

# AMBIRAD

ENERGY EFFICIENT HEATING SYSTEMS

## HERRINGBONE

HB COMBINED FLUE  
SYSTEM

Installation Manual



*An Ambi-Rad Group company*

# Index

- 1 General arrangement of Ambi-Rad  
Herringbone system
- 2 Instructions and installation
- 3 Manifold assembly
- 4 Fan to flue arrangement
- 5 Commissioning
- 6 Control system
- 7 Service instructions

## 1 General arrangement of Ambi-Rad Herringbone

The Ambi-Rad Herringbone HB combined manifold system may consist of either 'U' tube or linear heaters, linked into a common aluminum manifold system, which in turn is coupled to one vacuum fan to 'evacuate' the products of combustion to atmosphere via a flue system.

This document should be used in conjunction with the specific product installation manual for the ER Series.

Please refer to the 'HB' design manual to ensure correct manifold sizing.

The following appliances are certified by CSA Testing Laboratories for use on natural gas and propane:

### SC/ER/GX Series Heaters

The system may be controlled by an Ambi-Rad Black Bulb thermostat or a standard line or low voltage thermostat. Review system and building requirements when selecting the control system.

The Ambi-Rad Herringbone HB combined manifold system layout should be designed to be as compact as possible with the final connection to the vacuum fan approximately central in the manifold system. Please refer to the Ambi-Rad herringbone design manual.

The manifold system should be arranged to fall slightly in the direction of the vacuum fan. This ensures that any condensation formed in the manifold on cold start and cool down is not trapped or allowed to drain back into the heater unit and will flow towards the condensate trap located at the vacuum fan end of the manifold system. (See figure 8a for condensate trap arrangement)

The exhaust flue should be adequately supported from the building structure and installed in accordance with the Standard Code of Practice and Building Regulations. Alternatively, a telescopic through the wall discharge duct is available for either Type '0', or Type '2' fans.

Ambi-Rad will, upon receipt of a proposed drawing showing a Herringbone system, check the pressure drop of the manifold system to ensure it does not exceed the vacuum fan design criteria.

### 1.1 Standards

The Ambi-Rad heater must be installed in accordance with the relevant installation, Local Buildings and National Fuel Codes ANSI-Z223.1A and section 7.8A-3,Z223.1 and National Electric Code ANSI/NFPA 70-1987. See ER Installation Manual.

### 1.2 Ventilation requirements

Any portion of flue that passes through a combustible wall must be insulated, or use an approved insulating thimble.

Standard vent terminals must extend at least 6-inches from the wall and at least 24-inches from any combustible overhang. Protect the building material from degradation by flue gases.

Flue joints should be sealed using RTV high temperature sealant and secured using at least 3 sheet metal screws. Should condensation occur flue should be shortened or insulated.

The terminal must be at least 3 ft. away from any air intake to the building.

If the heater is equipped with ducted combustion air, the terminal must be at least 3 feet away from the air inlet and located higher than the inlet.

The vent terminal must be protected from blockage by snow.

### 1.3 Fresh air ducted intake

Whenever the heater is installed in locations where airborne dust or other polluted atmosphere is present, a fresh air supply should be ducted to the burner.

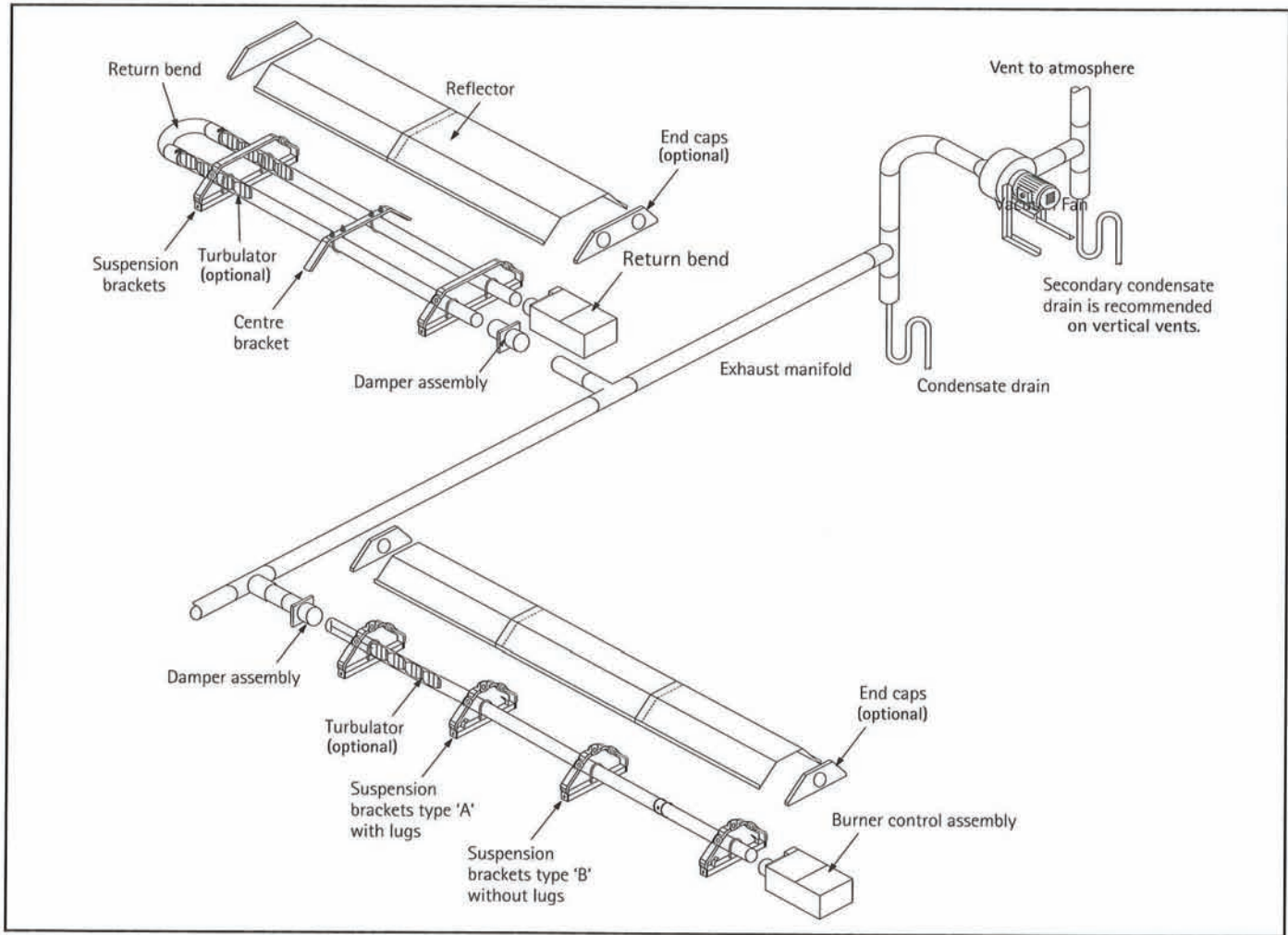
A heater modified for fresh air intake should be specified when ordering. This model is modified with a 4-inch dia. duct connection at the burner.

A fresh air duct of 4-inch dia. should be installed from the fresh air to the air intake connection on the burner housing. A flexible jointing piece should be installed at the burner connection with hose clamps to facilitate disconnection when servicing the burner assembly.

The maximum recommended length of fresh air duct is 25ft. and the maximum number of bends is two. The minimum length is 18 inches. The location of the fresh air duct inlet must be where it will receive dust-free clean air. An Ambi-Rad P6410 inlet cap with bird screen must be fitted at the inlet of the duct. If the duct inlet is located above the roof the underside of the inlet terminal must be at least 2ft above roof level and at least 10 inches above any projection on the roof within 7 ft of the inlet.

## 2 Instructions and installation

Figure 1 Typical Herringbone heating arrangement



### 3 Manifold assembly

After fixing the heaters in the desired position, the manifold system should be laid out on the floor, where possible, to the design layout before erecting.

After allowing for a minimum of 3" of penetration of the fittings into the tube, cut the tubes to the lengths required and remove all burrs and wipe off any grease or oil with a clean rag.

#### 3.1 Method of jointing aluminum tube

Using the applicator gun apply bead of

high temperature silicon jointing compound externally round the end of the fitting and internally round the end of the tube. (See figure 2)

Insert the fitting into the tube using a slight rotating movement to spread the jointing compound uniformly until a penetration of 3" is achieved.

*Note The silicon jointing compound remains workable after application for only 5 minutes.*

Secure the joint by drilling through the tube and fitting and fix with three screws at 12 o'clock, 4 o'clock and 8 o'clock positions.

#### 3.2 Damper assembly

The damper assembly secured to the outlet end of the heater unit must be located with its damper blade vertical. The manifold tube to be sealed and secured (as described in figures 2 and 3) to the damper assembly. For damper assembly see figure 4.

Figure 2

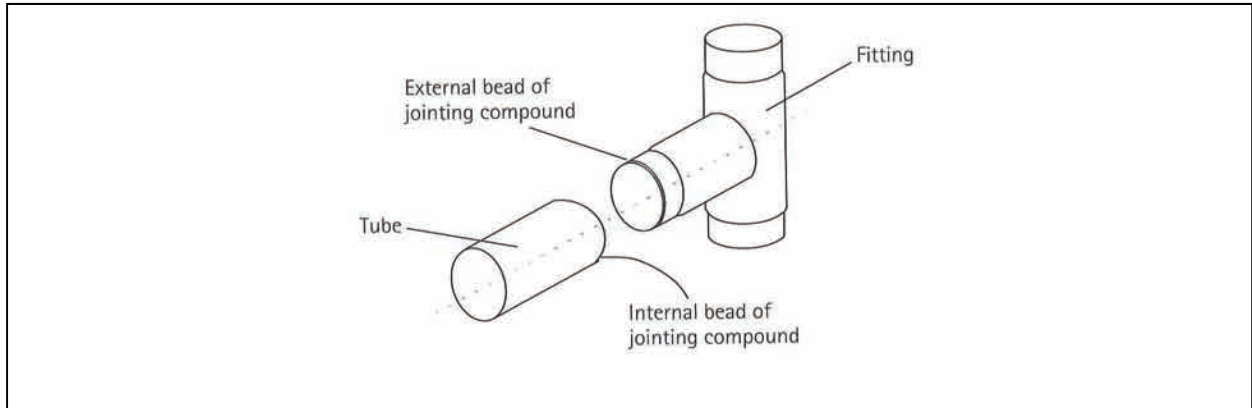


Figure 3

Important - fit screws and jointing compound, SEAL ALL JOINTS.

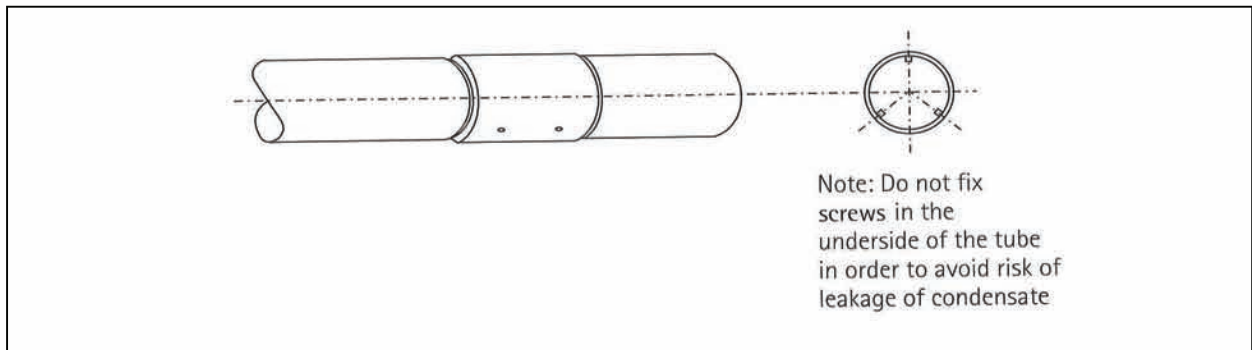
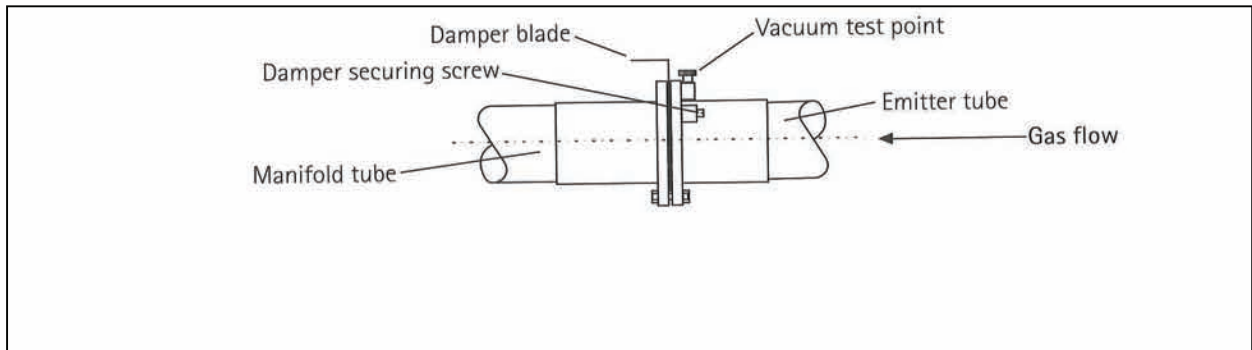


Figure 4

Important - fit damper in vertical position



### 3.3 Manifold suspension

The manifold should be supported by chain, stainless steel flexible wire, or other flexible means from the roof structure to allow movement caused by thermal expansion. For maximum support centers see figure 5.

Flexible couplers at certain points may be inserted within the manifold system to allow linear expansion to take place and prevent stress and strain on the system when required.

*Note The manifold must be supported either side of the flexible coupler.*

Where the HB heaters are to be inclined/wall mounted, the manifold must be installed at the same height as the center of the emitter tube. For typical wall mounting bracket arrangement see ER installation manual.

### 3.4 Condensate trap

A condensate trap assembly must be provided at the end of the manifold system before the vacuum fan. (See figure 8a)

The minimum depth of the condensate collecting chamber shall be 12" and the minimum depth of the condensate drain pipe 'U' trap shall be 18" deep.

The end cap of the collecting chamber to be fitted with a flush flanged tank connector. Any protrusion to be removed leaving the inside flush with end cap (see figure 9). The end cap to be sealed with silicon jointing compound and pop riveted or screwed into position.

All condensate drains from the flue collecting chamber to the disposal point shall be corrosion-resistant material of not less than 3/4" internal diameter. Copper or copper based alloy shall not

be used for condensation drains. Condensate drain pipes must be protected against the effects of freezing.

Figure 5

Manifold pipe size	Maximum distance between supports
4"	8ft
6"	10ft

#### 4 Fan to flue arrangement

The Type '0' and Type '2' vacuum fans have bottom horizontal discharge with rectangular connections (flanged on the type 0) and must be mounted in that position by means of the fan supports onto a suitable platform or brackets fixed to the building structure. For details of the fan outlet flange fixing holes see figure 6. For details of fan mounting bracket and fixing down holes see figure 7.

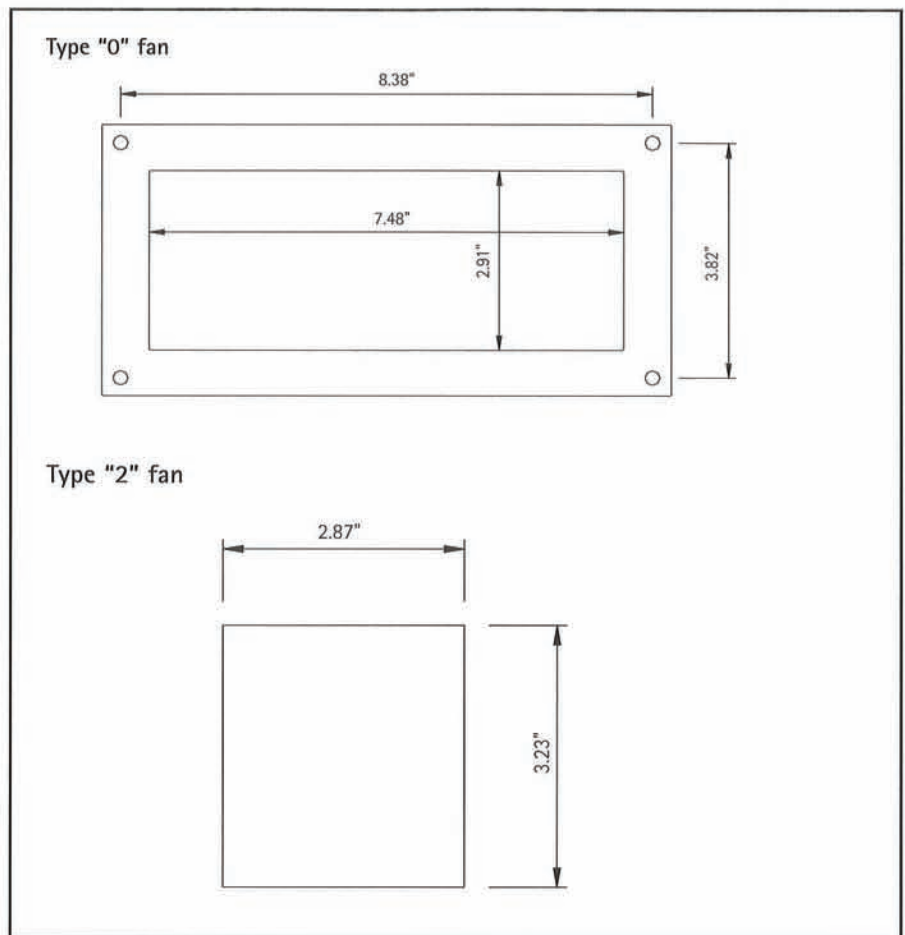
- a A conventional flue arrangement. (See figures 8d and 8e)
- b A telescopic through the wall flue. (See figure 8c)

Where a conventional flue is to be installed, Ambi-Rad provides an aluminum transition piece to which a 6" diameter flue should be attached.

The maximum length of flue which may be connected to the fan outlet must be calculated in accordance with the Ambi-Rad Herringbone design manual and must be adequately supported from the building structure.

Exhaust vents should be installed in accordance with the relevant ANSI and Local Codes. See ER Series owners manual.

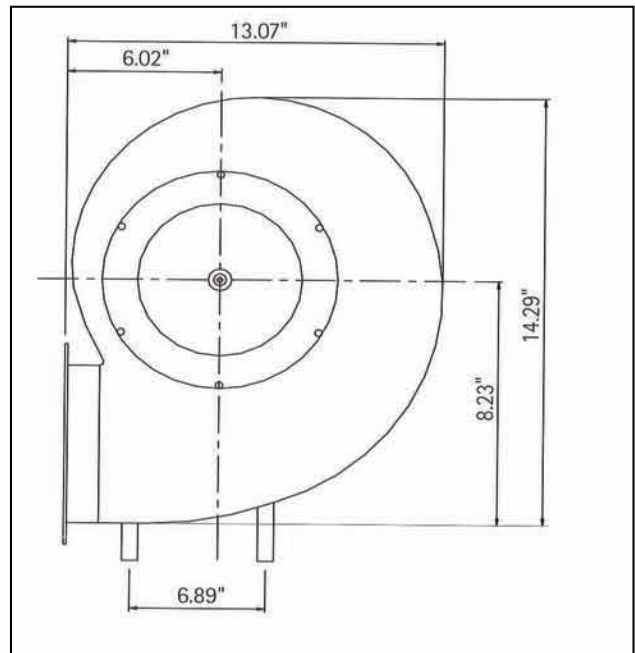
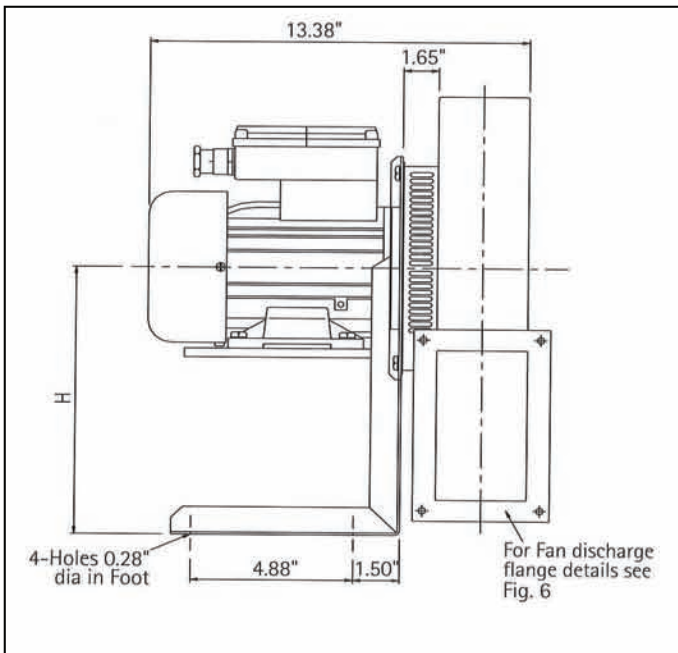
Figure 6 Dimensions of fan outlet



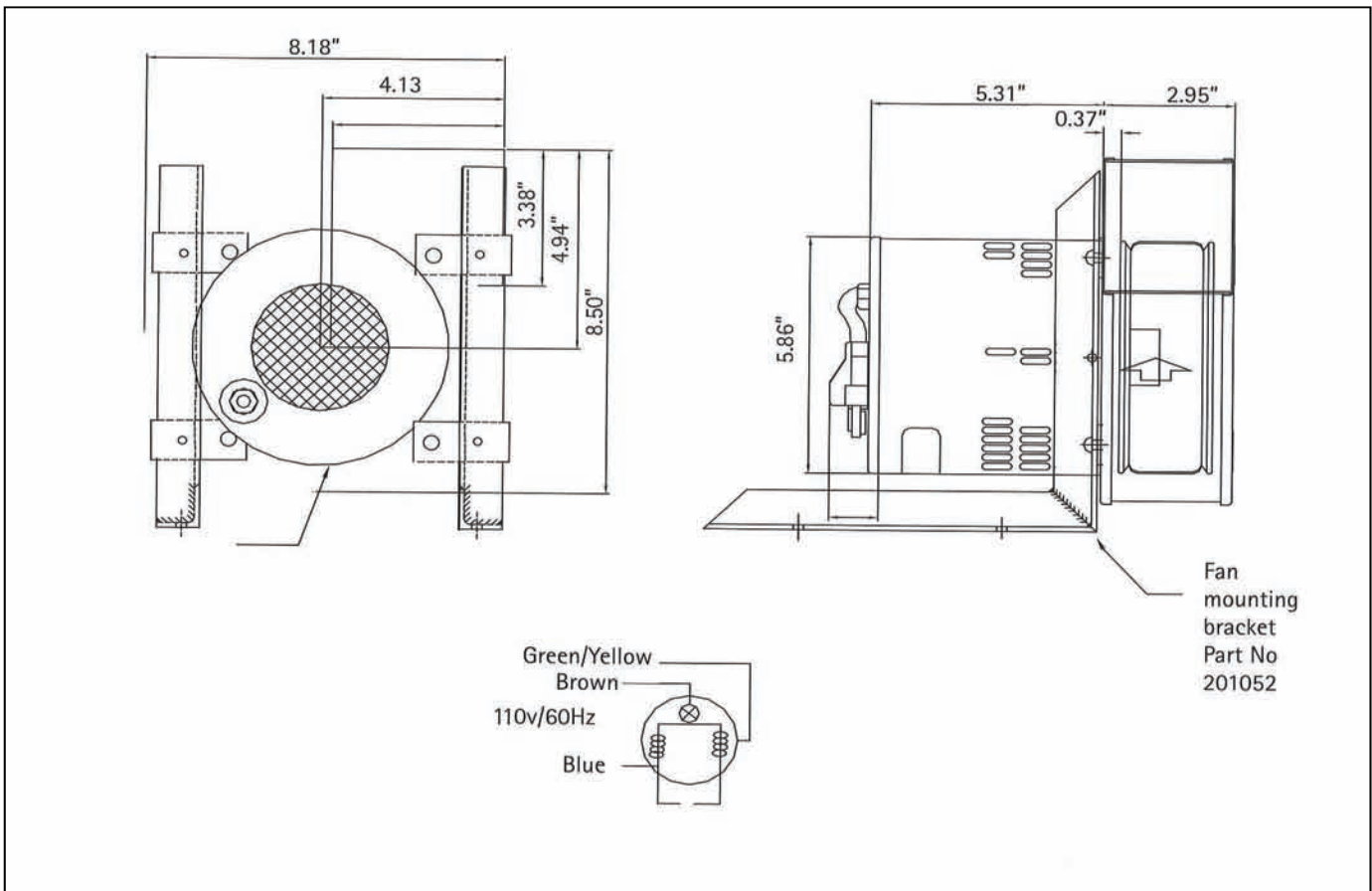
#### Do's and don'ts of Herringbone systems

Do's	Don't
Check design pressure drop.	Install system with extra 90° bends without asking Ambi-Rad if the system will operate correctly.
Check for corrosive industrial process in proposed building—eg. cleaning, electroplating, printers using sugar powder etc.	Run drains in copper pipe as it will corrode.
Drain all flue ducts and seal all joints.	Install flue going upwards without fitting a drain point at lowest level.
Secure joints with screws as well as sealing compound. (See figures 2 and 3)	Fit fan with outlet pointing vertically upwards or with top horizontal discharge.
Fit drain traps before and after fans where required. (See figure 8)	Fit damper assembly upside down, on its side or the wrong way round. (See figure 4)
Fit expansion joints before fan.	
Run drains in galvanized steel or plastic pipes.	
Follow guide to Combined Flue Heating System.	

Type "0" fan



Type "2" fan





Conventional fan to flue arrangements

Figure 8a High fan arrangement

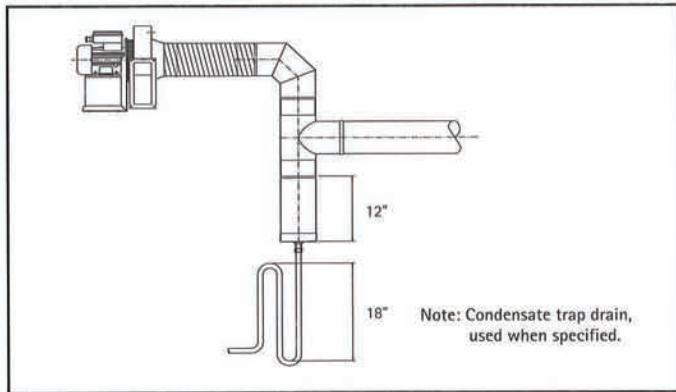


Figure 8d Conventional flue arrangement—roof vent

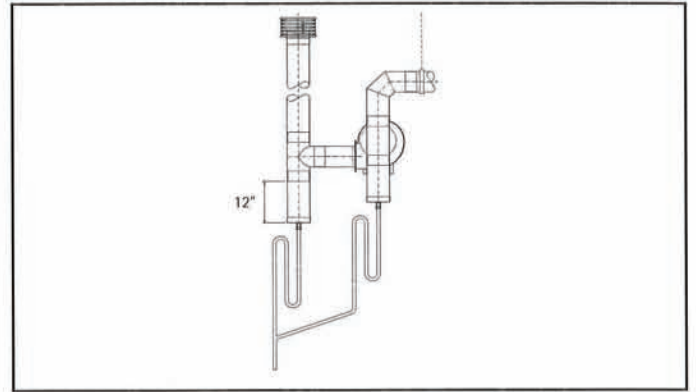


Figure 8b Low fan arrangement

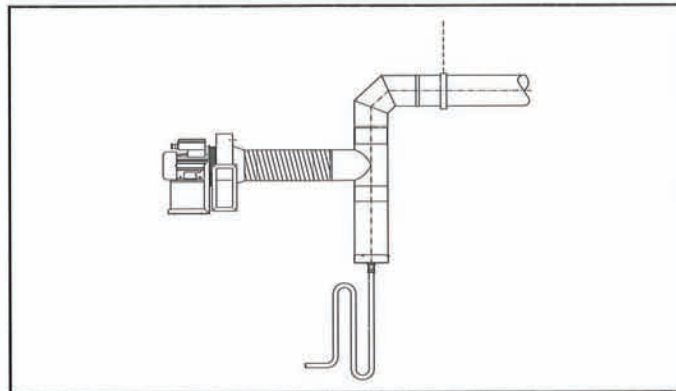


Figure 8e Conventional flue arrangement—wall vent

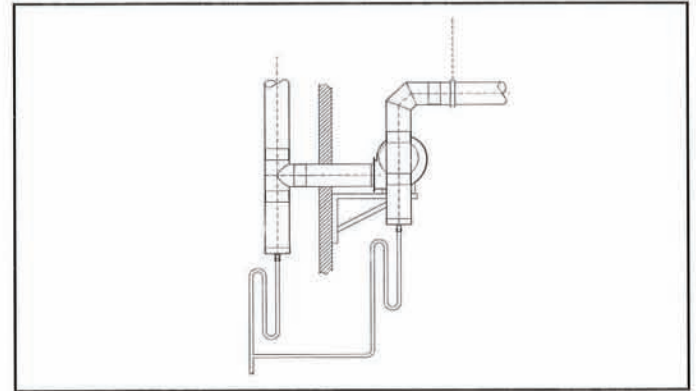


Figure 8c Stainless steel telescopic through the wall arrangement (available for Type '0' and Type '2' fans)

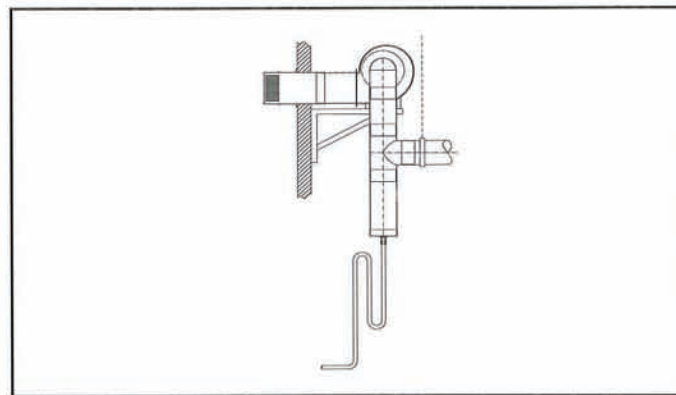
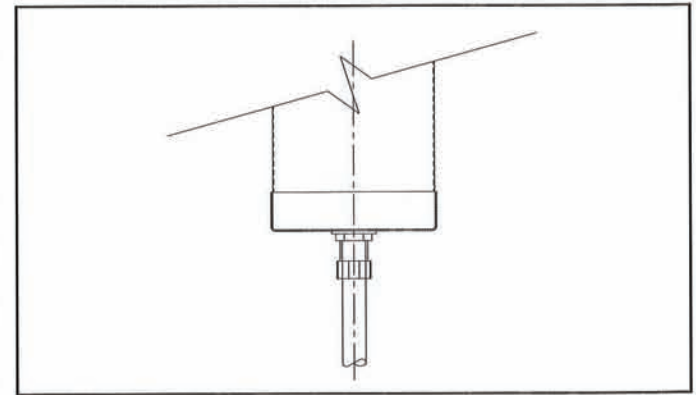


Figure 9 Collecting chamber arrangement



## 5 Commissioning

Inspect installation and ensure it has been carried out in accordance with these instructions.

Ensure that electrical and gas supplies are isolated.

The gas supply should be purged and tested for soundness in accordance with the standard Codes of Practice.

Ensure that the settings of any time switch and thermostats are such that the heating system will be required to operate (or put the mode switch to 'constant').

Before attempting to start up the heating system it is essential to perform the preliminary balancing of the vacuum level at each burner unit.

Isolate each heater unit by unplugging each electrical connector and closing each gas isolating valve.

### Damper settings

Cold setting 0.6"wc. Hot setting 0.42"wc.

Adjust the damper at the exit of each heater using a hexagon wrench in the locking screw. Observing the vacuum reading using a 'U' tube gauge connected to the vacuum test point (see figure 4) set each damper in turn to give a hot conditions reading as below.

### Referring to each unit

Open isolating valve and test gas connections for soundness using leak detecting solution. Remove the combustion chamber cover plate by unscrewing the fixing screws. Take care not to damage the sealing gasket. Inspect the burner and electrode assemblies ensuring these are securely fixed and all electrical connections securely made. Replace the cover plate ensuring that the sealing gasket is correctly positioned and the screws are fully tightened. The heater will not operate until this plate is refitted.

Remove the control housing cover by unscrewing the securing screws and lifting off the plate.

Ensure all internal components are securely fixed and all connections securely made.

To allow the heater to start up it is necessary to switch off the whole system at the time switch or manual switch and allow the fan to stop completely before switching on again. At this point the individual heater unit will start up with the following sequence.

The red mains on lamp will illuminate and the main fan will start to run. Safe-start checks are carried out automatically. After the fan has run up to full speed and a satisfactory vacuum condition has been established at the burner, a purge period of approximately 10 seconds will commence.

At the end of the purge period the ignition sequence will commence. The spark ignition will be energized producing a spark at the ignition electrode. The gas solenoid valve is energized and will open.

If ignition is successful the flame is detected by the flame sensing probe and the ignition spark is switched off. The amber burner on lamp indicates that the gas solenoid valve is energized.

If ignition is unsuccessful the gas valve is closed and the spark ignition de-energized. After three unsuccessful ignition attempts the electronic sequence controller will lock-out and the red mains on lamp only will remain illuminated. To reset this lock-out condition, switch off the power supply to the system, wait until the fan stops completely then restart it. If repeated lock-out occurs, investigate the cause.

*Note If an individual burner assembly unit is switched off and reconnected it cannot restart. The fan must stop running before the burner can be restarted.*

To shut down the heaters switch off the power supply to the system. Automatic control of the heating system is achieved through the control panel incorporated in the electrical supply. It is essential to allow a delay of 30 seconds after switching off heaters before attempting to restart the system.

If at any time after completion of the start up sequence loss of flame should occur, the electronic sequence controller will attempt to re-ignite a maximum of three times. If this is unsuccessful, heater lock-out will occur.

#### **To set the burner gas pressure**

Close gas valve. Ensure burner electrical supply is switched off. Unscrew the fixing screws of the control housing lid and remove pressure test point screw and connect a 'U' tube gauge to the pressure test point located

on the gas combination valve. Remove the cover at the pressure regulator to reveal the adjusting screw.

Open gas valve, switch on electrical supply to burner and start system.

Using a screwdriver, adjust the pressure regulator, turning the screw clockwise to increase the pressure or anti-clockwise to decrease the pressure. Set the burner pressure to the required figure given on the data label. Switch off the heater. Disconnect 'U' tube gauge and refit screw in pressure test point. Refit cover of pressure regulator. Replace cover plate on control housing and refit screws.

#### **Burner ignition**

To re-ignite heater, switch system off at control panel. Wait until fan stops completely and then restart system.

#### **Re-ignition**

Check the operation of the flame safeguard equipment as follows:

With the heater running normally switch off the gas supply at the appliance isolating valve. Observe that the burner on lamp extinguishes within 1 second. After a purge period of approximately 10 seconds the heater should attempt to re-light and if the gas isolating valves have been left off, lock-out should occur, indicated by power light only being illuminated and fan running.

#### **Vacuum proving switch**

Check the operation of the vacuum proving switch as follows:

With the heater running normally, switch off electricity. Pull off the silicone tube connecting the vacuum switch to the combustion chamber. Switch on electricity. Observe for at least 20 seconds that there is no attempt to re-ignite, switch off electricity and replace the silicone tube.

Replace the safety control housing lid and switch on electricity.

To re-ignite each heater in the system, the fan must stop running. Switch system off at the control panel. Wait until fan stops completely and then restart system.

Repeat the above procedure for each of the heater units in the heating system.

#### **Balancing system**

*Important When all the heaters have been commissioned as above, the vacuum settings must be finally balanced in the hot condition.*

*Start all burners up and allow them to run for at least 20 minutes. With the use of a 'U' tube manometer determine vacuum reading at the damper assembly on each heater. (See figure 4 for vacuum test point)*

*The damper should be readjusted and set at a hot condition reading as shown in figure 10 for the appropriate size heater and model.*

*It will be noted that the emitter has a tendency to bow when hot, this is normal and quite acceptable.*

## 6 Control system

The control system must be installed in accordance with the design specification.

### 6.1 Control panel design

Ambi-Rad control panels are available either as standard units to control single or multiple zones of heaters utilizing the Ambi-Rad Black Bulb radiant thermostat. Special control functions are available on request.

Herringbone control panels use the logic in figure 11 to operate in a safe and satisfactory manner.

### 6.2 Installation of control panel

To install the Ambi-Rad control panel remove the plastic plugs from the four holes in the back of the control box. Using these holes fix the box in a convenient position to a suitable plugged wall or solid structure with No. 10 gauge wood screws or 1/4" diameter bolts or set screws. Access to the holes may be gained from the inside of the box without the necessity of removing the wiring chassis. Make the electrical connections in accordance with figure 12a or 12b and cut holes in the removable gland plate provided in the box.

Figure 11 Logic sequence for Herringbone control panel

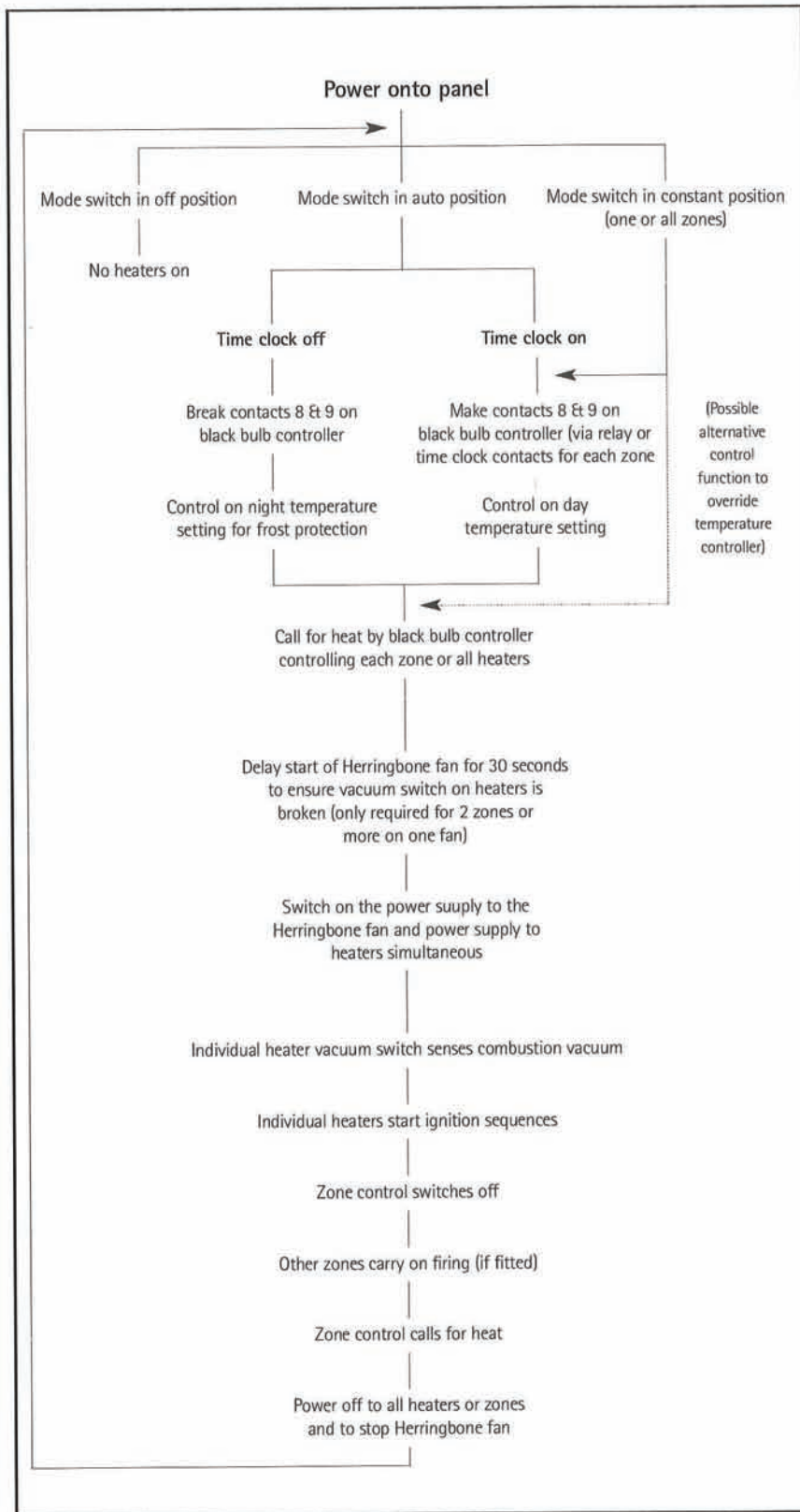


Figure 12a Single zone Herringbone control panel wiring diagram for Type '2' fan (single phase) incorporating the ARBB65 black bulb control thermostat

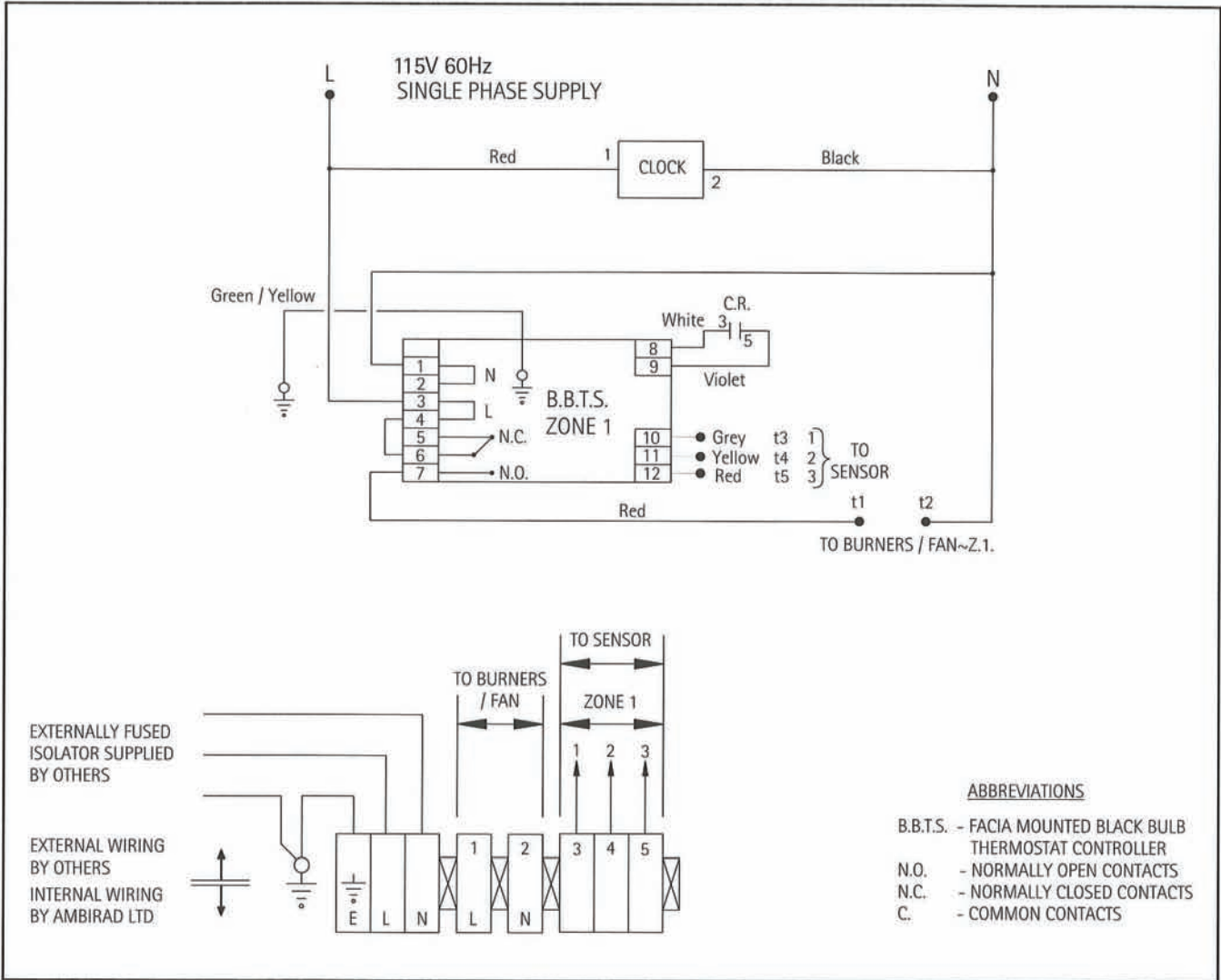
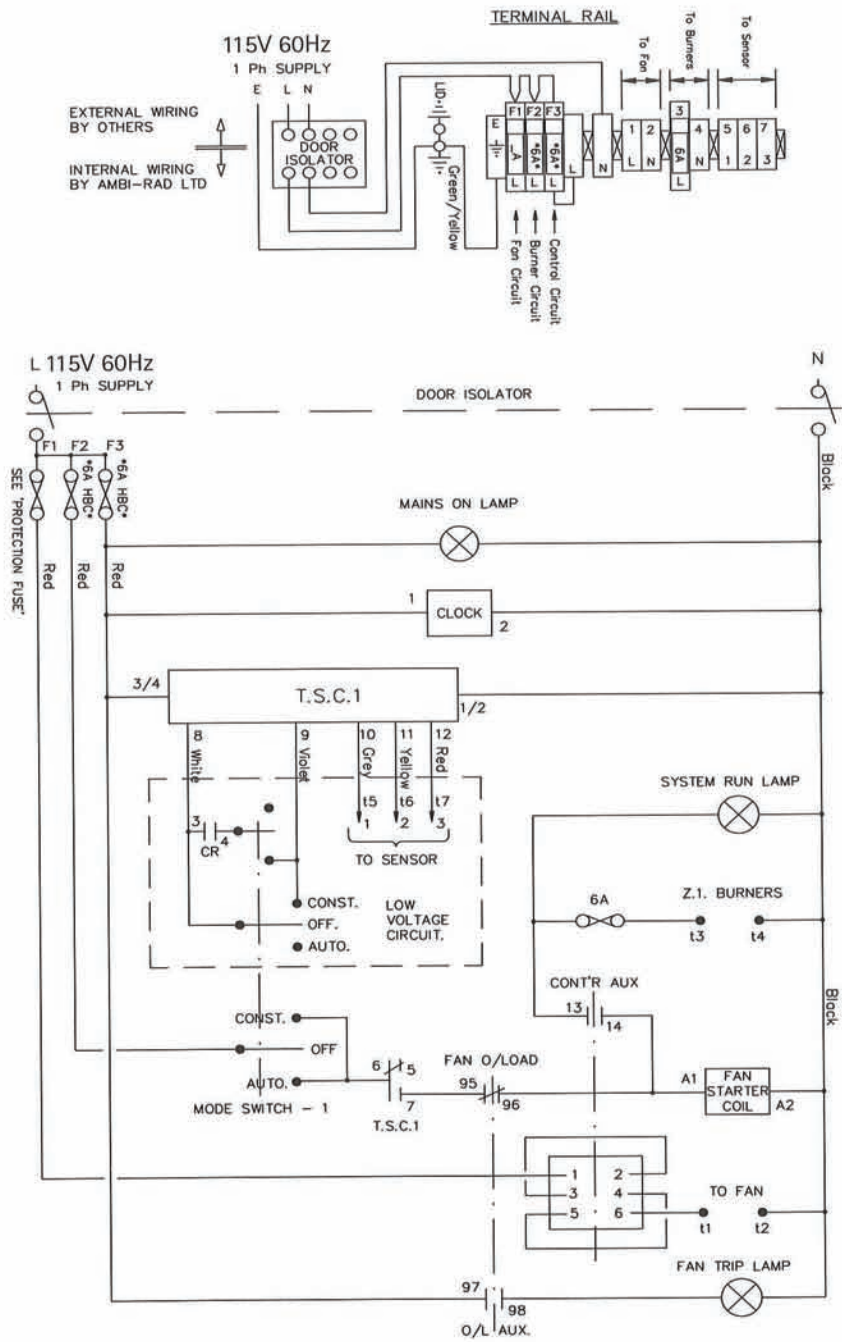


Figure 12b Wiring diagram for Type 'O' fan (single phase)



- KEY  
 T.S.C - ARBB 65 THERMOSTATIC CONTROLLER.  
 C.R. - CLOCK RELAY.  
 O/L - OVERLOAD

NOTES:  
 FUSE TO BE MOTOR RATED (EXCEPT WHERE STATED THUS '\*\*')

EQUAL OR ALTERNATIVE COMPONENTS CAN BE USED  
 SUBJECT TO CONSULTATION WITH AMBI-RAD.

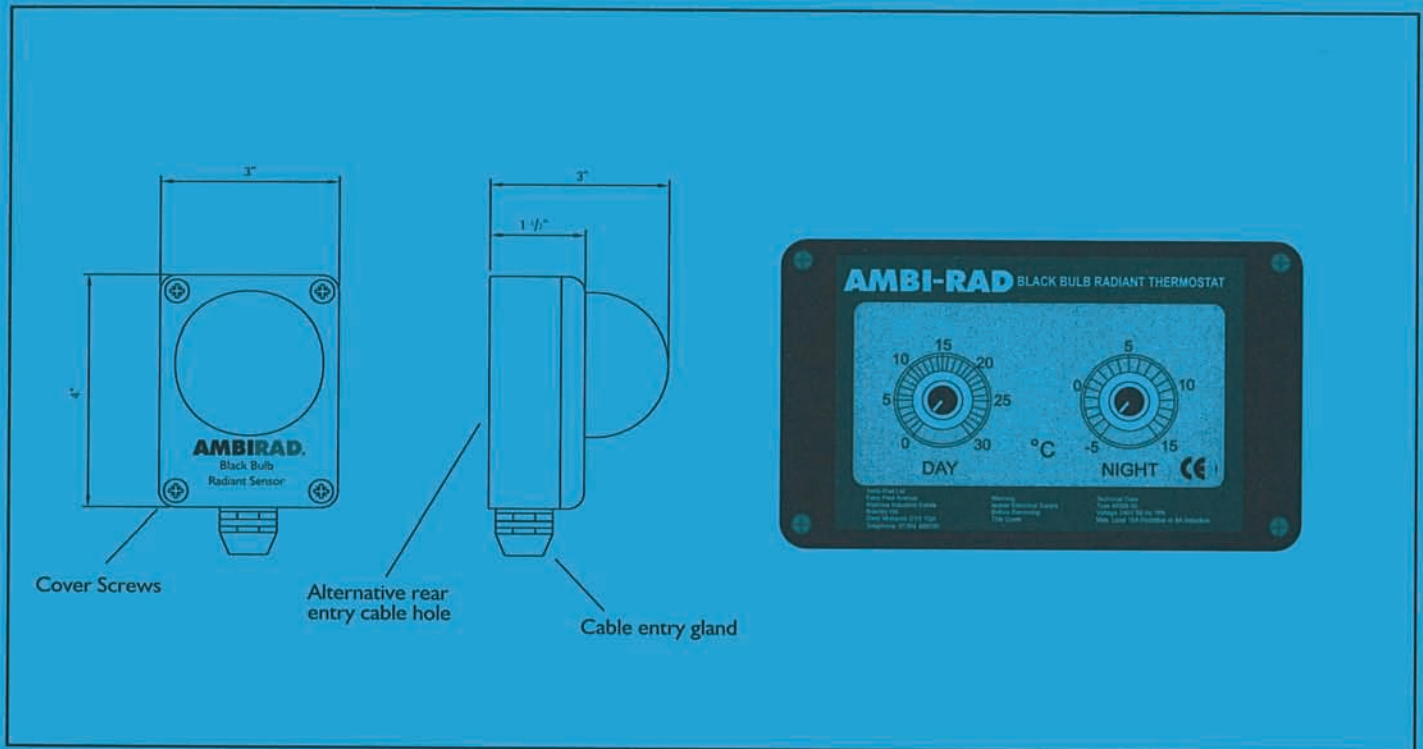
SYSTEM	FAN	RATING	RUN / START LOAD	PROTECTION FUSE F1
HERRINGBONE	TYPE O	1/3 h.p.	8.4A / 16.8A	15A

## Vacuum fan characteristics

Fan type		'0'	'2**
Power	watts	550	120
Running current (overload rating)	amps	3.8	0.8
Phase		Single	Single
Voltage		115	115

\* Overload not required

Figure 13 Black Bulb Sensor and Controller



### 6.3 Instructions for fixing sensor unit

- A position should be selected 5' from the floor where the sensor will be free from undue drafts and if necessary between 12' to 15' from the heaters to be controlled. Avoid placing the sensor where it will be in an area shadowed from radiant heat (behind racking etc.).
- Remove the cover of the sensor unit by undoing the four screws.
- Fix the base to the wall with two screws.
- Connect the sensor using a three core cable of not less than 18 ga. Maximum length of cable is 500' if 18 ga. is used. Secure wires in the cable gland provided (alternative rear cable entry available, replace gland and seal with grommet if rear entry used).

- Wire sensor to controller in accordance with wiring diagram. (See section 6)
- Refit the sensor to the base.

### 6.4 Fan starter overload

The red reset button on the fan starter is used only to restart the fan should it cut out due to overload or malfunction. Should repeated lock-out occur then a qualified electrician should be consulted.

## 7 Service instructions

It is recommended that the Ambi-Rad heater has a routine service once per year. In exceptionally dirty or dusty conditions, more frequent servicing may be desirable. Servicing work should be carried out by a qualified gas servicing engineer.

For heater routine service, trouble shooting checklist and spares list, please refer to the ER Series Installation Manual.



Ambi-Rad Limited  
P O box 617  
Fishers  
IN 46038  
Telephone (888) 330-4878  
Fax (317) 842-3989  
Website [www.ambi-radusa.com](http://www.ambi-radusa.com)

**AMBIRAD** is the registered trademark of Ambi-Rad Limited.

Due to continuous product innovation, Ambi-Rad reserves the right to change product specification without due notice.

Document reference number US/HB/13/0105

**AMBIRAD**  
ENERGY EFFICIENT HEATING SYSTEMS