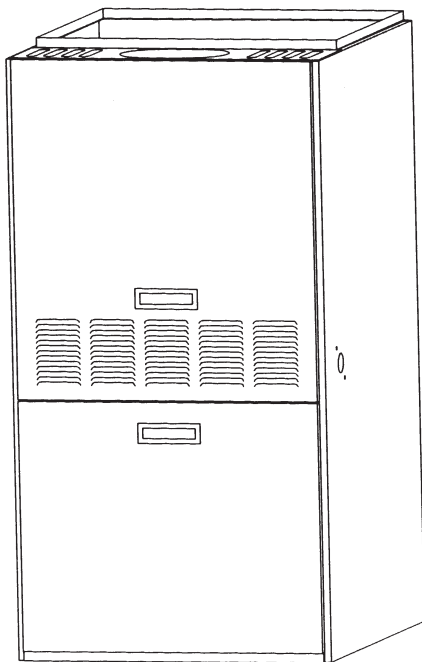


# INSTALLATION INSTRUCTIONS FOR UPFLOW OIL FIRED FURNACES



Recognize this symbol as an indication of Important Safety Information!

## ▲ WARNING

If the information in these instructions is not followed exactly, a fire or explosion may result, causing property damage, personal injury or death.

## ▲ WARNING

**PROPOSITION 65: THIS FURNACE CONTAINS FIBERGLASS INSULATION. RESPIRABLE PARTICLES OF FIBERGLASS ARE KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER. EXHAUST GAS FROM THIS FURNACE CONTAINS CHEMICALS, INCLUDING CARBON MONOXIDE, KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.**

## ▲ WARNING

THESE INSTRUCTIONS ARE INTENDED AS AN AID TO QUALIFIED SERVICE PERSONNEL FOR PROPER INSTALLATION, ADJUSTMENT AND OPERATION OF THIS UNIT. READ THESE INSTRUCTIONS THOROUGHLY BEFORE ATTEMPTING INSTALLATION OR OPERATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN IMPROPER INSTALLATION, ADJUSTMENT, SERVICE OR MAINTENANCE, POSSIBLY RESULTING IN FIRE, ELECTRICAL SHOCK, CARBON MONOXIDE POISONING, EXPLOSION, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.

**Do Not Destroy this Manual. Please read carefully and keep in a safe place for future reference by a serviceman.**

## ▲ FOR YOUR SAFETY

- Do not store or use gasoline or other flammable vapors and liquids, or other combustible materials in the vicinity of this or any other appliance.
- WHAT TO DO IF YOU SMELL FUEL OIL VAPORS
  - Do not try to light any appliance.
  - Do not touch any electrical switch; do not use any phone in your building.
  - Immediately call your fuel oil supplier from a neighbor's phone. Follow the fuel oil supplier's instructions.
  - If you cannot reach your fuel oil supplier, call the fire department.
  - Do not return to your home until authorized by the fuel oil supplier or fire department.
- DO NOT RELY ON SMELL ALONE TO DETECT LEAKS. DUE TO VARIOUS FACTORS, YOU MAY NOT BE ABLE TO SMELL FUEL GASES.
  - U.L. recognized fuel gas and CO detectors are recommended in all applications, and their installation should be in accordance with the manufacturer's recommendations and/or local laws, rules, regulations, or customs
- Improper installation, adjustment, alteration, service or maintenance can cause injury, property damage or death. Refer to this manual. Installation and service must be performed by a qualified installer, service agency or the fuel oil supplier.



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for Certification



ABS Quality Evaluations, Inc.  
★ Quality Assurance Certification ★



REGISTRAR  
ACCREDITATION  
BOARD

ISO 9002





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➤ Installation Instructions are updated on a regular basis. This is done as product changes occur or if new information becomes available. In this publication, an arrow (➤) denotes changes from the previous edition or additional new material.

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**IMPORTANT:** TO ENSURE PROPER INSTALLATION AND OPERATION OF THIS PRODUCT, COMPLETELY READ ALL INSTRUCTIONS PRIOR TO ATTEMPTING TO ASSEMBLE, INSTALL, OPERATE, MAINTAIN OR REPAIR THIS PRODUCT. ADDITIONALLY, UPON UNPACKING OF FURNACE, INSPECT ALL PARTS FOR DAMAGE PRIOR TO INSTALLATION AND START UP.

---

**INSTALLER: HANG THESE INSTRUCTIONS  
ADJACENT TO FURNACE**

**HOMEOWNER: KEEP THESE INSTRUCTIONS  
FOR FUTURE REFERENCE**

# SAFETY RULES

1. Do not install this furnace in a mobile home, trailer or recreational vehicle.
2. Keep area around furnace free and clear of combustible materials including gasoline and other flammable vapors and liquids.
3. Do not use furnace area for storage purposes or as a broom closet.

## ▲ WARNING

**THIS FURNACE IS DESIGN CERTIFIED TO OPERATE ON #2**

**FUEL OIL. DO NOT ATTEMPT TO CONVERT THIS FURNACE TO BURN NATURAL GAS OR LP GAS. FAILURE TO FOLLOW THIS WARNING CAN CAUSE A FIRE OR EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

4. This furnace must be vented through a good chimney to carry combustion products outdoors as described under the VENTING INSTALLATION section of this manual.

5. Provide adequate ventilation to the furnace area.
6. Make sure supply and return air ducts are sealed to the furnace casing. These ducts must be entirely separated from area supplying combustion and ventilation air.
7. Disconnect electrical power before servicing appliance.

# LOCATION REQUIREMENTS AND CONSIDERATIONS

## HELPFUL INFORMATION

The following national standards will help you in making this installation. Current editions of these standards should be obtained from:

American National Standards Institute  
1430 Broadway  
New York, NY 10018

National Electric Code  
ANSI/NFPA No. 70

National Fire Protection Association,  
Inc.  
Batterymarch Park  
Quincy, MA 02269

Installation of Oil Burning  
Equipment  
NFPA No. 31

Installation of Air Conditioning and  
Ventilating Systems  
NFPA No. 90A

Warm Air Heating and Air  
Conditioning Systems  
NFPA No. 90B

Standard for Chimneys, Fireplaces,  
Vents, and Solid Fuel-Burning  
Appliances NFPA No. 211

# INSTALLATION INSTRUCTIONS

## REQUIREMENTS

## ▲ WARNING

**IMPROPER INSTALLATION, ADJUSTMENT, ALTERATION, SERVICE OR MAINTENANCE CAN CAUSE PROPERTY DAMAGE, INJURY OR DEATH. CONSULT A QUALIFIED INSTALLER OR SERVICE AGENCY FOR SERVICE AND ASSISTANCE.**

The furnace should be installed in accordance with the latest editions of the NFPA 31 booklet, "Installation of Oil Burning Equipment," the NFPA 90B booklet, "Warm Air Heating and Air Conditioning Systems" the NFPA 90A booklet, "Installation of Venting and Air Conditioning Systems" and the NFPA 211 booklet "Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances" published by the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269.

## ▲ WARNING

**THIS FURNACE IS DESIGN CERTIFIED TO OPERATE ON #2 FUEL OIL. DO NOT ATTEMPT TO CONVERT THIS FURNACE TO BURN NATURAL GAS OR LP GAS.**

**FAILURE TO FOLLOW THIS WARNING CAN CAUSE A FIRE OR EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

## LOCATION

## ▲ WARNING

**THIS FURNACE IS NOT APPROVED FOR INSTALLATION IN A MOBILE HOME. DO NOT INSTALL THIS FURNACE IN A MOBILE HOME. INSTALLATION IN A MOBILE HOME COULD CAUSE FIRE, PROPERTY DAMAGE AND PERSONAL INJURY OR DEATH.**

Locate furnace as close to chimney as practical, giving considerations to duct trunk lines and accessibility of oil burner, controls, blower and filter. For basement installation, if there is no level concrete floor or if water may be encountered, a level concrete base should be provided. Furnaces may be installed on combustible floors. Allow a minimum of twenty-four inches at front of furnace for servicing oil burner and controls. Fire protection clearances are printed in Figure 1 and on the rating plate of the furnace.

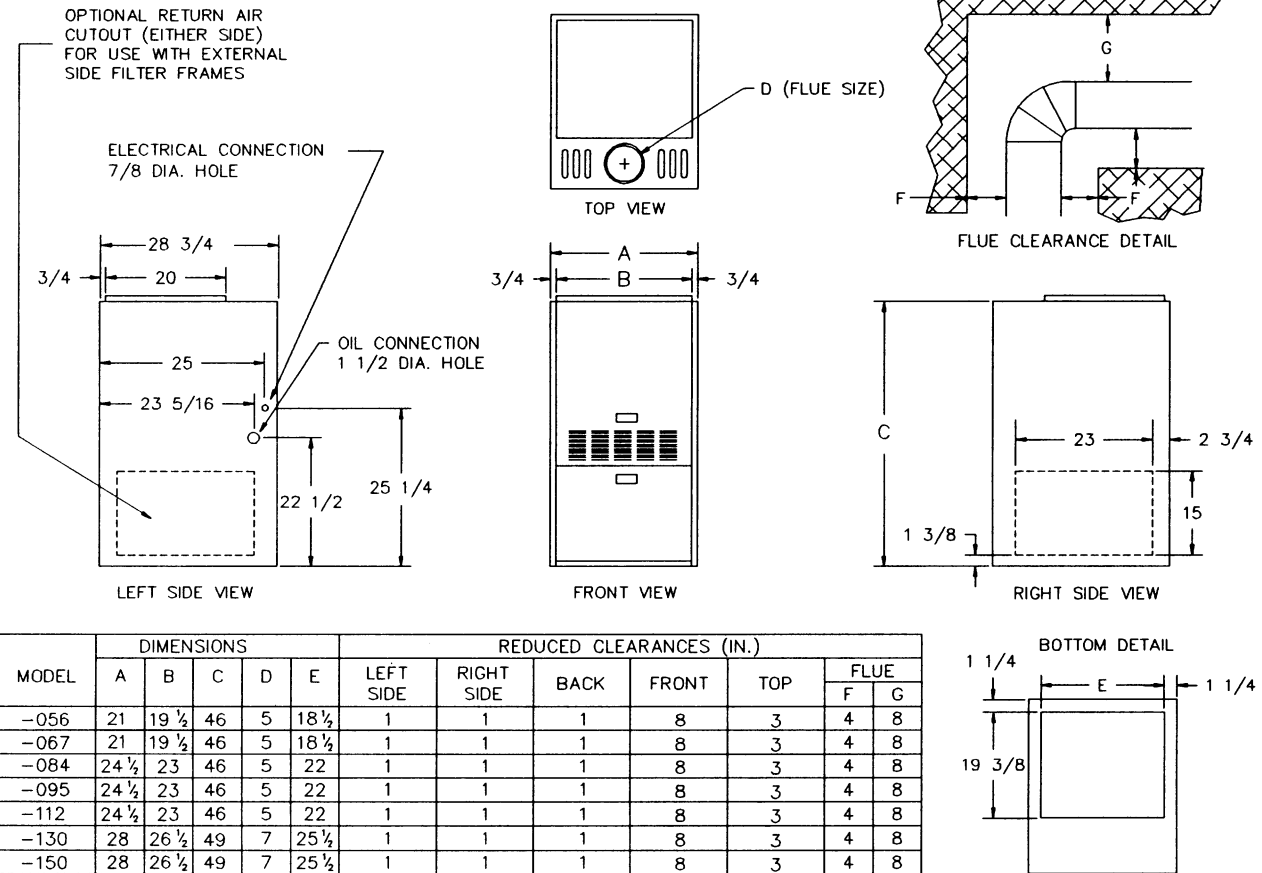
An oil-fired furnace installed in a residential garage must be located or protected to avoid physical damage by vehicles.

This furnace is approved for installation indoors only. Do not install unit outdoors.

## ▲ WARNING

**COMBUSTIBLE MATERIAL MUST NOT BE PLACED ON OR AGAINST THE FURNACE JACKET. THE AREA AROUND THE FURNACE MUST BE KEPT CLEAR AND FREE OF ALL COMBUSTIBLE MATERIAL INCLUDING GASOLINE AND OTHER FLAMMABLE VAPOR OR LIQUIDS. THE HOMEOWNER SHOULD BE CAUTIONED THAT THE FURNACE AREA MUST NOT BE USED AS A BROOM CLOSET OR FOR ANY OTHER STORAGE PURPOSES. COMBUSTIBLE MATERIAL PLACED AGAINST FURNACE JACKET COULD CAUSE FIRE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

**FIGURE 1**  
**DIMENSIONS AND CLEARANCES TO COMBUSTIBLES**



## COMBUSTION AIR SUPPLY

### ⚠ WARNING

**THIS FURNACE MUST BE PROVIDED WITH ENOUGH FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES. SOME HOMES MAY REQUIRE THAT OUTSIDE AIR BE SUPPLIED TO THE FURNACE AREA. FAILURE TO PROVIDE ENOUGH FRESH AIR CAN CAUSE DEATH FROM CARBON MONOXIDE POISONING.**

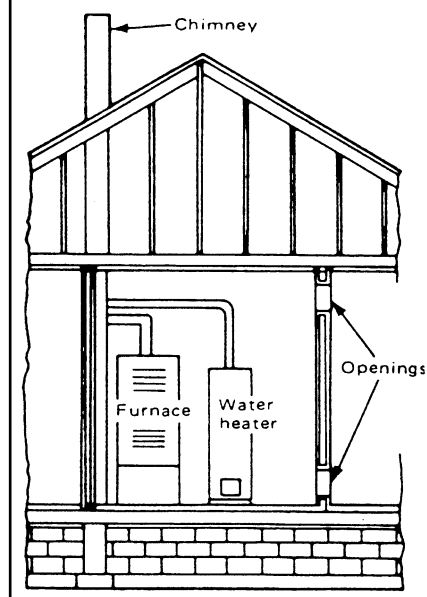
Adequate facilities for combustion and ventilation must be provided in accordance with section number 1-5, "Air for Combustion and Ventilation," of the *Standard for Installation of Oil Burning Equipment, NFPA No. 31*, latest edition or other applicable provisions of local building codes. The flow of combustion air to the furnace area must not be obstructed.

**Important:** Air for combustion and ventilation must not come from a corrosive atmosphere. Any failure due to corrosive elements in the atmosphere is excluded from warranty coverage. Combustion air must be free of acid-forming chemicals such as sulphur, fluorine and chlorine. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, air fresheners, paint and varnish removers,

refrigerants and many other commercial and household products. Vapors from these products when burned in a flame form acidic compounds and are highly corrosive when they condense.

When appliances are installed within a **confined** space and combustion air is taken from within the heated space, the

**Figure 2**  
**Openings for confined spaces**



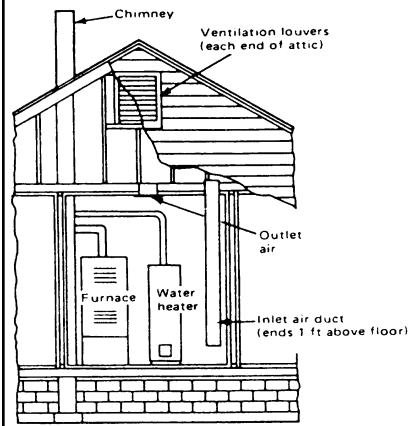
air supply must be through two permanent openings of equal area, one located within 12 inches of the ceiling and one within 12 inches of the floor (see figure 2). Refer to the rating plate label on the furnace for information on the minimum free area of these two openings.

When appliances are installed in an **unconfined** space in a building of conventional frame, brick or stone construction, infiltration normally is adequate to provide for combustion ventilation and draft control dilution. If the unconfined space is within a building of unusually tight construction, a supply of combustion, ventilation and draft control dilution air must be obtained from outdoors or spaces freely connected to the outdoors. Under these conditions a permanent opening or openings having a total free area of not less than 1 sq. in. per 5,000 BTU/HR of total input rating of all appliances shall be provided. This code is found in *NFPA 31, Standard for Installation of Oil Burning Equipment*. Other State, Provincial, and Local codes may apply, check with local inspectors.

When appliances are installed in a **confined** space within a building of unusually tight construction, air for combustion must be obtained from outdoors or from spaces or ducts freely drawing from the outdoors. Under these

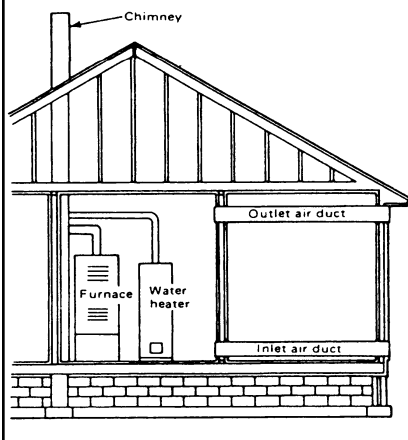
conditions, two openings of approximately equal area (one located near the top and one located near the bottom of the enclosure) must be provided each with a total free area of not less than 1 square inch per 4,000 BTU's / Hr. of total input rating of all appliances in the enclosure (see figure 3).

**Figure 3**  
**All air from ventilated attic**



If horizontal ducts are used, each opening shall have a free area of not less than 1 sq. in. per 2,000 BTU/HR of total input of all appliances in the enclosure (see figure 4).

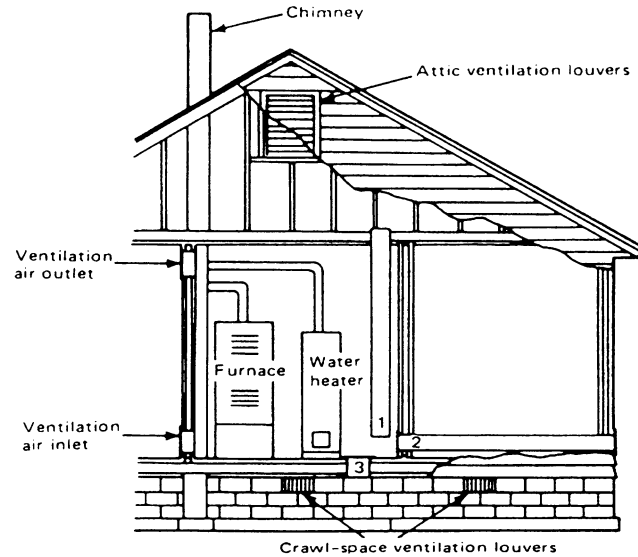
**Figure 4**  
**Directly connecting horizontal ducts to outdoors**



Appliances installed in confined spaces may be installed with ventilation air from inside the building and combustion air from outdoors. Consult state and local codes and the *NFPA No. 31, Standard for Installation of Oil Burning Equipment* for specific details (see figure 5 for an example).

Appliances installed in **confined** spaces with all required air coming from the outdoors may also get inlet air from continuously ventilated crawl spaces and outlet air to a ventilated attic (see figure 6).

**Figure 5**  
**Inside Ventilation Air, Outside Combustion Air**



"NFPA 31, *Standard for Installation of Oil Burning Equipment*" defines "confined space" and "unconfined space" as follows.

**Confined Space** - Any space whose volume is less than 50 cu. ft. per 1,000 BTU/HR (4.8 M3 per KW) of the aggregate input rating of all fuel-burning appliances installed therein.

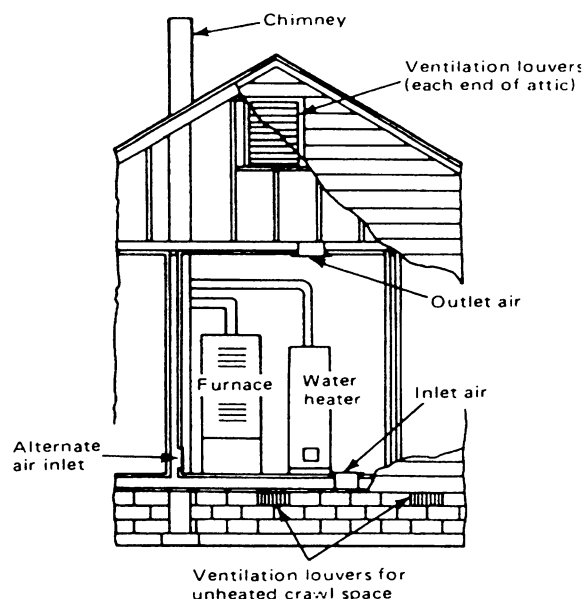
**Unconfined Space** - Any space whose volume is equal to or greater than 50 cu. ft. per 1,000 BTU/HR (4.8 M3 per KW) of the aggregate input rating of all fuel-burning appliances installed therein. Rooms connecting directly with the space in which the appliances are located by means of openings that have

no doors or closures, unless fully louvered, shall be considered part of the unconfined space.

When determining if the furnace is located in a confined or unconfined space it is important to realize that some buildings are so tight that normal infiltration does not meet air requirements for proper combustion or venting and outside air must be introduced.

**Important: All applicable codes must be followed when providing air to the confined space.**

**Figure 6**  
**Outside Air From Attic and Crawl Space**



## CIRCULATING AIR SUPPLY

Plenum chambers and air ducts must be installed in accordance with the Standard for the Installation of Air Conditioning and Ventilating Systems, NFPA No. 90A, or the Standard for the Installation of Warm Air Heating and Air Conditioning Systems, NFPA No. 90B.

The circulating air supply may be taken: (1) exclusively from return air ducts from several rooms, or (2) combined with outside air. When outside air is utilized, the system should be designed and adjusted such that the temperature of the combined return air to the furnace will not be below 50°F during the heating season. When using a combination of outside air and return air, be sure the ducts are so designed and a diverting damper so installed that the volume of circulating air entering the furnace cannot be reduced or restricted below that which would normally enter through the circulating air intake of the furnace.

When the furnace is installed so that the supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall be handled by a duct or ducts sealed to the furnace casing and terminated outside the space containing the furnace.

### ▲ WARNING

**IF THERE IS NO COMPLETE RETURN AIR DUCT SYSTEM, THE RETURN AIR CONNECTION MUST RUN FULL SIZE TO A LOCATION OUTSIDE THE UTILITY ROOM OR SPACE HOUSING THE FURNACE TO PREVENT A NEGATIVE PRESSURE ON THE VENTING SYSTEMS. A NEGATIVE PRESSURE CAN DRAW PRODUCTS OF COMBUSTION INTO CIRCULATING AIR.**

**NEVER ALLOW THE PRODUCTS OF COMBUSTION OR THE FLUE PRODUCTS TO ENTER THE RETURN AIR DUCTWORK OR THE CIRCULATING AIR SUPPLY. ALL RETURN DUCTWORK MUST BE ADEQUATELY SEALED AND SECURED TO THE FURNACE WITH SHEET METAL SCREWS, AND JOINTS TAPED. ALL OTHER DUCT JOINTS MUST BE SECURED WITH APPROVED CONNECTIONS AND SEALED AIRTIGHT.**

**FAILURE TO PREVENT PRODUCTS OF COMBUSTION FROM BEING CIRCULATED INTO THE LIVING SPACE CAN CREATE SOOT DAMAGE, SMOKE, ODORS OR CARBON MONOXIDE POISONING.**

*IMPORTANT: One of the most common causes of trouble in forced air heating systems is insufficient return air to the furnace. The return air system should be approximately equal to or greater than the area of the warm air discharge. CONSULT LOCAL CODES FOR SPECIAL REQUIREMENT.*

### ▲ WARNING

**DO NOT, UNDER ANY CIRCUMSTANCES, CONNECT RETURN OR SUPPLY DUCTWORK TO OR FROM ANY OTHER HEAT PRODUCING DEVICE SUCH AS A FIREPLACE INSERT, STOVE, ETC. DOING SO MAY RESULT IN FIRE, CARBON MONOXIDE POISONING, EXPLOSION, PERSONAL INJURY, PROPERTY DAMAGE OR DEATH.**

Install the cold air return to terminate through the floor under the furnace. A direct connection should be made to the bottom of the furnace. For installations where return air ducts cannot be run under the floor, return air may be taken from the sides and/or back by cutting the furnace casing and installing the appropriate accessory.

**NOTE:** Where the maximum air flow is 1800 CFM or more, both sides or the bottom must be used for return air.

When a cooling coil is used in conjunction with the furnace, it must be installed downstream of the outlet end of the furnace or in parallel with the furnace to avoid condensation in the heating element.

If the furnace is installed in parallel with a cooling unit, the damper or other means used to control the flow of air must be adequate to prevent chilled air from entering the furnace, and if manually operated must be equipped with means to prevent operation of the other unit unless the damper is in the full heat or cool position.

*IMPORTANT: Air openings in the casing front, return air grilles and warm air registers must not be obstructed.*

### ▲ WARNING

**BLOWER AND BURNERS MUST NEVER BE OPERATED WITHOUT BLOWER DOOR IN PLACE. THIS IS TO PREVENT DRAWING FUMES (WHICH COULD CONTAIN ANNOYING AND HAZARDOUS GASES) INTO THE HOME THAT COULD RESULT IN PERSONAL INJURY OR DEATH.**

## FLUE AND CHIMNEY EXHAUST

The vent connector should be as short as possible and installed so that it has a continuous rise from the furnace to the chimney or flue.

The number of elbows should be minimized and the flue pipe should be joined with sheet metal screw and properly supported with suitable pipe hangers.

A barometric draft regulator is required in each furnace vent connector and must be installed before the vent connector enters the chimney or flue.

**NOTE:** The size of the draft regulator diameter must be no smaller than the vent connector diameter.

The vent connector should be the same size as the furnace flue pipe connection. The sizes are:

| FURNACE<br>BTU OUTPUT | FLUE SIZE<br>INCHES |
|-----------------------|---------------------|
| 056                   | 5                   |
| 067                   | 5                   |
| 084                   | 5                   |
| 095                   | 5                   |
| 112                   | 5                   |
| 130                   | 7                   |
| 150                   | 7                   |

## CHIMNEY SIZE RECOMMENDATIONS

The following table shows recommended size and height for chimneys based on total BTU input of all the oil appliances being vented.

| GROSS BTU<br>INPUT | RECTANGULAR<br>TILE<br>(INCHES) | ROUND<br>TILE<br>(INCHES) | MINIMUM<br>HEIGHT<br>(FEET) |
|--------------------|---------------------------------|---------------------------|-----------------------------|
| 144,000            | 8½ x 8½                         | 8                         | 20                          |
| 235,000            | 8½ x 13                         | 10                        | 30                          |
| 372,000            | 13 x 13                         | 12                        | 35                          |
| 516,000            | 13 x 18                         | 14                        | 40                          |
| 612,000            | —                               | 15                        | 45                          |
| 768,000            | 18 x 18                         | —                         | 50                          |
| 960,000            | 20 x 20                         | 18                        | 55                          |

## VENTING

Unit must be vented through a chimney or flue. Check chimney for soot, leaks, obstruction and proper height to prevent down draft. Clean chimney and base if necessary.

The height of the chimney or flue shall be at least 3 feet above the highest point where it passes through the roof of a building and at least 2 feet higher than any portion of a building within 10 feet of such chimney.

Install a single wall, vent connector from flue outlet to chimney, sloping flue pipe continuously upward (at least 1/4 inch per foot) toward chimney. The vent connector should be the same diameter as the flue collar of the furnace for the entire length of run and should not exceed 10 feet in length. Avoid sharp turns that would create resistance to the flow of flue gasses. Vent connector should not extend beyond the inside wall of the chimney and must be firmly cemented to masonry.

**TABLE 1. Metal Thickness for Galvanized Steel Pipe Connectors**

| Diameter of Connector (in.) | Galvanized Sheet Gauge No. | Minimum Thickness (in.) | Minimum Thickness (mm) |
|-----------------------------|----------------------------|-------------------------|------------------------|
| < 6                         | 26                         | 0.019                   | 0.48                   |
| ≥ 6 to ≤ 10                 | 24                         | 0.024                   | 0.61                   |
| > 10 to ≤ 16                | 22                         | 0.029                   | 0.74                   |
| > 16                        | 16                         | 0.056                   | 1.42                   |

**IMPORTANT:** This furnace is agency approved by UL, ULC and CSA for use with the Tjernlund SS1-R sidewall vent system when installed in accordance with the installation instructions for the SS1-R provided by Tjernlund. The maximum vent length is 10 feet with 3 elbows when venting with the SS1-R. This is the only option given for side wall venting. It should be noted that common venting with another appliance **is not** an option when using the Tjernlund SS1-R. The use of any other type of power vent system is not approved or recommended by the manufacturer.

No other appliances or heating equipment should be connected to the vent connector servicing the furnace.

Bolt, screw and/or support joints to avoid sag. Fasten the single-wall vent connector to the outlet collar of the furnace with at least two sheet metal

screws. Refer to Figure 1 for distances to combustible materials.

*DEVICES ATTACHED TO THE FLUE OR VENT FOR THE PURPOSE OF REDUCING HEAT LOSS UP THE CHIMNEY HAVE NOT BEEN TESTED AND HAVE NOT BEEN INCLUDED IN THE DESIGN CERTIFICATION OF THIS FURNACE. WE, THE MANUFACTURER, CANNOT AND WILL NOT BE RESPONSIBLE FOR INJURY OR DAMAGE CAUSED BY THE USE OF SUCH UNTESTED AND/OR UNCERTIFIED DEVICES, ACCESSORIES OR COMPONENTS.*

## BAROMETRIC DRAFT CONTROL

The barometric damper (see figure 7) is a control installed in the flue pipe to regulate the draft in the furnace. If the draft increases in the chimney, the damper opens to maintain the preset draft in the furnace. Should the draft decrease in the chimney, the damper will close to maintain the preset draft of the oil furnace. A barometric damper is supplied with each furnace and must be installed by the following the instructions supplied by the manufacturer. The barometric damper control should be installed between the flue outlet of the furnace and the chimney (see figure 8). The barometric damper control should be set for proper draft on start up after the furnace has been operating for 10 to 15 minutes. See Oil Burner Adjustment Procedure Section for proper draft settings.

**On start up, the furnace must be set for field conditions with a combustion kit for proper operation.**

Note: Always use a separate barometric damper for each oil-fired appliance. Install the barometric damper with its hinge level and the face

**Figure 7  
Barometric Damper**



plumb. Tilting causes erratic damper operation. Installation of a barometric damper must be in accordance with the Installation and Operation Instructions provided with the damper.

The following standards and codes will help to make the installation. Current editions of these standards can be obtained from:

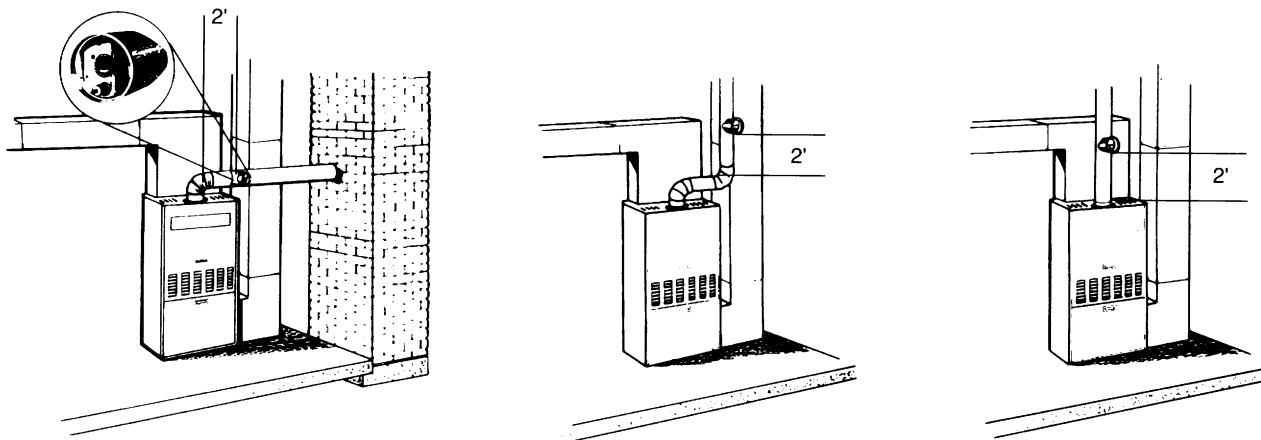
American National Standards Institute, 1430 Broadway, New York, NY 10018

## OIL BURNER / PRIMARY CONTROL

Oil burner and primary control are mounted to the furnace as a complete assembly. Standard equipment consists of the oil burner, primary control and flame sensor mounted as a single assembly to the furnace. The heat/cool relay is mounted to the unit's main junction box and the flame sensor (cadmium sulfide cell) is enclosed in the burner housing above the blower wheel.

*The standard oil burner is equipped with a single stage fuel pump. This single stage fuel pump may be used in either a one or two pipe system. If a two pipe system is required (burner is*

**Figure 8  
Recommended Barometric Damper Locations**





above tank) the lift and length of run must be considered so as not to overload the fuel unit. **NOTE:** If the length of run and the lift is beyond the recommended limits of the charts below, a booster prep unit should be used.

**Recommended Maximum Length of Tubing  
Used on a Single Stage (3450 RPM) Pump Two  
Pipe System**

| Lift (in feet)   | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7  | 8  | 9  | 10 |
|------------------|-----|-----|-----|-----|-----|-----|-----|----|----|----|----|
| 3/8" O.D. Tubing | 53  | 40  | 45  | 41  | 38  | 33  | 20  | 25 | 21 | 18 | 13 |
| 1/2" O.D. Tubing | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 99 | 83 | 68 | 52 |

**Recommended Maximum Length of Tubing  
Used on a Two Stage (3450 RPM) Pump Two  
Pipe System**

| Lift (in feet)   | 0   | 2   | 4   | 6   | 8   | 10  | 12  | 14  | 16  | 18 |
|------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
| 3/8" O.D. Tubing | 68  | 63  | 58  | 53  | 48  | 42  | 37  | 32  | 27  | 22 |
| 1/2" O.D. Tubing | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 88 |

## TANK AND OIL LINES

Oil storage tank should be of an approved type installed in accordance with the National Board of Fire Underwriters and local regulations.

In accordance with standards of the National Board of Fire Underwriters, inside tanks should be at least seven feet from burner, convenient for installing the fill, vent and feed lines. The fill and vent lines should be run to a convenient outdoor location and should slope downward to tank. They should terminate in approved fittings.

An approved type of oil gauge should be installed in accordance with manufacturer's instructions. Copper tubing no smaller than 3/8" O.D. is recommended for suction or feed line on basement tank installations. A hand shut-off valve should be installed at the tank outlet. An oil filter should be installed in the suction or feed line.

Underground tanks or tanks below the burner may require a two-pipe hook-up. A check valve should be installed in the suction line to keep the line primed and the internal by-pass in the fuel unit must be plugged as per instructions furnished with the burner.

All oil lines must be tight and free of traps. Lines should be buried or otherwise protected from mechanical injury. (See Typical Installation Diagrams.)

## ELECTRIC WIRING

### ⚠ WARNING

**TURN OFF ELECTRIC POWER AT FUSE BOX OR SERVICE PANEL BEFORE MAKING ANY ELECTRICAL CONNECTIONS. FAILURE TO DO SO CAN CAUSE ELECTRICAL SHOCK RESULTING IN PERSONAL INJURY OR DEATH.**

**CABINET MUST BE PERMANENTLY GROUNDED. A GROUND SCREW IS PROVIDED IN THE JUNCTION BOX FOR THIS PURPOSE.**

**GROUND CONNECTION MUST BE COMPLETED BEFORE MAKING ANY LINE VOLTAGE CONNECTIONS.**

### ⚠ WARNING

**FAILURE TO GROUND APPLIANCE COULD RESULT IN ELECTRICAL SHOCK, FIRE, PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

Installation of the electric supply line should be in accordance with the National Electric Code ANSI/NFPA No. 70, latest edition, and local building codes.

Use a separate fused branch electrical circuit containing a properly sized fuse or circuit breaker. Run this circuit directly from the main switch box to an electrical disconnect (switch) which must be readily accessible and located within sight of the furnace.

Connect from the disconnect to the junction box on the furnace inside the control compartment. Discard test leads and connect the line voltage wires in their place. (See appropriate wiring diagrams.)

*NOTE: H (hot) and N (neutral) polarity must be observed when making field connections to the furnace. The limit control will not interrupt H (hot) circuit if leads are reversed.*

## THERMOSTAT

Install the room thermostat in accordance with the instruction sheet packed in the box with the thermostat. Run the thermostat lead wires inside the blower compartment and connect to low voltage terminals as shown on the wiring diagram. Never install the thermostat on an outside wall or where it will be influenced by drafts, concealed hot or cold water pipes or ducts, lighting fixtures, radiation from fireplace, sun rays, lamps, televisions, radios or air streams from registers. Refer to instructions packed with the thermostat for "heater" selection or adjustment.

**NOTE: Do not use 24 volt control wiring smaller than No. 18 AWG.**

## HEAT ANTICIPATOR SETTING

The heating thermostat anticipator should be set for a 0.10 amp draw.

**TABLE 1  
LOW VOLTAGE WIRING**

| SOLID COPPER WIRE - AWG   |     |    |     |     |     |     |
|---|-----|----|-----|-----|-----|-----|
| THERMOSTAT<br>LOAD - AMPS   | 3.0 | 16 | 14  | 12  | 10  | 10  |
|   | 2.5 | 16 | 14  | 12  | 12  | 10  |
|   | 2.0 | 18 | 16  | 14  | 12  | 10  |
|   |     | 50 | 100 | 150 | 200 | 250 |
| LENGTH OF RUN - FEET ①  |     |    |     |     |     |     |
|   |     |    |     |     | 300 |     |
| ① The total wire length is the distance from the furnace to the thermostat and back to the furnace. |     |    |     |     |     |     |
| <b>NOTE: Do not use 24 volt control wiring smaller than No. 18.</b>                                 |     |    |     |     |     |     |

# TYPICAL INSTALLATION DIAGRAMS

FIGURE 9. TWO PIPE INSTALLATION

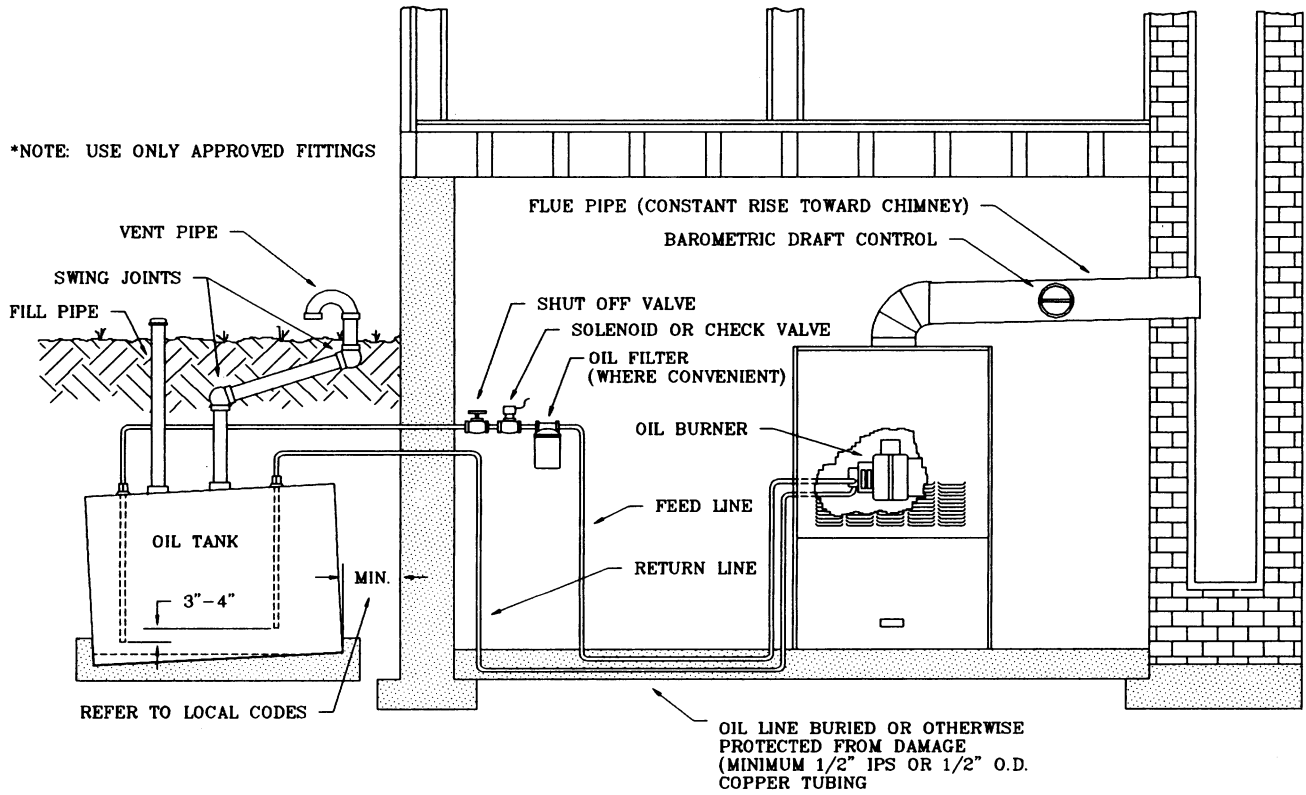
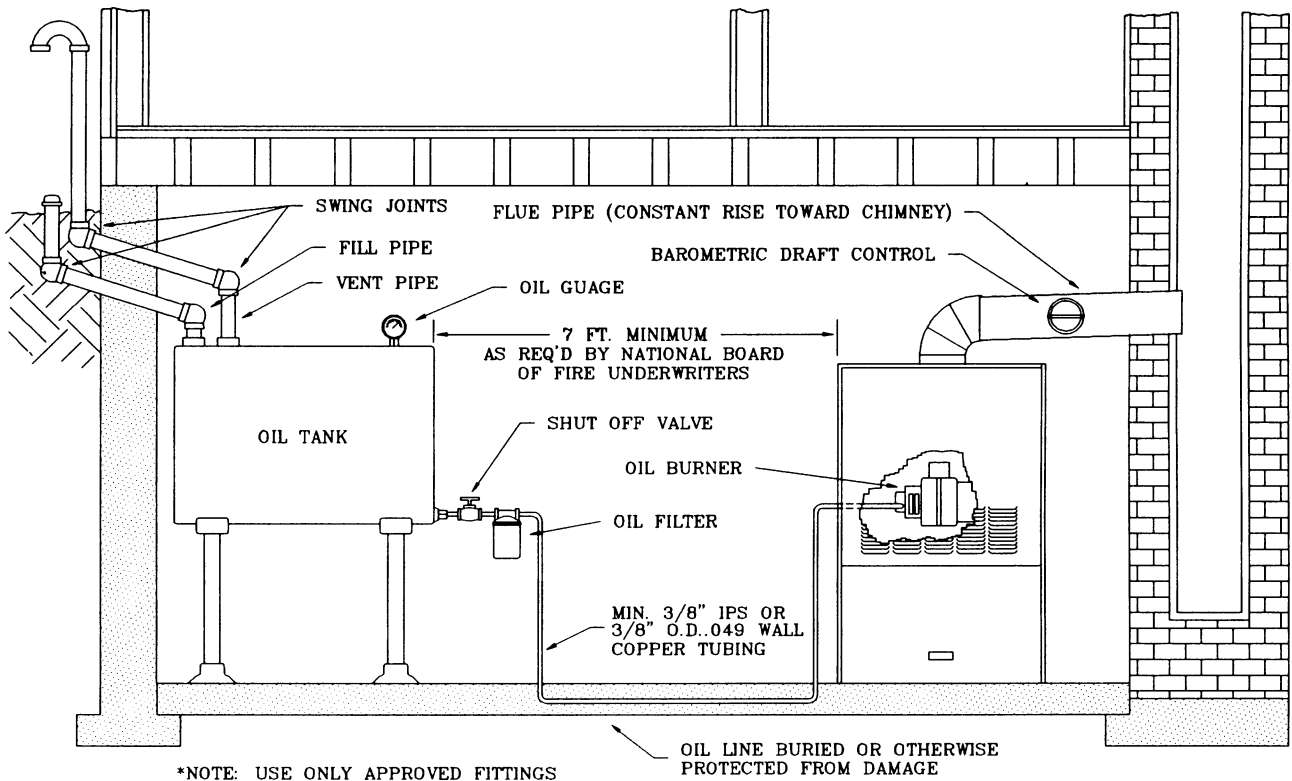


FIGURE 10. ONE PIPE INSTALLATION



# OPERATING INSTRUCTIONS

## LIGHTING INSTRUCTIONS

This appliance is equipped with an automatic electronic ignition device. This device lights the oil burner each time the room thermostat (closes) calls for heat. See oil burner instructions enclosed with furnace for further detail.

### **▲ WARNING**

**MAKE SURE THAT COMBUSTION CHAMBER IS FREE OF OIL BEFORE USING RESET BUTTON ON PRIMARY CONTROL. FAILURE TO DO SO CAN CAUSE FLASH FIRE OR EXPLOSION RESULTING IN PROPERTY DAMAGE, PERSONAL INJURY OR DEATH.**

### TO START FURNACE

1. Set room thermostat to highest setting.
2. Open shut-off valve in oil supply line.
3. Close line switch. Burner should start automatically.
4. Bleed the fuel pump as soon as the burner motor starts rotating. To bleed the fuel unit, attach a clear plastic hose over the bleed plug. Loosen the plug and catch the oil in an empty container. Tighten the plug when all air is purged.
5. Reset room thermostat to desired temperature setting.

### TO STOP FURNACE

1. Set the room thermostat to lowest temperature setting.
2. Turn "Off" line switch to the furnace.

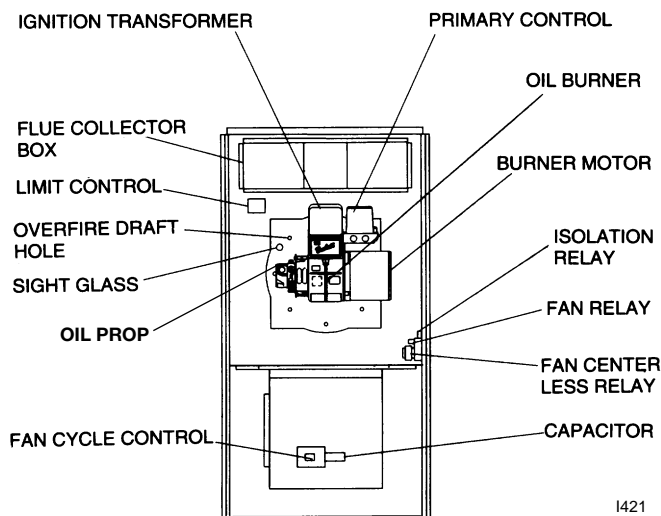
### IF BURNER DOES NOT START

1. Check fuse or breaker in the furnace circuit.
2. Assure room thermostat is set above room temperature.
3. Check oil level in the tank.
4. Make sure that oil line shut-off valves are open.
5. Wait five minutes to allow the control to cool, so that it will recycle. Reset the button on the primary control.

6. Depress manual reset button on the motor.

*NOTE: Do not expose cad cell to direct electric bulb light or sunlight. Light may enter through the air control band slot and upset the electric circuit of this device.*

**FIGURE 11. COMPONENT LOCATION**



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# FURNACE ADJUSTMENT

## OIL BURNER ADJUSTMENT

### ⚠ CAUTION

**AFTER FURNACE INSTALLATION, EACH OIL FURNACE MUST BE OPERATED IN THE HEATING CYCLE AND PROPER BURNER ADJUSTMENTS COMPLETED FOR EACH FURNACE INSTALLATION FIELD CONDITION. THIS IS REQUIRED FOR EACH OIL FURNACE INSTALLED. SEE "BURNER ADJUSTMENT" PORTION OF THE FURNACE INSTALLATION AND OPERATING INSTRUCTION. THE ADJUSTMENTS ARE NECESSARY TO PREVENT SMOKE, SOOT, ODOR FROM ENTERING THE STRUCTURE AND SUBSEQUENT FURNACE DAMAGE.**

**THE FOLLOWING ADJUSTMENTS ARE NECESSARY TO PREVENT SMOKE, SOOT, ODOR AND POSSIBLE EQUIPMENT DAMAGE. AN EXPERIENCED SERVICE MECHANIC AND RELIABLE INSTRUMENTS ARE REQUIRED.**

The following procedure is based on guidelines taken from *"The Professional Serviceman's Guide To Oil Heat Savings"* by R.W. Beckett Corporation, who based theirs on the U.S. Environmental Protection Agency's *"Guidelines for Residential Oil Burner Adjustments"* printed in 1975. Some procedures have been changed to meet the specific units being addressed.

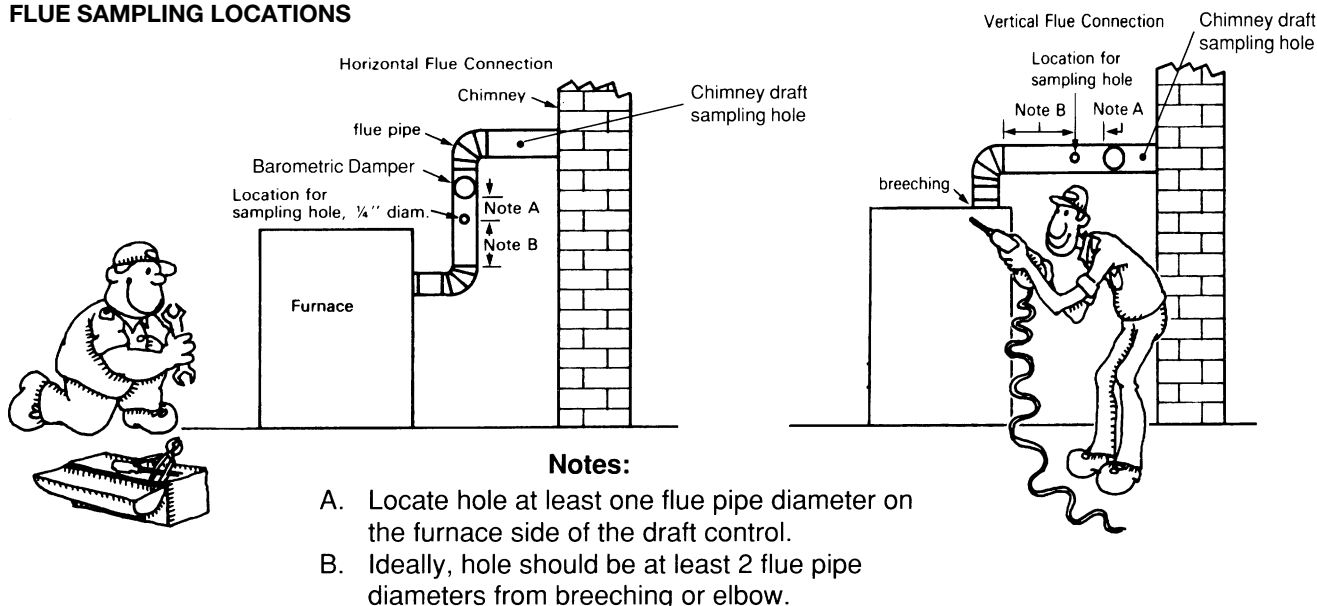
### PREPARATION STEPS

1. Calibrate and check the operation of all measuring equipment. Follow the manufacturer's recommended procedures for calibration and equipment check out. Calibration instructions are included in the operation instructions for the Fyrite CO<sub>2</sub> Gas Analyzer. See Fyrite CO<sub>2</sub> section in this manual.
2. Prepare the heating unit for testing. Drill ONE 1/4 inch hole in the flue between the heating plant and the barometric damper, if not already there as shown in Figure 12. If space permits, the hole should be located in a straight section of the flue, at least two flue diameters from the elbow in the flue pipe and at least one diameter from the barometric damper. Another 1/4 inch hole is provided by the manufacturer for testing over the fire.  
  
Drill another 1/4" hole between the barometric damper and the chimney as shown in Figure 12. The draft at this location must measure at least -.05 to -.06 inches W.C. within three minutes after the burner starts. Failure to achieve this measurement indicates chimney draft problems which must be corrected for proper operation. See Figure 22 for chimney problem correction.
3. Make sure the burner air tube, fan housing, and blower wheel are clear of dirt and lint.
4. Nozzle inspection. Annual replacement of the nozzle is recommended.

ed. The nozzle size should match the capacity of the unit installed. Nozzle size is listed on the unit nameplate. An in-line oil filter will reduce service problems due to nozzle clogging. It should be located as close as possible to the oil burner. Care should be taken to prevent air leakage into the oil suction line. Use continuous runs of copper tubing and use a minimum number of joints and fittings. Always use flare fittings. Refer to the nozzle specifications for the correct nozzle and spray pattern, whenever replacing the nozzle.

5. Adjustment of electrodes. Adjust the ignition electrodes according to the burner manufacturer's instructions to assure prompt ignition. See the electrode adjustment section in this manual for more information.
6. Operate the burner; adjust the air setting for a proper flame by visual observation (until no smoke is present), and run for at least 10 minutes or until operation has stabilized. If a proper flame is not obtainable reset the air band and air shutter settings to the original factory settings (see table 11).
7. Check pump pressure. Bleed air from the pump and nozzle piping. Check the pump pressure and adjust to 100 psi, if necessary. See the pump section in this manual for more information.

**FIGURE 12  
FLUE SAMPLING LOCATIONS**



## COMBUSTION ADJUSTMENT

### THE FOLLOWING BURNER ADJUSTMENTS MUST BE MADE AFTER 10 TO 15 MINUTES OF OPERATION.

8. Set the draft. Remove the heat shield and then remove the metal plug in the burner mounting plate. Check the draft reading over the fire with a draft gage through the 5/16" hole located in the burner plate. See the draft gauge section in this manual for more information. Adjust the barometric damper to give the overfire draft recommended by the manufacturer. If no such recommendations are available, set the overfire draft to assure a negative pressure within the combustion chamber (usually a negative 0.01 to 0.02 inches water column).

Replace the hole plug in the burner mounting plate after these tests have been made.

9. Check the smoke readings. After the burner has been operating 10 minutes, make a smoke measurement in the flue following the smoke tester instructions. See the smoke pump section in this manual for more information. Oily or yellow smoke spots on the filter paper are usually a sign of unburned fuel, indicating very poor combustion (and likely high emissions of carbon monoxide and unburned hydrocarbons). This condition can sometimes be caused by too much air, or other factors. If this condition cannot be corrected, major correction or even burner replacement may be necessary. Adjust the air shutter and air band for a 0 to a 1 smoke number (a trace).

10. Check the CO<sub>2</sub> with the Fyrite analyzer. See Fyrite Gas Analyzer section for methods and procedures. Adjust the air setting to reduce the CO<sub>2</sub> reading by between 1% and 2%. Lock the air adjustment and repeat all draft, CO<sub>2</sub>, and smoke measurements to make sure the setting has not shifted.

## COMBUSTION DIAGNOSIS

11. Check performance. A well-matched and well-tuned burner should be capable of operation at a CO<sub>2</sub> level between 10% and 12%.

## FINAL CHECKS

12. Measure the flue temperature. See the stack thermometer section in this manual for more information. Operating the unit at an excessive firing rate generates

more heat than the heat exchanger can utilize and results in unnecessary heat loss up the chimney. Other causes of excessive heat loss are badly sooted heat-exchanger surfaces and excessive draft. The temperature of the flue gas provides an indication of these heat losses.

Measure the net flue temperature by subtracting the room air temperature from the thermometer reading. Excessive flue loss is indicated if the net flue temperature during steady operation exceeds 600° F.

13. Check Ignition. Check the operation over repeated cycles to insure prompt ignition on starting.
14. Check pump cutoff. See pump section for the procedure for checking cut off pressure. Slow pump cutoff at the end of a firing cycle can cause smoke and other

pollutant emissions. Check for prompt pump cutoff by observing the flame or by checking for smoke at shutdown. If poor cutoff is observed, make sure all air is purged from the pump and nozzle line. If poor cutoff continues check for proper cutoff pressure.

15. Check Controls. Check the settings of all operating controls before leaving the installation and verify that they are in working order.
16. Check for proper temperature rise of the supply air. See the air supply temperature section in this manual for details.
17. Annual Cleanup. An overall burner checkup and cleanup is recommended annually. See the annual cleanup section in this manual for more information.

FIGURE 13

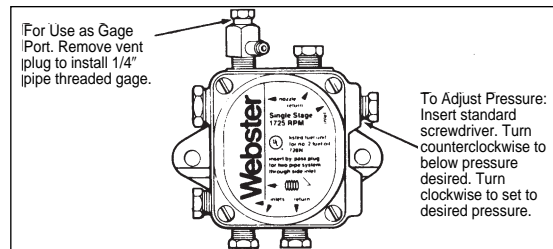


FIGURE 14

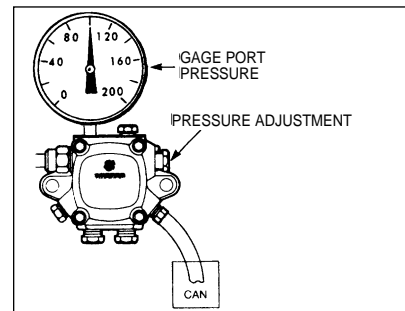
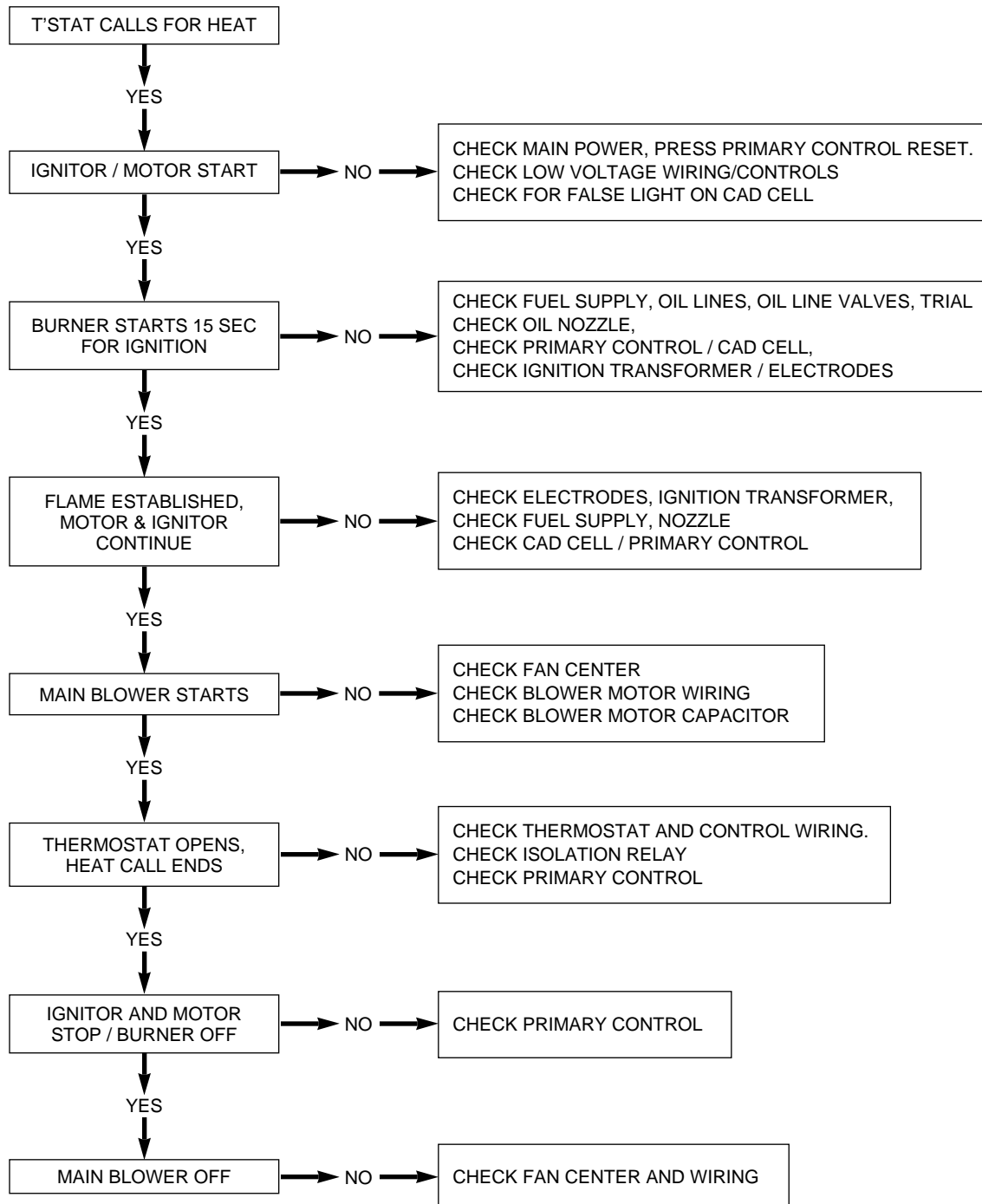


Table 11

| FACTORY AIR ADJUSTMENT SETTINGS |                     |                     |                  |                   |
|---------------------------------|---------------------|---------------------|------------------|-------------------|
| BURNER                          |                     | AIR SHUTTER SETTING | AIR BAND SETTING | OIL FURNACE MODEL |
| BECKETT MODEL                   | BECKETT DESIGNATION |                     |                  |                   |
| AFG                             | AF42JYPWHS          | 10                  | BLANK            | -056              |
| AFG                             | AF42JYPWHS          | 10                  | BLANK            | -067              |
| AFG                             | AF42XNPWHS          | 10                  | 2                | -084              |
| AFG                             | AF42XNPWHS          | 10                  | 2                | -095              |
| AFG                             | AF42XNPWHS          | 10                  | 2                | -112              |
| AFG                             | AF42JZPWHS          | 7                   | 4                | -130              |
| AFG                             | AF42JZPWHS          | 7                   | 4                | -150              |

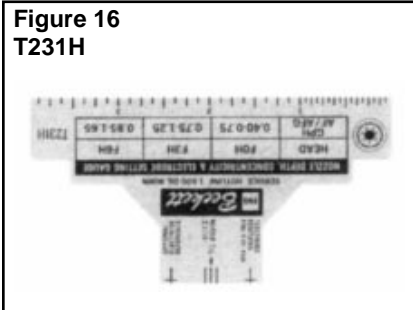
FIGURE 15



# ELECTRODE ADJUSTMENT

The T231H nozzle, electrode and head position gauge (see figure 16) is used to correctly position the electrodes, nozzle, and head. The gauge is the best way to ensure that these adjustments are correct.

**Figure 16**  
**T231H**



This gauge is used on the Beckett model "AFG" burners.

## ELECTRODE POSITION

1. With nozzle line/electrode assembly out of the burner, place the 1-1/8" wide gauge edge against the face of the nozzle and between the electrode tips (see figure 17).
2. Position the gauge so the center scribe mark is in line with the nozzle orifice. (Do not scratch the nozzle face)

3. If the electrode position is correct, the tips should be positioned where the identifying marks on the gauge intersect. These two lines determine:
  - a. Correct tip spacing above the nozzle.
  - b. Correct tip spacing ahead of the nozzle.

**The actual distance between electrodes must be correct within +/- 1/32".**

4. If the electrode position is not correct, the electrodes must be readjusted and rechecked.

## NOZZLE POSITION

1. Insert the nozzle line/electrode assembly into the air tube (see figure 18).
2. Place the wide section of the gauge against the burner head face with 1-1/8" wide end of the gauge inserted into head.
3. Slide the nozzle line/electrode assembly forward until the nozzle touches the gauge.
4. Secure the adjustable plate on the burner housing side by tightening the screw. Then tighten the nut, securing the nozzle line where it passes through the side of the

**Figure 18**  
**Nozzle Depth and Concentricity**



housing. This locks the assembly into position.

**The nozzle should now be located properly with 1-1/8" set back from the face of the burner head.**

## NOZZLE CONCENTRICITY

For proper burner operation the nozzle must be concentric with the burner head opening.

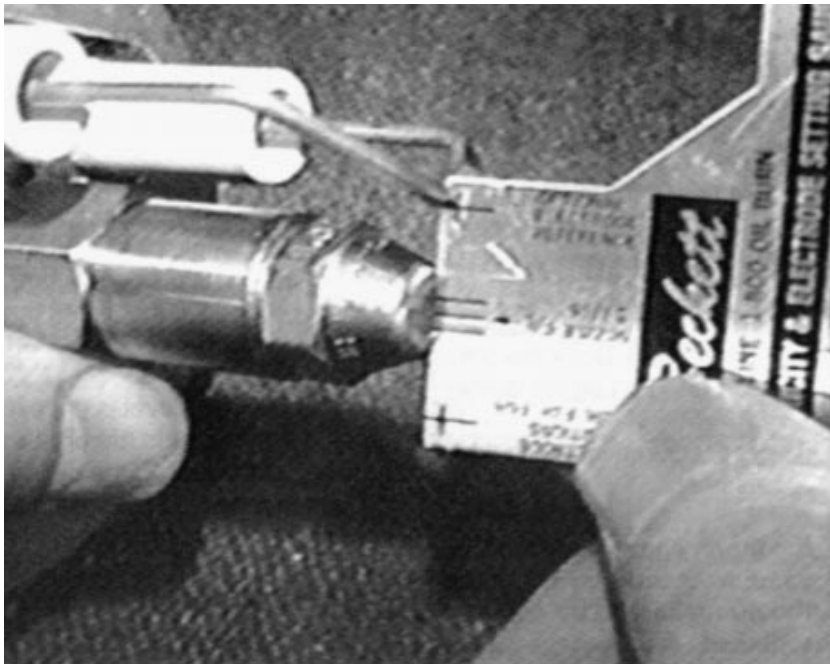
1. With the gauge inserted into the head (see figure 14), the nozzle orifice should be approximately in line with the center scribe mark on the 1-1/8" wide edge of the gauge. The maximum eccentricity allowable is identified by the two outer scribe marks (+/- 1/16").
2. Rotate the gauge to assure concentricity in a side-to-side as well as up-down position.

If the nozzle is not concentric within allowable limits, it generally indicates either improper construction or damaged parts. Do not use. Replace with a correct assembly.

## AIR VOLUME ADJUSTMENTS

The amount of air delivered by the blower is affected by the resistance of the ductwork and registers. The factory adjustment of the blower speed has been made to suit the average installation, designed and installed according to the manuals published by the National Warm Air Heating and Air Conditioning Association. The speed of the direct drive blower can be changed by rewiring motor leads as described in the wiring diagrams.

**Figure 17**  
**Electrode Adjustment**



## SUPPLY AIR TEMPERATURE

The temperature rise of the air through a furnace will vary with each furnace. For proper temperature rise of the furnace in question, check the rating plate on the furnace or Table 7 in this manual.

- A. Temperature rise is the temperature difference between the air entering and leaving the furnace.
- B. The proper way to measure the temperature rise follows: First open all registers and dampers to allow proper air flow. Then allow the furnace to operate 10 to 15 minutes before taking the readings.
- C. Use two thermometers; insert one in the supply air duct and one in the return air duct. Do not place a thermometer in the supply duct directly above the heat exchanger as the thermometer will pick up radiant heat from the heat exchanger. (See **Figure 19**.)
- D. Calculate by subtracting the return air temperature from the supply air temperature.

Example

Supply air temperature      155 degrees  
Return air temperature    75 degrees

Temperature rise        =    80 degrees

- E. Compare the calculated temperature rise with the specified temperature rise on the rating plate.

## TEMPERATURE RISE TOO HIGH

- Check for proper fan speed
- Check static pressure on duct system for proper air flow.
- Check proper cooling coil size.
- Check duct static pressures for proper air flow.
- Check for proper oil pressure.
- Check nozzle size for overfiring.
- Check for a clean air filter.
- Check duct sizes to assure adequate size for desired air flow.

The blower speed can be increased to deliver more air over the heat exchanger if the duct system is large enough to allow the increase. If the duct system is not of adequate size increasing fan speed may result in less air flow than originally found.

## TEMPERATURE RISE TOO LOW

- Check for proper fan speed.
- Check nozzle size to make sure it is of proper size.
- Check for excessive soot in the heat exchanger. Low system efficiency may indicate a sooted heat exchanger.

The motor speed can be changed to a lower speed to decrease the air flow over the heat exchanger.

## TRUE-SPOT

True-Spot smoke tester (see figure 19) by Bacharach is used to check smoke levels in flue products.

**Figure 19**  
**Determining Temperature Rise**

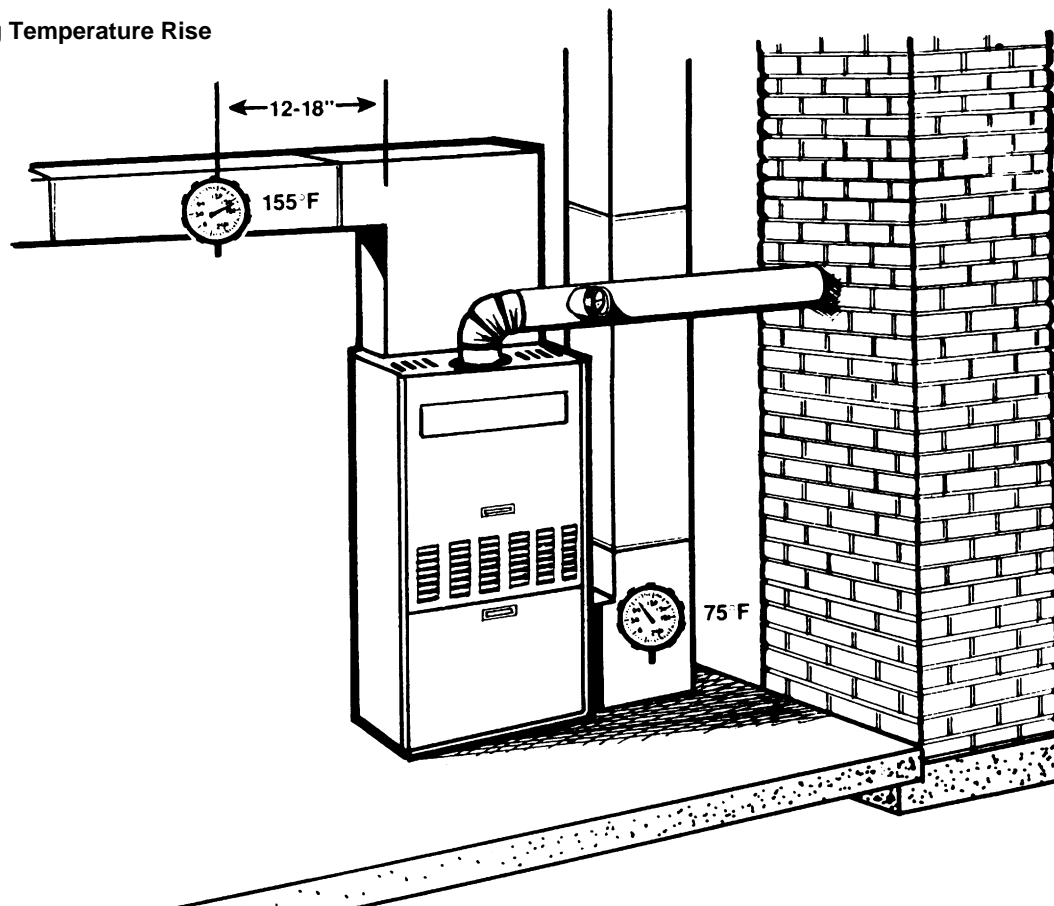




Table 7

## UPFLOW OIL FURNACE TEMPERATURE RISE CHART

| MODEL               | TEMPERATURE<br>RANGE<br>DEGREES F. |
|---------------------|------------------------------------|
| 056<br>&<br>067     | 40 - 70                            |
| 084<br>095<br>& 112 | 50 - 80                            |
| 130<br>&<br>15-     | 60 - 90                            |

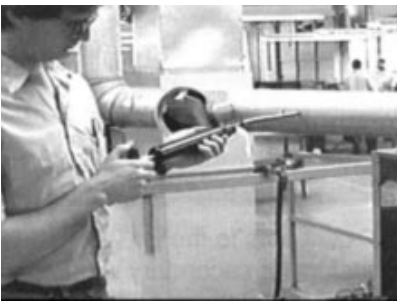
Figure 20  
True-Spot



### INSTRUCTIONS FOR USE:

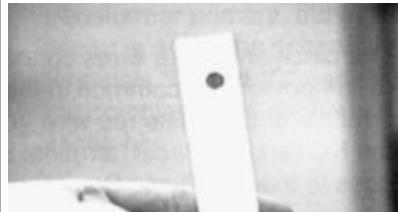
1. Tear a sample strip of filter paper along the perforation line; loosen the clamp screw, insert the filter paper strip in the slot and tighten the clamp screw.
2. Insert the sampling tube into the flue through a 1/4" diameter hole between the draft regulator and the furnace flue outlet (see figure 21).

Figure 21  
Smoke Sample



3. Pull the True Spot handle through 10 full pump strokes.
4. Remove the filter paper strip from slot (see figure 22).

Figure 22  
Smoke Spot



5. Match the smoke spot on the filter paper to the closest color shade on the Bacharach oil burner smoke scale RR 776 (see figure 22).

Figure 23  
Smoke Scale



6. To take additional samples clamp the filter paper strip in the slot so that the previous spot is visible.

### SMOKE SCALE READINGS:

1. **Excellent** - Little, if any, sooting.
2. **Good** - May be slight sooting, with little, if any, increase in flue gas temperature.
3. **Fair** - Substantial sooting, but rarely will require cleaning more than once a year.
4. **Poor** - This is a borderline smoke - some units may soot only moderately, others may soot rapidly.
5. **Very Poor** - Heavy sooting in all cases - may require cleaning several times during a heating season.
6. **Extremely Poor** - Severe and rapid sooting - may result in damage to the stack control and reduce the overfire draft dangerously.

### TIPS FOR BETTER SMOKE READINGS

1. Before using, tap the sampling tube to loosen any soot or rust, tighten the clamp screw without any filter paper in the slot and purge with several rapid pump strokes of room air.
2. Warm the True-Spot to room temperature before using.
3. In sampling, be sure to pull the pump handle through 10 full strokes and hold for several seconds at the end of each pull stroke. Use a steady pull motion such that a full stroke is obtained in 3 or 4 seconds.
4. Hold the smoke scale with the filter paper at arm's length when comparing the spot with the chart.
5. Take several readings.
6. Keep the Smoke Scale clean and store in an envelope provided when not in use.

## FAN/LIMIT CONTROL

The high limit cut-off switch is factory set to meet safety requirements. This setting is not adjustable.

The fan is cycled by a solid state fan timer control located in the blower cavity. (See Figure 11.)

# MAINTENANCE

## BURNER

For proper operation, replace the burner oil nozzle each year. It is located in the burner drawer. (See instructions furnished with burner for details.)

Periodically clean ignition electrodes, blower wheel and all filters in the oil line. Service should be performed by a qualified service technician at least once yearly at the beginning of the heating season.

## LUBRICATION

**IMPORTANT: DO NOT** attempt to lubricate the bearings on the blower motor. Addition of lubricants can reduce the motor life and void the warranty.

The blower motor is permanently lubricated by the manufacturer and does not require further attention.

The blower motor must be cleaned periodically by a qualified installer, service agency, or the oil supplier to prevent the possibility of overheating due to an accumulation of dust and dirt on the windings or on the motor exterior.

## AIR FILTER

The air filters must be kept clean. Dirty filters can restrict airflow. The motor depends upon sufficient air flowing across and through it to keep from overheating.

In a new house, the air filter may become clogged within a short time due to the presence of dust in the air and air ducts. A dirty filter retards the flow of air and prevents proper airflow. Permanent filters should be cleaned and disposable filters should be replaced at least once a year and more often if necessary (see User's Info. Manual).

**NOTE:** Do not use high static return air filters to replace standard furnace filters.

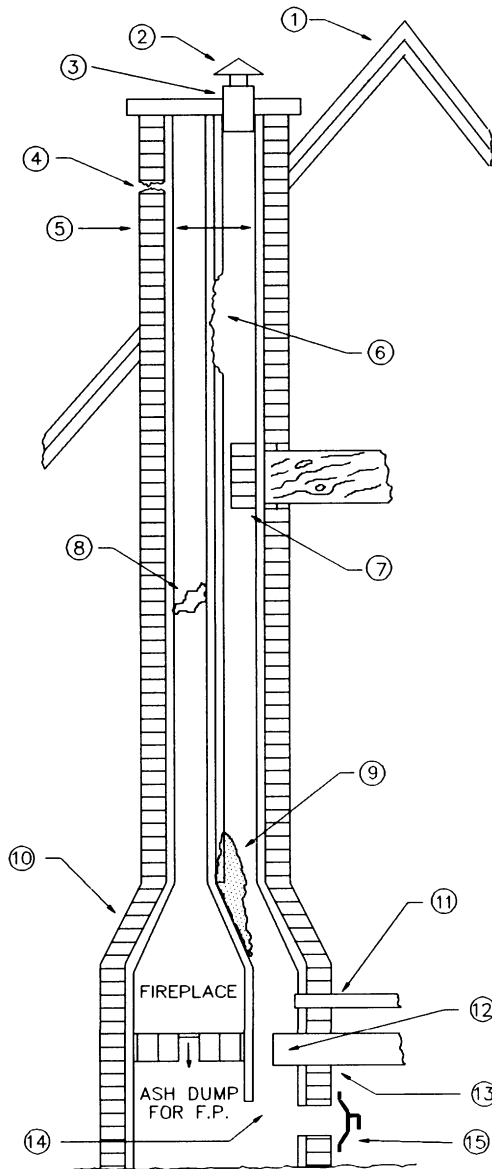
# BLOWER PERFORMANCE DATA—UPFLOW MODELS

| MODEL NUMBER  | BLOWER SIZE (IN.)<br>[mm] | MOTOR H.P.<br>[W] | BLOWER SPEED | CFM [L/s] AIR DELIVERY<br>E.S.P. INCHES [kPa] WATER COLUMN |            |             |             |
|---------------|---------------------------|-------------------|--------------|--|------------|-------------|-------------|
|               |                           |                   |              | 0.5 [.12]  | 0.4 [.10]  | 0.3 [.07]   | 0.2 [.05]   |
| (-)OBC-056LBA | 10 x 7<br>[254 x 178]     | 1/4<br>[186]      | LOW          | 600 [283]  | 620 [293]  | 635 [300]   | 645 [304]   |
|               |                           |                   | MED-LO*      | 795 [374]  | 835 [394]  | 870 [411]   | 885 [418]   |
|               |                           |                   | MED-HI       | 915 [432]  | 940 [444]  | 955 [451]   | 970 [458]   |
|               |                           |                   | HIGH         | 1140 [538]   | 1190 [562] | 1230 [580]  | 1260 [595]  |
| (-)OBC-056LBE | 10 x 7<br>[254 x 178]     | 1/4<br>[186]      | LOW          | 600 [283]  | 620 [293]  | 635 [300]   | 645 [304]   |
|               |                           |                   | MED-LO*      | 795 [375]  | 835 [394]  | 870 [411]   | 885 [418]   |
|               |                           |                   | MED-HI       | 915 [432]  | 940 [444]  | 955 [451]   | 970 [458]   |
|               |                           |                   | HIGH+        | 1140 [538]   | 1190 [562] | 1230 [580]  | 1260 [595]  |
| (-)OBC-067LBA | 10 x 7<br>[254 x 178]     | 1/4<br>[186]      | LOW          | 600 [283]  | 620 [293]  | 635 [300]   | 645 [304]   |
|               |                           |                   | MED-LO       | 795 [375]  | 835 [394]  | 870 [411]   | 885 [418]   |
|               |                           |                   | MED-HI*      | 915 [432]  | 940 [444]  | 955 [451]   | 970 [458]   |
|               |                           |                   | HIGH         | 1140 [538]   | 1190 [562] | 1230 [580]  | 1260 [595]  |
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|               |                           |                   | MED-LO       | 795 [375]  | 835 [394]  | 870 [411]   | 885 [418]   |
|               |                           |                   | MED-HI*      | 915 [432]  | 940 [444]  | 955 [451]   | 970 [458]   |
|               |                           |                   | HIGH+        | 1140 [538]   | 1190 [562] | 1230 [580]  | 1260 [595]  |
| (-)OBC-084QBA | 10 x 10<br>[254 x 254]    | 1/4<br>[186]      | LOW          | 580 [274]  | 620 [293]  | 645 [304]   | 670 [316]   |
|               |                           |                   | MED-LO       | 840 [396]  | 865 [408]  | 890 [420]   | 910 [429]   |
|               |                           |                   | MED-HI*      | 995 [470]  | 1030 [486] | 1070 [505]  | 1090 [514]  |
|               |                           |                   | HIGH         | 1260 [595]   | 1290 [609] | 1320 [623]  | 1340 [632]  |
| (-)OBC-084QBE | 10 x 10<br>[254 x 254]    | 1/2<br>[373]      | LOW*         | 1040 [491]   | 1065 [503] | 1080 [510]  | 1090 [514]  |
|               |                           |                   | MED-LO       | 1230 [580]   | 1260 [595] | 1285 [606]  | 1300 [614]  |
|               |                           |                   | MED-HI+      | 1375 [649]   | 1430 [675] | 1480 [698]  | 1530 [722]  |
|               |                           |                   | HIGH         | 1500 [708]   | 1575 [743] | 1645 [776]  | 1705 [805]  |
| (-)OBC-095QBA | 10 x 10<br>[254 x 254]    | 1/4<br>[186]      | LOW          | 580 [274]  | 620 [293]  | 645 [304]   | 670 [316]   |
|               |                           |                   | MED-LO       | 840 [396]  | 865 [408]  | 890 [420]   | 910 [429]   |
|               |                           |                   | MED-HI       | 995 [470]  | 1030 [486] | 1070 [505]  | 1090 [514]  |
|               |                           |                   | HIGH*        | 1260 [595]   | 1290 [609] | 1320 [623]  | 1340 [632]  |
| (-)OBC-095QBE | 10 x 10<br>[254 x 254]    | 1/2<br>[373]      | LOW          | 1040 [491]   | 1065 [503] | 1080 [510]  | 1090 [514]  |
|               |                           |                   | MED-LO*      | 1230 [580]   | 1260 [595] | 1285 [606]  | 1300 [614]  |
|               |                           |                   | MED-HI+      | 1375 [649]   | 1430 [675] | 1480 [698]  | 1530 [722]  |
|               |                           |                   | HIGH         | 1500 [708]   | 1575 [743] | 1645 [776]  | 1705 [805]  |
| (-)OBC-112QBA | 10 x 10<br>[254 x 254]    | 1/2<br>[373]      | LOW          | 1040 [491]   | 1065 [503] | 1080 [510]  | 1090 [514]  |
|               |                           |                   | MED-LO       | 1230 [580]   | 1260 [595] | 1285 [606]  | 1300 [614]  |
|               |                           |                   | MED-HI*      | 1375 [649]   | 1430 [675] | 1480 [698]  | 1530 [722]  |
|               |                           |                   | HIGH         | 1500 [708]   | 1575 [743] | 1645 [776]  | 1705 [805]  |
| (-)OBC-112QBG | 10 x 10<br>[254 x 254]    | 1/2<br>[373]      | LOW          | 1040 [491]   | 1065 [503] | 1080 [510]  | 1090 [514]  |
|               |                           |                   | MED-LO       | 1230 [580]   | 1260 [595] | 1285 [606]  | 1300 [614]  |
|               |                           |                   | MED-HI*      | 1375 [649]   | 1430 [675] | 1480 [698]  | 1530 [722]  |
|               |                           |                   | HIGH+        | 1500 [708]   | 1575 [743] | 1645 [776]  | 1705 [805]  |
| (-)OBC-130RBA | 11 x 10<br>[279 x 254]    | 1/2<br>[373]      | LOW          | 890 [420]  | 900 [425]  | 910 [429]   | 915 [432]   |
|               |                           |                   | MED-LO       | 1135 [536]   | 1145 [540] | 1160 [547]  | 1170 [552]  |
|               |                           |                   | MED-HI       | 1415 [668]   | 1435 [677] | 1445 [682]  | 1460 [689]  |
|               |                           |                   | HIGH*        | 1670 [788]   | 1690 [798] | 1710 [807]  | 1720 [812]  |
| (-)OBC-130RBJ | 11 x 10<br>[279 x 254]    | 3/4<br>[559]      | LOW          | 1045 [493]   | 1055 [498] | 1070 [505]  | 1090 [514]  |
|               |                           |                   | MED-LO       | 1375 [649]   | 1400 [661] | 1435 [677]  | 1450 [684]  |
|               |                           |                   | MED-HI*      | 1715 [809]   | 1745 [824] | 1760 [831]  | 1770 [835]  |
|               |                           |                   | HIGH+        | 2070 [977]   | 2110 [996] | 2145 [1012] | 2175 [1026] |
| (-)OBC-150RBA | 11 x 10<br>[279 x 254]    | 1/2<br>[373]      | LOW          | 890 [420]  | 900 [425]  | 910 [429]   | 915 [432]   |
|               |                           |                   | MED-LO       | 1135 [536]   | 1145 [540] | 1160 [547]  | 1170 [552]  |
|               |                           |                   | MED-HI       | 1415 [668]   | 1435 [677] | 1445 [682]  | 1460 [689]  |
|               |                           |                   | HIGH*        | 1670 [788]   | 1690 [798] | 1710 [807]  | 1720 [812]  |
| (-)OBC-150RBJ | 11 x 10<br>[279 x 254]    | 3/4<br>[559]      | LOW          | 1045 [493]   | 1055 [498] | 1070 [505]  | 1090 [514]  |
|               |                           |                   | MED-LO       | 1375 [649]   | 1400 [661] | 1435 [677]  | 1450 [684]  |
|               |                           |                   | MED-HI*      | 1715 [809]   | 1745 [824] | 1760 [831]  | 1770 [835]  |
|               |                           |                   | HIGH+        | 2070 [977]   | 2110 [996] | 2145 [1012] | 2175 [1026] |

NOTES: \*HEATING SPEED  
+COOLING SPEED

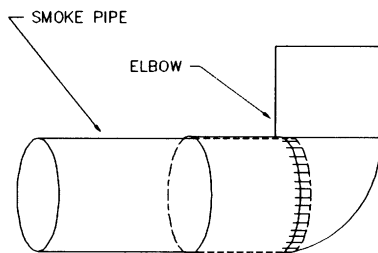
[ ] Designates Metric Conversions

# CORRECTION OF POOR CHIMNEY DRAFT CONDITIONS

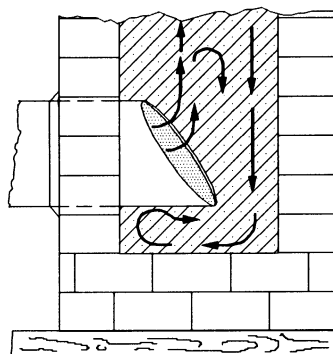


**FIGURE 24. CHIMNEY PROBLEMS**

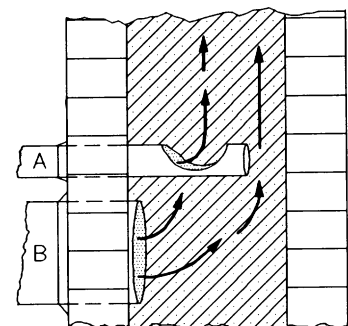
| CAUSE  | CORRECTION   |
|--|--|
| 1. Roof peak or other surrounding objects higher than chimney top.     | Extend chimney 24 inches above roof and surrounding objects within 30 feet.  |
| 2. Flue cap on chimney.  | Remove.  |
| 3. Coping smaller than chimney interior.                               | Enlarge to match chimney interior.   |
| 4. Air leak from loose bricks or mortar.                               | Replace loose bricks and mortar.   |
| 5. Inside dimensions of chimney are too small.                         | If all other causes have been eliminated a new chimney may have to be built.   |
| 6. Double chimney separation wall leaks due to loose bricks or mortar. | Replace loose bricks or mortar.  |
| 7. Joist protruding into chimney.                                      | Remove.  |
| 8. Brick, mortar or other obstruction lodged in chimney.               | Have chimney cleaned.  |
| 9. Soot accumulation in offset.  | Clean out.   |
| 10. Offset is too short.   | Straighten or lengthen offset.   |
| 11. More than one heating appliance connected to same chimney flue.    | Furnace ideally should have its own flue. If this is not possible, smoke pipe should be connected as shown in Figure 23. |
| 12. Smoke pipe protrudes into chimney or elbow too far.                | Make flush with inside of chimney.   |
| 13. Smoke pipe is loose fitting, too long or has too many elbows.      | Cement joints, shorten and eliminate elbows.   |
| 14. Opening between chimney flues.                                     | Seal openings permanently.   |
| 15. Loose fitting cleanout door.                                       | Seal openings, close door tightly.   |
| 16. New chimney.   | Allow 2 to 4 weeks to dry.   |
| 17. Excessive draft..  | Open barometric damper.  |



**FIGURE 25.** Pipe pushed too far inside elbow, as shown, interferes with draft.



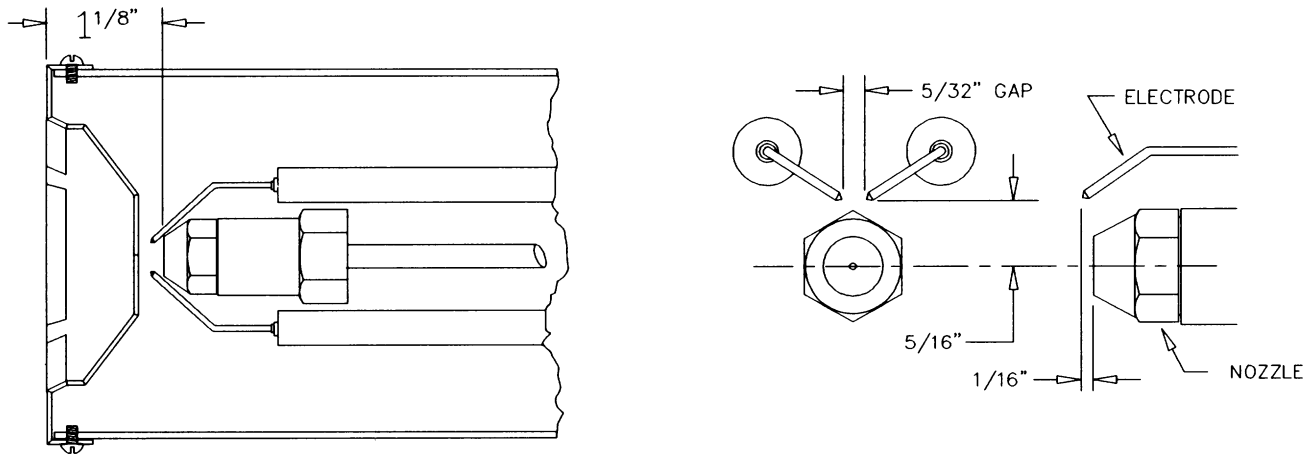
**FIGURE 26.** If chimney ends only a short distance below point where flue enters, make a "toothpick joint" as shown. Remove soot from below regularly.



**FIGURE 27.** If it is necessary to connect more than one heating appliance to the same chimney, connect furnace flue pipe as "B." Connect lower BTU appliance pipe as "A."

# OIL BURNER DATA

**FIGURE 28. BECKETT MODEL "AFG" BURNER**



# DRAWER ASSEMBLY DATA

| UNIT SIZE                  | NOZZLE*                      | END<br>CONE | STATIC DISC  | RATING |
|----------------------------|------------------------------|-------------|--------------|--------|
|                            | G.P.H./ANGLE/PATTERN         |             |              |        |
| BECKETT MODEL “AFG” BURNER |                              |             |              |        |
| 056/067                    | DELAVAN (.50, .60)-70°B      | F0          | 3-3/8” SOLID | AF**JY |
| 084/095/112                | DELAVAN (.75, .85, 1.0)-70°B | F3          | 3-3/8” SOLID | AF**XN |
| 130/150                    | DELAVAN (1.2, 1.35)-70°B     | F6          | 3-3/8” SOLID | AF**JZ |

\*NOTE: This appliance should only be used with specified Delavan or Monarch nozzles. Use of other nozzles may result in unsatisfactory performance.

## ► Troubleshooting

**Important: 90% of start-up problems are due to air leaks in the suction line.**

### Complaint

Odor, soot and smoky fire

### Check for:

1. Insufficient combustion air
2. Lack of proper draft
3. Cracked/plugged heat exchanger
4. Burner not adjusted properly with combustion kit
5. Improper setting of barometric draft control
6. Oil leaks
7. Wrong nozzle size, or nozzle worn or partially clogged
8. Improper setting of electrodes
9. Plugged oil filter
10. Fuel pump cutoff valve not cutting off
11. Nozzle or electrodes improperly positioned
12. Leakage on return side of air distribution system
13. After drip, reflected heat, or impingement of flame
14. Improper or distorted end cone
15. Air leakage into oil pump supply line
16. Burner blower air inlet restricted or burner blower wheel dirty
17. Restricted flue

Delayed ignition

1. Cracked, dirty or loose electrodes
2. Electrodes not properly adjusted
3. Incorrect nozzle
4. Improper primary air adjustment
5. Faulty ignition transformer
6. Water in fuel oil
7. Incorrect pump pressure
8. Furnace not properly set-up
9. Air leakage into oil supply line

Burner will not operate

1. Open switch
2. Open fuse or circuit breaker
3. Burner motor overload open
4. Thermostat improperly set
5. Burner primary control safety open

Burner motor runs but does not fire

1. Oil supply insufficient
2. Faulty oil pump
3. Broken oil pump drive coupling
4. Coke deposits on electrodes
5. Air in oil supply line
6. Restricted oil supply line
7. Clogged nozzle
8. Restricted oil line filter
9. Leak in oil line
10. Failed ignition transformer
11. Electrodes not properly set
12. Dirty fire detector

Pulsations

1. Improper nozzle
2. Inadequate draft
3. Air in oil line
4. Clogged flue
5. Furnace not properly set-up
6. Partially clogged pump strainer or oil line filter

| Complaint                           | Check for:   |
|-------------------------------------|--|
| Cad cell not functioning            | <ol style="list-style-type: none"> <li>7. Nozzle plugged</li> <li>8. Nozzle too far forward in air tube</li> <li>9. Barometric damper set wide open</li> </ol><br><ol style="list-style-type: none"> <li>1. Requires direct view of flame</li> <li>2. External light effecting cell operation</li> <li>3. Remove cad cell and check with an ohmmeter: <ol style="list-style-type: none"> <li>a. With cad cell covered, the resistance should be over 100K ohms</li> <li>b. With cad cell exposed to room light, the resistance should be under 1.5 K ohms</li> </ol> </li> </ol> |
| Low CO <sub>2</sub>                 | <ol style="list-style-type: none"> <li>1. High draft through furnace</li> <li>2. Improper primary air adjustment</li> <li>3. Damaged combustion chamber</li> <li>4. Faulty nozzle</li> <li>5. Incorrect oil pressure</li> <li>6. Draft regulator improperly set</li> <li>7. Incorrect fuel/air mixture</li> </ol>  |
| High stack temperatures             | <ol style="list-style-type: none"> <li>1. Damaged combustion chamber</li> <li>2. Furnace not set-up with combustion kit</li> <li>3. Undersized return air</li> <li>4. Overfired furnace</li> <li>5. Dirty heat exchanger</li> <li>6. High draft, barometric damper not properly set</li> <li>7. Excessive temperature rise</li> <li>8. Air shutter adjustment open too much.</li> </ol>  |
| High smoke reading                  | <ol style="list-style-type: none"> <li>1. Lack of combustion air</li> <li>2. Inadequate overfire draft</li> <li>3. Incorrect oil pressure</li> <li>4. Dirty burner blower wheel</li> <li>5. Incorrect nozzle</li> <li>6. Faulty oil pump</li> </ol>  |
| Burner motor runs but does not fire | <ol style="list-style-type: none"> <li>7. Dirty oil</li> <li>8. Burner motor not obtaining full speed</li> <li>9. Damaged combustion chamber</li> <li>10. Flame impingement</li> <li>11. Incorrect fuel/air mixture</li> </ol>   |
| Poor draft - overfire and stack     | <ol style="list-style-type: none"> <li>1. Improperly sized chimney or not enough chimney height</li> <li>2. Holes or cracks in chimney</li> <li>3. Restricted chimney</li> <li>4. Too many 90 degree elbows in vent pipe</li> <li>5. Outside chimney too cool</li> <li>6. Cool flue gases</li> <li>7. Barometric damper not properly set, sticking or in wrong location</li> <li>8. Oil furnace and fireplace chimney interconnected</li> <li>9. Heat exchanger passages plugged</li> <li>10. Overfired furnace</li> <li>11. Improper air shutter adjustment</li> </ol>          |
| Noisy Operation                     | <ol style="list-style-type: none"> <li>1. Bad coupling alignment</li> <li>2. Air in oil supply line (use only good flare fittings)</li> <li>3. Tank hum on two-pipe system and inside tank</li> </ol>  |

## Oil Pump Pressure Problems And Their Possible Causes

### Complaint

### Check for:

Excessive Pressure

1. Bypass plug in place with a single oil line system
2. Return oil line on two-pipe system clogged, kinked or restricted
3. Pressure regulating valve stuck
4. Oil too heavy
5. Improper pump setting

Insufficient Pressure

1. Nozzle size beyond rated pump pressure
2. Pump vapor bound due to high oil line vacuum
3. Nozzle badly worn
4. Pump gears worn
5. Suction line kinked, clogged or restricted
6. Pressure regulating valve worn or stuck in operating position
7. Dirty strainers
8. Dirty line filter
9. Motor does not come up to speed
10. Bad air leak at seal
11. Improper pump setting

Fluctuating Pressure

1. Pump gears worn
2. Vertical oil lift too great (over 10 feet)
3. Pump strainer or oil line filter partially clogged
4. Bypass plug not in place with two line system
5. Pump vapor bound due to high vacuum
6. Faulty foot or check valve
7. Suction line too small
8. Sticky pressure regulating valve
9. Motor coupling grabbing

No Pressure

1. Pump air bound
2. Loose coupling
3. Oil tank empty
4. Strainer or filter completely clogged
5. Suction line completely restricted
6. Air leaks in suction line
7. Gears badly worn and pump cannot create vacuum to lift oil
8. Badly leaking pump or filter seal
9. Wrong pump rotation
10. Tank vent clogged



# FURNACE ADJUSTMENT CHECK SHEET

Customer's Name \_\_\_\_\_ Date: \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

Furnace \_\_\_\_\_ Model # \_\_\_\_\_

Serial # \_\_\_\_\_

Nozzle Size/Angle/spray pattern \_\_\_\_\_ gal./hr. /° / pattern

Electrodes Adjusted \_\_\_\_\_

Nozzle Oil Pressure \_\_\_\_\_ p.s.i.g.

Overfire Draft \_\_\_\_\_ inches negative H<sub>2</sub>O

Breech Draft \_\_\_\_\_ inches negative H<sub>2</sub>O

Chimney Draft \_\_\_\_\_ inches negative H<sub>2</sub>O

Smoke Reading \_\_\_\_\_

%CO<sub>2</sub> \_\_\_\_\_

%CO<sub>2</sub> \_\_\_\_\_

Stack Temperature \_\_\_\_\_ degrees F.

Room Temperature \_\_\_\_\_ degrees F.

Net Stack Temperature \_\_\_\_\_ degrees F.

Burner Efficiency \_\_\_\_\_

Supply Air Temperature \_\_\_\_\_ degrees F.

Return Air Temperature \_\_\_\_\_ degrees F.

Supply Air Temperature Rise \_\_\_\_\_ degrees F.

Air Band / Air Shutter \_\_\_\_\_ settings

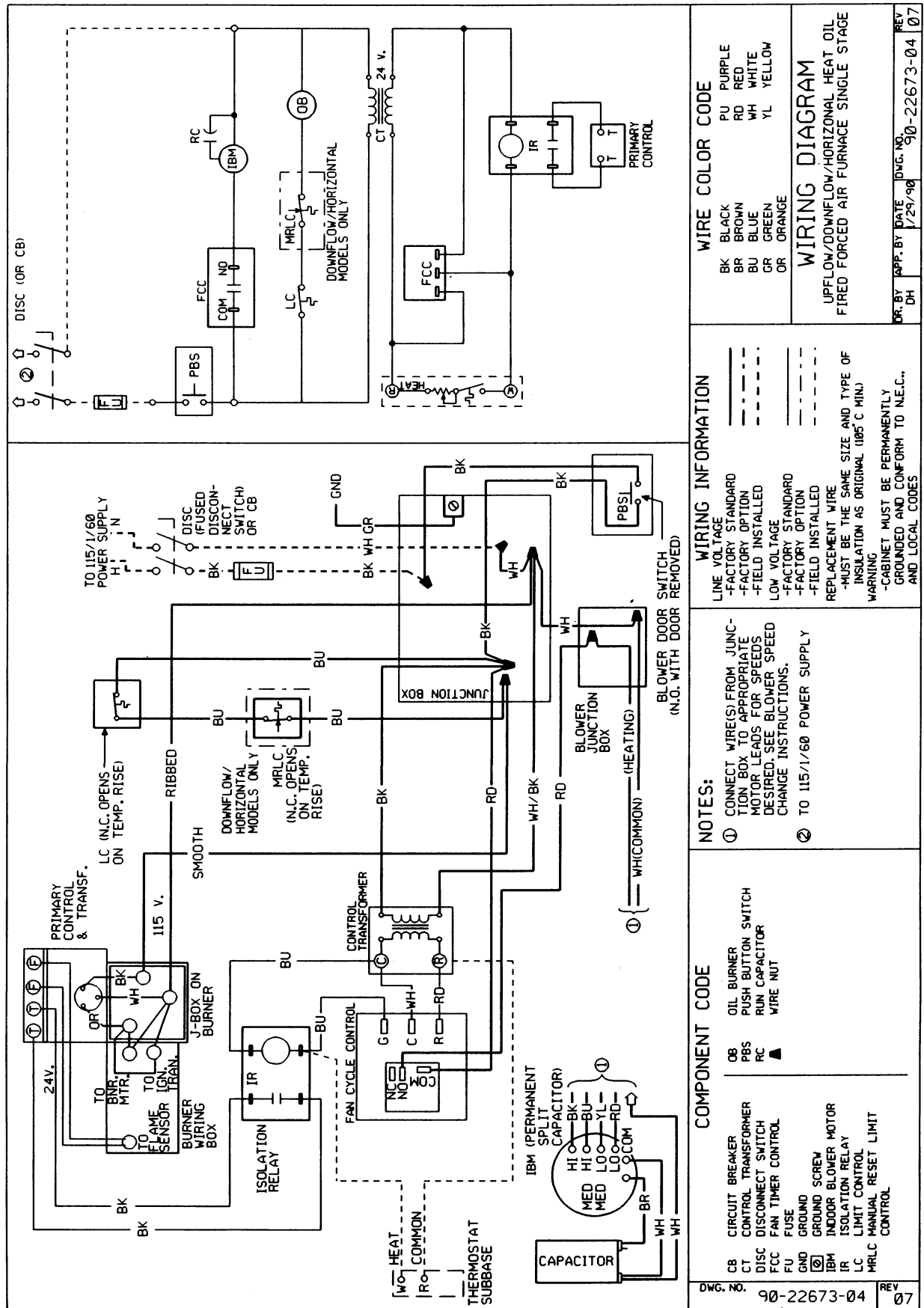
\_\_\_\_\_

\_\_\_\_\_  
Installer's signature

## 26



# PARALLEL WIRING UPFLOW OIL FURNACES SCHEMATIC



## 28



