Spirit Series by Thermo Products, LLC

OIL-FIRED CENTRAL FURNACE

Installation, Operation, and Service Manual
With Users Information Section
Models:
VC-CBP VLF-DBP VLR-DBP VLF-DCP VLR-DCP

⚠ **WARNING:** IF THE INFORMATION IN THESE INSTRUCTIONS IS NOT FOLLOWED EXACTLY, A FIRE OR EXPLOSION MAY RESULT CAUSING PROPERTY DAMAGE, PERSONAL INJURY, OR LOSS OF LIFE.
DO NOT STORE OR USE GASOLINE OR OTHER FLAMMABLE VAPORS AND LIQUIDS IN THE VICINITY OF THIS OR ANY OTHER APPLIANCE.
⚠ **WARNING:** IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE, OR MAINTENANCE CAN CAUSE INJURY OR PROPERTY DAMAGE. REFER TO THIS MANUAL. FOR ASSISTANCE OR ADDITIONAL INFORMATION CONSULT A QUALIFIED INSTALLER, OR SERVICE AGENCY.

⚠ **AVERTISSEMENT:** SI L'INFORMATION DANS CES INSTRUCTIONS N'EST PAS SUIVI À LA LETTRE, UN INCENDIE OU UNE EXPLOSION ENTRAÎNANT DES DOMMAGES MATÉRIELS, DES BLESSURES CORPORELLES OU DES PERTES DE VIE.
NE PAS ENTREPOSER NI UTILISER D'ESSENCE OU AUTRES VAPEURS ET LIQUIDES INFLAMMABLES À PROXIMITÉ DE CET APPAREIL OU DE TOUT AUTRE APPAREIL.
⚠ **AVERTISSEMENT:** UNE MAUVAISE INSTALLATION, D'AJUSTEMENT, DE LA MODIFICATION, D'ENTRETIEN OU DE MAINTENANCE PEUVENT CAUSER DES BLESSURES OU DOMMAGES MATÉRIELS, REPORTEZ-VOUS À CE MANUEL POUR OBTENIR DE L'AIDE OU DES RENSEIGNEMENTS SUPPLÉMENTAIRES, CONSULTER UN INSTALLATEUR QUALIFIÉ, OU ORGANISME DE SERVICE.

PLEASE READ THESE INSTRUCTIONS PRIOR TO INSTALLATION, INITIAL FIRING, AND BEFORE PERFORMING ANY SERVICE OR MAINTENANCE. THESE INSTRUCTIONS MUST BE LEFT WITH THE USER AND SHOULD BE RETAINED FOR FUTURE REFERENCE BY QUALIFIED SERVICE PERSONNEL.

VEUILLEZ LIRE CES INSTRUCTIONS AVANT L'INSTALLATION, LES PREMIERS TIRS, ET AVANT D'EFFECTUER TOUT ENTRETIEN OU MAINTENANCE. CES INSTRUCTIONS DOIVENT ÊTRE LAISSÉS AVEC L'UTILISATEUR ET DEVRAIT ÊTRE CONSERVÉ POUR RÉFÉRENCE FUTURE PAR UN TECHNICIEN QUALIFIÉ.

THERMO PRODUCTS, LLC.
PO BOX 237
DENTON, NC 27239
PHONE: 800-476-4328

AHRI CERTIFIED® www.ahridirectory.org

C ETL LISTED US
Intertek

MO-554
ECN 5635-MA 200715

Made in USA

Contents

Notice to the Installer

Installation of this oil-fired furnace **must** be performed by a qualified installer in accordance with all local codes and authorities having jurisdiction. In the absence of local governing codes, installation shall conform to these instructions and to the regulations of the National Fire Protection Association's Standard for the Installation of Oil-Burning Equipment, NFPA 31-2020, and the National Electrical Code, ANSI/NFPA 70-2017, or the latest editions thereof.

A qualified installer, also referred to in this instruction manual as a "qualified heating contractor", **is an individual, or agency, properly licensed and experienced to install and service oil-burning equipment in accordance with all local codes and ordinances.**

Material and Workmanship

This furnace was built with the highest quality materials and attention to workmanship. However, omissions and defects occasionally occur. Before installing the furnace, inspect the furnace thoroughly. If missing parts, defective material, or poor workmanship is evident, report the **model** and **serial numbers** imprinted on the furnace rating label to the seller for adjustment.

Packaging

A complete furnace is contained within a single package. The factory completed all feasible assembly. However certain components including draft regulator and, if supplied, door handle, air filter(s), and air filter rack(s), must be assembled to the furnace, or the venting system, in the field. Refer to the assembly instructions.

Shipping Damage

If this furnace was damaged during transit, please immediately request the transportation company inspect the furnace and issue a **concealed damage report**. The party receiving the furnace should file the claim for shipping damage. **Report any shipping damage immediately.**

It is absolutely essential that a damage report be obtained. If a concealed damage report is not obtained, we cannot provide assistance in recovering your claim against the transportation company.

Warranties

⚠ WARNING: The manufacturer of this equipment assumes no liability for any damages resulting from unauthorized modifications made to the furnace, or any components thereof, or improper installation of the furnace in the field. Furthermore, any such field modifications VOID THE WARRANTY and place responsibility for safe and reliable operation of the furnace on those who performed the modification(s).

Complete and return any enclosed warranty cards. These must be on file to verify installation dates for replacement of any warrantied part(s).

INSTALLATION GUIDELINES

Codes

All local codes and regulations take precedence over the instructions in this manual and shall be followed accordingly. In the absence of local codes, this installation must conform to these instructions and to the regulations of the National Fire Protection Association (NFPA) publications, the Standard for the Installation of Oil-Burning Equipment, NFPA 31-2020, and the National Electrical Code, ANSI/NFPA 70-2017 or the latest editions thereof,

Installation Location

⚠ WARNING:

- **These furnaces are designed for indoor installation ONLY.**
- **These furnaces are NOT to be used as construction heaters.**
- **DO NOT hang the horizontal / counterflow furnace from a structure, or surface, by any integral part or fastener of the furnace. The furnace was not designed to support itself in this manner.**

In as much as practical, the furnace should be positioned near a chimney or vent and should be centralized with respect to the air distribution system.

For a utility room installation, the entrance door must be wide enough to permit the largest part of the furnace to pass through the doorway or allow sufficient clearance to permit the replacement of another appliance, e.g. a water heater, in the room.

If the furnace is installed in a residential garage, it must be installed so the burner is located higher than 18 inches above the floor, unless the required combustion air is taken from the exterior of the garage. Also, the furnace must be located or protected to avoid physical damage from impacts by vehicles.

It is recommended that a commercially available CO alarm be installed in conjunction with any fossil fuel burning appliance. The CO alarm shall be installed according to the alarm manufacturer's installation instructions and be listed in accordance with the latest edition of the UL Standard for Single and Multiple Station Carbon Monoxide Alarms, UL 2034, or the CSA International Standard, Residential Carbon Monoxide Alarming Devises, CSA 6.19.

The furnace shall not be operated in a condition where the return air is consistently below 55°F.

Lowboy furnace models must rest on sturdy, stable, and level surfaces.

The horizontal / counterflow model may be mounted on a level surface, as described above, or it may be suspended from an overhead structure or surface. If this model is suspended from hanger rods, **support the furnace from the bottom casing surface at three (3) places**, across both ends of the casing and across the casing, near the middle of the furnace. Generally, a simple support frame for the furnace can be fabricated from

structural steel angle, threaded steel rod, and fastener hardware, refer to Figure 1. Adjust the height of the support angles to level the unit in position.

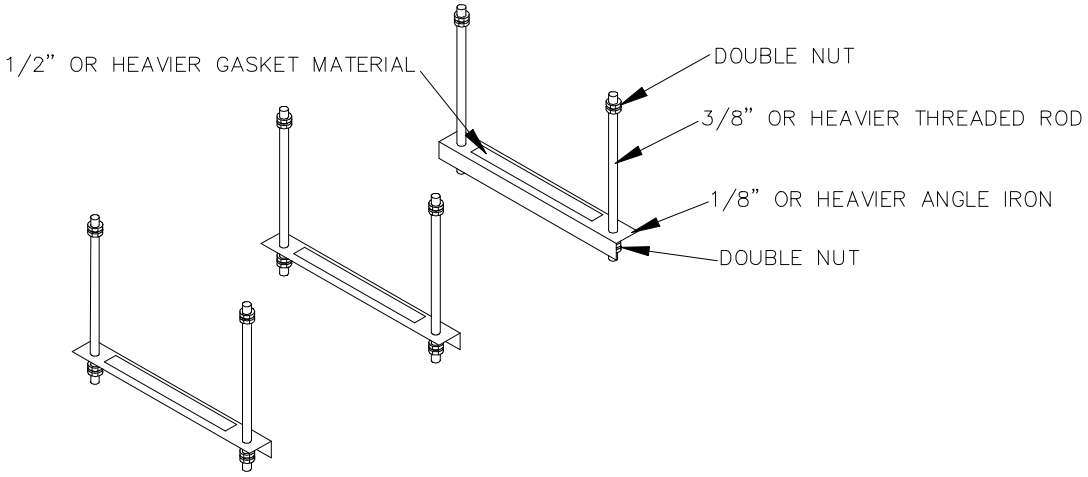


Figure 1: Recommended Support Frame for Horizontal / Counterflow Furnaces

Closet and Alcove Installation

All furnace models may be installed in a closet or alcove on combustible flooring with specified (standard) clearances to combustible construction. **The horizontal / counterflow furnace model requires an optional combustible surface-mounting base (model # VC-BASE) for vertical installation (i.e., counterflow configuration) directly on combustible materials, refer to Figure 2.**

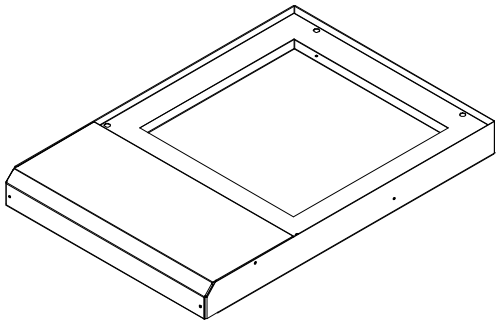


Figure 2: Counterflow Furnace Combustible Surface-Mounting Base

Standard Clearances

Standard clearances are mandatory minimum clearances from heated surfaces of the furnace to combustible materials to assure protection from fire hazard during furnace operation. (Refer to the Standard for the Installation of Oil-Burning Equipment, NFPA 31-2020, or latest edition, for definitions of combustible and non-combustible materials.

Accessibility clearances, which are typically greater, may exceed fire protection clearances. Therefore, consider providing at least 24 inches of clearance from the front and the rear, for lowboy furnaces) of the furnace to obstructions and surfaces for adequate service and maintenance access.

The minimum clearances from furnace casing surfaces to combustible materials are:

- 3 inches from casing sides and rear
- 8 inches from front casing of furnace
    - the lowboy rear flue model only requires 3 inches
    - the horizontal / counterflow furnace requires 22 inches
- 9 inches from flue pipe/vent connector
- 3 inches from casing top
- 3 inches from any side of supply air plenum
- 3 inches above supply air ducts, within 6 feet of furnace
- **For the horizontal / counterflow furnace only**, when the optional combustible floor base is used with the furnace in the counterflow configuration, adequate clearances from the supply end surface of the furnace casing to combustible surfaces are provided by the design of the mounting base.

Air for Combustion and Ventilation

⚠ CAUTION: Relief openings in the front or top of the furnace casing should not be obstructed or blocked. These openings supply combustion and ventilation air to the furnace.

Chloride, fluoride, iodide, and bromide bearing compounds when present, even in low concentrations, are in air supplied for combustion to the furnace, can result in accelerated and severe corrosion of the heat exchanger and/or the venting system.

Often, household chemicals contain chloride-bearing compounds. There are many compounds representative of this classification of chemicals. A few common examples are listed below.

- Cleaning solvents
- Varnish and paint removers
- Bleaches
- Fabric softeners
- Water softener salt
- Tile adhesives

Avoid storing or using these chemicals within close proximity to the furnace. In addition, avoid storing or using any chemicals, of an unknown and possibly flammable nature, in close proximity to the furnace.

The furnace shall be installed in a location within the building that permits a satisfactory supply of air for combustion, ventilation, and proper operation of the venting system. While all forms of building construction cannot be covered in detail in this manual, this requirement may usually be met by application of one of the following methods in

ordinary building construction. However, applicable local installation codes **always** take precedence and shall be followed.

The content of certain pertinent passages of NFPA 31-2001 on methods to obtain and ensure adequate airflow to the furnace has been excerpted and, in some cases, paraphrased below for reference purposes. Consult the Standard for the Installation of Oil-Burning Equipment, NFPA 31-2020, or latest addition for special cases and further details.

1. Utility Room (example of a confined space)

    a. In buildings of conventional construction with normal air infiltration, two (2) permanent openings connecting to a well-ventilated crawl space, attic, or another large, well-ventilated internal area shall be provided. Each opening shall have a minimum free area of one (1) square inch per 1000 BTUH of total input rate (sum of the individual appliance input rates) of all appliances to be installed in the utility room. One opening should be located near, or in, the ceiling of the room and the other should be located near, or in, the floor.
    b. In buildings of unusually tight construction (those having 0.35 air changes per hour, or less); provision must be made to provide sufficient air for combustion. The following method will usually be adequate to ensure sufficient airflow into the space.

    Provide two (2) permanent openings, one (1) located within 12 inches of the floor and one (1) within 12 inches of the ceiling, or roof, of the room. These openings shall allow for direct exchange of air between the room and outdoors. If required, ducting between the room and the outdoors shall be provided.

        - For horizontally -oriented ducts, each opening shall have a minimum free area of one (1) square inch per 2000 BTUH of the total input rate (sum of the individual appliance input rates) of all appliances to be installed in the room.
        - For vertically -oriented ducts, the minimum free area may be reduced to one (1) square inch per 4000 BTUH of the total input rate (sum of the individual appliance input rates) of all appliances to be installed in the room.
        - The minimum dimension of any air opening shall not be less than 3-inches.
        - When an opening in the outside wall must be provided, it should be furnished with properly screened metal sleeves.

2. Full Basement (example of an unconfined space)

    a. Where a furnace is installed in a full basement, in a building of conventional construction with normal air infiltration, infiltration is normally adequate to provide air for combustion and ventilation.

b. In buildings of unusually tight construction (such as those where weather stripping and storm sash windows are used, and where basement windows are also weather-stripped), one (1) permanent opening connecting to a well-ventilated attic, or with the outdoors shall be provided, using a duct, if necessary. This opening shall have a minimum free area of one (1) square inch per 5000 BTUH of total input rate (sum of the individual appliance input rates) of all appliances to be installed in the basement.

When an opening in the outside wall must be provided, it should be furnished with properly screened metal sleeves.

If an exhaust fan or additional air consuming machines (e.g. a cloth dryer), is present in the furnace room, there should be increased concern about providing adequate airflow to the furnace. Additional efforts may be required to assure an adequate supply of combustion and ventilation air is available to the furnace under all conditions.

Chimney Inspection

The chimney, vent, or any passageway for the stack gases to flow to the outdoor atmosphere is a very important part of the heating system. No furnace, regardless of the efficiency of the design, can perform satisfactorily when the chimney to which it is connected is inadequate or in poor condition. Any of the following symptoms may indicate a chimney has severe structural damage and is unsuitable for use.

- Chimney appears to be leaning to the side.
- Chimney appears to have structural damage, i.e. loose or missing blocks or bricks, or excessive deterioration at mortar joints.
- Tile liner damaged or missing.
- Flue gas leakage along the length of the chimney between the chimney connector and discharge termination.
- Excessive corrosion at the cleanout port or at the chimney connector entrance into the chimney.
- Structural debris, i.e. mortar or tile liner flakes, in base of the flue way.

A qualified person shall inspect the chimney to confirm it is correctly sized for the application, properly constructed, and in sound condition. Refer to the Standard for the Installation of Oil-Burning Equipment, NFPA 31-2001, for details on proper chimney sizing and construction. If needed, the chimney should be cleaned before installing the furnace. Any accumulation of dirt or debris at the bottom of the flue should be removed.

Flue / Chimney / Vent Connector

⚠ CAUTION:

- **DO NOT install a manual damper in the chimney or vent connector.**
- **Thermally- activated type vent dampers are NOT recommended for use on these furnaces.**

It is desirable to install the shortest vent connector (also referred to as a flue or chimney connector) possible with the fewest number of fittings, i.e. transitions and elbows.

Generally, 6-inch diameter, 24 Ga. or heavier, single wall, lock seam-type, galvanized steel vent pipe and fittings are satisfactory materials for the fabrication of a vent connector. However, always consult local codes and authorities for specific minimum requirements.

For some installations, it may be prudent to turn the furnace flue elbow 90 degrees clockwise, with respect to the front of the furnace, such that the elbow is open to the right-hand side of the unit, rather than upward. Due to the presence of the limit control and the wiring harness, **the elbow may not be rotated 90 degrees counterclockwise.** The installer must carefully mark and cut a hole in the furnace housing to allow the vent connector to pass through the housing.

If desired, with the furnace flue elbow turned to the right, the standard furnace top front panel (p/n 617346-2) may be replaced with the top front panel from the rear flue lowboy model (p/n 617383-2). Refer to Appendix D: Replacement Parts for sketches of these parts. Contact your distributor to purchase this part.

All horizontal sections of the vent connector must slope upward not less than ¼ inch per foot from the furnace to the vent termination. Long horizontal sections of the venting system must be supported at least every five (5) feet with metal straps to prevent sagging of the vent piping. Secure all joints in the vent connector with sheet metal screws or equivalent fasteners. Vent piping must **not** be inserted beyond the inside wall of the chimney flue.

Power (Side-Wall) Venting – Important Note Regarding

⚠ CAUTION: Thermo Products, LLC will NOT assume responsibility for damage to, and deterioration of, exterior building materials, e.g. brick, siding, clapboards, and etc., in close proximity to the vent terminal due to operation of a power vented, oil furnace. This policy is applicable regardless of the cause of sooting.

NOTICE: Thermo Products recommends the use of a chimney to vent residential oil furnaces. If a power venter must be used, it is the responsibility of the installer and power venter manufacturer to design, assemble, and demonstrate proper operation of the power venting system with the furnace.

Draft Regulator

A barometric-type, draft regulator is supplied with the furnace. Installation or operating conditions that produce excess amounts of draft can reduce the heating efficiency of the furnace. The purpose of the regulator is to adjust and control the flow of flue gases from the furnace by stabilizing the amount of chimney draft to which the furnace is subjected.

Always refer to the draft regulator manufacturer's installation instructions for application specific recommendations.

Duct Work and Air Conditioning

Design and installation of the duct system should follow the current guidelines of the Air Conditioning Contractors of America (ACCA) or the American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE). Refer to the Residential Duct Systems, Manual D, from the ACCA, and the ASHRAE Handbook Fundamentals volume, from ASHRAE, for recommended practices in duct system design and installation.

All furnaces are tested over a range of external static pressure that simulates the airflow resistance of the ductwork, fittings, and diffusers connected to the furnace for a typical (average) duct system. The furnace blower and blower motor have been selected to work successfully against the following range of duct system resistance.

Recommended range of the duct system external static pressure for all models: 0.2 to 0.5 in. W.G...

Due to the need to maintain an adequate supply of combustion and ventilation air, the furnace shall not be installed in small room without return air duct system. A return air duct shall be connected to the furnace return air opening and extend to a location outside the furnace room.

If the furnace is used in connection with a cooling coil, the coil must be installed in parallel with, or on the supply side of the furnace to avoid water vapor condensation in the furnace heat exchanger. If the cooling unit is installed in a parallel flow arrangement, dampers (or other means used to control airflow) should be provided to prevent chilled air from entering the furnace. If such a damper is manually operated, it must be equipped with a means to prevent operation of either unit, unless the damper is placed in either the full heat or full cool position.

NOTICE: Return air grilles and supply registers in the air distribution system should never be obstructed.

Air Filter Mounting

Lowboy furnaces are factory-equipped with permanent-type, air filters located above the blower compartment, in the rear of the furnaces.

NOTICE: Horizontal / counterflow furnaces are not factory-equipped with an air filter or filter rack. Furthermore, the furnace blower compartment does not contain enough free space to permit an air filter to be mounted within the furnace casing. However, the installer should supply, or fabricate a filter rack and mount an air filter in the return air plenum above, or upstream of, the furnace blower compartment.

Electrical Connections

NOTICE: All field wiring must conform to local, state, and national installation codes.

A disconnecting switch equipped with overcurrent protection rated at 15 A. (e.g. a time delay-type fuse or inverse time, circuit breaker) should be installed in the service line.

Since the furnace is entirely pre-wired at the factory, it is only necessary to connect the building electrical service lines to the two (2) pigtail wires extending from the junction box. The junction box is mounted inside the furnace burner compartment or mounted on the front exterior of the furnace, in the case of the horizontal / counterflow model. A ground connection must also be made in the junction box. The service lines to the furnace should be no smaller than 14 Ga., insulated copper wire with a temperature rating of 60ºC, or greater.

Refer to the electrical diagrams contained in Appendix B of this manual for an electrical schematic, a connection diagram, and operating instructions.

Room Thermostat

A room thermostat must be connected to the Oil Furnace control. This is typically a low voltage (24 VAC) circuit. Consult the National Electrical Code, ANSI/NFPA 70-2017, or latest edition for guidelines for proper wiring methods and materials for this circuit. The room thermostat should be located on an interior wall in the natural circulating path of the room air.

The thermostat should **not** be installed in a location where it is directly exposed to,

- cold air infiltration, i.e. drafts from outside openings such as windows and doors,
- air currents produced by supply air registers, and
- heat from a nearby source, such as a fireplace, electrical appliances, lamps, solar radiation, a wall enclosing warm air ducts, a chimney, or a flue gas vent.

Most room thermostats are equipped with an adjustable heat anticipator, set the thermostat heat anticipator to match the control current of the furnace as indicted on the furnace wiring diagram.

Combustion Chamber

The furnace combustion chamber is a hollow, circular cylinder sealed at the bottom end and open at the top end. The chamber is made of a lightweight, insulating, “soft”, refractory material. The refractory material is composed of organically bound, alumina-silica fibers that protect the heat exchanger from the intense heat of the oil burner.

Oil Burner and Oil Nozzle Installation

⚠ CAUTION: This oil furnace is designed to use No. 2 or lighter distillate fuel (home heating) oil. A Bio-fuel mixture may be used but the mixture is not to exceed a B5.

This furnace is designed to utilize the following specially modified, oil burner:

- R.W. Beckett Corp. model AFG burner, specification # EFL-401
- Carlin Combustion Technology, Inc. model EZ-1HP, specification 99032D

NOTICE: NO other burners may be used in this application.

The heat output from the furnace is fixed, based on the size of nozzle installed in the oil burner. Four (4) heat input rates are permissible: 85,000, 105,000, 120,000, and 140,000 BTUH, except for the counterflow/horizontal models which can only be fired at 85,000, 105,000 and 120,000 BTUH...

Nozzle selection (i.e. heating capacity of the furnace) shall be based on a rate of heat loss (heating load) calculation for the building. These calculations should be made according to the manuals provided by the Air Conditioning Contractors of America (ACCA) or the American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc. (ASHRAE).

Refer to the Residential Load Calculation, Manual J, from the ACCA, and the ASHRAE Handbook Fundamentals volume, from ASHRAE, for the recommended procedure to compute the design heating load of a residence.

The oil burner was installed in the furnace at the factory. In the field, if it is necessary to adjust the heating capacity of the furnace by changing the oil burner nozzle, refer to the oil burner manufacturer's operating instructions (included with the furnace) for detailed instructions on this procedure.

The furnace may have been handled roughly while in transit. Under some conditions, the combustion chamber can shift out of position. Check for proper alignment of the burner air tube with the circular opening in the combustion chamber and trial fit the burner to check the insertion depth of the oil burner into the combustion chamber.

The end of the burner air tube should be inserted no farther than 1/4 inch back from the inside surface of the combustion chamber, refer to Figure 4. Do not allow the burner tube/end cone to physically touch or protrude into the chamber. High temperatures in the combustion chamber can result in damage to the tube, the end cone, or both. A distance greater than 1/4 inch back from the inside chamber wall may cause flame impingement on the combustion chamber wall and subsequent sooting or carbon char buildup.

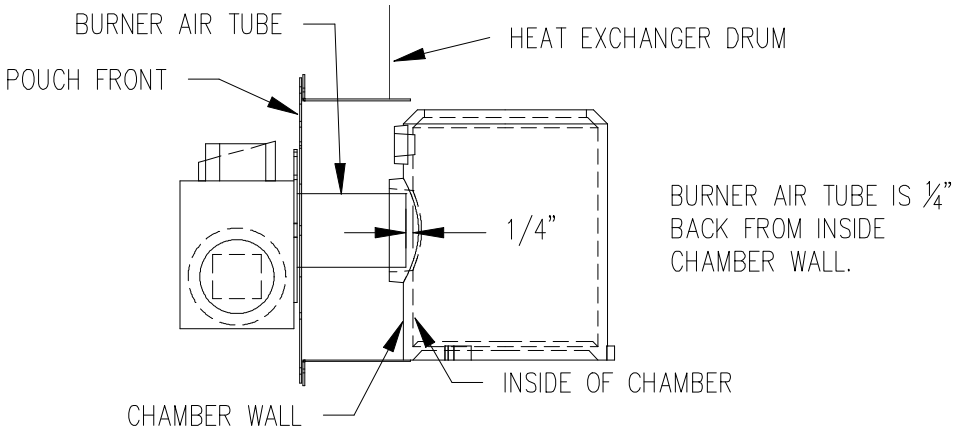


Figure 3: Side view of correct burner insertion into combustion chamber

The oil burner provided with this furnace requires initial inspection, set-up, and proper adjustment. Refer to this manual and the oil burner manufacturer's operating instructions for detailed information on the following items.

- Initial firing of burner
- Adjusting the burner combustion air
- Adjusting the fuel pump pressure
- Setting the draft control

NOTICE: This oil furnace must be installed and adjusted by only qualified oil heating contractor using calibrated combustion test instruments to ensure safe and reliable operation of the furnace.

Fuel System Installation

In situations where the oil storage tank is installed at the same level with, or above, the burner, a single oil supply line run from the oil tank to the burner will be usually be adequate. No return line will be required. If the oil tank is installed below the burner and the lift exceeds approximately 6-ft., an oil supply line and an oil return line are recommended.

Refer to the Standard for the Installation of Oil-Burning Equipment, NFPA 31-2020, or latest edition and the oil burner operating instructions for detailed information on oil storage tank & oil supply/return line installation.

NOTICE: We recommend installing a high efficiency oil filter, in the oil supply line, capable of filtering 10 to 20 micron diameter (or preferably smaller) particles from the fuel.

Horizontal / Counterflow Furnace Setup

The horizontal / counterflow furnace is shipped from the factory upright for vertical installation (counterflow configuration). If the furnace is to be installed lying down on the right-hand or left-hand side (horizontal configuration), the position may have to be changed. The horizontal furnace may be turned end for end, or rotated, making the top into the bottom, as shown in Figure 5. Refer to the following instructions for installing the oil burner.

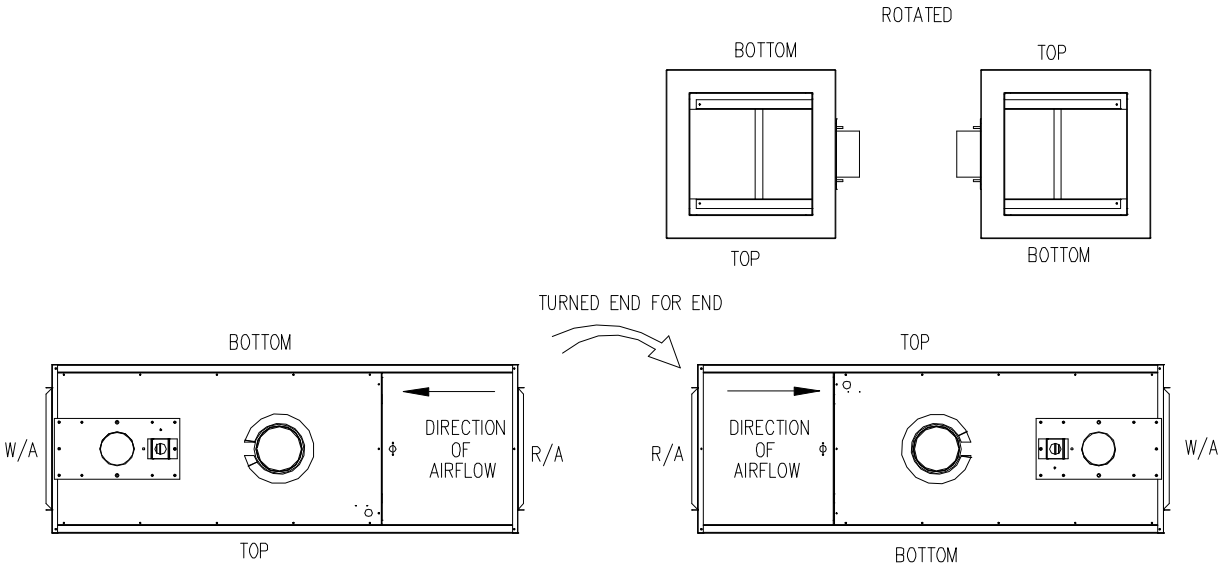


Figure 4: A horizontal furnace rotated 180° (or flipped end for end) to reverse airflow direction

1) **When the furnace is installed in the horizontal configuration,** the oil burner must be mounted in an upright position. It will be necessary to cutoff one (1) of the threaded burner-mounting studs before attempting to install the burner. Trial fit the burner to the burner mounting plate to determine which stud to remove. (A rotary tool with a cutting (abrasive) disk or a hacksaw should work well to remove the stud.) A machine screw (furnished with the parts package) will substitute for the removed stud and provide a third point to secure the burner flange to the burner mounting plate. Thread the screw through the burner-mounting flange and into the open hole within the burner mounting plate.

2) Install the flange gasket and the burner on the mounting plate threaded studs. Using fasteners supplied in the parts bag with each furnace [use two (2) or three (3) 5/16 in. brass hex nuts and flat washers, as required], secure the burner to the mounting studs on the burner mounting plate.

3) Secure the electrical conduit of the wiring harness to the oil burner junction box with the hardware provided.

Initial Operation of Furnace

Initial Burener Operation:

⚠ IMPORTANT: The start-up sheet found in Appendix A of this manual should be completed.

1. Turn the electrical disconnecting switch to the “OFF” position.
2. Set the room thermostat above room temperature.
3. Be sure the oil tank is full of clean # 2 fuel oil.
4. Open all shutoff valves in the oil line.
5. Refer to the oil burner manufacturer’s operating instructions (included with the furnace) for detailed startup instructions
6. Measure the oil pump pressure. If required, adjust it to deliver the appropriate pressure for the burner. The oil pump should be set to produce,

    - 130 PSIG, for the R.W. Beckett model AFG burner
    - 140 PSIG, for the Carlin Combustion Technology model EZ-1HP

7. Carbon Dioxide (CO2) and Carbon Monoxide (CO) – In order to assure that proper and safe combustion are taking place, carbon dioxide and carbon monoxide measurements must be taken. A CO2 reading within the limits of appendix C with no measurable CO is desirable. The maximum acceptable CO reading is about 50 PPM. If the CO reading is too high, open the burner air shutter, or air band, slightly to permit more combustion air to the flame. Recheck the CO level and adjust as required.
8. Draft – Draft measurements should be taken through the overfire port and in the vent connector, not more than 12 inches away from the furnace outlet. A 5/16 in. hex washer head bolt plugs the overfire port in the burner mounting plate. Remove the bolt and insert a suitable draft measurement gage.
9. Flue Gas Temperature – The flue gas temperature will vary depending on heat input rate, air temperature rise across the heat exchanger, and air flowrate through the furnace. To prevent excessive water vapor condensation from the flue gases, the gross flue gas temperature should not fall below 330ºF. In addition, if the gross flue gas temperature exceeds 650ºF, the heating efficiency of the furnace will be reduced.
10. Cycle the furnace several times to verify the burner lights off and shuts down smoothly without excessive noise or smoke production.

Supply/Return Airflow and Air Temperature

The supply/return airflow shall be set to obtain an air temperature rise, across the furnace, in the range of 55º to 85ºF for the lowboy models. The range for the counterflow/horizontal furnace for inputs of 85,000 and 120,000 BTUH shall also be 55º to 85ºF. The range for the 105,000 BTUH (as shipped) counterflow/horizontal shall be 47º to 77ºF. Since the flow resistance of each duct system is slightly different, the airflow (fan speed) may have to be changed in the field to achieve a satisfactory temperature rise.

The blower (fan) speed is adjusted by changing the fan motor winding energized by the control system. The furnace is set on the med-low fan speed, “ML”, at the factory; refer to furnace wiring diagram, Appendix B. To adjust the fan speed, follow this procedure.

a. Turn off all electrical power to the furnace at the disconnecting switch.
b. Remove the blower compartment access door on the counterflow/horizontal furnace.
c. The “Heat” tab is the connection for the heating speed activation thru the fan board. If a change in heating speed is desired simply pull the blue (ML) wire from the heat tab and replace it with the yellow (MH) wire. This changes the speed from medium-low to medium-high. Black (High) is connected to the “cool” tab for A/C speed operation. If a lower speed is desired for A/C, the speed is charged the same way. A tab marked “Low” is populated with a lower fan speed for continuous fan operation thru the “G” circuit of your T-stat. Unused blower speeds are connected to the “unused motor leads” tabs at bottom right of fan board.
d. Replace the blower compartment access door on the counterflow/horizontal unit.
e. Restore electrical power to the furnace at the disconnecting switch.
f. Recheck Temperature rise and adjust if needed.

Furnace Limit and Blower Controls

The control also has diagnostic features. A green light will illuminate under the thermostat terminal that is being activated. Also any time the board receives a call from the thermostat a red light near the center of control will illuminate.

If a limit switch opens the red light will flash, power will be interrupted to the Buner and the circulating air blower will be energized. The blower will continue to run and the burner will remain de-energized until the limit closes and the blower off delay expires.

! WARNING: The predetermined fan and limit locations on all of the Thermo Pride oil fired furnaces have been tested and approved by Thermo Products, LLC. Any attempt to relocate these safety controls or replace these safety controls with a control that is not approved, or is incompatible, may result in personal injury, substantial property damage or death.

Instructions to Our Customer / End User

! WARNING: If the burner does not operate properly after depressing the oil primary reset button, turn off the electrical power to the furnace and close the manual oil shutoff valve. Immediately contact a qualified heating contractor for service.

Before leaving a new installation, the installer should show the customer or end user where the furnace instruction manual is kept. He should also discuss the following points:

1) Describe the general operation of the furnace and, if properly equipped, the cooling system.

2) Show the location of the furnace air filter(s) and those in the duct system, if equipped. Demonstrate how to remove, clean, and replace the air filter(s).
3) Demonstrate how to set and adjust the room air temperature using the room thermostat.
4) Demonstrate how to operate (turn on and off), the heating system and, if properly equipped, the cooling system and the circulating air blower.
5) Show the location of the oil primary safety control in the furnace. Describe when and demonstrate how to depress the oil primary reset button.

SERVICE

Troubleshooting

⚠ WARNING: When testing electrical equipment, always follow standard electrical safety procedures.

Before beginning these troubleshooting procedures, always review these basic points.

1) Check for 120 VAC power to the furnace. If there is no voltage, check the disconnecting switch for circuit breaker trip or blown fuses.
2) Make sure the room thermostat is set on the heating mode and is “calling for heat”.
3) Check for sufficient oil supply and that all oil shutoff valves are open.
4) To successfully service this oil furnace, the following recently (within the last year) calibrated instruments must be available.

    - Smoke spot test kit with Bacharach-type oil burner smoke scale
    - Carbon dioxide (CO_2) and carbon monoxide (CO) test kit or analyzer
    - Flue gas temperature measuring instrument
    - Draft gauge, capable of measuring 0.01 to 0.25 in. W.G. draft
    - Multimeter (analog or digital type)
    - Oil pressure gauge, capable of measuring at least 0 to 200 PSIG

5) Be familiar with the correct operation of these instruments as well as how to adjust the oil burner settings (refer to burner manufacturer’s literature).

A. **Symptom: Furnace does not operate.**

Items to check:

⚠ WARNING: Repeated operation of the oil primary safety control reset button can cause a build-up of unburned oil in the combustion chamber. An accumulation of oil in the combustion chamber is a hazardous situation and may cause a fire or explosion.

1) Make sure the disconnecting switch is “ON” and the circuit breaker has not tripped, or fuses have not blown.
2) Confirm there is 120 VAC at the junction box and the oil furnace control terminal S1.

3) Confirm the room thermostat is wired correctly, set on the “HEAT” mode, and “calling for heat”.
4) Refer to the oil burner manufacturer’s operating instructions (included with the furnace) for primary control troubleshooting

B. **Symptom: Burner short cycles on high limit thermostat, but does not “lock out” on oil primary safety control.**

Items to check:

1) Open dampers or registers in the air distribution system. Clear any duct system restrictions.
2) Inspect and clean all air filters in the air distribution system.
3) Inspect blower for interference with rotation or locked rotor condition. Also, confirm the blower wheel is secured to the fan motor shaft.
4) The fan motor or run capacitor may be damaged. Test and replace the motor or capacitor, as required.
5) Increase fan speed.

C. **Symptom: Burner short cycles on high limit thermostat, but does not “lock out” on oil primary safety control.**

Items to check:

1) Open dampers or registers in the air distribution system. Clear any duct system restrictions.
2) Inspect and clean all air filters in the air distribution system.
3) Inspect blower for interference with rotation or locked rotor condition. Also, confirm the blower wheel is secured to the fan motor shaft.
4) The fan motor or run capacitor may be damaged. Test and replace the motor or capacitor, as required.
5) Increase fan speed.
6) Measure the draft at the point where the vent connector attaches to the heat exchanger flue pipe. With the burner operating, the stack draft should not exceed 0.05 in. W.G. If the stack draft has been adjusted above this value to give the proper overfire draft, the heat exchanger will require cleaning. If there is little or no stack draft, the chimney flue way may require cleaning, the chimney is too restrictive, or a downdraft condition exists.

D. **Symptom: Furnace blower will not start.**

Items to check:

1) Confirm there is 120 VAC at the blower terminal labeled “HEAT” on the oil furnace control.
2) If there **is not** 120 VAC at the blower motor terminal, measure the voltage at the S1 terminal on the oil furnace control. If the fan can be activated by itself from the room thermostat subbase, confirm it will operate. If so, the oil furnace control may have a burnt or damaged relay. Confirm and replace the control if necessary.

3) If there **is** 120 VAC at the blower motor terminal “HEAT”, either the run capacitor or blower motor may be damaged. Test and replace the capacitor or motor, as required.

E. Symptom: Blower cycles on and off after the burner has shutdown.

Item to check:

1) Increase the fan off time by changing the DIP switch selections on SW2. Refer to Table 2 for blower delay off settings.

NOTICE: If the high limit control is faulty, it should be replaced. However, it must only be replaced by the same make and model as the original. Refer to the electrical diagrams for proper electrical connections.

Flame Sensor (“Cad Cell”) Checkout Procedure

Refer to the oil burner manufacturer’s operating instructions (included with the furnace) for detailed cad cell troubleshooting.

Replacement Parts

Appendix D of this manual contains a list of replacement parts available for these furnaces.

MAINTENANCE

Air Filter(s)

⚠ CAUTION: To avoid injury from moving parts, hot surfaces, or electrical shock, shut off the power to the furnace and allow the furnace to cool BEFORE removing any furnace access doors to service air filters.

Lowboy furnace models are factory-supplied with a permanent-type, air filter. At least twice a year, remove the air filter(s) for cleaning. Clean a filter by soaking it in water with a mild detergent and then rinsing it with clean water. Allow the filter to air dry before reinstalling it in the furnace filter rack.

If the furnace, or duct system, is equipped with disposable-type (paper element), air filters, inspect them every month for an excessive accumulation of dust and dirt. Replace disposable air filters at least twice a year. Make certain the replacement filter is the same size as the one being replaced. The filter size is marked on the outer edge of the air filter. Install the filter with the arrow marked on the filter pointing toward the furnace.

Oil Burner

NOTICE: A qualified heating contractor MUST service the oil burner in this furnace at least once a year.

Generally, service to the burner will involve a thorough inspection and cleaning of the burner, replacement of the oil nozzle and oil filter, and readjustment of the burner to achieve proper ignition and clean combustion.

Blower and Motor

NOTICE: The fan motor has sealed bearings that do NOT require lubrication.

The blower and fan motor will **not** normally require any service. This furnace is equipped with a directly-driven blower. Therefore, it will **not** require any retensioning or replacement of a drive belt.

Heat Exchanger

⚠ CAUTION: DO NOT attempt to clean the heat exchanger unless electrical power and fuel flow to the furnace are turned off and the furnace is at room temperature.

⚠ CAUTION: The combustion chamber refractory material is fragile and can be easily damaged. If the inner radiator of the heat exchanger is cleaned, avoid scraping or hitting the walls of the combustion chamber.

CAUTION: Do not brush or scrape the surface of the combustion chamber. It can be easily damaged.

NOTICE: A qualified heating contractor MUST inspect the heat exchanger in this furnace at least once a year. If heavy deposits are found, immediate cleaning is required.

All heat exchanger surfaces should be as clean as possible for the most efficient operation of the furnace. The heat exchanger may require cleaning after every heating season, as combustion of fuel oil tends to produce soot, particulate matter, and scale, due to corrosion.

NOTICE: Accumulation of heavy soot deposits over one heating season may indicate the oil burner is out of adjustment.

The heat exchanger may be inspected and cleaned through an access, or cleanout, port located in the burner compartment, on lowboy models, or immediately behind the front casing panel, on the horizontal/counterflow model. The cleanout port consists of a 4-inch diameter stamped steel cap. The cap is retained by a single T-bolt through a circular opening located in the outside wall of the heat exchanger, refer to Figure 8.

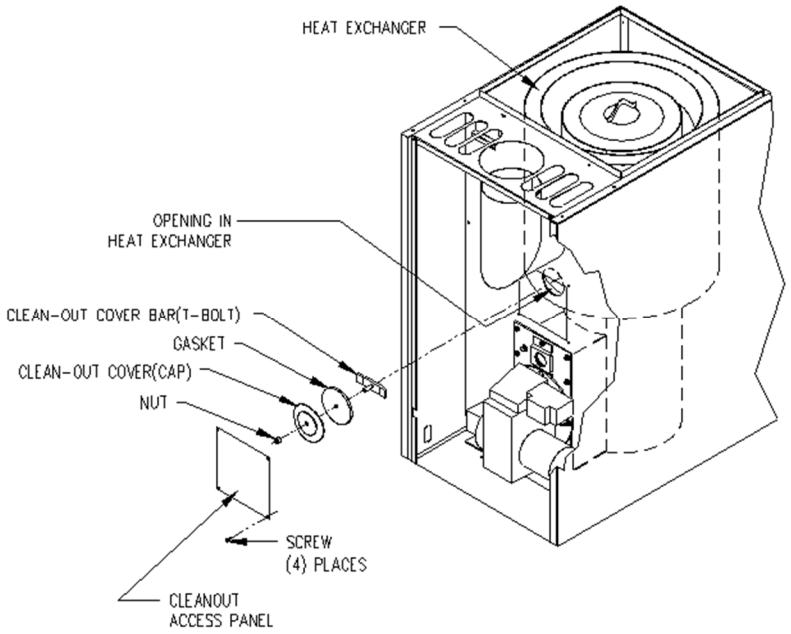


Figure 5: Location and Design of the Lowboy Heat Exchanger Cleanout Port

Using a screwdriver, remove the screws retaining the trim panel covering the cleanout port. With a wrench, or a ratchet with a deep-well socket, loosen the nut retaining the T-bolt and the cap to the heat exchanger. Carefully, remove the T-bolt, nut, gasket, and the cap from heat exchanger. Loosen and remove as much debris as possible.

The heat exchanger should also be cleaned through the flue pipe connection. Carefully remove the vent connector and the heat exchanger flue pipe to inspect and clean the heat exchanger.

Flue and Chimney

At least once a year, thoroughly inspect the heat exchanger flue pipe, the vent connector, the chimney, or vent, and the barometric damper for signs of sagging, loose connections, excessive corrosion, and deterioration. Clean, repair, or replace any components for continued safe and proper operation of the furnace.

USERS INFORMATION

⚠ IMPORTANT: This furnace must be serviced annually by a licensed professional technician, or equivalent.

⚠ WARNING:

- **The area around the furnace should be kept free and clear of flammable vapors, liquids, and material, especially papers and rags.**
- **NEVER burn garbage or refuse in the furnace. NEVER try to ignite oil by tossing burning papers or other material into the furnace.**
- **This oil furnace is designed to burn No. 2 distillate fuel (home heating) oil ONLY. NEVER USE GASOLINE OR A MIXTURE OF OIL AND GASOLINE.**
- **DO NOT attempt to make repairs to the furnace yourself!**

Operating Instructions

For your safety, read this information before operating this furnace.

⚠ WARNING: Failure to follow these instructions may result in fire or explosion causing property damage, personal injury, or loss of life.

WHAT TO DO IN THE EVENT OF AN OIL LEAK:

- Do not try to operate this or any other nearby appliance.
- If present, close the manual oil shutoff valve on the fuel oil supply line.
- Immediately call a qualified heating contractor for service.
- If you cannot reach a qualified heating contractor, call the fuel oil supplier or the fire department.

DO NOT use this furnace if any component was underwater. Immediately call a qualified heating contractor to inspect the furnace and replace any part of the furnace control system that was underwater.

This furnace does not have a pilot light. It is equipped with an electronic ignition system that automatically lights the burner. DO NOT attempt to light the burner by hand.

TO OPERATE THIS FURNACE:

1) Adjust the room thermostat to the lowest set point and set the operating mode, if equipped, to “OFF”.
2) Turn the manual oil shutoff valve to the open or “ON” position.

3) This furnace is equipped with an electronic ignition system that automatically lights the burner. DO NOT try to light the burner by hand.

4) Turn on the electric power to the furnace at the disconnecting switch.

5) Adjust the room thermostat to the desired set point and set the operating mode, if equipped, to “HEAT”.
6) If the furnace will not operate, call a qualified heating contractor for service.

TO INTERRUPT (STOP) OPERATION OF THIS FURNACE:

1) Adjust the room thermostat to the lowest set point and set the operating mode, if equipped, to “OFF”.
2) If service will be performed, turn off all electric power to the furnace at the disconnecting switch.
3) Turn the manual oil shutoff valve to the closed or “OFF” position.

Oil Supply

This oil furnace is designed to use No. 2 or lighter distillate fuel (home heating) oil. A Bio-fuel mixture may be used but the mixture is not to exceed a B5.

- DO NOT allow the fuel tank to run completely dry during the heating season. If the fuel tank runs completely dry, it may be necessary to purge the oil lines of trapped air. I
- During the warmer weather, **keep the tank full** to prevent condensation of moisture on the inside surface of the tank.
- **Keep the cap on the fuel tank** fill pipe tightly closed at all times to prevent the entrance of moisture, foreign matter, insects, etc. Also, check the tank, vent, and fill pipe for cracks and leaks.

Extended Shutdown

If the furnace will be shut down for an extended period of time:

1) Adjust the room thermostat to the lowest set point and set the operating mode, if equipped, to “OFF”.
2) Open the disconnecting switch serving the furnace.
3) Close the manual oil shutoff valve.

Combustion and Ventilation Air Supply

The furnace and venting system require a generous amount of clean air to operate safely. Lack of adequate combustion and ventilation air can result in erratic operation of the burner, noisy and poor combustion, sooting of the combustion chamber, and fuel odors in the air. **Never block off or restrict the supply of air to the furnace.**

Inspection Areas

Burner Compartment: On the lowboy furnace models, the burner compartment can be inspected by removing the front door of the furnace. Look for signs of excessive heat, such as discoloration of components, damage to material from rust or corrosion, soot or carbon build-up, and evidence of fuel oil leakage.

Exterior of Furnace: The exterior of the furnace should be inspected for signs of excessive heat such as discoloration of materials and damage from rust or corrosion. Confirm the base or frame supporting the furnace in level and in sound condition.

Venting System: The furnace flue pipe, vent connector, barometric damper, and chimney should be inspected for:

- Signs of excessive rust, corrosion pitting, and holes.
- Signs of condensation or moisture leakage.
- Evidence of structural damage, and loose or disconnected piping joints.
- Presence animal nests.
- Free movement of the vane of the barometric damper without binding or interference.

If any problems are evident, call a qualified heating contractor for assistance.

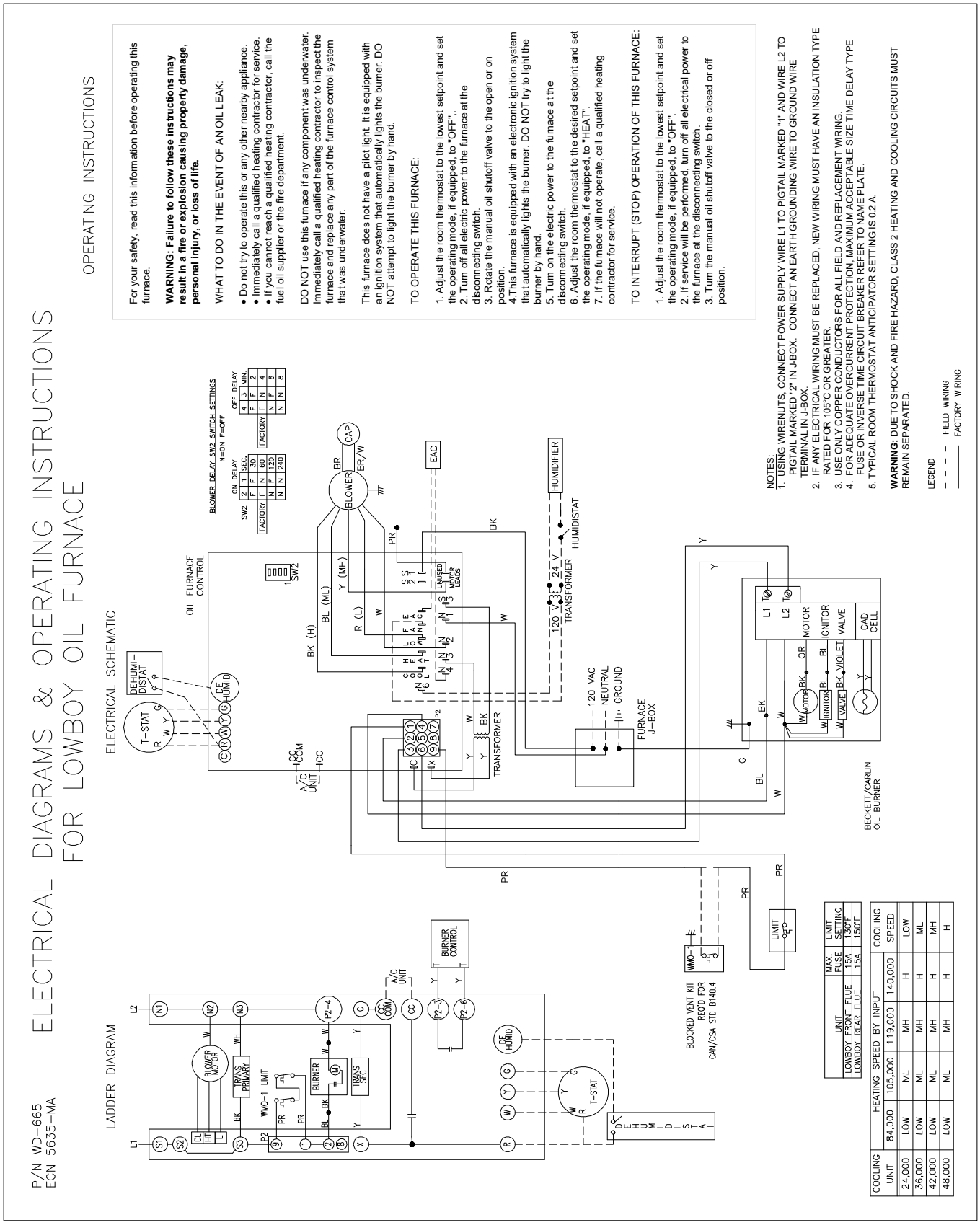
NOTICE: A qualified heating contractor MUST service the oil burner and inspect the heat exchanger in this furnace at least once a year.

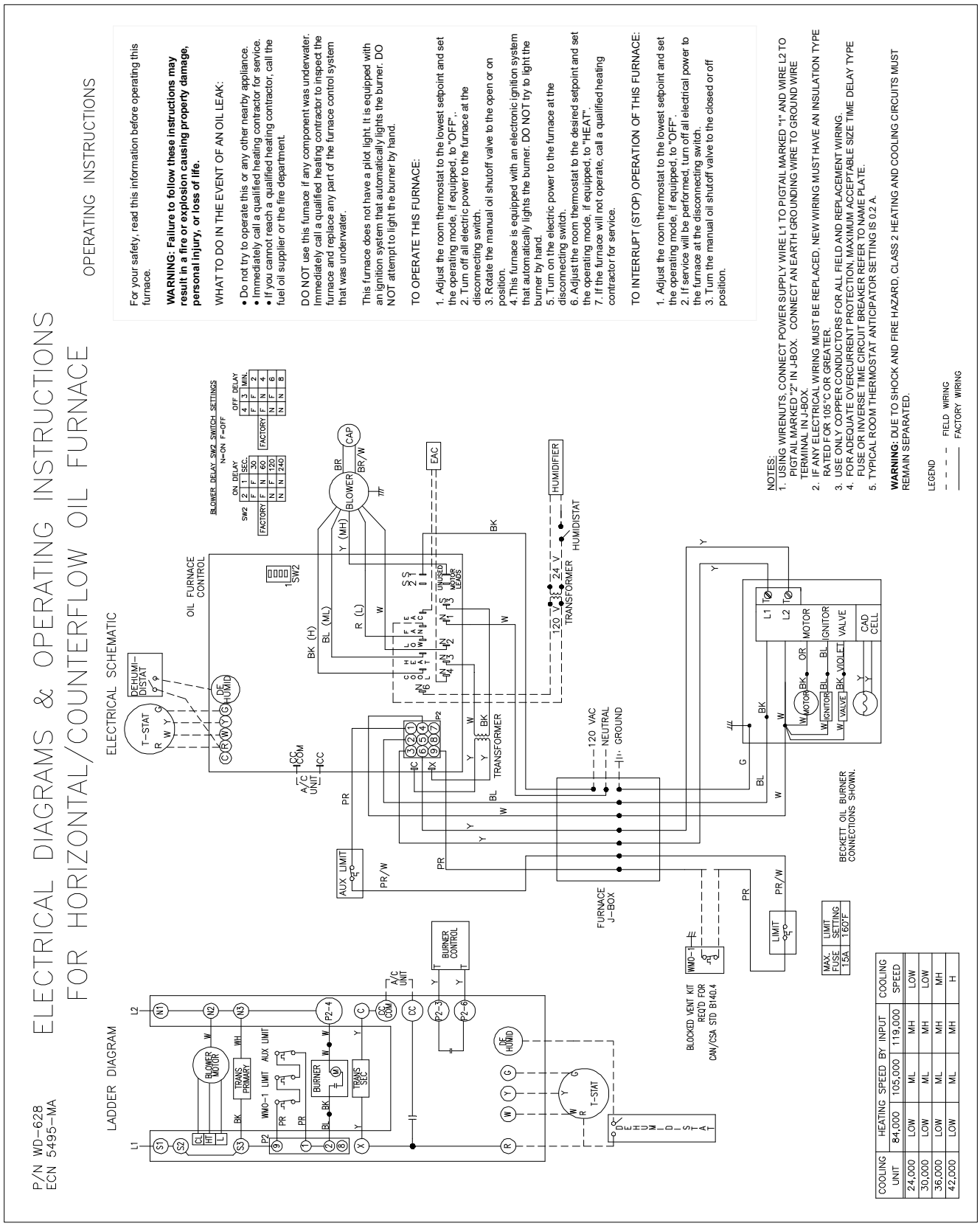
APPENDIX A: STARTUP SHEET

Combustion and Efficiency Testing for Spirit Oil Fired Furnaces:
Complete this form for each Spirit furnace installed. Read instruction manual carefully before taking test. Retain this form with furnace.

CUSTOMER	NAME				
	ADDRESS				
	CITY, STATE				
HEATING SYSTEM	FURNACE MODEL				
	FURNACE SERIAL				
	BURNER MODEL NO.				
	TYPE OF VENTING & OIL SYSTEM (CHECK ALL THAT APPLY)				
	☐ MASONRY CHIMNEY	☐ CLAY LINER ☐ METAL LINER		☐ MAKE UP AIR TO MECANICAL ROOM	
	☐ METAL CHIMNEY	☐ SIDEWALL POWER VENTER		☐ DIRECT VENT ☐ COMBUSTION AIR KIT	
	☐ DRAFT CONTROL	☐ FUEL FILTER		☐ 2 PIPE SYTEM	
COMBUSTION TEST Operate burner for at least 10 min. before taking readings.		INITIAL	SERVICE	SERVICE	SERVICE
	CO2 (%)				
	O2 (%)				
	CO (PPM)				
	SMOKE NO.				
	DRAFT -BREECH (IN W.C.)				
	DRAFT - OVERFIRE (IN W.C.)				
	GROSS FLUE TEMP (°F)				
	ROOM TEMP (°F)				
	EFFICIENCY (%)				
	SUPPLY TEMP (°F)				
	RETURN TEMP (°F)				
	TEMP RISE (°F)				
	NOZZLE (GPH/ANGLE/CONE)				
	PUMP PRESS (PSI)				
	SAFTEY CONTROL OPERATION				
	CHECK FOR LEAKS				
	TECHNICIAN				
	DATE				
INSTALLER	NAME	ADDRESS		PHONE	

APPENDIX B: ELECTRICAL DIAGRAMS
VLF-DBP, VLR-DBP, VLF-DCP, VLR-DCP Models





COOLING UNIT	HEATING	SPEED	BY- INPUT	COOLING
	84,000	105,000	119,000	SPEED
24,000	LOW	ML	MH	LOW
30,000	LOW	ML	MH	LOW
36,000	LOW	ML	MH	MH
42,000	LOW	ML	MH	H

APPENDIX C: SPECIFICATION SHEETS

MODEL NO.	VLF-DBP (Front Flue) or VLR-DBP (Rear Flue)				VLF-DCP (Front Flue) or VLR-DCP (Rear Flue)			
HEAT INPUT RATE (BTUH)	140,000	119,000	105,000	84,000	140,000	119,000	105,000	84,000
OUTPUT BTUH [1]	114,000	98,000	88,000	70,000	114,000	98,000	88,000	70,000
SEASONAL EFFICIENCY (% AFUE)[2]	85 [3]							
LARGEST REC A/C (Tons)	4							
NOMINAL TEMP RISE (° F)	70							
HEAT EXCHANGER AREA (SQ. FT.)	27.8 (front flue) / 30.0 (rear flue)							
CASING HEIGHT (IN.)	41.5							
CASING WIDTH (IN.)	22.25							
CASING DEPTH (IN.)	47							
NOMINAL FLUE OUTLET DIA. (IN.)	6							
APPROX SHIPPING WEIGHT (LBS)	300							
APPROVAL AGENCY	ETL							
QTY AND SIZE OF PERMANENT FILTERS (IN.)	(2) 10 X 20							
ELECTRICAL REQUIREMENTS	120v / 60hz / 1ph							
TOTAL CURRENT (AMPS)	11.2							
MAX FUSE SIZE (AMPS)	15							
HEIGHT, FLOOR - CENTER OF FLUE	30.375"							
SUPPLY AIR OUTLET SIZE (IN.)	20 W X 20 D							
RETURN AIR INLET SIZE (IN.)	20 W x 12.5 D							
BURNER MODEL	(BECKETT AFG)				(CARLIN EZ-1HP)			
AIR TUBE LENGTH (IN.)	5.875, effective				5.875, effective			
BURNER HEAD TYPE	Fixed, flame retention							
HEAD POSITIONING BAR	NA	NA	NA	NA	.85-1.0	0.75	.60-.65	
NOZZLE (GPH)	1.00	0.85	0.75	0.60	0.85	0.75	0.65	0.55
SPRAY ANGLE (Deg.)	80				60	60	60	70
SPRAY PATTERN:	Hollow (A)				Hollow (A)			
OIL PUMP PRESSURE (PSIG)	130				140			
IGNITION CONTROL TYPE	Interrupted, Direct Spark				Interrupted, Direct Spark			
CONTROL TIMING PRE / POST (Sec.)	15 / 0				15 / 15			
COMBUSTION CHAMBER TYPE	Preformed, refractory (ceramic fiber matrix material)							
MINIMUM CLEARACNES TO COMBUSTILBE MATERIALS								
SIDES (IN.)	3							
TOP (IN.)	3							
FRONT (IN.)	8 (front flue) / 3 (rear flue)							
REAR (IN.)	3							
FLUE/VENT PIPE (IN.)	9							
SUPPLY PLENUM (IN.)	3							

1 OUTPUT BTUH BASED ON ANNUAL FUEL UTILIZATION EFFICIENCY RATED BY MANUFACTURER.

2 SEASONAL EFFICIENCY (ALSO CALLED AFUE - ANNUAL FUEL UTILIZATION EFFICIENCY) RATINGS ARE BASED ON TESTS FOLLOWING U.S. DEPARTMENT OF ENERGY TEST PROCEDURES.

3 AFUE RATINGS AS SHIPPED AT 105,000 BTU INPUT.

MODEL NO.	VC-CBP		
HEAT INPUT RATE (BTUH)	119,000	105,000	84,000
OUTPUT BTUH [1]	97,000	88,000	69,000
SEASONAL EFFICIENCY (% AFUE)[2]	85 [3]		
LARGEST REC A/C (Tons) [4]	4		
NOMINAL TEMP RISE (° F)	70	62	70
HEAT EXCHANGER AREA (SQ. FT.)	27.8 (front flue)		
CASING HEIGHT (IN.)	61.25 Counterflow / 22.25 Horizontal		
CASING WIDTH (IN.)	22.25 Counterflow / 61.25 Horizontal		
CASING DEPTH (IN.)	22.25		
NOMINAL FLUE OUTLET DIA. (IN.)	6		
APPROX SHIPPING WEIGHT (LBS)	280		
APPROVAL AGENCY	ETL		
QTY AND SIZE OF PERMANENT FILTERS (IN.)	NA		
ELECTRICAL REQUIREMENTS	120v / 60hz / 1ph		
TOTAL CURRENT (AMPS)	10.2		
MAX FUSE SIZE (AMPS)	15		
HEIGHT, BOTTOM OF FURNACE - CENTER OF FLUE (IN.)	30.00 Counterflow (does not include any base) 11.00 Horizontal		
SUPPLY AIR OUTLET SIZE (IN.)	16 W X 16 D		
RETURN AIR INLET SIZE (IN.)	16 W x 16 D		
BURNER MODEL	(BECKETT AFG)		
AIR TUBE LENGTH (IN.)	5.875, effective		
BURNER HEAD TYPE	Fixed, flame retention		
NOZZLE (GPH)	0.85	0.75	0.50
SPRAY ANGLE (Deg.)	80		
SPRAY PATTERN:	Hollow (A)		
OIL PUMP PRESSURE (PSIG)	130		
IGNITION CONTROL TYPE	Interrupted, Direct Spark		
CONTROL TIMING PRE / POST (Sec.)	15 / 0		
COMBUSTION CHAMBER TYPE	Preformed, refractory (ceramic fiber matrix material)		
MINIMUM CLEARACNES TO COMBUSTILBE MATERIALS			
SIDES (IN.)	3		
TOP (IN.)	3		
FRONT (IN.)	22		
REAR (IN.)	3		
FLUE/VENT PIPE (IN.)	9		
SUPPLY PLENUM (IN.)	3		

1 OUTPUT BTUH BASED ON ANNUAL FUEL UTILIZATION EFFICIENCY RATED BY MANUFACTURER.

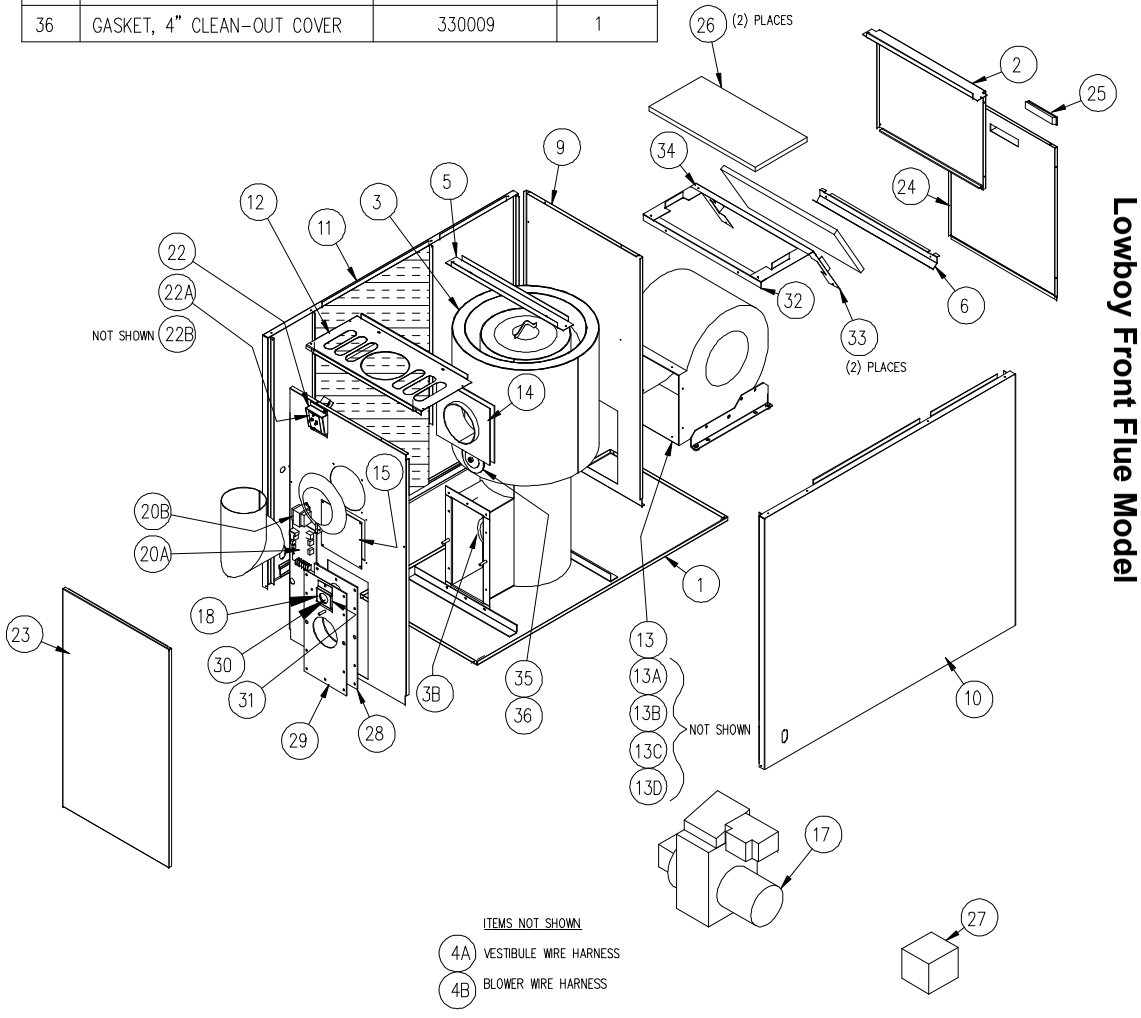
2 SEASONAL EFFICIENCY (ALSO CALLED AFUE - ANNUAL FUEL UTILIZATION EFFICIENCY) RATINGS ARE BASED ON TESTS FOLLOWING U.S. DEPARTMENT OF ENERGY TEST PROCEDURES.

3 AFUE RATINGS AS SHIPPED AT 105,000 BTU INPUT.

APPENDIX D: REPLACEMENT PARTS
Lowboy Front Flue Model

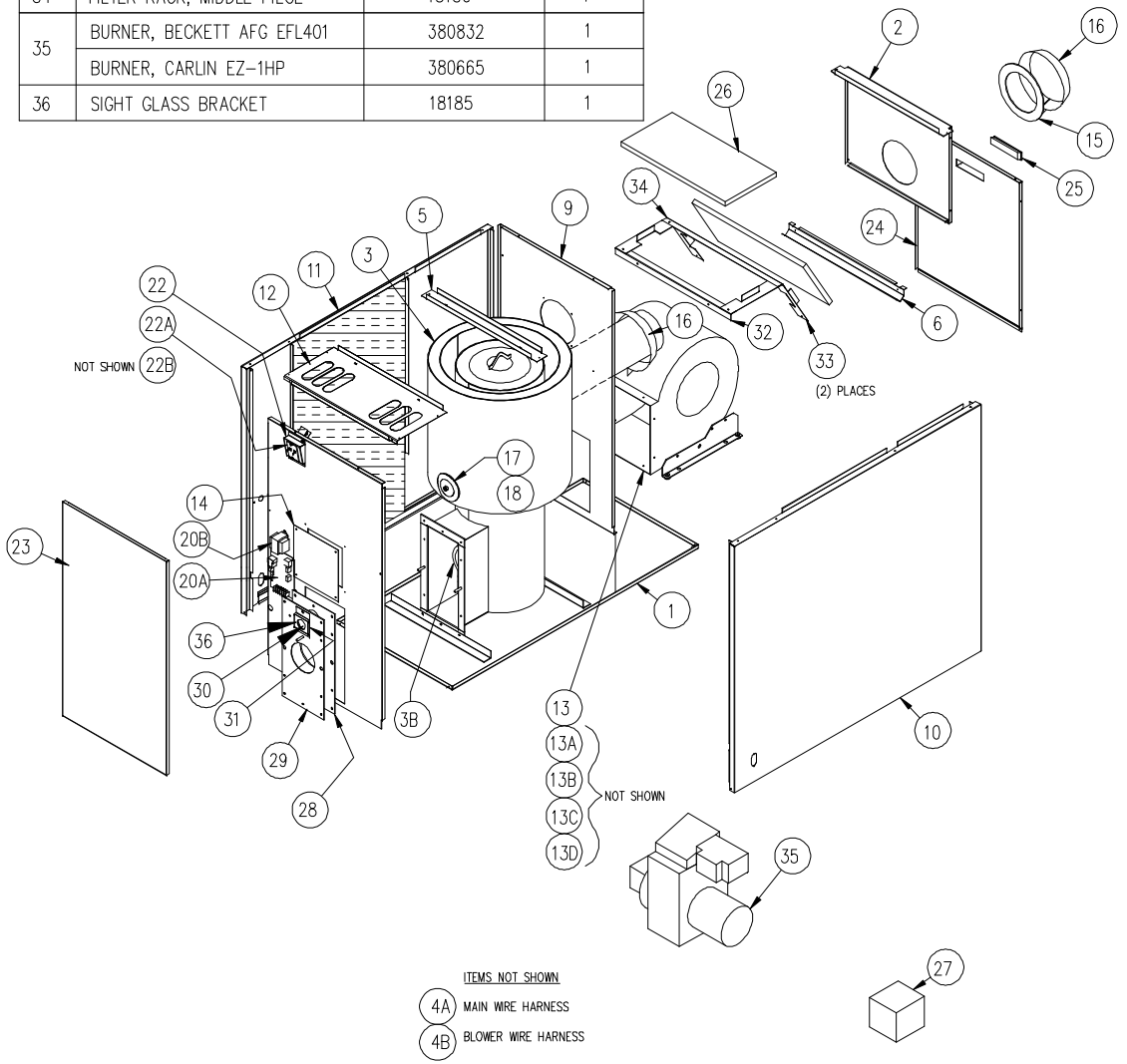
ITEM	PARTS DESCRIPTION	PART NO.	QTY.
1	BASE	28132	1
2	PANEL, REAR	617956-2	1
3	HEAT EXCHANGER	37940	1
3B	CHAMBER, REPLACEMENT	380698	1
4A	WIRE HARNESS, VESTIBULE	350267	1
4B	WIRE HARNESS, BLOWER	350269	1
5	PLENUM PIECE, TOP MIDDLE	618144-2	1
6	FILTER RACK, BOTTOM PIECE	18152	1
9	SEPARATOR PANEL, REAR	18154	1
10	SIDE CASING, RIGHT	628137-2	1
11	SIDE CASING, LEFT	628138-2	1
12	PANEL, TOP FRONT	617346-2	1
13	BLOWER SUB-ASSEMBLY	S00S4565	1
13A	BLOWER HOUSING w\ WHEEL	340080	1
13B	MOTOR w\ CAPACITOR	A0PS7653	1
13C	CAPACITOR	350077	1
13D	MOTOR BRACKET ASSY	A0PS7670	1
13E	BLOWER WHEEL	340083	1
14	GASKET, FLUE BACKING PLATE	330008	1
15	PANEL, CLEAN-OUT	17951	1
16	DRAW COLLAR	14131	1
17	BURNER, BECKETT AFG EFL401	380832	1
	BURNER, CARLIN EZ-1HP	380665	1
18	SIGHT GLASS BRACKET	18185	1
19	ELBOW	35719	1
20	SEPARATOR PANEL	619142	1
20A	OIL FURNACE CONTROL	A0PS8380	1
20B	TRANSFORMER	350464	1
22	LIMIT BRACKET	29156	1
22A	LIMIT SWITCH	350103	1
22B	INSULATING BOOT	350036	1
23	DOOR, FRONT	617352-2	1
24	PANEL, BLOWER ACCESS	617954-2	1
25	DOOR HANDLE	320157	1
26	FILTER	370188	2
27	DRAFT CONTROL	370190	1
28	GASKET, BURNER MOUNTING PLATE	330180	1

ITEM	PARTS DESCRIPTION	PART NO.	QTY.
29	BURNER MOUNTING PLATE	27801	1
30	PYREX SIGHT GLASS	330081	1
31	GASKET, SIGHT GLASS	330098	1
32	FILTER RACK, TOP PIECE	18151	1
33	FILTER RACK, SIDE PIECE	18149	2
34	FILTER RACK, MIDDLE PIECE	18150	1
35	CLEAN-OUT COVER ASSY W/GASKET	A0PS7684	1
36	GASKET, 4" CLEAN-OUT COVER	330009	1



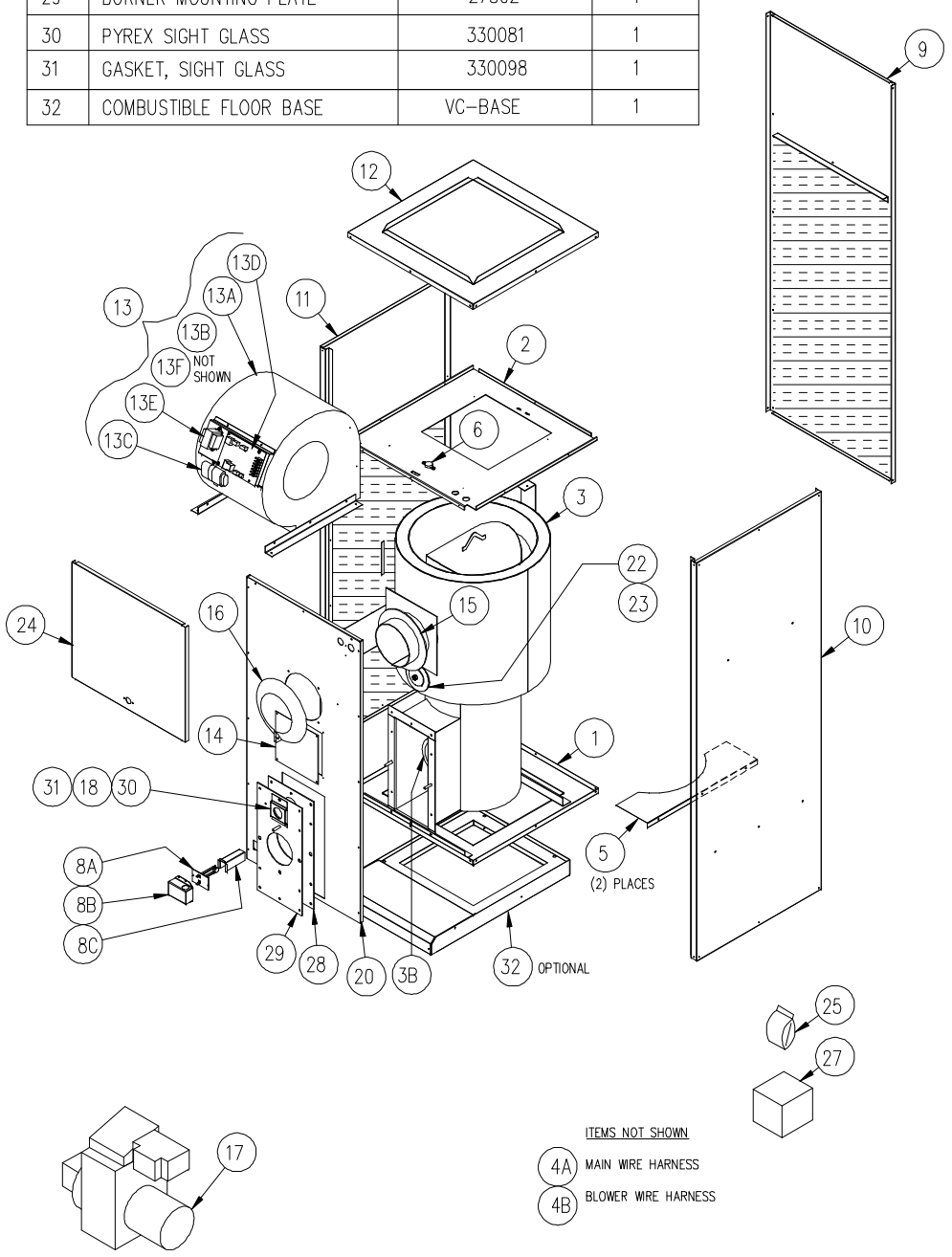
ITEM	PARTS DESCRIPTION	PART NO.	QTY.
1	BASE	28132	1
2	PANEL, REAR	617955-2	1
3	HEAT EXCHANGER	38135	1
3B	CHAMBER, REPLACEMENT	380698	1
4A	WIRE HARNESS, VESTIBULE	350267	1
4B	WIRE HARNESS, BLOWER	350269	1
5	PLENUM PIECE, TOP MIDDLE	618144-2	1
6	FILTER RACK, BOTTOM PIECE	18152	1
9	SEPARATOR PANEL, REAR	18143	1
10	SIDE CASING, RIGHT	628137-2	1
11	SIDE CASING, LEFT	628138-2	1
12	PANEL, TOP FRONT	617383-2	1
13	BLOWER SUB-ASSEMBLY	S00S4565	1
13A	BLOWER HOUSING w\ WHEEL	340080	1
13B	MOTOR w\ CAPACITOR	A0PS7653	1
13C	CAPACITOR	350077	1
13D	MOTOR BRACKET ASSY	A0PS7670	1
13E	BLOWER WHEEL	340083	1
14	PANEL, CLEAN-OUT ACCESS	17951	1
15	GASKET, FLUE COLLAR	330005	1
16	DRAW COLLAR	14131	2
17	CLEAN-OUT COVER ASSY W/GASKET	A0PS7684	1
18	GASKET, 4" CLEAN-OUT COVER	330009	1
19			
20	SEPARATOR PANEL	619143	1
20A	OIL FURNACE CONTROL	A0PS8380	1
20B	TRANSFORMER	350464	1
22	LIMIT BRACKET	19156	1
22A	LIMIT SWITCH	19154	1
22B	INSULATING BOOT	350036	1
23	DOOR, FRONT	617352-2	1
24	PANEL, BLOWER ACCESS	617954-2	1
25	DOOR HANDLE	320157	1
26	FILTER	370188	2
27	DRAFT CONTROL	370190	1
28	GASKET, BURNER MOUNTING PLATE	330180	1
29	BURNER MOUNTING PLATE	27801	1

ITEM	PARTS DESCRIPTION	PART NO.	QTY.
30	PYREX SIGHT GLASS	330081	1
31	GASKET, SIGHT GLASS	330098	1
32	FILTER RACK, TOP PIECE	18151	1
33	FILTER RACK, SIDE PIECE	18149	2
34	FILTER RACK, MIDDLE PIECE	18150	1
35	BURNER, BECKETT AFG EFL401	380832	1
	BURNER, CARLIN EZ-1HP	380665	1
36	SIGHT GLASS BRACKET	18185	1



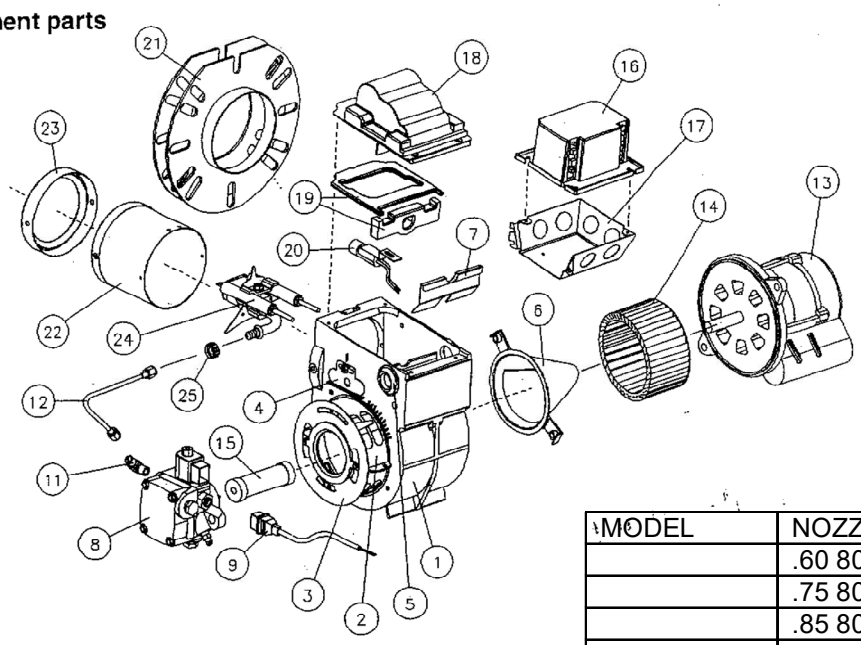
ITEM	PARTS DESCRIPTION	PART NO.	QTY.
1	END, WARM AIR	628180-2	1
2	BLOWER PAN	18156	1
3	HEAT EXCHANGER	37941	1
3B	CHAMBER, REPLACEMENT	380698	1
4A	WIRE HARNESS, MAIN	350265	1
4B	WIRE HARNESS, BLOWER	350266	1
5	BAFFLE, SIDE CASING	18161	2
6	AUX LIMIT SWITCH	350263	1
8A	LIMIT SWITCH	350264	1
8B	LIMIT COVER	19146	1
8C	LIMIT SHIELD	19144	1
9	CASING, BACK	628165-2	1
10	SIDE CASING, RIGHT BOTTOM	628160-2	1
11	SIDE CASING, LEFT TOP	628159-2	1
12	END, RETURN AIR	618180-2	1
13	BLOWER SUB-ASSEMBLY	S00S4206	1
13A	BLOWER HOUSING w\ WHEEL	340080	1
13B	MOTOR w\ CAPACITOR	AOPS7652	1
13C	CAPACITOR	350073	1
13D	OIL FURNACE CONTROL	AOPS8380	1
13E	TRANSFORMER	350464	1
13F	MOTOR BRACKET ASSY	AOPS7670	1
13G	BLOWER WHEEL	340083	1
14	PANEL, CLEAN-OUT	617944-1	1
15	GASKET, FLUE	330005	1
16	DRAW COLLAR	14131	1
17	BURNER, BECKETT AFG EFL401	380832	1
18	SIGHT GLASS BRACKET	18185	1
20	PANEL, FRONT	619136-9	1
22	CLEAN-OUT COVER ASSY W/GASKET	AOPS7684	1
23	GASKET, 4" CLEAN-OUT COVER	330009	1
24	DOOR, BLOWER ACCESS	618166-2	1
25	DOOR HANDLE PACKAGE	AOPS7578	1
27	DRAFT CONTROL	370190	1

ITEM	PARTS DESCRIPTION	PART NO.	QTY.
28	GASKET, BURNER MOUNTING PLATE	330180	1
29	BURNER MOUNTING PLATE	27802	1
30	PYREX SIGHT GLASS	330081	1
31	GASKET, SIGHT GLASS	330098	1
32	COMBUSTIBLE FLOOR BASE	VC-BASE	1



EFL 401 AFG BURNER PART# 380832

Replacement parts

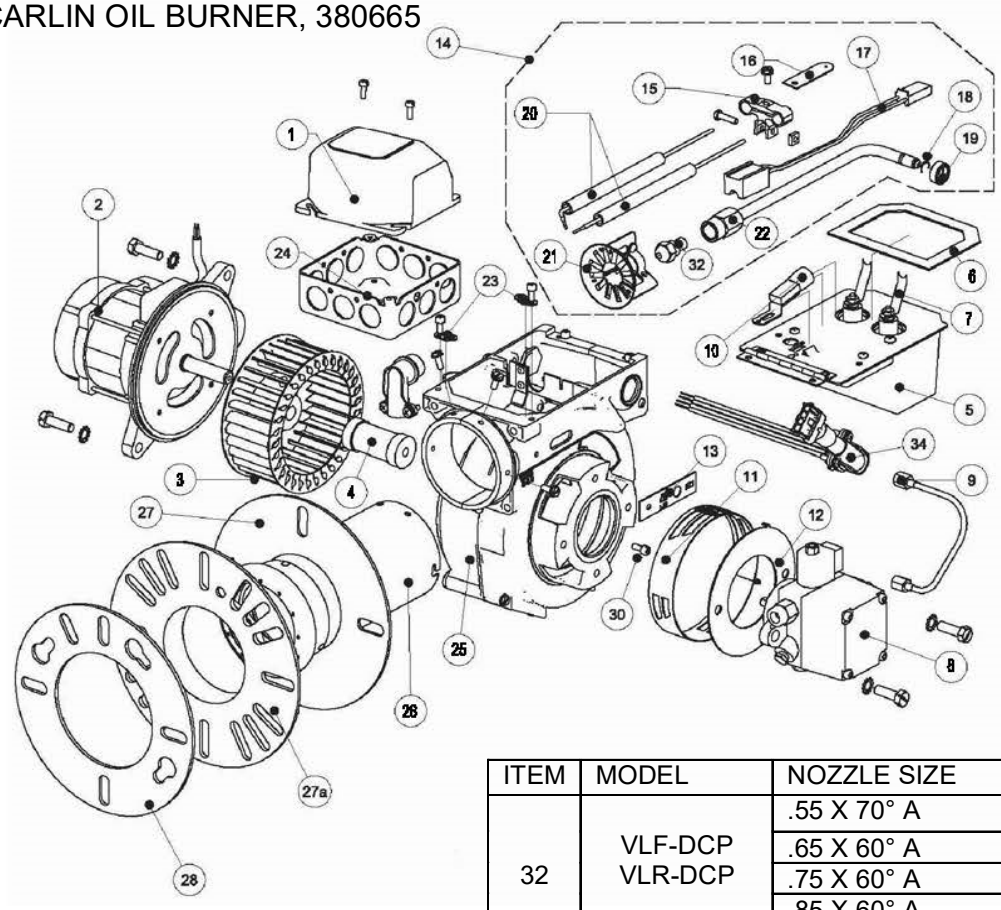


MODEL	NOZZLE SIZE	PART #
	.60 80° A	380398
	.75 80° A [1]	380366
	.85 80° A	380381
	1.0 80° A	380368

ITEM	DESCRIPTION	BECKETT PART #	TP PART #
1	BURNER HOUSING ASSY.	5874GY	
2	AIR BAND ASSY. 8 slot set @ 0	5151501	
3	AIR SHUTTER 4 SLOT set @ 7	3709U	380289
4	ESCUTCHEON PLATE	3493	
	SCREW		
5	HOLE PLUG		
6	AIR GUIDE	31231U	
7	LOW FIRING RATE BAFFLE	5880	
8	*PUMP 130 PSI	21844	380674
	*SOLENOID	21755	380654
9	VALVE CORD SET	21807	380653
11	PUMP ELBOW	2256	320815
12	CONNECTION TUBE	5394	380107
13	*MOTOR 1/7 HP 3450 RPM	21805E	380644
14	BLOWER WHEEL 4 ¼ X 2 7/16 TAB	2999	380271
15	*COUPLING	2454	380241
16	*PRIMARY CONTROL	7505B1500	350431
17	ELECTRICAL BOX	3741	
18	*IGNITER W/ GASKETS	51771U	380645
19	IGNITER GASKET KIT		
20	*CAD CELL w/ Socket C554A1919	7006Q	350104
21	FLANGE	3634BK	380265
	GASKET	3616	380270
22	AIR TUBE COMBINATION	AF57XNSS	380690
	BLAST TUBE ONLY		
23	HEAD F3	360003	380260
24	ELECTRODE NOZZLE ASSY		
	*ELECTRODES PAIR	5780	380269
	STATIC PLATE, 2 ¾ U	3383	380330
25	SPLINED NUT(BULKHEAD NUT)	3666	320121
	BULK HEAD FITTING	3488	320120

[1] NOZZLE SHIPPED INSTALLED IN BURNER

99032 EZ1 CARLIN OIL BURNER, 380665



ITEM	MODEL	NOZZLE SIZE	PART #
32	VLF-DCP VLR-DCP	.55 X 70° A	380861
		.65 X 60° A	380862
		.75 X 60° A	380395
		.85 X 60° A	380400

ITEM	DESCRIPTION	CARLIN PART #	TP PART #
1	PRIMARY W/ DISPLAY 70200 15 S PRE / 0 S POST	70200S	380845
2	1/6HP PSC MOTOR	98022S	380846
3	BLOWER WHEEL / FAN	77933S	380847
4	PUMP COUPLING	75564S	380848
5	IGNITOR	41000S	380849
6	IGNITOR BASEPLATE GASKET	40167S	
7	IGNITOR TERMINAL KIT (2 TERM. & NUTS)	24463	
8	PUMP W/SOLENOID 140 PSI	98750S	380850
	SOLENOID		380851
	PUMP ELBOW 3/16 FLARE X 1/8 NPT	29926	
9	CONNECTION TUBE	34470	380852
10	CAD CELL KIT	14407SES	380853
11 & 12	AIR BAND/AIR SHUTTER KIT @ .6	98055S	
13 & 30	HEADER BAR KIT (7 BARS & SCREW)	98055S	
	0.60/0.65 INSTALLED, W/ BURNER 0.50, 0.75, 0.85, 1.00		
14	COMBUSTION HEAD ASSY 7”	77966NOHTR	380863
15	ELECTRODE BRACKET	23135	
18 & 19	C RING & THUMB NUT KIT	50624S	
20	ELECTRODE WIRE SET	82776	380864
21	RETENTION RING ASSY	77438S	380856
22	NOZZLE LINE ADAPTER ASSEMBLY	56861	
23	IGNITOR HOLD-DOWN TABS (2 Req.)	44842	
24	ELECTRICAL BOX	44586	
25	HOUSING	50685A	
26	AIR TUBE W/FLANGE	98625	380865
27	FLANGE	N/A	
28	FLANGE GASKET	40204	380866