



Heating
Products

Commercial
Furnace
Installation
And
Operator's
Manual

Cox systems are shipped “ready to use”. All necessary standard equipment, controls, and wiring are packaged with the heating systems.

Use the supplied furnace **and** burner manual, together, to install the system.

Employ qualified, experienced installers, to insure the safe and efficient operation of your heating system.

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PACKING

1 – Package -

Prewired and tested furnace assembly:

- 1- Heat exchanger/combustion chamber and casing
- 1- Blower and pulley
- 1- Motor and pulley
- 1- Belt (2 on dual drives)
- 1- Instruction envelope and (2) wiring diagrams
- 1- Fan limit installed
- 1- Oil burner mounting flange

1 – Package-

Gas or oil burner:

- 1- Oil or gas burner and controls
- 1- Oil nozzle
- 1- Instruction manual and literature
- 1- Gas burner mounting flange

1 – Package-

Draft control or draft hood

NOTE: Actual packing may vary according to sizes, weights, models, custom jobs, etc. Optional equipment may or may not be packed separately.

FOR YOUR SAFETY

If you smell gas:

1. Open windows
2. Don't touch electrical switches
3. Extinguish any open flame
4. Immediately call your gas supplier.

FOR YOUR SAFETY

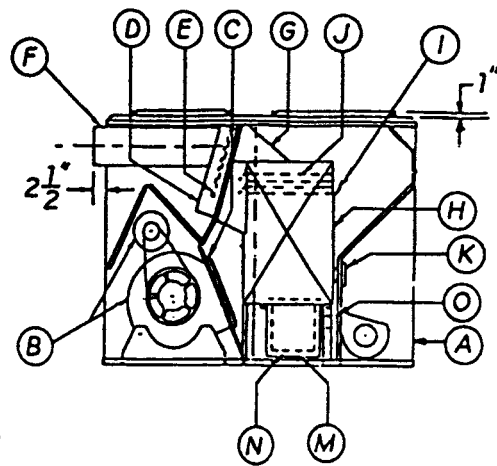
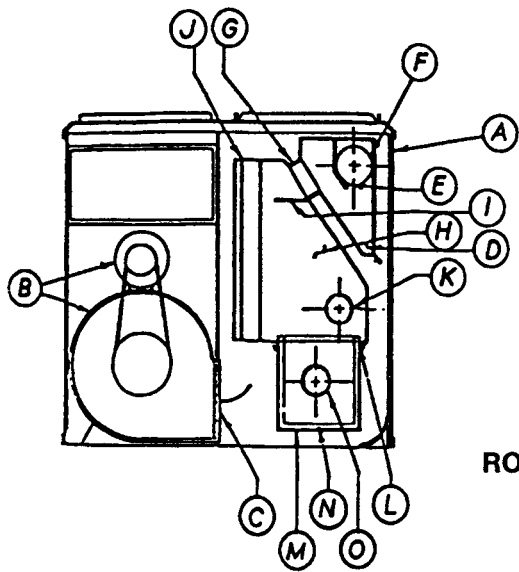
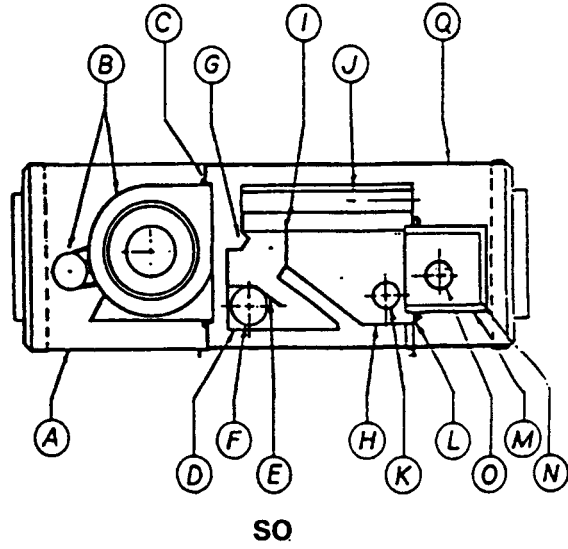
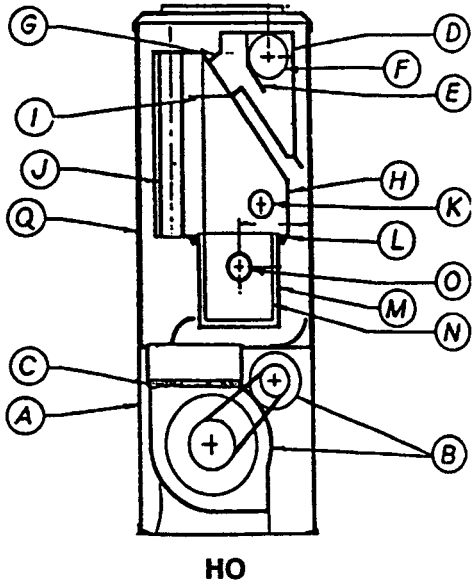
Do not store or use gasoline or other flammable vapors and liquids in the vicinity of this or any other appliance.

DO NOT DESTROY THIS MANUAL

Please read carefully and keep in a safe place for future reference.

ASSEMBLIES

- | | | |
|---|--|---|
| <p>A. Casing Jacket
 B. Fan and Motor
 C. Felt Pad
 D. Radiator
 E. Radiator Baffle</p> | <p>F. Stack
 G. Connector
 H. Heat Exchanger
 I. Heat Exchanger Baffle
 J. Air Tubes</p> | <p>K. Inspection Port
 L. Fiberglass Rope Seal
 M. Combustion Chamber
 N. Refractory Lining
 O. Burner Port</p> |
|---|--|---|



SPECIFICATIONS

SO Series (Horizontal Units)

Model	SO-225	SO-300	SO-400
Output BTU/HR	225,000	300,000	400,000
Input-Gas BTU/HR	281,250	375,000	500,000
Input-Oil GPH	2.00	2.50	3.50
CFM @ .33WC ESP	2400	3000	4400
Blower Motor HP	3/4	1	1-1/2
Stack Diameter (in.)	9	10	12

HO Series (High-Boy Units)

Model	HO-225	HO-300	HO-400
Output BTU/HR	225,000	300,000	400,000
Input -Gas BTU/HR	281,250	375,000	500,000
Input-Oil GPH	2.00	2.50	3.50
CFM @ .33 WC ESP	2400	3400	4400
Blower Motor HP	3/4	1	1-1/2
Stack Diameter (in.)	9	10	12

LO-Series (Low-Boy Units)

Model	LO-225	LO-300	LO-400
Output BTU/HR	225,000	300,000	400,000
Input-Gas BTU/HR	245,000	375,000	500,000
Input-Oil GPH	2.00	2.50	3.50
CFM @ .33 WC ESP	2400	3400	4800
Blower Motor HP	3/4	1	1-1/2
Stack Diameter (in.)	9	10	12

NOTES:

- 1. Gas burner through 400,000 BTU are AGA listed.**
- 2. Oil Burner is UL listed.**
- 3. Rights retained to change specifications and ratings without notice or liability.**

CLEARANCES

Unless materials used in building construction, and/or application of the heating equipment are of such a nature that local authorities to require otherwise, the clearance about the furnace should be:

ABOVE-6", SIDES AND REAR-6", FRONT-48", FLUE PIPE-18".

WARNING: LO Models must be placed on non-combustible flooring only.

SO (Horizontal) clearances

May be installed in an alcove with the following clearances to unprotected combustible material:

- 6" above furnace casing, bonnet or plenum.
- 6" above horizontal warm air duct within 6" of furnace.
- 48" from front of furnace.
- 18" from flue pipe in any direction.
- 6" from back of furnace.
- 6" from right side of furnace.
- 6" from any side of plenum.
- 6" from floor.

INSTALLATION

A. General

1. When burner is furnished with separate flange, caution should be used to insure the air tube penetrating the chamber to within 1/2" of the inside chamber surface. **(Don't push in too far).**
2. Wire burner as per wiring diagram. One diagram is fixed to the inside of the blower door and a copy is placed with this manual.
3. See installation and operation instructions for blower drive adjustment in D.5.
4. OIL MOTOR according to instructions on motor.
5. Suspend SO units by means of inserting hanging rods through hanging lugs on furnace. **Mount LO models on non-combustible floor only.**
6. Must be installed according to NFPA standards for installation of oil burning equipment. Pamphlet No.31 or NO. 54 for gas.
7. Must be installed according to Building Code Standards for the installation of heat producing appliances: heating, ventilating, air-conditioning, warm air heating and ventilating systems.

Area of the ventilating opening into the furnace room shall be not less than twice the area of the flue outlet.

Ready access shall be provided for all electrical components in service.

Draft regulator shall bear the listed marking.

The combination fan and limit control shall bear the control listee's name and listed marking.

The safety control shall bear the control listee's name, listed markings and group designation.

SO-300 and SO-400 "Air filters shall not be mounted on the unit or in the air duct system." UL ONLY.

8. Must be installed according to NFPA standards for the installation of air-conditioning, warm air heating and ventilating systems.
9. Air requirement into the furnace room for satisfactory combustion is an area not smaller than twice the cross sectional area of the flue pipe. See burner manual.

B. Flue

The chimney must be in good condition without cracks or openings or obstructions in the flue and of sufficient height to prevent a down draft. Before installing an oil burner, the smoke pipe and chimney should be thoroughly cleaned and repaired if required.

Minimum recommended chimney sizes: Oil

- Two gallons of oil per hour and under8"x8"
- Two to three gallons of oil per hour...8"x12"
- Over three gallons of oil per hour....12"x12"

All manual dampers should be removed from the smoke pipe before an oil burner is installed. For best results the draft should be preferably from .02 to .03 inches at the inspection door and from .05 to .06

inches at the stack. The draft may be accurately measured with any good draft gauge.

Excessive draft causes high stack temperatures and consequently a waste of fuel. Therefore, a reliable draft regulator is strongly recommended for practically all installations. Proper, uniform draft insures efficient, economical operation of the burner. A good draft regulator will usually pay for itself in a short time through a substantial savings in fuel costs.

Minimum recommended chimney sizes: Gas

<i>Input/hour</i>	<i>Draft Hood & Flue Pipe Size</i>
Up to 120,000.....	5"
120,001-180,000.....	6"
180,001-250,000.....	7"
250,001-320,000.....	8"
320,001-410,000.....	9"
410,001-510,000.....	10"
510,001-610,000.....	11"
610,001-730,000.....	12"
730,001-860,000.....	13"
860,001-1,000,000.....	14"
1,000,001-1,140,000.....	15"

NOTE: If the flue pipe exceeds 10 ft. in length, or contains more than 2 elbows use next size larger pipe and draft hood.

C. Combustion Air Supply

OIL

Do not install in rooms with insufficient air to supply combustion. Occasionally, it is necessary to install windows or louvers in a door to these rooms, to obtain sufficient air and to prevent less atmospheric air pressure in the room. If there is a lack of combustion air, the burner flame will be yellow and formation of soot will occur in heating unit. In buildings of conventional frame, brick or stone construction without utility rooms, basement windows, or stair doors, infiltration is normally adequate to provide air for combustion and for operation of the barometric draft control. For installation in an enclosed utility room with an outside wall, a fresh air opening to the outside should be made with a free cross sectional area of twice the area of the flue outlet of 100 sq. inches for each gallon nozzle size (Example: 10x10 for 1.00 GPH). For each 1,000 feet above sea level, increase the fresh air opening by at least four percent. The room should be isolated from any area served by exhaust fans. Do not install an exhaust fan in this room.

GAS

Fresh air requirement into the furnace room for satisfactory combustion is 1 square inch of free area for each 1,000 BTU input and a minimum of 100 sq. in.

D. Blower Adjustment

Because the Cox Heating unit is so versatile in its application, it is impossible to be specific in recommending blower speed. Obviously, the quantity and quality of the duct work and the manner in which it is applied affects the air delivery.

To adjust blower speed to the applied conditions, it is recommended that the thermostat be set at highest setting to gain prolonged burner operation. By means of thermometers, adjust the blower speed until the temperature rise through the unit is equal to 75 degrees – 80 degrees (difference in temperature between air entering and leaving the unit).

Unless the temperature of the air entering the units is excessively high (75 degrees or more) such adjustment will result in continued burner operation with a high limit setting of 180 degrees to 200 degrees. Should it be impossible to gain an 85 degree temperature rise through the unit, the indications are that the fan is running too fast for the intended application of the furnace. Should the air being supplied to the unit be at a temperature higher than 95 degrees, the indications are that the heated air leaving the unit is being short circuited back to the unit. The remedy is revision of the supply system, return system, or both.

In many instances, it will be possible to adjust the blower speed by setting the thermostat to highest setting (for purposes of continued burner operation during adjustment) and limit control 180 degrees to 200 degrees, increasing then, the blower speed until the burner no longer cuts out on high limit. Should the burner cycle on high limit setting, indications are that the duct static pressure is higher than intended by the manufacturer, or the temperature of the air being supplied the unit is excessive. This latter method is not as reliable as that described in the foregoing paragraph which will be applied by the better qualified installer. Should the blower motor cut out, indications are: inadequate firing rate, fan off setting too high, overload of motor, too high temperature air supplied to the unit or a combination of same. Duct heaters have a minimum air requirement as given in "Furnace Specification" Section Chart.

NOTE: Do not exceed motor rating.

E. Burner Installation

OIL

Equipment – The following equipment shall be available on each oil burner installation before the tests are started:

- 1) Where the oil rate is not indicated on the nozzle tip, a suitable device for determining the rate in terms of gallons per hour fed to the burner shall be used. This may be in the form of a graduated glass vessel.
- 2) A suitable flue gas analyzer for determining the percentage of CO₂ in the flue gases.
- 3) A suitable draft gauge graduated in hundredths of an inch of water.
- 4) A suitable thermometer to indicate the flue-gas temperatures.
- 5) Provision for inserting a thermometer in flue pipe as follows: Not more than 12” from the furnace outlet, measured on the center line of the flue pipe, there shall be a hole not more than ½” diameter, located at the side of the pipe on the center line so that the thermometer may be inserted horizontally.

The thermometer is to be placed so that the sensitive element is one fourth of the pipe diameter from the far side of the flue pipe. The opening around the thermometer shall be sealed to prevent air leakage. This same opening may be used for checking draft and sampling flue gases.

Test Procedure – The test procedure is as follows:

- 1) The burner shall be operated and the fuel rate adjusted to that required for the particular installation.
- 2) The draft then shall be adjusted to meet the burner manufacturer’s specifications, both over the fire and at the breeching. Refer to “Installation Instructions” Section, B.
- 3) Combustion air adjustments are to be made to give the highest CO₂ without visible smoke (unburned carbon) at the chimney. If the minimum required percentage of CO₂ cannot be obtained in the breeching, it will be permissible to take CO₂ over the fire, which will be acceptable. In this event, both CO₂ readings shall be recorded after 10 minutes of operation.

Readings – During the period of operation to permit flue gas temperature to reach maximum, periodic readings of draft CO₂ and oil rate shall be taken and the average recorded on the certificate.

All controls and limiting devices shall be checked for proper operation.

Air for Combustion – There must be openings into the furnace room to admit free air to maintain combustion, minimum opening of not less than twice the area of flue outlet of furnace.

Size – The burner shall be of adequate size for the furnace and the connected heating load as recommended on the oil burner certificate by the installer. Models and Firing Rate : See “Furnace Specification” Section.

Certificate – Following installation of the burner, certain test data shall be obtained and recorded by the installer on the oil burner certificate to be placed with each oil burner installation. The test shall cover the following points: CO₂ in the flue gas by analysis, draft, stack temperature, firing rate, and smoke.

Requirements – The standard requirements as approved by the industry as follows:

- 1) CO₂ – The CO₂ in the flue gas by analysis shall not be less than 8%.
- 2) Draft - The draft shall be in accordance with specifications in the manufacturer’s installation manual. An automatic draft regulator or its equivalent is required.
- 3) Stack Temperature – The stack temperature shall be measured on the furnace side of automatic draft regulator and not more than 12 inches from the smoke connection. The stack temperature shall be measured at the certified firing rate. If an automatic draft regulator is built into the furnace, such regulator shall be closed when the stack temperature is measured.
- 4) Firing rate – The firing rate shall be based on the burner manufacturer’s recommendation for the existing total connected load. Burner shall be fired at that rate.
- 5) Smoke – During the above test, there shall be no visible smoke at the chimney.
- 6) Installation Manual – The burner shall be installed in accordance with manufacturer’s installation manual.

Fuel Tank Connections – Pipe connections between fuel tank and the oil burner should be made with 3/8” copper tubing and brass fittings, however, galvanized pipe is quite satisfactory. All joints should be sealed with key paste or other good **oil resisting** compound, and **pulled up tight**. Where fuel tank is installed in a basement, a one-pipe system to the burner will be found entirely satisfactory.

When fuel tank is buried underground, all pipe connections should be arranged so they will not be broken if the tank should settle. Always use a good leak-proof check valve in the suction line.

Adjusting the Burner – After the installation of the burner, tank, and controls have been completed and all wiring carefully checked.

- 1) Leave line switch open and set thermostat well above room temperature.
- 2) Make sure that the resetting device on the control panel is in operating position.
- 3) Set can at gauge port or bleeder tube opening to catch oil. Close line switch and allow burner to pump oil until flows clear. If control locks out, reset, and when oil comes out clear, open line switch and replace plug or gauge.
- 4) Close line switch. The burner then should start.
- 5) Check oil pressure and adjust, if necessary, to 100 lbs.
- 6) Adjust air shutter on burner so that flame burns clean with slightly smoky tips. Burner is shipped with air shutter closed.
- 7) Start and stop the burner several times by opening and closing main line switch.
- 8) Close main line switch and change thermostat adjustment to below room temperature. Burner should stop.

GAS

Size – The burner shall be adequate size for the furnace and the connected heating load as recommended on the gas burner certificate by the installer. Models and BTU input rating: See “Furnace Specification” Section.

Certificate – Following the installation of the burner, certain test data shall be obtained and recorded by the installer on the gas burner certificate to be placed with each gas burner installation. The test shall cover the following points: CO₂ in the flue gas by analysis, draft, stack temperature, firing rate.

Requirements – The standard requirements as approved by the industry are as follows:

- 1) CO₂ – The CO₂ in the flue gas by analysis shall not be less than 8%.
- 2) Draft – The draft shall be in accordance with specifications in the manufacturer’s installation manual. An automatic draft regulator or its equivalent is required.
- 3) Stack Temperature – The stack temperature shall be measured on the furnace side of automatic draft regulator and not more than 12 inches from the smoke connection. The stack temperature shall be measured at the certified firing rate. If an automatic draft regulator is built into the furnace, such regulator shall be closed when the stack temperature is measured.
- 4) Firing Rate – The firing rate shall be based on the burner manufacturer’s recommendation for the existing total connected load. Burner shall be fired at that rate.
- 5) Smoke – During the above test, there shall be no visible smoke at the chimney.
- 6) Installation Manual – The burner shall be installed in accordance with manufacturer’s installation manual.

SEQUENCE OF OPERATION

OIL

1. Thermostat calls for heat.
2. Protector relay energizes motor and ignition transformer.
3. Pump supplies fuel to nozzle.
4. Burner ignites.
5. Furnace blower activates at blower “ON” setting.
6. Area is heated and thermostat is satisfied.
7. Protector relay de-energizes burner components.
8. Furnace blower continues to operate until fan limit “OFF” setting.
9. End of cycle.

GAS

1. Thermostat calls for heat.
2. Burner motor starts and spark ignition begins.
3. Pilot valve opens.
4. Pilot ignites.
5. Flame sensor proves pilot.
6. Main gas valve is opened.
7. Burner ignites.
8. Furnace blower activates at blower “ON” limit setting.
9. Area is heated and the thermostat is satisfied.
10. Thermostat de-energizes burner components.
11. Furnace blower continues to operate until fan limit “OFF” setting.
12. End of cycle.

MAINTENANCE

Servicing the Burner – After the burner installation has been put in service, it should be rechecked during the first two weeks to make certain that it is functioning properly. Note the combustion is proper and there are no gas or oil leaks, also that the different controls perform correctly.

OIL

Every oil burner should be serviced at least once a year, preferably at the beginning of the heating season.

- 1) Remove electrode assembly and clean, replace nozzle.
- 2) Oil motor.
- 3) Check all oil lines connections and make sure that there are no leaks.
- 4) Clean strainers in fuel unit.
- 5) Test starting and stopping of burner by moving thermostat.
- 6) Make certain that fire burns clean and that draft regulator is in good working order and adjusted for proper amount of draft.

GAS

Every gas burner should be serviced at least once a year, preferably at the beginning of the heating season.

- 1) Check and adjust electrode assembly.
- 2) Oil motor.
- 3) Check all gas lines connections and make sure that there are no leaks.
- 4) Test starting and stopping of burner by moving thermostat.
- 5) Make certain that fire burns clean and that draft regulator is in good working order and adjusted for proper amount of draft.

Employ only qualified personnel to service heating equipment. For safety, the main power switch must be in the “OFF” position.

1. **Air filters** – Inspect filters monthly and replace or clean when necessary.
2. **Oiling** – Oil the burner motor and blower motor according to the instructions on the motors. The blower bearing may be permanently lubricated and sealed and require no oil or grease.
3. **Belts** – Check belts for wear and proper tension. Belts may stretch or wear and require replacement. Belt tension may be checked by, depressing the belt at a point halfway between the pulleys. The belt should travel one inch.
4. **Burner** – Refer to the manual that was supplied with the burner for specific information. Oil nozzles should be replaced at least once in a season. Gas orifices should be cleaned yearly. Electrodes should be checked and set according to the burner manual. The blower wheel and housing should be cleaned if necessary.
5. **Combustion** – Using proper equipment, recheck for proper and efficient combustion (No CO, or less than #1 smoke, 8-9% CO₂).

NOTE: For complete burner operation instructions see the respective burner manual.

**Boyertown
Furnace
Company**

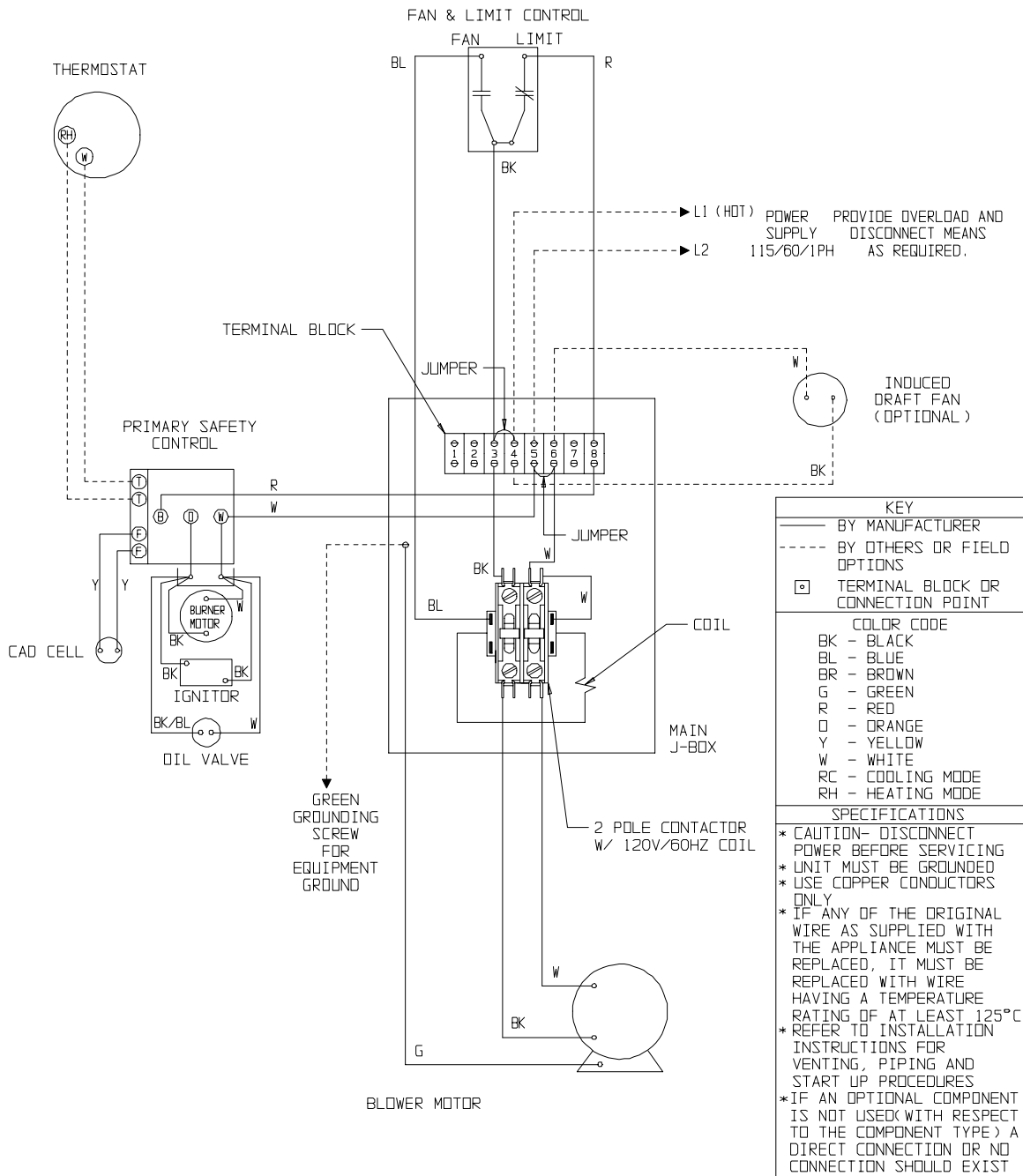
WIRING DIAGRAM for COMMERCIAL HEATING FURNACES
 MODELS: SO - RO - HO - OO
 OIL- FIRED
 OPTIONAL INDUCED DRAFT FAN
 SINGLE CIRCUIT, 120/1PH

DWG NUMBER
WDFS-002C

DATE
11-19-99

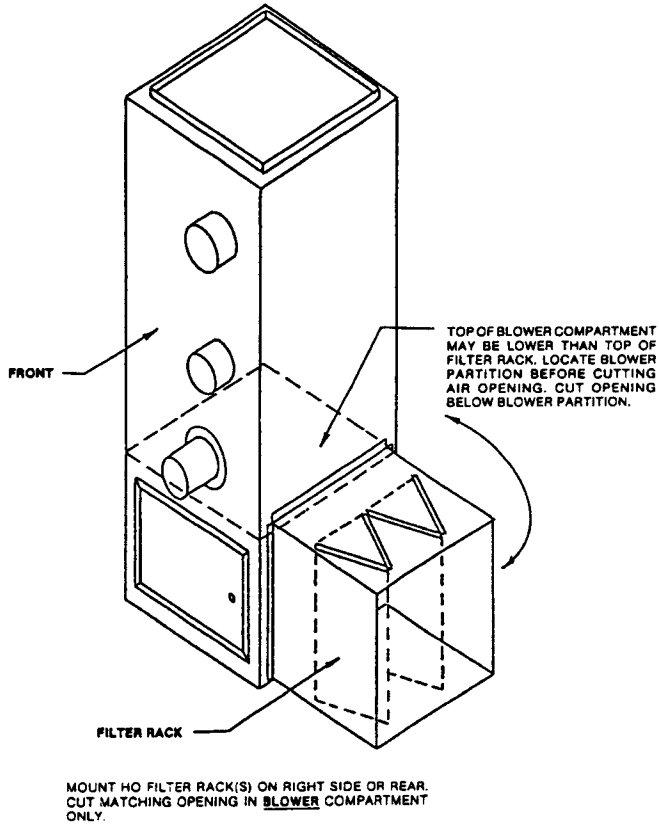
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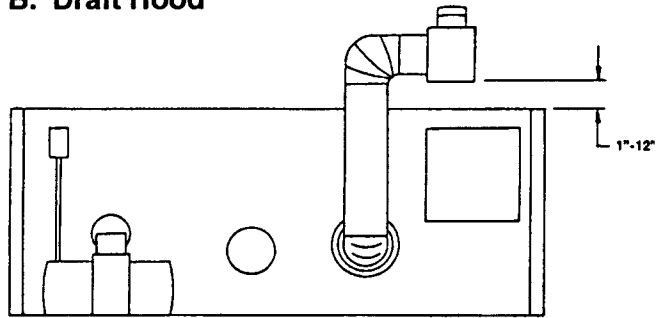


MISCELLANEOUS

A. Filter Rack



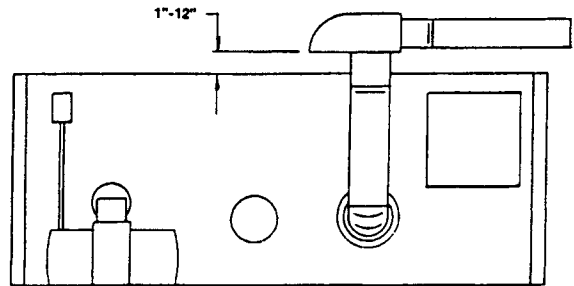
B. Draft Hood



VERTICAL DRAFT DIVERTER

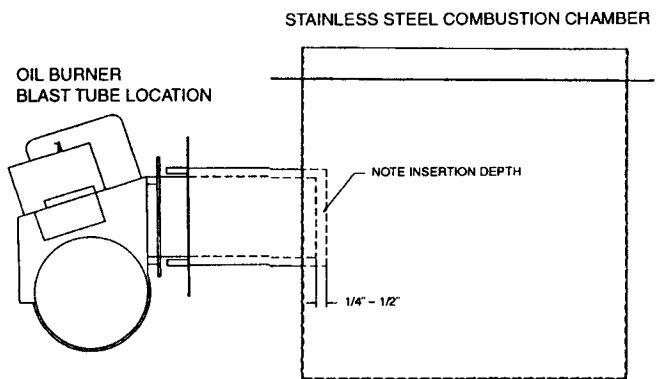
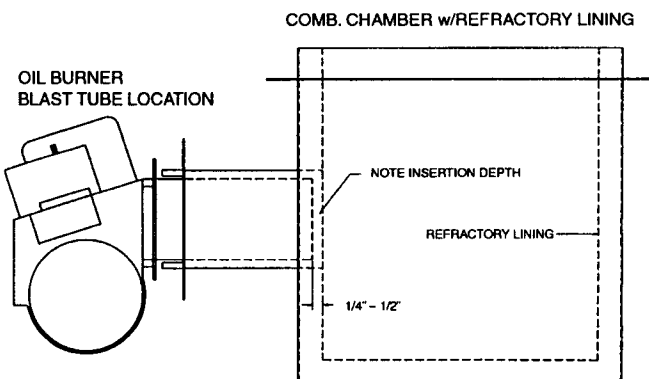
IDEAL
Skirt of draft control should be 12" above furnace casing.

MINIMUM
Skirt of draft control must be 1" above furnace casing.

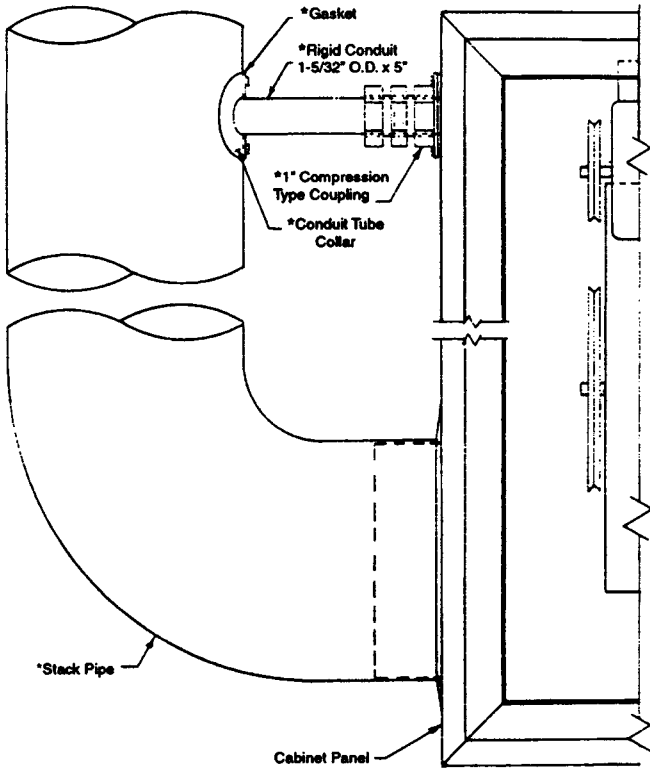


HORIZONTAL DRAFT DIVERTER

C. Oil Burner Blast Tube Location

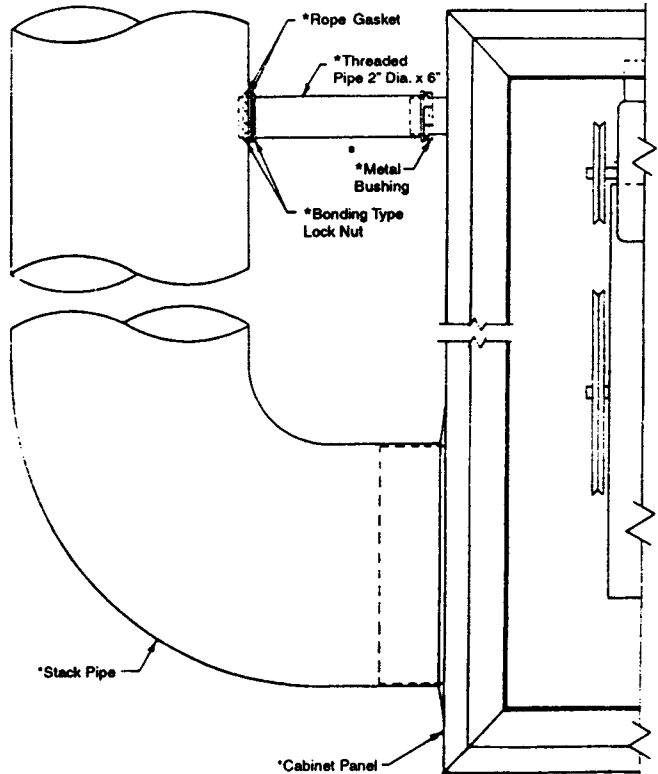


D. Bleeder Tube



*Parts Not
Furnished

Assembly of Bleeder Connection To Stack - Gas Only
SO-80-86-115-150



*Parts Not
Furnished

Assembly of Bleeder Connection To Stack - Gas Only
SO-225-300-400-525