

AMBIRAD

ENERGY EFFICIENT HEATING SYSTEMS

HERRINGBONE

HB COMBINED
FLUE SYSTEM



An Ambi-Rad Group company

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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 aluminium manifold system, which in turn is coupled to one hot gas 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 i.e AR or Optima Series.

Please refer to the design manual 042/93 to ensure correct manifold design.

The following appliances are tested and certified by an accredited test house for use on natural gas and propane:

AR Series BG/EC – 87/95/214

Optima BG/EC – 87/95/308

The system is controlled via an Ambi-Rad black bulb thermostat whose controller is housed in a lockable cabinet with fan starter for Type '0' fan only and time switch.

The Ambi-Rad Herringbone HB combined manifold system layout should be designed to be as compact as possible with the final connection to the hot gas vacuum fan approximately central in the manifold system. Please refer to document Ambi-Rad Herringbone design manual 042/93.

The manifold system should be arranged to fall slightly in the direction of the hot gas 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 British Standard Code of Practice – Flues for Gas Appliances, Local and Ministry Authorities and Building Regulations. Alternatively, a telescopic through the wall discharge duct is available for either Type '0', or Type '2' fan (available from Ambi-Rad).

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 hot gas vacuum fan design criteria.

1.1 Standards

The Ambi-Rad heater must be installed in accordance with the relevant provisions of the Gas Safety (Installations and Use) Regulations 1984 (as amended). Due account should also be taken of any obligations arising from the Health and Safety at Works etc. Act 1974. In addition the installation must be carried out in accordance with the current I.E.E. Regulations. The Building (Standards) (Scotland) Consolidation Regulations, the requirements of BS 5440:Part 1:1990, BS 6891:1998, BS 6896:1991 and any other relevant British Standards and Codes of Practice.

1.2 Ventilation requirements

Permanent ventilation is required as follows:

Natural ventilation (preferably at low level)

Up to and including 60kW - 4.5cm²/kW,
over 60kW - 270cm² + 2.25cm²/kW
in excess of 60kW total input.

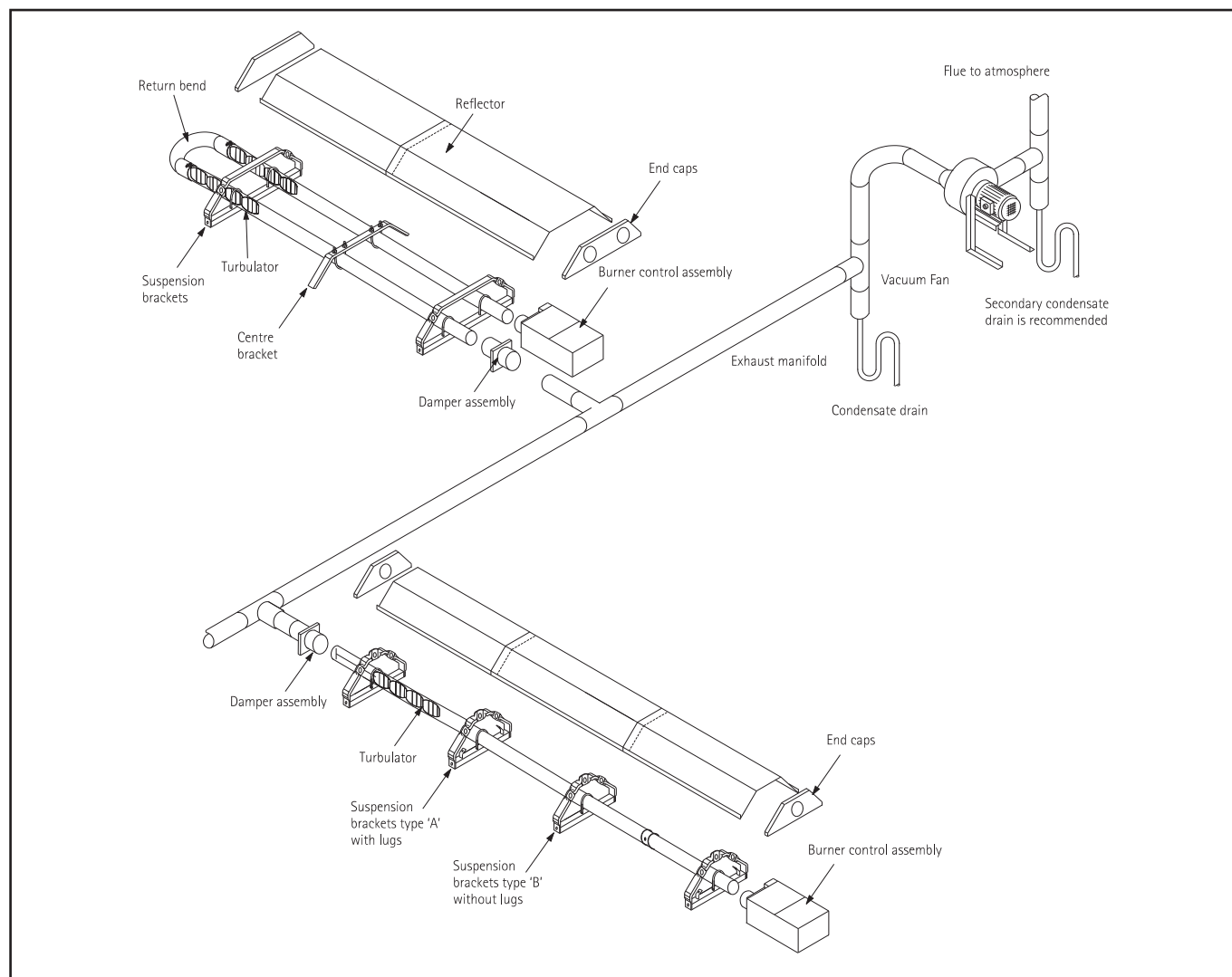
Forced ventilation

Minimum proven air flow –
2.35m³/h per kW of total rated input.

For detailed information please refer to Ambi-Rad design manual and/or BS 6896:1991, Installation of Gas Fired Overhead Radiant Heaters for Industrial and Commercial Heating.

2 Instructions and installation

Figure 1 Typical Herringbone heating arrangement using AR22HB and HB22AR heaters



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 75mm (3in) of penetration of the fitting 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 aluminium tube

Using the applicator gun exude 4mm diameter 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)

Enter the fitting into the tube using a slight rotating movement to spread the jointing compound uniformly until a penetration of 75mm (3in) 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 pop rivets at 12 o'clock, 4 o'clock and 8 o'clock positions. 3-5mm ($\frac{3}{16}$ in) diameter pop rivets are recommended. (See figure 3)

3.2 Damper assembly

The damper assembly secured to the outlet end of the heater unit must be located with its damper blade vertical and left in the closed position. 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

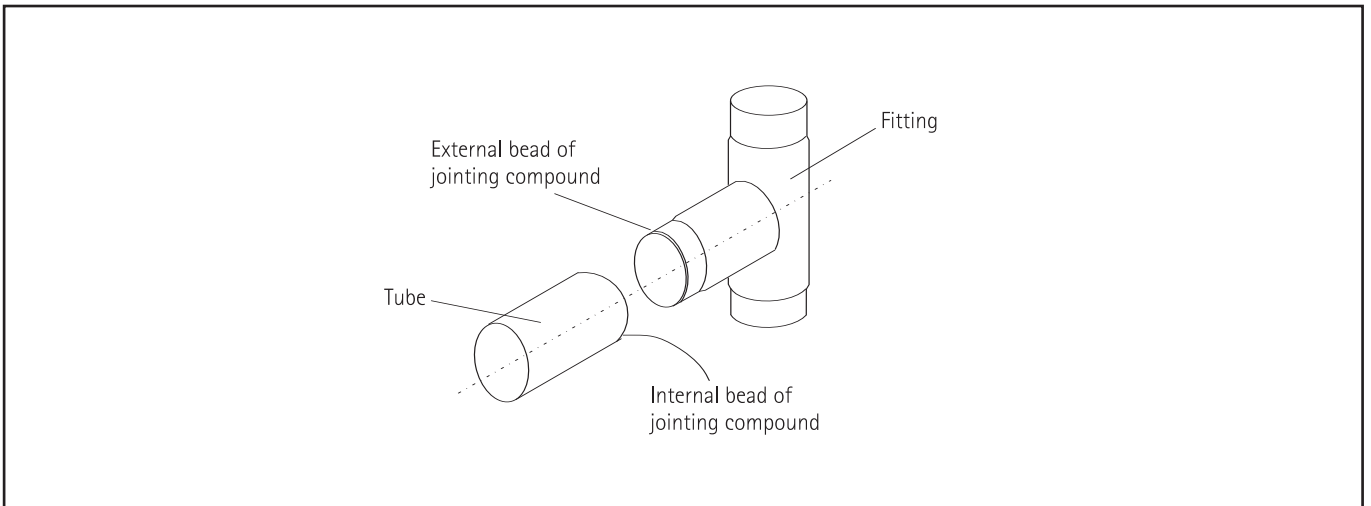


Figure 3

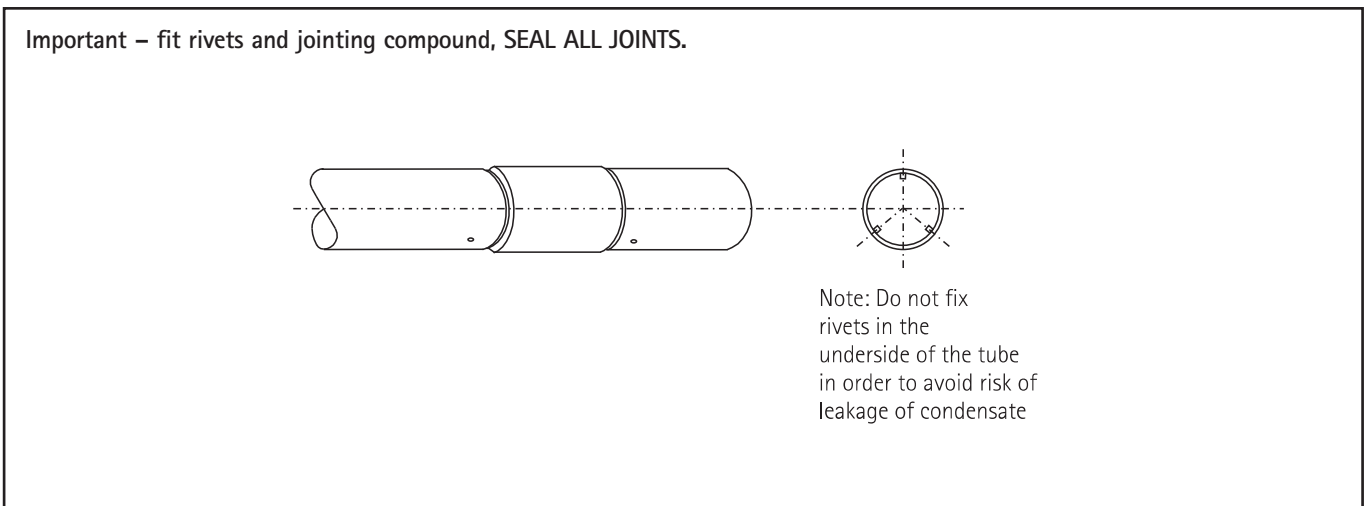
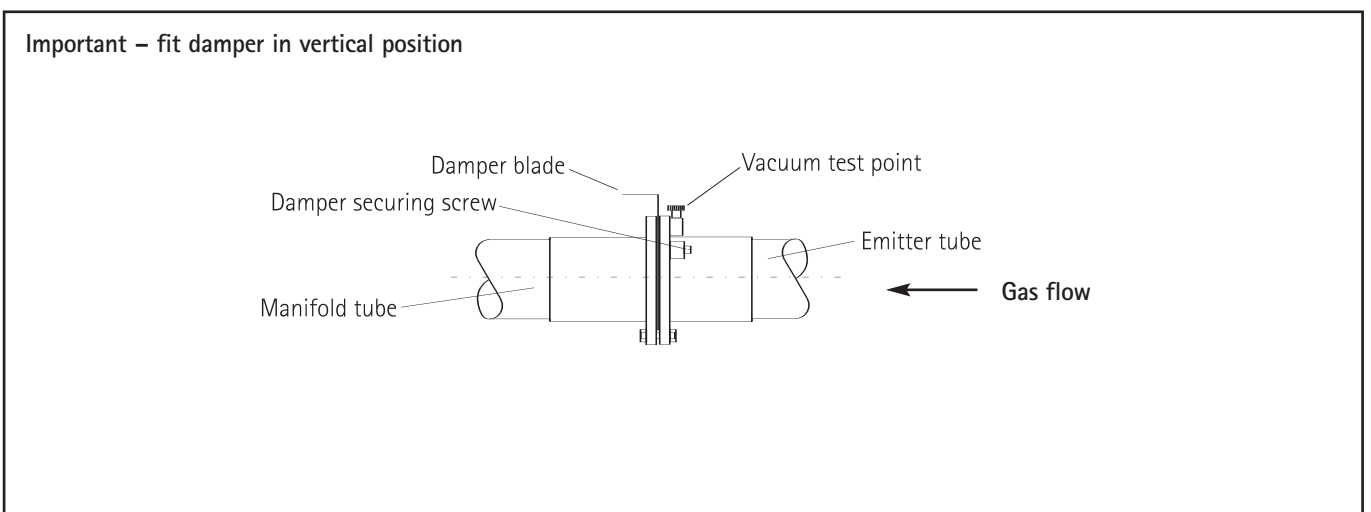


Figure 4



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 centres see figure 5.

Flexible couplers (supplied by Ambi-Rad) must be inserted within the manifold system to allow linear expansion to take place and prevent stress and strain on the system.

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 centre of the emitter tube. For typical wall mounting bracket arrangement see AR installation manual (GB/ARE(E)079/0501).

3.4 Condensate trap

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

The minimum depth of the condensate collecting chamber shall be 305mm (12in) and the minimum depth of the condensate drain pipe 'U' trap shall be 457mm (18in) 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 in position.

All condensate drains from the flue collecting chamber to the disposal point shall be corrosion-resistant material of not less than 22mm internal diameter. Copper or

copper based alloy shall not be used for condensation drains. See reference BS 6896:1991. Condensate drain pipes must be protected against the effects of freezing.

Figure 5

Manifold pipe size (mm)	Maximum distance between supports (m)
100	2.4
150	3.0

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 support stool 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.

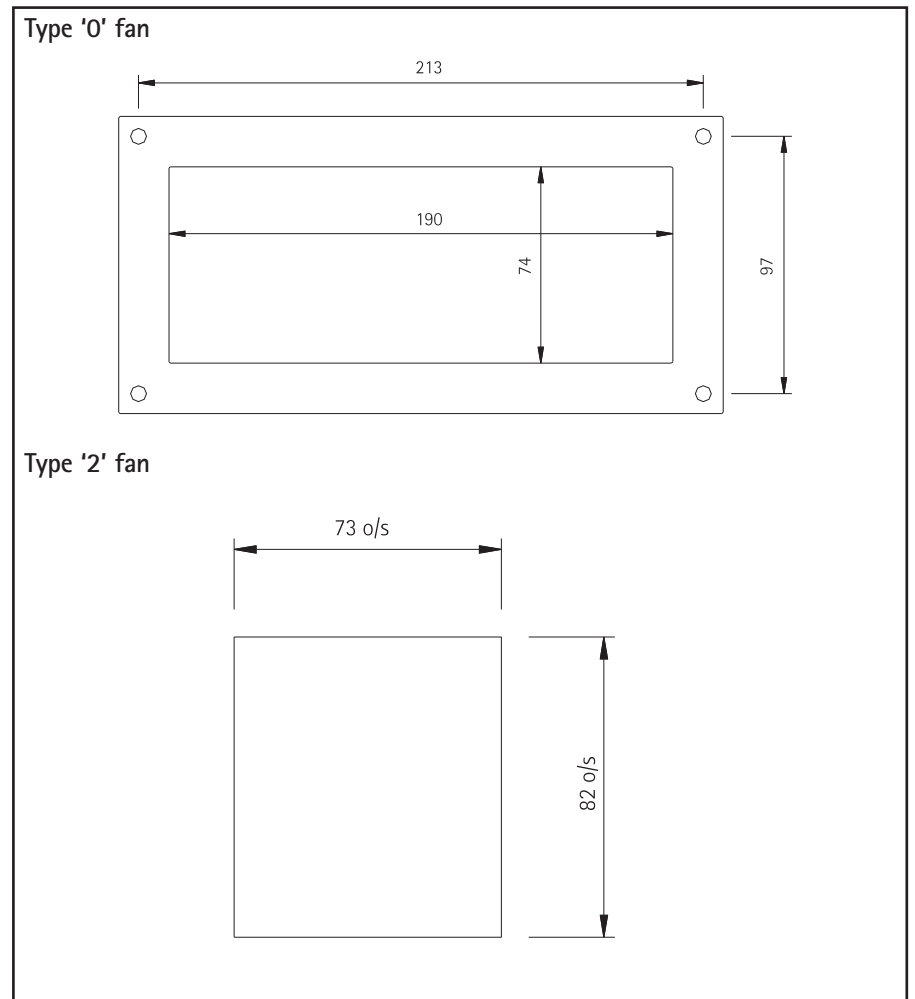
- a A conventional flue arrangement. (See figures 8d and 8e)
- b A telescopic through the wall flue. (See figure 8c)

Where a conventional flue is to be installed, Ambi-Rad supply an aluminium transformation piece to which a 150mm (6in) 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 (Ref 042/93) and must be adequately supported from the building structure.

Exhaust flues should be installed in accordance with the British Standard Code of Practice BS 5440: Part 1:1990 – Flues for Gas Appliances, I.E.E. Regulations, Local Ministry Authorities and Building Regulations.

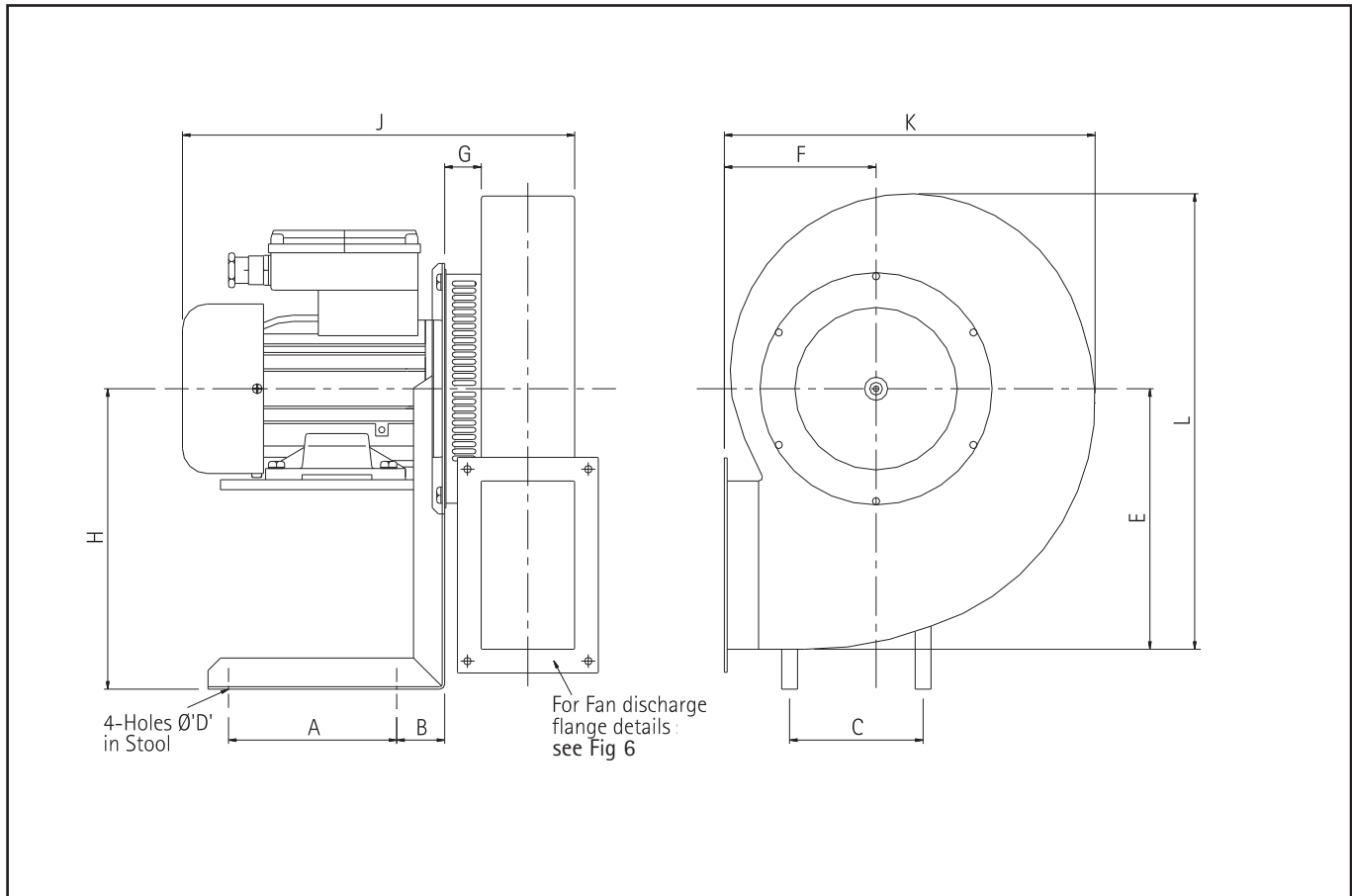
Figure 6 Dimensions of fan outlet – Type '0' fan



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 pop rivets 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. (See figure 8)	Fit damper assembly upside down, on its side or the wrong way round. (See figure 4)
Fit expansion joints before fan and at intermediate points on the Herringbone system.	
Run drains in galvanised steel or plastic pipes.	
Follow guide to Combined Flue Heating System.	

Figure 7 Vacuum fan mounting details



Fan type	'0'	'2'
A	124	80
B	38	35
C	175	174
D	7.1	7
E	209	125
F	153	100
G	42	25
H	239	120
J	340	210
K	332	205
L	363	215

All dimensions are in millimetres.

Conventional fan to flue arrangements

Figure 8a High fan arrangement

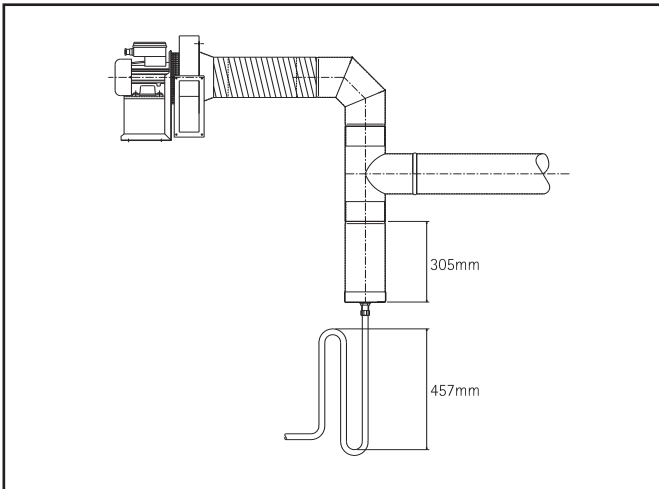


Figure 8d Conventional flue arrangement - roof exit

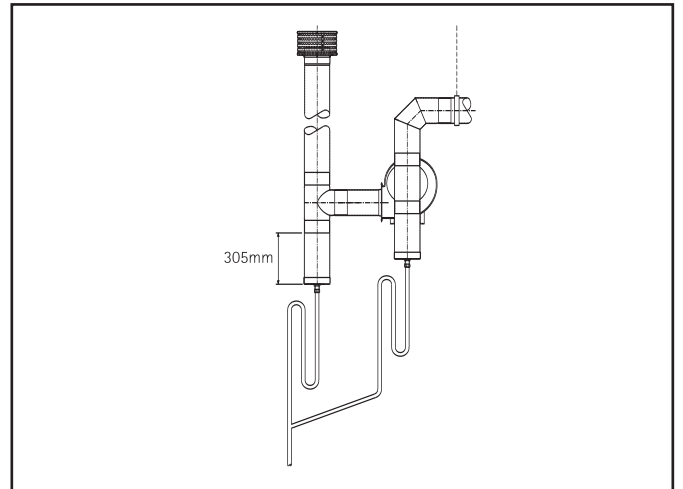


Figure 8b Low fan arrangement

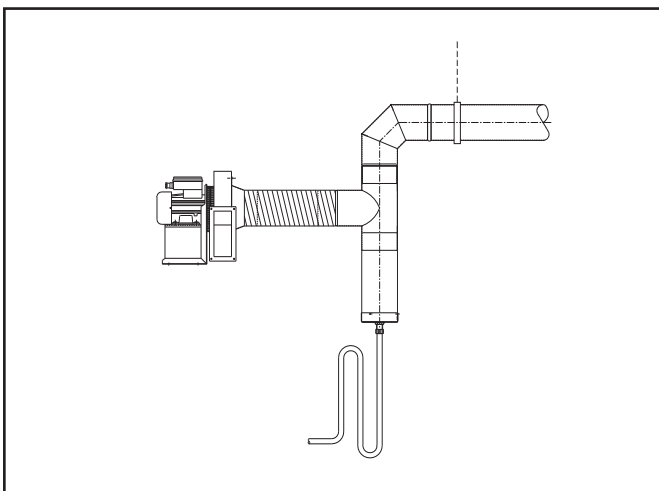


Figure 8e Conventional flue arrangement - wall exit

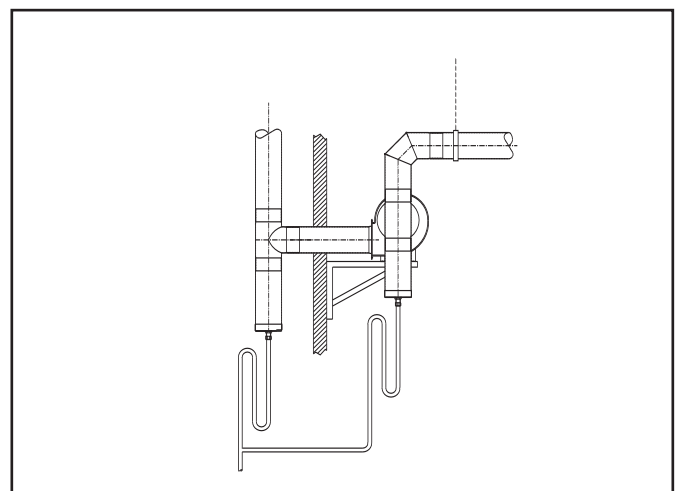


Figure 8c Stainless steel telescopic through the wall arrangement (available for Type '0' and Type '2' fans)

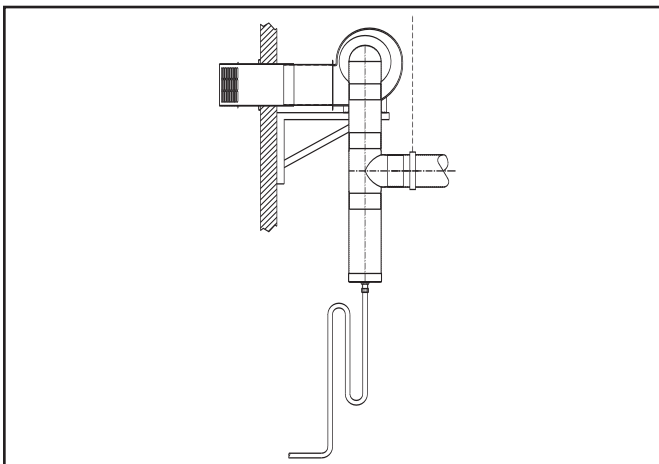
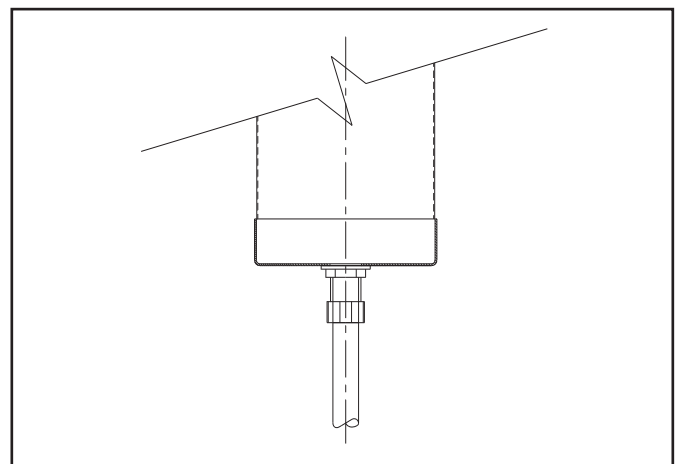


Figure 9 Collecting chamber arrangement



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 British Standard BS 6891:1998, BS 7671:1992, IGE/UP/2 and any other British Standards and Codes of Practice.

Ensure that the settings of any time switch and thermostat 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.

Adjust the damper at exit of each heater using a 4mm hexagon wrench in the M8 locking screw. Observing the vacuum reading using a 'U' tube manometer 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 safety control housing cover plate by unscrewing the securing screws and folding down/lifting off the plate.

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

Reinsert the electrical connector to the burner control assembly.

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 9 seconds will commence.

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

Figure 10 Damper settings

Heater type	Damper setting when hot (mbar)	Heater type	Damper setting when hot (mbar)
AR13SHN/22	1.7	ARE13SHN/22	1.1
AR13SHP/22	1.7	ARE13SHP/22	1.1
AR22SHN/27	1.4	ARE22SHN/27	1.1
AR22SHP/27	1.4	ARE22SHP/27	1.1
AR22SHN/32	1.4	ARE22SHN/32	1.1
AR22SHP/32	1.4	ARE22SHP/32	1.1
AR22SHN/36	1.4	ARE22SHN/36	1.1
AR22SHP/36	1.4	ARE22SHP/36	1.1
AR22SHN/39	1.4	ARE22SHN/39	1.1
AR22SHP/39	1.4	ARE22SHP/39	1.1
AR35SHN/33	1.5	ARE35SHN/33	1.2
AR35SHP/33	1.5	ARE35SHP/33	1.2
AR35SHN/42	1.2	ARE35SHN/42	1.0
AR35SHP/42	1.7	ARE35SHP/42	1.0
AR35SHN/51	1.0	ARE35SHN/51	1.0
AR35SHP/51	1.5	ARE35SHP/51	1.0
AR40SHN/42	1.6	ARE40SHN/42	1.4
AR40SHP/42	1.4	ARE40SHP/42	1.4
AR45SHN/50	1.9	ARE45SHN/50	1.6
AR45SHP/50	2.0	ARE45SHP/50	1.6
AR45SHN/60	2.0	ARE45SHN/60	1.9
AR45SHP/60	2.3	ARE45SHP/60	1.6
AR50SHN/50	1.9	ARE50SHN/50	1.8
AR50SHP/50	2.0	ARE50SHP/50	2.3
AR50SHN/60	2.0	ARE50SHN/60	1.8
AR50SHP/60	2.3	ARE50SHP/60	2.3

N & P refer to natural gas or propane respectively.

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 energised.

If ignition is unsuccessful the gas valve is closed and the spark ignition de-energised after approximately 4 seconds. After unsuccessful ignition attempt the electronic sequence controller will lock-out the red **mains on** lamp only will remain illuminated. To reset this lock-out condition, switch 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 lockable control panel, incorporated in the electrical supply, which may contain a time switch, black bulb controller with day and night settings, a 3 position mode switch giving constant on/off auto control and fan starter. 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. If this is unsuccessful, heater lock-out will occur.

To set the burner gas pressure

Close gas valve. Unplug mains input connector to heater. Unscrew the fixing screws of the safety control housing lid and remove pressure test point screw and connect a 'U' tube manometer to the pressure test nipple located on the combination valve. Remove the cover from the pressure regulator to reveal the adjusting screw.

Replace mains input connector, open gas valve and start system.

Using a suitable 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 by pulling out the mains connector. Disconnect 'U' tube manometer and refit screw in pressure test nipple. Refit cover of pressure regulator. Replace cover plate on safety 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 9 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, pull out the mains input connector. Pull off the silicone tube connecting the vacuum switch to the combustion chamber. Observe for at least 20 seconds that there is no attempt to re-ignite. Then replace the silicone tube.

Replace the safety control housing lid and reconnect the mains input connector.

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 utilising 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 9mm diameter 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 6mm 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. Conduit or strain relief glands should be used.

Figure 11 Logic sequence for Herringbone control panel

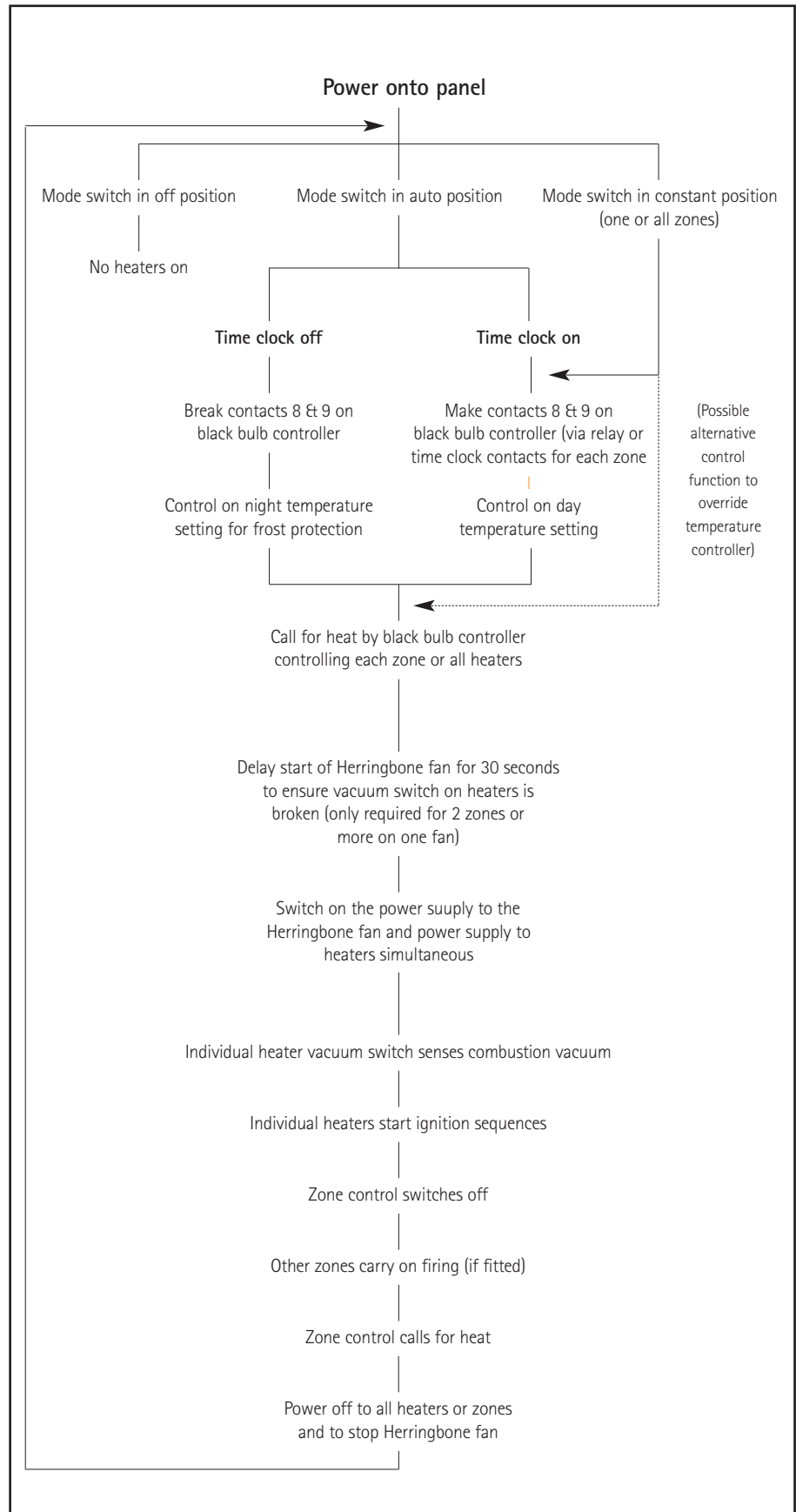


Figure 12a Single zone Herringbone control panel wiring diagram for Type '2' fan (single phase) incorporating the ARBB65 black bulb control thermostat

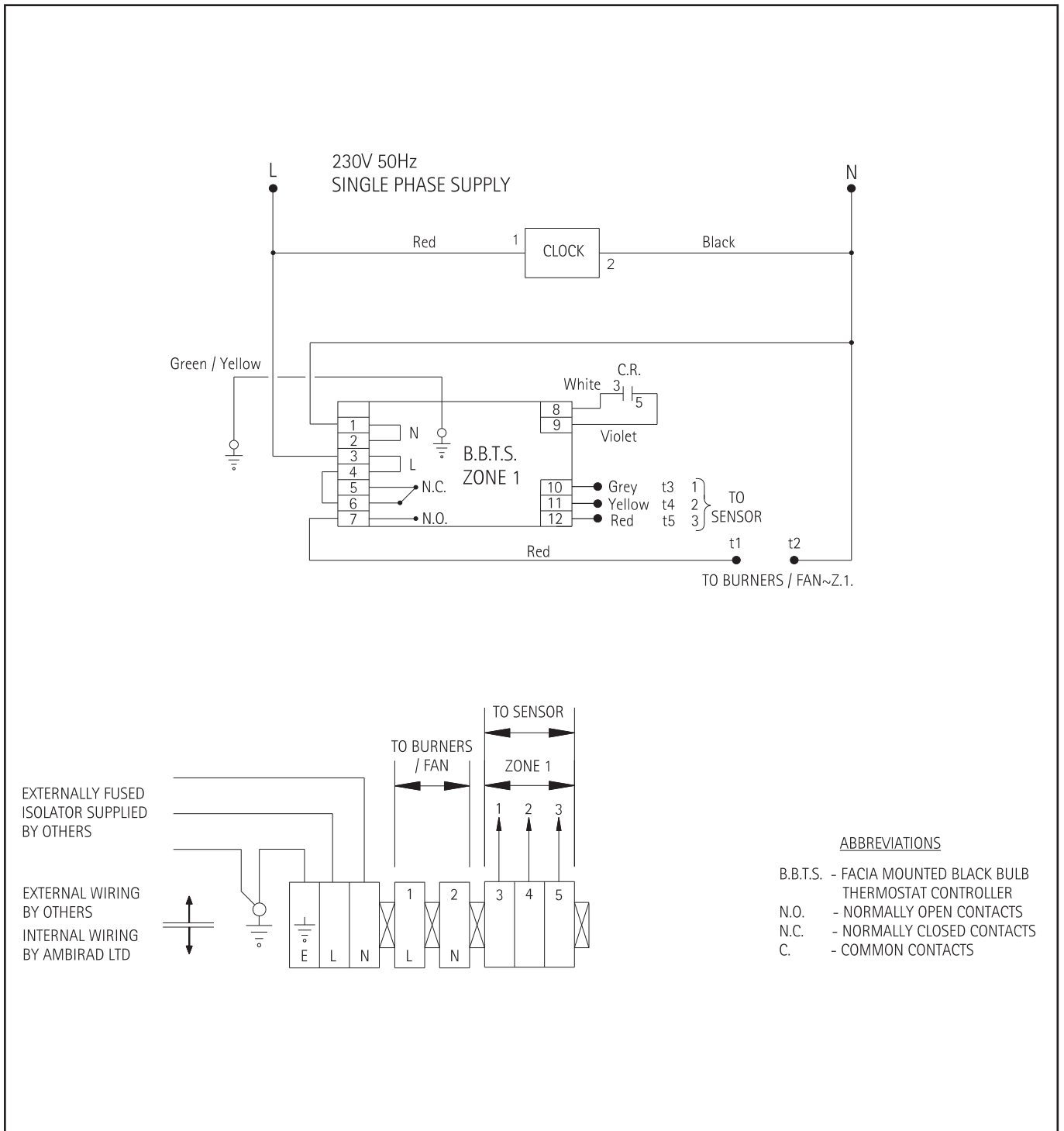
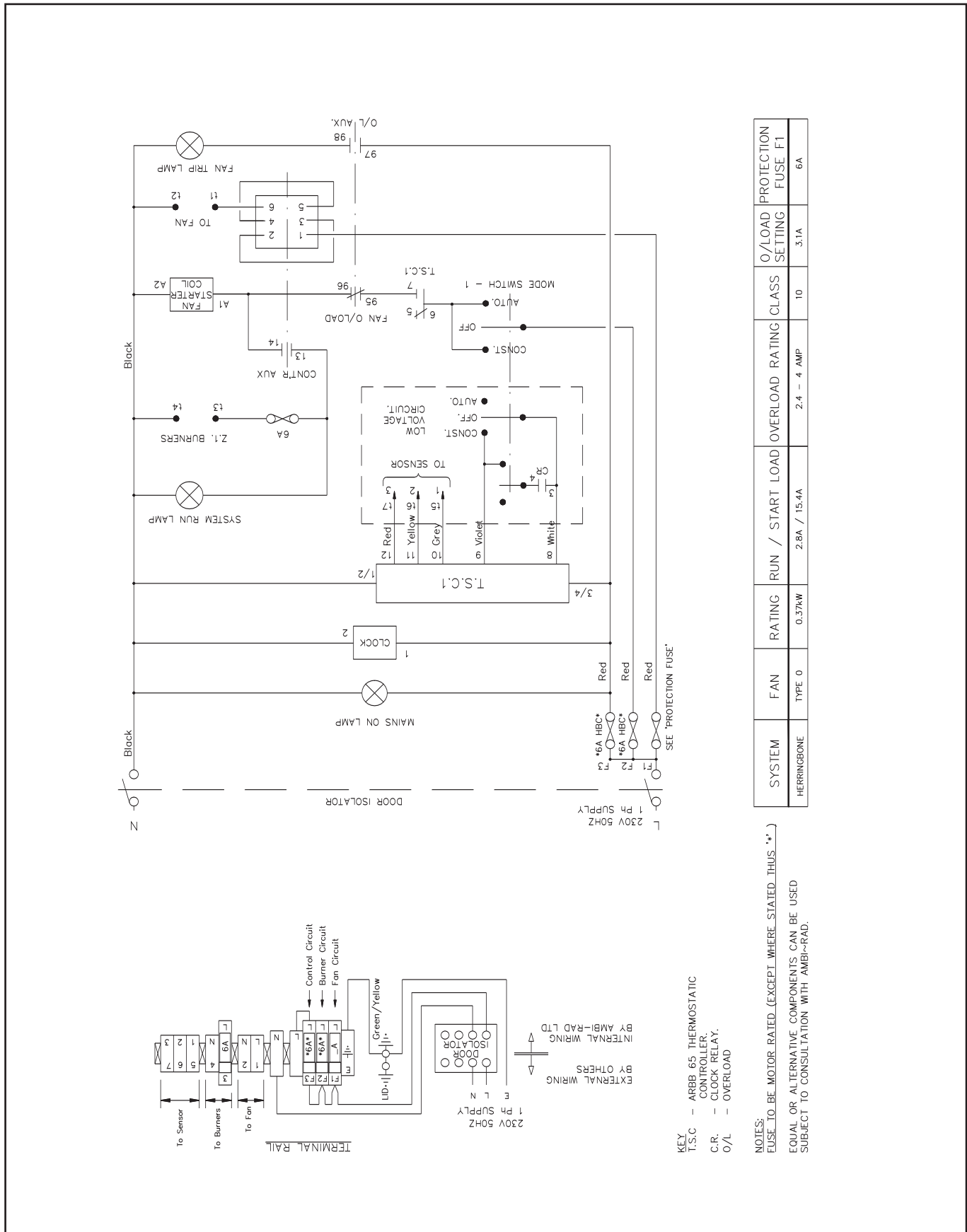


Figure 12b Wiring diagram for Type 'O' fan (single phase)

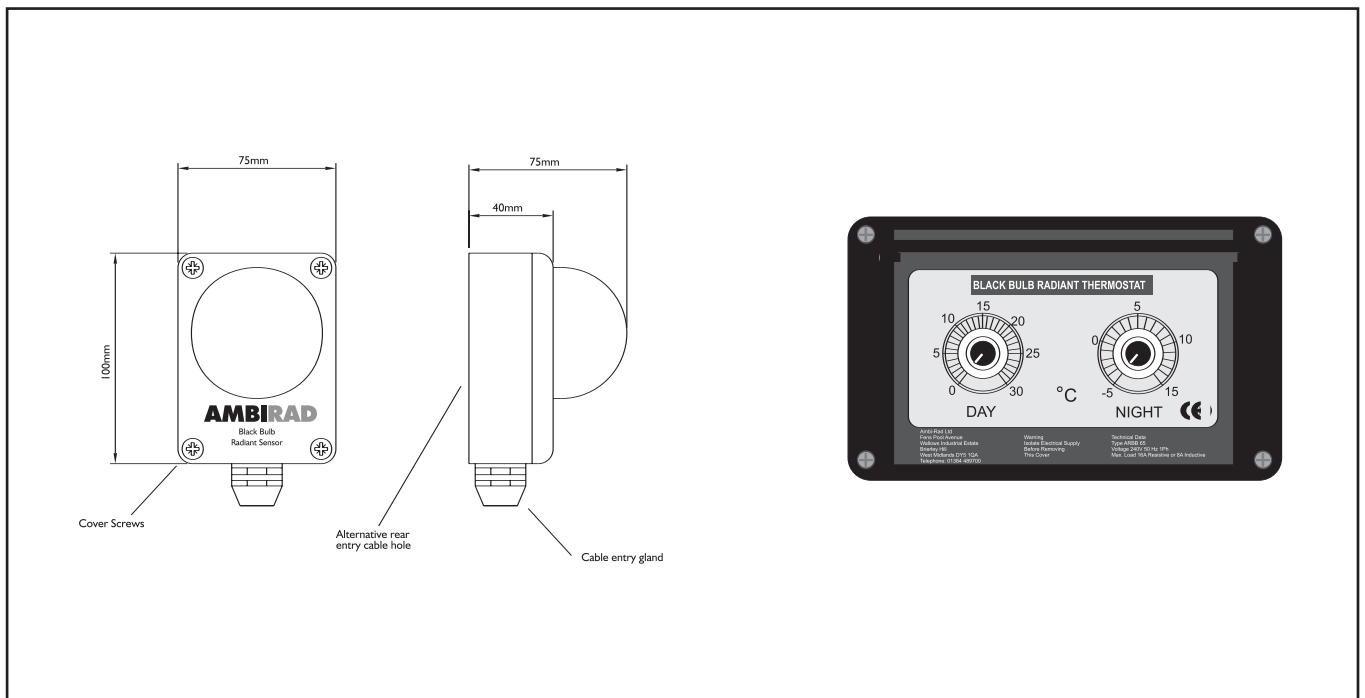


Vacuum fan characteristics

Fan type		'0'	'2'*
Power	watts	550	120
Running current (overload rating)	amps	3.8	0.8
Phase		Single	Single
Voltage		240	240

* Overload not required.

Figure 13 Black bulb sensor and controller



6.3 Instructions for fixing sensor unit

- a A position should be selected 1.5m from the floor where the sensor will be free from undue draughts and if necessary between 4 and 5m from one of the heaters to be controlled. Avoid placing the sensor where it will be in an area shadowed from radiant heat (behind racking etc).
- b Remove the cover of the sensor unit by undoing the four screws.
- c Fix the base to the wall with two screws.
- d Connect the sensor using a three core cable of not less than 0.5mm². Maximum length of cable is 200m if 0.5mm² is used. Secure wires in the cable gland provided (alternative rear cable entry available – remove gland and seal with grommet if rear entry used).
- e Wire sensor to controller in accordance with wiring diagram. (See section 6)

f 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

Under normal working conditions, 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 AR/ARE or Optima Installation Manual.



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