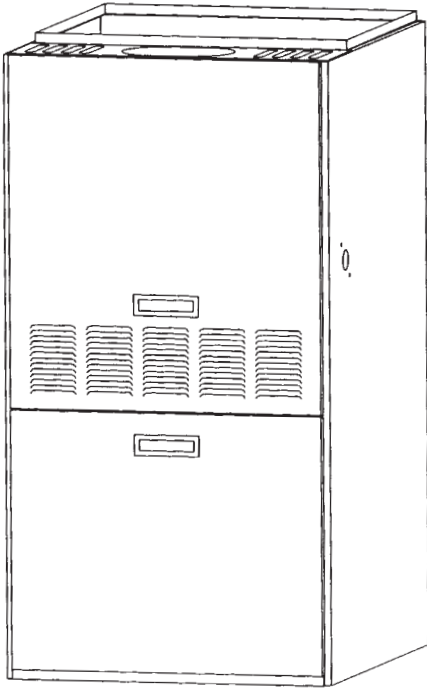


# INSTALLATION INSTRUCTIONS

## FOR (-)OBF UPFLOW OIL FIRED FURNACES



**IMPORTANT:** Do not use a power-robbing electronic thermostat with this furnace. Use only mechanical thermostats or battery powered electronic thermostats.



**ISO 9001:2000**

Certificate Number: 30164



**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

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.

### ▲ WARNING

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

### ▲ WARNING

- 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 (carbon monoxide) 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.

**DO NOT DESTROY THIS MANUAL. PLEASE READ CAREFULLY AND KEEP IN A SAFE PLACE FOR FUTURE REFERENCE BY A SERVICEMAN.**

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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

## **▲ WARNING**

**DO NOT USE THIS FURNACE IF ANY PART HAS BEEN UNDER WATER. A FLOOD-DAMAGED FURNACE IS EXTREMELY DANGEROUS. ATTEMPTS TO USE THE FURNACE CAN RESULT IN FIRE OR EXPLOSION. A QUALIFIED SERVICE AGENCY SHOULD BE CONTACTED TO INSPECT THE FURNACE AND TO REPLACE ALL GAS CONTROLS, CONTROL SYSTEMS PARTS, ELECTRICAL PARTS THAT HAVE BEEN WET OR THE FURNACE, IF DEEMED NECESSARY.**

## **▲ 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.**

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.
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. **IMPORTANT:** 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.
8. Install this furnace only in a location and position as specified in the general information section of these instructions. Provide adequate combustion and ventilation air to the furnace space as specified in the venting section of these instructions.
9. Provide adequate combustion and ventilation air to the furnace space as specified in venting section of these instructions.
10. Combustion products must be discharged outdoors. Connect this furnace to an approved vent system only, as specified in the venting section of these instructions.
11. Always install furnace to operate within the furnace's intended temperature-rise range with a duct system which has an external static pressure within the allowable range, as specified in general information section of these instructions. See furnace rating plate.
12. When a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.
13. The furnace is not to be used for temporary heating of buildings or structures under construction.

**Important:** All Rheem products meet current Federal OSHA Guidelines for safety. California Proposition 65 warnings are required for certain products, which are not covered by the OSHA standards.

California's Proposition 65 requires warnings for products sold in California that contain, or produce, any of over 600 listed chemicals known to the State of California to cause cancer or birth defects such as fiberglass insulation, lead in brass, and combustion products from natural gas.

All "new equipment" shipped for sale in California will have labels stating that the product contains and/or produces Proposition 65 chemicals. Although we have not changed our processes, having the same label on all our products facilitates manufacturing and shipping. We cannot always know "when, or if" products will be sold in the California market.

You may receive inquiries from customers about chemicals found in, or produced by, some of our heating and air-conditioning equipment, or found in natural gas used with some of our products. Listed below are those chemicals and substances commonly associated with similar equipment in our industry and other manufacturers.

- Glass Wool (Fiberglass) Insulation
- Carbon Monoxide (CO)
- Formaldehyde
- Benzene

More details are available at the Websites for OSHA (Occupational Safety and Health Administration), at [www.osha.gov](http://www.osha.gov) and the State of California's OEHHA (Office of Environmental Health Hazard Assessment), at [www.oehha.org](http://www.oehha.org). Consumer education is important since the chemicals and substances on the list are found in our daily lives. Most consumers are aware that products present safety and health risks, when improperly used, handled and maintained.

# 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

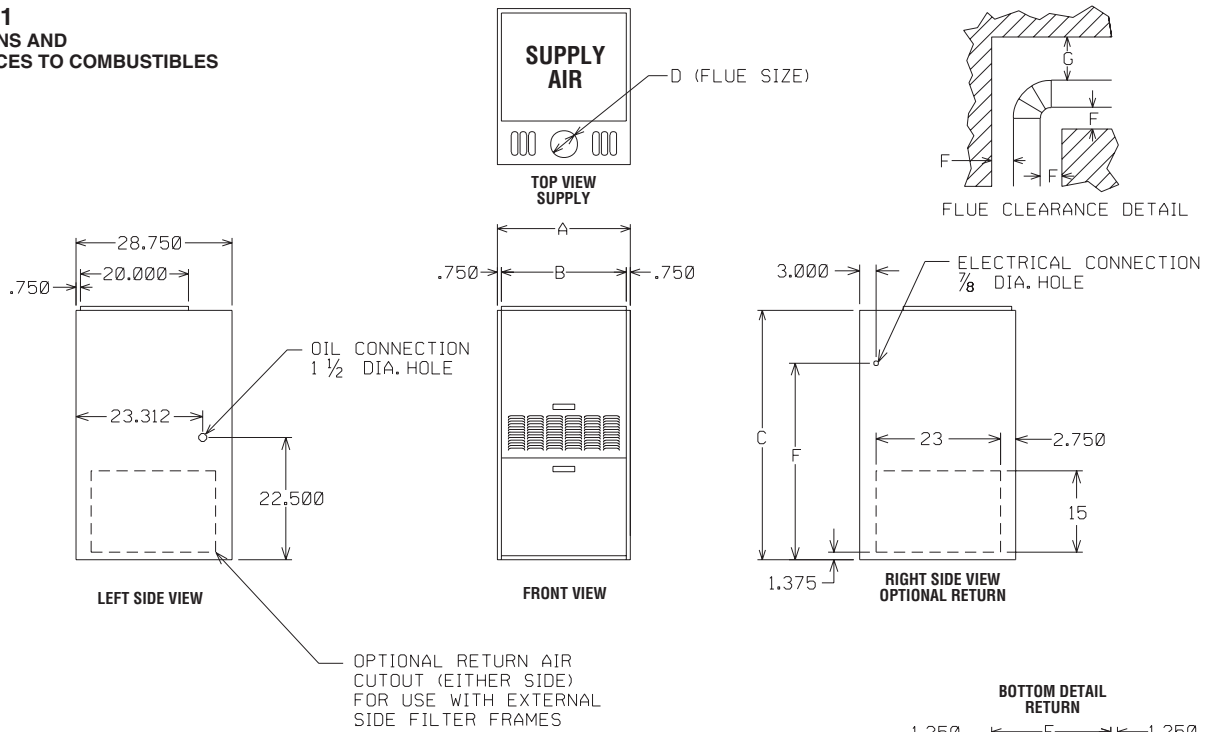
Installation of Air Conditioning and Ventilating Systems  
NFPA No. 90A

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

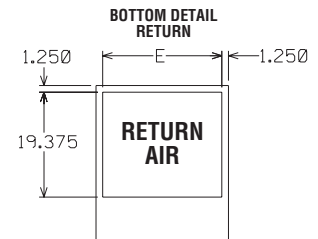
Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances NFPA No. 211

## GENERAL INFORMATION

**FIGURE 1**  
DIMENSIONS AND CLEARANCES TO COMBUSTIBLES



MODEL	HEATING CAPACITY	DIMENSIONS						REDUCED CLEARANCES (IN.)					FLUE	
		A	B	C	D	E	F	LEFT SIDE	RIGHT SIDE	BACK	FRONT	TOP	F	G
-067	56.000 67.200	21	19½	46	5	18½	33¾	1	1	1	8	3	4	8
-112	84000 95200 112000	24½	23	46	5	22	33¾	1	1	1	8	3	4	8
-150	134400 151200	28	26½	49	7	25½	36¼	1	1	1	8	3	4	8



a0965

**TABLE 1**  
**BLOWER PERFORMANCE DATA**

MODEL NUMBER	HEATING CAPACITY (BTU/H) [KW]	BLOWER SIZE	MOTOR HP	BLOWER SPEED	CFM AIR DELIVER E.S.P. INCHES WATER COLUMN				NOZZLE SIZES (GPH)	HEATING SPEED	COOLING SPEED
					0.5	0.4	0.3	0.2			
-067	56000 [16.41KW]	10 X 7	1/4	HIGH	1140	1190	1230	1260	0.5	MED-LOW	HIGH
	67200 [19.69KW]			MED-HIGH	15	940	955	970			
-112	84000 [24.62KW]	10 X 10	1/2	MED-HIGH	1500	1575	1645	1705	0.75	LOW	HIGH
	95200 [27.90KW]			MED-LOW	1375	1430	1480	1530			
	112000 [32.83KW]			LOW	1230	1260	1285	1300			
-150	134400 [39.38KW]	11 X 10	3/4	HIGH	2070	2110	2145	2175	1.20	MED-HIGH	HIGH
	151200 [44.30KW]			MED-HIGH	1715	1745	1760	1770			
				MED-LOW	1375	1400	1435	1450			
				LOW	1045	1055	1070	1090	1.35	HIGH	HIGH

**TABLE 2**  
**UPFLOW OIL FURNACE SPECIFICATIONS**

MODEL NUMBER	-067	-112	-150
HEATING CAPACITY (BTU/H) [KW]	56000 [16.41KW] 67200 [19.69KW]	84000 [24.62KW] 95200 [27.90KW] 112000 [32.83KW]	134400 [39.38 KW] 151200 [44.30KW]
BLOWER MOTOR DRIVE	DIRECT	DIRECT	DIRECT
BLOWER DIA. x WIDTH	10 x 7	10 x 10	11 x 10
MOTOR H.P. (NO. OF SPEEDS)	1/4 (4)	1/2 (4)	3/4 (4)
WIDTH	21	24½	28
DEPTH	28¾	28¾	28¾
HEIGHT	46	46	49
FILTER RACK RXGF-	Z16B	Z16B	Z16B
HEATING EXT. STATIC PRESSURE	2	2	2
MAX. EXTERNAL STATIC PRESSURE	.5	.5	.5
TEMPERATURE RISE RANGE F	40-70	50-80	60-90
BLOWER MOTOR FULL LOAD AMPS	5.7	8.7	11.0
TOTAL CURRENT	7.5	14.1	16.1
MINIMUM CIRCUIT AMPACITY	11.6	16.3	18.8
FLUE SIZE—DIA.	5"	5"	7"
AIR DELIVERY (HEATING/COOLING)	915/1140	1375/1500	1715/2070
AIR FILTER SIZE (QTY.)	(1) 16 x 25 x 1	(1) 16 x 25 x 1	(1) 16 x 25 x 1
APPROX. SHIP WT. (LBS.)	160	198	207

## SELECTING NOZZLE SIZE

All furnaces are capable of firing at multiple rates (see Table 3). The furnaces are shipped with the highest heat output rate nozzle installed. Smaller nozzles are included in the parts bag, shipped with the furnace. Select the appropriate nozzle by determining the load requirements of the house and comparing it to the Net Input (see Table 3). If the load is greater than the Net Input for the nozzle, select the next highest nozzle size. Use Table 1 to select the appropriate flow speed for the nozzle size selected.

### ▲ CAUTION

**NOZZLE CHANGES/INPUT RATE DETERMINATION SHOULD ONLY BE MADE BY A QUALIFIED SERVICE TECHNICIAN.**

### FIGURE 3

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF .50 GALLONS PER HOUR AND AN INPUT RATING OF 70,000 BTUH.

92-100538-01A-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF .60 GALLONS PER HOUR AND AN INPUT RATING OF 84,000 BTUH.

92-100538-01B-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF .75 GALLONS PER HOUR AND AN INPUT RATING OF 105,000 BTUH.

92-100538-01C-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF .85 GALLONS PER HOUR AND AN INPUT RATING OF 119,000 BTUH.

92-100538-01D-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF 1.00 GALLONS PER HOUR AND AN INPUT RATING OF 140,000 BTUH.

92-100538-01E-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF 1.20 GALLONS PER HOUR AND AN INPUT RATING OF 168,000 BTUH.

92-100538-01F-00

THIS FURNACE WAS INSTALLED WITH A NOZZLE HAVING A FIRING RATE OF 1.35 GALLONS PER HOUR AND AN INPUT RATING OF 189,000 BTUH.

92-100538-01G-00

#### INSTRUCTIONS:

PEEL OFF APPROPRIATE LABEL AND APPLY ADJACENT TO FURNACE RATING LABEL. FIRING RATE AND INPUT RATING ON LABEL MUST AGREE WITH THE ACTUAL FIRING RATE AND INPUT RATING OF THE FURNACE AS INSTALLED.

DISCARD REMAINING LABELS.

92-100538-01-00

**TABLE 3  
UPFLOW HEATING CAPACITY**

MODEL NUMBER	DELANO NOZZLE SIZES	DEL-O-FLO NOZZLE SIZES	GROSS INPUT (BTUH)	NET INPUT (BTUH)	AFUE (ISOLATED COMBUSTION)
-067	—	(.50, .65) - 70°B	70,000	58,000	82.9%
			84,000	67,000	80.8%
-112	(1.0) - 70°B	(.75, .85) - 70°B	105,000	86,100	82.0%
			119,000	96,900	81.4%
-150	(1.2, 1.35) - 70°B	—	140,000	112,000	80.0%
			168,000	136,000	81.0%
			189,000	154,000	81.5%

**FIGURE 2  
TYPICAL RATING PLATE INFORMATION**

OIL FIRED FURNACE / FOURNEAU CHAUFFÉ AU MAZOUT MADE IN THE USA

MODEL NO. SERIAL NO.

SCRATCH INK OFF OF INPUT RATING / BONNET CAPACITY / FIRING RATE FUEL OIL CS NO. 2 / SQUARE FOR APPROPRIATE CAPACITÉ D'ENTRÉE CAPACITÉ DU CAPOT TAUX DE CHAUFFAGE DU MAZOUT CS N°2

SETTING BTUH BTUH GPH

\*\*\* FACTORY RATE (SEE ITEM B INPUT FOR PROPER RATING TO BE INDICATED)

FOR USE WITH OIL BURNER / POUR UTILISATION AVEC LE FOURNEAU À MAZOUT

DRAFT REQUIRED AT FURNACE FLUE .04 IN. W.C. / TIRAGE REQUIS AU CONDUIT DU FOURNEAU: 0,04 POUCE CDE

ELECTRIC RATING / PUISSANCE: 115V, 60HZ, 1 PHASE

MAXIMUM OVERCURRENT PROTECTION / MINIMUM CIRCUIT AMPACITY / TOTAL CURRENT / CHARGE LIMITE EN AMPÈRES DU CIRCUIT COURANT TOTAL

PROTECTION MAXIMALE CONTRE LES SURTENSIONS AMPS AMPS AMPS

TESTED AT EXT. STATIC PRESSURE / BLOWER / HP / TEMP RISE / ÉLÉVATION DE TEMP

TESTÉ SOUS PRESSION STATIQUE EXT. SOUFFLEUR CV DE TEMP

INCHES W.C. / PO. CDE TO °C °F

DESIGNED MAXIMUM OUTLET AIR TEMP. / TEMP. MAX. D'AIR SORTANT:

THIS OIL FIRED FURNACE IS SUITABLE FOR USE WITH THE Tjernlund Model SS1-R POWER VENTER WHEN INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION INSTRUCTIONS. / CE FOURNEAU À MAZOUT CONVIENT POUR L'UTILISATION AVEC LA SOUFFLANTE ÉLECTRIQUE MODÈLE SS1-R TJERNLUND LORSQU'IL EST INSTALLÉ CONFORMÉMENT AUX INSTRUCTIONS D'INSTALLATION DU FABRICANT.

9120147-0405

#### NOTE:

When installing the furnace, be sure to mark the appropriate firing rate/nozzle size on the rating label (see Figure 2) by scratching the surface off of the appropriate square. The appropriate label from sheet 92-100538-01 (see Figure 3) must also be applied near the rating plate.

# 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. 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.**

## COMBUSTION AIR SUPPLY

### ▲ WARNING

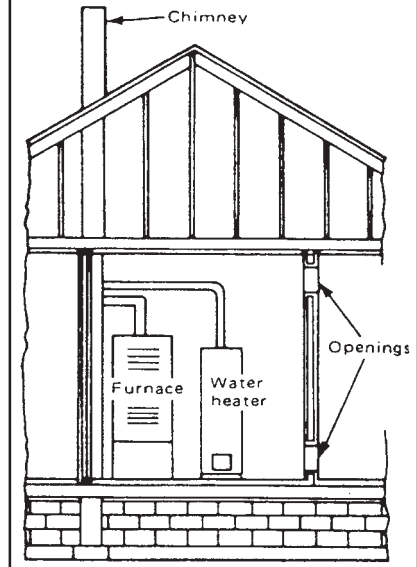
**THIS FURNACE MUST BE PROVIDED WITH ENOUGH FRESH AIR FOR PROPER COMBUSTION AND VENTILATION OF FLUE GASES. SOME HOMES MAY REQUIRE THAT OUTSIDE AIR BE SUPPLIED TO THE FURNACE AREA. FAILURE TO PROVIDE ENOUGH FRESH AIR CAN CAUSE DEATH FROM CARBON MONOXIDE POISONING.**

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 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 4). Refer to the rating plate label on the furnace for information on the minimum free area of these two openings.

**FIGURE 4**  
OPENINGS FOR CONFINED SPACES

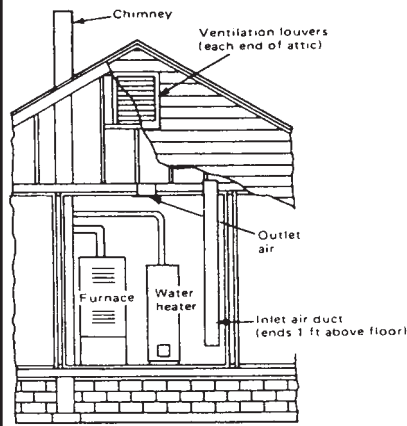


When appliances are installed in an **unconfined** space in a building of conventional frame, brick or stone construction, infiltration normally is adequate to provide for combustion ventilation and draft control dilution. If the unconfined space is within a building of unusually tight construction, 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 BTUH 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

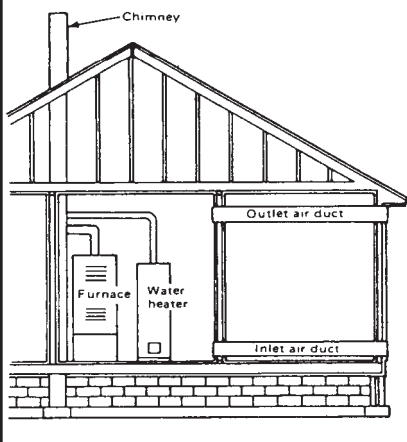
conditions, two openings of approximately equal area (one located near the top and one located near the bottom of the enclosure) must be provided each with a total free area of not less than 1 square inch per 4,000 BTU's / Hr. of total input rating of all appliances in the enclosure (see figure 5).

**FIGURE 5**  
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 BTUH of total input of all appliances in the enclosure (see figure 6).

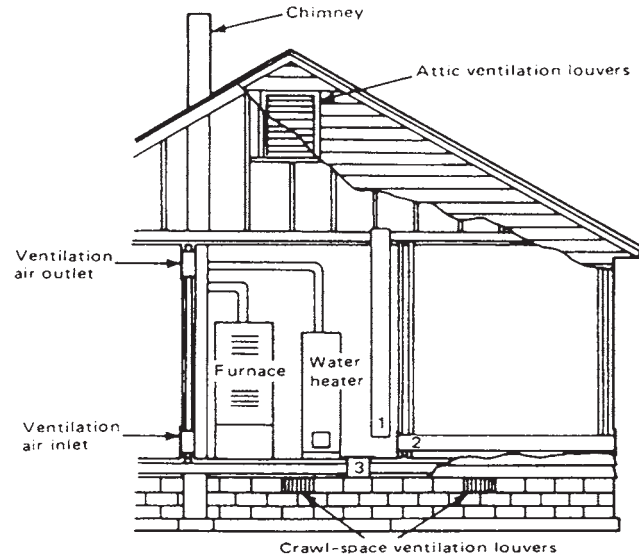
**FIGURE 6**  
DIRECTLY CONNECTING HORIZONTAL DUCTS TO OUTDOORS



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 7 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 8).

**FIGURE 7**  
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 BTUH of the aggregate input rating of all fuel-burning appliances installed therein.

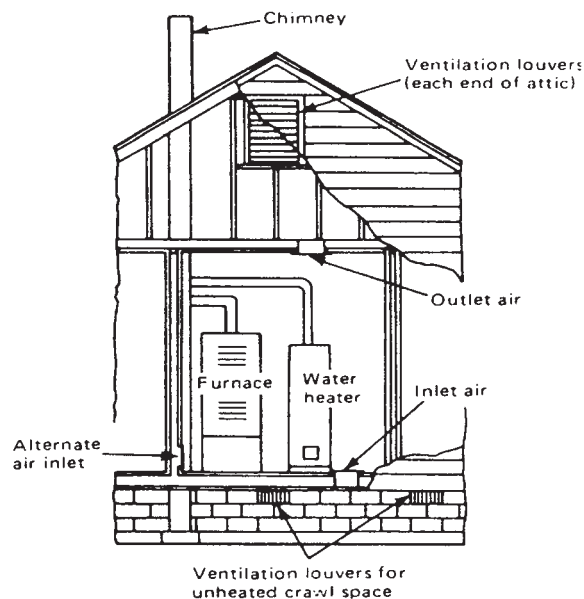
**Unconfined Space** - Any space whose volume is equal to or greater than 50 cu. ft. per 1,000 BTUH of the aggregate input rating of all fuel-burning appliances installed therein. Rooms connecting directly with the space in which the appliances are located by means of openings that have no doors

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 8**  
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 REQUIREMENTS.**

### ▲ 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 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 (supply-air side) or in parallel with the furnace to avoid condensation in the heat exchanger.

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:

**TABLE 4**

BTU OUTPUT	FLUE SIZE
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:

**TABLE 5**

GROSS BTU INPUT	RECTANGULAR TILE (INCHES)	ROUND TILE (INCHES)	MINIMUM HEIGHT (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.

**Metal Thickness for Galvanized Steel Pipe Connectors**

Diameter of Connector (in.)	Diameter of Connector (mm)	Galvanized Sheet Gauge No.	Minimum Thickness (in.)	Minimum Thickness (mm)
< 6	< 152	26	0.019	0.48
≥ 6 to ≤ 10	≥ 152 to ≤ 254	24	0.024	0.61
> 10 to ≤ 16	> 254 to ≤ 406	22	0.029	0.74
> 16	> 406	16	0.056	1.42

**IMPORTANT:** For horizontally vented applications, use the Tjernlund SS1-R power vent (date code of ??? or later) installed to the manufacturer's installation instructions.

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.

**⚠ WARNING**

*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 9) 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 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.

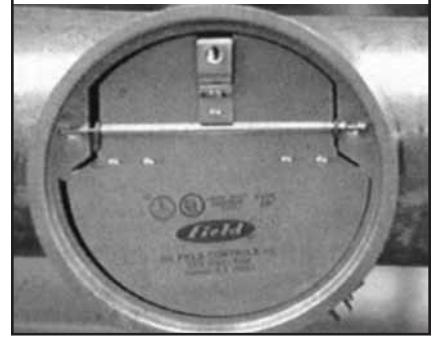
**On start up, the furnace must be set for field conditions with a combustion kit for proper operation.**

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

**FIGURE 9 BAROMETRIC DAMPER**



**OIL BURNER / PRIMARY CONTROL**

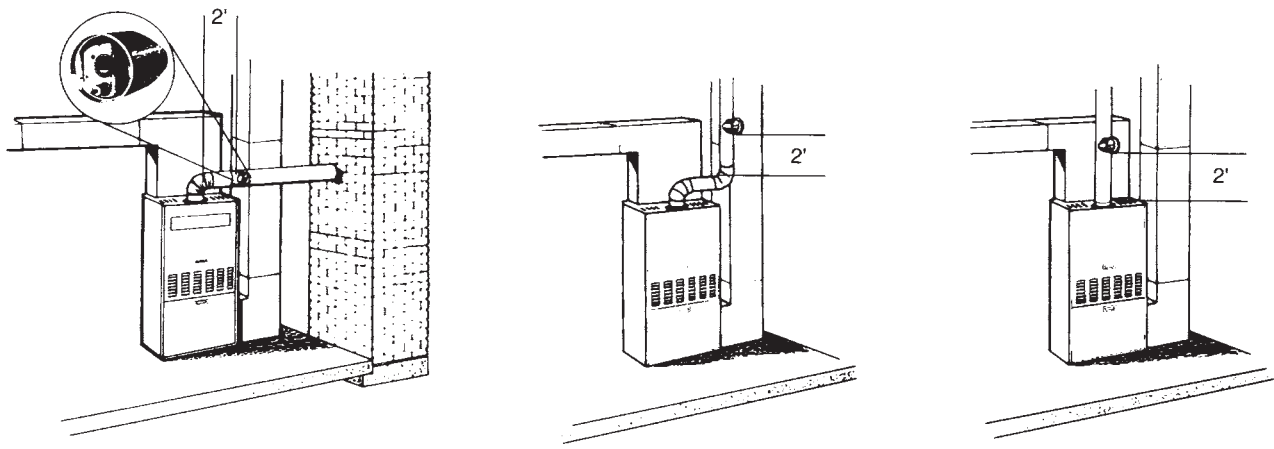
Oil burner and primary control are mounted to the furnace as a single assembly. Standard equipment consists of the oil burner, ignition transformer, and flame sensor (cadmium sulfide cell) with primary control and low voltage transformer all included on the burner assembly.

*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 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	99	83	68	52	

**FIGURE 10 RECOMMENDED BAROMETRIC DAMPER LOCATIONS**



**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.

### ▲ WARNING

**IN A TWO-PIPE SYSTEM (ONE SUPPLY AND ONE RETURN) DO NOT INSTALL A SHUTOFF VALVE ON THE RETURN LINE. DOING SO CAN CAUSE DAMAGE TO THE EQUIPMENT, OR CAUSE A FIRE RESULTING IN PROPERTY DAMAGE, INJURY OR DEATH.**

## SINGLE AND DUAL OIL FILTRATION

We recommend the use of a replaceable core, or spin-on type, supply line (suction) oil filter or dual filtration (primary and secondary) filters. As oil tanks age, sediment or sludge, will accumulate. Without a filter, suspended particles of moisture and heavy oil that fall to the bottom of the tank can make their way into the fuel pump or nozzle. These particles will stack and restrict flow at the nozzle slots.

Filters can be disposable, or cleanable construction (for number 2 fuel) sized for the suction line, using flare fittings. Do not use compression fittings.

Select the filter by GPH (gallon per hour) flow-rate and pressure drop through the filter after determining the maximum flow rate, one-pipe or two-pipe system, requirements. The filter should be installed indoors and serviced/replaced annually.

A pump strainer can filter particles at 150 microns, nozzles have filtration at 50 microns. The filter selected should

retain particles that are less than 50 microns (rated at 44 microns or 325 mesh, or less) in size to prevent accumulation of small particles (agglutination) at the nozzle slots and remove these particles before they reach these burner components.

Dual filtration, using a primary filter (mounted near the supply tank) to protect the secondary filter (usually mounted just ahead of the burner) should also be rated for particles less than 50 microns in size. The purpose of dual filtration is to prevent stacking, or agglutination, of particles less than 50 microns and may be necessary for some applications.

Filtration, single or dual, will protect the nozzle and prevent erratic or improper spray patterns that reduce efficiency, cause damage, higher maintenance costs or the need for emergency service.

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 figures 31, 32 & 33).

**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

POWER ROBBING THERMOSTATS

**IMPORTANT:** *There are three basic types of thermostats. They are: mechanical, battery powered and power robbing. Thermostats that are powered by furnace transformer voltage, referred to as "power robbing," may not be used. Use of a power robbing thermostat will result in intermittent operation.*

**TABLE 6  
LOW VOLTAGE WIRING**

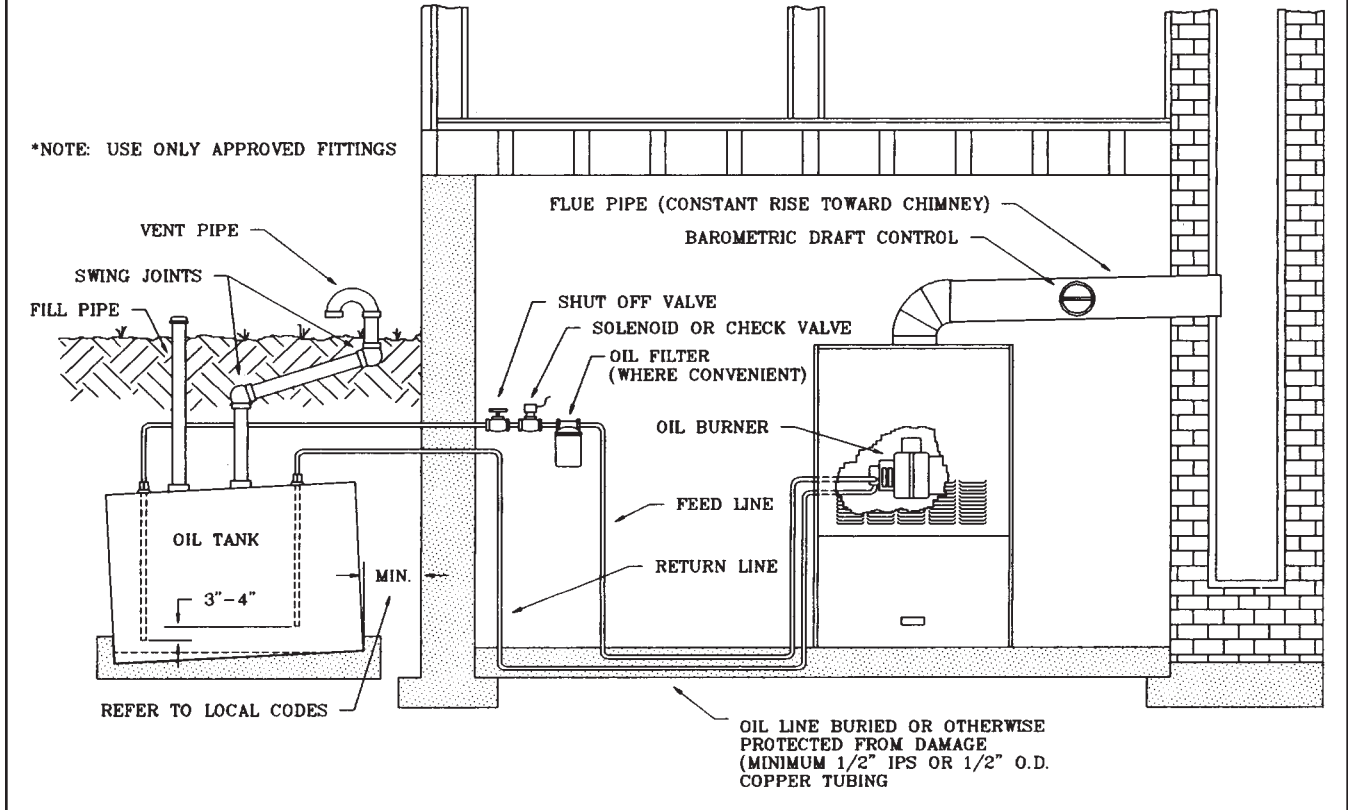
		SOLID COPPER WIRE - AWG					
THERMOSTAT LOAD - AMPS	3.0	16	14	12	10	10	10
	2.5	16	14	12	12	10	10
	2.0	18	16	14	12	12	10
		50	100	150	200	250	300
		LENGTH OF RUN - FEET ☺					

☺ The total wire length is the distance from the furnace to the thermostat and back to the furnace.

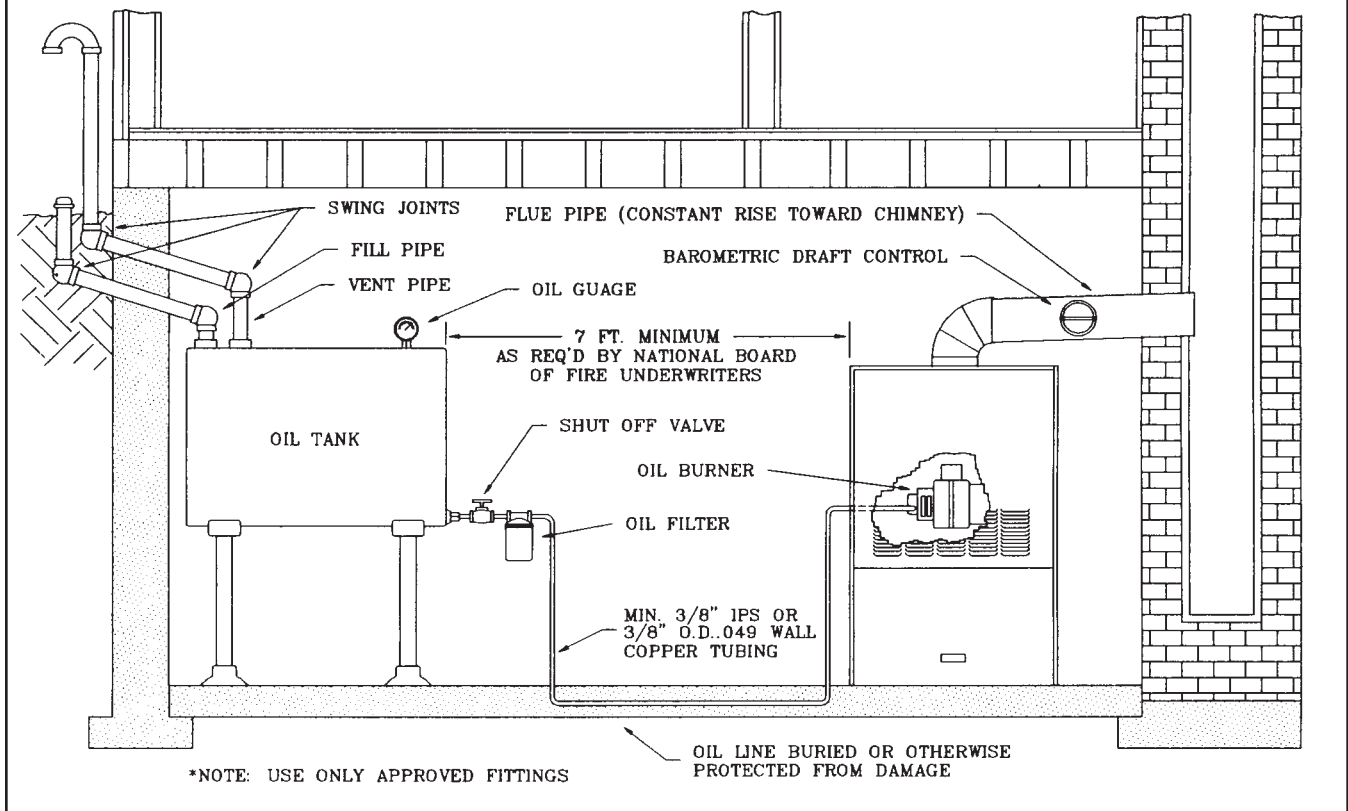
**NOTE: Do not use 24 volt control wiring smaller than No. 18.**

# TYPICAL INSTALLATION DIAGRAMS

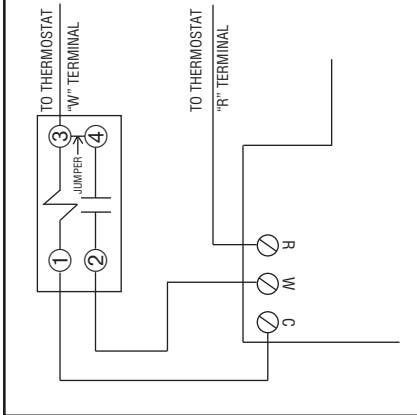
**FIGURE 11**  
TWO PIPE INSTALLATION



**FIGURE 12**  
ONE PIPE INSTALLATION



**FIGURE 13**  
ISOLATION RELAY



**NOTE:** Do not use 24-volt control wiring that is smaller than number 18 AWG. The maximum circuit ampacity is 1.6. The Heat Anticipator should be set for 0.10 amps.

**NOTE:** An isolation relay can be added to prevent any compatibility problems that may occur. Use a single-pole, single-throw relay with 24-volt AC coil. The contacts should be rated for .5 amps minimum at 24 volts. See Figure 13.

The current ProStock part number is 42-25104-01 for a SPNO Pilot/Power 24 volt relay.

**IMPORTANT:** Do not use a power-robbing electronic thermostat with this furnace. Use only mechanical thermostats or battery powered electronic thermostats.

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.

# 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. (See section titled "Oil Pump/Pump" for more information on bleeding the pump.)

5. Reset room thermostat to desired temperature setting.

## TO STOP FURNACE

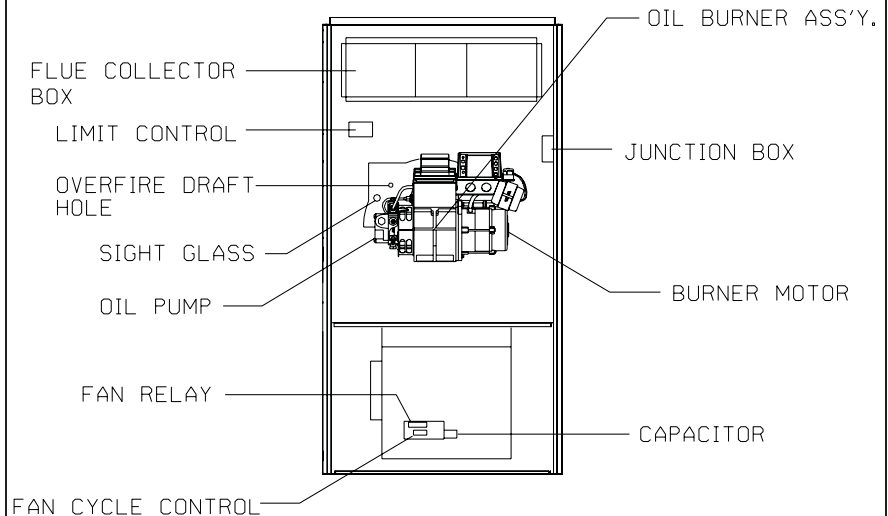
1. Set the room thermostat to lowest temperature setting.
2. Turn "Off" line switch to the furnace.

## 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 14**  
COMPONENT LOCATION



ST-A1066-01

# 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, and is based 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.

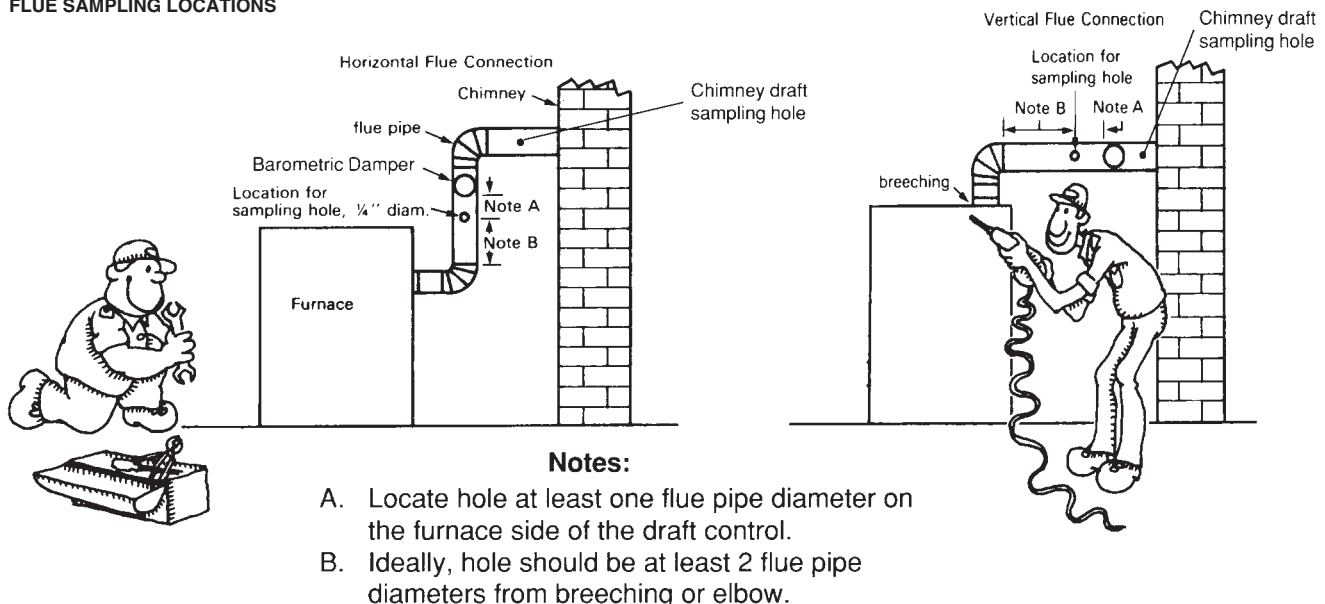
## PREPARATION STEPS

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 14. 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 14. 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 24 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 recommend-

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 7).
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 15  
FLUE SAMPLING LOCATIONS**



## COMBUSTION ADJUSTMENT

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

- 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.

- 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).
- 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

- 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

- 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.
- Check Ignition. Check the operation over repeated cycles to insure prompt ignition on starting.
- Check pump cutoff (80 psi is cutoff pump pressure). 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.

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

**Table 7**

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

## OIL PUMP/ PUMP BLEEDING

Before furnace operation can begin, the fuel line and pump must be bled of air. To do this, run a clear piece of hose with a special bleed tool attached from the bleed port on the pump to a bucket or can (see Figure 23). First, open the bleed port by turning it counterclockwise. Next, turn on the furnace by applying a heat call or 24 AC volts to the "W" terminal on the burner. The pump will begin to force the fuel oil and air through the clear tube. When no more air can be seen in the tube, turn off the valve by turning it clockwise. Finally, turn off or remove the heat call or 24 AC volts from the "W" terminal.

An assembly with a key to open the bleed port can be constructed like that shown in Figure 16.

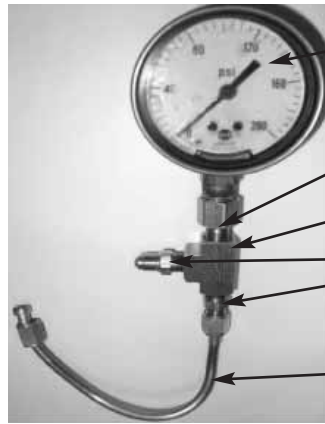
## CHECKING THE PUMP PRESSURE

The new Beckett burner assembly now includes a Clean-Cut shutoff pump. This pump will prevent oil from dripping into the heat exchanger after the pump has stopped. This is an improvement from the older designs. However, this now means that the new pump no longer has a spare port from which oil pressure can be easily taken.

To check the oil pressure on the new Clean-Cut pumps, an assembly of tube, pipe fittings and a pressure gage will need to be constructed as shown in Figure 17. The figure shows a list of components necessary to create the assembly. Other assemblies can be made, as this is not the only assembly that will work. This assembly can be used to check the pressure on other -OPF and -OBF oil furnaces so that only one assembly is necessary for a toolbox used in the field. Construct the assembly as shown in Figure 17 and install it as shown in Figure 18.

Once the pressure testing assembly has been made and installed as shown in Figure 18, turn on the furnace by applying a heat call or applying 24 AC Volts to the "W" terminal on the thermostat input terminal block. After the burner starts and flame has been established, turn the pump pressure

**FIGURE 17**  
EXAMPLE OF OIL PRESSURE TESTING ASSEMBLY.



General Service Pressure Gage 0-200 psi Range with 1/4" NPT Male Connection

Brass Threaded Pipe Adapter Fitting – 1/4" NPT Male to 1/8" NPT Female

Brass Threaded Pipe Fitting – Tee with 1/8" NPT Female Thread

Compression Tube Fittings – Male Straight Adapter (Self Aligning) 3/16" OD Tubing to 1/8" NPT Pipe

3/16" Copper Tubing with Standard 3/16" Compression Tube Fittings on Both Ends Approx. 4" Long.

adjustment screw (see Figure 16) counterclockwise until the pump cuts out. This will be to confirm the pump cut-out pressure. The pump should stop at about 80 psi. Once this is confirmed, turn the pump pressure adjustment screw clockwise a couple of turns and re-apply a heat call to start the pump and furnace running again.

Once the pump pressure has been properly adjusted, remove the pump pressure reading assembly and replace the fittings and tubes to their original configurations. Next, repeat the bleeding procedure as above to insure that no air remains in the oil supply line.

**FIGURE 18**  
OIL PRESSURE TESTING ASSEMBLY INSTALLED



Oil Pressure Testing Assembly from Figure 17.

One Fitting to Mount to Burner

Install Oil Pressure Testing Assembly to Existing Tube as Shown.

Existing Tubing Provided on Burner

Continue to adjust the pump until the mid temperature rise has been reached and at least 100 psi. is reached. Do not adjust the pump pressure to over 150 psi.

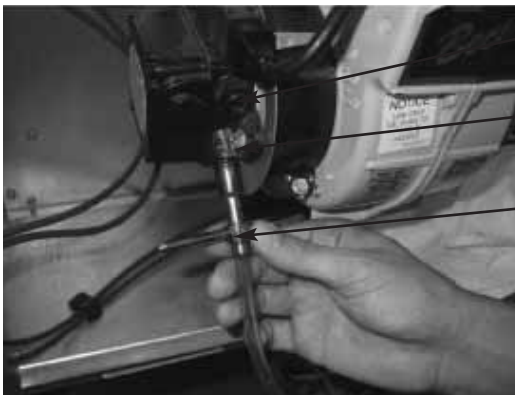
## PUMP SELECTION

For all -OBF and -OPF oil furnaces that use the R7184 primary control, a Clean-Cut pump with solenoid must be used. Use of a standard pump without the necessary solenoid will prevent operation of the furnace. For this reason, pumps from -OPC, -OPD, -OBC and -OBD oil furnaces cannot be interchanged with or used on the -OBF or -OPF models.

For long pipe runs and installations where the oil tank is below the burner, a separate two-stage pump is available from the parts replacement division. Be sure to purchase a two-stage pump with Clean-Cut solenoid. Use of a pump without a Clean-Cut solenoid will prevent furnace operation.

For information on when to use a two-stage pump, consult the section titled "OIL BURNER / PRIMARY CONTROL" of this document.

**FIGURE 16**  
BLEEDING THE PUMP



Pump Pressure Adjustment

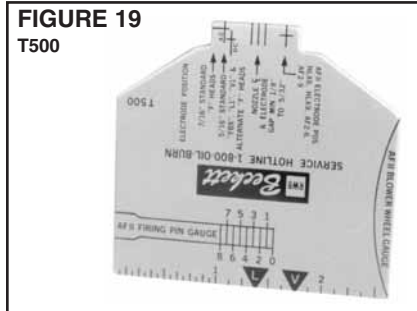
Pump Bleed Access Port

Bleed Tool with Hose Attached



# ELECTRODE ADJUSTMENT

The T500 nozzle, electrode and head position gauge (see figure 19) is used to correctly position the electrodes, nozzle, and head. The gauge is the best way to ensure that these adjustments are correct. 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 20).
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 21).
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 housing. This locks the assembly into position.

**FIGURE 21**  
NOZZLE DEPTH AND CONCENTRICITY



**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 21), 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 20**  
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 (see figure 2) or Table 8 in this manual.

- Temperature rise is the temperature difference between the air entering and leaving the furnace.
- 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.
- 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 22).
- 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

- 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.

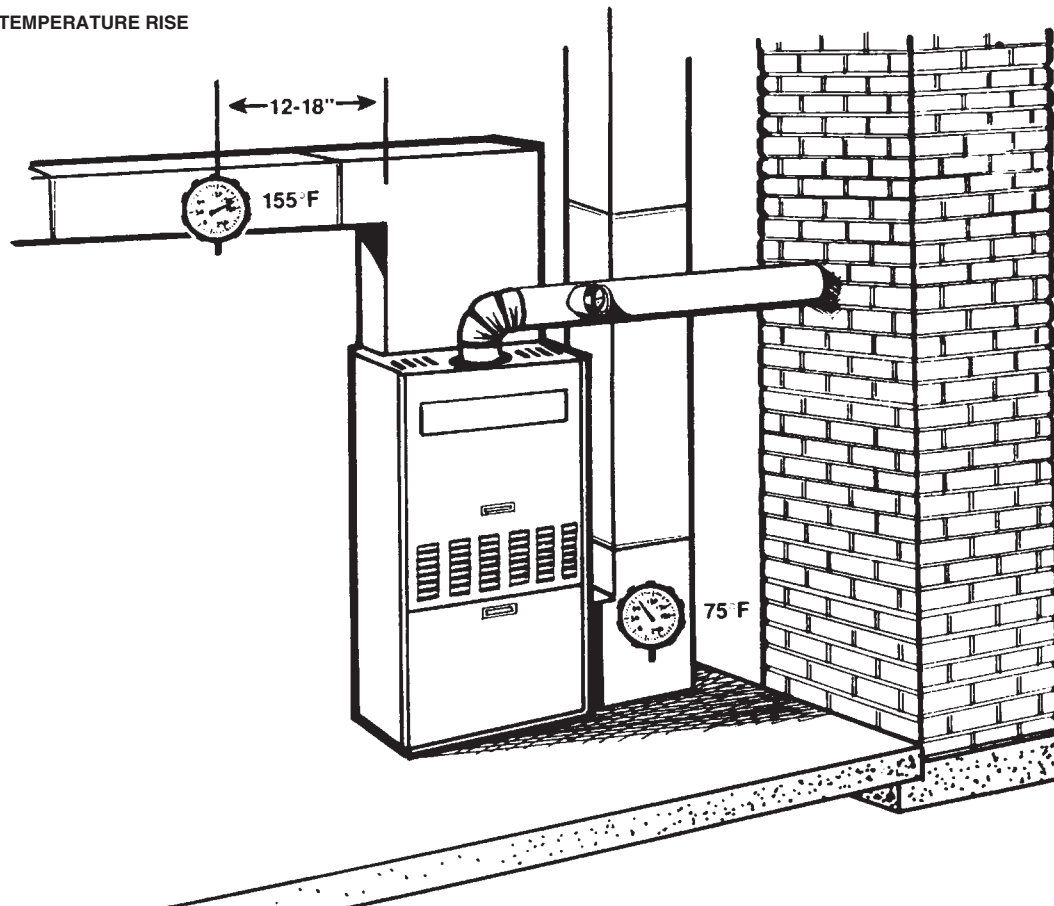
The blower speed can be increased to deliver more air over the heat exchanger if the duct system is large enough to allow the increase. If the duct system is not of adequate size increasing fan speed may result in less air flow than originally found.

### 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.

**FIGURE 22**  
DETERMINING TEMPERATURE RISE



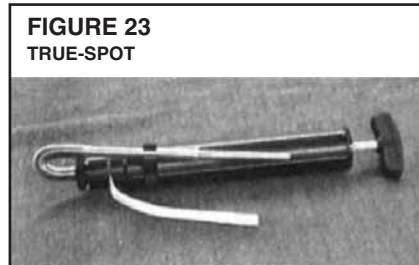
**TABLE 8**

MODEL NUMBER	DELAVAN NOZZLE SIZES	DEL-O-FLO NOZZLE SIZES	TEMPERATURE RISE RANGE* (DEGREES F)
-067	—	(.50, .65) -70°B	40 - 70
-0112	(1.0) -70°B	(.75, .85) -70°B	50 - 60
-150	(1.2, 1.35) -70°B	—	60 - 90

\*Recommended temperature rise is the midpoint of the given range.

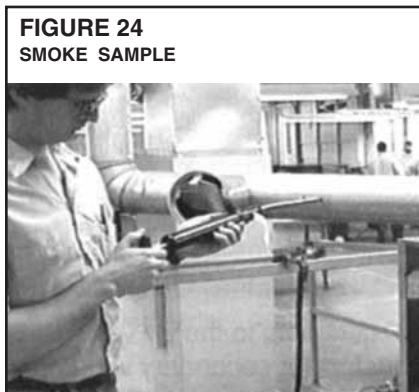
## TRUE-SPOT

True-Spot smoke tester (see figure 23) by Bacharach is used to check smoke levels in flue products.



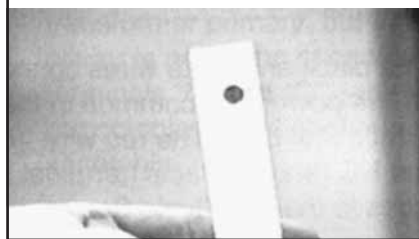
### INSTRUCTIONS FOR USE:

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 24).



3. Pull the True Spot handle through 10 full pump strokes.
4. Remove the filter paper strip from slot (see figure 25).

**FIGURE 25**  
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 26).

**FIGURE 26**  
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 14).

# MAINTENANCE

## BURNER

For proper operation, replace the burner oil nozzle each year with the factory recommended size and type. 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.

## ACCESSORIES

### RXOP-D25 PARALLEL FURNACE KIT

For twinning two upflow oil furnaces.

### PLENUM DATA

Plenum adapters are required in some instances for use on upflow applications when plenum and furnace size do not match.

FURNACE WIDTH (IN.) [mm]	PLENUM WIDTH (IN.) [mm]	PLENUM ADAPTER UPFLOW	COIL PLENUM
21 [533]	21 [533]	—	RXBC-A21
24½ [622]	24¼ [616]	—	RXBC-A24
28 [711]	24½ [622]	RXBA-AD	RXBC-A24

### SS1-R SIDEWALL VENT SYSTEM

This furnace is agency approved by UL, ULC for use with the Tjernlund SS1-R Sidewall Vent System (date code of 012204 or later) when installed in accordance with the installation instructions provided by Tjernlund. 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.

### TWO-STAGE PUMP

For applications requiring extra lifts, two-stage fuel pumps are available from PROSTOCK™ as part number.

### FOSSIL FUEL KITS

RXPF-F01—Use for standard heat pump applications.

RXPF-F02—Use for TVA (Tennessee Valley Authority) applications.

## 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

Filter application and placement are critical to airflow, which may affect the heating and cooling system performance. Reduced airflow can shorten the life of the systems major components, such as motor, limits, elements, heat exchanger, evaporator coil or compressor. Consequently, we recommend that the return air duct system have only one filter location. The most common location will be inside the furnace or air handler or a filter base. For systems with a return air filter grill or multiple filter grills, can have a filter installed at each of the return air openings. **DO NOT DOUBLE FILTER THE RETURN AIR DUCT SYSTEM. DO NOT FILTER THE SUPPLY AIR DUCT SYSTEM.**

If high efficiency filters or electronic air cleaners are used in the system, it is important that the airflow is not reduced to maximize system performance and life. Always verify that the systems airflow is not impaired by the filtering system that has been installed, by performing a temperature rise and temperature drop test.

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).

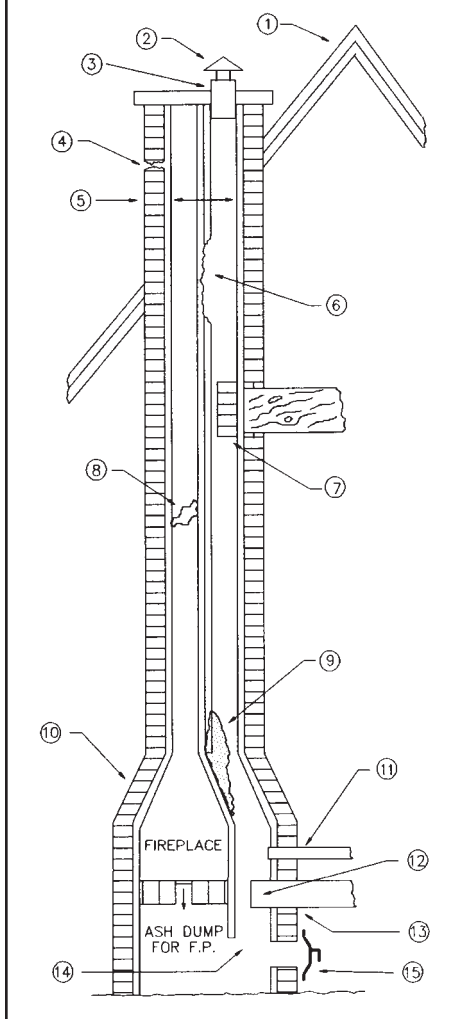
**NOTE:** Do not use high static return air filters to replace standard furnace filters.

# CORRECTION OF POOR CHIMNEY DRAFT CONDITIONS

## CAUSE

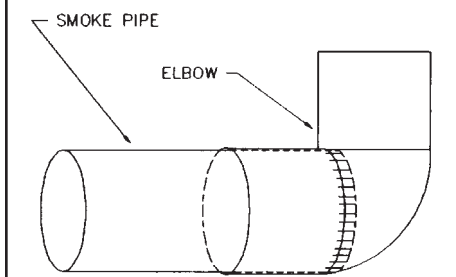
## CORRECTION

**FIGURE 27**  
CHIMNEY PROBLEMS



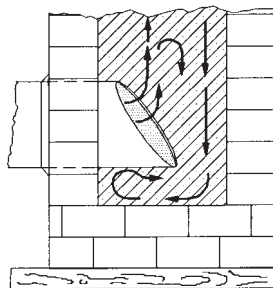
- |   |   |
|---|---|
| <ol style="list-style-type: none"> <li>1. Roof peak or other surrounding objects higher than chimney top.</li> <li>2. Flue cap on chimney.</li> <li>3. Coping smaller than chimney interior.</li> <li>4. Air leak from loose bricks or mortar.</li> <li>5. Inside dimensions of chimney are too small.</li> <li>6. Double chimney separation wall leaks due to loose bricks or mortar.</li> <li>7. Joist protruding into chimney.</li> <li>8. Brick, mortar or other obstruction lodged in chimney.</li> <li>9. Soot accumulation in offset.</li> <li>10. Offset is too short.</li> <li>11. More than one heating appliance connected to same chimney flue.</li> <li>12. Smoke pipe protrudes into chimney or elbow too far.</li> <li>13. Smoke pipe is loose fitting, too long or has too many elbows.</li> <li>14. Opening between chimney flues.</li> <li>15. Loose fitting cleanout door.</li> <li>16. New chimney.</li> <li>17. Excessive draft..</li> </ol> | <p>Extend chimney 24 inches above roof and surrounding objects within 30 feet.</p> <p>Remove.</p> <p>Enlarge to match chimney interior.</p> <p>Replace loose bricks and mortar.</p> <p>If all other causes have been eliminated a new chimney may have to be built.</p> <p>Replace loose bricks or mortar.</p> <p>Remove.</p> <p>Have chimney cleaned.</p> <p>Clean out.</p> <p>Straighten or lengthen offset.</p> <p>Furnace ideally should have its own flue. If this is not possible, smoke pipe should be connected as shown in Figure 29.</p> <p>Make flush with inside of chimney.</p> <p>Cement joints, shorten and eliminate elbows.</p> <p>Seal openings permanently.</p> <p>Seal openings, close door tightly.</p> <p>Allow 2 to 4 weeks to dry.</p> <p>Open barometric damper.</p> |
|---|---|

**FIGURE 28**  
Pipe pushed too far inside elbow, as shown, interferes with draft.



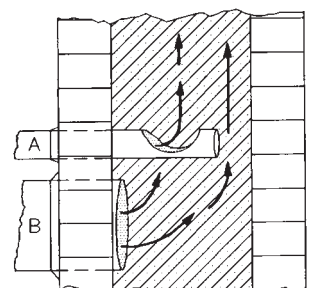
**FIGURE 29**

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



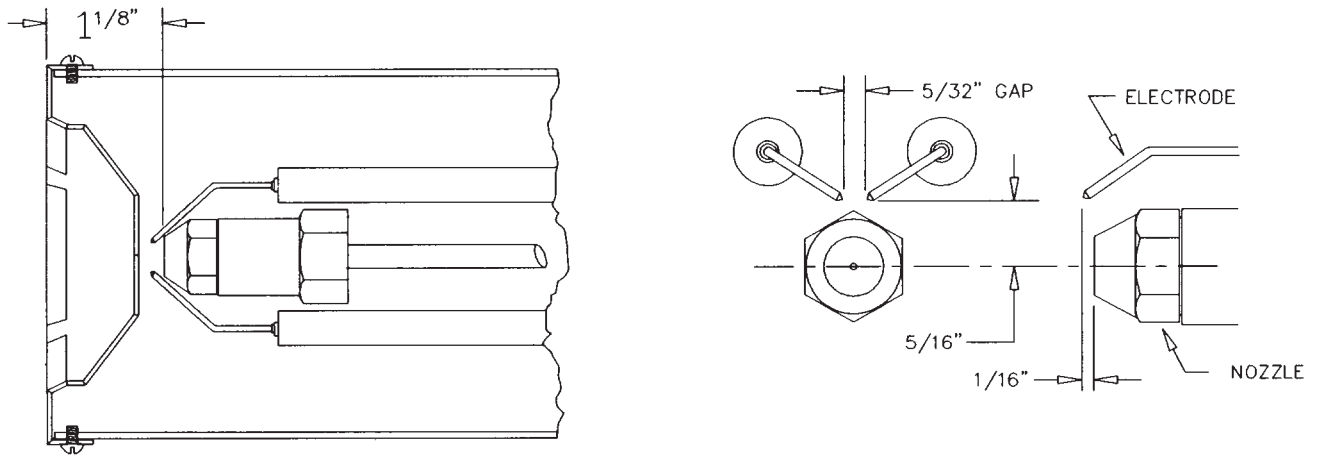
**FIGURE 30**

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 31**  
BECKETT MODEL "AFG" BURNER



**TABLE 9**  
DRAWER ASSEMBLY DATA

UNIT SIZE	NOZZLE*	END CONE	STATIC DISC	RATING
	G.P.H./ANGLE/PATTERN			
<b>BECKETT MODEL "AFG" BURNER</b>				
-067	DEL-O-FLO (.50, .65) -70°B	F0	3-3/8" SOLID	AF**JY
-112	DELAVAN (1.0) -70°B	F3	2-3/4" SOLID	AF**XN
	DEL-O-FLO (.75, .85) -70°B			
-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 Del-O-Flo 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
7. Nozzle plugged
8. Nozzle too far forward in air tube
9. Barometric damper set wide open

COMPLAINT	CHECK FOR:
Cad cell not functioning	<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**

Excessive Pressure

Insufficient Pressure

Fluctuating Pressure

No Pressure

**CHECK FOR:**

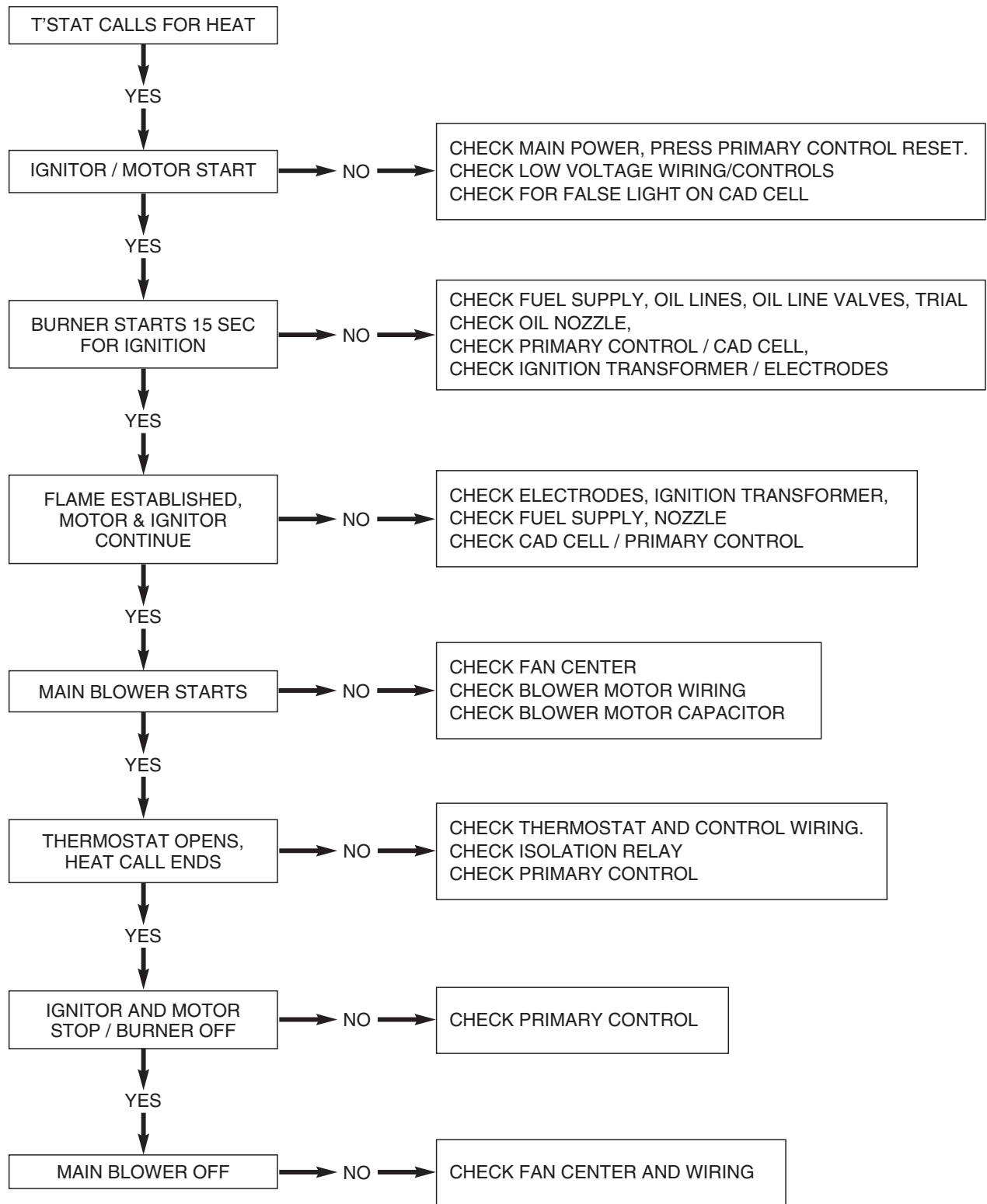
1. Bypass plug in place with a single oil line system
2. Return oil line on two-pipe system clogged, kinked or restricted
3. Pressure regulating valve stuck
4. Oil too heavy
5. Improper pump setting

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

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

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

**FIGURE 32**  
**TROUBLESHOOTING**  
*(see page 22 for more extensive troubleshooting solutions)*



# 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 \_\_\_\_\_ PSIG

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.

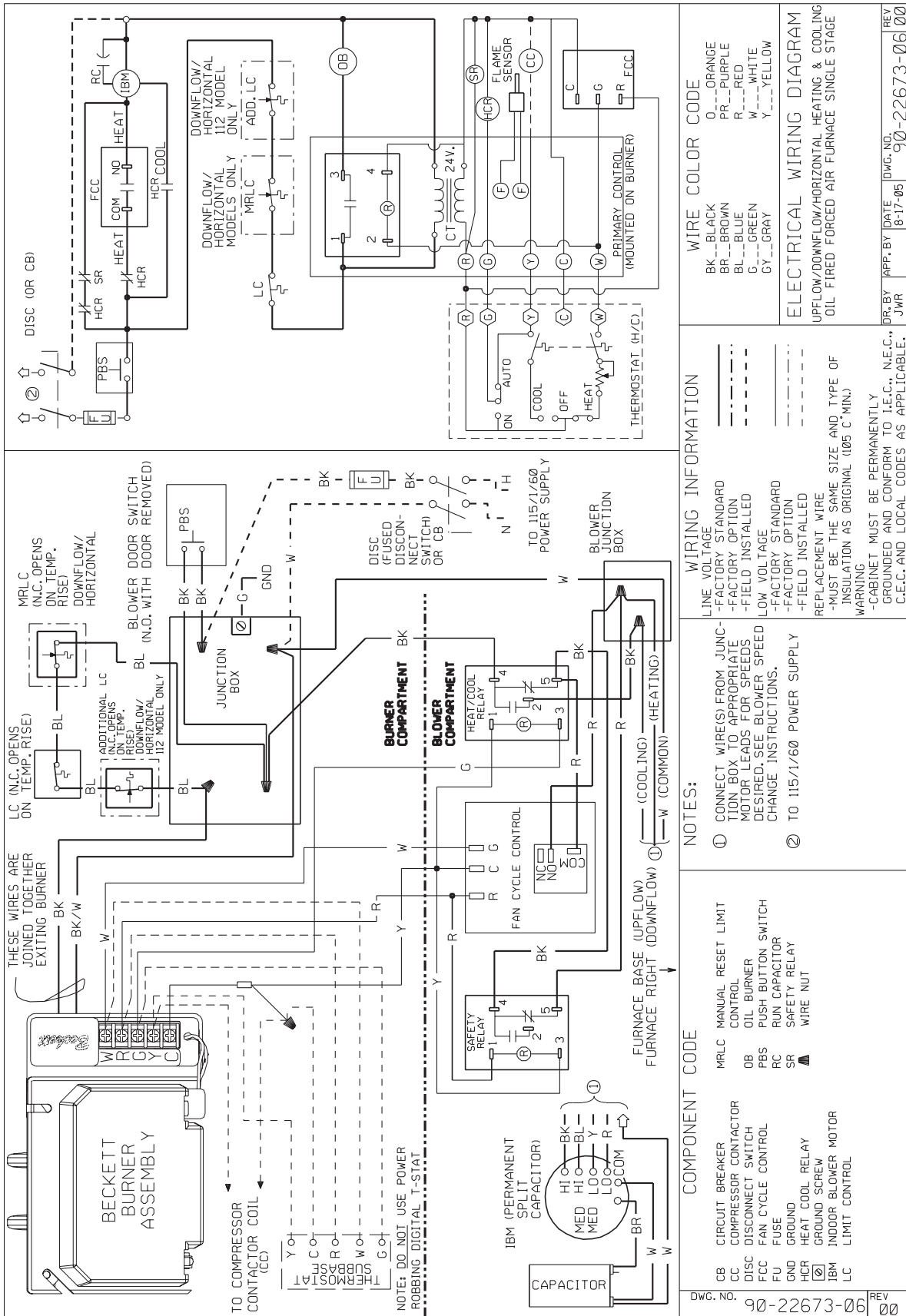
Supply Air Temperature Rise \_\_\_\_\_ degrees F.

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

\_\_\_\_\_

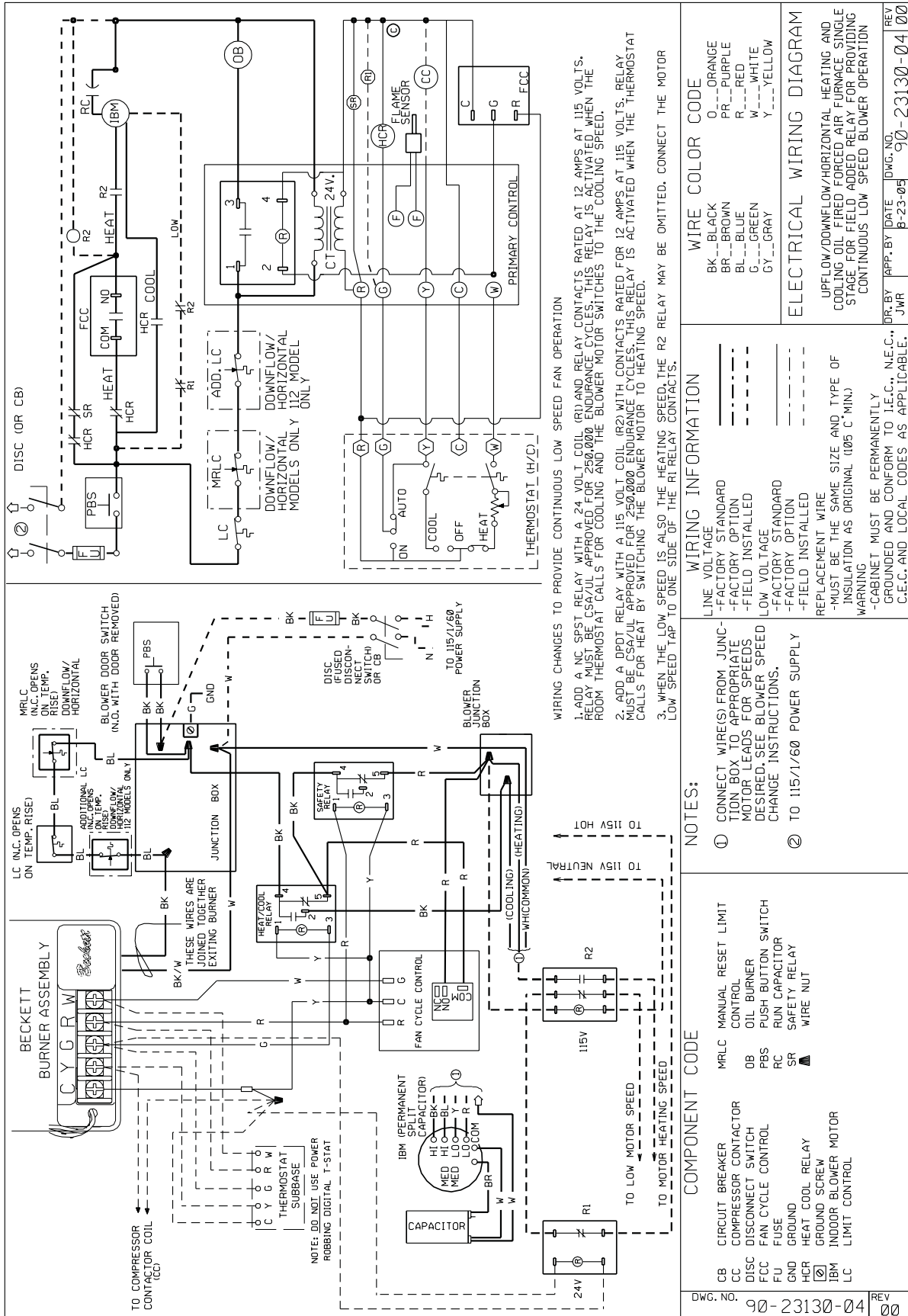
\_\_\_\_\_  
Installer's signature

**FIGURE 33**  
HEATING AND COOLING SCHEMATIC



**IMPORTANT:** Do not use a power-robbing thermostat with this furnace. Use only mechanical thermostats or battery powered thermostats.

**FIGURE 34**  
HEATING AND COOLING CONTINUOUS LOW SPEED BLOWER SCHEMATIC



**IMPORTANT:** Do not use a power-robbing thermostat with this furnace. Use only mechanical thermostats or battery powered thermostats.

# NOTES

# NOTES

# NOTES