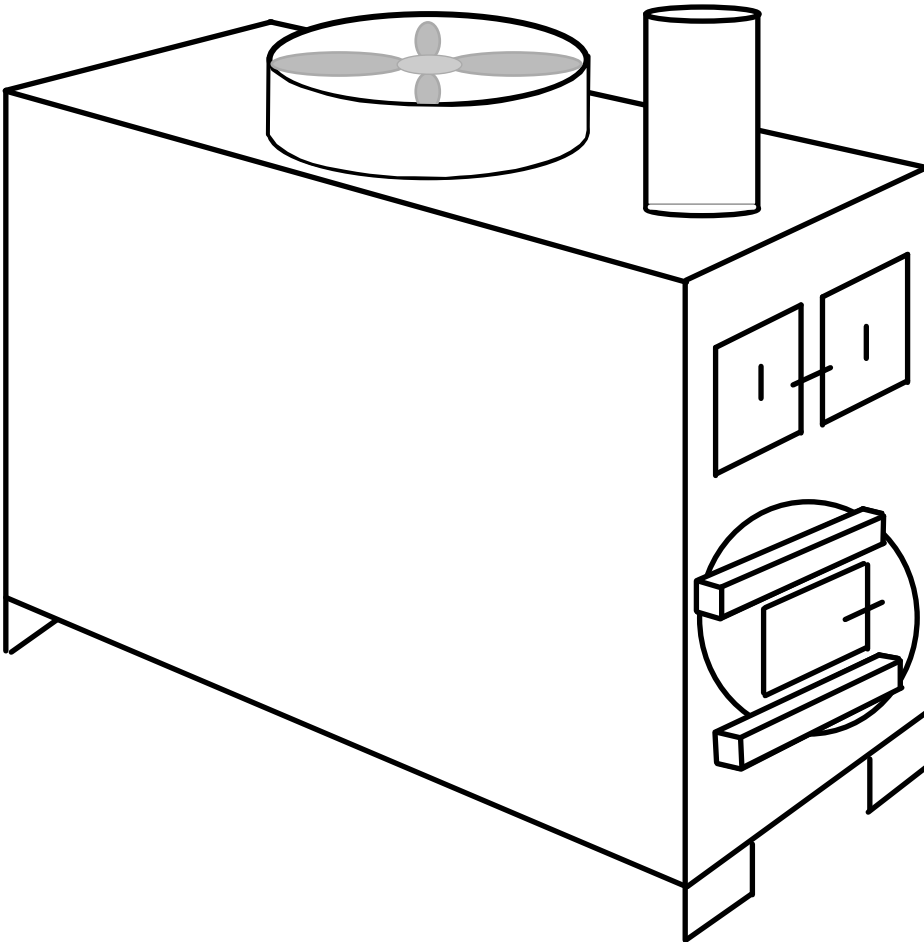


BIOMASS COMBUSTION SYSTEMS, INC.
67 MILLBROOK ST., SUITE 502
WORCESTER, MA 01606
508-798-5970 - FAX 508-798-5971

B.C.S. Shop Heaters
26", 30" & 36" (36" shown)



INSTALLATION MANUAL
HAND FIRED SYSTEMS

TABLE OF CONTENTS

1 RECEIVING	2
2 LOCATING THE SYSTEM	2
3 INSTALLING THE STACK	4
4 ELECTRICAL CONTROLS	7
5 WIRING THE SYSTEM	8
6 SUB-ASSEMBLIES	11
7 SAFETY LABELS	12

This publication is intended for use by trained personnel to install, operate, and maintain BCS Shop heating Furnaces. Read this manual carefully before beginning.

Note: Where measurements, sizes or ratings are given, the first number refers to a 36" Shop Heater, the number in parenthesis () refers to the 30" or 26" Shop Heater.

Installation is to be performed only by a qualified installer.

Save These Instructions.

Refer to markings on shop heater for additional information.



SECTIONS MARKED BY THIS SYMBOL CONTAIN IMPORTANT SAFETY INFORMATION. READ AND FOLLOW COMPLETELY.



WARNING! RISK OF FIRE OR EXPLOSION! DO NOT BURN GARBAGE, GASOLINE, DRAIN OIL OR ANY OTHER FLAMMABLE LIQUID.



CAUTION – HOT SURFACES
KEEP CHILDREN AWAY
DO NOT TOUCH DURING OPERATION



THE INSTALLATION OF THIS FURNACE SHOULD CONFORM TO ANY APPLICABLE STATE AND LOCAL LAWS OR ORDINANCES. SUCH APPLICABLE REGULATIONS AND REQUIREMENTS TAKE PRECEDENCE OVER THE GENERAL INSTRUCTIONS IN THIS MANUAL.



DO NOT OPERATE WITH FUEL OR ASH REMOVAL DOORS OPEN

1. RECEIVING

BCS Shop Heaters require some additional assembly. Complete shipment should include:

- Furnace assembly
- Stack
- Ash Hoe
- Clean Out Rod
- Plenum Thermostat
- Temperature Gauge
- (2) Temperature Probes
- Fine & Course Wire Brushes
- Welders gloves
- Manuals & Caution/Safety Label

2. LOCATING THE SYSTEM



OBSERVE ALL CODES AND REGULATIONS APPLICABLE TO INSTALLING A HEATING SYSTEM. LOCAL FIRE AND INSURANCE CODES PREVAIL OVER THE CONVENIENCE OF BURNER LOCATION.



AS A GENERAL GUIDELINE; KEEP ANY COMBUSTIBLE SURFACE OR MATERIAL AT LEAST THREE FEET FROM THE SIDES OF THE BURNER OR HEAT EXCHANGER AND SIX FEET FROM THE FRONT OR BACK OF THE BURNER.



DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.



DANGER – RISK OF FIRE OR EXPLOSION – DO NOT BURN GARBAGE, GASOLINE, DRAIN OIL OR OTHER FLAMMABLE LIQUIDS.

The furnace must be installed over a non combustibile flooring.

Try not to locate the furnace near a door that is opened often. The colder the air entering the furnace, the cooler the heated air coming out of the furnace.

The firebox, heat exchanger, and electric controls must be protected from adverse weather conditions. Rapid cooling of a hot furnace as may be caused by a rain or snow can cause cracking or warping of the steel. The electric controls are NOT designed to be exposed to rain or snow.

If a room for the furnace is to be built outside the main shop, insulate all exposed walls and ceiling. Use the room as the return plenum for the furnace. Install ductwork from the furnace's hot air outlet to the area that is to be heated and provide return air vents from the heated area to the furnace room return of an adequate size to prevent negative pressure in the room otherwise back drafts may occur.

It is important not to install the furnace in a building with negative pressure. This negative pressure can suck flue gases (smoke) out of the firebox and into your facility. Since combustion and induced draft air for the furnace can create negative pressure in the furnace room, be sure there is an adequate air returning to the furnace to prevent negative pressure around the furnace. If the facility is under negative pressure, adequate outside air must be brought into the furnace area so the pressure around the furnace remains neutral. In some areas this will require ducting the intake on the induced draft fan and combustion air manifolds to the outside. Any fan installed in the storage area should not create negative pressure in the room where the solid fuel burning appliance is located.

Return air should flow at 650 ft/min or less to prevent negative pressure in the furnace room. A 36" Shop Heater requires up to a total of 10,480cfm of return air for the combustion and warm air fans. This calls for 16 sq. feet of *free* grate area to keep air flow at 650 ft/min or less. Keep in mind that a 4' x 5' grate rated at 85% open area has only 17 sq. feet of free grate area. If you are using dust filters, double the size of the air returns.

A 30" Shop Heater requires up to 6,862cfm of return air for both fans and 10.6 sq. feet of free grate area. A 26" Shop Heater requires up to 3,412cfm of return air for both fans and 5.25 sq. feet of free grate area.

If the furnace is operated in a building in conjunction with a supplementary heating system, and combustion air for the wood furnace is not brought in from the outside, it is essential that the existing supplementary heater be checked when the wood furnace is operating to ensure that the negative pressure created from the furnace's combustion air does not adversely effect its operation.

Outside combustion air may be necessary if:

1. The furnace does not draw steadily, smells, experiences smoke roll-out, burns poorly, or back-drafts whether or not combustion is present.
2. Any of the above symptoms are alleviated by opening a window slightly on a calm day.
3. Building is equipped with a well sealed vapor barrier and tight fitting windows and/or has any powered devices that exhaust interior air.
4. There is excessive condensation on windows in the winter.
5. A ventilation system is installed on the building.

The warm air supply outlet from this furnace should not be connected to the cold air return inlet of a central furnace because the possibility exists for the central heater to dangerously overheat.



OBSERVE THE PROPER CLEARANCES FROM COMBUSTIBLE MATERIALS! IF YOU ARE IN DOUBT ABOUT THE SAFETY OF YOUR BURNERS LOCATION TALK WITH THE APPROPRIATE AUTHORITIES.

3. INSTALLING THE STACK



BURNER IS DESIGNED TO BE USED ONLY WITH A STRAIGHT STACK.



IT IS THE CUSTOMER'S RESPONSIBILITY TO MEET STATE AND LOCAL FIRE CODES FOR CLEARANCES SURROUNDING A STACK.



DO NOT CONNECT THIS UNIT TO A CHIMNEY FLUE SERVING ANOTHER APPLIANCE.



INSPECT AND CLEAN FLUES AND CHIMNEY REGULARLY.



BURN WOOD ONLY

The BCS supplied stacks are standard 8", 10" and 12" pipe with their Outside Diameters listed below:

- 26" 250,000 BTU Furnace - 8-5/8"
- 30" 500,000 BTU Furnace - 10-3/4"
- 36" 800,000 BTU Furnace - 12-3/4"

It is recommended that you check with local building officials to determine if the Biomass Combustion Systems supplied stack meets local standards.

The supplied stack should rise straight above the induced draft nozzle without any turns elbows or stack caps. No off-sets in the stack are permitted. Any obstruction above the nozzle will greatly reduce the effect of the induced draft system. Please call B.C.S. if you have any questions regarding the layout of your stack. The stack should rise at least four feet above the rough surface (roof).

Center a plumb bob above the stack stub on the front of the burner. Run a line up to the ceiling and mark the location where the stack will penetrate the roof. Move the furnace to center the stack between trusses if necessary. Cut a hole with at least 2" minimum clearance around the stack.

Lift or lower the stack into place using a crane or a fork lift on top of the burner. The connection between the stack stub and the stack should be beveled and welded with a triple pass of 7018 welding rod.

Roof shoe and storm collars are not supplied by B.C.S. A local sheet metal shop or duct installer should be able to make one to match the angle and design of your roof. Make sure the stack can grow in height when heated without upsetting the shoe. No cap should be used on the stack because it will impair the induced drafting. See Diagram for a sample of a roof shoe and storm collar.

ROOF SHOE AND STORM COLLAR
FOR 8", 10" AND 12" OD STACKS

For angled roofs use
your roof angle to set the
pitch of the roof shoe

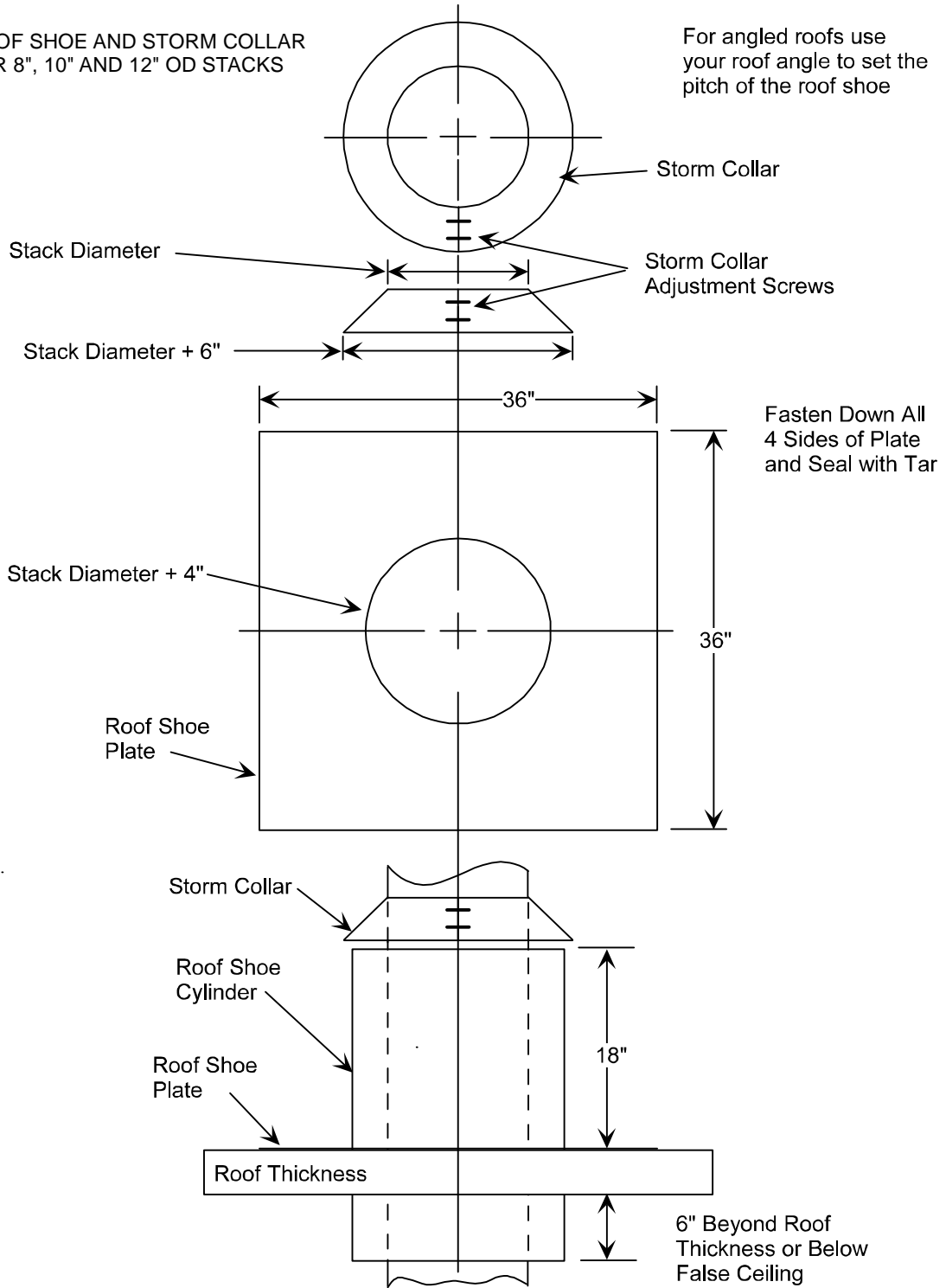


DIAGRAM #2

December 5, 2009

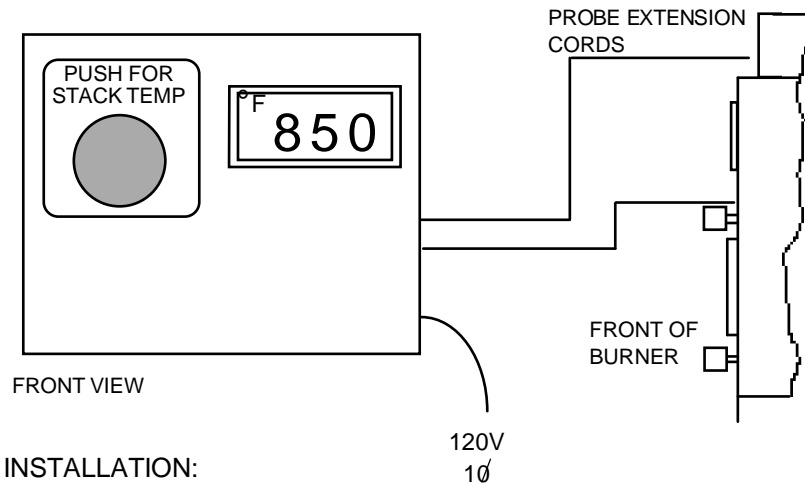
4. ELECTRICAL CONTROLS

Install magnetic starters (customer provided) and switches for the fans following the instructions in this section 5. This will provide your Shop Heater with manual operation of the induced draft fan and automatic or manual control of the firebox cooling fan. A safety control circuit will turn off the induced draft fan if the plenum thermostat (included) senses excessive heat from the burner. This will prevent overheating should the cooling fan malfunction.

The temperature gauge displays the firebox temperature to aid you in adjusting the air controls, to determine when fuel should be added, and to indicate when the heat exchanger tubes need cleaning. Install the temperature probes as shown below and connect them to the 'firebox' and 'stack' leads attached to the temperature gauge.

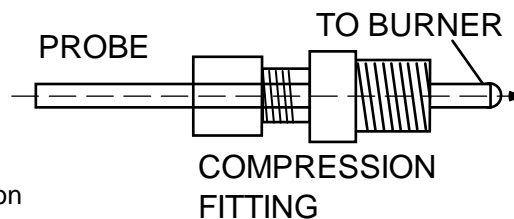
See diagram for more information on the installation of the temperature gauge and probes.

TEMPERATURE GAUGE / PROBE LOCATIONS



PROBE INSTALLATION:

Slide (1) probe into well above the loading door as far as it will go then back it out 1/4" - 1/2" and tighten the compression fitting. Slide the second probe into the opening at the base of the stack stub until 1" to 2" remains sticking out and tighten that compression fitting.



5. WIRING THE SYSTEM



MANY STATES REQUIRE A LICENSED ELECTRICIAN FOR ANY ELECTRICAL WORK. CONSULT LOCAL REGULATIONS BEFORE PROCEEDING.

Motor HP	Volts	Frequency	Phase	Full load Amps
1/2	208	60 Hz	3	2.4
1/2	230	60Hz	3	2.2
1/2	460	60Hz	3	1.1
1/2	230	60 Hz	1	9.8
3/4	208	60 Hz	3	3.5
3/4	230	60 Hz	3	3.2
3/4	460	60Hz	3	1.6
3/4	230	60Hz	1	13.8
1	208	60Hz	3	4.6
1	230	60Hz	3	4.4
1	460	60Hz	3	2.1
1	230	60Hz	1	16
1.5	208	60Hz	3	6.6
1.5	230	60Hz	3	6.0
1.5	440	60Hz	3	3.0
1.5	230	60Hz	1	20
2	208	60Hz	3	7.5
2	230	60Hz	3	6.8
2	440	60Hz	3	3.4
2	230	60Hz	1	24

See diagrams for wiring assistance.

Mount the temperature gauge (included) two magnetic starters and a start/stop switch (not supplied) on a convenient wall away from excessive heat. One magnetic starter and the start/stop switch control the induced draft fan while the other magnetic starter controls the hot air/cooling fan.

The hot air/cooling fan is cycled on and off by a fan and limit switch mounted above the fan. The switch is pre set to turn on at 110-125 degrees, to turn off at 80-90 degree, with the upper limit shut off set at 200 degrees. Mount the switch on the ductwork above the cooling fans 6" above the fan. The body of the switch mounts to the outside of the ductwork and the 5" probe extends into the ductwork where heated air naturally rises to when the fan is off.

If no ductwork will be attached to the fan you may attach the fan and limit switch directly to the fan. Position the switch with the probe over the top flange of the fan. Secure the 3/4" diameter probe to the flange with a U bolt. It will be necessary to drill holes for the U-bolt. Tighten the bolt enough to hold the probe without distorting it.

All hot lines coming into the system, both 110 and 3 phase, should be controlled at a master service box with circuit breakers (not supplied). Run the 3 phase and the 110 volt wiring to both magnetic starters and run the 110 volt wiring to the thermostat as shown in the diagrams.

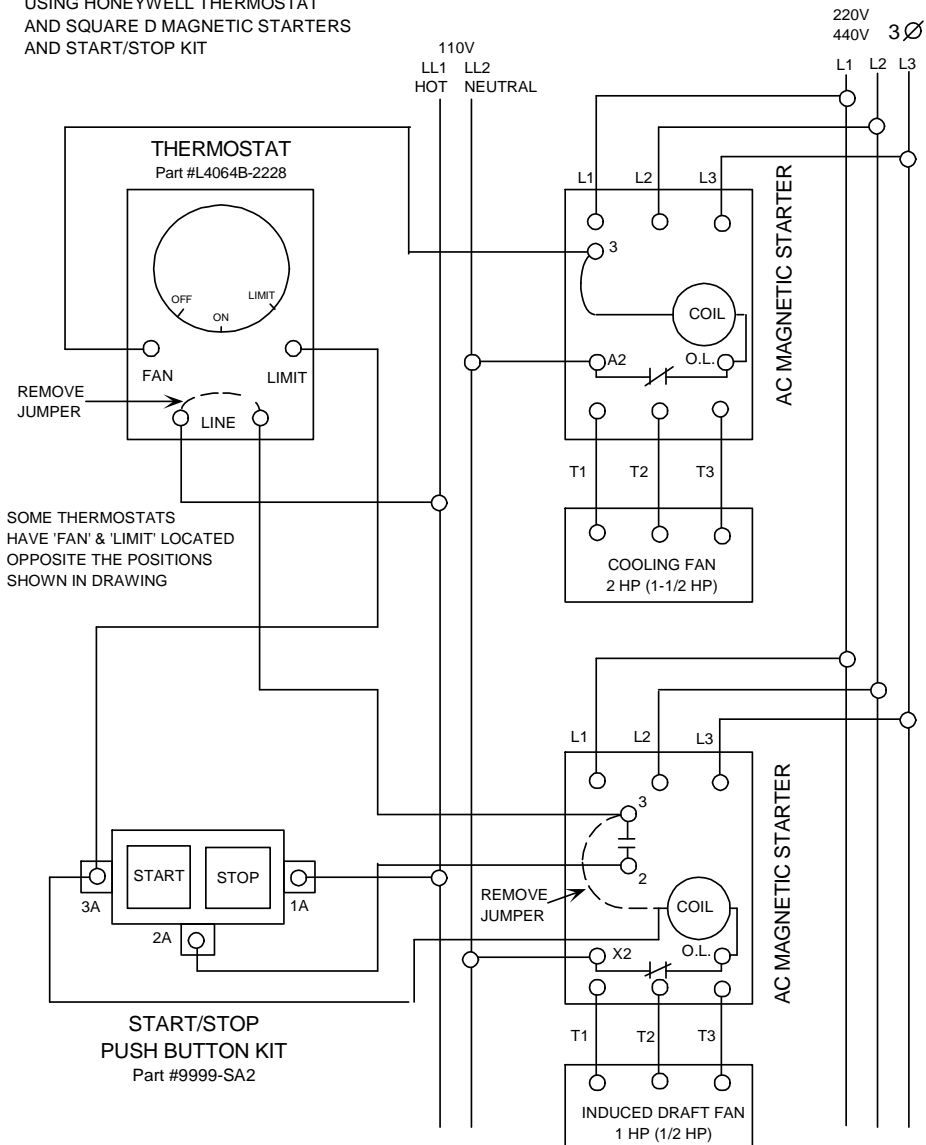
The start/stop kit is installed in the NEMA enclosure for the 1 HP (1/2 HP) magnetic starter. This switch will control the induced draft fan. If the switch did not come installed it should be done now. Complete instructions for this should be included with the push button station.

Next wire the coil in the 2 HP (1-1/2 HP 30", 3/4HP 26") magnetic starter to the thermostat. Use coils that are 110 volt AC as is the thermostat. Use the fan side of the thermostat for wiring to the coils in the magnetic starter. Verify operation electrically.

Now that this magnetic starter functions via the plenum thermostat, the wiring can be brought to the fan motor through the contact points in the starter. All hot lines must be broken within the magnetic starter. Once wiring is completed, test for proper rotation of the fan. Correct if necessary. Wire the induced draft fan through the contact points in the first magnetic starter in the same way, test for proper rotation, and correct if necessary.

The limit side of the thermostat can now be wired to the induced draft magnetic starter. This is a safety circuit designed to turn off the induced draft fan if, for any reason, the heat exchanger overheats. Check the wiring diagrams for details.

TYPICAL WIRING DIAGRAM
 USING HONEYWELL THERMOSTAT
 AND SQUARE D MAGNETIC STARTERS
 AND START/STOP KIT



Note:

All Terminals for field wiring are required to use aluminum or copper conductors

For Supply connections use 10 AWG or larger wires acceptable for at least 194 degree F or equivalent.

Furnace systems, when ordered, have voltage and phase specified by the customer. All components sent are proper for that specification. Voltage should be checked and should vary no more than 10% from name plate on motors. After wiring, ductwork, and

thermostat installations are complete, simulate operating conditions and check amperage on all fans.

The temperature gauge is 120 volt. Thermocouples used to measure firebox and stack temperatures are provided with each burner. The gauge can display one thermocouple reading at a time.

Thermocouple wire may not be run in the same conduit as non-thermocouple wires. Electricity passing through the non-thermocouple wires creates a magnetic field which distorts the thermocouple signal. Thermocouple wires may be run together in the same conduit, or you may run them along the outside of the existing conduit.

If you are unsure of your readings, they should be checked. This may be done by comparing against another or temperature gauge, or by placing the probe in a known heat source such as boiling water which should produce a reading of approximately 212° F.

An access hole is provided to locate the thermocouples just above the overfire air manifold in the face of the firebox, and just below the induced draft nozzle in the stack stub on the top front of the burner. Install the temperature probes using the compression fittings provided. Connect the probes to the temperature gauge leads marked 'stack' and 'firebox'. See diagram for details.

6. SUB-ASSEMBLIES

Ductwork

Any required ductwork should now be attached to the outlet of the hot air fan to control the flow of heated air in your building. Any plenums used must be constructed of metal. Warm air supply ducting must be constructed of materials with a minimum temperature rating of 250 °F.

It is also recommended that the inlet of the induced draft fan be ducted to the outside or to a non heated area. If it is ducted to the outside position the inlet so as not to suck in rain, snow, or debris.

The ID fan can blow as much as 490cfm (300cfm 30" and 26") of air into and out the stack to induce a draft in the furnace. Blowing heated air up the stack needlessly throws away btu's while using denser, cooler air can be more efficient at creating a draft. The second benefit to adding duct to the inlet of the ID fan is that the fan noise is greatly reduced.

7. SAFETY LABELS

Make sure that all applicable safety labels are posted in clearly noticeable locations. Safety labels to be posted by each burner are provided at no charge to our customers. Please contact BCS if you need additional labels.



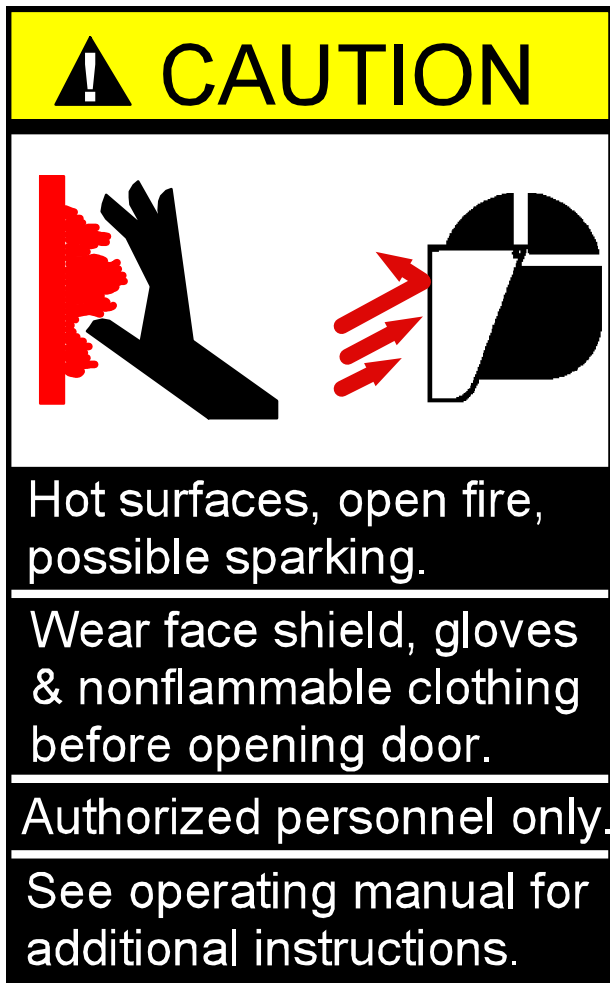
WARNING – RISK OF FIRE

DO NOT OPERATE WITH FUEL LOADING OR ASH CLEAN OUT DOORS OPEN



INSPECT AND CLEAN FLUES AND CHIMNEY REGULARLY

DO NOT STORE FUEL OR OTHER COMBUSTIBLE MATERIALS WITHIN MARKED INSTLLATION CLEARANCES.



Place this caution notice on wall near firebox door, in view of operator.