

M115AGA, M115G, T115AGA, T115G, R215AGA, R215G

THE M115AGA, T115AGA
AND R215AGA ARE
A.G.A. DESIGN CERTIFIED

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HAZARD SUMMARY

The following are general safety precautions that personnel must understand and apply during the installation, operation and maintenance phases of the equipment described by this technical manual.

-CAUTION-

Only qualified personnel should attempt installation, service and repair of this equipment. Extreme caution and observance of safety regulations should be observed at all times.

Do not recirculate in the following applications:

1. High Hazard Areas:

Grain elevators, ammunition stores, paint spraying or storage, dry cleaning, or any process area using flammable solids, liquids or gases.

2. Fluorinated Hydrocarbons:

Areas where urethane foam is being used, or any area with concentrations of freons, refrigerants or aerosols.

NOTE: Direct gas-fired recirculation requires a minimum of 4 CFM of fresh air ventilation per 1000 BTU/Hour of heat input.

-WARNING-

Any unauthorized modifications to this equipment may void warranty.

UNCRATING INSTRUCTIONS

- a. Verify number of items shipped with number of items received.
- b. Remove items from shipping cartons and check for damage.
- c. If damage in transit is found, notify carrier immediately for claim.
- d. Check items received and verify data on nameplates to make sure it agrees with ordering information.
- e. Remove lag bolts fastening unit to skid. Loosen bolts on side of unit, invert "L" angle, and retighten bolts. "L" angles now become hanging brackets for installation.
- f. Do not discard any components and accessories or make any unauthorized substitutions.
- g. Familiarize yourself with physical characteristics of unit and accessories.

-CAUTION-

Do Not remove unit from skid. Utilize skid to prevent damage during mounting.

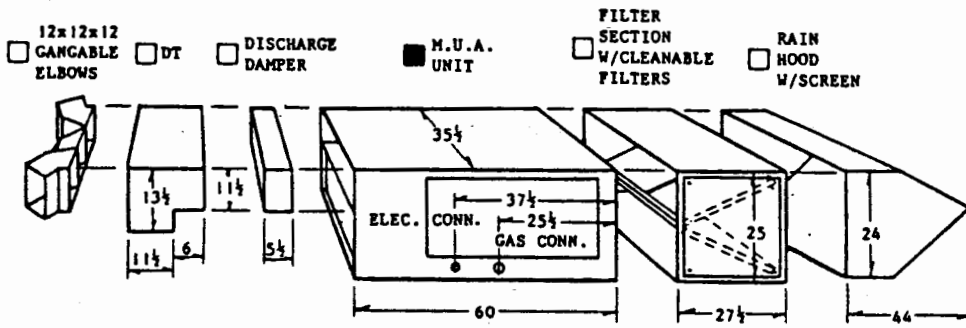
-NOTE-

Factory service information available; contact Cambridge Systems Services Department at (314) 532-2233.

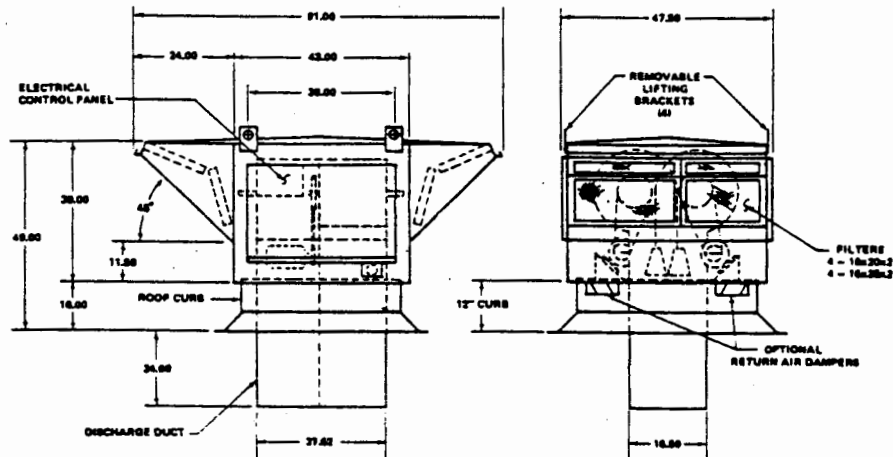
ACCESSORY ASSEMBLY

-NOTE-

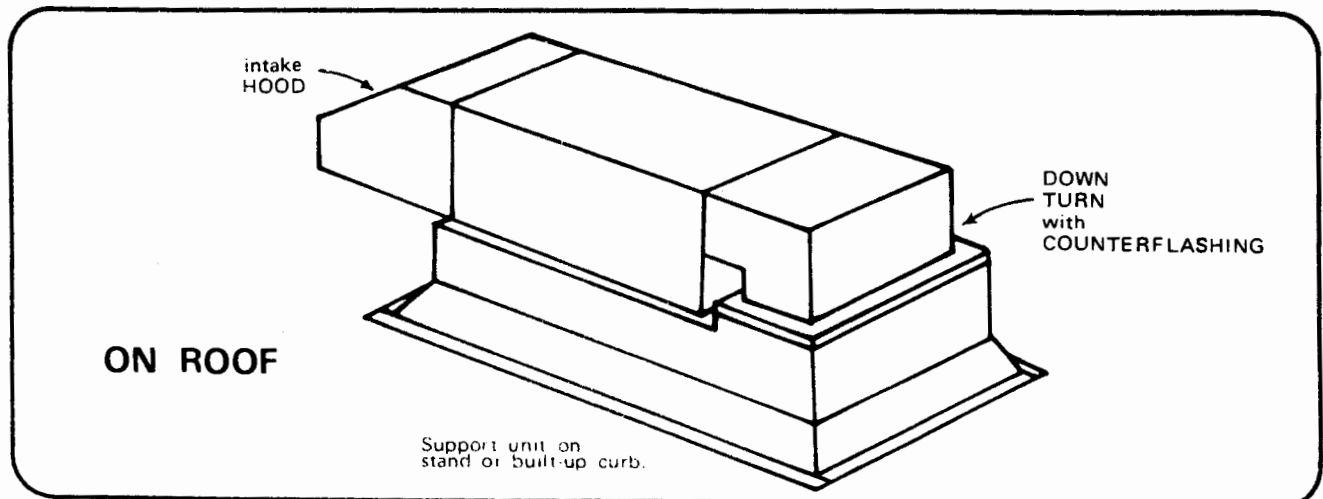
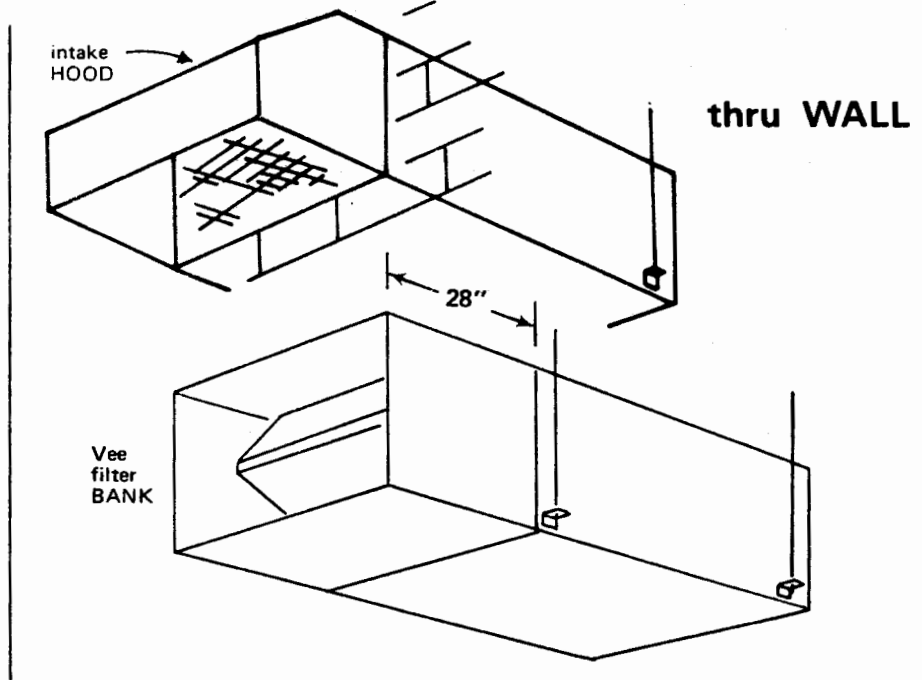
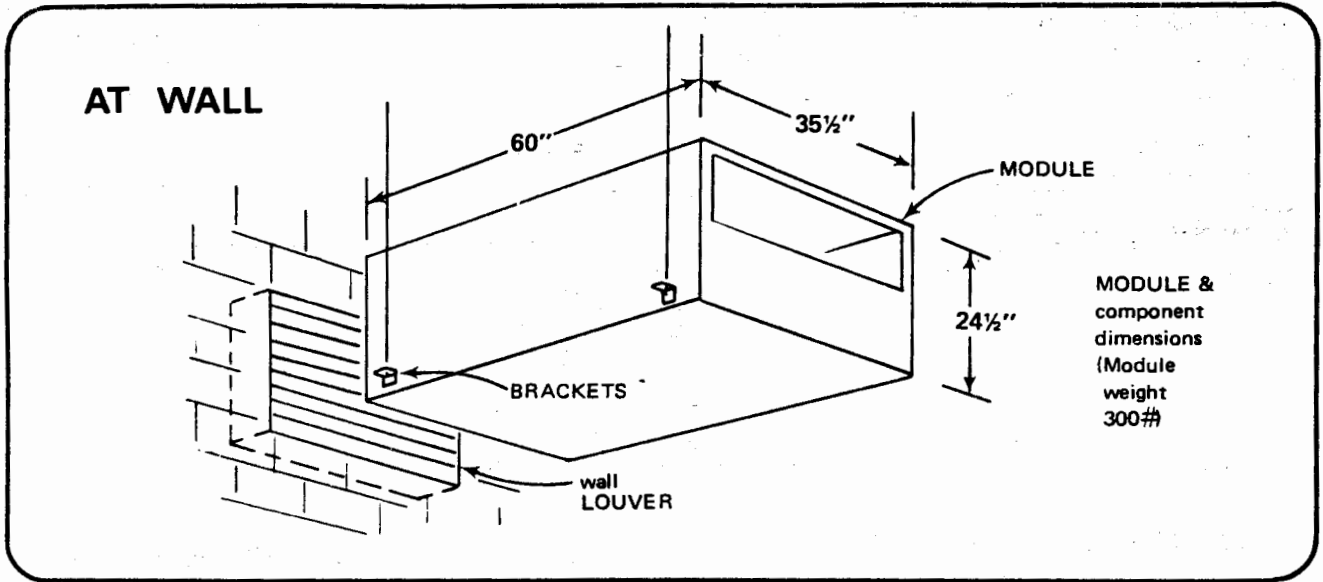
As a matter of convenience, it is recommended that all accessory items, except directional elbows, be installed on unit before mounting. In doing so, remember to verify dimensions, clearances, and be aware of obstructions that may inhibit installation.



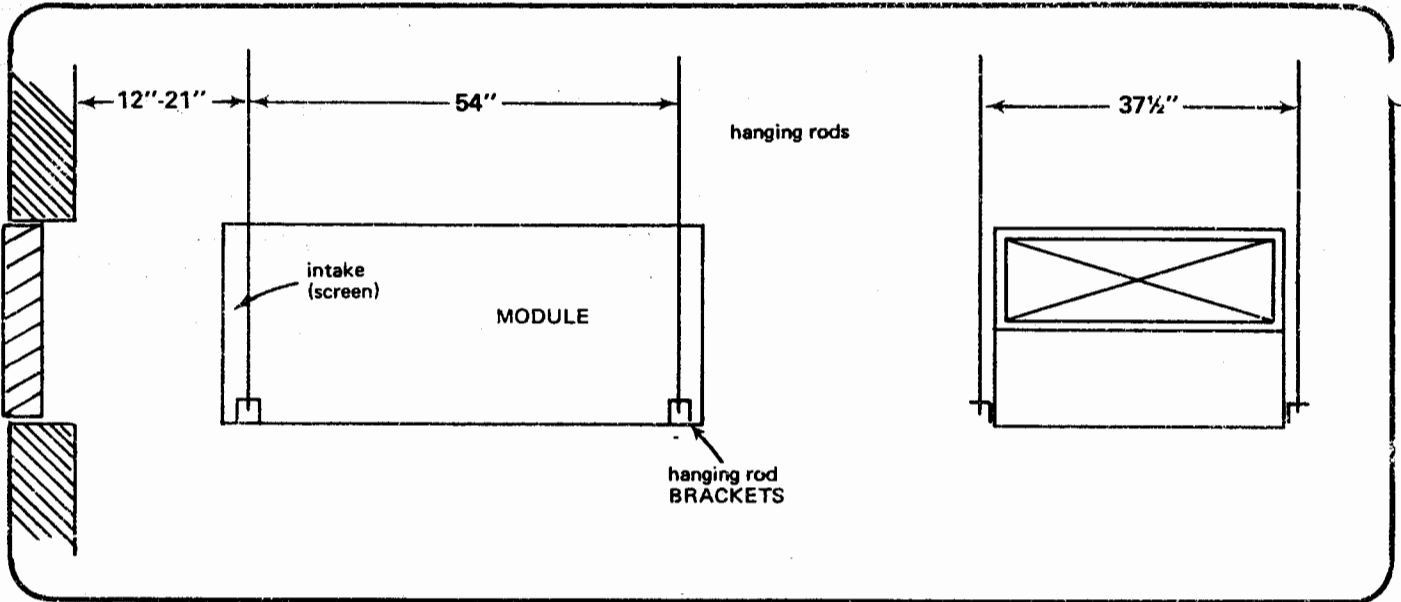
M115G



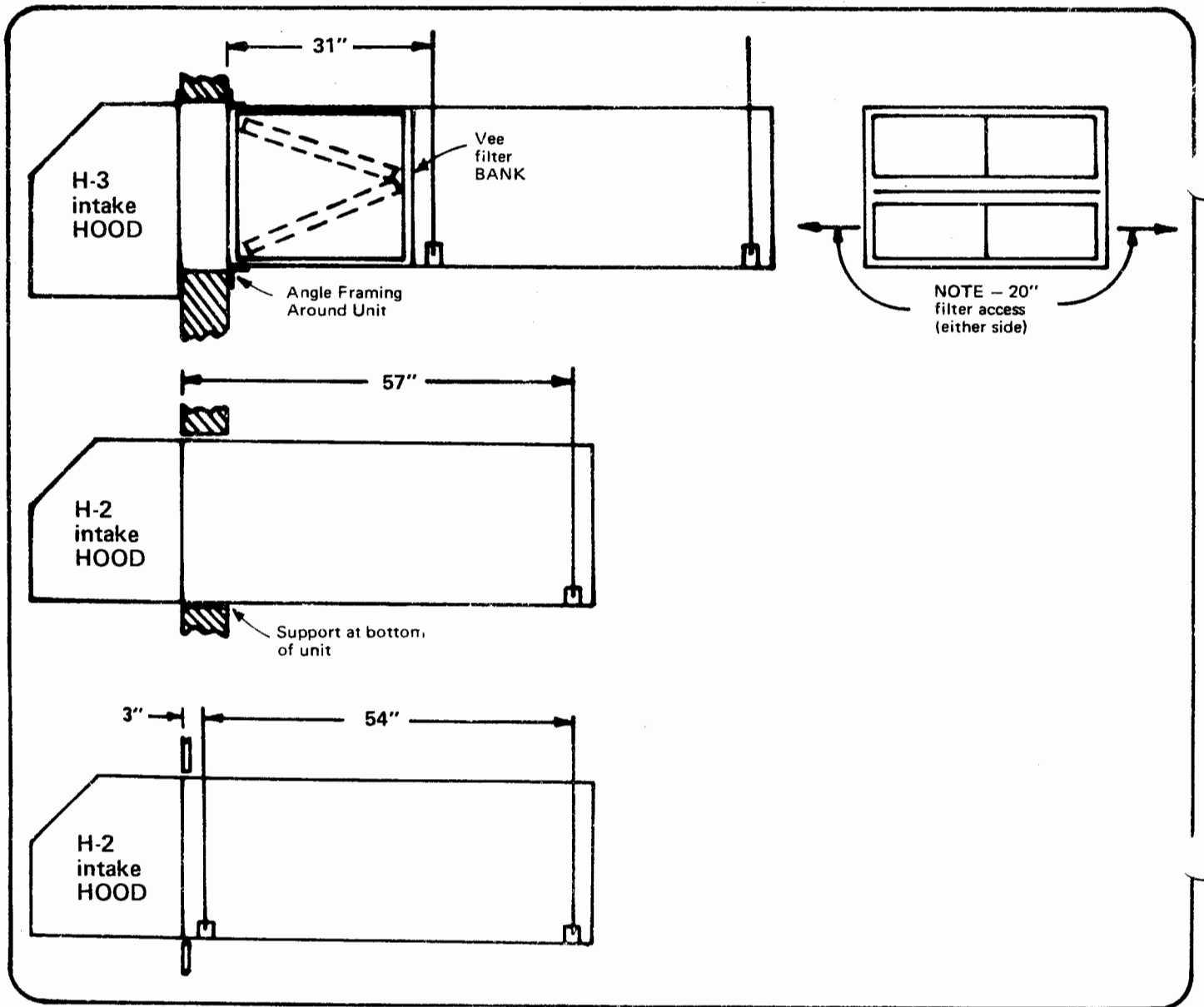
R215G



WALL INSTALLATION — AT WALL



THROUGH WALL



- 1 PROVIDE HOLE IN WALL 26" HIGH X 37" WIDE
- 2 SUSPEND HANGING RODS — 1/4" dia. (100 lbs. ea) req'd.
- 3 ASSEMBLE COMPONENTS to Module — on floor

A LEAVE MODULES ON SKIDS —
(to prevent damage to Modules)

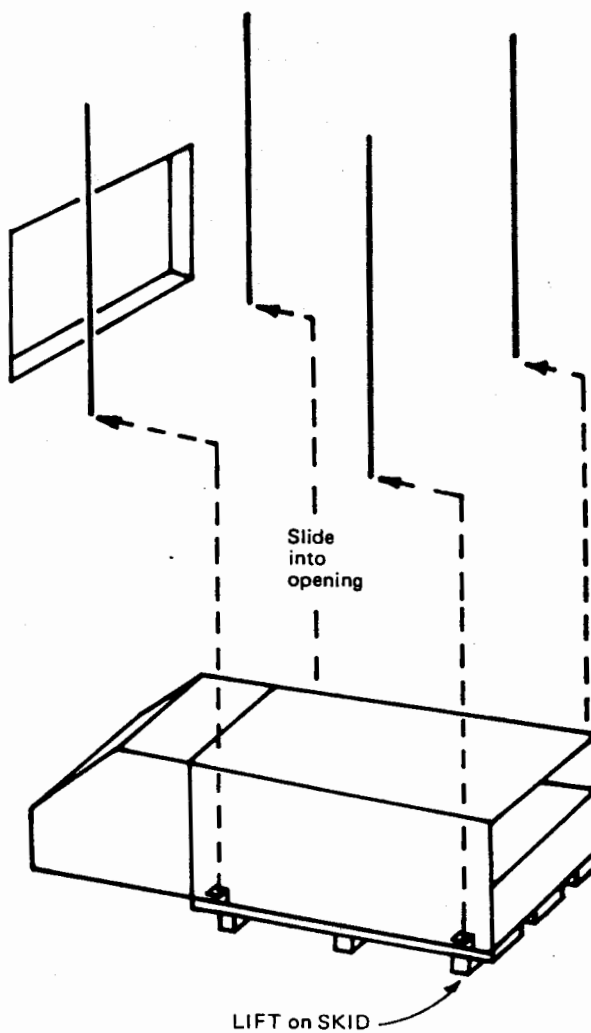
B ATTACH INTAKE HOOD, FILTER BANK, etc.
(they slip over Module, use 10 S/M screws)

C Attach hanging rod BRACKETS to side of Module.

THEN —

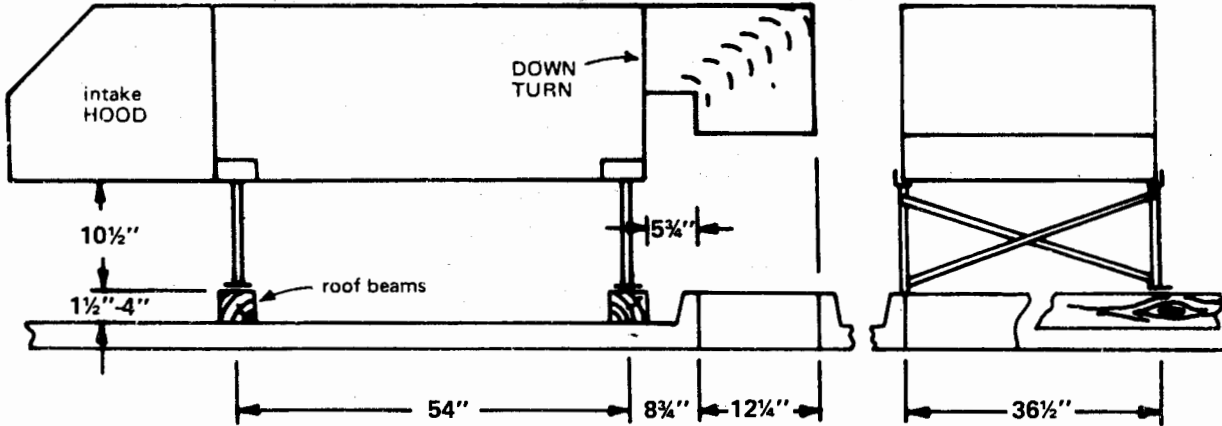
- 4 RAISE ASSEMBLED PACKAGE UP TO OPENING,
and slide in to hole. Put nuts on hanging rod & level unit.

[Caulk around outside of intake hood.]

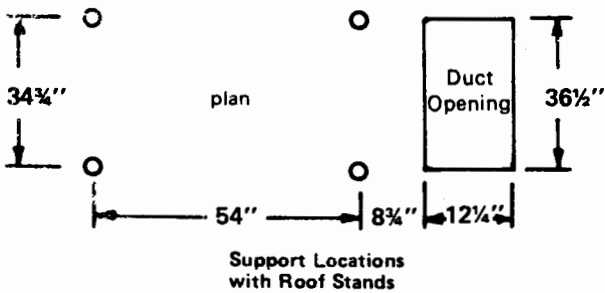
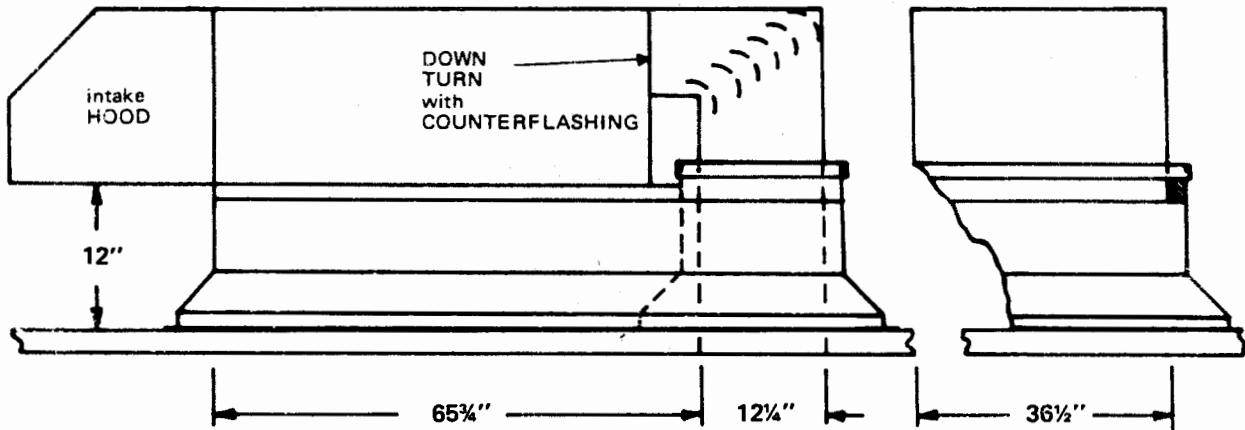


ROOF MOUNTED —

WITH ROOF STANDS



WITH ROOF CURB



CAUTION: Leave Modules IN CARTON when lifting to roof to prevent damage.

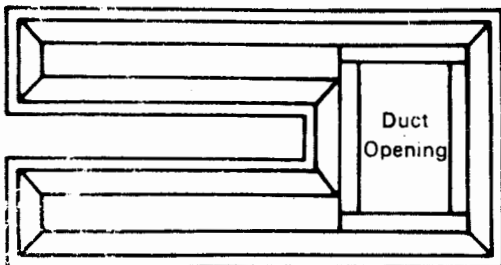
1 SET ROOF BEAMS or CURB per layout.

2 ATTACH STAND to MODULE — or place module on roof curb.

A Leave ON SKID when lifting
B Set on ROOF BEAMS

3 ATTACH HOOD and DOWN TURN (Duct down with proper flashing)

4 CAULK joints & TOUCH UP scratches and holes with outdoor enamel.



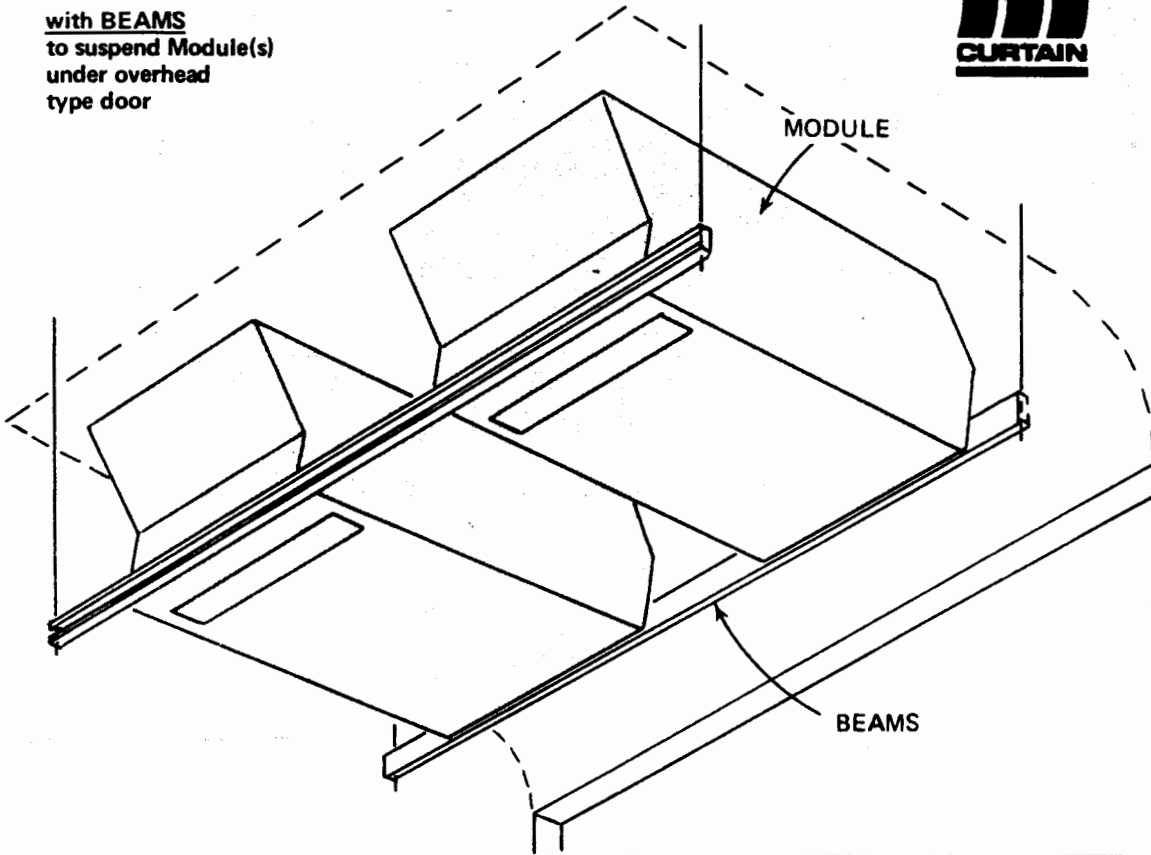
Module roof curb with integral discharge duct. Consult factory for dimensions of various types of curbs

T HANGING

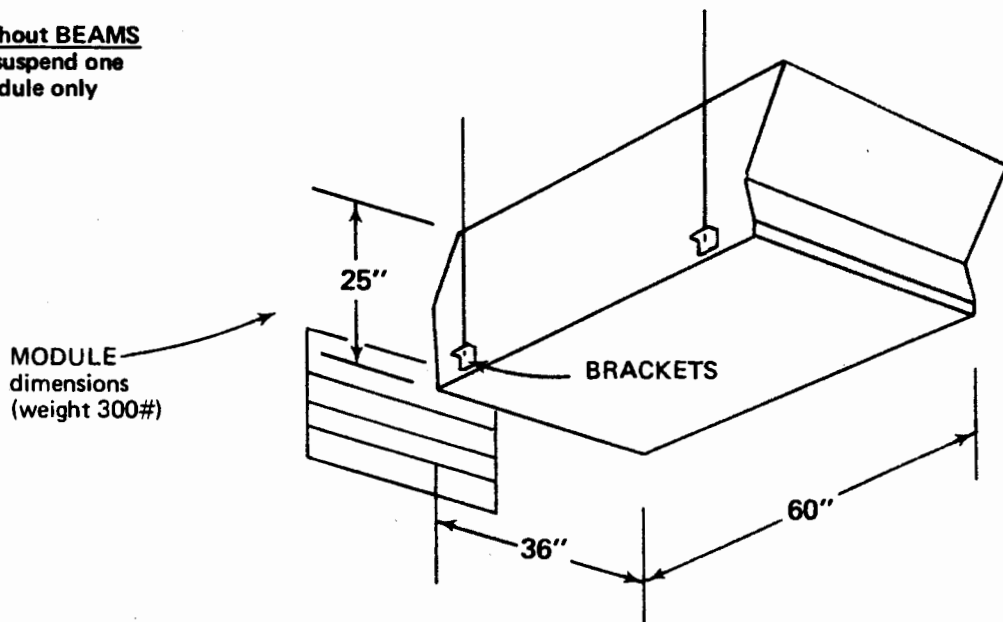
[Two Module 'package' shown
Use similar methods for
1, 3, 4 or 5 Module 'packages']



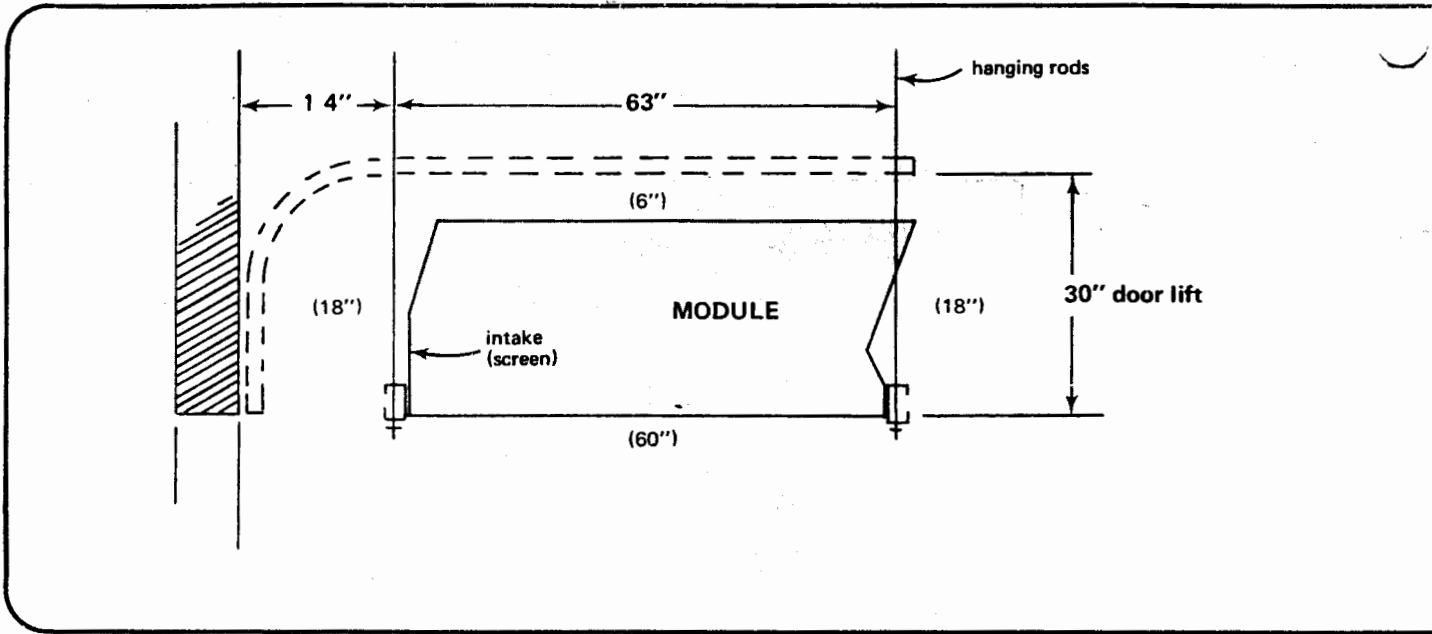
with BEAMS
to suspend Module(s)
under overhead
type door



without BEAMS
to suspend one
Module only



DOOR INSTALLATION – WITH BEAMS

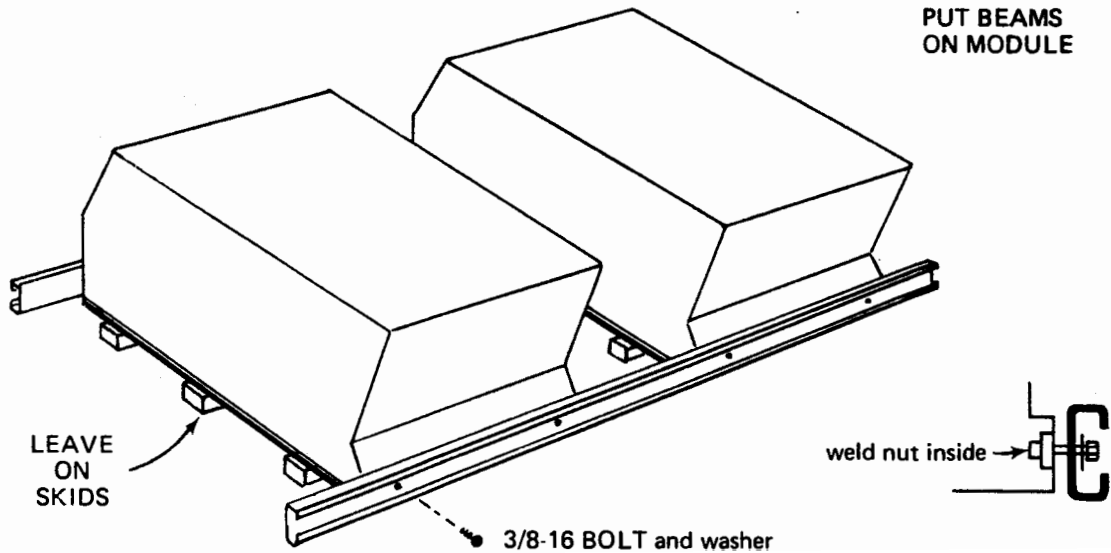


1 SUSPEND HANGING RODS – as above, and

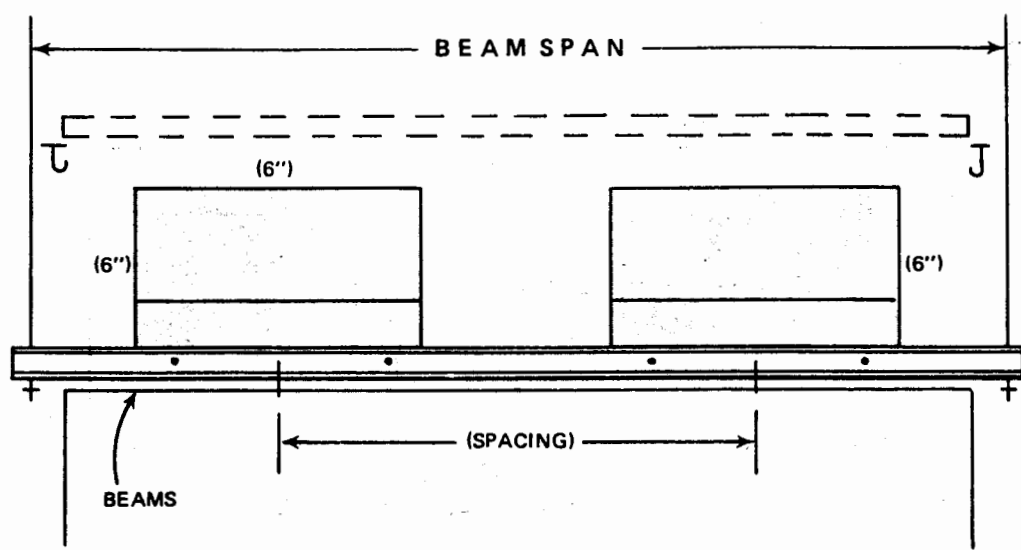
| number of Modules | 1 | 2 | 3 | 4 | 5 |
|----------------------|------|-------|-------|-------|-------|
| total hanging weight | 350# | 675# | 1000# | 1325# | 1650# |
| rod dia (4 ea req'd) | 1/4" | 5/16" | 3/8" | 1/2" | 1/2" |

2 ASSEMBLE MODULES to BEAMS – on floor

- A LEAVE MODULES ON SKIDS – (to prevent damage to Modules)
- B BOLT BEAMS TO MODULES – (insert ALL bolts fingertight first, then tighten.)



(minimum clearances to combustible material shown)



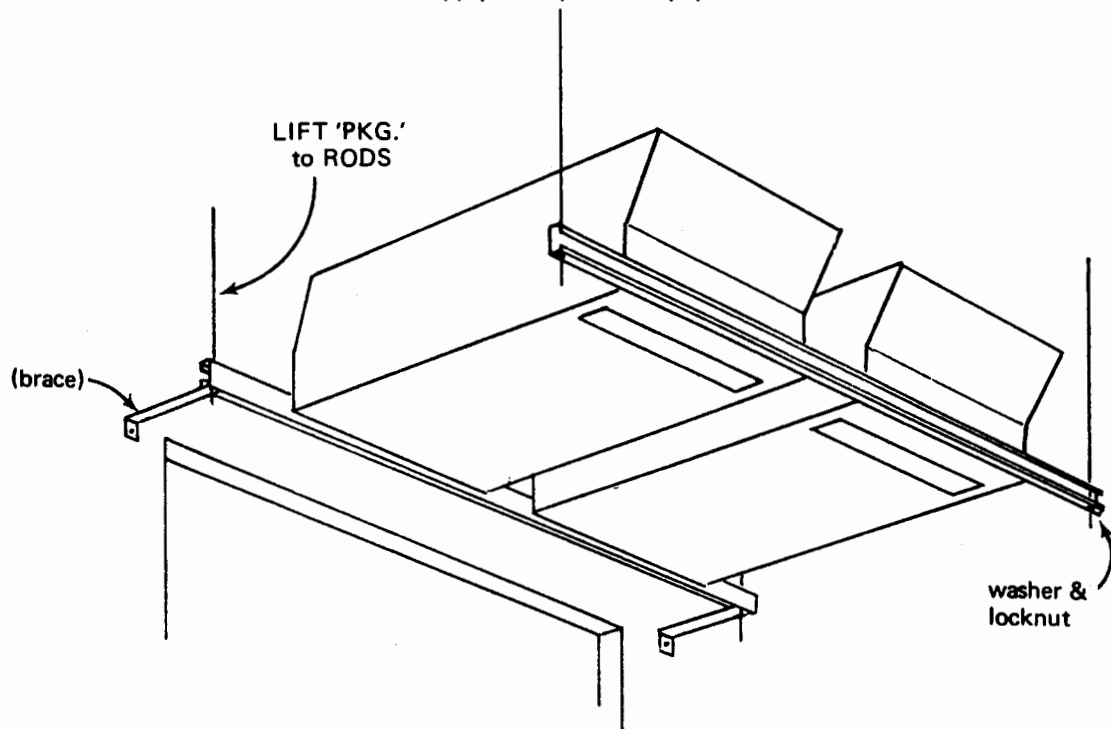
THEN -

3 LIFT ASSEMBLED 'PACKAGE' up to RODS -
carefully, with LONG forks on lift truck or
2 hoists properly slung at ends of beams.

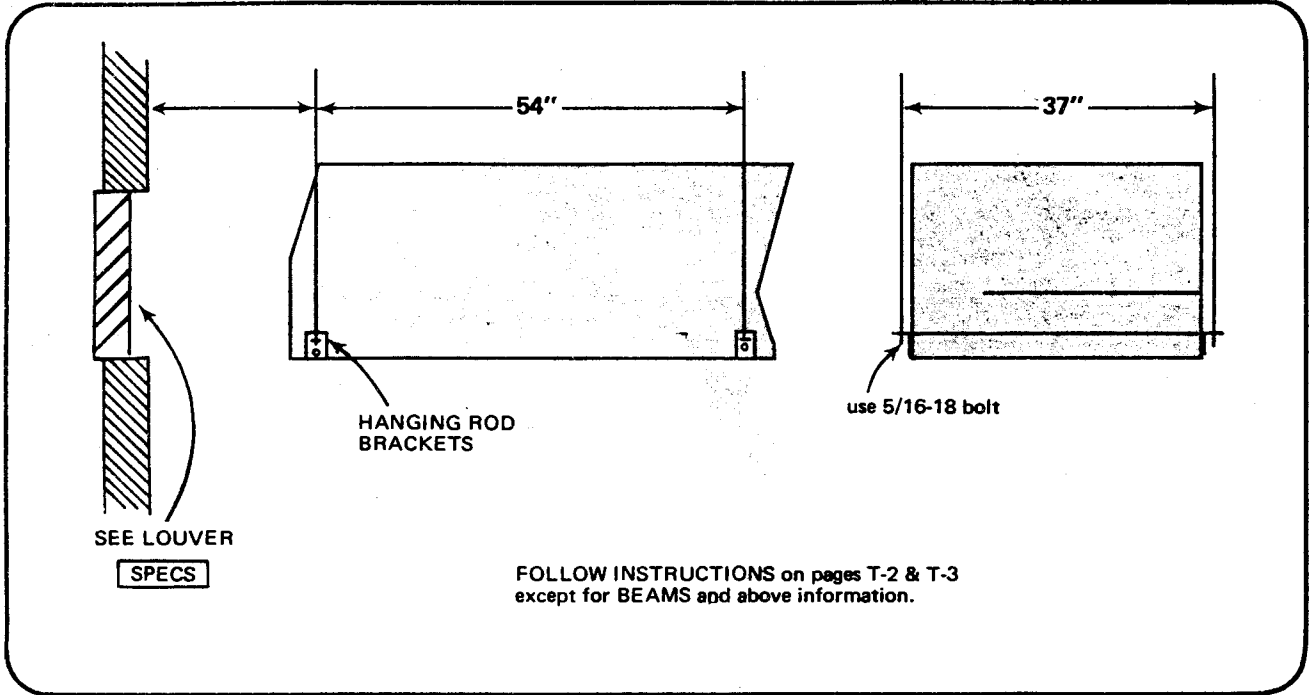
4 LEVEL UNITS at LINTEL HEIGHT or higher
use washers and locknuts on rod ends.

[IF IT IS DESIRED TO ELIMINATE EXCESSIVE SWAYING OF UNITS,
USE STRAP IRON BRACE TO WALL or JAMB & under ROD END.]

CAUTION: if BEAMS are not supplied with 'package',
installer must supply them per factory specifications.



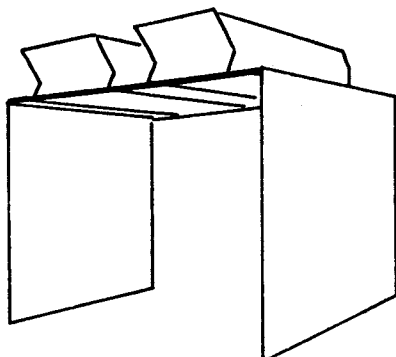
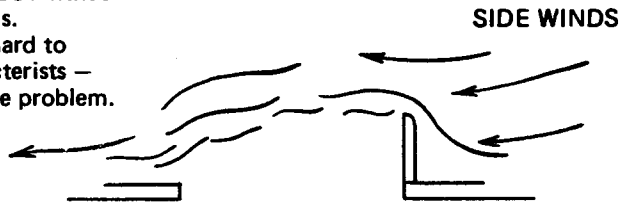
HIGH WALL LOCATION – WITHOUT BEAMS



NOTES DO NOT CONNECT DUCT WORK, BAFFLES, etc. to discharge or intake of MODULE
 LOCATE Modules INDOOR, dry (or weather proof) overhead location only – see clearances required.

TO HANDLE ADVERSE WIND CONDITIONS AT DOORS –

WIND BREAKS, outside the door, can help DEFLECT winds in many unusual situations of prevailing winds.
 In any case, wind problems are variable and hard to solve – each building will have various characteristics – and several methods must be tried to solve the problem.



SIDE CURTAINS, of canvas, plywood, etc., in some cases, can afford additional protection against winds and negative pressures.

ELECTRICAL
INSTALLATION INSTRUCTIONS

-WARNING-

High voltage electrical input to this equipment is required. Extreme caution should always be exercised.

Before attempting installation, review following instructions and wiring diagrams to make sure you have a thorough understanding of what is required.

-CAUTION-

This equipment must be electrically grounded in accordance with local codes or in accordance with National Electrical Code ANSI/NFPA No. 70-198.

-NOTE-

A low temperature limit control should be installed in areas where freeze up protection is needed in the event of burner shutdown. (See instructions on page 27)

INSTALLATION

- a. Check nameplate on side of unit to determine electrical input requirements to equipment.
- b. Remove access panel on nameplate side of unit.
- c. Remove cover on internal electrical control enclosure for wiring diagrams.
- d. Remove knockout and mount disconnect (per National Electrical Code) to left side of access opening.
- e. Mount remote control panel. This panel should be mounted to provide convenient accessibility to operate without being susceptible to damage.
- f. The following instructions are applicable to units having operating thermostat, EDS, or night set-back options.
 - 1) The above are to be installed in a location out of the direct line of discharge air currents from unit and where they will maintain the desired comfort levels with maximum efficiency.

- g. Run conduit and primary wiring to disconnect switch on side of unit (per N.E.C.).
- h. Run interconnecting conduit and wiring from disconnect switch to unit (per N.E.C.).
- i. Check type of controls provided.
- j. Wire remote control panel and other temperature control options per Cambridge wiring diagram.

-CAUTION-

Observe special notes and instructions on wiring diagrams.

-WARNING-

Do not attempt to start unit at this time. Premature start-up can result in damage to equipment and components.

- k. Return wiring diagram to inside of electrical control enclosure and replace and fasten all covers and panels.

**GAS PIPING
INSTALLATION INSTRUCTIONS**

-WARNING-

If supply pressure is in excess of 14" W.C., a separate positive shut-off high-pressure regulator must be added upstream of the unit's individual shut-off valve. This regulator must be vented to outside of building with no reduction in size of the vent piping. A bug vent must be installed at the line termination to prevent blockage of the line by insects. Check with local utility or gas supplier for gas supply pressure.

HIGH PRESSURE REGULATOR SELECTION CHART FOR CAMBRIDGE EQUIPMENT

| Gas Supply Pressure | 1/2 to 1# | 1.5 to 2# | 3 to 5# |
|------------------------------|---|---|---------------------------------------|
| Below 500,000 BTU/Hr. | HPR-1 1/2 Orifice Silver Spring | HPR-1 1/2 Orifice Silver Spring | HPR-1 1/2 Orifice Silver Spring |
| 500,000 to 650,000 BTU/Hr. | HPR-2 5/8x3/4 Orifice Silver Spring | HPR-1 1/2 Orifice Silver Spring | HPR-1 1/2 Orifice Silver Spring |
| 650,000 to 1,300,000 BTU/Hr. | HPR-3 7/8x1 Orifice Black Spring | HPR-2 5/8x3/4 Orifice Silver Spring | HPR-1 1/2 Orifice Silver Spring |

- a. Run piping to unit and secure per National Fuel Gas Code.

-NOTE-

A 1/8" N.P.T. plugged tapping accessible for manometer connection must be installed immediately upstream of the gas supply connection to the heater. An adequate drip leg must be installed as close to the inlet of the heater as practical. The piping must be sized and conform with local building codes or in the absence of local codes, with the National Fuel Gas Code, ANSI Z223.1-1974 and Addenda Z223.1a-1978.

b. Check for leaks in supply piping system. Use soap solution.

-CAUTION-

If the test pressure is in excess of 14" W.C. (1/2 PSIG), the heater and its manual shut-off valve must be disconnected from the gas supply system.

-CAUTION-

If the test pressure is less than or equal to 14" W.C. (1/2 PSIG), the heater must be isolated from the gas supply piping by closing its manual shut off valve during pressure testing.

-CAUTION-

Make sure all supply piping is free of foreign matter and purged.

-WARNING-

Do not attempt to start unit at this time. Premature start-up can result in damage to equipment and components.

CAMBRIDGE EQUIPMENT

START UP WORK SHEET

JOB NAME _____ S.O.# _____

MODEL _____ SERIAL NO. _____

ELECT. SUPPLY VOLTAGE _____ GAS SUPPLY PRESSURE _____

BLOWER MOTOR

BLOWER MOTOR VOLTAGE _____ BLOWER MOTOR CURRENT _____ BLOWER RPM _____

MANIFOLD PRESSURE

MANIFOLD STATIC PRESSURE (BLOWER ONLY) _____ NAME PLATE MANIFOLD PRESSURE _____

ADJUSTED MANIFOLD PRESSURE _____

FLAME SIGNAL CHECK

MICRO-AMPS HIGH FIRE _____ MICRO-AMPS LOW FIRE _____

CONTROLLER SETTINGS

RECORD SETTING OF CONTROLS THAT ARE APPLICABLE TO THIS UNIT

FM HIGH LIMIT _____ MD _____

DT _____ DIFFERENTIAL (FACTORY SET AT 10⁰) _____

LOW TEMPERATURE CUTOUT _____ ST _____

OT _____ DIFFERENTIAL _____

START UP PERFORMED BY _____

DATE _____

START-UP PROCEDURE FOR

M115AGA, M115G, T115AGA, T115G

-WARNING-

Before proceeding, read following instructions. Make sure you have a full understanding of start-up procedure. Any unauthorized modification to, or deviation from these instructions may void warranty.

STEP ONE

INSTALLATION INSPECTION

- a. When installed, this heater must be electrically grounded in accordance with local codes or in the absence of local codes, with the National Electrical Code ANSI/NFPA No. 70-1984.
- b. Review wiring diagram (located in control panel of unit) and operating sequence (page 32 of this manual). Review special controls and interlocks.
- c. With disconnect in "OFF" position, check for proper supply voltage and for adequate branch protection in accordance with the National Electrical Code ANSI/NFPA No. 70-1984. (See heater nameplate for proper unit voltage.)

-WARNING-

Do not proceed with start-up unless supply voltage agrees with nameplate voltage. If supply voltage is not correct, check with your local agent or Cambridge Engineering's Service Department to determine what changes are required to correct heater voltage.

- d. Turn off all gas using manual shut-off valves. Note: A 1/8" N.P.T. tap accessible for manometer connection has been provided immediately upstream of the gas supply connection to the heater. Verify that an adequate drip leg was installed as close to the inlet of the heater as practical. Check piping to insure that it has been properly sized for the required gas flow and that it conforms with local building codes or in the absence of local codes with the National Fuel Gas Code ANSI Z223.1-1980.

- e. Check with local utility or gas supplier for gas supply pressure. If supply pressure is in excess of 14" W.C., a separate positive shut-off high pressure regulator is required upstream of the unit's individual shut-off valve. This regulator must be vented outside of the building with no reduction in the size of the vent piping. A bug vent must be installed at the line termination to prevent blockage of the line by insects.
- f. Check for leaks in supply piping system. Use soap solution.

-CAUTION-

If the test pressure is in excess of 14" W.C. (1/2 PSIG), the heater and its individual shut-off valve must be disconnected from the gas supply system.

-CAUTION-

If the test pressure is less than or equal to 14" W.C. (1/2 PSIG), the heater must be isolated from the gas supply piping by closing its individual shut-off valve during any pressure testing of the gas supply piping system.

- g. Reconnect piping to unit and open all manual shut-off valves.
- h. Refer to unit nameplate for motor horsepower rating and compare with nameplate on motor. Check belt tension and alignment. Verify that motor and fan pulley set screws are properly tightened.

-CAUTION-

Verify that all wiring and special controls are installed in accordance with manufacturer wiring diagrams and specifications.

STEP 2

BLOWER AND MOTOR ADJUSTMENTS

- a. Turn on disconnect switch.
- b. Burner switch is to remain in "OFF" position. Turn blower switch (at remote control station) to "ON" position. Blower should start. (Units with dampers will have slight delay before blower starts. Make sure damper is fully open. If not, refer to adjusting damper linkage and end switch section, page 37). Check for proper fan rotation. This normally requires turning off blower and observing fan rotation as it slows down. If rotation is incorrect, "turn off" disconnect switch and reverse any two of the three motor leads on three phase motors. On single phase motors, follow reversing instructions on motor nameplate.

- C. Record blower RPM _____ . Check and record motor voltage _____ and AMPS _____. Compare readings with those on unit nameplate. If voltage is correct and AMP readings are high, excessive blower RPM is indicated. Open motor pulley in 1/2 turn increments until AMP readings are equal to or less than shown on motor nameplate. Note: AMP readings on 3 phase should be the average of the three leads. Inlet accessories may require access doors to be installed in order to obtain accurate motor amperage. Record final readings: RPM _____ AMPS _____. Check setting of overload relay to make sure it is properly adjusted. The reading on the dial adjusting screw should not exceed the FLA rating on motor nameplate.

STEP 3

ADJUSTING BURNER MANIFOLD PRESSURE

-NOTE-

Set all temperature controls at highest setting during start up. Units having entering air theromstats (EAT) option require moving wire from right terminal on the stat to left terminal. Units having discharge thermostats (DT) option require moving wire from "B" terminal to "R" terminal on stat.

- a. Turn off power to heater and close manual gas shut-off valve at manifold. Connect "U" tube manometer to 1/8" tap on manual shut-off valve at burner manifold. Turn on power and open manual gas shut-off valve to burner. Start the blower only and record a static pressure reading at the burner manifold. The burner static may be positive or negative. Record static reading _____. Now refer to nameplate on unit for specified manifold differential pressure. If a negative static reading was obtained, subtract that reading from the nameplate manifold pressure to obtain the correct "adjusted manifold pressure setting". If the burner static was positive, add this to nameplate manifold pressure to obtain the correct "adjusted manifold pressure setting". All readings and adjustments must be made with the unit running and the temperature control set on its highest setting. Adjustments during warm weather may require cycling of unit to keep burner at high fire. Turn on burner and adjust the regulator until actual manifold pressure agrees with the differential pressure obtained above.

-NOTE-

It may be necessary to temporarily jumper the airflow switch to permit the completion of the above step.

-NOTE-

If there is no flame and unit resets, wait one minute and depress reset button. Flame should appear. It may be necessary to repeat this procedure several times if gas piping was not purged. If unit fails after several tries, refer to troubleshooting section of manual.

STEP 4

FLAME SIGNAL CHECK

-WARNING-

Shut down entire system to prevent electrical shock.

- a. Remove wire from end of flamerod and connect positive lead from microammeter to end of flamerod. Connect other lead from meter to end of wire just removed.
- b. Start blower and burner. Turn MD valve to HI fire setting (9) and record meter reading . Reading on HI fire should be greater than 7 microamps on the scale and should not fluctuate more than 5 microamps on scale. If fluctuations are greater than 5 microamps on scale, consult with factory.
- c. Turn MD valve to low fire setting (1) and record meter reading . Reading on low fire should be greater than 7 microamps on the scale and should not fluctuate more than 5 microamps on scale. If fluctuations are greater than 5 microamps on scale, consult with factory.

-NOTE-

Rapid cycling of the gas valve indicates fluctuating flame signal.

STEP 5

AIR FLOW SWITCH ADJUSTMENT

-NOTE-

Remove jumper if previously installed.

- a. With the burner operating, adjust screw on airflow switch clockwise until burner goes out. Turn the adjustment screw out quickly (counter-clockwise) until the burner lights. Note position of slot on screw and repeat several times to identify exact point of re-ignition. Back the adjustment screw out another 1/2 turn from the re-ignition point. This procedure will properly set the airflow safety switch.

STEP 6

BURNER IGNITION CHECK

- a. Adjust controllers from high to low fire setting and cycle several times at both conditions by turning burner on and off. Check for immediate ignition. This test should be tried with the unit hot and cold at both settings.

STEP 7

FLAME SAFEGUARD RELAY CHECK

- a. While burner is on, turn off gas at the burner manual shut-off valve. The flame Safeguard Relay should trip within 4 seconds. Circuit breaker will then trip approximately 6 seconds later. Unit with KVS option (local reset button) must be electrically cycled 4 or 5 times before circuit breaker will trip.

STEP 8

REMOVE TEST EQUIPMENT

- a. Turn electrical disconnect switch to "OFF" position and remove manometer, replace plug, disconnect microammeter and re-attach wire to flame rod. If unit has entering air thermostat or discharge thermostat then replace wires previously removed to original location.

STEP 9

RESTART UNIT

- a. Perform a visual inspection of all wiring and gas valve plugs to be sure they have been properly replaced. Make sure all sensing bulbs (MD, etc.) are in their proper location. Turn electrical disconnect switch to "ON" position.

STEP 10

CHECK GAS TRAIN FOR LEAKS

- a. Operate unit at HI fire. Check all pipe connections and plugs with liquid gas detector. Tighten joints as necessary.

STEP 11

CONTROLLER ADJUSTMENT

-NOTE-

A low temperature limit control should be installed in areas where freeze up protection is needed in the event of burner shutdown. (See instructions on page 27)

-NOTE-

Before making any adjustments, read appropriate control adjustment. See pages 24 thru 26.

- a. Adjust temperature controller for desired Heat Level. For AGA units, MD settings should be placed on #4. For non AGA units MD setting should be placed on #6.

STEP 12

SECURE UNIT

- a. Place wiring diagram(s) inside control panel of unit and re-install control panel and unit access doors.

STEP 13

OPERATING CONTROLS CHECK

- a. Cycle unit several times at remote control station to insure proper operation. Set optional operating thermostat and controls to desired heat level.

START-UP PROCEDURE FOR

R215G & R215AGA

-NOTE-

When performing start-up on R215 units, always begin with Side One of unit (J Box in lower left corner of service area.)

-WARNING-

Before proceeding, read following instructions. Make sure you have a full understanding of start-up procedure. Any unauthorized modification to, or deviation from these instructions may void warranty.

STEP ONE

INSTALLATION INSPECTION

- a. When installed, this heater must be electrically grounded in accordance with local codes or in the absence of local codes, with the National Electrical Code ANSI/NFPA No. 70-1984.
- b. Review wiring diagram (located in control panel of unit) and operating sequence (page 32 of this manual). Review special controls and interlocks.
- c. With disconnect in "OFF" position, check for proper supply voltage and for adequate branch protection in accordance with the National Electrical Code ANSI/NFPA No. 70-1984. (See heater nameplate for proper unit voltage.)

-WARNING-

Do not proceed with start-up unless supply voltage agrees with nameplate voltage. If supply voltage is not correct, check with your local agent or Cambridge Engineering's Service Department to determine what changes are required to correct heater voltage.

- d. Turn off all gas using manual shut-off valves. Note: A 1/8" N.P.T. tap accessible for manometer connection has been provided immediately upstream of the gas supply connection to the heater. Verify that an adequate drip leg was installed as close to the inlet of the heater as practical. Check piping to insure that it has been properly sized for the required gas flow and that it conforms with local building codes or in the absence of local codes with the National Fuel Gas Code ANSI Z223.1-1980.

- e. Check with local utility or gas supplier for gas supply pressure. If supply pressure is in excess of 14" W.C., a separate positive shut-off high pressure regulator is required upstream of the unit's individual shut-off valve. This regulator must be vented outside of the building with no reduction in the size of the vent piping. A bug vent must be installed at the line termination to prevent blockage of the line by insects.
- f. Check for leaks in supply piping system. Use soap solution.

-CAUTION-

If the test pressure is in excess of 14" W.C. (1/2 PSIG), the heater and its individual shut-off valve must be disconnected from the gas supply system.

-CAUTION-

If the test pressure is less than or equal to 14" W.C. (1/2 PSIG), the heater must be isolated from the gas supply piping by closing its individual shut-off valve during any pressure testing of the gas supply piping system.

- g. Reconnect piping to unit and open all manual shut-off valves.
- h. Refer to unit nameplate for motor horsepower rating and compare with nameplate on motors. Check belt tension and alignment. Verify that motor and fan pulley set screws are properly tightened.

-CAUTION-

Verify that all wiring and special controls are installed in accordance with manufacturer wiring diagrams and specifications.

STEP 2

BLOWER AND MOTOR ADJUSTMENTS

- a. Turn on disconnect switch.
- b. Burner switch is to remain in "OFF" position. Turn blower switch (at remote control station) for Side One to "LO" position. Blower should start. Units with dampers will have slight delay before blower starts. Make sure damper is fully open. If not, refer to adjusting damper linkage and end switch section (page 37). Check for proper fan rotation. This normally requires turning off blower and observing fan rotation as it slows down. If rotation is incorrect, "turn off" disconnect switch and reverse any two of the three motor leads on three phase motors. On single phase motors, follow reversing instructions on motor nameplate.

- c. Record blower RPM _____ . Check and record motor voltage _____ and AMPS _____. Compare readings with those on unit nameplate. If voltage is correct and AMP readings are high, excessive blower RPM is indicated. Open motor pulley in 1/2 turn increments until AMP readings are equal to or less than shown on nameplate. Note: AMP readings on 3 phase should be the average of the three leads. Record final readings: RPM _____ AMPS _____. Check setting of overload relay to make sure it is properly adjusted. The reading on the dial adjusting screw should not exceed the FLA rating on motor nameplate.

STEP 3

ADJUSTING BURNER MANIFOLD PRESSURE

-NOTE-

Set all temperature controls at highest setting during start up. Units having entering air thermostats (EAT) option require moving wire from right terminal on the stat to the left terminal. Units having discharge thermostats (DT) option require moving wire from "B" terminal on stat to "R" terminal.

- a. Turn off power to heater and close manual gas shut-off valve at manifold. Connect "U" tube manometer to 1/8" tap on manual shut-off valve at burner manifold. Turn on power and open manual gas shut-off valve to burner. Start the blower only and record a static pressure reading at the burner manifold. The burner static may be positive or negative. Record static reading _____. Now refer to nameplate on unit for specified manifold differential pressure. If a negative static reading was obtained, subtract that reading from the nameplate manifold pressure to obtain the correct "adjusted manifold pressure setting". If the burner static was positive, add this to nameplate manifold pressure to obtain the correct "adjusted manifold pressure setting". All readings and adjustments must be made with the unit running and the temperature control set on its highest setting. Adjustments during warm weather may require cycling of unit to keep burner at high fire. Turn on burner and adjust the regulator until actual manifold pressure agrees with the differential pressure obtained above.

-NOTE-

It may be necessary to temporarily jumper the airflow switch to permit the completion of the above step.

-NOTE-

If there is no flame and unit resets, wait one minute and depress reset button. Flame should appear. It may be necessary to repeat this procedure several times if gas piping was not purged. If unit fails after several tries, refer to troubleshooting section of manual.

STEP 4

FLAME SIGNAL CHECK

-WARNING-

Shut down entire system to prevent electrical shock.

- a. Remove wire from end of flamerod and connect positive lead from microammeter to end of flamerod. Connect other lead from meter to end of wire just removed.
- b. Start blower and burner. Turn MD valve to HI fire setting (9) and record meter reading _____. Reading on HI fire should be greater than 7 microamps on the scale and should not fluctuate more than 5 microamps on scale. If fluctuations are greater than 5 microamps on scale, consult with factory.
- c. Turn MD valve to low fire setting (1) and record meter reading _____. Reading on low fire should be greater than 7 microamps on the scale and should not fluctuate more than 5 microamps on scale. If fluctuations are greater than 5 microamps on scale, consult with factory.

-NOTE-

Rapid cycling of the gas valve indicates fluctuating flame signal.

STEP 5

AIR FLOW SWITCH ADJUSTMENT

-NOTE-

Remove jumper if previously installed.

- a. With the burner operating, adjust screw on airflow switch clockwise until burner goes out. Turn the adjustment screw out quickly (counter-clockwise) until the burner lights. Note position of slot on screw and repeat several times to identify exact point of re-ignition. Back the adjustment screw out another 1/2 turn from the re-ignition point. This procedure will properly set the airflow safety switch.

STEP 6

BURNER IGNITION CHECK

- a. Adjust controllers from high to low fire setting and cycle several times at both conditions by turning burner on and off. Check for immediate ignition. This test should be tried with the unit hot and cold at both settings.

STEP 7

FLAME SAFEGUARD RELAY CHECK

- a. While burner is on, turn off gas at the burner manual shut-off valve. The Flame Safeguard Relay should trip within 4 seconds. Circuit breaker will then trip approximately 6 seconds later. Unit with KVS option (local reset button) must be electrically cycled 4 or 5 times before circuit breaker will trip.

STEP 8

REMOVE TEST EQUIPMENT

- a. Turn electrical disconnect switch to "OFF" position and remove manometer, replace plug, disconnect microammeter and re-attach wire to flame rod. If unit has entering air thermostat or discharge thermostat then replace wires previously removed to original location.

STEP 9

RESTART UNIT

- a. Perform a visual inspection of all wiring and gas valve plugs to be sure they have been properly replaced. Make sure all sensing bulbs (MD, etc.) are in their proper location. Turn electrical disconnect switch to "ON" position.

STEP 10

CHECK GAS TRAIN FOR LEAKS

- a. Operate unit at HI fire. Check all pipe connections and plugs with liquid gas detector. Tighten joints as necessary.

STEP 11

CONTROLLER ADJUSTMENT

-NOTE-

A low temperature limit control should be installed in areas where freeze up protection is needed in the event of burner shutdown. (See instructions on page 27)

-NOTE-

Before making any adjustments, read appropriate control instructions. See pages 24 thru 26.

- a. Adjust temperature controller for desired Heat Level. For AGA units, MD settings should be placed on #4. For non AGA units MD setting should be placed on #6.

STEP 12

SECURE UNIT

- a. Place wiring diagram(s) inside control panel of unit and re-install control panel and unit access doors.

STEP 13

OPERATING CONTROLS CHECK

- a. Cycle unit several times at remote control station to insure proper operation. Set optional operating thermostat and controls to desired heat level.

STEP 14

PERFORM START-UP PROCEDURE ON SIDE 2

- a. Turn blower switch at RCS box to "HI" position. Both blowers will operate. Repeat Step 2 thru 13.

MD CONTROL ADJUSTMENT

NOTE:

MD controls will not turn the unit "ON" and "OFF". These controls regulate discharge temperature from a maximum to a minimum.

General

This system utilizes a mechanical proportioning valve with a discharge-mounted bulb to maintain a constant discharge temperature. The bulb must be placed in the discharge airstream. The controller has an adjustment knob graduated from 1-9. The controller will maintain a constant discharge temperature and is adjustable from 60° - 180° F, with each dial graduation being equal to about 14° F.

For Space Heating Application

The mechanical valve should be set on #4 for AGA and #6 for standard units maximum heat output. For space heating it is desirable to cycle the unit and this requires an optional operating thermostat. The "OT" (operating thermostat) must be connected across terminals Z1 and Z2 and the blower switch in the "AUTO" position. The unit will completely shut down when space temperature satisfies operating thermostat.

For Constant Make-Up Air Application

The mechanical valve should be set to maintain a discharge temperature approximately 10° F warmer than the desired space temperature. For example, a building designed to have a space temperature of 65° F. The mechanical valve should be set to maintain about a 75° F discharge temperature or a setting of about 2 on the dial. An optional entering air thermostat (EAT) should be installed to obtain maximum energy efficiency and prevent overheating during mild weather.

For Kitchen Ventilation Systems

The mechanical valve should be set to maintain a constant discharge temperature equal to the desired space temperature. For example, a kitchen is designed to maintain a 60° F. The mechanical valve should maintain a discharge temperature of 60° F or a dial setting of 1.

EDS CONTROL ADJUSTMENT

NOTE:

EDS controls will not turn the unit "ON" and "OFF". These controls regulate discharge temperature from a maximum to a minimum.

General

An EDS system consists of a modulating gas valve, a discharge thermostat, and a space thermostat. The thermostats are connected in parallel. The discharge thermostat mounted in the unit will maintain a constant temperature until the space thermostat senses an uncomfortable condition. The space thermostat then overrides the discharge thermostat and raises the temperature to warm the conditioned area. When the desired temperature is reached, the discharge thermostat regains control.

For Space Heating

The discharge thermostat should be set at 90°F. The space thermostat should be set at the desired space temperature (about 68°F). The space thermostat can increase the discharge temperature. For space heating, it is desirable to cycle the unit and this requires an optional operating thermostat. The "OT" (operating thermostat) must be connected across terminals Z1 and Z2 and the blower switch in the "AUTO" position. The unit will completely shut down when space temperature satisfies the operating thermostat.

For Constant Make-Up Air Application

The discharge thermostat should be set at 10°F higher than the desired space temperature. The space thermostat should be set at the desired space temperature. An optional entering air thermostat (EAT) should be installed to obtain maximum energy efficiency and prevent overheating during mild weather.

For Kitchen Ventilation Systems

Set both the space and discharge thermostat at about 60°F.

EDR CONTROL ADJUSTMENT

NOTE:

EDR controls will not turn the unit "ON" and "OFF". These controls regulate discharge temperature from a maximum to a minimum.

General

This system consists of a modulating gas valve, a discharge thermostat and a remote manual controller (potentiometer). The discharge thermostat mounted in the unit maintains a constant temperature. The remote manual controller (potentiometer) will allow operator to raise the discharge temperature from the remote control station.

For Constant Make-Up Air Application

Set the discharge thermostat 10°F higher than the space temperature desired (about 78°F). Do not set the discharge thermostat too high. The potentiometer can increase the discharge temperature. An optional entering air thermostat (EAT) should be installed to obtain maximum energy efficiency and to prevent overheating during mild weather.

For Kitchen Ventilation Systems

Set the discharge thermostat at about 60°F . The potentiometer can increase the discharge temperature if necessary.

**LOW TEMPERATURE CUTOUT
FIELD INSTALLATION INSTRUCTIONS**

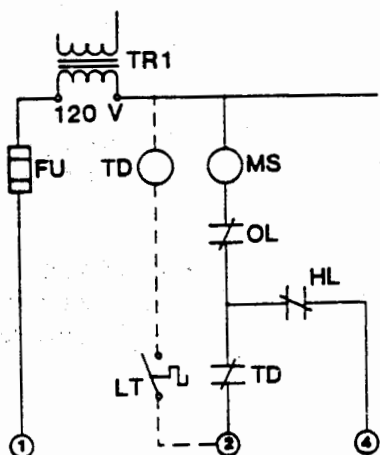
Items Required:

- 1 - Time delay relay
 - a) 120 volt coil
 - b) adjustable from 3 - 300 seconds

- 1 - Thermostat
 - a) line voltage
 - b) open on rise
 - c) range from 30° - 90°
 - d) remote sensing bulb

Installation

- a. Install thermostat on side of discharge duct and mount remote sensing bulb in the discharge airstream. Connect thermostat to control panel using flexible conduit.
- b. Mount time delay relay in open space in bottom of control panel. Do not mount where it will hinder servicing of other components.
- c. Wire normally closed contact of time delay relay in series with existing motor starter coil. (See drawing below)
- d. Wire thermostat and time delay relay coil in series with each other, and in parallel to the existing motor starter coil. (See drawing below)
- e. Set thermostat for a minimum allowable discharge temperature (about 40° - 50°F).
- f. Adjust the time delay relay for approximately 120 seconds.
- g. Run unit through a cycle at normal discharge temperature, and then at an abnormally low discharge temperature to insure proper operation of all components.



- TR 1 Control Transformer
- FU Fuse
- HL High Limit
- MS Motor Starter Coil
- OL Overload Heater Control
- TD Time Delay Relay
Coil + Contact
- LT Low Limit Thermostat

Schematic - Low Temperature Cut-out Option

**NIGHT SETBACK SYSTEM
(INSTALLATION INSTRUCTIONS)**

-WARNING-

DO NOT MOVE THE TIME POINTER. To set time, pull time dial outward and rotate in either direction until time pointer aligns with correct time of day.

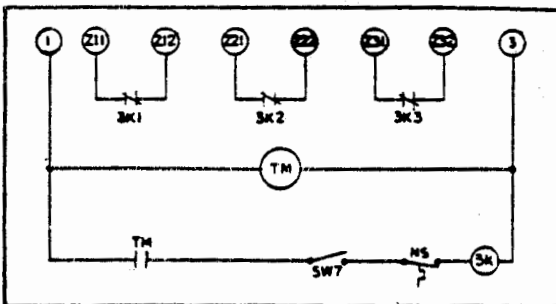
-NOTE-

In the event of power failure, time dial will have to be reset with correct time of day.

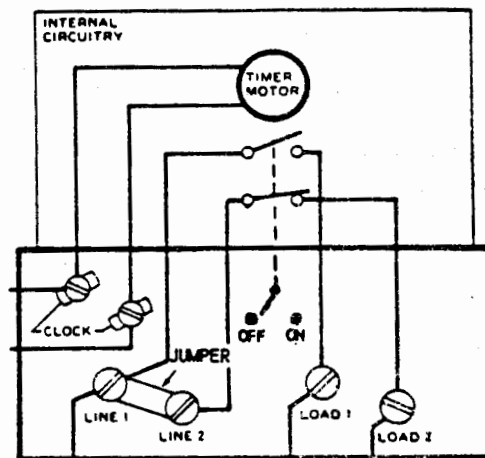
INSTALLATION

NOTE:

- a. Connect terminals 1 + 3 to matching terminals in Cambridge unit, or to separate 120 volt power supply.
- b. This night setback control can handle up to three units. Unit #1 should be connected to terminals Z11 + Z12; Unit #2 should be connected to terminals Z21 + Z22; Unit #3 should be connected to terminals Z31 + Z32.



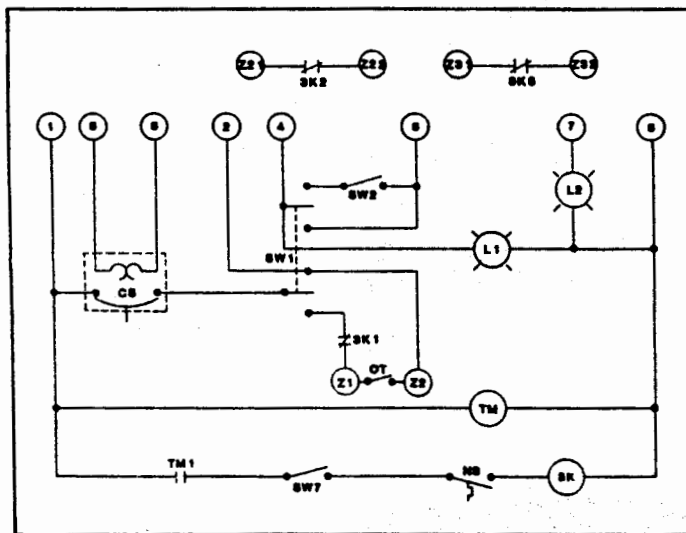
Circuit shown with manual lever in ON position



Manual lever in the OFF position.

TIME CLOCK FUNCTION

With the manual lever in the "ON" position, the timer contact for load 2 is open and the automatic heater control circuit functions normally thru the operation of the operating thermostat (OT). (The 3K relay is not energized and therefore the normally closed 3K1, 2, and 3 contacts are closed.) When the "OFF" tripper passes by the manual level, it throws the lever to the "OFF" position which closes the timer contact for load 2. Provided the override switch (SW7) is closed, the 3K relay is energized and the normally closed 3K1, 2, and 3 contacts open. With the 3K1, 2, and 3 contacts open, the automatic heater control circuit cannot operate.

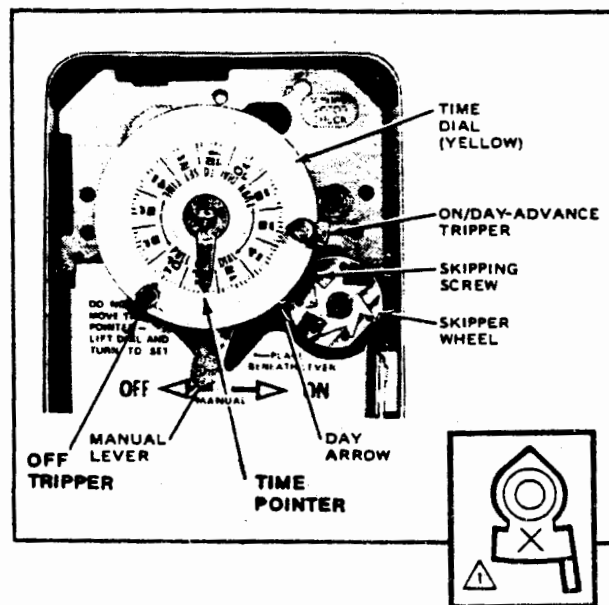


NSB THERMOSTAT FUNCTION

The night setback thermostat opens when the temperature drops below its setting which de-energizes the 3K relay and re-makes the normally closed 3K1, 2, and 3 contacts in the automatic heater control circuit. (NOTE: The night setback thermostat is a refrigeration stat that makes on temperature rise and opens on temperature fall.)

SETTING THE TRIPPERS

- a. Loosen the screw on the silver tripper labeled with "X".
- b. Move the "X" tripper around the edge of the time dial until it points to the time (AM or PM) you desire the manual lever to turn ON. (When the manual lever is turned ON, the timer contact for load 2 is open which permits normal operation of the heater in conjunction with the day stat.)
- c. Hold the tripper firmly against the edge of the dial and tighten the screw securely.
- d. Repeat Steps 1 through 3 for the OFF tripper (Black) setting the time you desire to switch the system OFF. (When the manual lever is turned OFF, the timer contact for load 2 is closed which permits the night thermostat to control the heater operation thru the 3K relay.)



SETTING THE SKIP-A-DAY FEATURE

- a. Manual lever should be in the OFF position.
- b. Insert a skipping screw (or screws) in the skipper wheel for the day (or days) on which system is to remain off. Tighten the screw(s) firmly.
- c. Rotate the skipper wheel until the day arrow points to the correct day of week. (If the "X" tripper has not yet advanced the skipper wheel, the day arrow should point to the previous day.)

**NIGHT SETBACK SYSTEM
(OPERATOR INSTRUCTIONS)**

-WARNING-

DO NOT MOVE THE TIME POINTER. To set time, pull time dial outward and rotate in either direction until time pointer aligns with correct time of day.

-NOTE-

In the event of power failure, time dial will have to be reset with correct time of day.

AUTOMATIC OPERATION INSTRUCTIONS

- a. Place setback switch on front panel in "ON" position.
- b. Place blower switch in "AUTO" position.
- c. Place burner switch in "ON" position.

MANUAL OPERATION INSTRUCTIONS

Place lever on time clock to desired position. The manual lever can override the automatic operation of the time switch for the duration of one cycle only.

OPERATOR INSTRUCTIONS

POWER ON.

- A) CONTROL TRANSFORMER ENERGIZED.
- B) OPERATOR MUST SELECT MANUAL (ON) OR AUTOMATIC (AUTO) MODE.

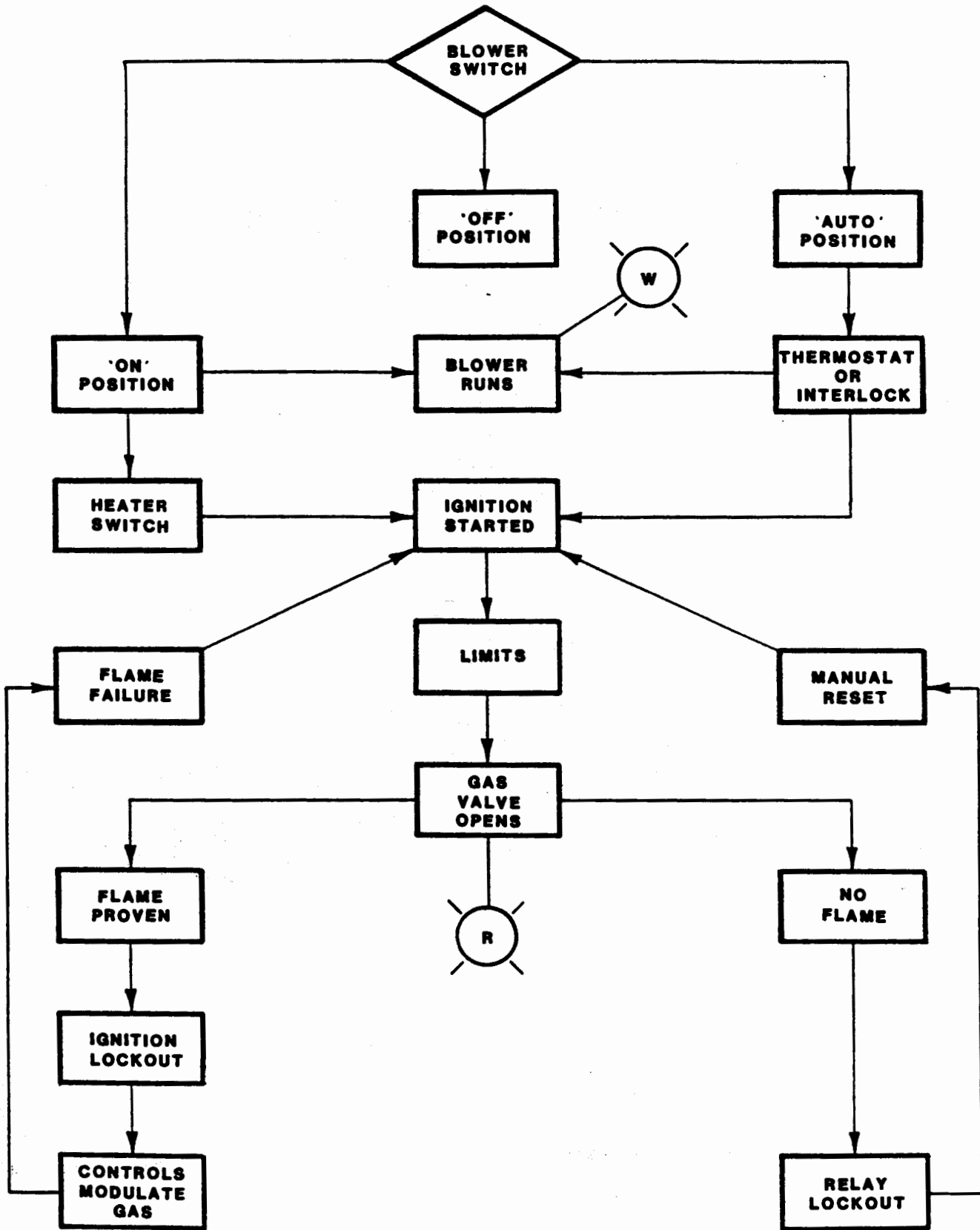
MANUAL "OPERATOR" CONTROLLED MODE

- A) BLOWER SWITCH TO "ON" POSITION.
- B) BLOWER MOTOR STARTS.
- C) AIR FLOW SWITCH CLOSES.
- D) HEAT SWITCH TO "ON" POSITION.
- E) GAS VALVE OPENS.
- F) IGNITION STARTED.
- G) BURNER LIGHTS.
- H) IGNITION STOPPED.
- I) UNIT CONTINUES TO RUN UNTIL MANUALLY TURNED OFF.

AUTOMATIC "OPERATING THERMOSTAT" CONTROLLED MODE

- A) BLOWER SWITCH "AUTO" POSITION HEAT SWITCH "INOPERABLE". (NON-APPLICABLE TO KITCHEN VENTILATION SYSTEMS.)
- B) POWER TO OPERATING STAT OR INTERLOCK (NOTHING OCCURS UNTIL THIS CONTROL CALLS FOR HEAT).
- C) BLOWER MOTOR STARTS.
- D) AIR FLOW SWITCH CLOSES.
- E) GAS VALVE OPENS.
- F) IGNITION STARTED.
- G) BURNER LIGHTS.
- H) IGNITION STOPPED.
- I) UNIT RUNS UNTIL OPERATING STAT OR INTERLOCK OPENS (UNIT SHUTS OFF).
- J) STEPS B THRU I REPEAT THEMSELVES AUTOMATICALLY AS NECESSARY.

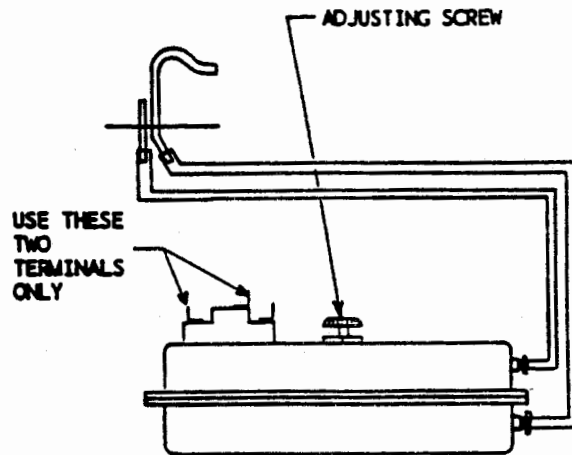
CONTROL SEQUENCE



INDIVIDUAL COMPONENT FUNCTIONS

HI-TEMPERATURE LIMIT - On AGA, FM and IRI units this opens when discharge air temperature exceeds 150°F. Burner shuts off and may shut off blower. Manual reset is required. On non-AGA, non-FM, and non-IRI, the high limit opens when the discharge temperature exceeds 185°F and automatically resets when cooled.

AIR FLOW SWITCH - Closes when blower is on, forcing air through pitot tube. Will not allow SOV to open unless airflow is detected.



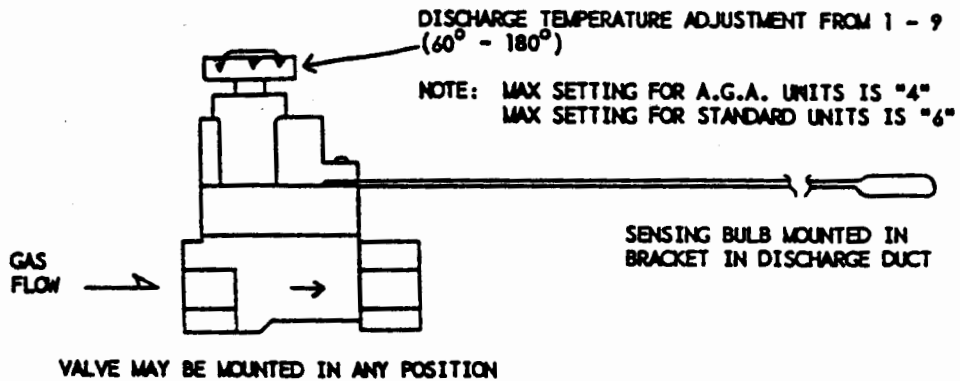
TRANSFORMER - Supplies low voltage (120V) for control circuit.

FIRESTAT

- Safety device intended to shut down unit should air flow switch fail to shut off burner when blower stops. Manual reset required.

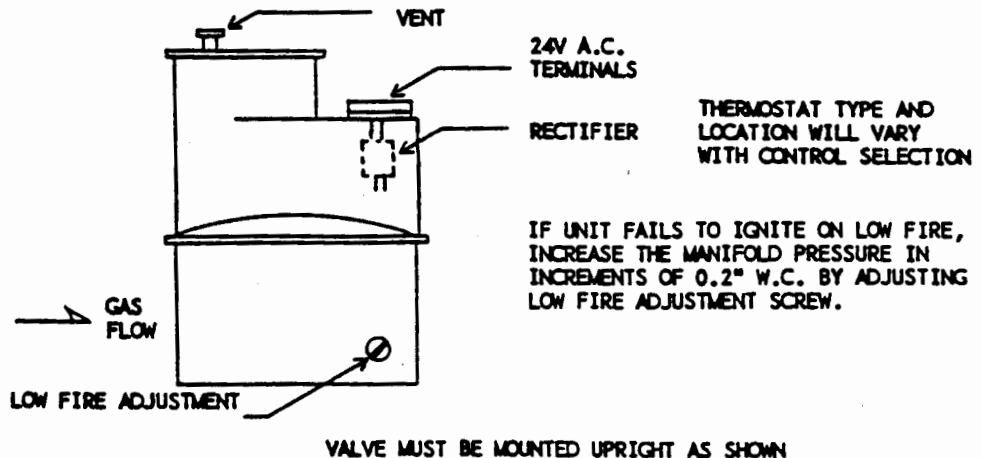
MD TEMPERATURE CONTROL VALVE

- Mechanical proportioning valve used to maintain constant discharge temperature. Sensing bulb is mounted in discharge airstream.



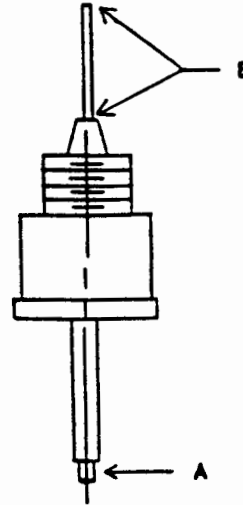
MV TEMPERATURE CONTROL VALVE

- An electronically controlled modulating gas valve. The electronic controls consist of a discharge thermostat that senses the discharge air temperature and a space thermostat that can override the discharge thermostat should ambient air temperature fall below desired space temperature set point.



FLAME ROD

- Senses flame and signals FSR to stop ignition. Also senses loss of flame.

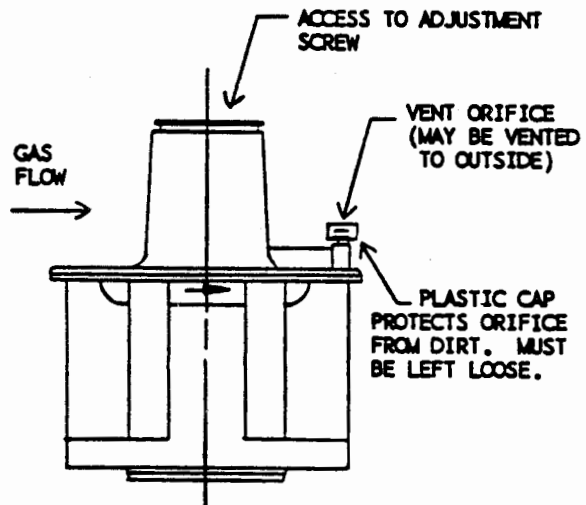


NOTES:

1. CHECK WIRE AT TERMINAL "A" FOR TIGHT CONNECTION.
2. CHECK FOR CONTINUITY FROM ALL OF PORTION B TO TERMINAL A. IF POOR OR NO READING. REPLACE FLAME ROD.

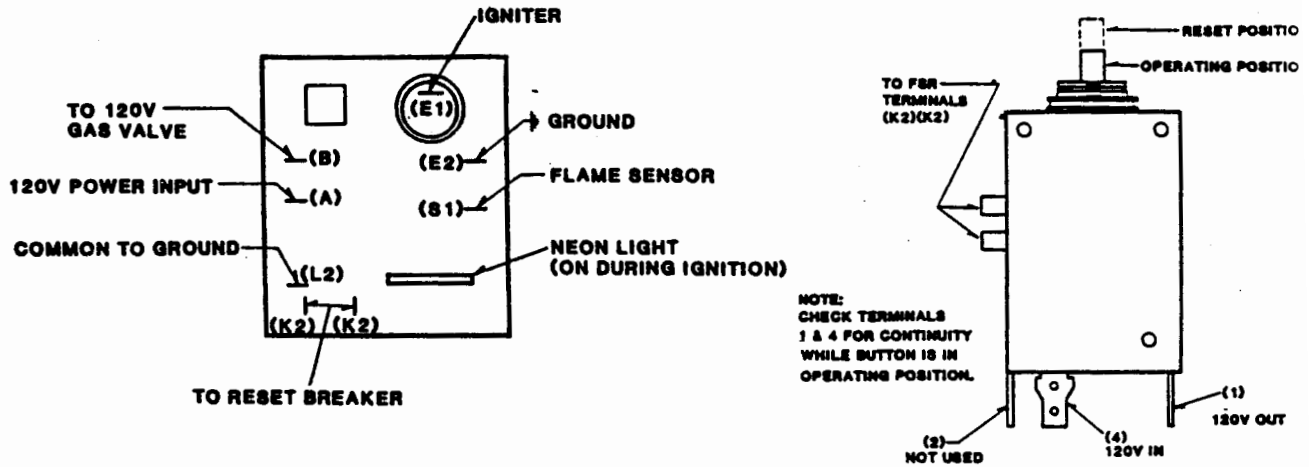
PRESSURE REGULATOR

- Adjusted to hold constant and correct burner manifold pressure.



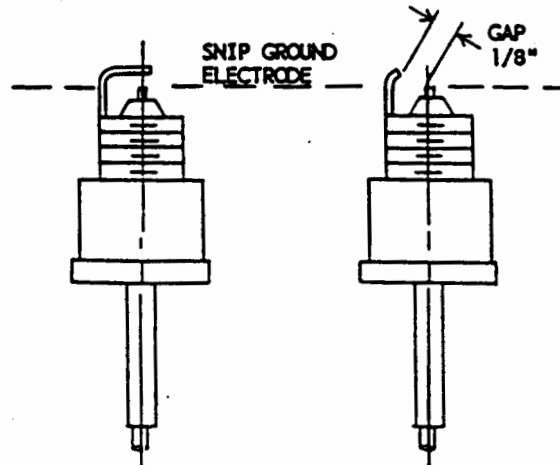
VALVE MUST BE MOUNTED UPRIGHT AS SHOWN.

FLAME SAFEGUARD RELAY - Applies control voltage to gas shut off valve. Supplies ignition voltage to igniter. Senses absence of and/or presence of flame through flame rod. Should loss of flame occur, FSR will attempt re-ignition. Circuit breaker will open if flame is not detected.



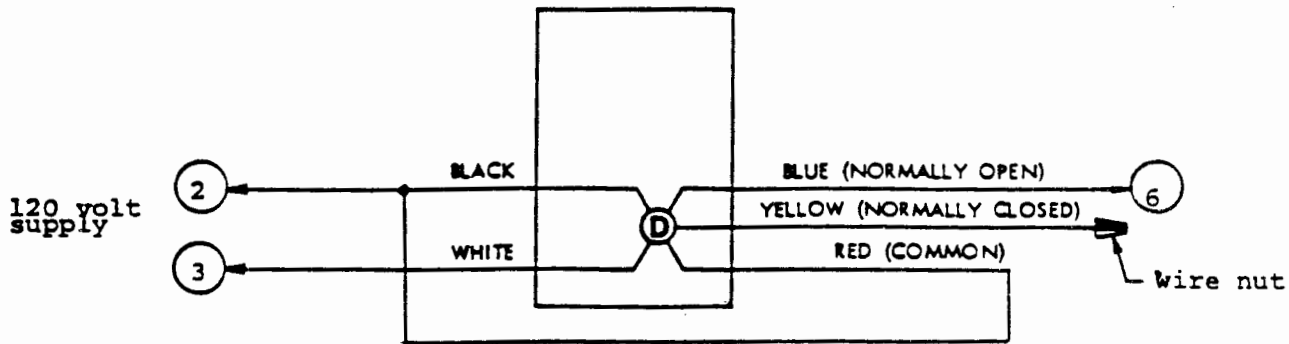
IGNITER

- Provides spark to ignite gas in burner. (Plug is factory snipped.)



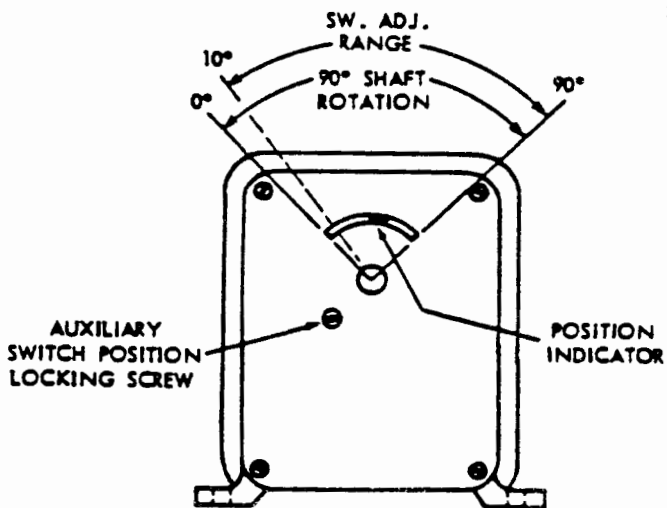
NOTE: GAP IGNITER AT 1/8" FOR FENVAL 05-14 SERIES IGNITION SYSTEMS

DAMPER MOTOR WIRING



Terminals 2, 3 & 6 are located in control enclosure.

AUXILIARY SWITCH ADJUSTMENT



The internal SPDT auxiliary switch can be adjusted to operate between 10 and 90 degrees shaft rotation. The switch will close the R-B circuits (N.O. contacts) during the power stroke (shaft rotating counterclockwise, viewed from flange end).

To adjust switch proceed as follows:

- Loosen locking screw.
- Adjust position indicator to approximate midpoint of slot, tighten locking screw.
- Apply power to motor
- Note system function when switch operates.
- If motor has not rotated far enough when switch operates move indicator clockwise.
- If motor has rotated too far, move indicator counter-clockwise.
- Repeat power stroke and note system function.
- Re-adjust as necessary
- Tighten locking screw.

TROUBLESHOOTING GUIDE

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|-----------|---|---|
| NO BLOWER | 1. Flame Safeguard Relay Reset Breaker. | |
| | A) Breaker in reset. B) Defective breaker. | A) Depress reset button. B) Replace breaker. |
| | 2. Blower Switch. | |
| | A) Switch in improper position. B) Defective switch. | A) Turn switch on. B) Replace switch. |
| | 3. Belts and Drives. | |
| | A) Broken or loose belt. B) Broken or slipping pulley. | A) Replace or tighten belt. B) Tighten or replace pulley. |
| | 4. Control Transformer. | |
| | A) No input voltage. B) Blown control fuse. C) Defective transformer. | A) Check disconnect and supply fusing. B) Replace control fuse. C) Replace transformer. |
| | 5. Motor Contactor. | |
| | A) Defective contactor. B) No switching action. | A) Replace contactor. B) Replace or repair contactor. |
| | 6. Motor. | |
| | A) Improper wiring. B) Defective motor. C) No input voltage. | A) Repair wiring. B) Replace motor. C) Check fusing. |
| | 7. Blower. | |
| | A) Bad or locked bearings. B) Check for physical damage. | A) Replace bearings. B) Replace or repair blower. |
| | 8. Motor Protection. | |
| | A) Overload relay tripped. B) Overload relay defective. C) Improper overload heater elements. | A) Check motor amps. B) Replace. C) Check heater selection with motor amps & volts. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|--|
| BLOWER RUNS; NO HEAT; DOESN'T RESET | 1. Burner Switch. | |
| | A) Switch in wrong position. | A) Turn on switch. B) Replace switch. |
| | 2. Hi-Temp Limit. | |
| | A) May require manual reset. | A) Push reset button. |
| | B) Open contacts in limit. | B) Repair or replace limit. |
| | 3. Flame Safeguard Relay. | |
| | A) No input voltage. | A) Check and repair wiring. |
| | B) Faulty relay. | B) Replace relay. |
| | 4. Reset Breaker. | |
| | A) Faulty breaker. | A) Replace breaker. |
| | B) Missing breaker. | B) Install breaker. |
| | BLOWER RUNS; NO HEAT; UNIT RESETS | 1. Igniter. |
| A) Cracked porcelain. | | A) Replace igniter. |
| B) No spark. | | B) Check gap and burner compartment for good ground. |
| C) Bad Lead. | | C) Replace lead. |
| 2. Gas Valve. | | |
| A) No input voltage. | | A) Check wiring and flame safeguard relay. |
| B) Faulty solenoid. | | B) Replace solenoid coil. |
| C) Locked up gas valve. | | C) Inlet pressure too high. May require high pressure regulator. |
| 3. Regulator. | | |
| A) Clogged vent orifice. | | A) Clean or replace orifice. |
| B) No supply pressure. | | B) Check all gas cocks and piping. |
| C) Defective regulator. | | C) Replace regulator. |
| D) Improper manifold pressure. | | D) Adjust regulator. |
| 4. Air Flow Switch. | | |
| A) Clogged pitot tube or tubing. | | A) Clean or replace tube and tubing. |
| B) No switching action. | | B) Adjust sensitivity of switch. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|--|--|--|
| BLOWER RUNS; NO HEAT; UNIT RESETS (CONT'D) | 5. Low Air Flow. | |
| | A) Blocked intake or discharge. | A) Find and remove blockage. |
| | B) Blower rotation. | B) Reverse motor direction. |
| | 6. Firestat. | |
| | A) Manual reset required. | A) Determine reason for reset. |
| | B) Defective firestat. | B) Replace firestat. |
| BLOWER RUNS; UNIT HEATS; UNIT RESETS | 1. Flame Rod. | |
| | A) Faulty flame rod or lead. | A) Replace flame rod or lead. |
| | B) Flame rod not located in flame. | B) Adjust burner flame to nameplate specification. |
| | 2. Flame Safeguard Relay. | |
| | A) Faulty relay. | A) Replace relay. |
| | B) Improper air flow across burner. | B) Adjust air flow. |
| BLOWER RUNS; UNIT HEATS; SHORT CYCLE WITHOUT RE- SETTING | C) Defective burner. | C) Replace burner. |
| | 1. High Limit. | |
| | A) Defective limit. | A) Replace limit. |
| | 2. Temperature Controller. | |
| | A) No modulation; discharge is too hot and unit is cycling on limit. | A) Adjust or replace controller. |
| | B) Faulty supply pressure. | B) Adjust regulator. |
| | 3. Air Flow Switch. | |
| | A) Improper adjustment. | A) Adjust switch. |
| | B) Defective switch. | B) Replace switch. |
| | C) Clogged or dirty pitot tube or tubing. | C) Clean or replace pitot tube and tubing. |
| 4. Faulty Safeguard relay. | | |
| A) Faulty relay. | A) Replace relay. | |
| BLOWER RUNS; UNIT HEATS; INADEQUATE HEAT OUTPUT | 1. Regulator Adjustment. | |
| | A) Wrong size spring. | A) Replace spring. |
| | B) Regulator not adjusted. | B) Adjust regulator |
| | C) Clogged vent orifice. | C) Clean or replace vent on regulator. |

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|--|--|--|
| BLOWER RUNS; UNIT HEATS; INADEQUATE HEAT OUTPUT (CONT'D) | 2. Temperature Controller Adjustment. | A) Mount bulb in holder provided. B) Adjust temperature controller. C) Replace controller. |
| | A) Control Bulb in wrong location. | |
| | B) Controller setting is too low. | |
| | C) Defective controller. | |
| | 3. Inadequate Gas Supply. | A) Adjust regulator. B) Check flow capacity on regulator; replace as needed. |
| | A) Regulator adjustment. B) Improper regulator. | |
| | C) Pipe too small. | C) Check flow capacity of pipe; replace as needed. |
| | D) Supply pressure too low. | D) Call utility company. |

MAINTENANCE INSTRUCTIONS

1. Motor bearings should be lubricated at one year intervals. Use Shell Dolium R, medium consistency, Polyurea lubricant. Blower bearings are permanently lubricated.
2. Drive belts should be adjusted after an initial run-in period. Adjustment should result in a belt deflection of 3/8 to 1/2" with a 6 to 7 lb. force applied inwardly at the center of the belt span.
3. Blower wheel should be examined periodically for accumulation of dust on the concave side of the blades. These surfaces must be kept clean, as any dirt loading will result in greatly reduced air flows.
4. Annual check should be made of burner and components. Check burner plates for carbon build-up and clean, if necessary. Clean igniter and flame rod and examine porcelain for cracks. Refer to burner cleaning procedures below.
5. Periodically check gas control assembly, internal and external piping for leaks. Relief vents on gas controls should be checked for clogging.
6. An annual check of the pitot tube for the air flow switch should be made to insure against stoppage.

BURNER CLEANING PROCEDURE

The Cambridge Engineering burner is for the most part self-cleaning; however, if the application is extremely dirty or dusty, it may become necessary to periodically clean the burner. Remove and clean the burner in accordance with the following recommended procedures:

- 1) Shut off electrical disconnect to unit. Shut off the gas cock that supplies gas to the unit.
- 2) Loosen unions in the gas train and relocate gas train assembly out of way for burner removal.
- 3) Disconnect ignition cable and flame sensor lead from burner and then remove flame rod and ignition plug.
- 4) Remove fasteners that secure burner to housing. Burner will be free to lift out with the removal of the last fastener.

- 5) Clean burner by back-flushing the burner using high pressure air (40-80#). Be sure to take necessary safety precautions such as wearing eye protection, etc., before attempting this step. Continue back-flushing until dust particles are completely expelled from burner.
- 6) Reassemble burner, using above steps in reverse order.

LIMITED WARRANTY AND LIABILITY COMMERCIAL AND INDUSTRIAL PRODUCTS

The Company warrants its manufactured commercial and industrial products to be free from defects in material and workmanship for a period of twelve (12) months from date of installation, or fifteen (15) months from date of shipment whichever occurs first. The Company shall be notified in writing that the product has been installed by qualified personnel; that it has been started and adjusted, and that it is operating under normal conditions in accordance with design documents, Company's instructions and all governing codes and regulations. THIS WARRANTY IS VALID ONLY IF SAID WRITTEN NOTICE OF INSTALLATION IS FILED WITH THE COMPANY WITHIN THIRTY DAYS AFTER INSTALLATION OF THE PRODUCT. MISUSE OR MISAPPLICATION OF THE PRODUCT, MODIFICATIONS TO THE PRODUCT FROM ITS ORIGINAL DESIGN OR SPECIFICATIONS, OR CHANGES IN ORIGINAL SPECIFICATIONS OR OPERATING CONDITIONS (WITHOUT WRITTEN PERMISSION FROM THE COMPANY) SHALL VOID THIS WARRANTY. The manufacturer's obligation, under the terms of this warranty, shall be limited to the repair or, at the Company's option, replacement of parts returned to Company's factory and found by the Company to be defective. Replacement parts are shipped F.O.B. Company's factory with all freight costs paid by customer. Replacement parts provided shall not extend the warranty period for said part or for the total unit. No liability whatever shall attach to the Company under this warranty unless and until said products have been paid for in full, and then Company's liability shall be limited to the purchase price of the products found to be defective. The warranty period shall begin as described above, whether or not payment has been made.

This warranty does not apply to field labor charges for parts removal and replacement, service, adjustments, repairs or other work; nor does it apply to corrosion or water caused deterioration, wear and tear, misuse or misapplication or field modifications, components supplied by others, defects in parts resulting from negligence, neglect, accident, fire, explosion, voltage instability or fluctuation, inadequate electrical service or interruption of electrical service, jumping or jamming of control components and circuitry, operation beyond factory rated capacity, belt replacement, filters, light bulbs, or other components subject to normal wear. This warranty does not apply to products which are damaged in transit or which have not been installed, operated and serviced according to Company's instructions and specifications; nor to products damaged by persons other than Company agents or representatives. The Company neither assumes, nor authorizes any other person to assume for it, any obligation or warranty other than those stated herein. This warranty applies only to Company's manufactured commercial and industrial products and does not apply to consumer products used for personal, family or household purposes. The Company makes no warranty whatever with respect to motors, switches and controls in as much as they are warranted separately by their manufacturers.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IS MADE IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTIES OF MERCHANTABILITY OR WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. COMPANY'S LIABILITY SHALL BE LIMITED TO THE TERMS OF THIS WRITTEN WARRANTY WHICH IS THE ONLY WARRANTY MADE BY IT AND THE COMPANY SHALL NOT, IN ANY EVENT, BE LIABLE FOR INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES OF ANY KIND WHATSOEVER. THE BUYER'S REMEDIES SHALL BE LIMITED TO THOSE PROVIDED HEREIN.

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