

## Installation and Service Instructions

# DIRECT GAS FIRED, ELECTRIC, STEAM AND HOT WATER



### NOTICE

**Read These Instructions before installation**

Project Name: \_\_\_\_\_

Phone No.: \_\_\_\_\_

Location: \_\_\_\_\_

Installer: \_\_\_\_\_

Phone No.: \_\_\_\_\_

Date Installed: \_\_\_\_\_

**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.**

**WARNING: Improper installation, adjustment, alteration, service or maintenance can cause property damage, injury or death. Read the installation, operating and maintenance instructions thoroughly before installing or servicing this equipment.**

**FOR YOUR SAFETY**

**The use and storage of gasoline or other flammable vapors and liquids in open containers in the vicinity of this appliance is hazardous.**

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# SECTION 1 – General Information

## A. INSTALLATION AND SERVICE INSTRUCTIONS

The purpose of the following instruction is to present a guide for proper installation and operation of said equipment and to act as a supplement to the services of a qualified field service engineer at initial start-up of a Hastings piece of equipment. We recommend that this manual be readily available to operating personnel for reference as an aid for trouble diagnosis and proper maintenance.

Information for installation of the heater: (1) in airplane hangars in accordance with the Standard for *Aircraft Hangers, ANSI/NFPA 409*, and (2) public garages in accordance with the standard for *Parking Structures, ANSI/NFPA 88A*, or the Standard for *Repair Garages, ANSI/NFPA 88B*, and with *CAN/CGA B149 Installation Codes*.

The installation shall conform with local codes, or in the absence of local codes, in accordance with the *National Fuel Gas Code, ANSI Z223.1*, or the *CAN/CGA B149 Installation Codes*.

Instructions require that if the failure or malfunction of this heater creates a hazard to other fuel burning equipment in the building, (e.g. when the heater is providing the make-up air to a boiler room), the unit is to be interlocked to open inlet air dampers or other such devices.

Authorities having jurisdiction should be consulted before installations are made. Local codes may require additional safety controls and/or interlocks.

## B. IMPORTANT NOTICE TO EQUIPMENT USERS

Models SBD-112 through SBD-218, EBD-112 through EBD-128 and LU-112 through LU-218 are shipped with burner section and blower section assembled. Intake hood and birdscreen, filter section, intake or discharge damper sections, or other large accessories are assembled, but shipped as individual items.

Models SBD-222 through SBD-240 are shipped as separate sections.

SBE, SBD, SBS, SBW, and vertical units are shipped in the same manner as explained above.

All options and accessories are shipped mounted and wired whenever possible – within the limitations of shipping and handling. Any accessories which include wiring that are shipped separate (i.e., intake or discharge dampers) require no additional conduit or wiring in the field. All wire leads will be tagged for reconnection in the field.

The SB unit is designed to simplify field installation. All parts have been designed in module form to facilitate field installation of parts and accessories. The purpose of this manual is to supplement, **but not to replace** the services of qualified field service personnel to supervise the initial start-up and adjustment of the SB unit. Persons without previous experience with large commercial and industrial make-up air equipment should not attempt the initial adjustment and check-out procedure essential before such installations may be considered as ready for operation.

## C. EQUIPMENT SERVICING AND SHIPPING INFORMATION

### 1. Periodic Service

Periodic service on any piece of mechanical equipment is necessary for efficient operation. Hastings has a nationwide service organization available to make quick and dependable servicing of make-up air, return air, heating, ventilation, or air handling type equipment.

Representatives of this service organization are trained at the factory by qualified engineering and service personnel. In addition, the company has trained service engineers who are always available for consultation on any service problems in the field.

### 2. Factory Start-Up Service

This service includes the presence of a factory service engineer to perform the initial start-up and adjustment of the equipment, instruction of the owner's maintenance personnel in proper operation and maintenance, and return calls for any adjustments required to a particular unit (excluding any parts failures) within a period of ninety (90) days after start-up is complete. Customer's loss of power, fuel, or misuse will not constitute need for any return calls.

3. **Factory Operations Test**  
All air handling, heating/ventilating, and make-up air units are given a complete operations test and control circuit check-out before final shipment. A copy of the flame test report and bill of material with testers certifications stamp is included with each unit shipped.
4. **Inspection of Shipment Upon Arrival**  
Shipments are made F.O.B. Hastings, Nebraska, by truck. The unit is securely strapped, tied, and blocked to prevent shipping damage. All shipments are checked by an inspector before they are accepted by the carrier. Parts that are shipped unmounted are noted on the bill of materials. These parts, where feasible, are packaged and shipped with the units. Upon receipt of shipment, all units should be checked against the bill of lading to insure all items have been received. The units should be checked carefully for physical damage in the presence of the carrier's representative. If parts are missing or damage has occurred, a claim should be filed immediately with the carrier. Widely varying conditions under which the units are transported to the jobsite, unloaded, and installed make it impossible for Hastings to assume responsibility for handling of equipment in transit.

## **D. SPECIFICATIONS**

1. **General**  
Units are of the horizontal type with choice of HR-1, HR-2, and HR-3 blower discharge arrangements. Vertical units and units with a variety of blower discharge arrangements are available on request.
2. **Cabinet**  
All cabinet parts are made from coated steels. All outside surfaces are primed and finish coated. Lifting lugs are provided for ease in handling – see Figure No. 1 and Figure No. 2
3. **Blower(s)**  
There are one or two centrifugal DWDI forward curved fan(s) (SB-240 provided with 2 backward incline fans) with a one piece solid shaft or self-aligning prelubricated ball bearings on each unit. Blower wheel(s) are statically and dynamically balanced. Adjustable drives are standard on all units through 10 HP. An open drip-proof ball bearing squirrel cage induction T-frame motor is provided as standard for all voltages.
4. **Gas Burner**  
The burner is a direct fired non-premix design with cast iron manifold and stainless steel mixing plates. A spark ignited intermittent pilot for natural or propane gas at inlet pressure from 6 ounces through 1 pound is standard. The burner is capable of a 22:1 turndown ratio. Maximum temperature rise is 119°F.
5. **Gas and electric Controls**  
The following are furnished as standard components on all direct gas fired units: NEMA 1 control box, remote control station with switches and indicating lights, electronic flame safeguard system with ignition transformer, pilot controls, and electric safety shut-off valve, main gas hand shut-off valve, main and pilot gas pressure regulators, motor starter, control transformer, high temperature limit switch, air flow switch, automatic mild weather burner cut-out, and a modulating gas control system.
6. **Low-temperature control system**  
If the low-temperature control system is not an integral part of the heater, then it is recommended that a low-temperature limit control be installed in areas where freeze-up protection is needed in the event of burner shut-down.
7. **Electric Heating**  
The following are furnished as standard components on all SBE electric heating units: the heating section is UL listed with open type electric heating elements, control panel, circuit fuses, step controller and transformer with primary and secondary fusing, automatic reset thermal cut-out, heat limiter type secondary safety protection, de-energizing contactors, and connecting block(s) for wiring of power supply. All fusing per NEC and UL. Control transformer and disconnecting means are optional.
8. **Steam or Hot Water Heating**  
The following is standard on all SBS and SBW units: coil section for indicated pressure or water temperature. Heating units shall have standard type coil. Heating/ventilating and make-up air units shall have steam distributing type coil(s). Steam or hot water valves, linkage, and valve motors are shipped for field mounting and wiring.
9. **Control System**  
The standard control system permits the unit to operate for make-up air heating or heating and ventilating purposes or run the blower(s) only for summer ventilation. Refer to the detailed sequence of operation included with this manual for exact unit operation.

# SECTION 2

## E. INSTALLATION PROCEDURE

The following recommendations are not intended to supplant any requirements of federal, state, or local codes having jurisdiction. This equipment shall be installed and wired in accordance with regulations of the National board of Fire Underwriters, National Electric Code, and local governing bodies. In Canada, equipment should be installed in accordance with the applicable provincial regulations.

### 1. Handling the Equipment

The units have been designed for rigging and handling through the units channel base frame and/or special lifting lug hooks installed on the unit. All lifting operations must be accomplished with a load spreader of sufficient width to insure that the lifting cables clear the side of the unit. If this type of spreader is not available, wood strips should be inserted between the cables and unit where necessary. See Figure No. 1 and No. 2 in this manual.

Units are suspended from same lifting lugs as used for handling. See Figure No. 3 and Figure No. 4

To be properly set, the unit should be placed on a solid flat and level foundation and set exactly as detailed later in the installation guide.

During the transit, unloading, and setting of the unit, bolts and nuts may have become loosened, particularly in the pillow block ball bearing assemblies on blower section. It is recommended that all nuts and set screws be tightened. Turn blower fan shaft by hand to make certain that no rubbing occurs and to check that bearing lock rings are tight.

Open the cover on the electrical control box located at the top on the side of the burner section (blower section if air handling unit only). Box can be opened by turning main fused disconnect switch to the "off" position (disconnect is optional on air handling equipment). Inspect all wire terminals and wiring terminations to ensure connections are tight. If unit is supplied with an electric heating section, check the separate electrical terminal box for any loose connections.

### 2. Locating the Unit

Prior to locating the unit, authorities having jurisdiction should be consulted before installations are made. Approval permits should be checked against the unit received.

Locate the unit exactly level, making certain there is enough clearance for opening and removing access doors. Special attention should be given to supply (if required) and discharge duct connections. Electrical power and control hook-up points and steam or hot water supply and return lines (if required) should also be noted. This information should be cross-checked with the position of support beams and stand pipes to insure that support structure dimensions coincide with those of the unit. Under structure beam spacing should also be checked to preclude any interference with air ducts. Allow adequate clearance on both sides of unit for access to bearings, motor, and all internal components. The heater inlet shall be located in accordance with the applicable building code provisions for ventilation air.

Provide the following clearances:

Control Side - 48" (from unit mounted Main Control Panel)

Opposite Control Side - 12"

Top - 12"

Bottom - 12" (from combustibles)

Front - 36"

Rear - 36"

If main disconnect switch is shipped unmounted or provided by installer, a minimum clearance of 48" is required and must be within sight of the unit.

### 3. Location of Accessories

The remote control panel will be located in the burner or electric section of the unit and must be removed and installed by the electrical contractor. Remote control panels for air handling units will be located in the blower section for shipment. See remote control panel details in this bulletin. Field constructed intake accessories should be properly designed to minimize the entry of snow and rain. Instructions should be given that adequate building relief must be provided so as to not over pressurize the building when the heating system is operating at its rated capacity. It should be noted that this can be accomplished by taking into account, through standard engineering methods, the structure's designed infiltration rate; by providing properly sized relief openings; or by interlocking a powered exhaust system; or by a combination of these methods.

### 4. Electrical Connections

a. All wiring must comply with all applicable local, state, provincial, and national electric codes. Prior to running power to the unit, visually inspect all nameplates, control voltage wiring, control transformer, and main fused disconnect switch on the unit – cross check with bill of material to insure that the voltage option on the order is the voltage option received.

If optional motorized dampers are used, connect electrical wires supplied (in factory furnished conduit) with unit to damper motor as shown on electrical wiring diagram. Adjust linkage so that damper will close when blower switch in remote control panel is in "off" position. For Series 14 or Series 44 selectra modulation with temperature selector dial, which is shipped unmounted or mounted on remote panel, the wiring for the dial must be shielded cable or ran in separate conduit. Complete all wiring to any optional accessories as shown on unit bill of material and electrical wiring diagram as required before applying voltage to the unit.

- b. The total amperage of the main fused disconnect switch, blower motor, and control circuit transformer fusing is affected by the addition of 25% to the full load amps as required by the National Electric Code. Check the supply voltage before energizing the unit. The maximum voltage variations should not exceed  $\pm 10\%$ . Phase voltage unbalance must not exceed 2%. Use proper wire sizing practices when running wires for the remote control panel. If the automatic gas ignition control system is exterior to the heater, the heater shall be installed such that the gas ignition control system is not directly exposed to water spray, rain or dripping water. Identify the entry location(s) for field-installed wiring and control wiring. Adequate instructions shall be provided for field wiring of equipment, if applicable. An electric disconnect switch having adequate ampacity (see marking on the heater for voltage and ampacity) if not provided as part of the heater, shall be installed in accordance with Article 430 of the *National Electrical Code, ANSINFPA 70*.
- c. If not supplied by the factory, provide a disconnect switch having adequate ampacity (see specification plate on heater for voltage and ampacity) and install in accordance with Article 430 of the National Electrical Code, ANSI/NFPA 70.
- d. Install heater such that the ignition system is not directly exposed to water spray, rain or dripping water.
- e. Refer to markings on heater control box for locations for field installed wiring and control wiring.

## 5. Piping Connections

- a. All gas piping connections are not shown in this manual because of the many manifold arrangements available due to approval codes and types of gas modulation. All gas piping must comply with "Standard of National Board of Fire Underwriters" and all applicable local codes. Contact factory if exact gas piping dimensions are required. Standard pipe caps are furnished on manifold for shipment from factory. Run correctly sized gas line to unit. Install manual shut-off valve and regulator if not already installed. Note: gas line pressure must be as shown on specification plate when unit is operating at full input. Vent pressure regulator(s) and vent valve, if included with unit, to outside of building. With vent pipe outside, install a proper vent cap and/or screen to prevent entrance of foreign material and plugging. The heater and its individual shutoff valve must be disconnected from the gas supply piping system during any pressure testing of that system at test pressures in excess of 1/2 psi (3.5 kPa.) The heater must be isolated from the gas supply piping system by closing its individual manual shutoff valve during any pressure testing of the gas supply piping system at test pressures equal to or less than 1/2 psi (3.5 kPa.).
- b. If steam, hot water, or chilled water coils are used, all piping connections must be made according to accepted trade practices or the general arrangement drawings furnished with the unit. Because of the many variations of supply and drain connections required, it is not possible to include all piping connections in this manual. Piping must comply with "Standards of National Board of Fire Underwriters" and all applicable local codes. Standard pipe caps are furnished on manifold for shipment from factory.
- c. Pipe couplings for connection of condensate drains on applicable units are furnished. Standard pipe caps are furnished for shipment from factory. A trap must be installed in the drain line to minimize the loss of conditioned air.
- d. Refer to heater rating plate for determining the minimum gas supply pressure for obtaining the maximum gas capacity for which this heater is specified.

## 6. Duct Connection(s)

- a. Indoor Units – See Figures No. 3 and No. 4.
  - 1. Lifting lugs serve as suspension points on all indoor type units – see Figures No. 5 and 6.
  - 2. Make required opening in wall and line with an angle frame. Inside should be completed before outside is started to avoid any crumbling of penetrated wall. – see Figure No. 7.
  - 3. Insert insulated fresh air collar through the opening with flanges turned out to provide rigidity.
  - 4. Anchor intake hood with birdscreen to outside of wall.
  - 5. Caulk perimeter of opening to make connection water tight.

6. Units with a VUR-1 or HR-3 vertical – upblast discharge arrangement must have discharge ductwork supported from building support members and not supported from the equipment. **NO DISCHARGE DUCTWORK IS TO BE SUPPORTED BY EQUIPMENT DISCHARGE OPENING CONNECTIONS.**

NOTE: On indoor units, intake hood and birdscreen and any appropriate ductwork must be full size of unit opening.

b. Outdoor Units – See Figures No. 1 and No. 2.

1. Prior to assembly of unit sections or accessories, caulking must be applied to the flat surfaces where the pre-punched fastener holes are located (See Figures No. 1, 2, and 10) on each section. Caulk perimeter of opening to make connection watertight.
2. Units with a vertical – upblast discharge arrangement must have discharge ductwork supported from building support members and not supported from the equipment. **NO DISCHARGE DUCTWORK IS TO BE SUPPORTED BY EQUIPMENT DISCHARGE OPENING CONNECTIONS.**

Connect discharge air duct or discharge grill to unit outlet. If unit is installed outdoors, be sure that duct opening to building is adequately flashed and sealed to prevent leakage. All air to the heater must be ducted directly from the outdoors. Recirculation of room air is not permitted. Adequate instructions shall be provided to address heater installations where a duct work system is attached to the inlet of the heater to purge the volume of the duct system with at least four air changes prior to an ignition attempt. If in doubt regarding the application, consult the heater manufacturer.

## 7. Remote Control Panel

- a. Standard remote control panel: This panel is furnished with two heavy duty toggle switches and three 115 volt signal lights. The switches control the blower (blower switch) and the burner (season switch). The signal lights indicate supply blower operation (white light marked blower), burner operation (amber light marked heating), and safety lockout (red light marked lockout). See typical remote control panel illustrated in Figure No. 8 in this manual.
- b. Optional remote control panel(s): Same as described above but with the addition of lights and switches depending upon options ordered.

## 8. Remote Control Panel Specifications

Signal Lights: Pilot lights are rectangular neon type for 115 V.A.C. service. Lights are UL approved and have 18 AWG 16/30 standard 105° C plastic wire leads. Bezel is chrome finished.

Switches: On-Off and On-Off-ON switch action with screw terminals. Rated at 15 AMPS at 115 V.A.C. service with 3/4 HP rating at 115 V.A.C.

Lids and Cover: Remote control panel lids are 16 gauge brushed stainless steel. 1/8" high letters are screen painted using Wornoy Duwell Enamel series 10-000 ink. Wiring box dimensions are 8" x 5" x 3-1/2" deep.

Terminal Blocks: Blocks are medium duty 15 AMP screw type. All terminals are numbered according to corresponding wiring diagram.

Wiring: All wiring is 16 AWG 16/30 standard 105° C thermoplastic or equivalent. Wiring is color coded per corresponding wiring diagram.

## 9. Remote Control Panel Installation

- a. Refer to Figure No. 9.
- b. Align box with spirit level.
- c. If box is to be surface mounted, three (3) mounting holes in back of box are recommended. One in each top corner and one at bottom center.
- d. If mounting holes are to be located in side of box as shown, four (4) holes are recommended. Two at top and two at bottom.
- e. If wiring box is to be recessed, install so that open edge of box will be flush with finish wall. Install optional flush mounting wall plate.
- f. Examine wiring box and control panel for clearance before providing conduit hole(s)
- g. All wiring must comply with applicable electric codes.
- h. Control panel is furnished with components wired to coded terminal strip. Installer to connect numbered terminal blocks on remote control panel to corresponding terminal block(s) in master control panel on unit.
- i. The following table should be followed for proper low voltage wiring of remote control panel based on a maximum voltage drop of two (2) volts.



Wire Size	Maximum Wire Length in Feet
16 .....	160
14 .....	245
12 .....	395

- j. See Wiring diagram level referencing shielded cable for remote temperature dial connection.

10. Miscellaneous Installation Guidelines

- a. All sections not shipped attached must be assembled in the field by 1/4 – 20 x 5/8” sheet metal screws provided in the cloth bag with each ship along section. See previous instructions – Important Notice to Equipment Users – or follow general arrangement drawing provided for this unit to determine which items are crated and shipped separately. Figure No. 1 through Figure No. 4 show typical unit assemblies.
- b. For outdoor or weather-proof models, a water-proof caulking is provided to seal all joints between optional sections as they are bolted together. Perimeter caulking on each ship along section must be completed to insure a water tight unit.
- c. If filter section is used, bolt to appropriate section by sheet metal screws provided. Provide caulking as required. Filters and filter spacer(s) (if required) will be shipped installed in filter rack wherever possible. If filters are shipped separately, install filters and filter racks (see filter maintenance for details). Filter spacer(s) will be banded to filter channel where shipping necessitates filters going separately from filter section.
- d. If intake or discharge dampers are used, bolt to appropriate section with sheet metal screws provided. Provide caulking as required. Re-connect conduit and wiring to damper motor(s) as required. Electrical wires for damper motor(s) have been tagged for ease in connecting in the field.
- e. Vertical Unit Installation – see Figure No. 10.

All sections not shipped attached must be assembled in the field with splice channels and 1/2” bolts that are provided. Models SB-112 through SB-218 are shipped with burner section and blower section assembled. LU models are all produced with blower and burner in a common cabinet. Intake hood and birdscreen, filter section, intake or discharge damper sections, or other large accessories are assembled, but shipped as individual items.

Models SB-222 through SB-240 are shipped as separate sections.

All sections are shipped in a horizontal position. SB-112 through SB-218 has top mounting channel and base channel shipped assembled with blower/burner section. SB-222 through SB-240 has top mounting channel shipped as one section, but not physically attached to either blower or burner section – see Figure No. 10.

Unit base assembly is shipped separately for field connection to mounting channels and anchoring to floor. Optional filter and/or inlet damper section(s) mount in base assembly – see Figures No. 11 and 12. All 1/2” bolts and splice plates for unit assembly in the field are included with each unit.

The vertical SB and LU units are designed to simplify field installation. All parts have been designed in module form to facilitate field installation of parts and accessories. The purpose of this manual is to supplement, **but not to replace** the services of qualified field personnel to supervise the initial start-up and adjustment of vertical SB and LU units. Persons without previous experience with large commercial and industrial make-up air equipment should not attempt the initial adjustment and check-out procedure essential before such installations may be considered as ready for operation

**F. PRE-START INSPECTION**

This inspection is extremely important and should be completed with greatest care given to detail. A good pre-start inspection will insure against possible unit damage on start-up and will save valuable analysis time in the event malfunctions occur on start-up and check out.

1. Check to see that all factory installed plastic pipe plugs have been removed from gas valve inlet and any shipped along gas pressure regulators and manual hand valves.
2. Make sure all field wiring and gas piping are in accordance with local and national codes.
3. Again, check supply voltage against unit voltage.
4. If an electric heating section is supplied, check supply voltage against element voltage.
5. Check all electrical connections in the main control panel and remote control panel.
6. Check that all fuses are installed and that fuse sizing agrees with the unit bill of material.
7. If optional steam, hot water, or chilled water coils are supplied, check to see that all piping connections are secure and that face areas of coil(s) have not been damaged or blocked.

8. Check to see if all gas connections are tight and that all joints have been properly lubricated.
9. Check to see if all condensate drain piping has been completed (if required).
10. Insure that all insulation is fastened securely to walls, ceiling, and floor areas.
11. Check blower supply area to insure freedom of shaft rotation and proper belt tension - Remove any shipping blocks and isolation support frame securing bolts (if ordered).
12. Check blower motor to insure that pulleys are secure and drive belts are tight
13. Check filters for cleanliness, and in the case of throw-away filters, make certain that they are free of moisture. (Note: Wet filters will collapse under static pressure and the media will be sucked into the downstream sections of the unit.)
14. If any optional dampers are supplied, make certain that all dampers linkage is free to move and that no binding will occur. If dampers are of the modulating type, check control capillary tubes to insure that the tubes will not rub against any stationary objects.
15. Check all areas for cleanliness.
16. Secure all access doors.
17. Check all canvas connectors (where used) between the unit and any duct work used.
18. Instructions specify that service personnel shall perform a gas leak check during heater start-up, to verify the gas tightness of the heater's components and piping under normal operating conditions.
19. Adequate instructions shall be provided for adjusting the pilot flame.
20. Adequate instructions shall be provided for checking the gas tightness of the safety shut-off valve(s).
21. Check blower shaft/coupler alignment on units with backward incline fans or split fan sets.
22. Follow all list pre-checks prior to start-up as listed on factory start-up information form sent with equipment.

## G. START-UP

All safety and operating controls have been checked during the factory test period, however, it is advisable to complete a similar check when first operating the unit.

1. Remove any shipping blocks from (gas units only):
  - a. High limit switch (if mercury bulb type) mounted on burner cabinet. Remove limit switch cover, remove paper blocking, and tilt mercury bulb to reset.
  - b. Gas pressure switch(es) (if required) may have shipping screws. Remove screws if supplied.
  - c. Unit programming controller may be shipped with a paper shipping block. Remove programmer cover and remove paper shipping block – re-install cover and adjust manual reset.
2. Refer to heater rating plate for determining the minimum gas supply pressure for obtaining the maximum gas capacity for which this heater is specified.
3. Prior to starting the heating sequence of the system, air needs to be purged from gas supply line up to the Hastings equipment. **CAUTION:** The use of soap bubbles or an electronic leak detector is recommended to check for leaks - Do not check for leaks with gas flame torch - Do not check for leaks with gas flame torch - Do not depend on sensing the odor of gas to determine if the air has been purged from the gas line.
4. The unit is equipped with an electronic modulating gas valve which is controlled by a discharge sensor located in the discharge opening. Check to see that the sensor is properly positioned. Set the selector dial for desired discharge temperature - factory set at 70°.
5. If 70° F discharge temperature is not desired, move appropriate discharge selector dial to new position and set inlet air controller to a temperature at least 5° F below this setting. Note: No adjustment required on modulating gas valve. High and low fire positions are factory set for proper operation. In some cases, it may be possible or desirable to reduce the low fire: be sure to keep continuous flame the full length of burner.
6. Check setting of inlet air controller. This is factory set at 65° F to shut down burner when outside temperature rises above 65° F. If unit is to be test run when outside temperature is above 65° F, this setting will have to be raised for burner to operate. After unit has been test run, reset controller at 65° F.
7. Close gas hand valves and pilot cock.
8. Set all switches to "Off" position.

- 9 Wait five minutes.
10. Push reset button on electronic relay.
11. Push manual reset button on gas pressure switches, starters, and limit control if necessary.
12. Check if limit control is locked at 180 deg. F. discharge temperature.
13. Close main disconnect switch to turn power on.
14. Standard units are operated from the toggle switches in the remote control panel. If it is necessary to check blower motor rotation from the unit, jumper the respective electrical terminals at the unit as shown on the electrical wiring diagrams.  
Move blower switch to "on" position. White signal light marked "blower" should indicate that the blower is operating. If blower runs but light does not come on, blower may be running in reverse direction. All applicable safety controls are in series with blower motor starter coil and must be in the electrical circuit for proper unit operation – see appropriate electrical wiring schematic.
15. All three phase motors were properly phased during factory testing. If rotation is reversed, interrupt main power supply and interchange any two of the incoming power leads. Re-establish power and re-check blower operation.
16. On three phase unit, the starter contacts should pull in and hold quietly without "clatter" (relays serve as starters on single phase units). If they do not operate quietly, check immediately for proper line voltage. Even temporary low voltage at start-up will cause constant operating trouble and must be corrected before SB unit is placed in service.
17. If the motor current is excessive, adjust the variable speed pulley (standard through 10 hp) on the motor to lower the amp draw on the motor. **Caution:** Current readings should be taken with the access door in place.
18. Re-check all set screws on motor sheave, blower sheave, and blower wheel(s). Check alignment of belts and pulleys. Lubricate blower bearings prior to start-up per instructions in section Miscellaneous Maintenance -Item 3. Run blower for a few minutes and adjust motor take-up if necessary. Do not over-tighten belts since excessive tension will reduce belt life and cause excessive load on bearings. After initial start has been made, give the belts a few days running time to become seated in pulley grooves – re-adjust take-up bolt(s) as necessary. Run drive at full speed and adjust take-up until only a slight bow appears in the slack side of the belts. **Do not** roll belts over grooves or sheaves, as this results in permanent belt damage.
19. Open hand valve and pilot cock.
20. Move season switch to "winter" position to light pilot – blower must be operating. Amber signal light marked "heating" should indicate that the burner is operating. If pilot does not light, depress reset button on programming relay. If it becomes necessary to adjust pilot flame, check the micro ampere reading. Adjust to obtain a micro ampere reading of 2. Make sure all gas cocks are open and gas pressure switch(es) (if required) are reset for burner operation.
21. Unit is factory pre-set to provide gas pressure as specified on unit spec/data plate mounted on unit for standard burner when firing at full input. Before making any regulator adjustments, be sure there is sufficient inlet pressure.
22. The burner will come on at high fire initially, then gradually modulate down. While the unit is on high fire, check the flame length. It must be approximately 14" - 18" beyond end of burner. Check the manifold pressure - should not exceed operating pressure and noted on unit spec plate. Check temperature rise and/or gas rate. If too high, set at desired rate by reducing high fire setting for "MR" or "M" modulating valve. If no high fire adjustment is available, reset modulating control to design temperature rise plus current outdoor temperature to approximate full input. If input is too low, increase setting on main regulator ("M" valve only) but not past point where no further pressure increase is evident. With burner running, reset modulating control point less than incoming air temperature to drive valve to low fire position. Then gradually reduce low fire stop, or bypass till fire tends to go out. Increase to the smallest stable (1" - 1-1/2" flame length), full length fire. If a local weak spot appears, check for clogged low fire air ports or extreme turbulence at affected portion. Make low fire adjustments patiently. Due to low gas flow rate, response to adjustments will be slow.
23. Modulation System
  - a. Unit with Selectra Modulation - See page 11 for valve information.
    1. Standard selectra system (Series 14)
      - a. MR212 valve high fire manifold adjustments
        1. Disconnect wires from terminal #4 in the amplifier – see page 11 – this causes the valve to call for continuous high fire.

2. Remove seal cap (A) and turn regulator pressure adjusting screw to obtain desired manifold pressure. (Clockwise rotation increases pressure) - see page 11.
  3. Reconnect the wires to terminal #4.
- b. MR212 valve low fire or by-pass adjustment.
1. Disconnect wire from terminal #8 in the amplifier – see page 11. This causes the valve to call for continuous low fire.
  2. Remove seal cap (B) and loosen lock screw (C). Turn (D) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate) - see page 11.
  3. Tighten set screw (C), replace cap (B) and reconnect wire to terminal #8.
- c. MR611 valve high fire manifold adjustment.
1. Disconnect wires from terminal #4 in the amplifier – see page 11. This causes the valve to call for continuous high fire.
  2. Adjust the pressure regulator to obtain the desired manifold pressure (7" WC. Max.).
  3. Reconnect the wires to terminal #4.
- d. MR611 valve low fire or by-pass adjustment.
1. Disconnect wire from terminal #8 in the amplifier – see page 11. This causes the valve to call for continuous high fire.
  2. Remove cap (A) and turn adjusting screw (B) to desired low fire adjustment – see page 11.
  3. Replace cap (A) and reconnect wire to terminal #8.

NOTE: If calibration of the amplifier or remote temperature selector is necessary, place an accurate temperature measuring device as near the discharge air sensor as possible. Set the remote temperature at least 10° F above the outside air temperature.

1. If calibrating at the amplifier, adjust calibration potentiometer (A), see page 11, until temperature reads the same as the set temperature. If the temperature is below the set point, then rotate calibration potentiometer (A) clockwise. If the temperature is above the set point, rotate the calibration potentiometer counter-clockwise.
  2. If calibrating the remote temperature selector, rotate the calibration potentiometer (A), see page 11, until the correct temperature is obtained. If the temperature is above the set point, the calibration potentiometer (A) should be turned counter-clockwise.
24. Once start-up is complete, set temperature selector dial at desired temperature. Turn Summer-Off-Winter switch to the "Off" position.

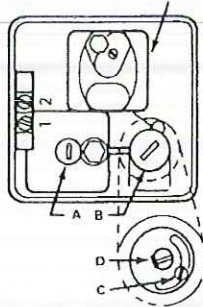
## H. VALVE ADJUSTMENTS

### MR 212 Valve

#### High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal #4. This causes the valve to call for continuous high fire.
2. Remove seal cap (a), and turn regulator pressure adjusting screw to obtain desired manifold pressure. (Clockwise rotation increases pressure.)
3. Reconnect the wires to amplifier terminal #4.

NOTE: If low fire bypass is on maximum, the desired high fire outlet pressure may not be achieved.



#### Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal #8, this causes valve to call for continuous low fire.
2. Remove cap (B), and loosen lock screw (C). Turn (D) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Tighten set screw (C), replace cap (B) and reconnect wire to amplifier terminal #8.

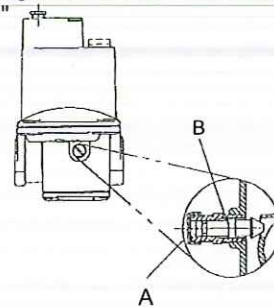
### M411, 511, 611 VALVE

#### High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal #4, this causes the valve to call for continuous high fire.
2. Adjust the pressure regulator to obtain the desired manifold pressure (7" w.c. maximum).
3. Reconnect the wires to amplifier terminal #4.

#### Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal #8, this causes the valve to call for continuous low fire.
2. Remove cap (A), and turn adjusting screw (B) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Replace cap (A), and reconnect wire to amplifier terminal #8.

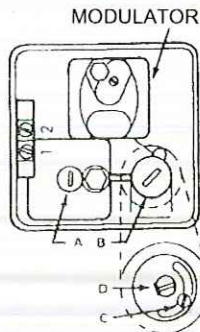


### MR 212 VALVE

#### High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal #2 & #4. This causes the valve to go to continuous high fire.
2. Remove seal cap (a), and turn regulator pressure adjusting screw to obtain desired manifold pressure. (Clockwise rotation increases pressure.)
3. Reconnect the wires to amplifier terminal #2 & #4.

NOTE: If low fire bypass is on maximum, the desired high fire outlet pressure may not be achieved.



#### Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal #8, this causes valve to go to continuous low fire.
2. Remove cap (B), and loosen lock screw (C). Turn (D) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Tighten set screw (C), replace cap (B) and reconnect wire to amplifier terminal #8.

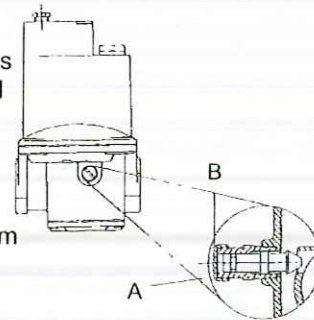
### M411, 511, 611 VALVE

#### High Fire Manifold Adjustments:

1. Disconnect wires from amplifier terminal #2 and #4, this causes the valve to go to continuous high fire.
2. Adjust the pressure regulator to obtain the desired manifold pressure (7" w.c. maximum).
3. Reconnect the wires to amplifier terminal #2 & #4.

#### Low Fire or Bypass Adjustments:

1. Disconnect wire from amplifier terminal #8, this causes the valve to go to continuous low fire.
2. Remove cap (A), and turn adjusting screw (B) to desired low fire adjustment. (Clockwise rotation reduces minimum flow rate.)
3. Replace cap (A), and reconnect wire to amplifier terminal #8.



## I. SEQUENCE OF OPERATION

### 1. Typical sequence of operation – direct gas fired units:

Closing fused disconnect switch supplies 115 volt power to control circuit through 115 volt control transformer. Unit is ready for operation.

#### Summer Operation

If three position season switch is in the “summer” position and two position blower switch is “on”, power is supplied to the two position fresh air/discharge air damper motor. After approximately one minute, the damper motor has reached its full open position, closing the damper proving switch. Power is supplied to blower motor starter. Blower motor will run if blower motor overloads are not tripped. Burner is inoperative. System white light in remote control panel will be operational.

#### Winter Operation

If three position season switch is in the “winter” position, and if the high limit switch is operational, blower starts as explained in summer operation above. If air flow is sensed by the air proving switch and auxiliary starter contacts are closed, power is supplied to burner protectorelay.

If entering air temperature is below the setting of the entering air temperature controller, protectorelay powers ignition transformer and pilot valve opens. When pilot is lit, flame rod detects pilot flame and ignition transformer drops out of electrical circuit. Main gas solenoid valve opens and pilot lights main burner. The alarm safety switch lockout terminals will close if detection of flame (or flame simulating conditions) occurs, if there is a failure to ignite main flame, or on a loss of flame while burner is running. The alarm lockout terminals will energize the safety lockout relay which will open the lockout relay contacts and shut down the blower and burner. Safety lockout light in remote control panel will be operational.

Burner flame is controlled by the modulating valve and discharge air controller.

Flame is increased and decreased as discharge temperature rises and falls above and below setpoint of discharge air controller.

### 2. Typical sequence of operation – electric units:

Closing optional main disconnect switch supplies 115 volt power to control circuit through 115 volt control transformer. Unit is ready for operation.

#### Summer Operation

If three position season switch is in the “summer” position and the three position blower switch is in the “on” position, power is supplied to the blower motor starter. Blower relay and blower delay timer must be operational. Blower motor will run if blower motor overloads are not tripped. Heater is inoperative. System white light in remote control panel will be on if auxiliary blower motor starter contacts are closed. Optional clogged filter light in remote control panel will be operational if a blocked intake or clogged filter situation occurs.

#### Winter Operation

If three position season switch is in the “winter” position, heating control relay is operational, and air flow through unit has been proven by blower air proving switch, the electronic sequencer will modulate for desired heat if power is supplied to sequencer through sequencer control transformer and automatic reset thermal cutout.

Heating is controlled by the modulating sequencer through the action of the over-riding modulating room thermostat. If the discharge temperature of the unit falls below the setting of the modulating discharge air controller, the over-riding room thermostat is over-ridden and heating output is increased until the modulating discharge air controller is satisfied.

If the discharge temperature of the unit rises above the setting of the modulating high limit control, the over-riding room thermostat is over-ridden and heating output is decreased until the modulating high limit control is satisfied.

The sequencer automatically recycles to the off position on any interruption of power.

System heating light in remote control panel will be on when season switch is in the “winter” position.

### 3. Typical sequence of operation – steam, hot water units:

Closing optional main disconnect switch supplies 115 volt power to control circuit through 115 volt control transformer. Unit is ready for operation.

#### Summer Operation

If three position season switch is in the “summer” position and the three position blower switch is in the “on” position, and the entering air temperature is above the freezestat setting, power is supplied to the blower motor starter. Blower motor will run if blower motor overloads are not tripped. Heating coil is inoperative. System white light on remote control panel will be on if air proving switch is closed. Optional clogged filter light on remote control panel will be operational if a blocked intake or clogged filter situation occurs.

## Winter Operation

If the entering air temperature is below the entering air controller setpoint and the blower is operating, the heating coil valve is energized and powered open, and the heat "on" light is energized on the remote control panel.

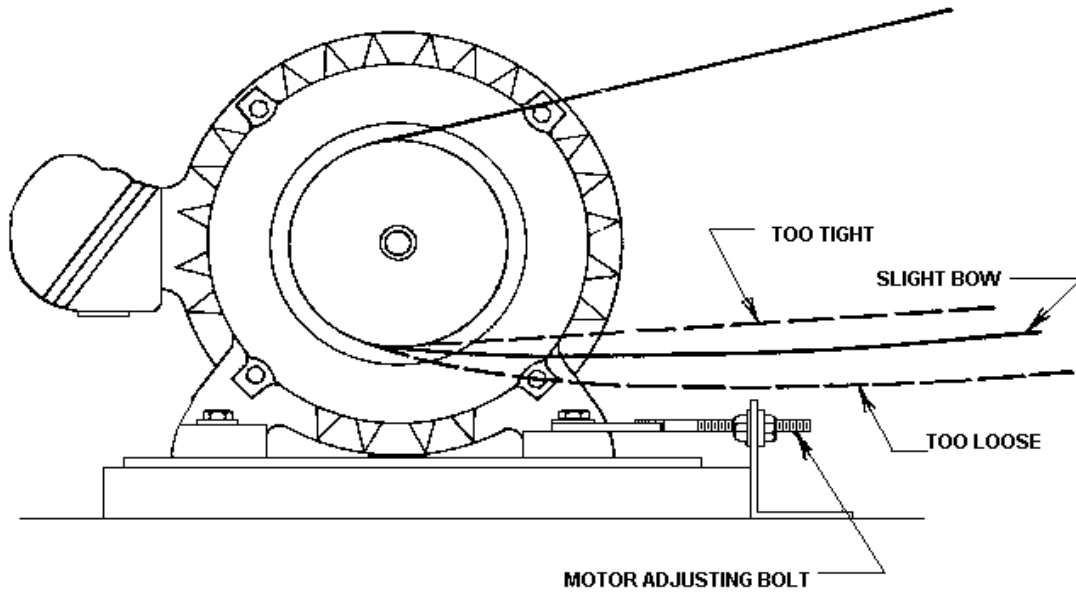
Discharge air temperature is controlled by discharge air controller.

If the entering air temperature is above the entering air controller setpoint, the heat is de-energized and the blower continues to operate.

## J. MISCELLANEOUS MAINTENANCE

1. Filters – check filters at least once each season and clean or replace as necessary.  
Standard filters are of the heavy duty fiberglass mesh throw-away type. No attempt should be made to clean and re-use these filters. Replacement filters should be an equivalent to the type supplied standardly with the unit. See bill of material for size, type, and number required.  
The optional cleanable filters are of the high velocity aluminum mesh type. These filters may be washed with water, as the mesh is originally coated with a water soluble oil solution. The filters should be dried and recoated with oil solution, such as "Evans Filter Fluid". Replacements for damaged filters should be of an equivalent type as originally supplied with the unit. See bill of material for size, type and number required. The oil coating solution is available from the filter manufacturer.  
Filter racks as supplied with some sizes of SB units may have at least one filter spacer to eliminate the by-passing of unfiltered air. These spacers (if used) must be re-installed after the completion of any maintenance work.
2. Blowers – check blower and related components at least twice yearly.  
Blower motor bearings need periodic lubrication. Motor bearings vary with size and type of application. Refer to motor instructions for proper maintenance schedule. Belts must be tightened as explained previously if so required. Check pulleys for proper alignment
3. Lubricate main fan bearing with a high grade lithium base grease. Perform at least every quarter (three months) or schedule according to equipment use.
4. Blower belts should be checked twice a year for wear and adjustment - See data below.
5. Burner - Check orifice openings annually - contact factory for proper orifice drill size for cleaning.

**MOTOR ADJUSTING BOLT AND BELT TENSION - FOR BELT "DEFLECTION" TABLE BELOW.**



**DEFLECTION TABLE**

Belt Cross Section (marked on belt)	Motor Pulley Pitch Diameter	Deflection Force	
		Minimum	Maximum
A	3.0" – 3.6"	2.62 lbs.	3.25 lbs.
	3.8" – 4.8"	3 lbs.	4 lbs.
	5.0" - 7.0"	3.25 lbs.	5 lbs.
B	3.4" – 4.2"	3 lbs.	5 lbs.
	4.4" – 5.6"	4 lbs.	5.87 lbs.
	5.8" – 8.6"	5.25 lbs.	7.87 lbs.



## K. INSTALLATION OF ROOF CURBS

Units can be supplied with an optional roof curb. The curb greatly facilitates installation thereby reducing installation costs. All connections to the unit ductwork, piping, and electrical power and control wiring can be made through the roof opening.

The curb may be shipped prior to unit shipment, or may accompany the unit to the jobsite. All roof curbs are shipped knocked down from factory. The curb is 3 1/2" thick and includes a 2" high wood nailer strip curb adaptor, and sealing tape. Curb is made from 18 gauge galvanized steel. Curb does not include insulation or cant strip (may be required to adapt to all types of roofing – including gypsum). See Figure No. 13 and Figure No. 14.

Use extreme caution in handling the curb. Proper handling and positioning will insure a water tight curb unit installation.

Re-check approval prints prior to installation. Be sure that there are no obstructions to ducting and that proper planning has been exercised in connection of piping and/or electrical services.

The curb assembly must be supported by roof trusses at intervals no greater than eight feet. It may be bolted or welded to either trusses or roof decking; however, connection to roof trusses is recommended. The curb is designed to carry the weight of the unit. Additional support is required for certain applications.

Placement of the curb is critical in squareness and leveling. Shims for leveling must be applied to the curb; application of shims to the unit will tend to destroy the sealing effect after installation. Make sure sealing tape and adaptor strip are in place before unit is set. A bubble level must be used in the leveling process. Squareness must be checked by measuring diagonals. Allowable tolerance is 1/4" difference between diagonal measurements. Double check approval prints before setting of unit. Upon completion of setting the curb, apply roofing material and flashing as required.

The unit manufacturer will not assume responsibility for leaks if the curb adaptor gasket (provided by others) and sealing tape (provided by others) are not used. Be careful not to allow gaps where two pieces of sealing tape meet. Unit is now ready for setting on the roof.

SBD-222, 227 233, and 240 require a field fabricated sheet metal skirt around base of unit. (Contact factory for details).

## SECTION 3

### L. TROUBLE SHOOTING THE DIRECT GAS FIRED UNIT

#### 1. If Blower Fails to Operate, Check to See If:

- a. Main disconnect switch or circuit breaker closed.
- b. All main fuses (if disconnect switch used) are in line.
- c. Control transformer is supplying 115 volts to control circuit.
- d. Blower switch in remote control panel is "on".
- e. High limit control is in circuit (manual reset switch).
- f. Magnetic motor starter is in circuit (manual reset starter).
- g. There are any loose wires or connections in blower circuit at either terminal block or control components.

Also check the following optional controls, if used, to see if:

- a. Main gas cock is open – units equipped with manual reset low gas pressure switch must have gas at switch for proper switch operation.
- b. Low gas pressure switch in circuit (manual reset switch).
- c. High gas pressure switch in circuit (manual reset switch).
- d. Damper motor end switch is closed (damper motor must be full open).
- e. Low limit temperature control setting too high or n.c. over-riding timer contacts open.
- f. Access door switch(es) open.

NOTE: If other optional controls are supplied on special applications, check to see if they are in the electrical circuit.

#### 2. If blower runs, but remote control panel blower light doesn't come on, air proving switch is faulty, discharge is blocked, belt(s) loose and slipping, or blower is running backwards. Also check to see if air proving switch sensing tube is plugged or has been crimped. Also check to see if RPM and CFM required match specification plate on unit. Confirm burner profile opening dimensions - contact factory for data.

- a. If a pre-purge timer (separate from programming relay) is used, blower light won't come on until unit has purged.

- b. Blower light in remote panel will not function until all air proving safety controls are operational.  
NOTE: Units that have SP-L and AP-H air proving switches are factory set and not to be tampered with. AP-L is set to .25" w.c., AP-H is set to 1.0" w.c.
3. Units equipped with filter sections will have a clogged filter or blocked intake light in remote control panel. If filter light is on and blower light is off, check for:
- Dirty filters.
  - Blocked intake.
4. If blower starts and remote control panel blower light comes on, operates for a short time, and then stops, check:
- Starter reset and possible motor overloading.
  - To see if unit equipped with low outlet temperature shut-off with cold start time delay.
    - Low limit control setpoint too high.
    - Over-riding timer completing its cycle before burner operates.
    - Burner fails to operate.
5. If blower operates and blower signal light is on, but burner fails to operate, check to see if:
- Season switch in remote control panel is in "winter" position.
  - Auxiliary starter contact in magnetic motor starter closed.
  - Programming relay in safety lockout.
  - Intake air temperature controller set point above outdoor ambient temperature.
  - Ignition transformer functioning properly.
  - Air proving switch is open due to under or over velocity (See Item 2b note.)
  - Spark gap is approximately 3/8".
  - Flame rod wire and spark ignition wire for loose connections and/or reversed wires.
  - Any electrode insulators are cracked – replace as required.
  - Pilot gas valve is open and that pilot has been lit (purge pilot gas line to eliminate any air).
  - A three to four micro-amp reading for pilot is being attained.
  - Main gas valve(s) open.
6. If unit does not heat air, check to see if:
- Modulating valve is functioning properly.
  - All gas cocks are in full open position.
  - Inlet pressure to unit agrees with unit specification plate.
  - Gas pressure at burner is 4 -1/2" W.C. If not, adjust main gas pressure regulators on unit until there is 4 -1/2" W.C. at burner. (If unit is designed for reduced manifold pressure, correct pressure to agree with that shown on unit specification plate).
7. If burner ignites, but modulating valve fails to open, check to see if:
- Temperature selector dial is set at proper temperature range.
  - Motor and controller are wired properly.
  - Setting of discharge temperature selector dial or modulating room thermostat.
8. If unit is equipped with motorized pre-mix burner and burner does not operate, check to see if:
- Burner relay or starter coil energized.
  - Burner starter (if required) needs resetting.
  - Differential burner proving switch closing (blower must run for switch to close).

9. If burner flame is not consistent across the entire burner length and darker areas are noticed, burner orifice openings are blocked and require cleaning - contact factory for orifice drill size.

## **M. TROUBLE SHOOTING THE ELECTRIC SB UNIT**

1. If blower fails to operate, check to see if:
  - a. Optional main disconnect switch or circuit breaker closed.
  - b. All main fuses (if disconnect switch used) are in line.
  - c. Control transformer is supplying 115 volts to control circuit.
  - d. Blower switch in remote control panel is "on" if unit used for make-up air, or in the "on" or "auto" position if unit is being used for space heating or heating/ventilating.  
NOTE: If blower switch is in "auto" position, blower will operate for approximately 90 seconds after switch is turned off.
  - e. Blower start relay coil energized and contact closed.
  - f. Fan delay timer heating element energized and contacts closed.
  - g. Magnetic motor starter is in circuit (manual reset starter).
  - h. There are any loose wires or connections in blower circuit at either terminal block or control components.

Also check the following optional controls, if used to see if:

- a. Damper motor and end switch is closed (damper motor must be full open).
- b. Low limit temperature control setting too high or n.c. over-riding timer contacts open.
- c. Access door switch(es) open.

NOTE: If other optional controls are supplied on special applications, check to see if they are in the electrical circuit.

2. If blower runs, but remote control panel blower light doesn't come on, auxiliary starter contact in magnetic motor starter not closing.
3. Units equipped with filter sections will have a clogged filter or blocked intake light in remote control panel.
4. If blower operates, but electric heater fails to operate, check to see if:
  - a. Season switch in remote control panel is in "winter" position.
  - b. Air proving switch is closed – check to see if:
    1. Discharge is blocked
    2. Belt(s) are loose and slipping.
    3. Blower is running backwards.
    4. Sensing tube is blocked or crimped.
  - c. Heating relay coil is energized and contacts closed.
  - d. Standard modulating step controller has power – check to see if:
    1. Step controller power transformer fuses are in electrical circuit.
    2. Power transformer supplying 115 volts.
    3. Automatic reset thermal cutout is closed.
  - e. Step controller is functioning.
  - f. Any or all sub-circuiting heating element fuses in circuit.
  - g. Magnetic heating element contractor coils are energized and contacts are closed.
  - h. Thermally operated heat limiters are in power legs to heating elements.

5. If unit does not heat air, check to see if:
  - a. Modulating step controller is operating through all heating steps.
  - b. Sub-circuit heating element fuses in circuit.
  - c. All magnetic heating element contactors are operational
  - d. Heat limiters are n.c. and in the electrical circuit.

NOTE: Electric heating SBE units **may not** be furnished with a disconnect switch or circuit breaker. If any service work is to be required, opening more than one disconnect switch may be required to completely de-energize system. Make no attempt to re-wire any heating element circuits if a failure occurs. **Contact home office.**

## N. TROUBLE SHOOTING THE STEAM OR HOT WATER SB UNIT

1. If blower fails to operate, check to see if:
  - a. Main disconnect switch or circuit breaker closed.
  - b. All main fuses (if disconnect switch used) are in line.
  - c. Control transformer is supplying 115 volts to control circuits.
  - d. Season switch in remote control panel in "summer" position, or if in "winter" position that heating control relay coil is energized and contacts are closed.
  - e. Freezestat(s) are n.c. and in the electrical circuit.
  - f. Freezestat control relay coil energized and contacts are closed.

Also check the following optional controls, if used, to see if:

- a. Damper motor end switch is closed (damper motor must be full open).
2. If blower runs, but remote control panel blower light doesn't come on, air proving switch is faulty, discharge is blocked, belt(s) are loose and slipping, or blower is running backwards. Also check to see if air proving sensing tube is plugged or has been crimped.
3. If blower operates and blower signal light is on, but system fails to heat air to desired temperature, check to see if:
  - a. Season switch in remote control panel is in "winter" position.
  - b. Heating relay contacts are closed.
  - c. Two position or modulating valve (and controller if modulating system) is functioning properly.
  - d. All steam and hot water lines are open and free flowing.
  - e. Steam pressure, water temperature and flow rates are per specifications.
  - f. On two coil systems that outside air temperature controller is functioning properly.

NOTE: We cannot guarantee coils against freezing, but the likelihood of freezing can be minimized if the installer takes the following precautions:

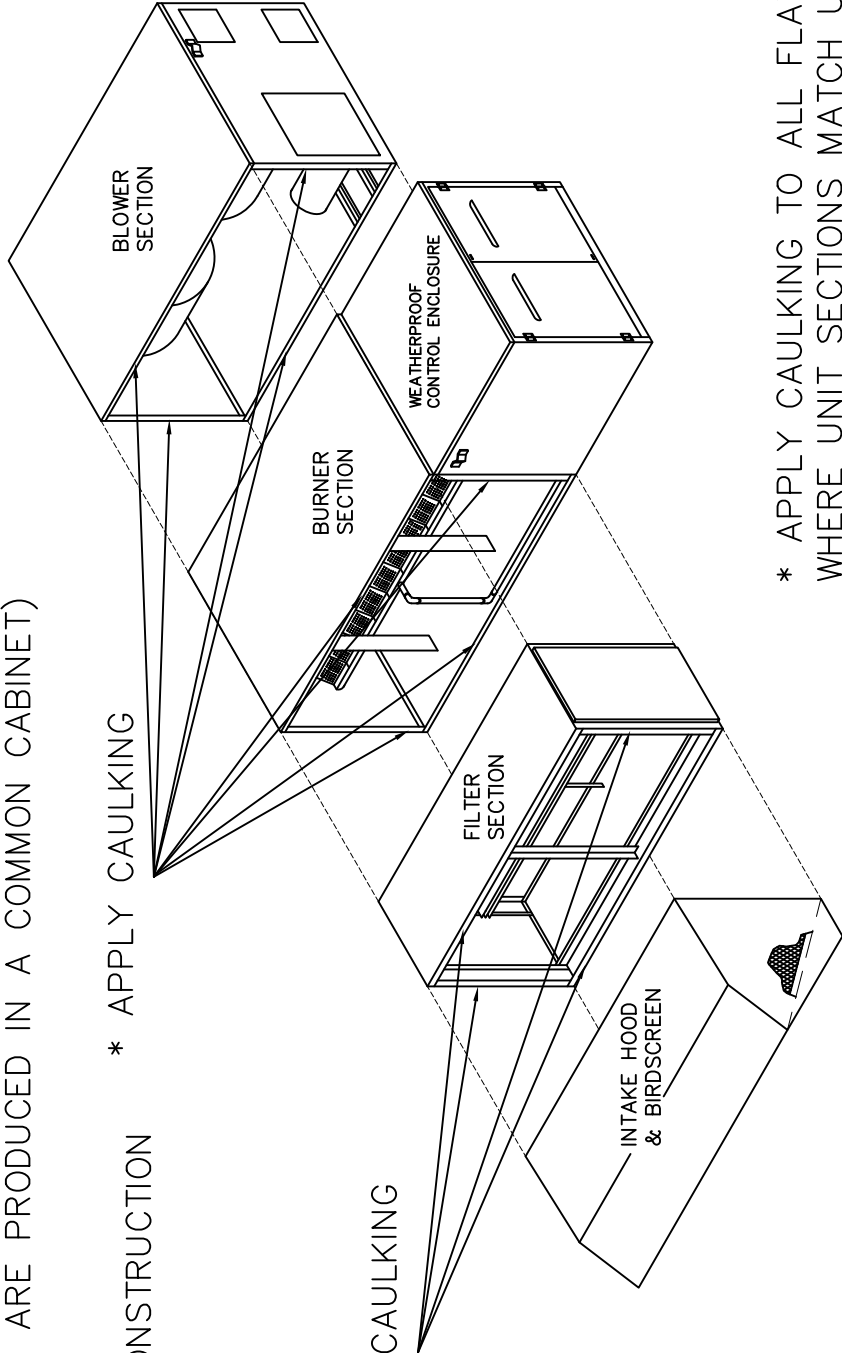
1. Provide adequate sizing of condensate return lines, traps, and vents to provide for a speedy flow of condensate from the coil
2. Do not bush or reduce return trapping size.
3. Do not drain steam mains or branch lines through coils. Steam lines should always be drained ahead of control valves.
4. When more than one coil section is installed, a separate steam trap must be provided for each.
5. Use only bucket or float and thermostatic traps for condensate removal. Use thermostatic traps for venting only.
6. Steam traps should be sized for three (3) times the calculated condensate load at coil design conditions.
7. Traps should be selected for the pressure differential across the trap – not boiler pressure.
8. Strainers should be installed ahead of traps to prevent dirt and sludge from affecting operation.

9. Vacuum breakers should be provided. A 1/2" 15 degree swing check valve is recommended, installed as close to the coil as possible. The vacuum breaker line can be vented to atmosphere or connected into the return line on the distant side of the steam trap on low pressure systems. On steam systems at 15 PSIG and above, air and non-condensable gases should be continuously vented from the return by a 1/4" petcock in a riser off the condensate return ahead of the trap. The petcock should be left open for continuous venting. Vent air lines should not be returned to the condensate return main.
10. If condensate must be lifted above coil return level into overhead mains or if return mains are pressurized, a pump and receiver should be installed between condensate traps and return mains.

Most of the common causes of trouble have been covered and one or more remedies suggested to correct the malfunction, but if SB unit still fails to operate properly, notify the nearest Hastings service representative.

TYPICAL SB-112 THROUGH SB-218 UNIT ASSEMBLY  
 (EBD-112 THROUGH EBD-128 AND LU-112 THROUGH LU-218  
 BLOWER AND BURNER ARE PRODUCED IN A COMMON CABINET)  
 INCLUDING:

- LIFTING LUGS
- WEATHERPROOF CONSTRUCTION
- LINE BURNER



\* APPLY CAULKING TO ALL FLAT SURFACES  
 WHERE UNIT SECTIONS MATCH UP TOGETHER.  
 APPLY AROUND THE ENTIRE PERIMETER FOR  
 WATER-TIGHT JOINT.

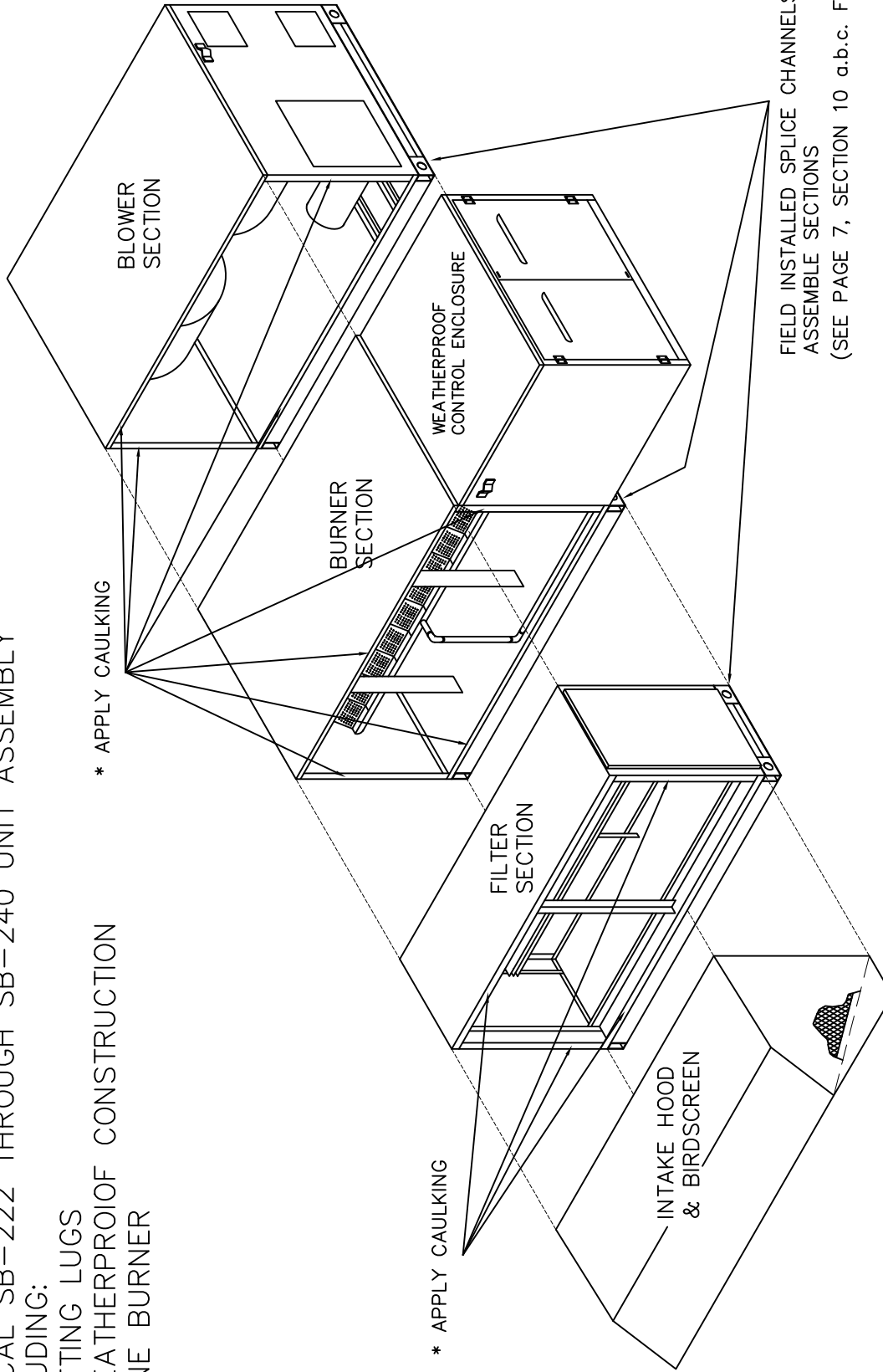
FIGURE NO. 1

TYPICAL SB-222 THROUGH SB-240 UNIT ASSEMBLY  
INCLUDING:

LIFTING LUGS

WEATHERPROOF CONSTRUCTION

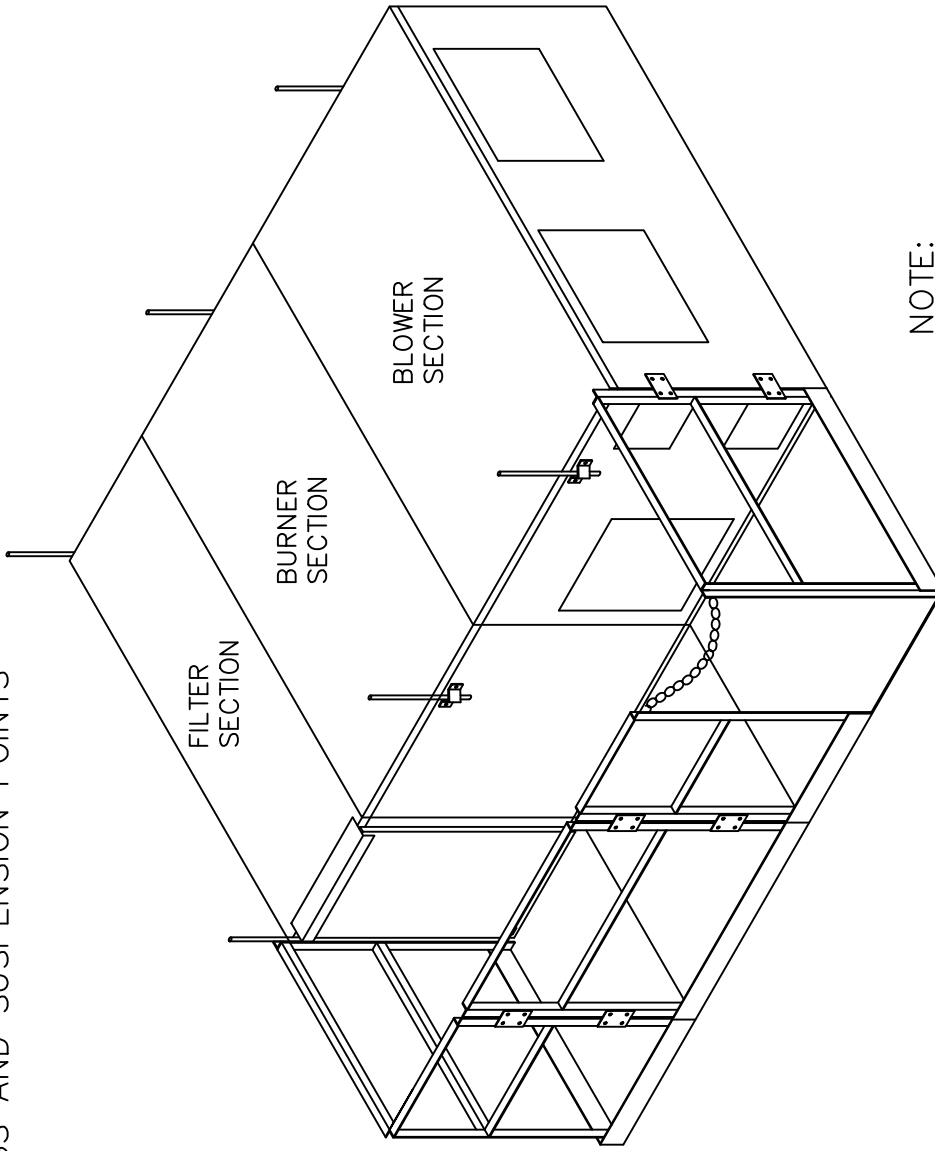
LINE BURNER



\* APPLY CAULKING TO ALL FLAT SURFACES  
WHERE UNIT SECTIONS MATCH UP TOGETHER  
APPLY AROUND THE ENTIRE PERIMETER FOR  
WATER-TIGHT JOINT.

FIGURE NO. 2

TYPICAL SB-112 THROUGH SB-218 AND LU-112 THROUGH LU-218  
INDOOR SUSPENDED UNIT INCLUDING:  
SERVICE PLATFORM  
LIFTING LUGS AND SUSPENSION POINTS

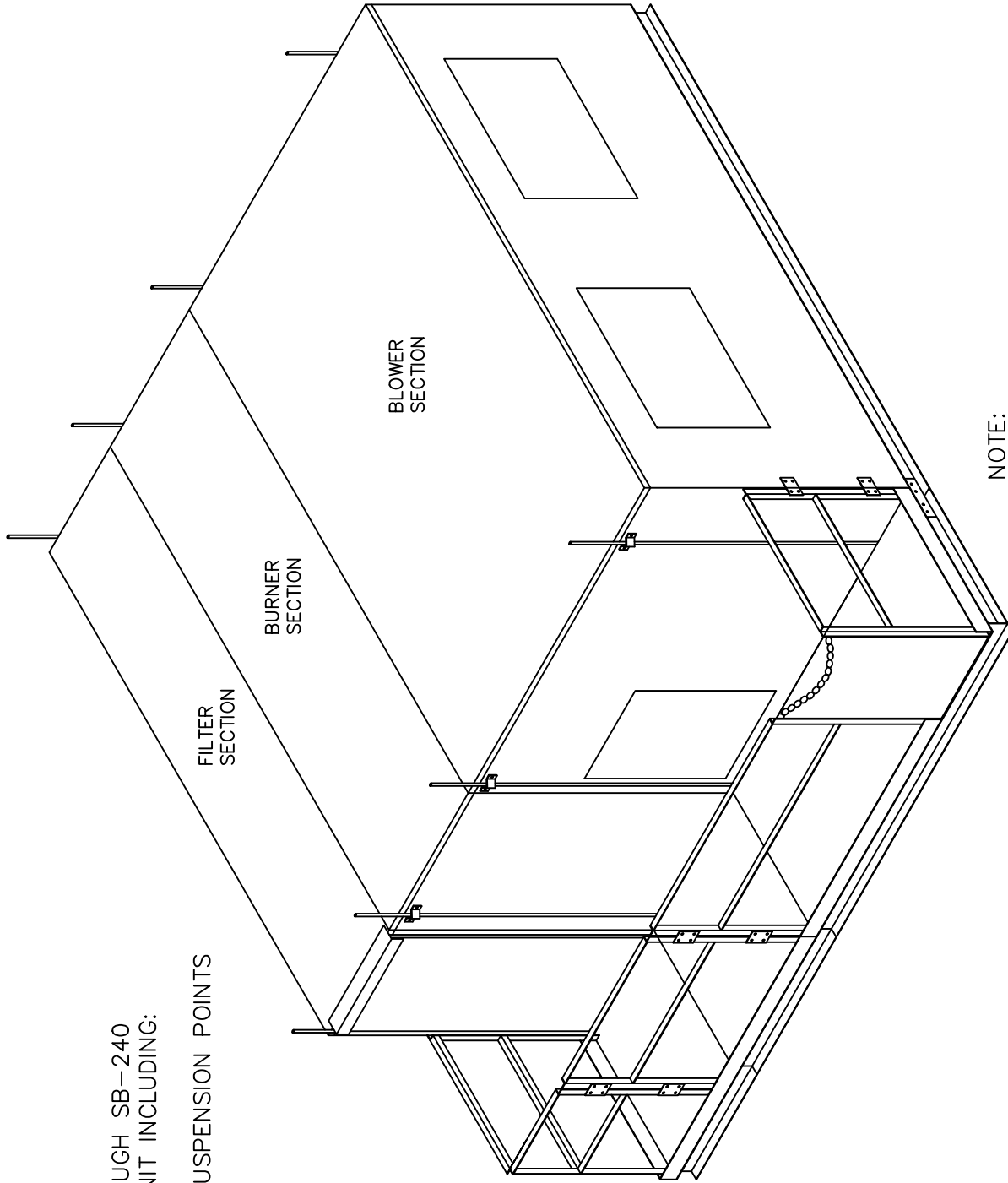


NOTE:  
SERVICE PLATFORM SUSPENSION POINTS WILL VARY  
WITH MANIFOLD AND CONTROL OPTIONS.

FIGURE NO. 3



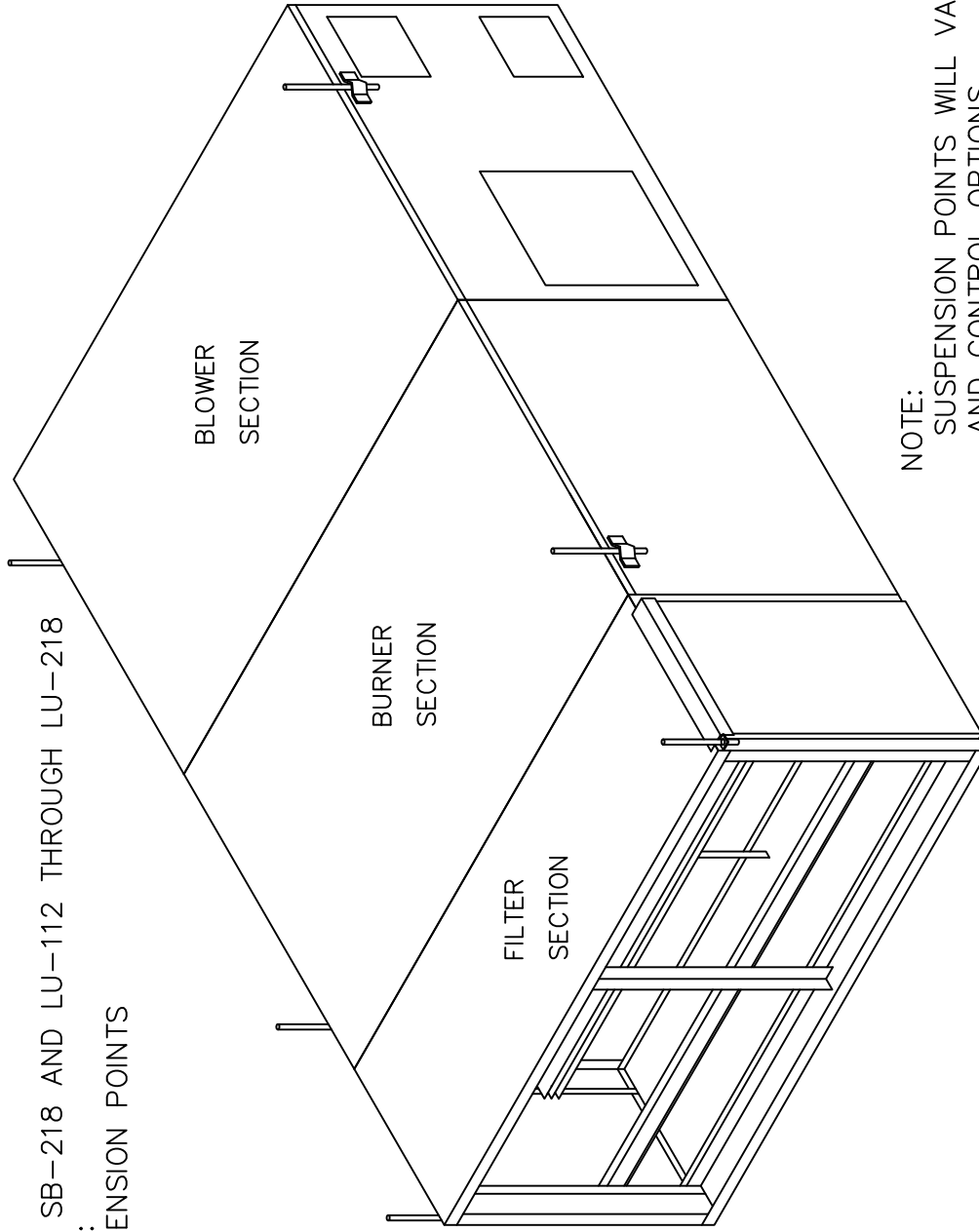
TYPICAL SB-222 THROUGH SB-240  
INDOOR SUSPENDED UNIT INCLUDING:  
SERVICE PLATFORM  
LIFTING LUGS AND SUSPENSION POINTS



NOTE:  
SERVICE PLATFORM SUSPENSION POINTS WILL VARY  
WITH MANIFOLD AND CONTROL OPTIONS,  
SUSPENSION RODS NOT FURNISHED BY UNIT  
MANUFACTURER.

FIGURE NO. 4

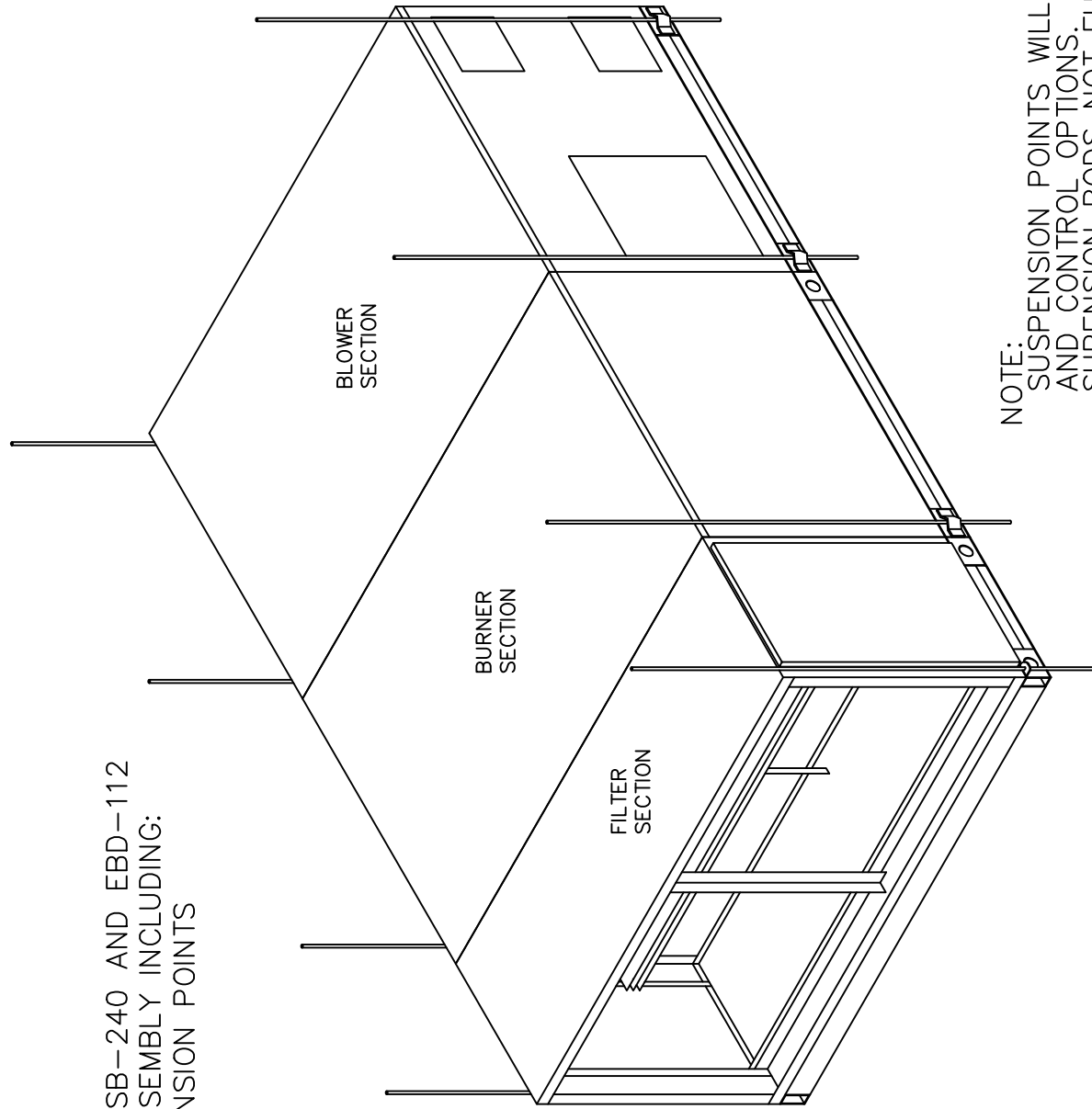
TYPICAL SB-112 THROUGH SB-218 AND LU-112 THROUGH LU-218  
UNIT ASSEMBLY INCLUDING:  
LIFTING LUGS AND SUSPENSION POINTS



NOTE:  
SUSPENSION POINTS WILL VARY WITH MANIFOLD  
AND CONTROL OPTIONS.  
SUSPENSION RODS NOT FURNISHED BY UNIT  
MANUFACTURER.

FIGURE NO. 5

TYPICAL SB-222 THROUGH SB-240 AND EBD-112  
THROUGH EBD-128 UNIT ASSEMBLY INCLUDING:  
LIFTING LUGS AND SUSPENSION POINTS



NOTE:  
SUSPENSION POINTS WILL VARY WITH MANIFOLD  
AND CONTROL OPTIONS.  
SUSPENSION RODS NOT FURNISHED BY UNIT  
MANUFACTURER.

FIGURE NO. 6

TYPICAL DUCT CONNECTION—INDOOR UNITS

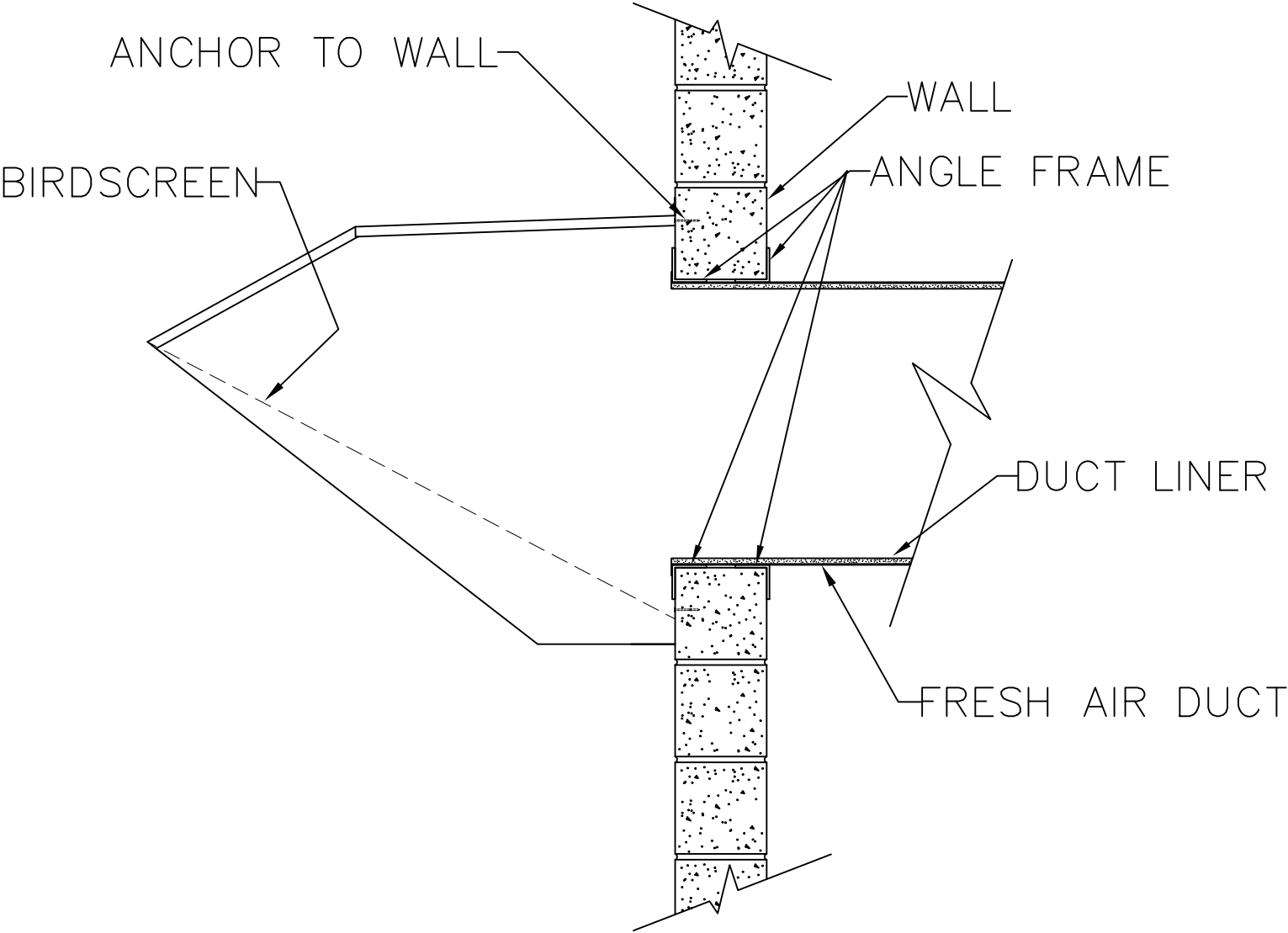


FIGURE NO. 7

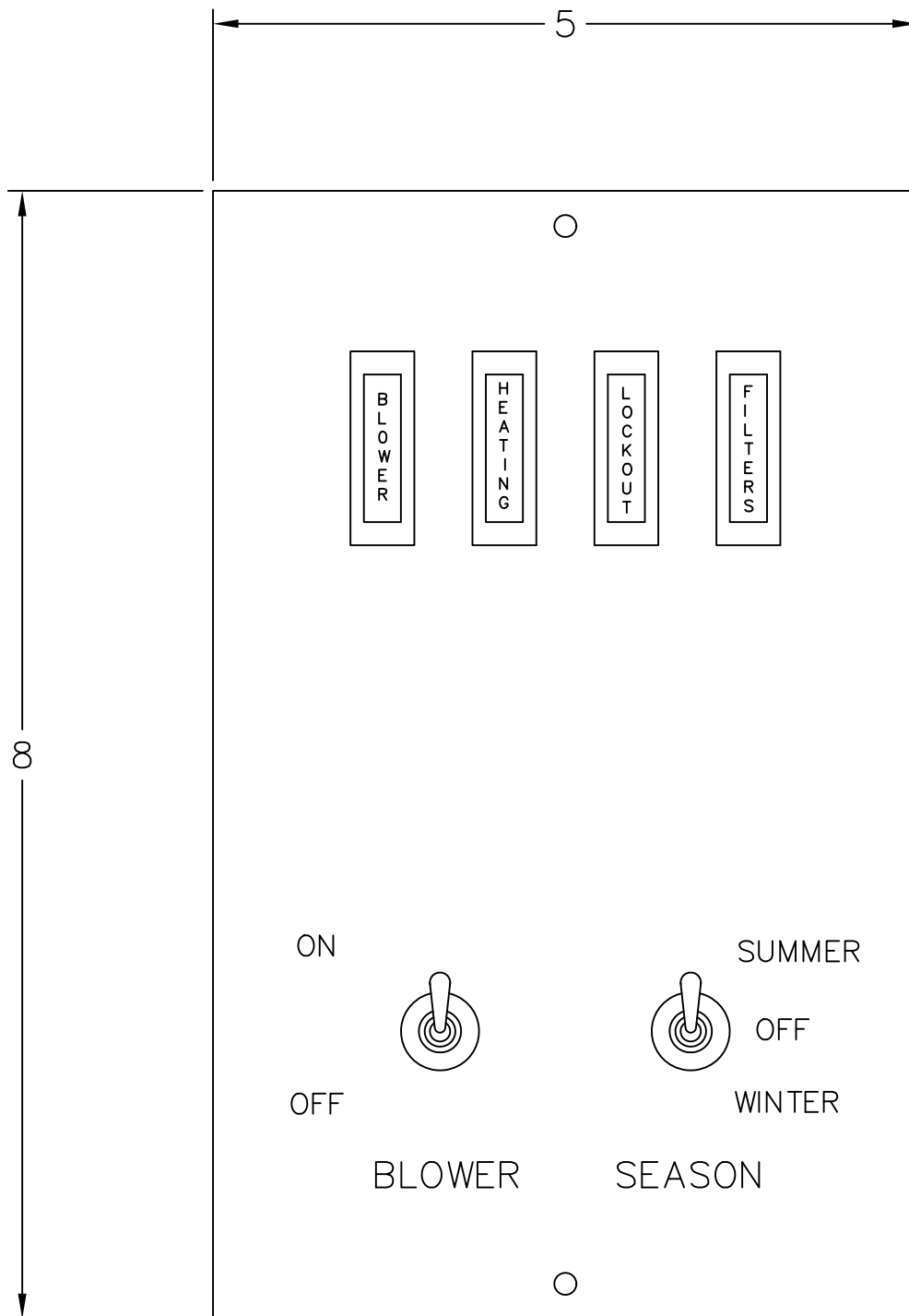


FIGURE NO. 8

TYPICAL REMOTE CONTROL PANEL  
 REMOTE CONTROL PANEL DEPTH 3 1/2"  
 LID IS 16 GA BRUSHED STAINLESS STEEL  
 ALL LETTERS ARE SILKSCREENED BLACK

NOTE:

FILTER LIGHT MAY NOT BE REQUIRED ON ALL APPLICATIONS.

TYPICAL REMOTE CONTROL PANEL INSTALLATION

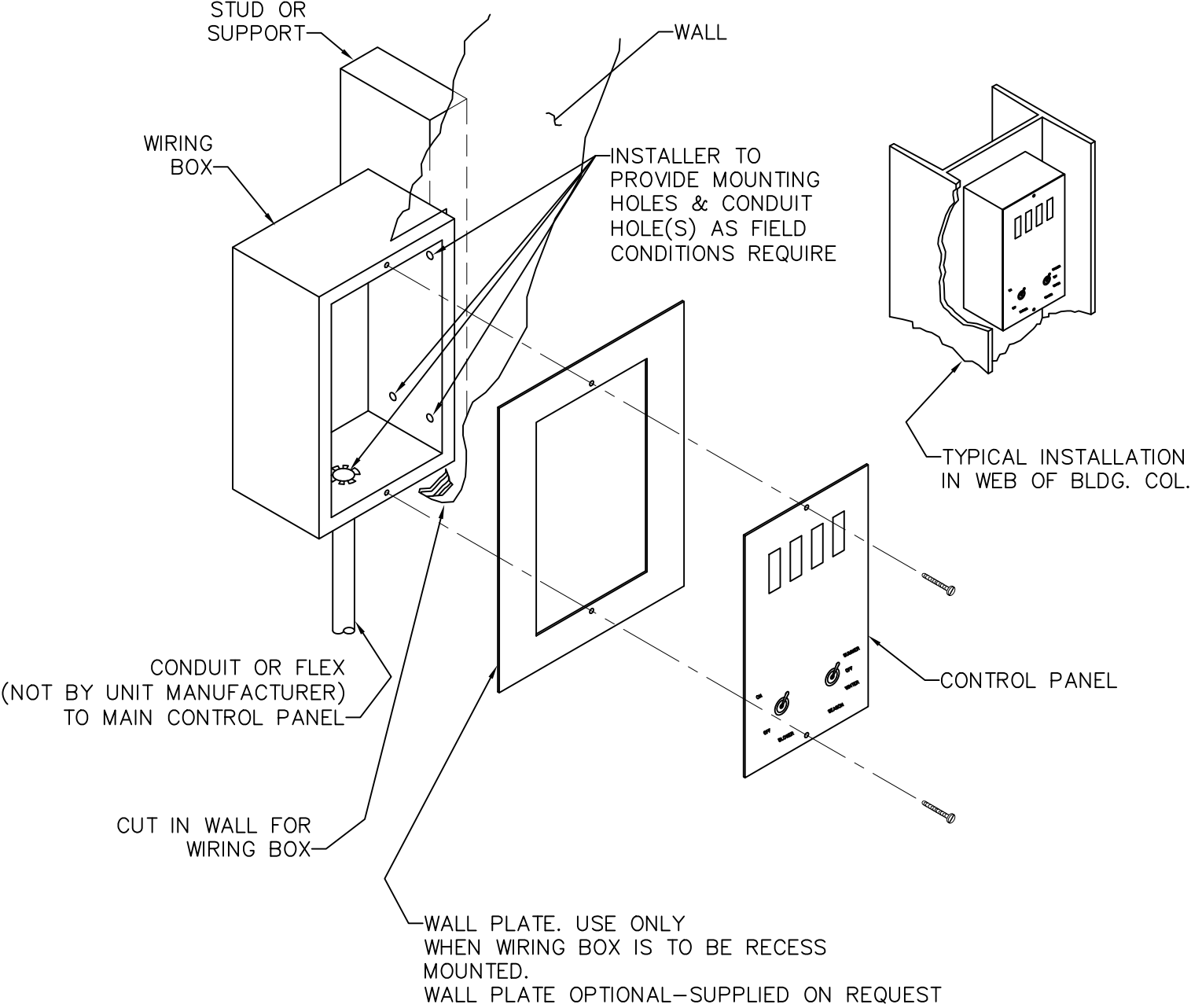
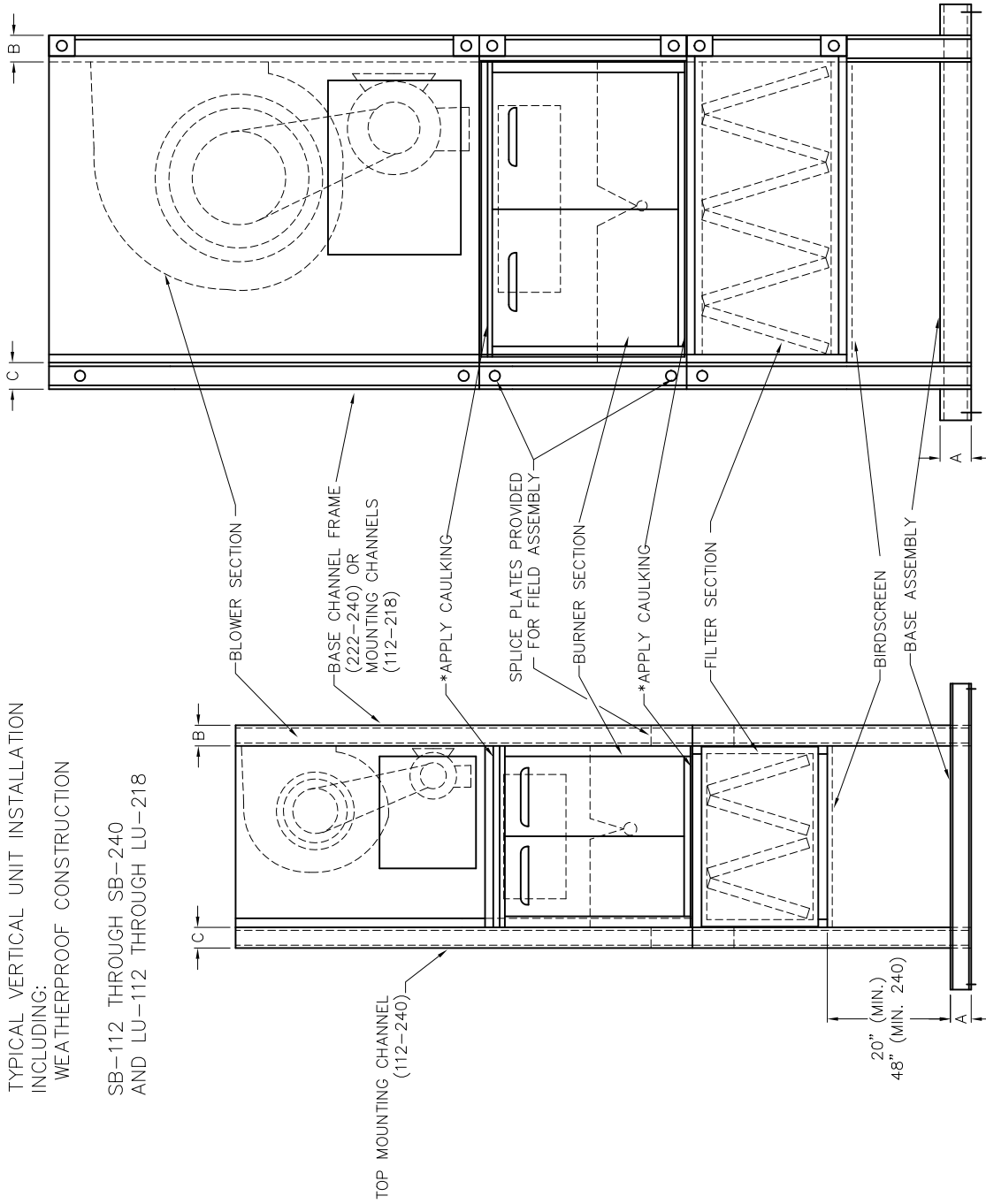


FIGURE NO. 9

TYPICAL VERTICAL UNIT INSTALLATION INCLUDING WEATHERPROOF CONSTRUCTION

SB-112 THROUGH SB-240 AND LU-112 THROUGH LU-218



UNIT SIZE	DIMENSIONS (IN INCHES)		
	A	B	C
112-218	4	4	4
222-233	6	5 1/8	5 1/8
240	6	6	6

\* APPLY CAULKING TO ALL FLAT SURFACES WHERE UNIT SECTIONS MATCH UP TOGETHER. APPLY AROUND THE ENTIRE PERIMETER FOR WATER-TIGHT JOINT

FIGURE NO. 10

TYPICAL SB-112 THROUGH SB-218 & LU-112 THROUGH LU-218  
VERTICAL UNIT FRAME  
BOLTING ASSEMBLY

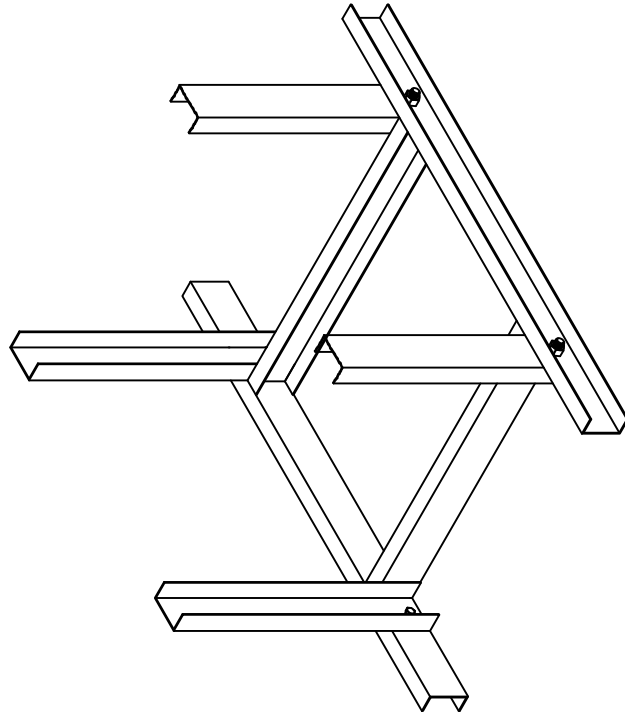
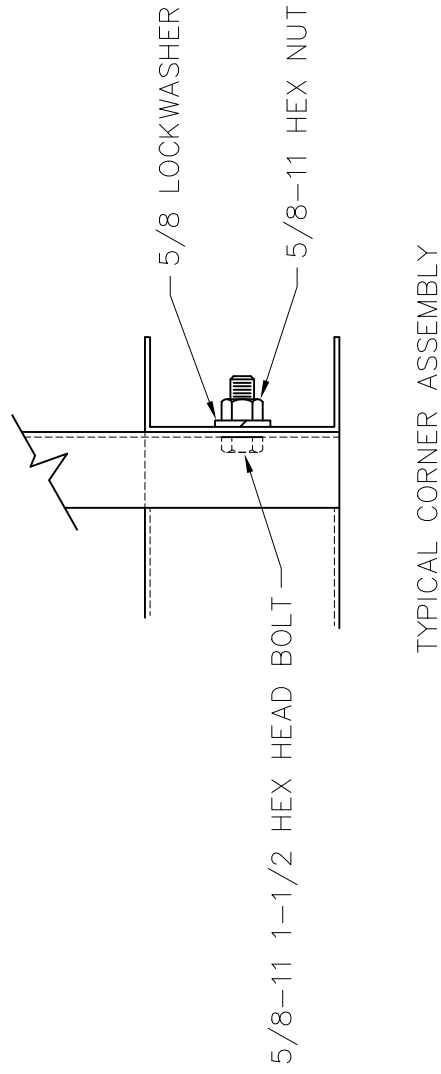


FIGURE NO. 11



TYPICAL SB-222 THROUGH SB-240 VERTICAL UNIT FRAME  
BOLTING ASSEMBLY

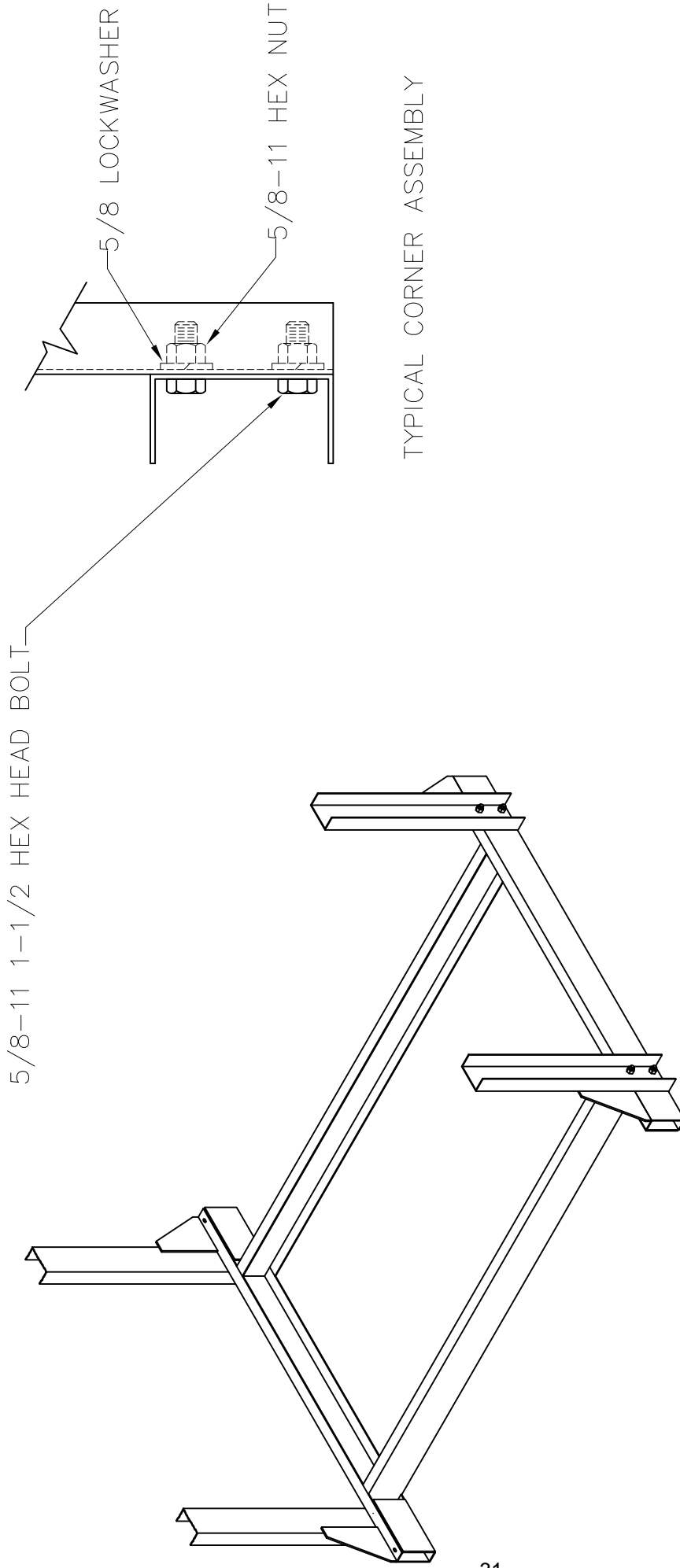


FIGURE 12

TYPICAL ROOF CURB DETAILS  
 FOR SB-112 THROUGH SB-218, EBD-112 THROUGH EBD-128  
 AND LU-112 THROUGH LU-218

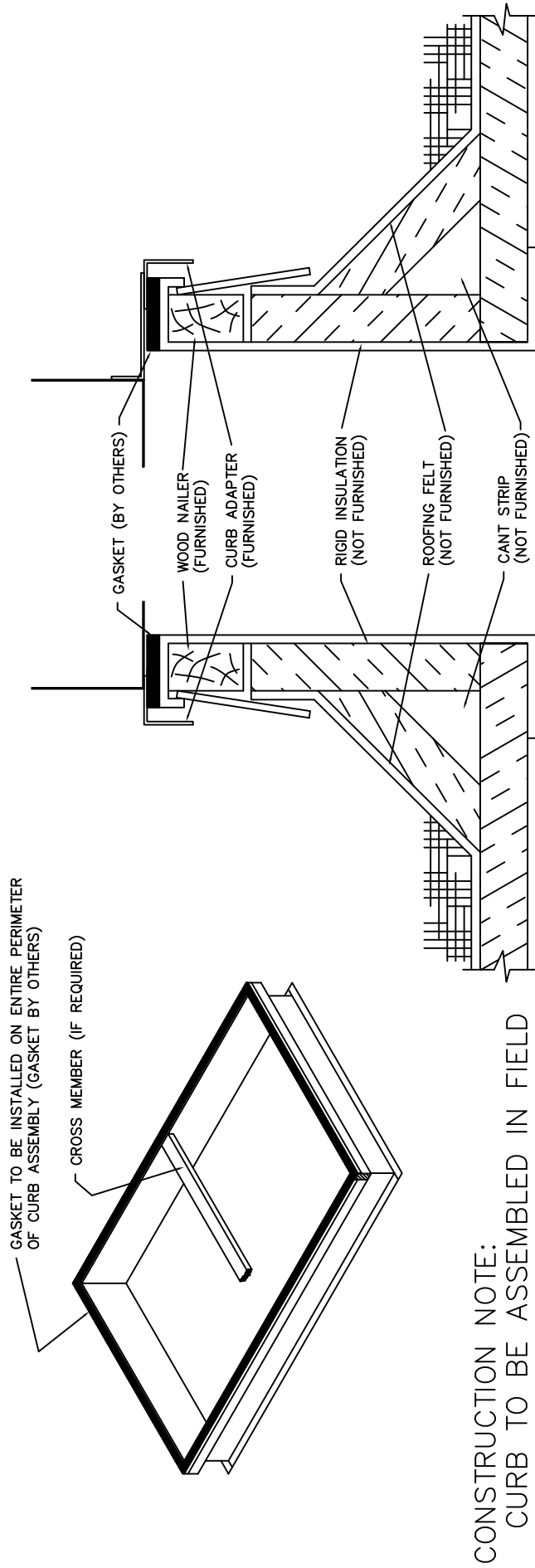
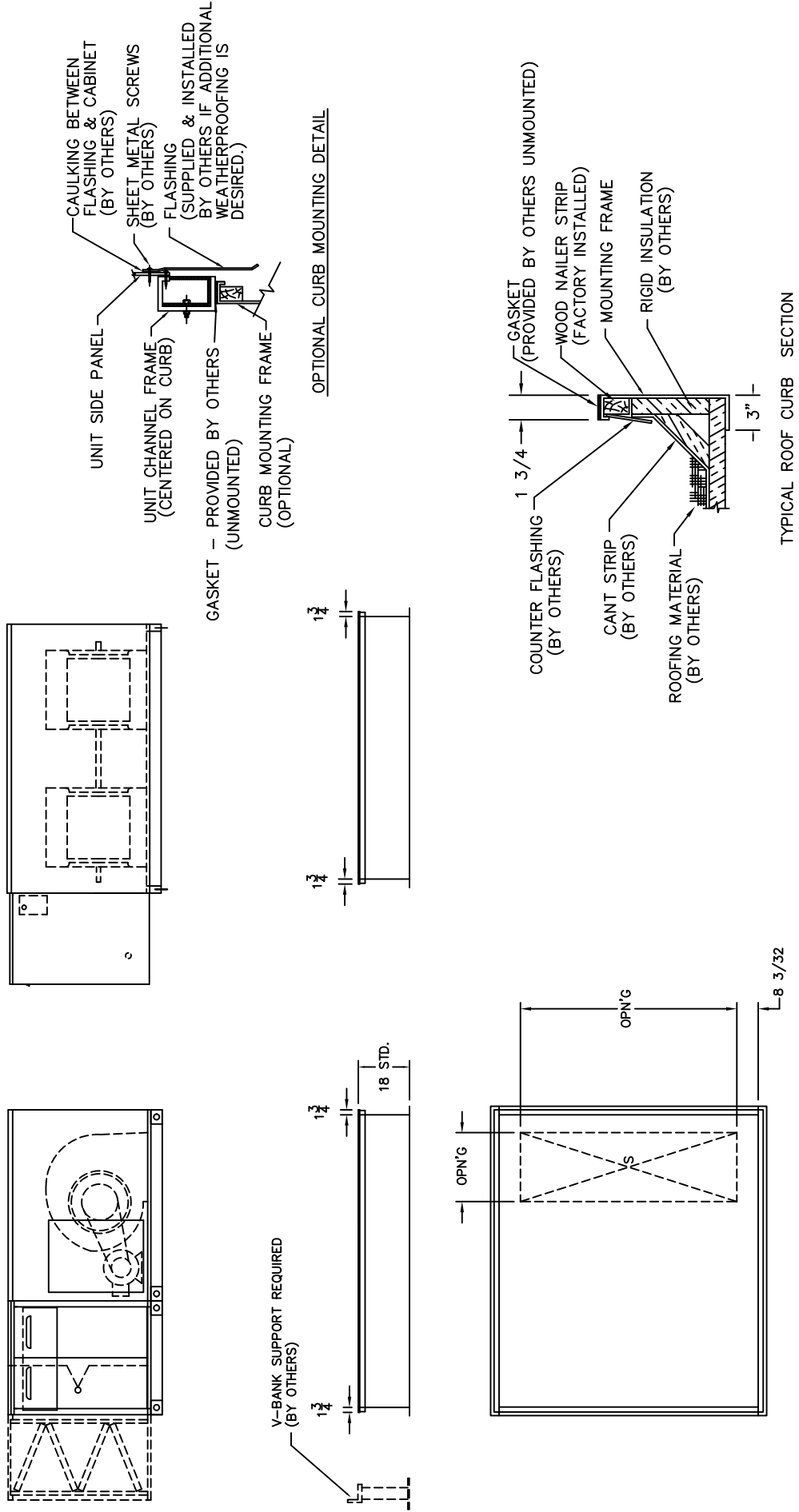


FIGURE NO. 13



TYPICAL SB-222 THRU 240 ROOF CURB DETAILS

FIGURE NO. 14



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