

Installation, Operation and Maintenance Manual Oil Fired Warm Air Furnaces

O5LD-091A-12-R (Lowboy Model)

FOR YOUR SAFETY:

**Do not store or use gasoline or other flammable liquids or
vapors in the vicinity of this, or any other appliance.**

**ALL INSTALLATIONS MUST MEET ALL
LOCAL, PROVINCIAL/STATE, AND
FEDERAL CODES WHICH MAY
DIFFER FROM THIS MANUAL**

Nortek Global HVAC, LLC

Read this complete manual before
beginning installation. These instructions
must be kept with the furnace for future
reference.

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IMPORTANT:

SAVE THESE INSTRUCTIONS FOR FUTURE REFERENCE

1. INTRODUCTION

Please read these instructions completely and carefully before installing and operating the furnace.

MODELS O5LD-091A-12-R

Model O5LD-091A-12-R is an oil fired forced air up-flow furnace with an output capacity range of 59,000 BTU/Hr. to 85,000 BTU/Hr.

CAUTION

DO NOT USE GASOLINE, CRANK CASE OIL, OR ANY OIL CONTAINING GASOLINE.

All models are CSA listed, (NRTL/C) for use with No. 1 (Stove) and No. 2 (Furnace) Oil. Please refer to the tables in Appendix A for performance and dimensional data.

In Canada, the installation of the furnace and related equipment shall be installed in accordance with the regulations of CAN/CSA - B139, Installation Code For Oil-Burning Equipment, as well as in accordance with local codes.

In the United States of America, the installation of the furnace and related equipment shall be installed in accordance with the regulations of NFPA No. 31, Standard for the Installation of Oil-Burning Equipment, as well as in accordance with local codes.

Regulations prescribed in the National Codes and Local regulations take precedence over the general instructions provided on this installation manual. When in doubt, please consult your local authorities.

All models are shipped assembled and pre-wired. The furnace should be carefully inspected for damage when being unpacked.

2. HEAT LOSS

The maximum hourly heat loss for each heated space shall be calculated in accordance with the procedures described in the manuals of the Heating, Refrigeration and Air Conditioning Institute of Canada (HRAI), or by other means prescribed, or approved by the local authority having jurisdiction.

In the United States, Manual J. titled, "Load Calculation" published by the Air Conditioning Contractors of America, describes a suitable procedure for calculating the maximum hourly heat loss.

3. LOCATION OF UNIT

The furnace should be located such that the flue connection to the chimney is short, direct and consists of as few elbows as possible. When possible, the unit should be centralized with respect to the supply and return air ductwork. A central location minimizes the trunk duct sizing. All models may be installed on combustible floors.

The minimum installation clearances are listed in Table 1.

Table 1: Clearances – (Inches)

Location	Clearance to Combustibles
Top	1
Bottom	0
S/A Plenum	1
Rear	6*
Sides	1**
Front	1*
Flue Pipe	4 in. measured horizontally or below flue pipe. 8 in. measured vertically or above flue pipe
Enclosure	Closet
** 18 in. required on one side for service access to rear	
* 24 in. required for service clearance	

4. AIR CONDITIONING APPLICATIONS

If the furnace is used in conjunction with air conditioning, the furnace shall be installed in parallel with or upstream from the evaporator coil to avoid condensation in the heat exchanger. In a parallel installation, the dampers or air controlling means must prevent chilled air from entering the furnace. If the dampers are manually operated, there must be a means of control to prevent the operation of either system unless the dampers are in the full heat or full cool position. The air heated by the furnace shall not pass through a refrigeration unit unless the unit is specifically approved for such service.

The blower speed must be checked and adjusted to compensate for the pressure drop caused by the evaporator coil. Refer to Appendix B for recommended wiring and electrical connections of the air conditioning controls.

5. COMBUSTION AIR

If the furnace is installed in a closet or utility room, two openings must be provided connecting to a well-ventilated space (full basement, living room or other room opening thereto, but not a bedroom or bathroom). One opening shall be located above the level of the upper vent opening and one opening below the combustion air inlet opening in the front of the furnace. Each opening shall have a minimum free area of 1½ square inches per 1,000 Btu/h of total input rating of all appliances installed in the room.

For furnaces located in buildings of unusually tight construction, such as those with high quality weather stripping, caulking, windows and doors, or storm sashed windows, or where basement windows are well sealed, a permanent opening communicating with a well ventilated attic or with the outdoors shall be provided, using a duct if necessary. The duct opening shall have a free area of 1½ square inches per 1,000 Btu/h of total input rating of all appliances to be installed. When a furnace is installed in a full basement, infiltration is normally adequate to provide air for combustion and draft operation. Furnace rooms under 65m³ (700 ft³) should automatically be treated as confined space.

6. CHIMNEY VENTING

The flue pipe should be as short as possible with horizontal pipes sloping upward toward the chimney at a rate of one-quarter inch to the foot. The flue pipe should not be smaller in cross sectional area than the flue collar on the furnace. The flue pipe should connect to the chimney such that the flue pipe extends into, and terminates flush with the inside surface of the chimney liner. Seal the joint between the pipe and the lining. The chimney outlet should be at least two feet above the highest point of a 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.

NOTE: THE FURNACE IS APPROVED FOR USE WITH TYPE L VENT OR EQUIVALENT.

⚠ CAUTION

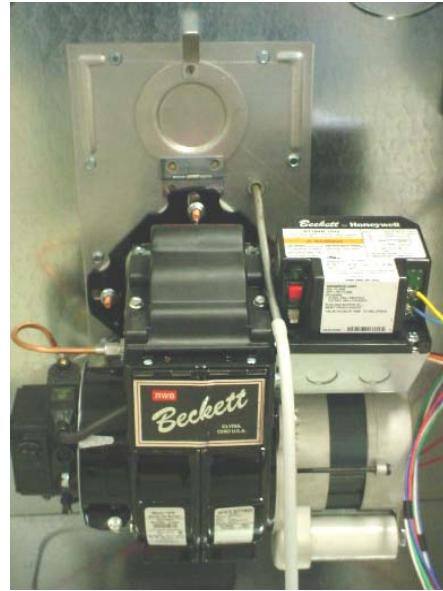
CHIMNEY VENTED VERSIONS OF THE FURNACE MUST BE CONNECTED TO A FLUE HAVING SUFFICIENT DRAFT AT ALL TIMES TO ENSURE SAFE AND PROPER OPERATION OF THE APPLIANCE.

NOTE: THE RECOMMENDED OVER-FIRE DRAFT PRESSURE IS -0.02 IN. W.C. (SEE FIG. 1).

The flue pipe must not pass through any floor or ceiling, but may pass through a wall where suitable fire protection provisions have been installed. Refer to the latest edition of CAN/CSA B-139 for rules governing the installation of oil burning equipment. In the United States, refer to the latest edition of NFPA 31 for regulations governing the installation of oil burning equipment.

See appendix A for burner set-up.

Fig. 1: Checking Over-Fire Draft.



7. BAROMETRIC DAMPER CONTROL.

The barometric damper control, also known as a draft regulator, is used on conventional chimney venting only. This control automatically maintains a constant negative pressure in the furnace to obtain maximum efficiency. It ensures that proper pressures are not exceeded. If the chimney does not develop sufficient draft, the draft control cannot function properly. The draft regulator, when installed should be in the same room or enclosure as the furnace and should not interfere with the combustion air supplied to the burner. The control should also be located near the furnace flue outlet and installed according to the instructions supplied with the regulator. The flue outlet pressure (measured between the furnace and draft regulator, or the oil burner mounting plate over-fired draft access port. Fig 1) should be set to -0.02 in. w.c.

8. FAN TIMER BOARD AND LIMIT CONTROL (FIG.2) (page 17)

The Electronic Fan Timer integrates control of all burner and circulator fan operations. This control is the central wiring point for most of the electrical components in the furnace. The **United Technologies 1158-120** has an adjustable fan on time that is set by selecting the dipswitch combination displayed in Chart 1. This fan on delay can be set at 30, 60, 90 or 120 seconds. This provides a delay between the burner ignition and blower start-up to eliminate excessive flow of cold air when the blower comes on. The **United Technologies 1158-120** has an adjustable fan off time of 2, 3, 4 or 6 minutes displayed in Chart 1. The fan off delay time starts when the burner motor is de-energized at the end of a call for heat. Blower shutdown is delayed to remove any residual heat from the heat exchanger and improve the annual efficiency of the furnace.

The electronic fan timer board works in conjunction with snap disc limit controls, which perform a safety function, and breaks power to the oil burner primary control, which shuts off the burner if the furnace overheats. The limit control is thermally operated and automatically resets. The limit control is factory installed pre-set and is not adjustable.

If the limit control opens with the **United Technologies 1158-120** electronic fan control, the circulating fan will be energized as well. When the limit closes, the fan off timer will begin. At the end of the fan off time cycle the burner will be energized, initiating a normal burner cycle.

CHART 1
United Technologies 1158-120

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

9. ELECTRICAL CONNECTIONS

The furnace is listed by the Canadian Standards Association under the NRTL (North American) Standard. It is factory wired and requires minimal field wiring. All field wiring should conform to CAN/CSA C22.1 Canadian Electrical Code, Part 1, and by local codes, where they prevail. In the United States, the wiring must be in accordance with the National Fire Protection Association NFPA-70, National Electrical Code, and with local codes and regulations.

The furnace should be wired to a separate and dedicated circuit in the main electrical panel; however, accessory equipment such as electronic air cleaners and humidifiers may be included on the furnace circuit. Although a suitably located circuit breaker can be used as a service switch, a separate service switch is advisable. The service switch is necessary if reaching the circuit breaker involves becoming close to the furnace, or if the furnace is located between the circuit breaker and the means of entry to the furnace room. The furnace switch (service switch) should be clearly marked, installed in an easily accessible area between the furnace and furnace room entry, and be located in such a manner to reduce the likelihood that it would be mistaken as a light switch or similar device.

The power requirement for the O5LD-091A-12-R model is: 120 VAC, 1 Ø, 60 Hz., 12A.

Accessories requiring 120 VAC power sources such as electronic air cleaners and humidifier transformers may be powered from the electronic fan timer board where provisions have been made for connections, but should have their own controls. Do not use the direct drive motor connections as a power source, since there is a high risk of damaging the accessories by exposure to high voltage from the auto-generating windings of the direct drive motor.

Thermostat wiring connections and air conditioning contactor low voltage connections are shown in the wiring diagrams in Appendix B. Some micro-electronic thermostats require additional controls and wiring. Refer to the thermostat manufacturer's instructions.

The thermostat should be located approximately 5 feet above the floor, on an inside wall where there is good natural air circulation, and where the thermostat will be exposed to average room temperatures. Avoid locations where the thermostat will be exposed to cold drafts, heat from nearby lamps and appliances, exposure to sunlight, heat from inside wall stacks, etc.

The thermostat heat anticipator should be adjusted to the amperage draw of the heating control circuit as measured at the "R" and "W" terminals of the thermostat. To reduce the risk of damaging the heat anticipator, do not measure this current with the thermostat connected to the circuit. Measure the amperage by connecting an ammeter between the two wires that will connect to the thermostat "R" and "W" terminals.

10. HUMIDIFIER

A humidifier is an optional accessory available through most heating supplies outlets. Installation should be carried out in accordance with the humidifier manufacturer's installation instructions. Water or water droplets from the humidifier should not be allowed to come into contact with the furnace heat exchanger. Do not use direct drive motor connections as a source of power for 120 VAC humidifiers and humidifier transformers.

11. PIPING INSTALLATION

The entire fuel system should be installed in accordance with the requirement of CAN/CSA B-139, and local regulations. Use only an approved fuel oil tanks piping, fittings and oil filter.

In the United States the installation must be in accordance with NFPA No. 31 and local codes and authorities.

Install the oil filter as close to the burner as possible. For further details of the oil supply tank and piping requirements, please refer to the instructions and illustrations in the oil burner and oil pump instructions shipped with the furnace.

12. OIL FILTER

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

13. OIL BURNER NOZZLES

The O5LD-091A-12-R is certified for multiple firing rates, ranging from 70,000 to 105,000 Btu/h. By manipulating the oil burner nozzle, flame retention head, static plate and temperature rise; the furnace may be fired at an ideal rate for a wide range of structures. Refer to Table A-1, and the furnace rating plate to determine the proper combinations.

14. OIL BURNER ADJUSTMENT

The burner air supply is adjusted to maintain the *fuel to air ratio* to obtain ideal combustion conditions. A lack of air causes "soft" and "sooty" flames, resulting in soot build-up throughout the heat exchanger passages. Excess combustion air causes a bright roaring fire and high stack temperatures resulting in poor fuel efficiency. The O5LD-091A-12-R furnace operates most efficiently with a No. 1 smoke spot on the Bacharach Scale. This is not necessarily the optimum setting; however, because dust will inevitably build up on the air moving components of the oil burner assembly. This will result in decreased air supply with the potential result of soot building up in the flue gas passageways of the heat exchanger. Soot behaves as an insulator and impairs good heat transfer. Stack temperature will increase, and the overall efficiency will decrease. As a means of avoiding this problem, it is advisable to adjust the air supply to provide no more than a trace smoke spot on the Bacharach Scale.

CAUTION

BEFORE OPERATING THE FURNACE CHECK BURNER ALIGNMENT WITH COMBUSTION CHAMBER. THE END CONE OF THE AIR TUBE MUST BE CENTRED TO THE ACCOMODATING RING PROVIDED IN THE DESIGN OF THE COMBUSTION CHAMBER. ADJUST AS NECESSARY.

15. BURNER ELECTRODES

Correct positioning of the electrode tips with respect to each other, to the fuel oil nozzle, and to the rest of the burners is essential for smooth light ups and proper operation. Refer to the oil burner instructions shipped with the furnace for electrode specifications.

NOTE: Beckett AF Series Burner electrode specifications have been revised. They should be adjusted to be 5/16" above the nozzle centerline.

16. Burner Primary (Safety) Control

The furnace is equipped with a primary combustion control, sometimes referred to as the burner relay or burner protector relay, which uses a light sensing device (cad cell) located in the burner housing, to monitor and control combustion. Over time, dust or combustion residuals can build up on the lens of the cad cell impairing its response to the flame. The cad cell should be checked for cleanliness and proper alignment if the primary control frequently shuts down combustion.

⚠ CAUTION

ALL FURNACE CONTROLS ARE SENSITIVE AND SHOULD NOT BE SUBJECTED TO TAMPERING. IF PROBLEMS PERSIST, CALL YOUR SERVICE CONTRACTOR.

17. COMBUSTION CHAMBER

This furnace is equipped with a high quality cerafelt combustion chamber. It is 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. The combustion chamber should be inspected for damage or carbon build up whenever the oil burner is removed for repairs or routine maintenance.

⚠ CAUTION

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

18. CIRCULATING AIR BLOWER

The O5LD-091A-12-R furnace model is equipped with PSC motor Direct Drive blower systems. Direct drive blower speed adjustments are not normally required in properly sized extended plenum duct systems. The motor RPM and air CFM delivery will vary automatically to accommodate conditions within the usual range of external static pressures typical of residential duct systems. Under-sized duct systems may require a higher blower speed to obtain a reasonable 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.

This system may require modification to provide some resistance to the airflow to prevent over-amping of the direct drive blower motor. Selecting a lower blower speed may correct this problem. Direct drive blower speeds are adjusted by changing the "hot" wires to the motor winding connections. Please refer to wiring diagrams in Appendix B or the wiring diagram label affixed to the furnace. **THE NEUTRAL WIRE (normally the white wire) IS NEVER MOVED TO ADJUST THE BLOWER SPEED.**

It is possible and acceptable to use a single blower speed for both heating and cooling modes. The simplest method to connect the wiring from both modes is to use a "piggy-back connector" accommodating both wires on a single motor tap. It is also acceptable to connect the selected motor speed with a pigtail joined to both heating and cooling speed wires with a wire nut. As a safety precaution against accidental disconnection of the wires by vibration, it is advisable to secure the wire nut and wires with a few wraps of electricians tape.

⚠ CAUTION

DO NOT CONNECT POWER LEADS BETWEEN MOTOR SPEEDS. THE NEUTRAL WIRE MUST ALWAYS BE CONNECTED TO THE MOTOR'S DESIGNATED NEUTRAL TERMINAL.

If the joining of the blower speed wiring is done in the furnace junction box, tape off both ends of the unused wire.

Do not use the blower speed wires as a source of power to accessories as electronic air cleaners and humidifier transformers. The unused motor taps auto-generate sufficiently high voltages to damage accessory equipment.

⚠ WARNING

DISCONNECT THE POWER SUPPLY TO THE FURNACE BEFORE OPENING THE BLOWER ACCESS DOOR TO SERVICE THE AIR FILTER, FAN AND MOTOR. FAILURE TO SHUT OFF POWER COULD ALLOW THE BLOWER TO START UNEXPECTEDLY, CREATING A RISK OF DEATH OR PERSONAL INJURY.

19. MAINTENANCE AND SERVICE

A: Routine Maintenance By Home Owner

Other than remembering to arrange for the annual professional servicing of the furnace by the service or installation contractor, the most important routine service performed by the homeowner is to maintain the air filter or filters. A dirty filter can cause the furnace to over-heat, fail to maintain indoor temperature during cold weather, increase fuel consumption and cause component failure.

The furnace filter(s) should be inspected, cleaned or replaced monthly. The furnace is factory equipped with a semi-permanent type filter. If the filter is damaged, replace with filters of the same size and type. (See Appendix A, Table A-8).

During the routine service, inspect the general condition of the furnace watching for signs of oil leaks in the vicinity of the oil burner, soot forming on any external part of the furnace, soot forming around the joints in the vent pipe, etc. If any of these conditions are present, please advise your service or installation contractor.

Annual Service By Contractor

CAUTION

THE COMBUSTION CHAMBER (FIREPOT) IS FRAGILE. USE CARE WHEN INSPECTING AND CLEANING THIS AREA.

The heat exchanger should be inspected periodically and cleaned if necessary. If cleaning is necessary, **SHUT OFF POWER TO THE FURNACE** and remove the burner. Using a stiff brush with a wire handle, brush off scale and soot from inside the drum and flue pipe. To clean the radiator, remove the clean-out caps screws, and remove the caps carefully to avoid tearing the gaskets. A wire brush can be used to loosen dirt and debris on the inside surfaces of the radiator. Clean out all accumulated dirt, soot and debris with a wire handled brush and an industrial vacuum cleaner. Before replacing the clean-out caps, inspect the gaskets. If the gaskets are broken, remove the remnants and replace with new gaskets.

The blower motor is factory oiled and permanently sealed. **DO NOT LUBRICATE.** Excess oil causes premature electric failure.

Inspect the blower fan. Clean if necessary.

Oil Burner Maintenance: Follow the instructions of the oil burner manufacturer. (See oil burner manufacturer's instructions supplied with furnace or burner). It is advisable to change the oil burner nozzle and oil filter on an annual basis.

The venting system should be cleaned and inspected for signs of deterioration. Replace pitted or perforated vent pipe and fittings. The barometric damper should open and close freely.

All electrical connections should be checked to ensure tight connections. Safety controls such as the high limit controls should be tested for functionality. The fan control should be checked to ensure that the fan on and off delay function continues to start and stop the blower fan at the optimal settings.

20. OPERATING INSTRUCTIONS

Before Lighting

Open all supply and return air registers and grilles.

Open all valves in oil pipes.

Turn on electric power supply.

To Light Unit

Set the thermostat above room temperature to call for heat. The burner should start. NOTE: It may be necessary to press the RESET button on the primary combustion control relay.

There will be a fan on time delay before the circulating fan is energized. The **United Technologies 1158-120** has an adjustable fan on time that is set by selecting the dipswitch combination displayed in Chart 1. This fan on delay can be set at 30, 60, 90 or 120.

Set the thermostat below room temperature. The oil burner should stop.

The air circulation blower will continue to run until the time off setting selected on the electronic fan timer control times out. The **United Technologies 1158-120** have an adjustable fan off time of 2, 3, 4, & 6 minutes. The fan timer control adjustments may be altered if the air at the room registers is uncomfortably high upon blower start up or shutdown.

The necessary adjustments to the fan control settings should be determined by measuring the temperature of the air in the supply air take-off, or within the first few inches of the supply air trunk. The side mid point of the transition is usually ideal, providing that the thermometer probe is beyond the "line of sight" wherein false readings from radiant heat could be observed. The system temperature rise is *the difference in temperature between the supply air and return air*.

To check the operation of the limit switch, shut off power to the furnace. Temporarily remove the neutral wire from the direct drive blower motor. Restore the electrical power to the furnace and set the thermostat above room temperature.

After three or four minutes of burner operation, the limit control should turn the burner off. When the limit function test is complete, shut off electrical power to the furnace, replace the neutral wire to the blower fan motor, and then restore power. The blower fan will start up immediately. Once the temperature has dropped and the limit control has reset, the fan will operate until the fan off time is achieved. The oil burner will then resume operation and continue until the thermostat is satisfied. Restore the thermostat setting to a comfortable temperature.

To Shut Down Unit

Set the thermostat to the lowest possible setting.

Set the manual switch (if installed) in the Electrical Power Supply Line to "OFF".

NOTE: IF THE FURNACE IS TO BE SHUT DOWN FOR AN EXTENDED PERIOD OF TIME, CLOSE THE OIL SUPPLY VALVE TO THE BURNER.

CAUTION

DO NOT ATTEMPT TO START THE BURNER WHEN EXCESS OIL HAS ACCUMULATED, WHEN THE FURNACE IS FULL OF VAPOUR, OR WHEN THE COMBUSTION CHAMBER IS VERY HOT. NEVER BURN GARBAGE OR PAPER IN THE FURNACE, AND NEVER LEAVE PAPER OR RAGS AROUND THE UNIT.

APPENDIX A – O5LD-091A-12-R

O5LD-091A-12-R furnace may be used with the following oil burners.

Please note: The Beckett AF oil burner is for applications using indoor air for combustion only.

Table A-1 Beckett AF Oil Burner Set-Up

Beckett AF Series Oil Burners (For use with chimney vented units only)							
Furnace Model	Output BTU/Hr	Burner Model	Nozzle	Pump Pressure	Flow Rate	Head ¹	Static Plate
O5LD-070A-12-R ²	59,000	AF76BNHS	0.50 / 80°A	100 psig	0.50 usgph	F3	3- 3/8 in.
O5LD-091A-12-R	76,000	AF76BNHS	0.65 / 80°A	100 psig	0.65 usgph	F3	3- 3/8 in.
O5LD-105A-12-R	85,000	AF76BNHS	0.75 / 80°A	100 psig	0.75 usgph	F3	3- 3/8 in.

¹ Head is shielded by ceramic insulator. ² Low Firing Rate Baffle required when using a 0.50-gallon nozzle. Bold models indicate the factory equipped firing rate.

A.1 OIL BURNER AIR ADJUSTMENT

For complete details, consult the oil burner instruction manual provided in the furnace documents envelope.

Beckett AF Burner

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

A.2 BURNER ELECTRODES

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

Beckett AF Burner

Electrode gap: 5/32 inch.

Distance above horizontal centerline: 5/16 inch. Older instruction sheets specify 7/16 inch. The current specification is 5/16 inch.

Distance ahead of nozzle: 1/16 inch.

“Z” dimension, the distance from the front of the end cone (head) to the face of the nozzle should be 1-1/8 inches. If a ceramic head is used, the distance from the end cone to the nozzle face is increased to 1-3/8 inches.

A.3 START UP

The furnace should be operated for a minimum of 10 minutes to reach steady state conditions before fine tuning combustion. The warm up time is ideal for testing the oil pump pressure.

Drill a 1/4-inch test port in the venting between the furnace flue outlet and draft regulator (barometric damper). Insert a stack thermometer and note the flue gas temperature. The flue gases should be within a range of 350°F to 450°F. If the flue gases are below the range, it may be necessary to slow down the blower fan. If the flue gases are above the range, the blower fan may require speeding up. Stack temperature varies directly with the system temperature rise. System temperature rise is the difference between the furnace outlet temperature and furnace inlet temperature as measured in the vicinity of the connection between the plenum take-offs and the trunk ducts. Temperature rise value is listed on the system rating plate.

Perform a smoke spot test. The smoke spot should not exceed No. 1 on the Bacharach Scale.

After the air adjustments have been completed, re-check the draft pressure at the test port on the burner mounting plate as shown in Figure 2. The draft should be adjusted to -0.02 inches w.c.

In the United States, the Beckett AF Burner may be equipped with Beckett's "*Inlet Air Shut-Off*" to increase efficiency. (Beckett Part No. AF/A 5861).

NOTE: USE OF THE INLET AIR SHUT-OFF COULD CAUSE POST COMBUSTION NOZZLE DRIP.

Table A-5 Direct Drive Blower Set-Up

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			
O5LD-070A-12-R	10-10T DD	Low	1/2 HP	Med-Low	1/2 HP	3	1/2 HP	700 – 1600
O5LD-091A-12-R	10-10T DD	Med-Low	1/2 HP	Med-Low	1/2 HP	3	1/2 HP	700 – 1600
O5LD-105A-12-R	10-10T DD	Med-Low	1/2 HP	Med-High	1/2 HP	3	1/2 HP	700 – 1600

Table A-6 Direct Drive Blower Characteristics

Furnace Model	Blower	Motor HP	Motor FLA	ΔT	Speed	CFM				
						External Static Pressure – Inches w.c.				
						0.2	0.3	0.4	0.5	0.6
O5LD-A-12-R 070 - 105	10-10T DD	1/2 HP	7.1	70°F	High	1722	1645	1516	1462	1375
					Med-High	1604	1545	1473	1383	1302
					Med-Low	1147	1133	1106	1063	1013
					Low	747	738	720	702	669

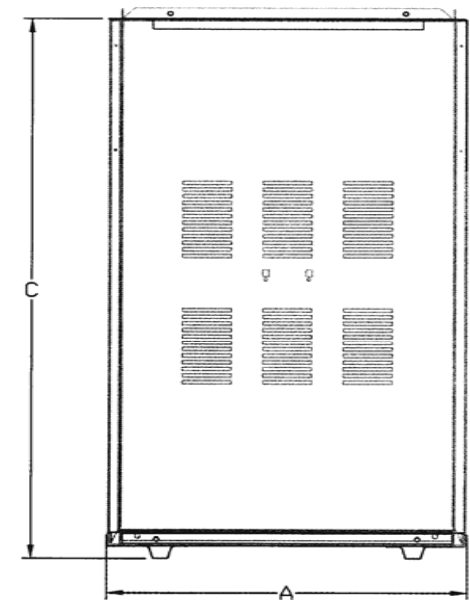
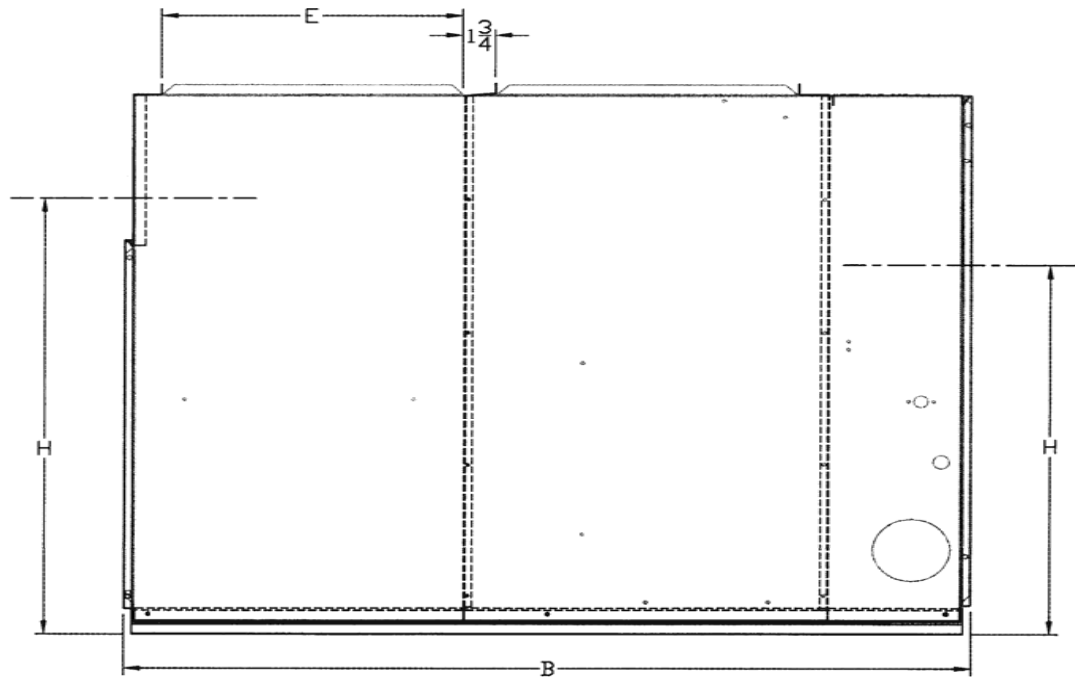
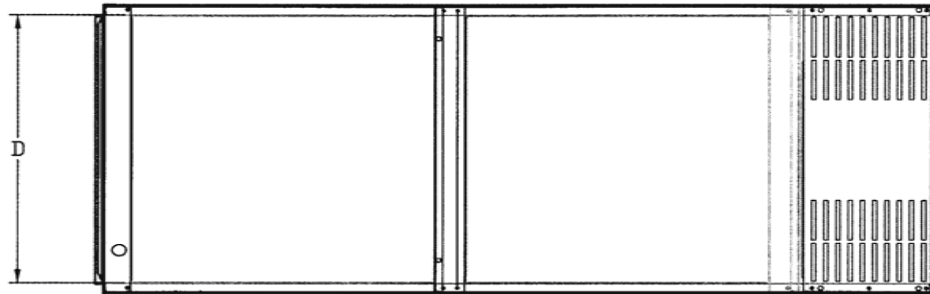
TIP: These Formulae will assist with the design of the ductwork and the determination of airflow delivery:

$$\text{CFM} = \text{Bonnet Output} / (1.085 \times \text{System Temperature Rise } (\Delta T))$$

$$\text{System Temperature Rise } (\Delta T) = \text{Bonnet Output} / (1.085 \times \text{CFM})$$

Table A-9: General Dimensions (Inches)

CABINET			PLENUM OPENINGS		FLUE		FILTER (PERM)	SHIP WEIGHT (LBS.)
WIDTH A	LENGTH B	HEIGHT C	SUPPLY D X E	RETURN F X G	DIAM.	HEIGHT H		
O5LD-091A-12-R								
22	51½	32	20½ x 19	20½ x 18½	5	26.25	20 x 20 x 1	240



Chimney Vent Burner Wiring Diagram

O5LD-091A-12-R



OPERATION OF OIL BURNER

Once the furnace flue pipe, electrical and oil line connections have been made, use the following instructions to set the burner:

Shut off the electrical power to the furnace.

Install an oil pressure gauge to the pressure port on the oil pump. (Refer to the oil pump specification sheet included with the burner instructions).

Restore electrical power to the furnace.

Start the furnace and bleed all air from the fuel oil lines.

Close the purge valve and fire the unit.

Allow the furnace to warm up to normal operating temperatures. During this time, set the pump pressure in accordance with the data provided in Appendix A, Table A-2, and A-5.

When the furnace has reached "*steady state*" (after approximately 10 minutes). Set combustion air damper to get a TRACE of smoke.

Check the system temperature rise. *The temperature rise is the difference between the return air temperature measured at a point near the return air inlet, and the supply air temperature measured near the furnace outlet.* The system temperature rise is listed on the furnace rating plate. If the temperature rise is too high, the airflow must be increased. If the temperature rise is too low, the fan should be slowed down.

Turn off the burner. Observing the duct thermometer in the supply air stream, note the temperature at which the blower fan stops. The fan adjustments can be made by moving the dipswitch settings on the timer control board for fan off delay.

To check the operation of the limit switch, shut off power to the furnace. Temporarily remove the neutral wire from the direct drive blower motor. Restore the electrical power to the furnace and set the thermostat above room temperature. After three or four minutes of burner operation, the limit control should turn the burner off. When the limit function test is complete, shut off electrical power to the furnace, replace the neutral wire to the blower fan motor, and then restore power. The blower fan will start up immediately. Once the temperature has dropped and the limit control has reset, the fan will operate until the fan off time is achieved. The oil burner will then resume operation and continue until the thermostat is satisfied. Restore the thermostat setting to a comfortable temperature.

Set the heat anticipator adjustment in the thermostat (if so equipped), by removing the "R" or "W" wire to the thermostat, then reading the amperage draw between the two wires. Failure to remove one of the wires from the thermostat while performing this test could burn out the heat anticipator. Set the heat anticipator to the amperage measured.

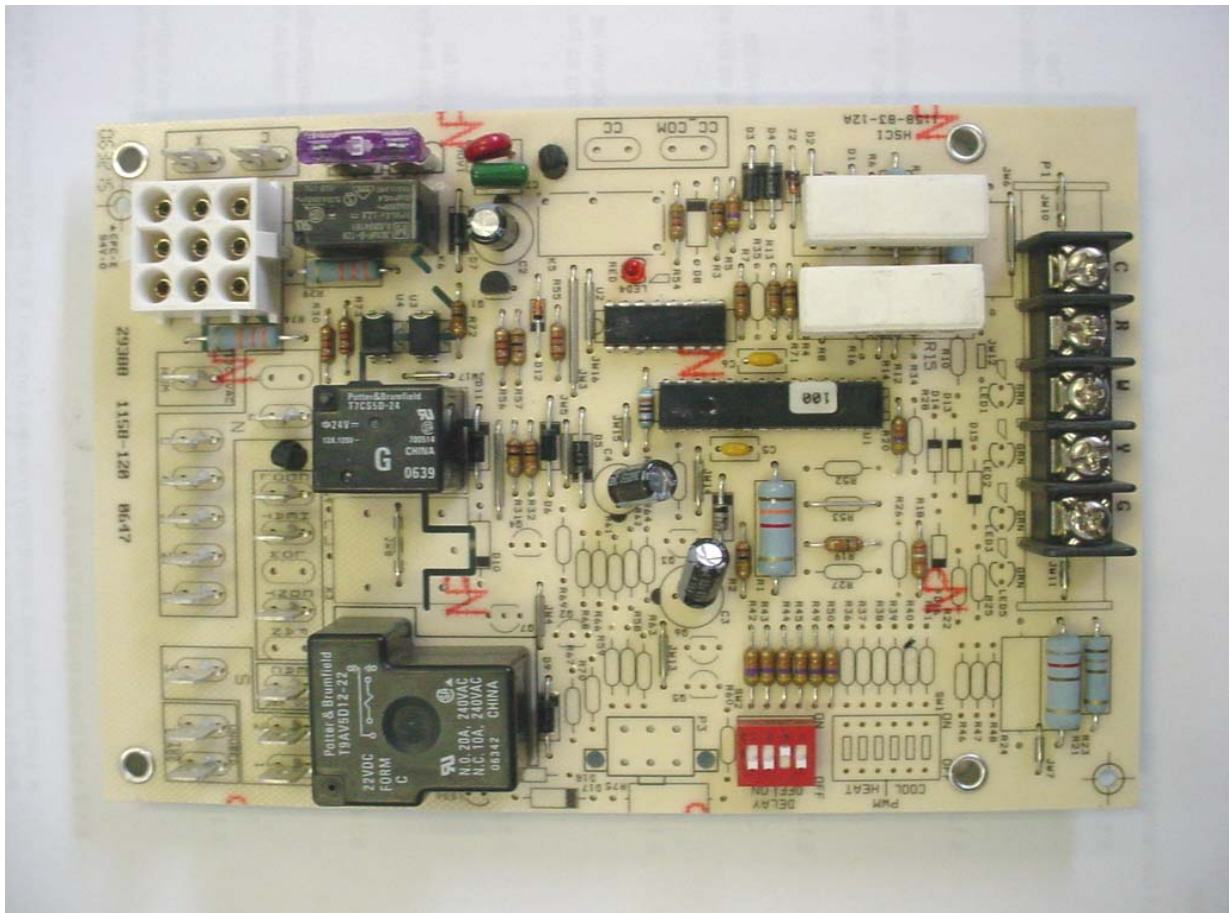
NOTE: THE FURNACE SHOULD BE RUN THROUGH AT LEAST THREE FULL CYCLES BEFORE LEAVING THE INSTALLATION, TO ENSURE THAT ALL CONTROLS ARE OPERATING PROPERLY AND AS EXPECTED.

NOTE: ALL JOINTS IN ANY POSITIVE PRESSURE VENTING SYSTEM MUST BE CHECKED FOR LEAKS BEFORE LEAVING THE INSTALLATION SITE

Table C-1: 1158-120 ELECTRONIC FAN TIMER (EFT) DETAILED SEQUENCE OF OPERATION

Mode	Action	System Response
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, (30 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.

FIGURE 2: UNITED TECHNOLOGIES 1158-120 FAN TIMER BOARD (O5LD-019A-12-R)



Troubleshooting

IMPORTANT: Due to the potential hazard of line voltage, only a trained, experienced service technician should perform the troubleshooting procedure.

PRELIMINARY STEPS:

Check the diagnostic light for indications of burner condition. Refer to the oil primary control LED DIAGNOSTIC LIGHT section for details.

CAUTION

WHEN SIMULATING A CALL FOR HEAT AT THE OIL PRIMARY CONTROL, DISCONNECT AT LEAST ONE THERMOSTAT LEAD WIRE FROM THE T1 - T2 TERMINALS TO PREVENT DAMAGE TO THE THERMOSTAT. NEGLECTING THIS PROCEDURE MAY BURN OUT THE HEAT ANTICIPATOR OF A STANDARD 24 VAC THERMOSTAT, OR CAUSE HARM TO COMPONENTS WITHIN A MICRO-ELECTRONIC THERMOSTAT.

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

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

Check Oil Primary Control and Igniter

If the trouble does not appear to be in the burner or ignition hardware, check the oil primary control and the igniter by using the following equipment:

Screwdriver, Voltmeter (0 - 150 VAC)

Insulated jumper wires with both ends stripped.

WARNING

ELECTRICAL SHOCK HAZARD.

TROUBLESHOOTING IS DONE WITH THE SYSTEM POWERED. BE CAREFUL TO OBSERVE ALL NECESSARY PRECAUTIONS TO PREVENT ELECTRICAL SHOCK OR EQUIPMENT DAMAGE.

Preliminary Checks:

Make sure that limit switches are closed and contacts are clean.

Check for line voltage power on the oil primary control black and white lead wires.

Refer to Table C-4 or C-5 for further troubleshooting information.

Table C4: System and General Troubleshooting

Problem	Possible Cause	Remedy
Furnace will not start.	Thermostat not calling for heat.	Check thermostat and adjust. Also, check thermostat for accuracy; if it is a mercury switch type, it might be off level.
	No power to furnace.	Check furnace switch, main electrical panel furnace fuse or circuit breaker. Also look for any other hand operated switch, such as an 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 T1 - T2. Check for 24V across T -T. If no voltage is present, check for 115V to oil primary control. If 115V is present, go to Table C-3.
Furnace will not start.	Photo Cell wiring shorted or room light leaking into photo cell compartment	Check photo cell (cad cell) wiring for short circuits. Also, check for room light leaking into cad cell compartment. Repair light leak if necessary. See Table C-3.
	Open safety switch.	Check for open limit or auxiliary limit. Also, 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 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. Ensure that 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.
Furnace starts, but cuts out requiring manually resetting the 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: The photocell should have a resistance of 100K Ω in absence of light; a maximum of 1500 Ω in the presence of light. Ensure that room light is not leaking into the cad cell compartment. (See diagnostic light section).
Furnace starts, but cuts out requiring manually resetting the 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. Ensure that 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).
Problem	Possible Cause	Remedy

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 transformer high voltage connections or defective transformer.	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 / 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 ideally should not exceed 85°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 a duct thermometer in the supply air plenum take-off or first few inches of the supply air trunk duct. Ideally, the fan will shut off at a temperature of 90° - 100°F. Manipulate the 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 350° to 450°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 the thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to more suitable location.
Too much smoke.	Insufficient combustion air adjustment at oil burner, or improper draft pressure.	Adjust the oil burner combustion air band and draft regulator to gain the highest practical CO ₂ or lowest practical O ₂ content in the flue gases. See Burner Set Up.
	Heat exchanger partially clogged.	Check for soot build-up in heat exchanger flue passages, especially in the 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 the inside surface of the 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 the 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 the thermostat is being influenced by drafts, sunlight, duct work, etc., relocate to more 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 a duct thermometer to assess accuracy of limit control. Check for obstructions to airflow around limit switch bi-metal 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.

Table C-4: System and General Troubleshooting *continued*

Problem	Possible Cause	Remedy
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 differential between fan control "fan off" and "fan on" settings. (L4064B, L6064A fan / limit controls only, no adjustments available for L4064W fan / limit control). Register air deflectors may help.
	Excessive duct losses.	Check supply air ductwork. Seal leaky joints and seams. Insulate ductwork if necessary.

FINAL CHECK OUT

ENSURE THAT ALL SAFETY DEVICES AND ELECTRICAL COMPONENTS HAVE BEEN SET FOR NORMAL OPERATION. ENSURE THAT ALL ELECTRICAL CONNECTIONS ARE TIGHT AND THAT THE WIRING IS SECURE.



IMPORTANT:

Please ensure that the homeowner is informed and understands:

1. Where the circuit breaker or fuse is located in the main electrical panel.
2. Where the furnace switch is located, and the switch "on" and "off" positions if not obvious.

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

4. How to operate the thermostat, and other related accessories.

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

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

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

8. Who to call for emergency service and routine annual service.

9. The terms and conditions of the manufacturer's warranty and the contractor's warranty.

HOMEOWNER'S REFERENCE TABLE

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

If different from Installation Contractor:

Service Tech.	
Telephone No.	
After Hours No.	

Fuel Supplier

Fuel Oil Supplier	
Contact	
Telephone No.	
After Hours No.	

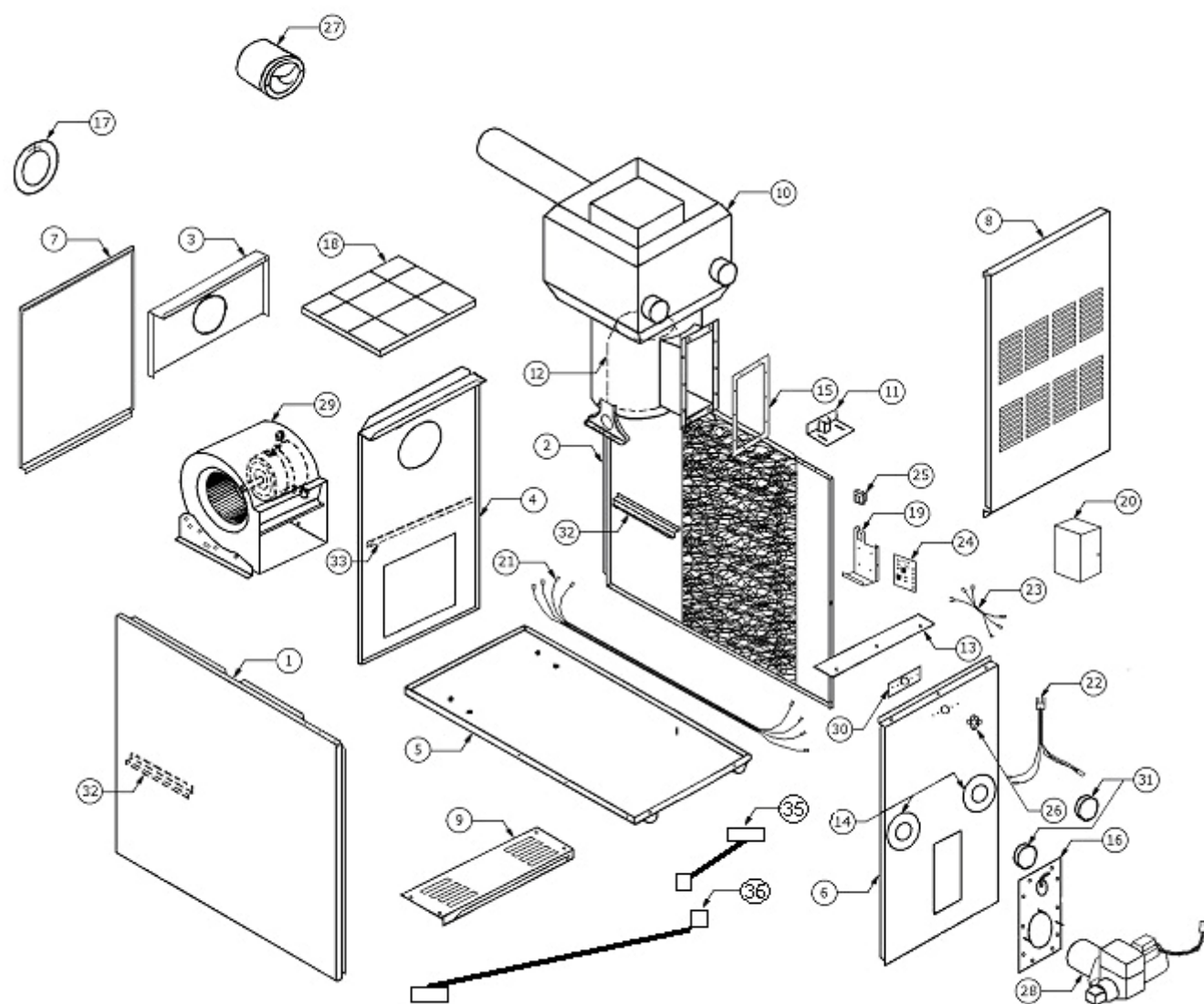
PARTS LISTING: LOWBOY MODEL: O5LD-091A-12-R

Ref. No.	Description	Part No.
1	Left Side Panel Assembly	29631AD
2	Right Side Panel Assembly	29630AD
3	Upper Rear Panel	29638AD
4	Blower Division Panel Assembly	29676
5	Base Panel Assembly	28459
6	Inner Front Panel	30154
7	Blower Access Door	27367AD
8	Front Door Panel	30157AD
	Logo Bezel	28479
	Logo Label	28563
9	Top Front Panel	26017AD
10	Heat Exchanger Assembly Kit	550001635
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	Oil Burner Mounting Plate Assembly	109007674
	Inspection Door Gasket	29871
16	Pouch Gasket	2080175
17	Flue Pipe Collar	27476
18	Air Filter – 20 x 20 x 1 (Permanent)	2180032
19	Control Panel	29653
20	Control Panel Cover	29654
21	Wire Harness Blower Motor Direct Drive	29690
22	Wire Harness Fan Timer Board	29364
23	Wire Harness Transformer and Supply	29751
24	Fan Timer Control 1158-120 UTEC	29388
25	Transformer, 4000-01V18BB2, 120/24V, 40 va	240005330
26	Limit Control 60T11 (L260°F) BOF (Black Oxide Finish)	30153
27	Draft Regulator	27494

PARTS LISTING: LOWBOY MODEL: O5LD-091A-12-R

Ref. No.	Description	Part No.
28	*Beckett AF Oil Burner Assembly, AF76BNHS	*30067
	Burner Motor 1/7 HP 3450 RPM PSC	29689
	Oil Pump, Clean-Cut A2EA6520	29688
	Solid State Igniter	29522
	*Flame Retention Head, F3	*11961
	*Air Tube Combination, AF76BN	*29892
	Low Fire Kit	29880
	Low Firing Rate Baffle	25521101
	Nozzle, 0.50/80° A	29389
29	Blower Assembly, Complete, Direct Drive, ½ hp, 4-Speed	29668
	Blower Housing and Wheel, 100-10T DD	30626
	Blower Motor, ½ hp, 4-Speed	102000131
	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
30	Insulation Retainer	20602
31	Clean-out Pipe Cover (2 per unit)	240007841
	Clean-out Cap Gasket (2 per unit)	240006333

Model 05LD-091A-12-R



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