

# BENSON HEATING

## GAS FIRED HEAT EXCHANGE MODULE AIR HANDLING UNIT

# INSTALLATION OPERATION AND SERVICING MANUAL

**Issue 2**

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## **IMPORTANT NOTICE TO INSTALLERS**

**Installers should satisfy themselves that the gas pipework installation is carried out in accordance with all current legislation, Codes of Practice and recommendations . Additionally it may be necessary to protect the gas valves which form part of the heater or burner assembly from potential pipe contamination particularly, but not exclusively , where copper gas pipework is used.**

**In instances where copper pipework is to be used for all or part of a gas pipework installation, including short length final connections then we advise that installers consult with gas supplier or provider and satisfy themselves what additional precautions may be necessary**

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 within a strictly controlled quality environment within the parameters of ISO 9001.2000 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 have an output range from 117kW to 1000kW, and are suitable for use with natural gas.

The EM units within the range have been classed as B<sub>23</sub> 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 Delivery and pre-installation checks**

On receipt of the unit, the following checks should be carried out;

- a) The model is as per order
- b) That it is undamaged
- c) That it is suitable for the fuel supply
- d) That it is suitable for the electrical supply

If any of these points are not satisfied then contact should be made with the Sales Office at Benson Heating as soon as possible by telephoning 01547-528534. In the case of claims for damage, this must be signed for as damaged and reported in writing within 24 hours of delivery, in order to comply with insurance criteria

### **1.4 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. 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

In addition BS6230 2005 should be consulted regarding condensate drainage pipework any external pipework should be kept to a minimum to avoid freezing and should have a diameter of not less than 22mm

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<sub>2H</sub> (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.

The isolating cock should be of the 90° turn type and should be clearly marked OPEN / CLOSED it should also be installed so as to fall to the closed position

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

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**

Consideration must be given to the provision of air for the purposes of combustion and ventilation of the heated space, plant room or enclosure where heaters are to be installed

## Note

**It** is strongly recommended that BS 6230 : 2005 is referred to for further information concerning ventilation requirements

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

### 2.3.1 Heaters installed within the heated space

Where heaters are installed within the space to be heated (i.e. not a plant room or enclosure Combustion air or heater related ventilation air **Will not be required if**

The design air change rate of the heated space is 0.5 air changes per hour or greater The design air change rate may be satisfied by natural infiltration or by mechanical ventilation

Combustion and General ventilation **will be required if**

The design air change rate of the heated space is less than 0.5 air changes per hour

Where the heated space has an air change rate of less than 0.5 air changes per hour then it will be necessary to provide **either** natural ventilation openings to the heated space (section 2.3.1.1. refers) **or** the mechanical ventilation of the heated space (section 2.3.1.2. refers)

#### 2.3.1.1 Natural Ventilation Openings to the Heated Space

If the heated space design air change rate is less than 0.5 air changes per hour then provision for low level natural ventilation openings will only be necessary The minimum free area of the low level natural ventilation opening shall be

- 2cm<sup>2</sup> for each kW of rated heat input

The low level natural ventilation opening should be situated on an external wall and be within 1000 mm of floor level for natural gas and ideally at floor level for l.p.g gas

installations but in any event no higher than 250 mm.

The table below provides specific data for

Model	Minimum Free Area of ventilation opening	
	High Level	Low Level
	cm <sup>2</sup>	cm <sup>2</sup>
60	None	140
88	None	204
117	None	272
150	None	349
175	None	406
235	None	592
301	None	678
375	None	865
440	None	991
525	None	1182
600	None	1352
700	None	1578

each heater model as -

#### 2.3.1.2 Mechanical Ventilation to the Heated Space

In the event that the heated space has a design air change of less than 0.5 air changes per hour and that installer prefers to mechanically ventilate the heated space rather than provide ventilation openings then -

- The heated space needs to be mechanically ventilated so that the design air change is 0.5 air changes or greater.
- It is a requirement that the mechanical ventilation shall be of the 'input' type with either natural or mechanical extraction.
- Systems of mechanical extraction with a natural inlet shall not be used

It is necessary to provide an automatic means to safely inhibit heater(s) operation should mechanical air supply fail for any reason

### 2.3.2. Heaters Installed within a Plant Room or Enclosure

A plant room means a room housing the heater plant and probably other items of building service plant and would generally have generous space for maintenance

An enclosure is where the heater is installed within a compartment or confined area where space is limited

Where heaters are installed within a plant room or enclosure then provision for both combustion air and air for general ventilation will be required by means of high **and** low level ventilation openings (sections 2.3.2.1 refers to plant room applications and sections 2.3.2.2 refers to enclosure applications).

Alternatively the plant room or enclosure may be mechanically ventilated (section 2.3.2.3 refers)

#### 2.3.2.1 Natural Ventilation Openings to Plant Rooms

For plant room applications the minimum free area of ventilation opening shall be

- At high level 2 cm<sup>2</sup> for each kW of rated heat input
- At low level 4 cm<sup>2</sup> for each kW of rated heat input

The high level ventilation opening should be sited on an external wall and positioned as high as is practical and always within the top 15% of the wall height

The low level natural ventilation opening should be situated on an external wall and be within 1000 mm of floor level for natural gas and ideally at floor level for l.p.g gas

installations but in any event no higher than 250 mm.

Model	Minimum Free Area of ventilation opening	
	High Level	Low Level
	cm <sup>2</sup>	cm <sup>2</sup>
60	140	280
88	204	408
117	272	544
150	349	698
175	406	812
235	592	1184
301	678	1356
375	865	1730
440	991	1982
525	1182	2364
600	1352	2704
700	1578	3156

The table below provides specific data for each heater model as -

#### 2.3.2.2 Natural Ventilation Openings to Enclosures

For enclosure applications the minimum free area of ventilation opening shall be

- At high level 5 cm<sup>2</sup> for each kW of rated heat input
- At low level 10 cm<sup>2</sup> for each kW of rated heat input
- 

The high level ventilation opening should be sited on an external wall and positioned as high as is practical and always within the top 15% of the wall height

The low level natural ventilation opening should be situated on an external wall and be within 1000 mm of floor level for natural gas and ideally at floor level for l.p.g gas

installations but in any event no higher than 250 mm

The table below provides specific data for each heater model as -

Model	Minimum Free Area of ventilation opening	
	High Level	Low Level
	cm <sup>2</sup>	cm <sup>2</sup>
60	350	700
88	510	1020
117	680	1360
150	872	1740
175	1015	2030
235	1480	2960
301	1695	3390
375	2160	4320
440	2475	4950
525	2955	5910
600	3380	6760
700	3945	7890

### 2.3.2.3 Mechanical Ventilation to a Plant Room or Enclosure

In the event that the installer prefers to mechanically ventilate the plant room or enclosure rather than provide ventilation openings then -

- The plant room or enclosure needs to be mechanically ventilated at the rate of 4.14 m<sup>3</sup>/h of fresh air per kW or rated heat input.

It is a requirement that the mechanical ventilation shall be of the 'input' type with either natural or mechanical extraction. Where mechanical extraction is selected then the extraction rate should be 5%-10% less than the input rate.

- Systems of mechanical extraction with a

natural inlet shall not be used

- It is necessary to provide an automatic means to safely inhibit heater(s) operation should mechanical air supply fail for any reason

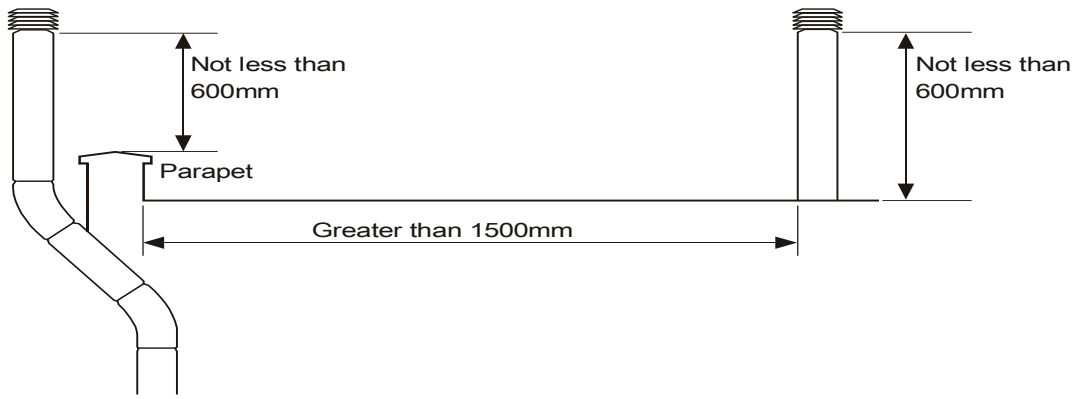
MODEL	Mechanical Ventilation Rate for Plant Room or Enclosure
	M <sup>3</sup> /h
60	299
88	422
117	563
150	722
175	840
235	1225
301	1043
375	1788
440	2049
525	2447
600	2799
700	3266

The table below provides specific data for each heater model as -

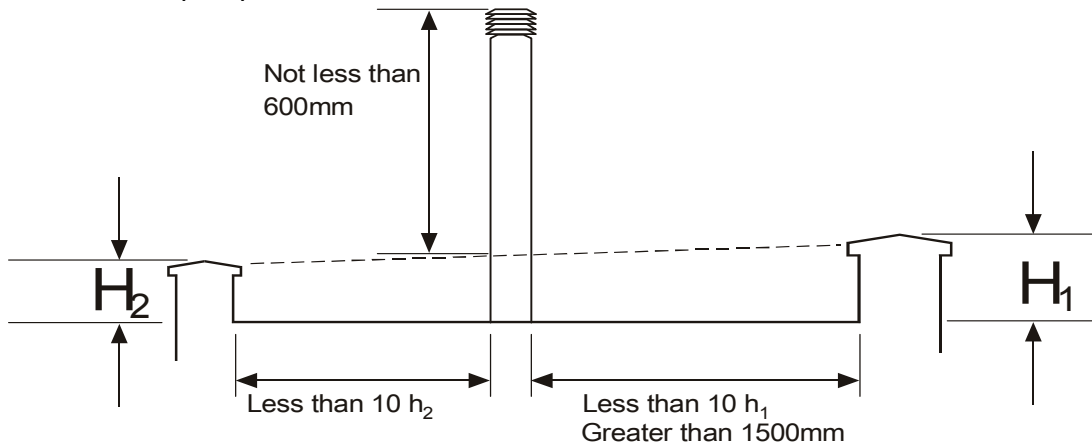
## 2.4 Flue system

### Warning

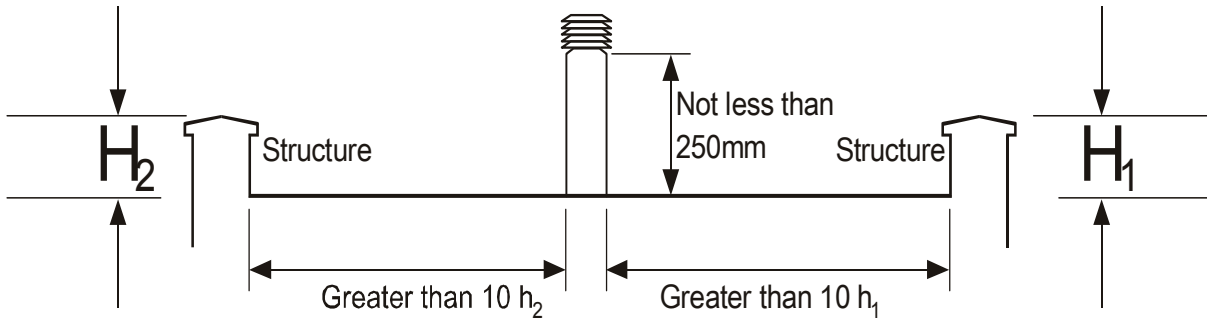
It is essential that the products of combustion are flued to the outside of the building. Each EM unit must have its own separate flue, with a flue diameter of not less than the flue spigot fitted to the EM unit. The minimum vertical length of flue must not be less than 1m. The flue must be constructed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



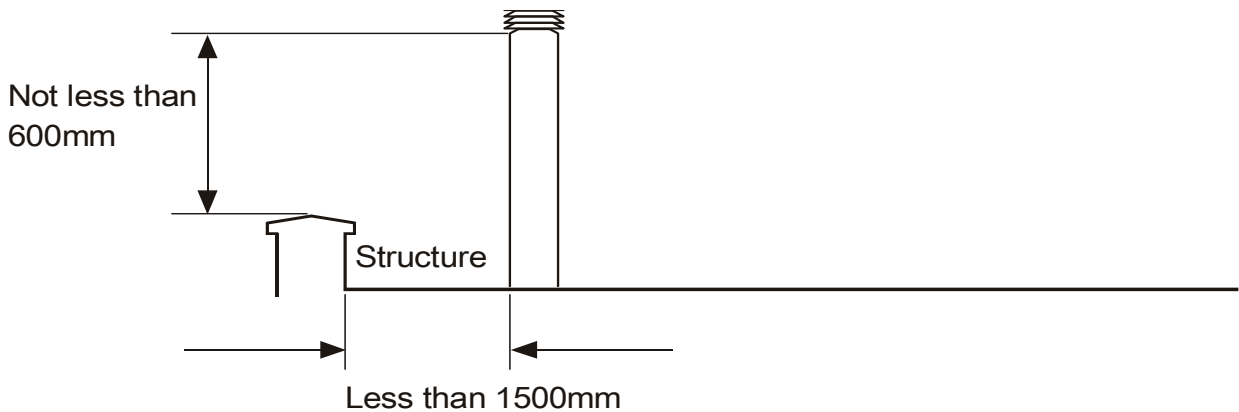
Flat roof with parapet



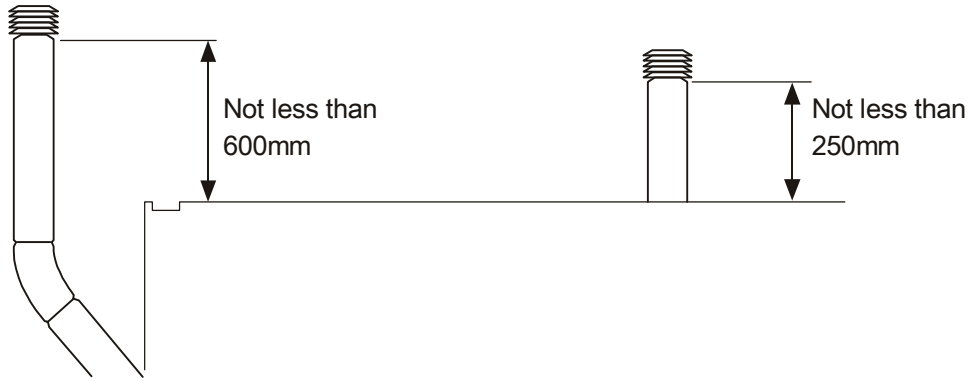
Flat roof envelope method



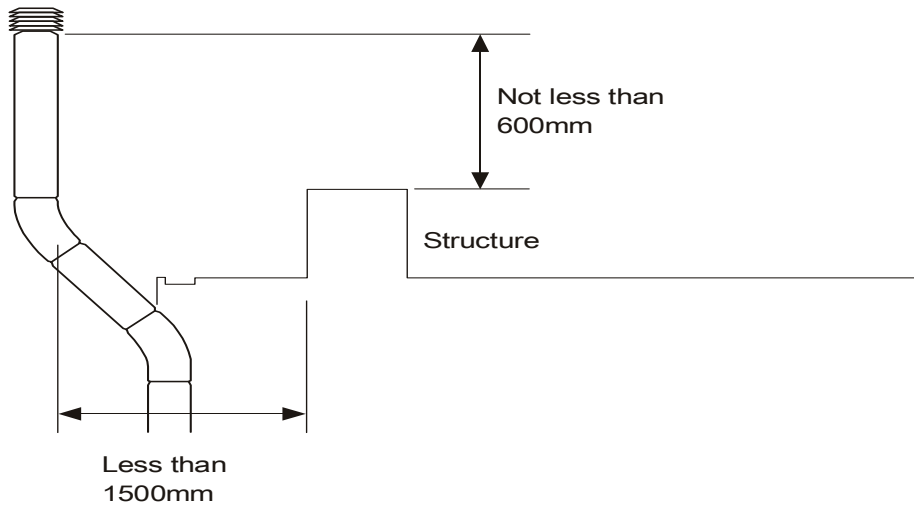
Flat roof where the flue height is more than 10 Heights (H) away from all structures



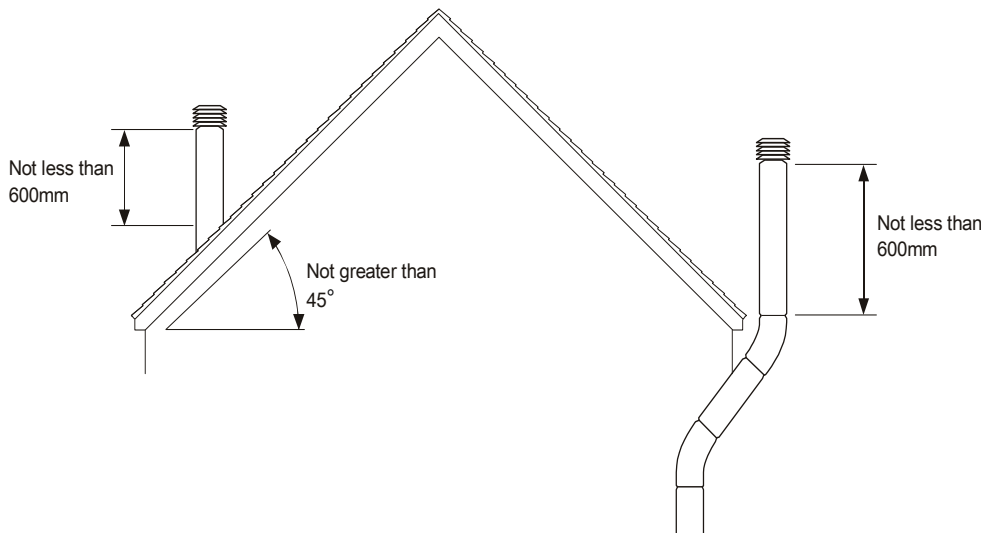
Flat roof with flue close to parapet



Flat roof with no parapet



Flat roof with structure close to flue outlet



Pitched roof not greater than 45°

## 2.5 Flue Installation

An integral condensate tee is fitted to all EM models, 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  $\frac{3}{4}$  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.

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.

### 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

Combustion Chamber Internal Resistance		
EM 60 —	EM 88	0.4 Mbar
EM 117 —	EM175	0.6 Mbar
EM235 —	EM 301	0.9 Mbar
EM 375		0.6 Mbar
EM 440		0.9 Mbar
EM 525 —	EM600	0.7 Mbar
EM 700		1.1 Mbar

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 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.

### 3.5 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.

### 3.6 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 unit.

#### Warning

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

#### Caution

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

Airflow volume (m <sup>3</sup> /h)	Min	Max
EM 60	0.91	2.25
EM 88	1.33	2.25
EM 117	1.77	3.5
EM 150	2.27	5.1
EM 175	2.65	5.1
EM 235	3.55	6.75
EM 301	4.5	7.75
EM 375	5.5	11.25
EM 440	6.65	12.1
EM 525	8.1	16.9
EM 600	9.1	17.9
EM 700	10.6	18.9

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 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/standby	- 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/standby - standby
  - heat/ventilation - heat
  - manual/automatic - automatic
- (d) Turn main electrical supply to on
- (e) Select on position for on/standby 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.

- (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,

**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

Time Interval	Operation
1 to 5 Seconds	If applicable combustion air damper is actuated fan motor starts purge cycle
2 to 40 Seconds	Pilot valve opens, ignition transformer provides spark for ignition
<b>either</b>	
3 to 40 Seconds	Ignition failure caused by gas starvation resulting in burner lockout / shut down

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

<b>or</b>	
3 to 40 Seconds	Pilot Ignition Burner Ignition
4 to 60 Seconds	Burner Ignition cycle complete

- (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 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 effect 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 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 unit service:

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

**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**

**(Facsimile) + 44 (0) 1547 520399**

**Email**

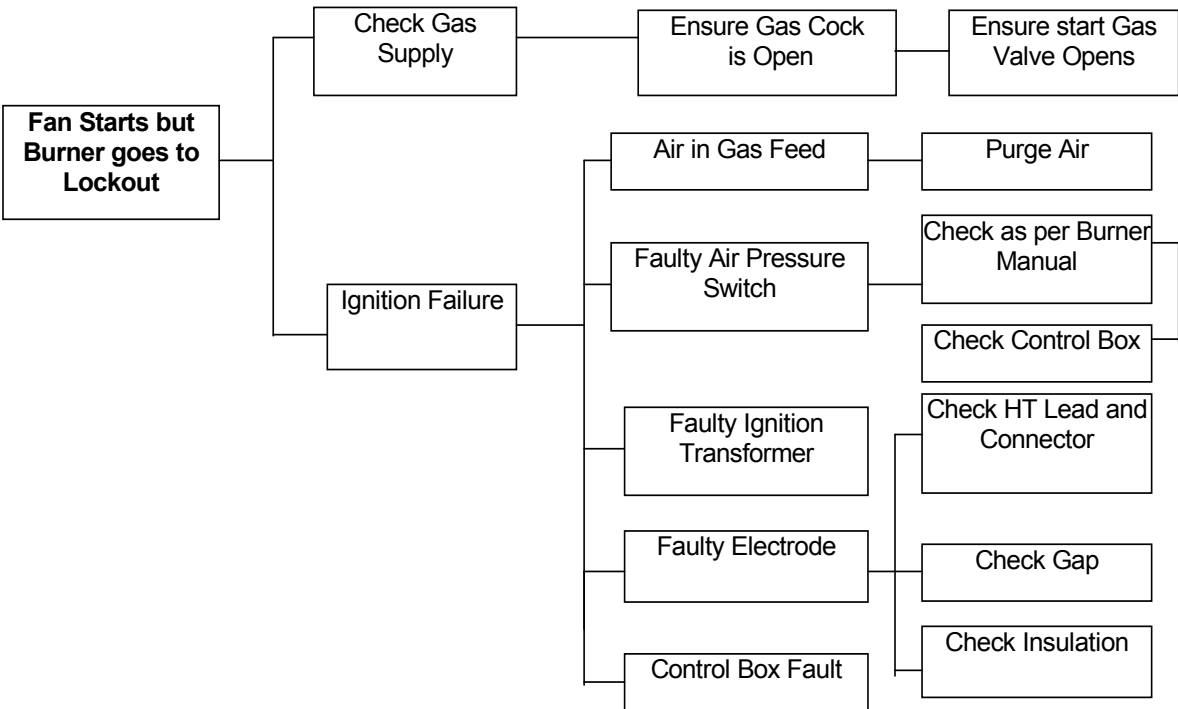
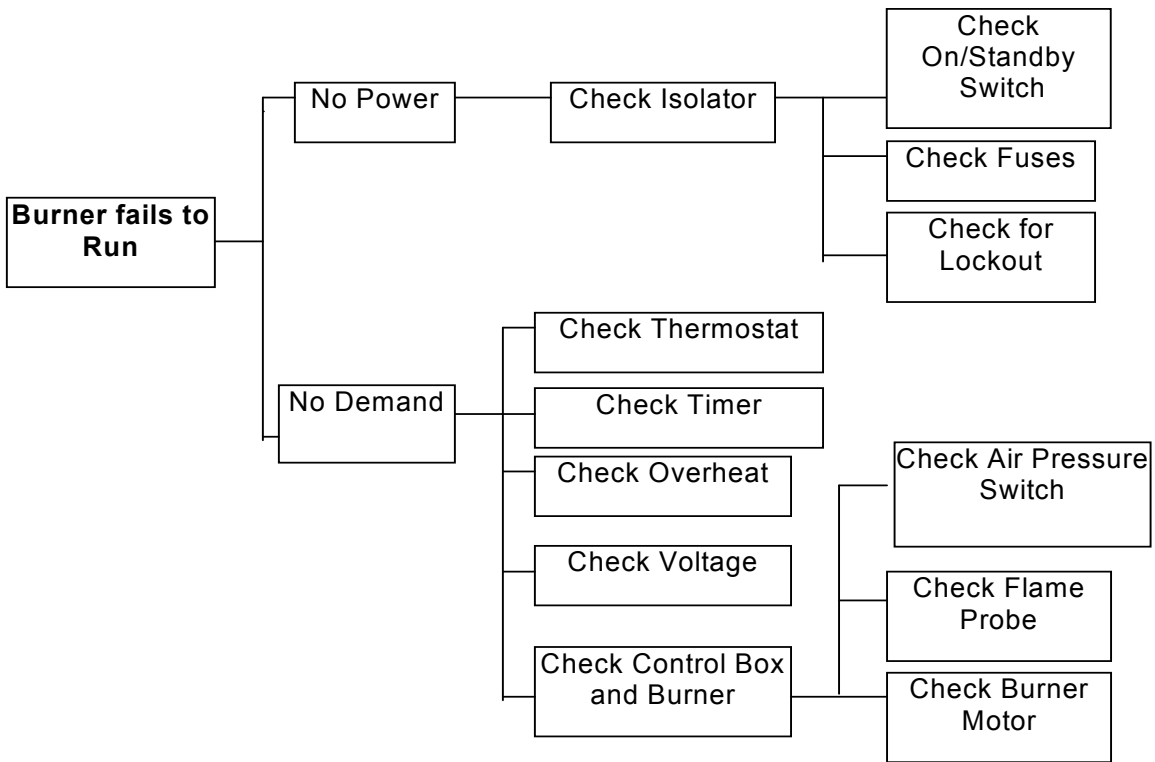
**Information@bensonheating.co.uk**

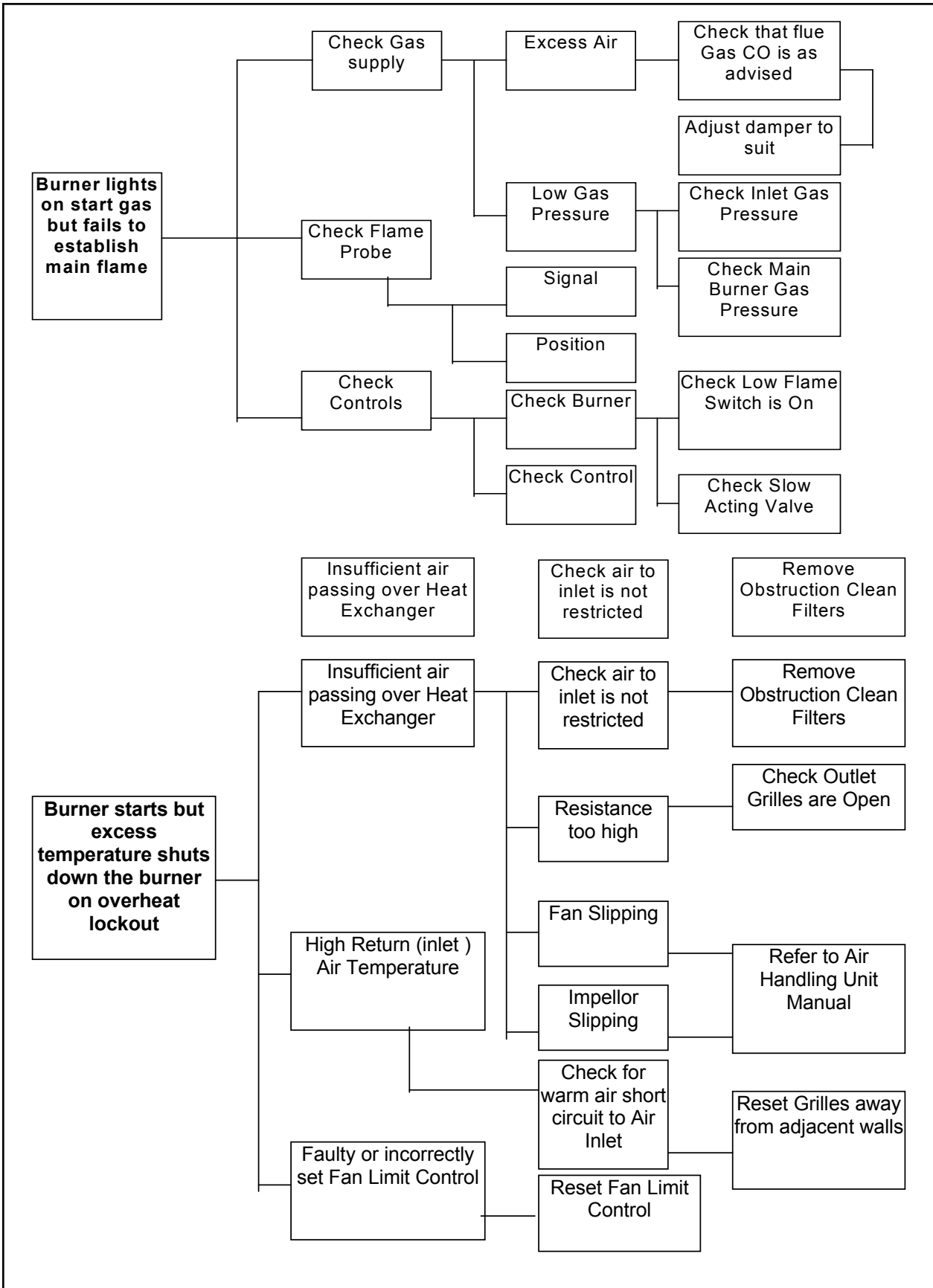
In the interests of health and safety the manufacturer is keen to offer technical assistance and support when or wherever this maybe required. Further information concerning fault diagnostics is contained within the burner manual which is supplied as part of the information pack with each EM unit.

The following fault diagnosis chart is therefore only an initial guide.

**Due to the variety of applications where**

## 6.0 Fault Diagnosis





# 7.0 Wiring Diagrams

**2050081**

**HM & FP 117/175  
RIELLO GS20D**

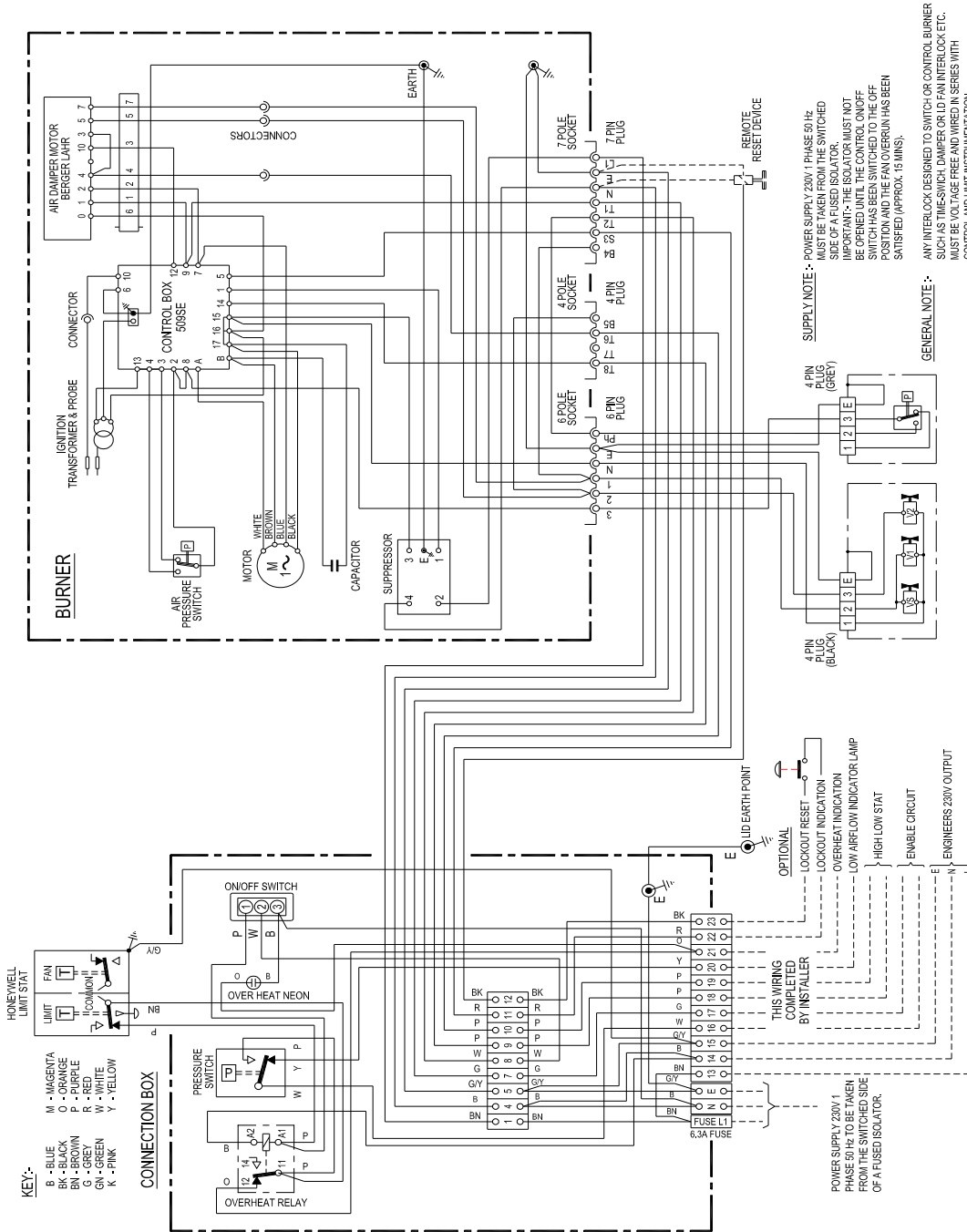
**GAS FIRED  
HIGH/LOW**

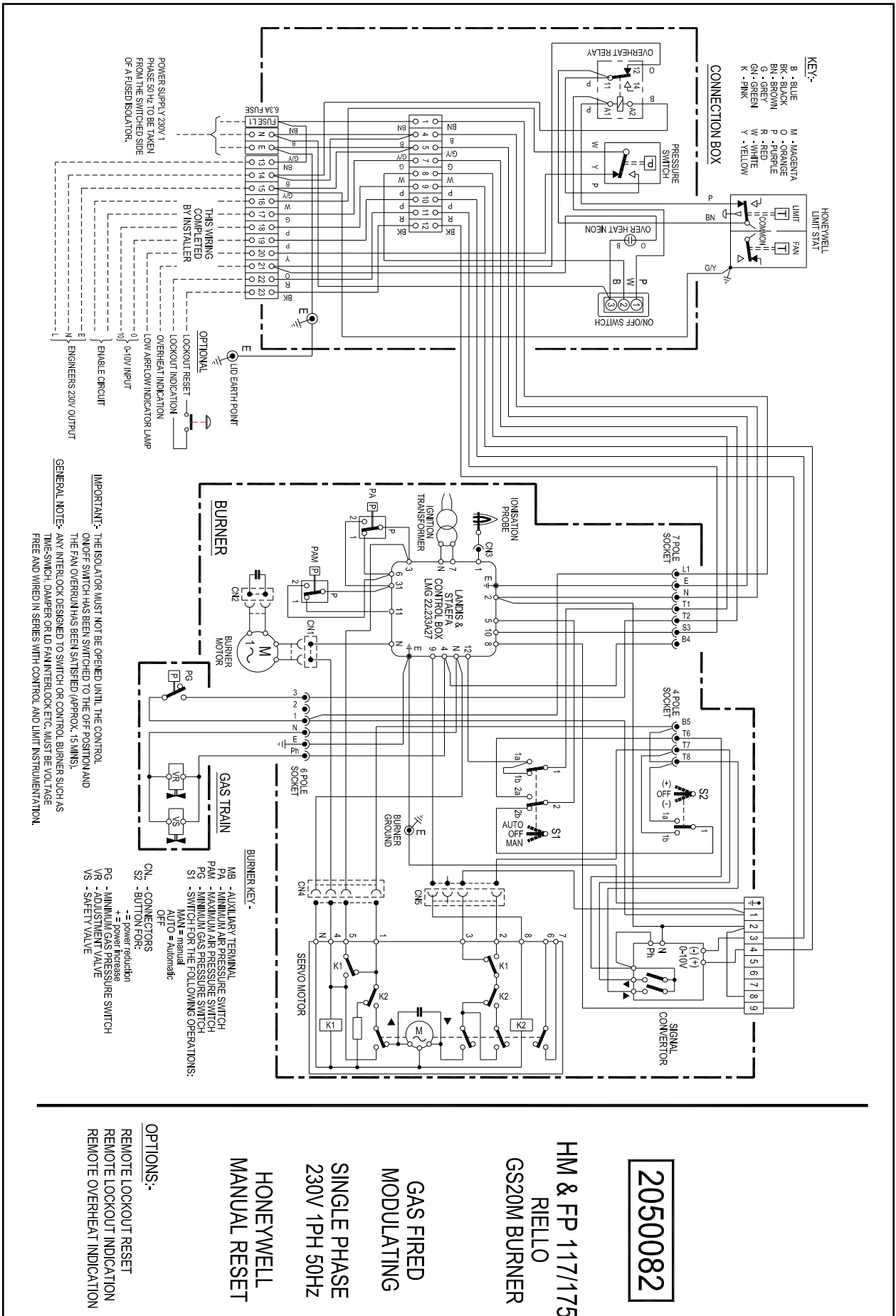
**SINGLE PHASE  
230V 1PH 50HZ**

**HONEYWELL  
LIMIT STAT**

**OPTIONS:-**

- REMOTE LOCKOUT RESET
- REMOTE LOCKOUT INDICATION
- REMOTE OVERHEAT INDICATION





**2050082**

**HM & FP 117/175  
RIELLO  
GS20M BURNER**

**GAS FIRED  
MODULATING**

**SINGLE PHASE  
230V 1PH 50HZ**

**HONEYWELL  
MANUAL RESET**

**OPTIONS:-**

- REMOTE LOCKOUT RESET
- REMOTE LOCKOUT INDICATION
- REMOTE OVERHEAT INDICATION

# 2051102

## HM & FP 200/300 RIELLO RS28M

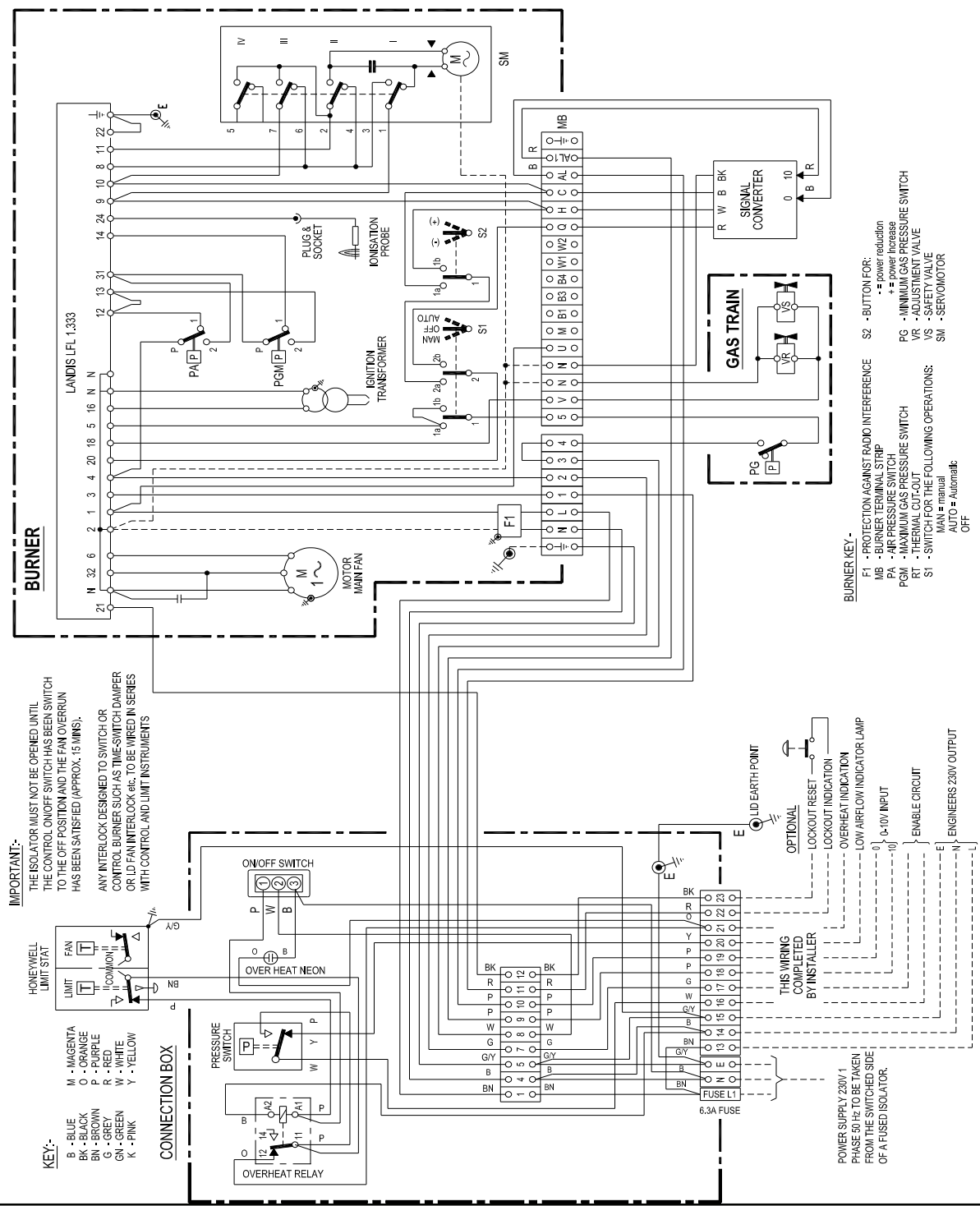
MODULATING  
GAS FIRED  
SINGLE PHASE  
230V 1PH 50HZ  
BURNER SUPPLY

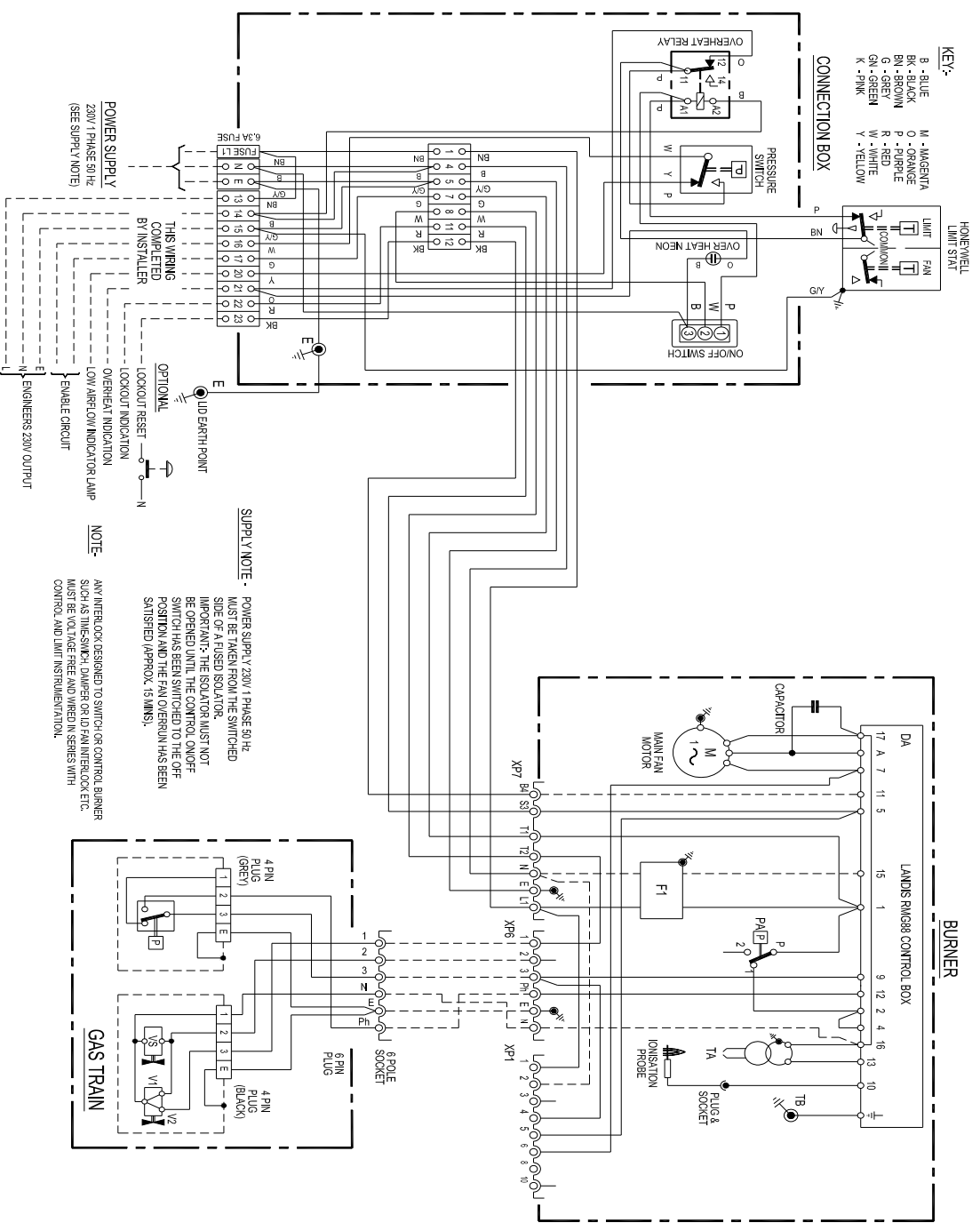
MANUAL RESET  
LANDIS LFL 1.333  
CONTROL BOX

HONEYWELL  
LIMIT STAT

### OPTIONS:-

REMOTE LOCKOUT RESET  
REMOTE LOCKOUT INDICATION  
REMOTE OVERHEAT INDICATION





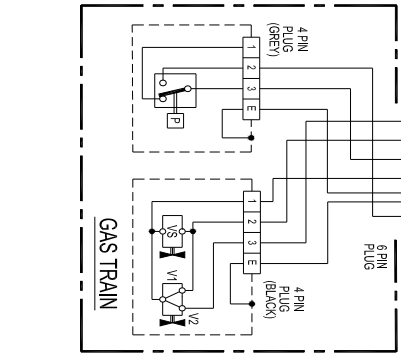
**KEY:-**  
 B - BLUE  
 BK - BLACK  
 BR - BROWN  
 G - GREEN  
 GN - GREEN  
 K - PINK  
 M - MAGENTA  
 O - ORANGE  
 P - PURPLE  
 R - RED  
 W - WHITE  
 Y - YELLOW

**POWER SUPPLY**  
 230V, 1 PHASE 50Hz  
 (SEE SUPPLY NOTES)

**OPTIONAL**  
 - LOOKOUT RESET  
 - OVERHEAT INDICATION  
 - LOW FAN FLOW INDICATOR LAMP  
 - ENABLE CIRCUIT

**SUPPLY NOTE -** POWER SUPPLY 230V, 1 PHASE 50Hz MUST BE TAKEN FROM THE SWITCHED SIDE OF A FUSED ISOLATOR. IMPORTANT: THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN/OVERHEAT HAS BEEN SATISFIED (APPROX. 15 MINS).

**NOTE -** ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME-SWITCH, DAWPER OR LD FAN INTERLOCK ETC. MUST BE VOLTAGE FREE AND WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTATION.



2051111

HM & FP200-300  
 RIELLO RS28.1

**GAS FIRED**

**ON/OFF SINGLE PHASE**

**HONEYWELL MANUAL RESET**

**OPTIONS:-**  
 - REMOTE LOCKOUT RESET  
 - REMOTE LOCKOUT INDICATION  
 - REMOTE OVERHEAT INDICATION

2053081

HM & FP 375  
RIELLO RS38M

HM & FP 400/500  
RIELLO RS50M

HM & FP 600  
RIELLO RS70M

HM & FP 700/800  
RIELLO RS100M

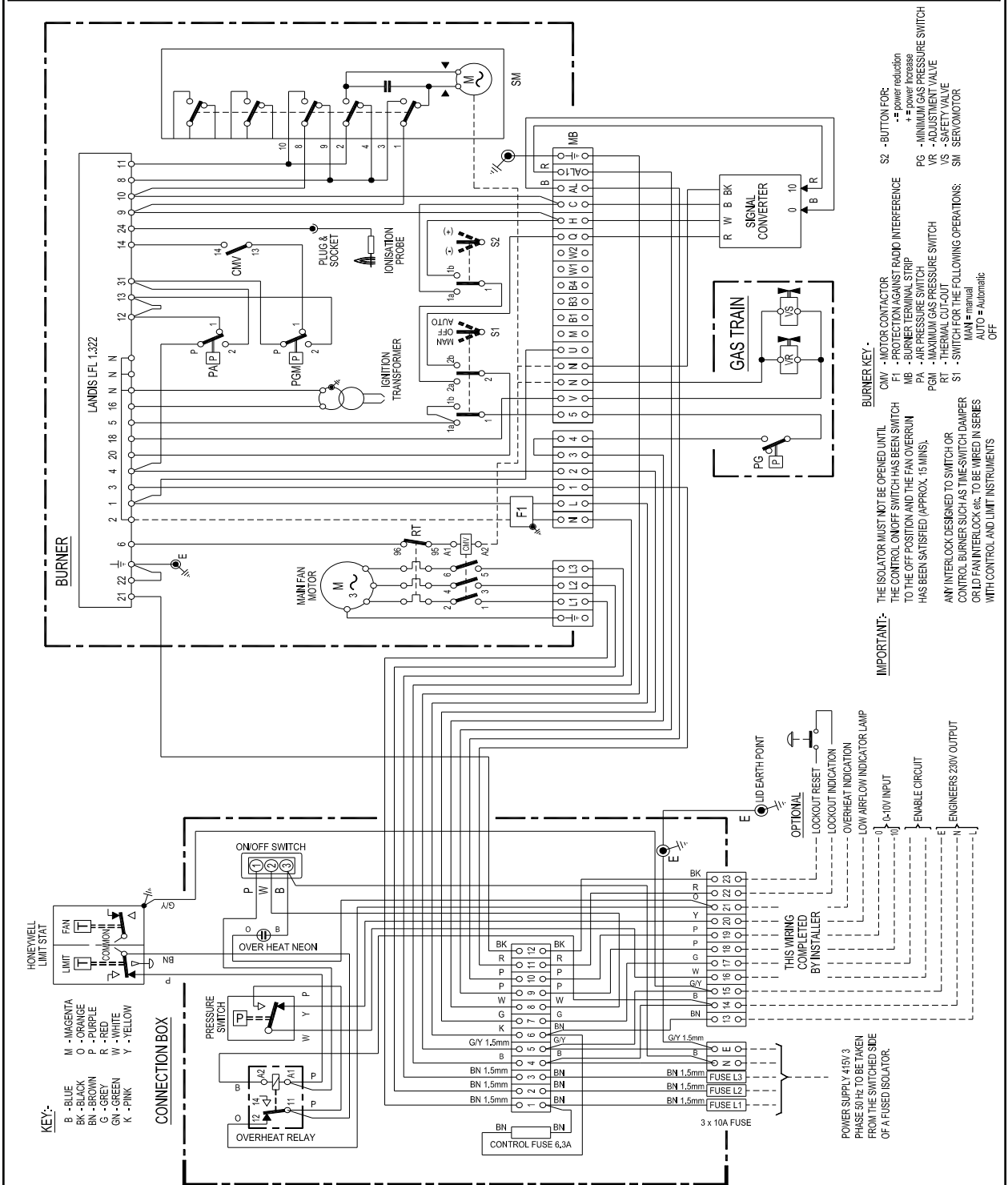
HM & FP 1000  
RIELLO RS130M

MODULATING  
GAS FIRED

THREE PHASE  
415V 3PH 50Hz  
BURNER SUPPLY

MANUAL RESET  
LANDIS LFL 1.322  
CONTROL BOX

OPTIONS:-  
REMOTE LOCKOUT RESET  
REMOTE LOCKOUT INDICATION  
REMOTE OVERHEAT INDICATION



- KEY:-**
- B - BLUE
  - BK - BLACK
  - BN - BROWN
  - G - GREY
  - GN - GREEN
  - K - PINK
  - M - MAGENTA
  - O - ORANGE
  - P - PURPLE
  - R - RED
  - W - WHITE
  - Y - YELLOW

**CONNECTION BOX**

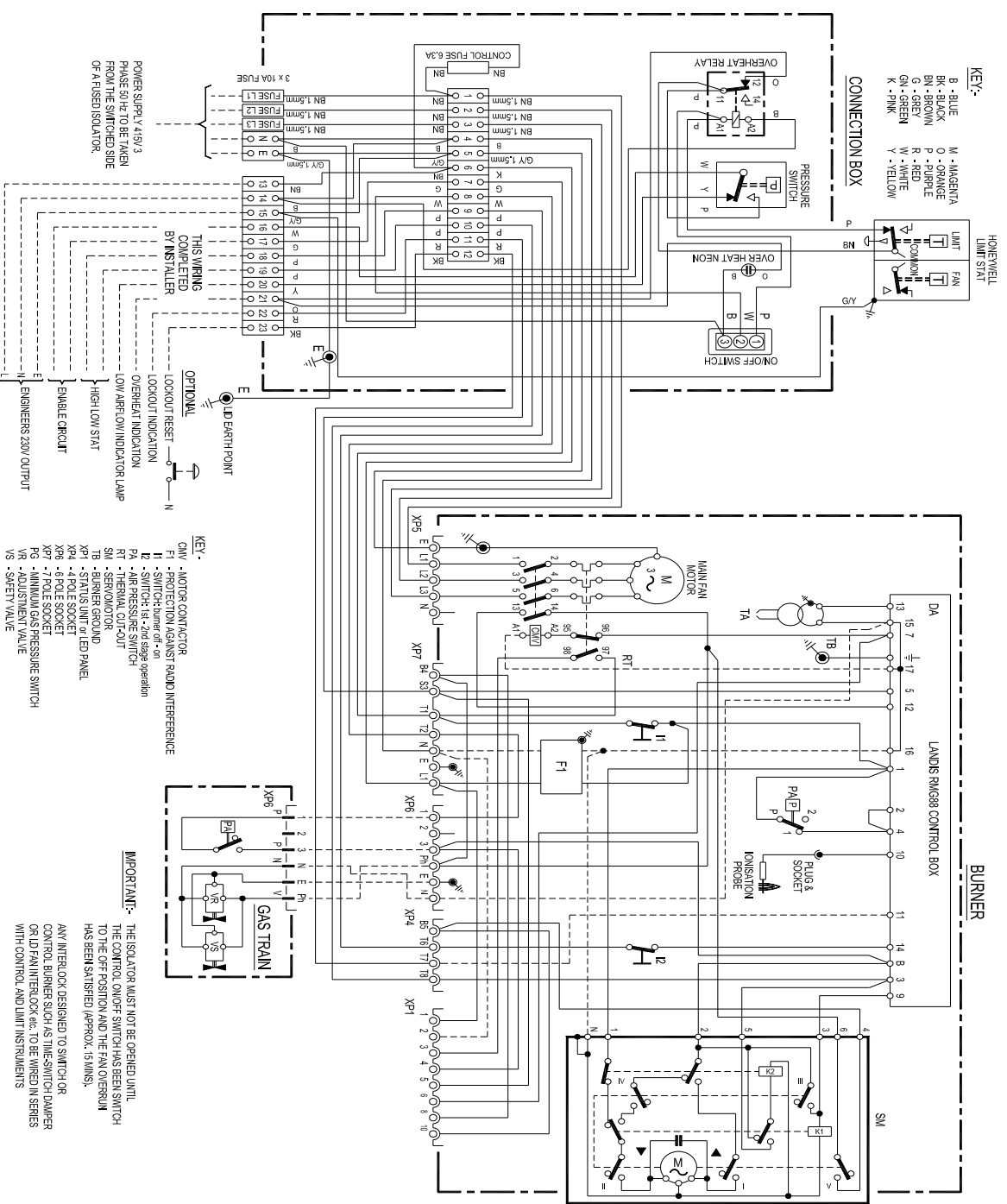
- IMPORTANT:-**
- THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN OVERRUN HAS BEEN SATISFIED (APPROX. 15 MINS).
  - ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME-SWITCH DAMPER OR LD FAN INTERLOCK etc. TO BE WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTS

- BURNER KEY:-**
- CMV - MOTOR CONTACTOR
  - F1 - PROTECTION AGAINST RADIO INTERFERENCE
  - MB - BURNER TERMINAL STRIP
  - PA - AIR PRESSURE SWITCH
  - PGM - MAXIMUM GAS PRESSURE SWITCH
  - RT - THERMAL CUT-OUT
  - S1 - SWITCH FOR THE FOLLOWING OPERATIONS:  
MAM = manual  
AUTO = Automatic  
OFF

- OPTIONAL:-**
- LOCKOUT RESET
  - OVERHEAT INDICATION
  - LOW AIRFLOW INDICATOR LAMP
  - ENABLE CIRCUIT
  - ENGINEERS 230V OUTPUT

- THIS WIRING COMPLETED BY INSTALLER**
- OPTIONAL LOCKOUT RESET
  - OVERHEAT INDICATION
  - LOW AIRFLOW INDICATOR LAMP
  - ENABLE CIRCUIT
  - ENGINEERS 230V OUTPUT

POWER SUPPLY 415V/3 PHASE 50 Hz TO BE TAKEN FROM THE SWITCHED SIDE OF A FUSED ISOLATOR.



2053113

HM & FP 375  
 RIELLO RS38  
 HM & FP 400/500  
 RIELLO RS50

HIGH/LOW  
 GAS FIRED

THREE PHASE  
 415V 3PH 50HZ  
 BURNER SUPPLY

HONEYWELL LIMIT STAT  
 LANDIS RMG88  
 CONTROL BOX

OPTIONS:-  
 REMOTE LOOKOUT RESET  
 REMOTE LOOKOUT INDICATION  
 REMOTE OVERHEAT INDICATION

KEY:-  
 B - BLUE  
 BK - BLACK  
 G - GREEN  
 GN - GREEN  
 K - PINK  
 M - MARGINA  
 O - ORANGE  
 P - PURPLE  
 R - RED  
 W - WHITE  
 Y - YELLOW

POWER SUPPLY 415V/3 PHASE 50 HZ TO BE TAKEN FROM THE SWITCHED SIDE OF A RISED ISOLATOR.

KEY:-  
 ONV - MOTOR CONTACTOR  
 I1 - PROTECTION AGAINST RADIO INTERFERENCE  
 I2 - SWITCH - burner off - on  
 PA - AIR PRESSURE SWITCH  
 RT - THERMAL CUT-OUT  
 SM - SERVOMOTOR  
 TB - BURNER MOTOR  
 XPI - STATUS UNIT AT LEAD PANEL  
 XPE - POLE SOCKET  
 XPT - 7 PIN SOCKET  
 PG - MINIMUM GAS PRESSURE SWITCH  
 VR - ADJUSTMENT VALVE  
 VS - SAFETY VALVE

IMPORTANT:- THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN OVERRUM HAS BEEN SATISFIED (APPROX. 15 MINS).

ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME SWITCH DAMPER OR OLD FAN INTERLOCK etc. TO BE WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTS

OPTIONAL:-  
 LOCKOUT RESET  
 LOCKOUT INDICATION  
 OVERHEAT INDICATION  
 LOW AIR/FLOW INDICATOR LAMP  
 HIGH LOW STAT  
 EMERGE CIRCUIT  
 ENGINEERS 230V OUTPUT

## Technical Data

Model		EM 60	EM 88	EM 117	EM 150
Heat Output (Max)	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 G20	M <sup>3</sup> /h	7.23	10.59	14.08	18.05
Riello R 40	On / Off	R40GS10	R40GS10	R40GS10	R40GS10
Riello R 40	Hi / Lo	R40GS10	R40GS10	R40GS20	R40GS20
Riello R.S	Modulating	R40GS10M	R40GS10M	R40GS20M	R40GS20M
Min Gas Inlet Pressure G20	M/bar	17.5	17.5	17.5	17.5
Burner Head Pressure Zero Resistance cover fitted	On/Off Hi/Lo Modulating	4.0 / 1.8		4.9 / 2.0	
Gas Connection	BSP	½"	½"	¾"	¾"
Resistance @Max Air Volume	Pascals	165	165	190	350
Max Air Volume	M <sup>3</sup> /sec	2.25	2.25	3.5	5.1
Min Air Volume	M <sup>3</sup> /sec	0.91	1.33	1.77	2.27
Air Pressure Setting	M/bar	0.4	0.4	0.4	0.4
Max Temp Rise	Deg C	55	55	55	55
Comb Chamber Resistance	M/bar	0.4	0.4	0.6	0.6
Flue Pressure	Max M/bar Min M/bar	+0.6 -0.2	+0.6 -0.2	+0.6 -0.2	+1.6 -0.4
Flue Diameter I/D	mm	150	175	175	175
Electrical Supply	STD	230/1/50	230/1/50	230/1/50	230/1/50
Fuse Rating Internal	Amps	6	6	6	6
Burner Running Current	Amps	3	3	3	3
Controls input	Vdc	10	10	10	10
CO	Ppm	<100	<100	<100	<100
CO2	%	9	9	9	9
Flue gas Temp @20 Ambient	Deg C	100 / 250	100 / 350	200 / 300	130 / 330
Weight Nett	Kg	191	191	305	305

Model		EM 175	EM 235	EM 301	EM 375
Heat Output (Max)	kW/hr	175	235	301	375
Heat Input (Gross)	kW/hr	225.3	293.8	376.3	480.0
Gas Consumption G20	M <sup>3</sup> /h	21.02	27.4	35.1	44.8
Riello R 40	On / Off	R40GS20	RS28.1	RS28.1	RS38.1
Riello R 40	Hi / Lo	R40GS20	RS 28	RS28	RS38
Riello R.S	Modulating	R40GS20M	RS28M	RS28M	RS38M
Min Gas Inlet Pressure G20	M/bar	17.5	17.5	17.5	17.5
Burner Head Pressure Zero Resistance cover fitted	On/Off Hi/Lo Modulating	0.6 / 6.2	8.3 0.8 / 8.0	10.4 / 4.6 2.0 / 10.4	3.1/ 9.4
Gas Connection	BSP	1"	1¼"	1¼"	1½"
Resistance @Max Air Volume	Pascals	350	200	240	250
Max Air Volume	M <sup>3</sup> /sec	5.1	6.75	7.75	11.25
Min Air Volume	M <sup>3</sup> /sec	2.65	3.55	4.5	5.5
Air Pressure Setting	M/bar	0.4	0.4	0.4	0.4
Max Temp Rise	Deg C	55	55	55	55
Comb Chamber Resistance	M/bar	0.6	0.9	0.9	0.6
Flue Pressure	Max M/bar Min M/bar	+0.6 -0.2	+0.6 -0.2	+0.6 -0.2	+1.6 -0.4
Flue Diameter I/D	mm	175	225	225	250
Electrical Supply	STD	230/1/50	230/1/50	230/1/50	230/1/50
Fuse Rating Internal	Amps	6	6	6	6
Burner Running Current	Amps	3	3	3	3
Controls input	Vdc	10	10	10	10
CO	Ppm	<100	<100	<100	<100
CO2	%	9	9	9	9
Flue gas Temp @20 Ambient	Deg C	180 / 365	110 / 290	115 / 370	230 / 300
Weight Nett	Kg	305	435	435	800

<b>Model</b>		<b>EM 440</b>	<b>EM 525</b>	<b>EM 600</b>	<b>EM 700</b>
Heat Output (Max)	kW/hr	440	525	600	700
Heat Input (Gross)	kW/hr	550	656	750.3	875.8
Gas Consumption G20	M <sup>3</sup> /h	51.3	61.2	70.0	81.7
Riello R S	On / Off	N/A	N/A	N/A	N/A
Riello R S	Hi / Lo	RS50	RS70	RS70	RS100
Riello R.S	Modulating	RS50M	RS70M	RS70M	RS100M
Min Gas Inlet Pressure G20	M/bar	17.5	17.5	17.5	17.5
Burner Head Pressure Zero Resistance cover fitted	On/Off Hi/Lo Modulating	0.5 / 8.0	7.8 / 3.1	10.4 / 3.8 1.6 / 10.4	0.6 / 6.4
Gas Connection	BSP	2"	2"	2"	2"
Resistance @Max Air Volume	Pascals	275	225	250	275
Max Air Volume	M <sup>3</sup> /sec	12.1	16.9	17.9	18.9
Min Air Volume	M <sup>3</sup> /sec	6.65	8.1	9.1	10.6
Air Pressure Setting	M/bar	0.4	0.4	0.4	0.4
Max Temp Rise	Deg C	55	55	55	55
Comb Chamber Resistance	M/bar	0.4	0.4	0.6	0.6
Flue Pressure	Max M/bar Min M/bar	+0.6 -0.2	+0.6 -0.2	+0.6 -0.2	+1.6 -0.4
Flue Diameter I/D	mm	250	350	350	350
Electrical Supply	STD	230/1/50	230/1/50	415/3/50	415/3/50
Fuse Rating Internal	Amps	6	6	6	6
Burner Running Current	Amps	3	3	3	3
Controls input	Vdc	10	10	10	10
CO	Ppm	<100	<100	<100	<100
CO2	%	9	9	9	9
Flue gas Temp @20 Ambient	Deg C	250 / 370	160 / 250	200 / 260	100 / 280
Weight Nett	Kg	800	1765	1765	1765



**BENSON  
HEATING**

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Facsimile +44 (0) 1547 520399  
email [information@bensonheating.co.uk](mailto:information@bensonheating.co.uk)  
Web [www.bensonheating.com](http://www.bensonheating.com)**