor 1/2 HP ECM Programmed	109007380
	Motor Mounting Band - TR6884B	17811
	Motor Mount Arms - 10-10 DD Blower (3 per unit)	26251
	Motor Run Capacitor, 10 mfd @ 370 VAC	27743
	Capacitor Strap	27760
	Blower Base ( 2 per unit)	109005826
	Grommet, Blower Feet (4 per Unit)	26415
	Blower Assembly Complete, Belt Drive, 1/2 HP, One Speed	109006191
	Blower Housing and Wheel, 100-10T Belt Drive	30627
	Blower Motor, 1/2 HP, One Speed	102000154
	Motor Pulley, 3-1/4" x 1/2"	2240001
	Blower Pulley, 7" x 3/4"	2240008
	Belt, 4L380	2240017
	Blower Base (2 per unit)	109005826
	Grommet, Blower Feet (4 per unit)	26415
	30	Insulation/Limit Disc Retainer
31	Radiator Clean-out Pipe Cover (2 per unit)	240007841
	Radiator Clean-out Cap Gasket (2 per unit)	240006333
32	Filter Side Rail (2 per unit)	27370
33	Filter Blower Division Rail	27369
35	Wire Harness ECM Motor Control (from Fan Timer)	240007276
36	Wire Harness ECM Motor Control (from Motor)	240007272
*	Wire Harness ECM Motor Power	240007273
37	Flue Pipe	3002356
*	Flue Pipe Insulator	29713
*	Flue Pipe Gasket	21994
*	Blocked Vent Safety Switch Kit Complete	30690
*	Blocked Vent Safety Switch - Replacement Switch Only	30660
*	Flue Pipe for Blocked Vent Safety Switch	30655
*	Door Handle (2 per unit)	28673

**PARTS LISTING**

**Parts Listing: Direct Vent Models BML80(BB2U2, BRBU2) and BMLV80(BB2U2, BRBU2)**

Ref. No.	Description	Part No.
<b>All parts are the same as listed on previous pages for chimney vent Model BML-80B and BMLV-80B except where noted below.</b>		
15	Pouch Gasket (Second gasket required for Direct Vent)	2080175
22	Wire Harness Fan Timer Board Direct Vent	30745
28	Beckett Oil Burner AFII 85	30069
	Burner Motor 1/7 HP 3450 RPM PSC	28907
	Beckett Clean-cut Oil Pump A2EA6520	29688
	Solid State Ignitor	28558
	Oil Primary Combustion Control 7505P1530	
	Air Tube Combination FBX80HGXS	28561
	Flame Retention Head (FB3)	28533
	Riello Oil Burner 40BF3	30427
34	Appliance Vent Adapter 5" x 3"	240006904
*	Pressure Switch -0.28" WC	30700
*	10 Second Bypass Timer GPS00C9X10 (Use with Beckett AFII)	30699
*	25 Second Bypass Timer GPS00C9X25 (Use with Riello 40BF3)	240005182

## APPENDIX D - HOMEOWNER'S REFERENCE TABLE

Model No.	
Serial No.	
Date Installed	
Contractor	
Contact	
Address	
Postal Code	
Telephone No.	
After Hours No.	

### **Fuel Supplier**

Fuel Oil Supplier	
Contact	
Telephone No.	
After Hours No.	



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All specifications subject to change without notice.

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