

Benson Heating
HEAT EXCHANGE MODULE RANGE
Installation Operation & Servicing Manual

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Any reference made to Laws, Standards, Directives , Codes of Practice or other recommendations governing the application and installation of heating appliances and which may be referred to in Brochures, Specifications, Quotations, and Installation, Operation and Maintenance manuals is done so for information and guidance purposes only and should only be considered valid at the time of the publication. Benson Heating cannot be held responsible from any matters arising from the revision to or introduction of new Laws, Standards, Directives, Codes of Practice or other recommendations.

1,0 Introduction

The Exchange Module range of gas fired process EM units are manufactured by Benson Heating within a strictly controlled quality environment within the parameters of ISO 9001.

Benson Heating has taken reasonable and practical steps to ensure that their Exchange Modules are safe and without risk when properly used. These appliances should therefore only be used in the manner and for the purpose for which they were intended, and in accordance with the recommendations detailed herewith. The EM units have been designed, manufactured, assembled, inspected, and tested, with safety and quality in mind, there are certain basic precautions which the installer and user should be aware of, and they are strongly advised to read all the information accompanying the appliance, prior to installation or use.

It is the responsibility of the installer, owner, user, or hirer, of such products supplied by Benson Heating, to ensure that they are familiar with the appropriate information/manuals, supplied by the manufacturer, and that they are suitably aware of the purpose of the manuals and the safety instructions. In addition, operators must be suitably trained in the use of the appliance so as to ensure its continued safe and efficient use.

Benson Heating has a commitment to continuous improvement, and reserves the right to amend or change the specification of the Exchange Module range. Whilst the manufacturer has made every effort to ensure that the information and data accompanying the unit is accurate and up to date, the manufacturer cannot accept liability for any inadvertent errors or omissions.

Contained within the text of the manual, the words '**Caution**' and '**Warning**' are used to highlight certain points.

Caution is used when failure to heed or implement the instruction(s) can lead to premature failure or damage to the appliance or its component parts.

Warning is used when failure to heed or implement the instruction(s) can lead to not only component damage, but also to a hazardous situation being created where there is a risk of personal injury.

1,1 General product information

The EM range of indirect gas fired forced convection process EM units has an output

range from 60kW to 700kW, and are suitable for use with natural gas.

The EM units within the range have been classed as B₂₃ appliances under BS EN 1020.

Key criteria should have been considered at the specification stage so as to ensure that EM units are installed and operated within suitable applications.

The EM units are intended for use within ducted applications, with the EM unit providing the heat source within an air handling system.

The units can be mounted at floor or high level. Units which are externally situated must be weatherproofed either within an AHU or by means of a weatherproof enclosure.

Each unit must be connected to its own individual open flue of the appropriate size and construction.

Each EM unit is fitted with a fully match tested forced draught burner which has been test fired and pre-set prior to despatch. The safety functions of the burner are by way of a fully sequential control box fitted to the burner.

1,2 Safety Features

Safety devices, in the form of an air pressure switch, and combined fan and limit thermostat, are fitted to all EM units.

Air Pressure Switch

This safety feature provides constant monitoring of the air pressure produced by the fan unit, whilst the fan unit is operational. If the air pressure drops below a preset level the burner control circuit is broken, and a failsafe and burner lockout situation results.

Fan and Limit Thermostat

This is wired in series with the air pressure switch and has a dual function; to provide a fan overrun facility in order to dissipate the heat from the heat exchanger on burner shut down, and to provide a failsafe facility in the event that the heat exchanger upper temperature limit should be reached.

1,3 General requirements**Caution**

The gas supply to the appliance must be capable of delivering the required minimum dynamic volume. Ensure that the gas service to the appliance carries the correct gas type and that the supply pressure is in accordance with the supply type and pressure stated on the appliance

data plate. Ensure that the electrical supply is in accordance with the information contained on the data plate.

Installation, commissioning, and servicing must only be carried out by appropriately qualified and competent persons.

Warning

Unauthorised modifications to the appliance, or departure from the manufacturers guidance on intended use, or, installation contrary to the manufacturers recommendations may constitute a hazard.

The installation of the appliance must meet all of the relevant local, national, and/or international criteria.

Prior to installation the following points should be considered;

- a) The position of the appliance and air handling unit for the optimum efficient distribution and circulation of warm air
- b) The position of the appliance relative to the route of the flue
- c) The position of the appliance relative to the supply of gas
- d) The position of the appliance and air handling unit relative to the electrical services and any additional controls.
- e) The position of the appliance and air handling unit relative to the supply of fresh air
- f) The position of the appliance and air handling unit relative to the service and maintenance requirements

Caution

The EM unit must not be installed within an area where the conditions are unsuitable, e.g. where the atmosphere is highly corrosive, has a high degree of salinity, or where high wind velocities may affect burner operation. Suitable protection should be provided for the appliance when it is located in a position where it may be susceptible to external mechanical damage from; for example, fork lift trucks, overhead cranes etc.

2,0 Location/positioning

Indirect fired EM units must not be located in hazardous areas, however, it is permissible for the EM unit to supply air to such areas.

The EM unit must not be installed within an environment where there is a high concentration of chlorides, fluorides, salts, or other aggressive or volatile chemicals/compounds. Nor should the EM unit be positioned where the burner could be adversely affected by high winds or draughts.

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The location chosen for the EM unit must allow for the fitting of an effective flue system, it must also offer adequate clearance for the following; the air handling unit and air supply, return air circulation, gas supply, electrical supply, safe working access to all parts of the AHU and EM unit

The appliance must be installed on a flat and level surface made from non-combustible material, which is sufficiently robust to withstand the weight of the AHU and EM unit, and any ancillary equipment. Any combustible material adjacent to the EM unit or flue system must be so placed or shielded so that its surface temperature does not exceed 65°C.

All EM units are designed to include a pressure relief facility. Care should therefore be taken when siting service connections and controls so that they are well away from the pressure relief vent.

Warning

Under no circumstances must the pressure relief be restricted, blocked, or have the free exit of exhaust gas impaired or re-directed.

Where anti-vibration mountings are used, usually to reduce noise levels, it is essential that the gas, electrical, flue, and duct-work connections are of a flexible type, so as to insulate the unit and thereby prevent possible damage through transmitted vibration.

2,1 Gas supply

The Exchange Module range is manufactured and supplied with burners pre-set for use with natural gas to I_{2H} (G20).

The EM unit must be compatible with the gas supply, and each EM must be installed with a separate approved isolating gas cock positioned adjacent to and upstream of the union between the service pipe and the appliance. Service and Installation pipe work must be of a diameter equal to or greater than the inlet

connection on the EM unit, all joints must be sealed using an approved sealing compound, and the system purged and tested for soundness in accordance with accepted procedures.

2,2 Electrical supply

Wiring external to the EM unit must be installed in accordance with any local, national, and/or international requirements.

A selection of wiring diagrams are provided under section 7 of this manual. Other wiring options are available on request

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The means of connection to the main electrical supply must allow for complete electrical isolation of the appliance, furthermore, in the case of units wired for a three phase supply, the supply should only be used to serve the unit and respective air handling system. The position of the isolation switch must be such that it is adjacent to the appliance and easily accessible at all times. Additionally the isolator itself must have a contact separation of not less than 3mm. The main isolator fuse ratings must be as per detailed on the appliance data plate.

Warning

Ensure that the electric and gas supplies are turned off before any electrical work is carried out on the EM unit. Ensure that wiring cannot make contact with any surfaces liable to be subject to high temperatures, and where the insulation of the wiring could be impaired as a result of such contact. All EM units must be earthed.

Caution

The main electrical supply must not be switched off or disconnected as a method for stopping the EM unit, the exception to this is in an emergency, or during servicing, when the heat exchanger has been allowed to cool sufficiently to prevent any damage from occurring.

2,3 Air supply

Provision must be made for the existence of an air supply for both combustion and ventilation.

It is a requirement that the area where the air EM unit is located must have a permanent air vent of negligible resistance direct to the outside air. Such air vents must be positioned so as not to become blocked or flooded, nor should they be placed so as to introduce undesirable matter (e.g. flammable, volatile, or aggressive chemicals/compounds or potentially hazardous or harmful substances) either direct from the outside, or through their proximity to an adjacent extraction system.

The criteria necessary for establishing the minimum size of natural vents is detailed in the following table based upon BS 5440 part 2. An alternative reference would be BS 6230 1991.

It should be noted that where mechanical ventilation is used it is a requirement that the inlet is of the mechanical type, and the outlet is either mechanical or natural.

Position of vent Area of vent direct to outside	
Low level (inlet)	$540\text{cm}^2 + 4,5\text{cm}^2$ per kW of rated input per EM unit
High level (outlet)	$270\text{cm}^2 + 2,25\text{cm}^2$ per kW of rated input per EM unit

Caution

Systems of ventilation that employ mechanical extraction and natural inlet must not be used. Furthermore, where the air supply is by way of a mechanical means the inlet must be positioned at low level and capable of providing the required minimum throughput. The natural extraction air vents must have a minimum area as previously detailed, and it is recommended that natural extraction vents are situated at high level. Additionally, an automatic control interlocked to the burner must be fitted to ensure burner shutdown in the event of air flow failure or restriction.

If the EM unit is to be installed within its own building or plant room, the above details do still apply, as does the requirement for minimum space.

2,4 Flue system

Warning

It is essential that the products of combustion are flued to the outside of the building. Each EM unit must have its own separate flue, with a flue diameter of not less than the flue spigot fitted to the EM unit. The minimum vertical length of flue must not be less than 1m. The flue must be constructed using the appropriate products and must rise vertically, and terminate with an approved cowl.

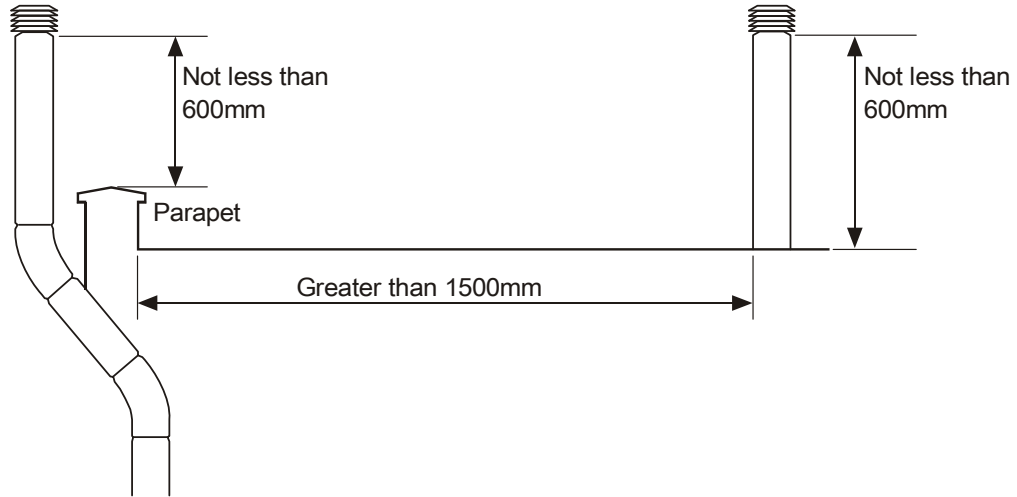
The position of the flue terminal must be in accordance with those detailed within BS 5440 part 1, for units rated at less than 60kW, or BS 6644 for units rated at more than 60kW.

The manufacturers recommendation is that the flue terminal must be positioned so as to be 1m higher than any other object or structure within 3m of the flue terminal.

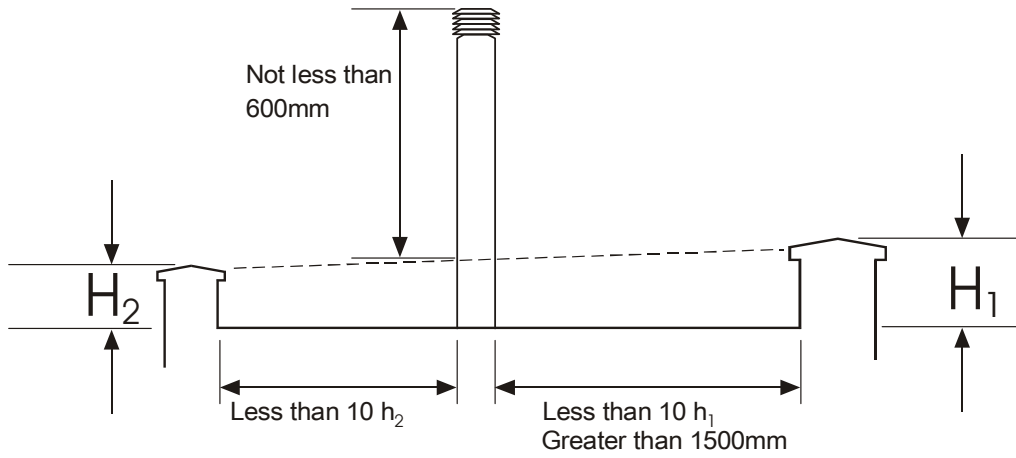
Warning

The amount of draw within the flue and combustion circuit can influence combustion. It is therefore recommended that the flue structure is checked to ensure that the combustion chamber and flue pressures are within the limits detailed by the manufacturer.

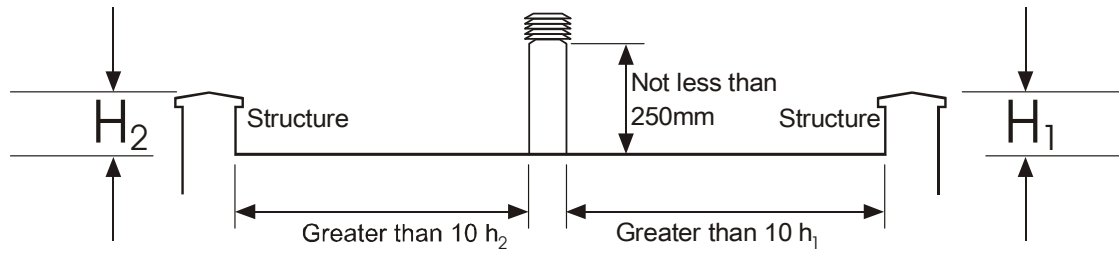
EM RANGE GAS FIRED



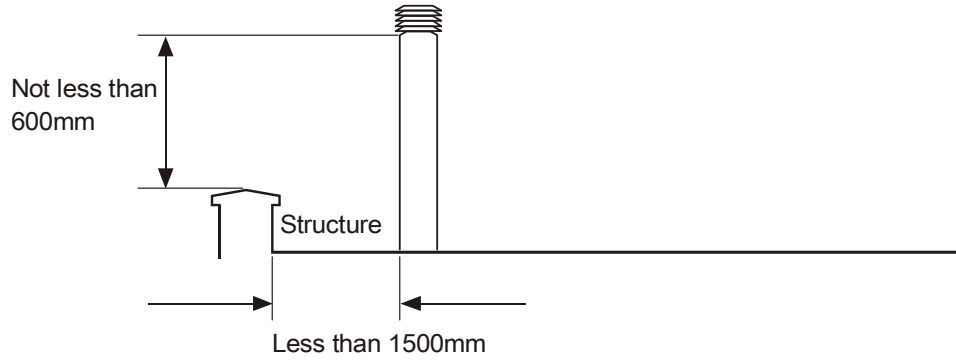
Flat roof with parapet



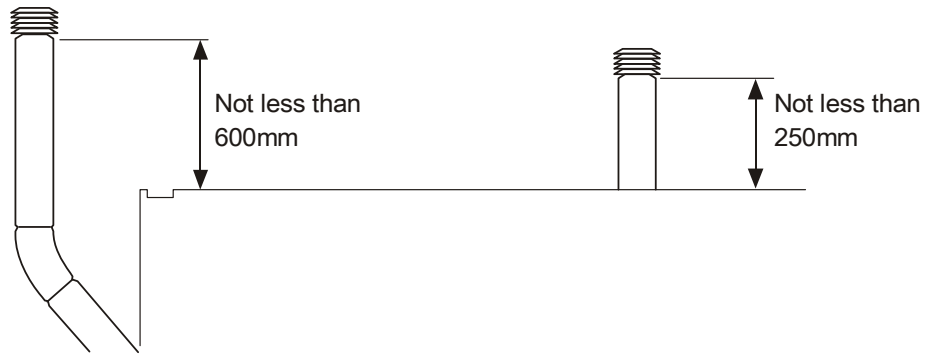
Flat roof envelope method



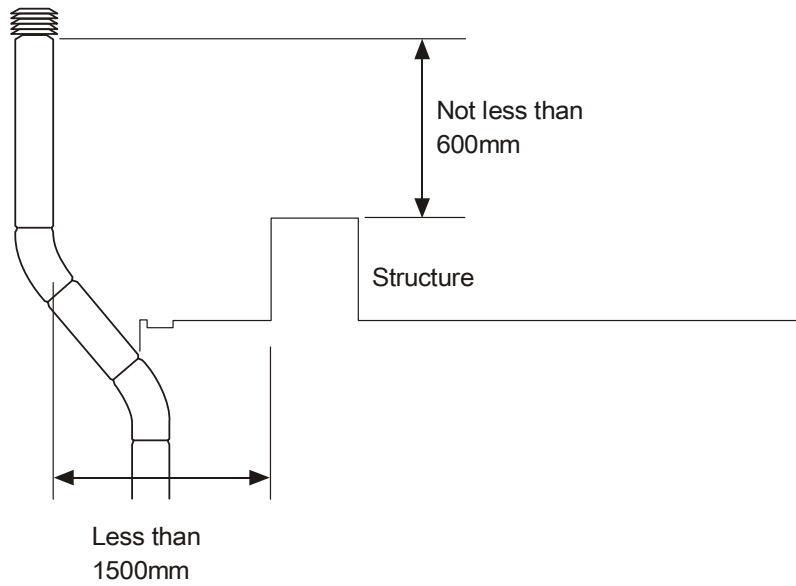
Flat roof where the flue height is more than 10 Heights (H) away from all structures



Flat roof with flue close to parapet

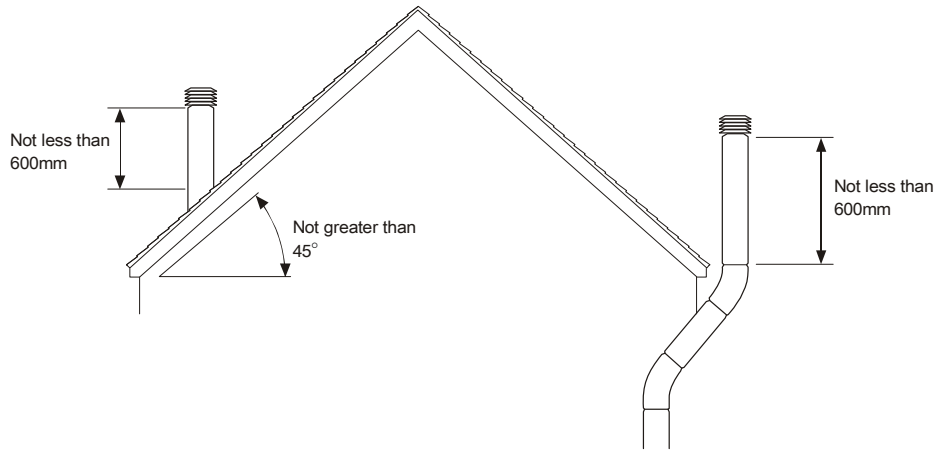


Flat roof with no parapet

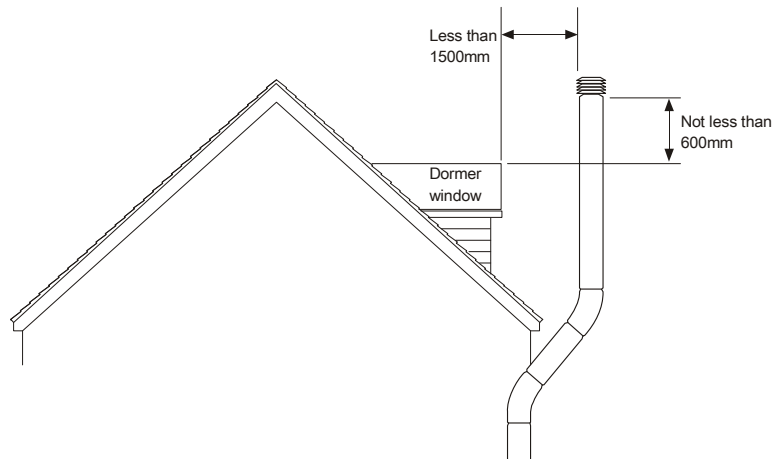


Flat roof with structure close to flue outlet

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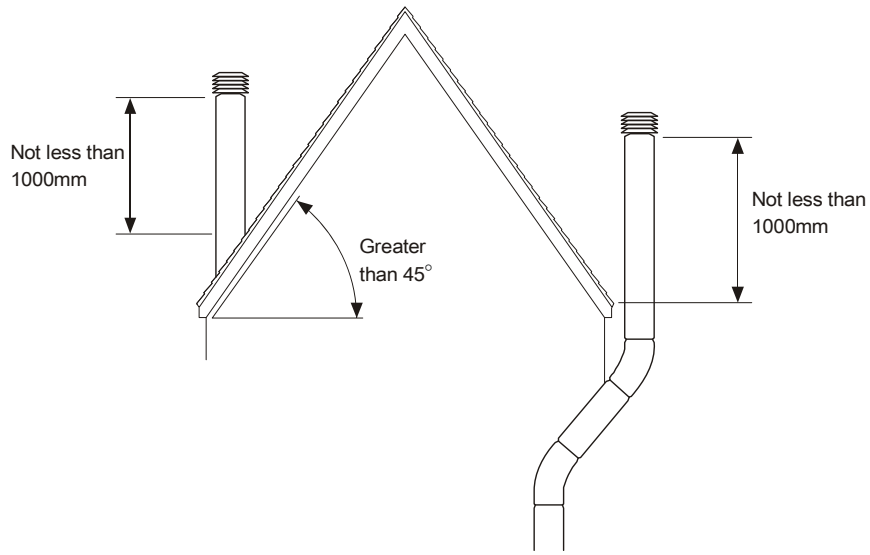


Pitched roof not greater than 45°

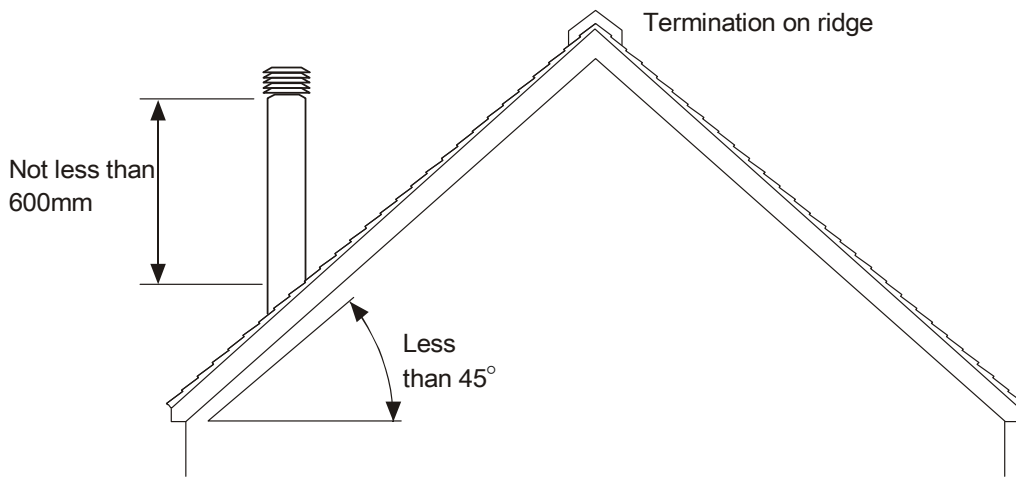


Pitched roof chimney within 1.5m from dormer window measured horizontally

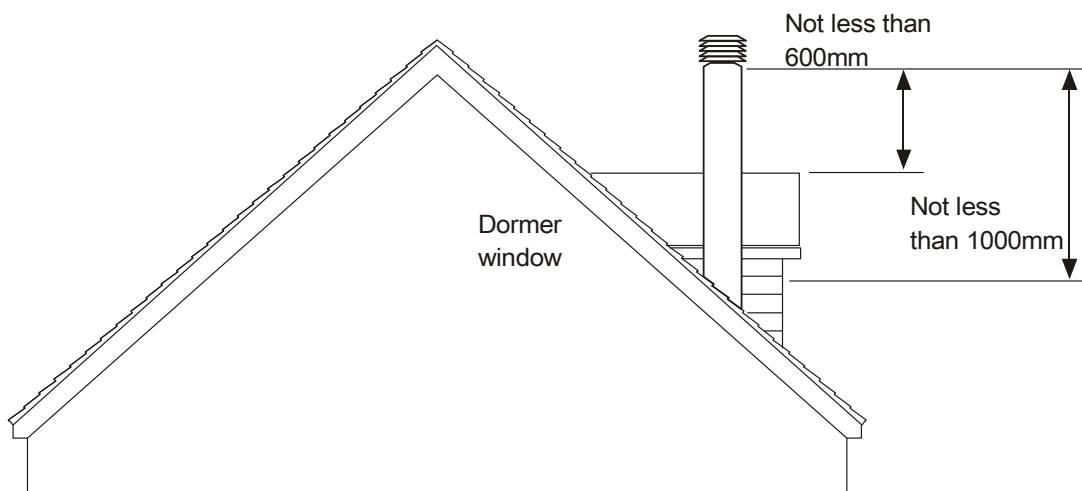
EM RANGE GAS FIRED



Pitched roof exceeding 45°



Pitched roof internal route not exceeding 45° and ridge termination



Pitched roof chimney within 1.5m from dormer window measured horizontal.

Combustion Chamber Internal Resistance

EM60 - EM88	0.4 mbar
EM117 - EM175	0.6 mbar
EM235 - EM301	0.9 mbar
EM375	0.6 mbar
EM440	0.9 mbar
EM525 - EM600	0.7 mbar
EM700	1.1 mbar

Warning

Special flue configurations such as those featuring dilution systems and fan assisted flues can only be used if they do not adversely effect the combustion. The resistance figures detailed in section 8 must therefore be adhered to.

Horizontal runs must be kept to an absolute minimum, and wherever possible the flue should rise vertically. If this is not possible 45° bends should be used. If a horizontal run is necessary it should be installed so as to rise by 5° and should be followed by a vertical rise of at least twice that of the horizontal run.

The flue must feature an approved terminal, and the flue system should be effectively sealed.

The design and construction of the flue must also take account for the provision of external flue support for installations with long flue runs.

Warning

Care should be taken when siting the AHU as the flue temperature of the condensate tee may be in excess of 350° C .

An optional flue guard is available as an accessory

3,0 Installation**Note**

It is strongly advised that the installer reads and is familiar with Section 2 and Section 3 of this manual prior to starting any installation work. It is a requirement that only qualified and competent personnel may undertake installation, commissioning, and servicing.

Caution

Particular attention should be paid to the ventilation requirements of small plant rooms when installing AH units. The radiated heat from the flue exit ducts may cause the burner compartment ambient temperature to exceed the **60° C** maximum operating temperature for the burner if the compartment ventilation is inadequate

3,1 Positioning and siting

It is advisable that when positioning the appliance the lifting eyes are used, thereby reducing the risk of inadvertent damage.

3,2 Flooring and support

The EM unit must be installed on a level non combustible surface capable of supporting the weight of the EM unit and any ancillary equipment.

3,3 Minimum clearances

Sufficient clearance must be allowed to enable installation, commissioning and servicing to be carried out safely and effectively. The manufacturer recommends that a clearance of at least 1m at the front and the back of the EM unit so as to allow burner servicing (on front panel) and heat exchanger tube cleaning (on the back panel).

3,4 Flue Installation

An integral condensate tee is fitted to all Exchange Modules, thereby allowing the flue to connect directly into the appliance. The design of the flue must ensure that it can be disconnected to allow for cleaning and servicing, furthermore, all of the flue section joint sockets must face upwards, and the seal between the sections achieved through mechanical joints or through the use of approved caulking string and grout.

Where condensation is likely to be a problem provision should be made, preferably at the design stage. All EM units are fitted with a drain point at the bottom of the condensate tee. The manufacturer recommends that on units fitted with high-low or modulating burners the drain facility is connected so as to allow condensates to drain freely.

3,5 Gas Installation**Warning**

If a gas leak is suspected, all potential sources of ignition must be extinguished, gas supply cocks closed to isolate the leak, doors and windows opened to allow the dissipation of the gas to occur, and the gas supplier informed immediately.

Never search for gas leaks with a naked flame.

Pipe work and meters must be sized so as to take into account the required dynamic volume for

the EM unit and any other plant reliant upon the supply.

Service pipe work must terminate at an approved gas cock, and be adjacent to the position of the appliance. The connection to the EM unit can be made by way of either an approved flexible coupling, or rigid connection. Threaded connections must comply with ISO 228/1 or ISO 7/1. The diameter of the pipe work from the cock to the burner connection must not be less than the diameter of the burner connection inlet.

The installation must be purged and tested for soundness prior to commissioning in accordance with the current approved methods.

Caution

Excess gas pressure can damage the control valves within the gas train. Insufficient gas pressure can cause nuisance burner lockouts. The gas supply at the inlet to the gas train should be set at 22.5 millibar.

3,6 Electrical Installation

Reference should be made to the wiring diagram(s) contained later in this manual prior to installation or connection to the electrical supply.

Note

The wiring diagram number can be found on the data plate

The electrical supply must be as specified and suitable for the EM unit, and must be run within conduit to a point adjacent to the EM unit, and be terminated to provide an isolation point that will prevent remote or inadvertent use. All EM units are supplied fused and pre-wired, all must be earthed. Final connections for the air handling unit and external controls must be completed on site, and must be carried out according to the appropriate regulations.

On EM units fitted with High-low or modulating burners it is a requirement that the high flame and modulating flame signal cables are sufficiently protected and screened so as to prevent any external influence associated with induced voltages etc.

Separate user information is provided for the burner, and forms part of the product information pack which accompanies every EM unit when despatched.

Warning

Always isolate from mains electrical supply before commencing work on the EM unit.

3,9 EM unit Control Installation

All EM units are manufactured with the fan and limit thermostat, air pressure switch, and burner pre-wired and installed. It is the responsibility of the installer to make the appropriate connections, and to supply and install suitable ancillary controls to ensure that the unit performs satisfactorily, for example, room thermostat, time clock, building management systems, process management systems etc.,

Warning

Ancillary controls must not be wired so that they may override any of the safety controls or safety devices.

Caution

It is the responsibility of other suppliers to ensure that thermostat/sensor positioning and the controls package in general, allows for satisfactory operation of the EM unit. Room thermostats must be positioned so as not to be directly within the airflow from the appliance, nor should the thermostats be positioned so that they are subject to elevated temperatures associated with strong or direct sunlight. Ideally the thermostats should be positioned so that they are approximately 1.6m above floor level within the area to be heated by the EM unit.

4,0 Commissioning

The air delivery system must have already been fully commissioned and balanced prior to the commissioning of the EM unit, thereby ensuring that required air flow characteristics are in accordance with those recommended for the EM unit.

Warning

The maximum and minimum air volumes detailed as follows must be adhered to.

Airflow Volumes (m ³ /s)	min	max
EM60	0.9	1.7
EM88	1.2	2.3
EM117	2.2	3.5
EM150	2.4	4.5
EM175	2.4	5.3
EM235	3.0	7.0
EM301	3.2	7.7
EM375	6.0	11.2
EM440	7.0	12.5
EM525	8.0	15.8
EM600	9.5	17.0
EM700	11.3	18.9

Caution

The air delivery system must have been fully commissioned and balanced before the EM unit

can be commissioned. A fan overrun facility must have been programmed into the fan controls so as to allow for residual heat to be dissipated at the end of a heating cycle.

Failure to provide this facility will result in frequent overheat situations which over prolonged periods can compromise the longevity of the EM unit and its controls. The residual heat can also damage the flue system.

Further, if fire dampers are fitted within the ducting these can be activated by the residual heat if insufficient fan overrun time has been allowed for and programmed in.

Note

In applications where fire alarm systems are integrated with the AHU/EM controls it should be noted that when these fire systems are activated they usually cut power to the AHU and EM unit resulting in residual heat build up (when activated during a heating cycle or within the fan overrun time). This will cause overheat situations and can also activate duct mounted fire dampers. Frequent overheat situations can compromise the longevity of the EM unit and its controls.

It is a requirement that only suitably qualified and competent personnel are allowed to undertake the commissioning of the appliance. It is also strongly recommended that prior to commissioning the engineer familiarises himself with the information contained within the information pack that accompanies the EM unit, the EM unit/air handling system itself, and becomes familiar with the specific installation/application. The following checks should be carried out after the familiarisation process.

Warning

All EM units undergo a rigorous test programme prior to being despatched, whilst such a programme does involve pre-commissioning and setting up the EM unit to operate within its designed operational limits, this does not mean that on site commissioning is less important than might otherwise be the case.

4.1 Commissioning - Pretest

The air system and controls must have been commissioned and proven prior to commissioning the EM unit.

Check to ensure electrical safety, and inspect and purge the gas train installation, testing for soundness.

(a) Ensure that the electrical supply is turned off

- (b) Ensure that the gas supply is turned off
- (c) Check that all panels and fasteners are secure and in place
- (d) Check that the EM and air handling unit is installed so that it is square and that the support is adequate
- (e) Ensure that warm air delivery outlets are open and that ducting is adequately supported
- (f) Ensure that if filter assemblies are fitted that they are secure and correctly located
- (g) Check that air inlets are clear and that return air paths are adequate
- (h) Ensure that the flue is secure, adequately supported, and that the various joints are properly sealed
- (i) Check that condensate trap and drain facilities are adequate
- (j) Check that there is provision for flue gas sampling and that this sample point can be plugged and sealed after commissioning
- (k) Check that fan and limit stat settings have not been disturbed
- (l) Ensure that the burner is securely attached to the EM unit
- (m) Test for electrical earth continuity between the appliance, gas pipe work, and mains supply
- (n) Turn the main electrical supply to on, select the following settings (it should be noted that as the controls package is usually supplied by others the actual settings may vary from those detailed as follows, the rationale is to check that airflow characteristics are in accordance with those detailed previously)
on/off - on
heat/ventilation - ventilation
manual/automatic - manual
The fan will start enabling the airflow direction etc to be verified
- (o) Check that the volumetric air flow over the combustion chamber and heat exchanger is as recommended and is sufficient to satisfy the air pressure switch. On completion of airflow tests reset on/off switch to the off position
- (p) Set room thermostat and time clock to on positions
- (q) Turn mains electrical supply to off

4,2 Commissioning - Ignition

Warning

Do not proceed with commissioning unless all the criteria detailed within sections 4,0 and 4,1 have been satisfied.

- (a) Ensure that the electrical supply is turned to off
- (b) Ensure that the gas supply is turned to off
- (c) Select the following control settings
 on/off - off
 heat/ventilation - heat
 manual/automatic - automatic
- (d) Turn main electrical supply to on
- (e) Select on position for on/off control
- (f) Check for the following burner sequence

Note

It is strongly recommended that the separate manual concerning the operational details of the burner supplied with the EM unit as part of the information package is studied prior to firing the burner.

Time intervals within the ignition sequence will vary slightly from one model to another.

Time interval	Operation
1 - 5secs	If applicable, combustion air damper is actuated, fan motor starts purge cycle...
2 - 40secs	Pilot valve opens, ignition transformer provides spark for pilot ignition... <i>either</i>
3 - 40secs	Ignition failure caused by gas starvation resulting in burner lock-out/shut-down...

- (g) Clear burner lockout using burner reset function
- (h) Set EM unit control on/off switch to off position
- (i) Open gas cocks and repeat steps 4,1 q, and 4,2 c,e,f,

<i>or</i>	
3 - 40secs	Pilot ignition, Burner ignition...
4 - 60secs	Burner ignition cycle complete.

Warning

If burner ignition is not satisfactorily accomplished, commissioning must not proceed until the reason or fault has been identified and rectified, if necessary by reference to the separate burner information or to section 6,0 of this manual.

- (j) Repeat steps 4,2 c,a,
- (k) Re-check all connections and joints for gas soundness using an approved leak detection fluid
- (l) Attach manometers to check pressure settings
- (m) Repeat steps 4,2 d,e,f, allowing the EM unit to reach thermal equilibrium
- (n) Check pressure settings are in line with the technical data (if adjustment is necessary refer to separate burner information)

Note

The figures quoted in section 8 are independent test figures based upon zero flue resistance.

- (o) Adjust room thermostat to its highest setting, and allow the EM unit to continue to fire
- (p) Gradually reduce the temperature setting on the room thermostat until the burner shuts down, and then gradually increase the temperature setting on the thermostat until heat is called for, and the burner automatically re-fires
- (q) Re-set time clock to a minimum off period, checking that the burner shuts down, and then automatically re-lights once the minimum off period has elapsed

Note

If specific temperature rise characteristics are a requirement then these should be noted, and the burner rated accordingly prior to flue gas analysis.

- (r) Undertake flue gas analysis and efficiency checks across the operational range using approved and calibrated apparatus.

Note

All EM units are test fired and pre-commissioned as part of the manufacturing process, if however, during on site commissioning the data are found not to be in accordance with the manufacturers data, then the following course of action is recommended;

- Re-check all readings and calculations

- Adjust burner as per manufacturers instructions
- Consult Benson Heating Technical Department

(s) Complete commissioning report and provide operating instructions for the user, high-light the fact that the manufacturer recommends that in the interests of safety and efficiency the EM unit is serviced on a regular basis by qualified and competent persons.

(t) Set all controls to the requirements of the user

4,3 Commissioning - hand over

(a) Upon full and satisfactory completion of commissioning, a record of commissioning information (contact, date, etc) should be left with the unit.

(b) The commissioning engineer must ensure that the user is familiar with the safe and efficient use of the appliance, detailing the function of all controls, and main components

(c) The user should be made aware of the following in particular

- Lighting, shutdown, and operational information.
- Safety features, data plate, and labelling.
- The requirement for regular inspection - especially if the EM unit is within a more demanding environment - and the need for regular servicing, carried out by competent and qualified persons.

5,0 Servicing

Warning

Servicing must be carried out on a regular basis, the maximum interval between services being 1 year or 1000 hours. It is a requirement that only suitably qualified and competent persons are allowed to undertake servicing.

Before any maintenance or servicing work is carried out, the appliance must be shut down and allowed to cool. The gas and electric supplies must also be turned off at the gas cock and isolator respectively.

Warning

Only approved spare/replacement parts can be fitted, failure to comply with this can compromise the safe and efficient running of the EM unit, and can also invalidate any warranty claim.

5,1 Planned Servicing

In order to maintain the efficient operation of the Exchange Module and its accompanying air handling unit it is recommended that the following planned servicing and preventative maintenance programme is adopted by the user.

Quarterly Inspection

- Visual inspection of the burner
- Clean and check ionisation probes
- Check air pressure switch is operational

Bi-Annual Inspection

As per quarterly inspection, plus...

- Combustion check

Annual Inspection

As per half year inspection, plus...

- Combustion circuit inspection and cleaning
- Electrical connections
- Volumetric air test
- Gas Supply
- Burner
- Flue
- Report

5,2 Servicing Procedure - Major Component Parts

Flue

A visual inspection should be carried out to ensure that the flue remains adequately supported, both internally as well as externally, and that the various joints are effectively sealed. Inspection covers, where fitted, should be removed and the flue checked to see whether cleaning is required. If inspection covers are not fitted the gas exit duct and flue spigot will provide not only an indication of the cleanliness of the flue, but will also enable access for cleaning. The flue should also be checked for signs of internal and external corrosion. The presence of the flue terminal should be checked as should the effectiveness of the seal between the roof and the flue.

If a condensate trap and drain facility is fitted this should be checked to ensure that it continues to function correctly, and the drainage of condensates is not impaired.

Heat Exchanger

The heat exchanger requires a visual inspection at least once per year, this should be accompanied by cleaning. It is recommended that a flue brush and vacuum cleaner are used to facilitate this. Access to the heat exchanger is gained through the removal of the inspection covers on the back panel and heat exchanger tube bank. Servicing and cleaning should be performed as follows.

- (a) Remove brass nuts and cover from heat exchanger end assembly to expose heat exchanger tubes.
- (b) Remove any accumulated deposits from the tubes by pushing through the full length with a flue brush.
- (c) The flue brush should be withdrawn so as to pull any deposits back into the bottom of the EM unit and flue box where they can then be removed by using a vacuum cleaner.
- (d) Particular attention should be paid to the upper internal surfaces of the tubes, where through convection heavier deposition is likely to occur.
- (e) Any deposits which may have accumulated within the combustion chamber can be removed with a vacuum cleaner once the burner is removed.

Note

It is most important that a build up of deposits is not allowed to occur as this can have an adverse effect upon the efficiency of the EM unit and reduce the life of the heat exchanger.

- (f) The heat exchanger and combustion chamber should be visually inspected for signs of splits, cracks, and distortion.
- (g) All gaskets should be checked to ensure that they continue to provide a gas tight seal, if there is an element of doubt then they should be replaced.

Caution

The seal between the inspection cover and the heat exchanger tube bank must be maintained. Any air leakage from the high pressure airflow into the chamber can adversely affect combustion and will lead to premature failure of the combustion chamber and/or heat exchanger. It is recommended that this seal is replaced each time the inspection cover is removed.

- (h) The condensate drain points should be checked to ensure that they are free from blockages or obstructions.

Warning

If the condition or integrity of the combustion chamber or heat exchanger gives cause for concern the Service Department at Benson Heating should be advised pending a more detailed examination. If it is suspected that the combustion chamber or heat exchanger is holed or split a full examination combined with combustion analysis should take place as soon as is possible.

Electrical Supply

All connections must be checked to ensure that they are secure, and free from corrosion. Terminals and connections should also be

checked to ensure that no stray strands are bridging terminals. Electrical continuity should also be checked.

Gas Supply

The gas supply pipe work and fittings should be inspected to ensure that they are free from corrosion, and to ensure that where brackets have been fitted these remain secure and offer adequate support. The system should be soundness tested.

Burner

Service requirements for the burner are covered in the separate manual prepared by the burner manufacturer, and which is provided within the information pack supplied with the EM unit.

Warning

It is most important that the burner is serviced regularly and in accordance with the manufacturers instructions. Prolonged operation of the burner outside the tolerance of its original setting can compromise the longevity of the combustion circuit, and can, in extreme circumstances result hazardous situations being created.

Report

A full and detailed service report should be prepared, it is advised that the report should not be completed until the EM unit has been re-commissioned, where upon the completed report can then be explained in detail in the presence of the user.

5,3 Service Re-commissioning

The appliance should be re-commissioned as follows; this must be regarded as a necessary part of the EM unit service:

- (a) As Section 4,1
- (b) As Section 4,2
- (c) As Section 4,3

6,0 Fault Diagnosis

Due to the variety of applications where EM units are successfully used it is impossible for Benson Heating to create representative fault diagnostics for each and every application or eventuality.

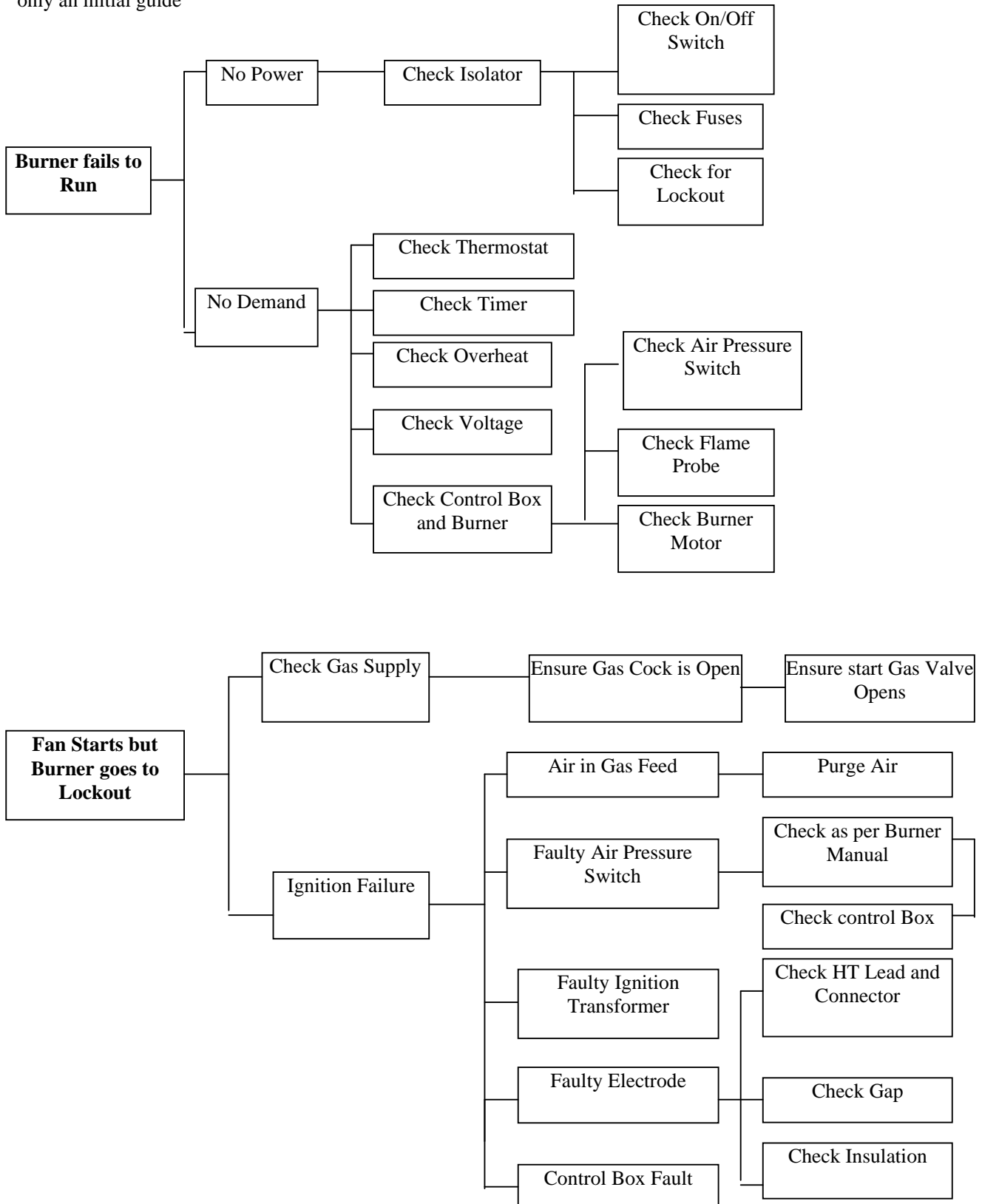
Technical support is available through contact via The Service Dept at Benson Heating (Telephone + 44 (0) 1547 528 534).

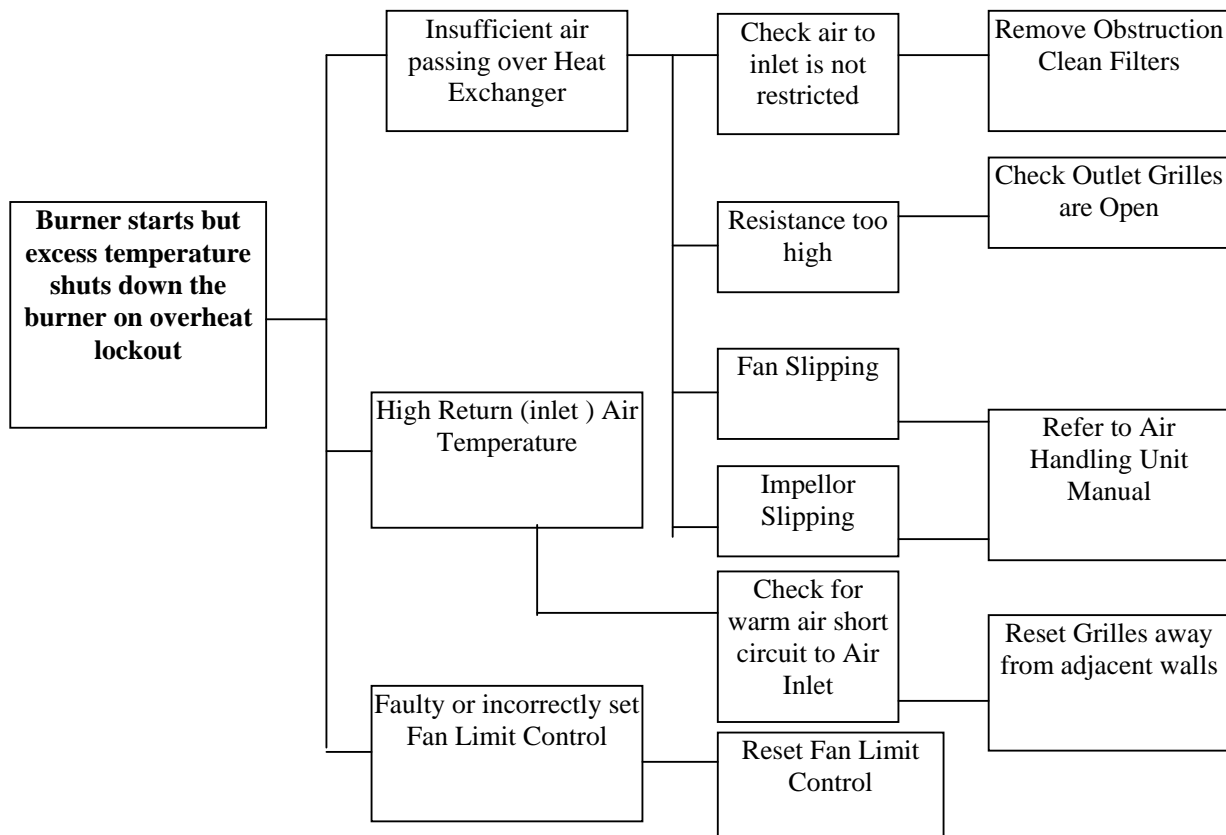
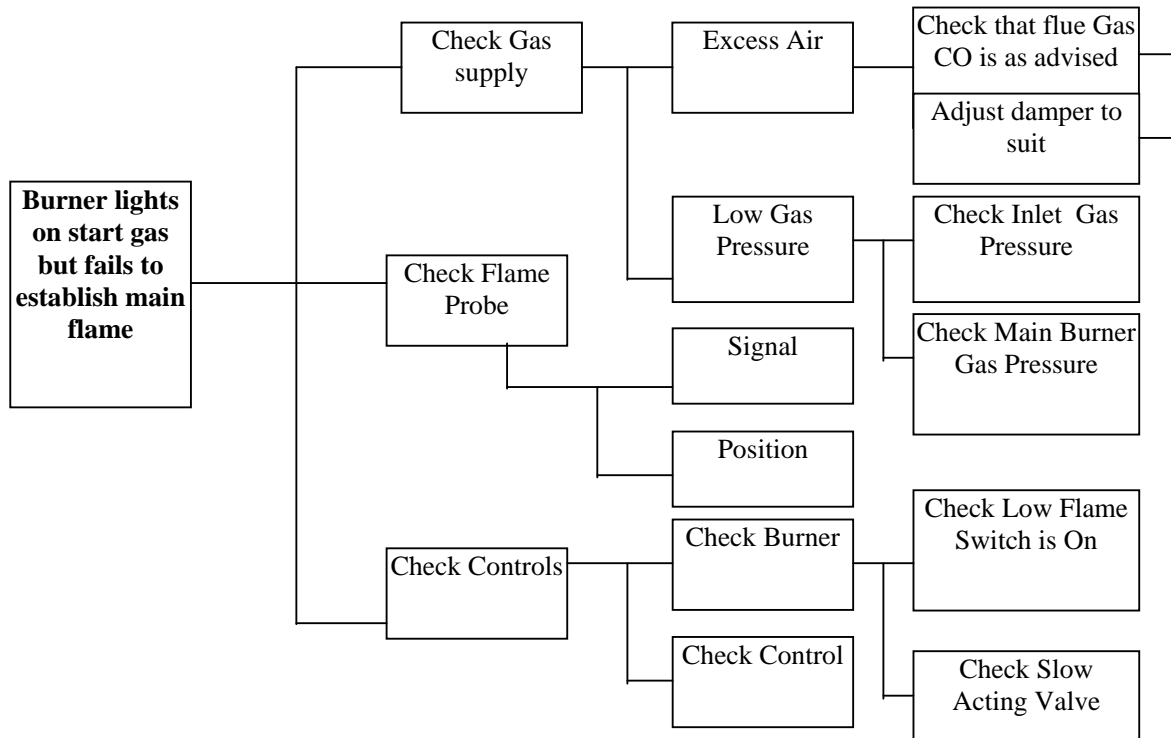
In the interests of health and safety the manufacturer is keen to offer technical assistance and support when or wherever this maybe required. Further information concerning

EM RANGE GAS FIRED

fault diagnostics is contained within the burner manual which is supplied as part of the information pack with each EM unit.

The following fault diagnosis chart is therefore only an initial guide





7.0 Wiring Diagrams

20-33-660 EM 175 / 235 / 301 RIELLO RS28.1 ON / OFF
230V/3ph/50Hz

20-33-661 EM 265 / 300 RIELLO RS38.1 ON / OFF
230V/3ph/50Hz

20-33-666 EM 235/301 RIELLO RS28 EM375 RIELLO RS38 (nonstd) HI / LO
230V/3ph/50Hz

20-33-667 EM 375 RIELLO RS38 EM440 RIELLO RS50 HI / LO
415/3ph/50Hz

**20-33-680 EM235/301 RIELLO RS28M GAS MODULATING
230V/1PH/50Hz**

**20-41-210 EM375/ 440/600/700 RIELLO RS38M / 50M / 70M /100M
415/3PH/50Hz Burner supply**

**20-41-211 EM525/600 RIELLO RS70 EM700 RIELLO RS100 HI/LO
415/3PH/50Hz**

**20-46-157 EM60,88,117,150, RIELLO GS10 / 20 BURNER ON/OFF
230V/1PH/50Hz**

**20-46-213 EM60 to 175 RIELLO GS10D /20D GAS FIRED HI/LO
230V/1PH/50Hz**

20-46-374 EM 60-175 RIELLO GS10/GS20M GAS FIRED MODULATING

8.0 Technical Data

MODEL		EM60	EM88	EM117	EM150
HEAT OUTPUT	kW/hr	60.0	88.0	117.0	150.0
HEAT INPUT (GROSS)	kW/hr	77.5	113.5	151.0	193.5
GAS CONSUMPTION	m ³ /hr	7.23	10.59	14.08	18.05
BURNER TYPE	RIELLO	R40 GS10	R40 GS10	R40 GS20	R40 GS20
BURNER HEAD PRESSURE Mbar (zero resistance cover fitted)	On/Off Hi/Lo	4.0/1.8		4.9/2.0	
MINIMUM GAS INLET PRESSURE	m/bar Ins WG	17.5 7	17.5 7	17.5 7	17.5 7
HEAD SETTING (zero flue resistance)	Number				
AIR SHUTTER SET (zero flue resistance)	Number				
GAS CONNECTION	BSP	1/2	1/2	3/4	3/4
RESISTANCE @ MAXIMUM AIR	Pascals	165	165	190	350
RESISTANCE @ MINIMUM AIR	Pascals				
MAXIMUM AIR VOLUME	m ³ /sec	2.25	2.25	3.5	5.1
MINIMUM AIR VOLUME	m ³ /sec	0.91	1.33	1.77	2.27
MAXIMUM TEMPERATURE RISE	Deg C	55	55	55	55
SOUND LEVEL	DbA				
COMBUSTION CHAMBER (press)	m/bar	0.4	0.4	0.6	0.6
FLUE RESISTANCE	Min m/bar Max m/bar	-0.2 +0.6	-0.2 +0.6	-0.2 +0.6	-0.2 +0.6
FLUE DIAMETER	mm	150	175	175	175
CONTROLS INPUT	Vdc	10	10	10	10
ELECTRICAL SUPPLY	Standard	230V/1ph/50Hz	230V/1ph/50Hz	230V/1ph/50Hz	230V/1ph/50Hz
FUSE RATING (UNIT)	Amps	6	6	6	6
RUNNING CURRENT	Amps	3	3	3	3
CABLE SIZE	mm ²	1.5	1.5	1.5	1.5
CO	Ppm	<100	<100	<100	<100
CO ₂	%	9%	9%	9%	9%
FLUE GAS Vol @ Full load	m ³ /hr				
FLUE TEMP (GROSS)	@ 20° C Ambient	250	350	315	390
AIR PRESS SETTING	m/bar	0.4	0.4	0.4	0.4
FAN/LIMIT SET (std)	Deg C	30-50-90	30-50-90	30-50-90	30-50-90
FAN/LIMIT (hi temp)	Deg C	30-50-125	30-50-125	30-50-125	30-50-125
NETT WEIGHT	KG	191	191	305	305

EM RANGE GAS FIRED

MODEL		EM175	EM235	EM301	EM375
HEAT OUTPUT	kW/hr	175	235	301	375
HEAT INPUT (GROSS)	kW/hr	225.3	293.8	376.3	480.0
GAS CONSUMPTION	m ³ /h	21.02	27.4	35.1	44.8
BURNER TYPE	RIELLO	R40 GS20S	RS 28.1	RS 28	RS 38
BURNER HEAD PRESSURE Mbar (zero resistance cover fitted)	On/Off Hi/Lo Modulating		8.3 0.8 / 8.0	10.4 / 4.6 2.0 / 10.4	1.6 / 9.4
MINIMUM GAS INLET PRESSURE	m/bar Ins WG	17.5 7	17.5 7	17.5 7	17.5 7
HEAD SETTING (zero flue resistance)	Number				
AIR SHUTTER SET (zero flue resistance)	Number				
GAS CONNECTION	BSP	1"	1¼	1¼	1½
RESISTANCE @ MAXIMUM AIR	Pascals	350	200	240	250
RESISTANCE @ MINIMUM AIR	Pascals				
MAXIMUM AIR VOLUME	m ³ /sec	5.1	6.75	7.75	11.25
MINIMUM AIR VOLUME	m ³ /sec	2.65	3.55	4.5	5.5
MAXIMUM TEMPERATURE RISE	Deg C	55	55	55	55
SOUND LEVEL	Db				
COMBUSTION CHAMBER (press)	m/bar	0.6	0.9	0.9	0.6
FLUE RESISTANCE	Min m/bar Max m/bar	-0.4 +1.6	-0.4 +1.6	-0.4 +1.6	-0.4 +1.6
FLUE DIAMETER	mm	175	225	225	250
CONTROLS INPUT	Vdc	10	10	10	10
ELECTRICAL SUPPLY	Standard	230V/1ph/50Hz	230V/1ph/50Hz	230V/1ph/50Hz	230V/1ph/50Hz
FUSE RATING (UNIT)	Amps	6	10	10	10
RUNNING CURRENT	Amps	3	6	6	6
CABLE SIZE	mm ²	1.5	1.5	1.5	1.5
CO	Ppm	<100	<100	<100	<100
CO ₂	%	9%	9%	9%	9%
FLUE GAS Vol @ Full load	m ³ /hr				
FLUE TEMP (GROSS)	@ 20° C Ambient	360	300	345	330
AIR PRESS SETTING	m/bar	0.4	0.4	0.4	0.4
FAN/LIMIT SET (std)	Deg C	30-50-90	30-50-90	30-50-90	30-50-90
FAN/LIMIT (hi temp)	Deg C	30-50-125	30-50-125	30-50-125	30-50-125
NETT WEIGHT	KG	305	435	435	800

EM RANGE GAS FIRED

MODEL		EM440	EM525	EM600	EM700
HEAT OUTPUT	kW/hr	440	525	600	700
HEAT INPUT (GROSS)	kW/hr	550	656	750.3	875.8
GAS CONSUMPTION	m ³ /hr	51.3	61.2	70.0	81.7
BURNER TYPE	RIELLO	RS 50	RS 70	RS 70	RS 100
BURNER HEAD PRESSURE Mbar (zero resistance cover fitted)	On/Off Hi/Lo Modulating	0.5 / 8.0	7.8 / 3.1	10.4 / 3.8 10.4 / 1.6	6.4 / 0.8
MINIMUM GAS INLET PRESSURE	m/bar Ins WG	17.5 7	17.5 7	17.5 7	17.5 7
HEAD SETTING (zero flue resistance)	Number				
AIR SHUTTER SET (zero flue resistance)	Number				
GAS CONNECTION	BSP	2"	2"	2"	2"
RESISTANCE @ MAXIMUM AIR	Pascals	275	225	250	275
RESISTANCE @ MINIMUM AIR	Pascals				
MAXIMUM AIR VOLUME	m ³ /sec	12.1	16.9	17.9	18.9
MINIMUM AIR VOLUME	m ³ /sec	6.65	8.1	9.1	10.6
MAXIMUM TEMPERATURE RISE	Deg C	55	55	55	55
SOUND LEVEL	DbA				
COMBUSTION CHAMBER (press)	m/bar	0.9	0.7	0.7	1.1
FLUE RESISTANCE	Min m/bar Max m/bar	-0.4 +1.6	-0.4 +1.6	-0.4 +1.6	-0.4 +1.6
FLUE DIAMETER	mm	250	350	350	350
CONTROLS INPUT	Vdc	10	10	10	10
ELECTRICAL SUPPLY	Standard	230V/1ph/50Hz	230V/1ph/50Hz	415V/3ph/50Hz	415V/3ph/50Hz
FUSE RATING (UNIT)	Amps	10	10	10	10
RUNNING CURRENT	Amps	6	6	6	6
CABLE SIZE	mm ²	1.5	1.5	1.5	1.5
CO	Ppm	<100	<100	<100	<100
CO ₂	%	9%	9%	9%	9%
FLUE GAS Vol @ Full load	m ³ /hr				
FLUE TEMP (GROSS)	@ 20° C Ambient	350	250	270	300
AIR PRESS SETTING	m/bar	0.4	0.4	0.4	0.4
FAN/LIMIT SET (std)	Deg C	30-50-90	30-50-90	30-50-90	30-50-90
FAN/LIMIT (hi temp)	Deg C	30-50-125	30-50-125	30-50-125	30-50-125
NETT WEIGHT	KG	800	1765	1765	1765

EM RANGE GAS FIRED