

# Total Indoor Comfort

## INSTALLATION INSTRUCTIONS

### OIL FIRED CENTRAL FURNACE

DIRECT, BELT DRIVE			NORDYNE MODEL
MODEL	REAR FLUE	FRONT FLUE	
LOW BOY	R164-10A	T164-10A	03LD
DOWN FLOW	—	T165-10A	03ED
UP FLOW	—	T167-10A	03HD

### CAUTION

Read all instructions carefully before starting the installation.

**WARNING:** IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE INJURY OR PROPERTY DAMAGE. FOR ASSISTANCE OR ADDITIONAL INFORMATION CONSULT A QUALIFIED HEATING PROFESSIONAL

SAVE THIS MANUAL FOR FUTURE REFERENCE

### FOR YOUR SAFETY

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

# **NOTICE TO THE** **INSTALLER**

INSTALLATION OF THIS OIL FURNACE AND OIL-BURNER MUST BE DONE BY A QUALIFIED INSTALLER IN ACCORDANCE WITH REGULATIONS OF THE NATIONAL FIRE PROTECTION STANDARD FOR OIL-BURNING EQUIPMENT, NFPA NO.31, AND IN COMPLETE ACCORDANCE WITH ALL LOCAL CODES AND AUTHORITIES HAVING JURISDICTION.

A QUALIFIED INSTALLER IS AN INDIVIDUAL OR AGENCY WHO IS RESPONSIBLE FOR THE INSTALLATION AND ADJUSTMENT OF THE EQUIPMENT AND WHO IS PROPERLY **LICENSED** AND **EXPERIENCED** TO INSTALL OIL-BURNING EQUIPMENT IN ACCORDANCE WITH ALL CODES AND ORDINANCES.

A properly designed chimney of adequate size and height and adequate combustion air supply are essentials for the proper operation of any heating plant.

When installing the furnace and/or burner be sure to provide adequate space for easy service and maintenance.

RE-CHECK ALIGNMENT OF THE COMBUSTION CHAMBER AND OIL BURNER BEFORE FIRING AS IT IS POSSIBLE FOR THE COMBUSTION CHAMBER TO SHIFT IF THERE HAS BEEN ROUGH HANDLING WHILE IN TRANSIT.

For the safe, efficient and proper operation of this appliance be sure to follow the instruction procedures for both the furnace and oil burner. Furthermore, annual furnace inspection and service is required for safe and proper operation.

The oil burner provided requires **inspection, set-up and proper adjustment.** (See manual).

Burner **must** be adjusted with combustion instruments.

<p><b>CAUTION: VENTILATE HOUSE WHILE OPERATING FURNACE FOR THE FIRST TIME.</b></p>
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## REPORT DAMAGE IMMEDIATELY

In case of damage to this unit please IMMEDIATELY request the TRANSPORTATION COMPANY to inspect this unit and issue a CONCEALED DAMAGE REPORT. The CLAIM for such damage should be filed by you.

It is absolutely necessary that a Concealed Damage report be obtained. If this is not done, we cannot assist you in recovering your claim against the transportation company.

## MATERIAL AND WORKMANSHIP

We have endeavored to build this unit with the highest quality material and workmanship. However, inspect unit thoroughly for any possible defects.

In case of defective material or workmanship in this unit, report the MODEL AND SERIAL NUMBER, which is stamped on the RATING PLATE.

## PACKAGING

This assembled furnace is in one carton.

## WARNING

The manufacturer of this equipment will not be liable for any damage resulting from changes made in the field to the furnace or components thereof or improper installation. Any such changes **VOID** the warranty and places the liability on the ones who make the change.

## WARRANTIES

Make certain you return the warranty card(s). These must be on file to verify installation dates for replacement of warranted part(s).

## CODES

All local codes and/or regulations take precedence over the instructions in this manual and should be followed accordingly. In the absence of local codes, this installation must conform with these instructions, regulations of the National Fire Protection Association and the National Electrical Code (ANSI/NFPA 70).

## LOCATION

This unit should be located near the chimney or flue and should be as centralized with respect to the air distribution system as is possible.

Air openings in the casing front should not be obstructed since they supply air to the combustion chamber.

Return air grilles and supply air registers should not be obstructed. When the unit is installed in a small room, and no return air ducts are used, the return openings to the unit should extend full size to a location outside the furnace room. When air supply from the room or nearby area is inadequate for combustion, an opening in the outside wall must be provided and furnished with properly screened metal sleeves.

## AIR FOR COMBUSTION & VENTILATION

Chloride, fluoride, iodide and bromide bearing compounds, when present in certain concentrations in air supplied for combustion to the furnace, can result in an accelerated and severe corrosion condition in the heat exchanger and/or venting systems. This condition can occur with less efficient furnaces but is more likely to happen on furnaces with efficiencies of 80% or greater.

The most common chemicals found in the household are chloride bearing compounds. There are many compounds representative of this classification of chemicals. Shown below are just a few examples.

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

Avoid installing the furnace in areas where it is evident that these chemicals are being stored or using these chemicals in the vicinity of the furnace. Further advise that if in doubt as to the chemical nature of the compound to avoid storing or using in the proximity of the furnace. If it is necessary to store or use these compounds in the same space as the furnace, all containers should be sealed when not in use, or, if possible, also keep chemicals in a space closed off with a door.

The unit shall be installed in a location in which the facilities for ventilation permit satisfactory combustion and proper venting under normal condition of use while all forms of building construction cannot be covered in detail, this requirement may usually be met by application of one of the following methods in ordinary building construction. Local codes take precedence and must be followed, if available.

### 1. Utility Room

- a. In buildings of unusually tight construction, such as those where weather stripping and storm sash windows are used, an opening connecting to a well ventilated crawl space, attic or with the outdoors shall have a minimum free area of one (1) sq. inch per 1000 B.T.U. per hour of the total input rating of all appliances to be installed in the BUILDING, and should preferably be located near the floor.

### 2. Full Basement

- a. Where a furnace is installed in a full basement, infiltration is normally adequate to provide air for combustion.

- 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 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) sq. inch per 1000 B.T.U. per hour of the total input rating of all appliances to be installed in the basement.

### STANDARD CLEARANCES (LOW-BOY UNITS ONLY)

These Low-Boy Furnaces are approved for installation at Standard Clearances.

Standard Clearances are those clearances to combustible construction which must be complied with for the installation of these furnaces. Accessibility clearances must take precedence over fire protection clearances. These clearances are:

6"	From casing sides and rear
Alcove	From front of unit
18"	From flue pipe
2"	Above plenum
6"	From sides of plenum
2"	Above supply air ducts within 6 ft. of furnace

Though these are approved clearances for these furnaces. (T164 and R164 Series) space must be provided on one side (18 inches minimum) and in the rear for access to and for service or replacement of the Filters, Blower and Motor.

In a utility room installation, the door must be wide enough to allow the largest part of the furnace to enter or to permit the replacement of another appliance, such as a Water Heater.

### CLOSET AND/OR ALCOVE INSTALLATION

Hi-Boy and Counter-Flow furnaces may be installed in a closet or alcove with clearances to combustible construction. See chart in this instruction.

For minimum clearances to combustible construction for Hi-Boy and Counter-Flow furnaces see chart in this instruction.

### FLUE CONNECTION

Horizontal portions of the venting system must be supported at least every five feet with metal straps to prevent sagging.

All horizontal sections of the vent connection must slope upwards not less than 1/4 inch per foot from the furnace to the vent termination.

### CHECK YOUR CHIMNEY

This is a very important part of your heating system. No

furnace, however efficient its design, can perform satisfactorily if the chimney that serves it is inadequate. Check your chimney to make certain that it is the right size, properly constructed and in sound condition.

The chimney should be cleaned before installing the furnace. Any accumulation of dirt at the bottom of the chimney should be removed. Vent piping must not be inserted beyond the inside wall of the chimney flue. Do not install a manual damper in the vent pipe. If a motorized vent damper is to be installed, refer to the installation instructions included with the damper.

### THERMAL TYPE VENT DAMPERS ARE NOT RECOMMENDED FOR USE ON THESE FURNACES.

Install the barometric regulator at least two feet from the outlet of the furnaces, preferably in the highest part of the flue pipe near the chimney.

### FURNACE LIMIT AND BLOWER CONTROLS

The furnace is supplied with a limit and blower control. The limit control has a setting which will not permit a discharge air temperature above 200°F.

The blower control should be set so that the greatest efficiency of the furnace is obtained. We have found that a blower "ON" setting of 120°F generally gives the best results. After the burner shuts down, the blower will stay on until the temperature inside the cabinet falls below the lower setting on the fan control. If a longer cool down period is desired, the fan control may be set to give any length of cycle desired.

On the Counterflow furnaces only, an auxiliary limit control is provided to prevent the blower motor and filters from becoming overheated. Often times the filters become clogged with dirt, a motor fails, or the blower belt breaks, which tends to cause excessive heat in the blower compartment. Should the furnace become inoperative, it is necessary to remove the Blower and Filter access Door to examine for any of the above mentioned failures. After the correction has been made normal operation will ensue. Be sure to replace Blower and Filter Access Door.

### EXTERNAL STATIC PRESSURE

All furnaces are tested for a specific external static pressure which is the resistance of duct, fittings and diffusers external to the furnace. The normal external static pressure on which motors, blowers and pulleys are sized for the average application is as follows:

External Static Pressure (inches Water Column)	Input to Furnace (BTU per hour)
0.12	80,000 and under
0.15	Over 80,000 to 100,000
0.20	Over 100,000 to 200,000

The adjustable pulley on blower motors can vary these amounts to produce the proper air rise through the furnace at the above system static pressure.

### **BLOWER SPEED & AIR TEMPERATURE**

This installation shall be adjusted to obtain an air temperature rise of between 70°-100°F which is the design certified operating rise for this furnace series. Since there are different resistance's in each duct system, we recommend using a thermometer in the return air duct and another thermometer in the supply duct 12 inches from the warm air plenum. After furnace has been firing continually for at least 20 minutes, the temperature difference between the readings of the two thermometers should not exceed 100°F nor be less than 70°F. A midway point of 85°F is considered best.

If it is impossible to insert thermometers in the return and supply duct, as in some Counter-Flow furnace installations, the air at the face of the closest warm air register when measured by a thermometer should not exceed 135°F.

Adjust the motor pulley by opening the sheave to increase air temperature or close the sheave to decrease air temperature. The sheave or pulley can be opened or closed by loosening the allen set screw turning the outer portion of the pulley one turn, and then re-tightening the set screw on the flat of the pulley shaft.

### **THERMOSTAT**

The room thermostat should be located in the natural circulating path of room air. The thermostat should not be placed so that it is exposed to cold air infiltration, drafts from outside openings such as windows and doors, air currents from supply or return air registers, or so that the natural circulation of the air is cut off such as behind doors, in shelves, or in corners. It should be located on an interior wall.

The thermostat should not be exposed to heat from a nearby fireplace, radio, television set, lamps, rays of the sun, or mounted on a wall containing warm air ducts, or a chimney or gas vent, which affect its operation and prevent it from properly controlling the room temperature.

Most thermostats are equipped with "adjustable heat anticipation." Check the AMP draw of the oil burner primary safety control (usually marked inside the cover of the control). Set the thermostat heat anticipator to match the AMP draw of the oil burner primary safety control.

### **COMBUSTION CHAMBER**

The Combustion Chamber is circular and made of a light weight insulating refractory. This refractory is composed of Alumina Silica Fibers which provide for quieter operation

and improved efficiency due to a faster heat up time.

### **OIL BURNER AND ACCESSORY INFORMATION**

The refractory type Combustion Chamber, Oil Burner and Nozzle are installed at the factory. Run the oil supply line from the oil tank to the burner. We recommend installation of a Filter in the oil line.

Refer to the "Oil Burner Operating instructions" for information on the following:

- Oil Storage Tank
- Air Supply
- Starting of Burner
- Adjustment of Burner
- Fuel Pump
- Setting Draft Control

### **ELECTRICAL**

(Refer to sketches and wiring diagrams in this instruction)

Since this furnace is entirely pre-wired by the factory, it is only necessary to connect the House Service Lines to the Junction Box in the Furnace Vestibule. We recommend a 15 AMP fused switch be installed in the Service Line for shutting down and protecting the furnace. The Service Line to the furnace should be a NO. 12 Ga. Type R wire or equivalent.

All wiring must conform to Local, State and National Codes.

### **BURNER OPERATION**

Turn the main electrical switch to the "OFF" position. Set the room thermostat above the room temperature. Be sure the oil tank is full. Open all valves in the oil line. Open the inspection door above the burner. Turn on the electrical switch and prime the oil pump according to the pump manufacturers recommendations. Check the oil pump pressure.

**CAUTION.** Do not run the pump dry for more than two (2) minutes.

When ignition is established make a temporary air adjustment for a clean smoke free flame. Close the inspection door above the burner. At this point the final burner adjustment should be made using test instruments to measure draft, smoke, carbon dioxide (CO<sub>2</sub>) and stack temperature. In order to achieve the most ideal combustion efficiency the following procedure must be followed:

- 1.) Draft - Draft readings should be taken over the fire (through the hole in the inspection door) and in the flue pipe not more than 12 inches away from the

furnace flue outlet. The over fire draft should be -.01" to -.02". Water Column Pressure and the flue draft should be -.02" to -.04" Water Column Pressure. The overfire draft reading takes precedence over the flue draft reading when adjusting the barometric draft control.

- 2.) Smoke - A smoke sample should be taken in the same opening that the flue draft was taken. If the first reading is "0", close burner air shutter until a NO. 1 smoke reading is obtained. Open the air shutter just enough to obtain a "0" smoke reading. Tighten the air shutter in position.
- 3.) Carbon Dioxide (CO 2) - In order to assure that proper combustion is taking place a CO 2 reading must be taken. A reading of from 10% to 12.0% is considered normal.

While CO 2 settings in excess of 12.0% may be attainable they are not recommended. Excessive CO 2 readings can lead to Oil Burner choke or end cone problems.

- 4.) Flue Gas Temperature - The flue gas temperature will vary with BTU inputs, duct design and air flow across the Heat Exchanger. The net stack temperature should not be below 350°F. A net stack temperature below 350°F could result in condensation in the flue pipe.

### **IMPORTANT:**

The oil Burner MUST be set-up and adjusted with calibrated combustion instruments by a qualified oil heat professional prior to operation. (See Oil Burner Manual.)

## -TROUBLE SHOOTING-

Before beginning these trouble shooting procedures **ALWAYS** review these basic points:

- 1.) Check 115 volt supply to furnace. If there is no supply voltage, check fuses and service switch. **CAUTION:** When testing electrical equipment, always follow standard electrical safety procedures.
- 2.) Make sure thermostat is calling for burner operation.
- 3.) Check oil supply and make sure all valves are open.
- 4.) To successfully service the oil furnace you must have these instruments:
  - A.) A smoke tester
  - B.) A carbon-dioxide (CO<sub>2</sub>) or oxygen (O<sub>2</sub>) analyzer
  - C.) A flue stack temperature measuring device
  - D.) A draft gauge. Scale should read from (-) .01" WC to (-) .25" WC
  - E.) A volt/OHM/milliamper multimeter
  - F.) A pressure gauge capable of reading 0-150 lbs./sq. inch. (For oil only)
- 5.) Be familiar with these instruments as well as the burner manufacturers recommended settings.

SYMPTOM (BURNER)	ITEMS TO CHECK
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|---------------------------------|---|
| A.) Burner motor does not start | <ol style="list-style-type: none"> <li>1.) Check fuses and make sure service switch is on.</li> <li>2.) Check for line voltage into furnace junction box.</li> <li>3.) Make sure the thermostat is calling for heat and that the wiring to the thermostat is correct.</li> <li>4.) Check for voltage from primary relay to burner motor. Make sure the primary relay has not locked out on safety.</li> </ol> |
|---------------------------------|---|

- |  |   |
|--|---|
| B.) Burner short cycles or locks out on primary relay safety | <ol style="list-style-type: none"> <li>1.) If the primary relay control is not popping out the reset button measure the milliamperage at the thermostat and set the heat-anticipator accordingly. Also check wiring from the thermostat to the burner.</li> <li>2.) Check the alignment of the cad cell to assure it is aimed at the fire.</li> <li>3.) Check nozzle and electrode position. (Reference burner manufacturers instructions).</li> <li>4.) Check ignition transformer output (9,000 Volts/AC minimum).</li> </ol> |
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|---|--|
| C.) Unable to achieve clean combustion by setting air adjustments | <ol style="list-style-type: none"> <li>1.) Check tube insertion and alignment.</li> <li>2.) Check nozzle and electrode position. (Reference burner manufacturers instructions).</li> <li>3.) Replace nozzle.</li> <li>4.) Check pump pressure. (Should be 100-120 PSI)</li> <li>5.) Check overfire draft.</li> </ol> |
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SYMPTOM (FURNACE BLOWER)	ITEMS TO CHECK
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|-----------------------------------|---|
| A.) Furnace blower will not start | <ol style="list-style-type: none"> <li>1.) Check belt and pulleys.</li> <li>2.) Check for 115V to the blower motor. If present, replace motor.</li> <li>3.) Check wiring from Fan &amp; Limit control. See if blower motor will run when it is switched on manually at the thermostat sub-base. (If sub base is installed)</li> </ol> |
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|---|--|
| B.) Blower cycles on and off after the burner has shut down | <ol style="list-style-type: none"> <li>1.) Adjust fan "off" setting. The fan "off" setting should be 30 degrees below the fan "on" setting.</li> </ol> |
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## CAD CELL CHECKOUT PROCEDURE

To check CAD Cell operation, use the following procedure:

- 1.) Remove CAD CELL leadwires from the f-f terminals on the primary safety control, then start burner. Shortly after burner starts, place a temporary jumper between terminals f-f. Connect ohmmeter across CAD CELL leadwires - resistance should be under 1600 ohms.
- 2.) Stop burner and remove temporary jumper.
- 3.) With burner off, check dark cell resistance across CAD CELL leadwires. Resistance should be greater than 20,000 ohms. If cell resistance's are different from above, recheck wiring and location of cell, etc. If necessary, replace plug-in portion of cell.

## MAINTENANCE INSTRUCTIONS

If your furnace is equipped with a disposable type filter(s), Check them every month for dirt. Replace them at least once a year. The filter size is marked on the edge of the filter. Make certain that the replacement filter is the same size as the one being replaced.

### OIL BURNER:

The oil burner on this furnace MUST be checked, cleaned and serviced at least once a year by a qualified oil heat technician. (See separate oil burner installation manual).

**BLOWER AND MOTOR:** Each time the filters are cleaned, the blower and motor should be checked. Make certain the blower and motor pulleys are in good condition. Follow the motor manufacturer's oiling instructions, otherwise oil annually with 3 drops of S.A.E. #10 oil. Do not over oil as this can be as harmful as no lubrication.

**HEAT EXCHANGER:** The heat exchanger and burner MUST be cleaned at least once each year. With a mirror inserted through the inspection door opening above the burner, you can determine if any soot has collected on the inside of the cylindrical primary heat exchanger surface. If this requires cleaning it may be done as follows:

Remove the burner and burner mounting plate. Using a brush on a flexible handle loosen any soot on the inside of the heat exchanger. Remove any soot with a vacuum.

**CAUTION:** Use care in cleaning to avoid damage to the combustion chamber.

### FLUE AND CHIMNEY:

Thoroughly inspect the flue, flue connections and chimney regularly for safe and proper furnace operation.

## R-164 SERIES

To clean the wrap around radiator, remove the front clean out cover to expose the front clean out plate. Remove the front clean out plate by removing the six (6) NO. 14 sheet metal screws that hold the front clean out plate to the radiator. Use caution not to damage the gasket between the front clean out plate and the radiator flange. If the gasket is damaged it must be replaced.

## T164,T165,T167, SERIES

To clean the wrap around radiator, disconnect the vent pipe and remove the flue collector box exposing the flue outlet of the radiator.

With a long flexible handled brush and vacuum loosen and remove any soot from the radiator.

## FAN & LIMIT CONTROL

If the Fan and Limit Control is faulty, it can be replaced, but make certain it is the same make and model and has the same temperature cut-out setting. (See the parts list at the rear of this instruction.)

BEFORE LEAVING THE JOB, THE INSTALLER SHOULD SHOW THE HOME OWNER WHERE THE INSTRUCTIONS ARE KEPT, AND THEN EXPLAIN:

- 1.) How to remove, clean and replace the filter.
  - 2.) How to operate the Blower and Oil Burner.
  - 3.) How to oil the Blower Motor and Oil Burner Motor per the manufacturers instructions otherwise annually with S.A.E. #10 oil.
  - 4.) How to operate the Room Thermostat.
  - 5.) How and when to operate the "SAFETY" Button on the Oil Burner Primary Safety Control.
- WARNING:** Repeated operation of the "SAFETY" button can cause a build up of oil in the combustion chamber and must be avoided. If the burner does not operate properly after resetting the "SAFETY" button two (2) times, turn off the electric power to the furnace and call your service company.
- 6.) Explain the general operation of the furnace.

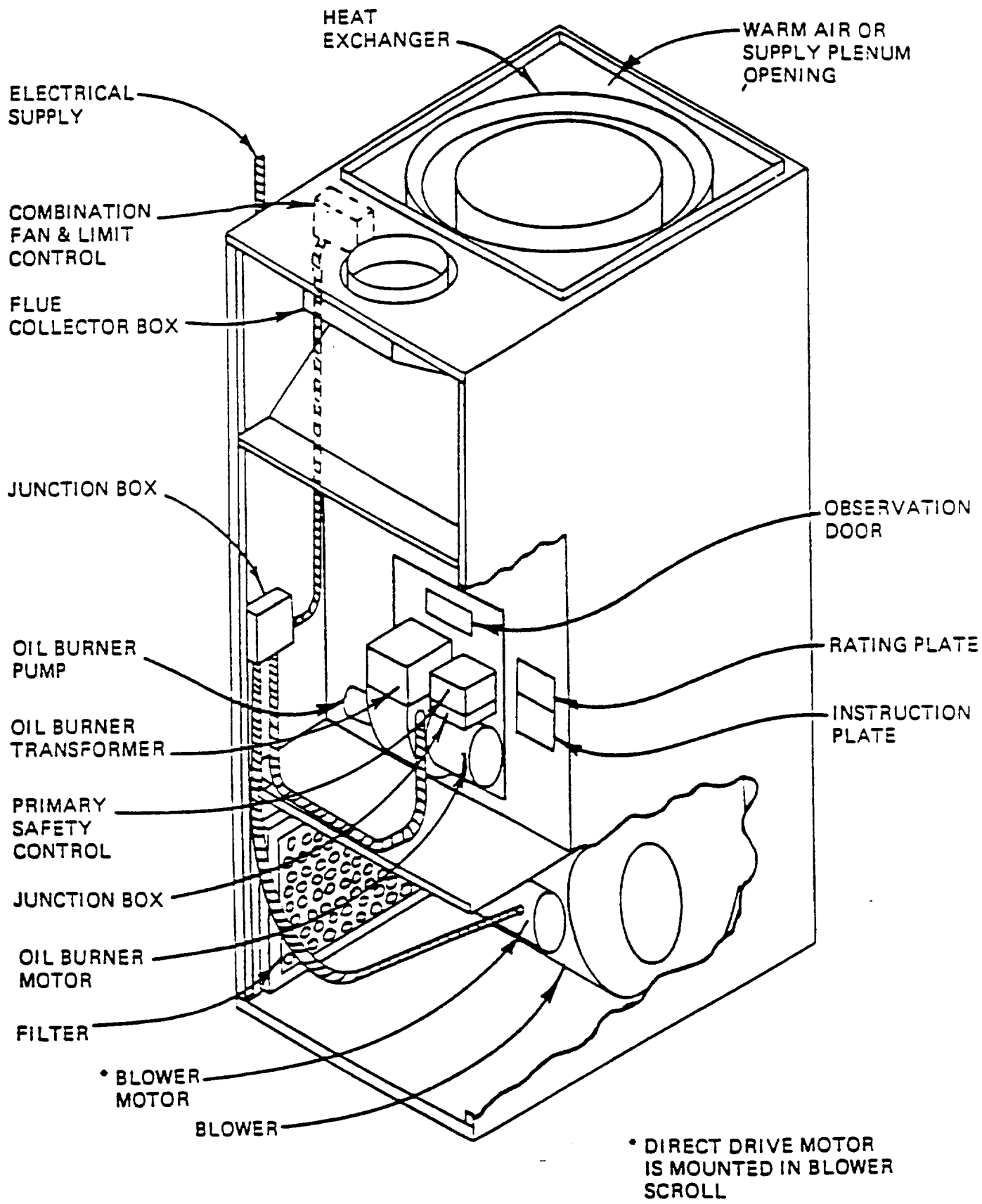


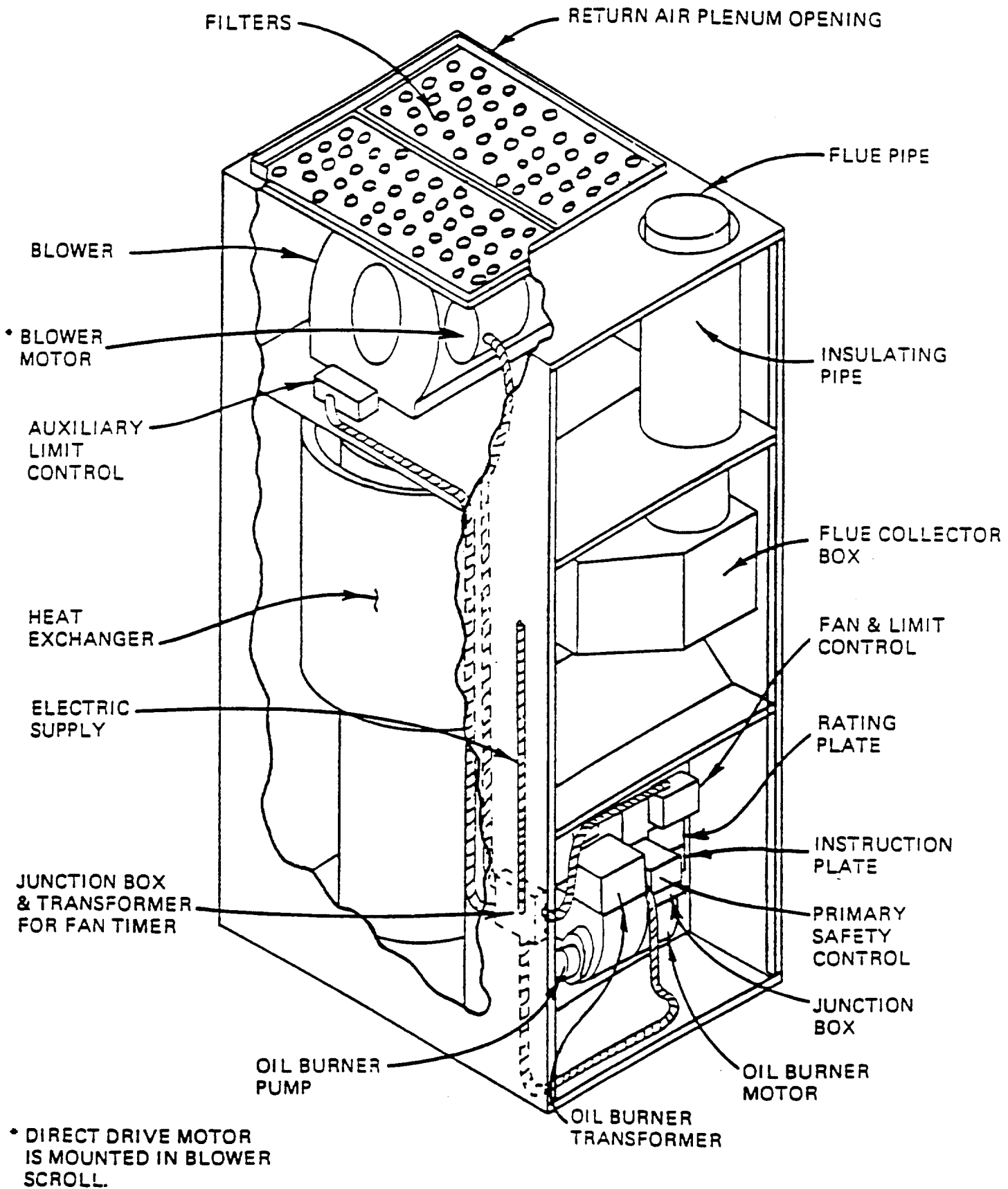
## MINIMUM CLEARANCES TO COMBUSTIBLE SURFACES AND COMBUSTION AIR FOR FURNACES

FURNACE MODEL NUMBER	COUNTER FLOW T165-10A	HI-BOY T167-10A
Ceiling to top of Plenum	2"	2"
Ad Top of Horizontal W.A. Duct within 6 ft. of furnace	2"	2"
From front of furnace	Alcove	Alcove
Flue Pipe to Wall	9"	9"
Flue Pipe to Ceiling	<sup>1</sup> 18"	18"
From rear of furnace	6"	6"
Left side of furnace	6"	6"
Right side of furnace	<sup>1</sup> 6"	6"
From any side of W.A. plenum	2"	2"
Furnace to Non-Combustible floor	0	0
Furnace to Combustible floor	<sup>2</sup> 12"	0
Minimum width air openings in door	24"	24"
Minimum height air openings in door	12"	12"
Width of combustible floor openings	20-1/2"	
Length of combustible floor openings	23"	
Width of Plenum for combustible floor	18"	
Length of Plenum for combustible floor	20-1/2"	

### T165-10 SUB-BASE

- 1.) May be reduced if a protective shield is installed on the combustible surface opposite the flue pipe. This shield must be made of 1/4 in. millboard spaced 1 in. from closet wall and extend so that no part of the exposed wall is within 9 in. of the flue pipe.
- 2.) When factory produced and approved "Base for Combustible Floor" is used, this clearance may be reduced to 2 in.. The height of "Base for Combustible Floors" is 2-1/4 in..

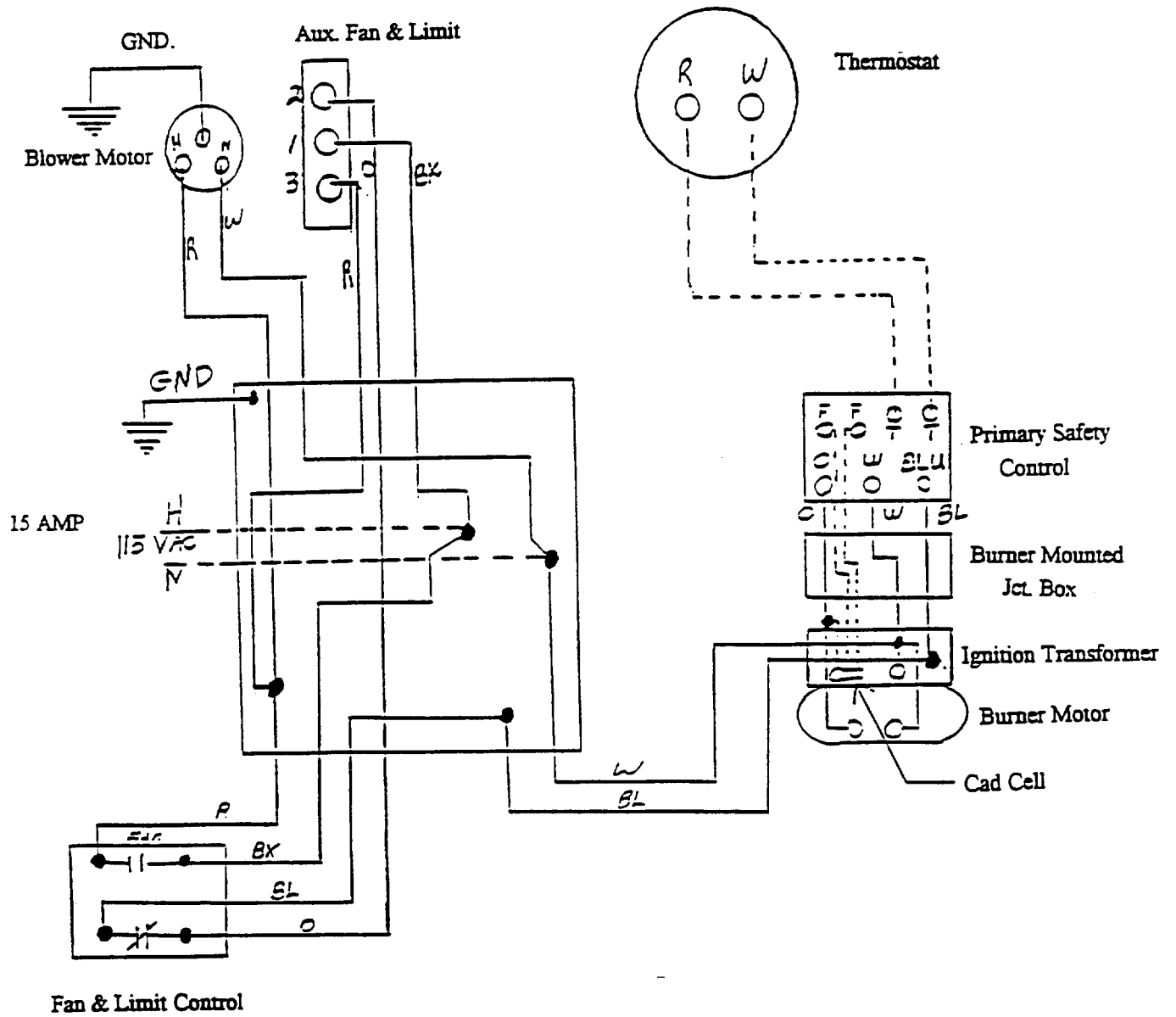




T165

COUNTER-FLOW FURNACE

# WIRING DIAGRAM T165 SERIES OIL FURNACE BELT DRIVE



# WIRING DIAGRAM T165 SERIES OIL FURNACE DIRECT DRIVE

