

**Benson Climate Systems**  
**HEAT MODULE / FRONT PLATE RANGE**  
**Installation Operation & Servicing Manual**

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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

## HM/FP RANGE GAS FIRED

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 Heat Module range of gas fired process HM/FP units are manufactured by Benson within a strictly controlled quality environment within the parameters of ISO 9001.

Benson Climate Systems has taken reasonable and practical steps to ensure that their Heat 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 HM/FP 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 Heat Module Front Plate 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 HM/FP range of indirect gas fired forced convection process HM/FP units have an output range from 117kW to 1000kW, and are suitable for use with natural gas.

The HM/FP 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 HM/FP units are installed and operated within suitable applications.

The HM/FP units are intended for use within ducted applications, with the HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP units must not be located in hazardous areas, however, it is permissible for the HM/FP unit to supply air to such areas.

The HM/FP 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 HM/FP unit be positioned where the burner could be adversely affected by high winds or draughts. The location chosen for the HM/FP 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 HM/FP 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 HM/FP unit, and any ancillary equipment. Any combustible material adjacent to the HM/FP unit or flue system must be so placed or shielded so that its surface temperature does not exceed 65°C.

All HM/FP 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 Heat Module range is manufactured and supplied with burners pre-set for use with natural gas to I<sub>2H</sub> (G20).

The HM/FP unit must be compatible with the gas supply, and each HM/FP 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.

## HM/FP RANGE GAS FIRED

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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP units must be earthed.

#### Caution

The main electrical supply must not be switched off or disconnected as a method for stopping the HM/FP 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 HM/FP 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)	540cm <sup>2</sup> + 4,5cm <sup>2</sup> per kW of rated input per HM/FP unit
High level (outlet)	270cm <sup>2</sup> + 2,25cm <sup>2</sup> per kW of rated input per HM/FP 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 HM/FP 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.

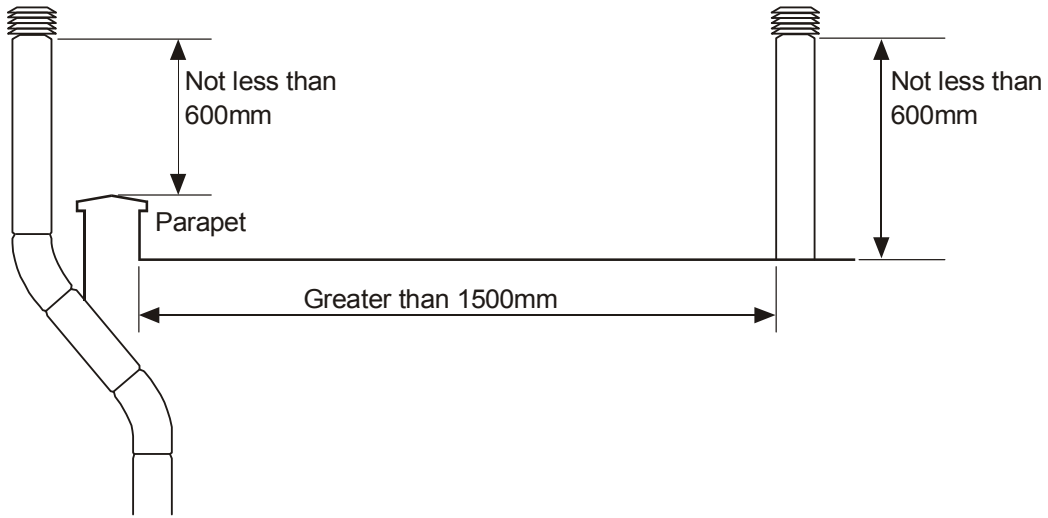
### 2,4 Flue system

#### Warning

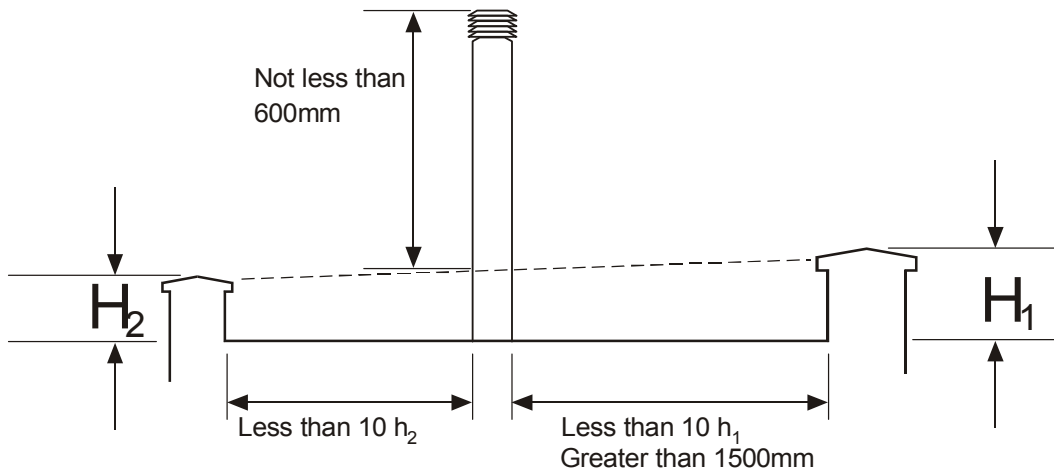
It is essential that the products of combustion are flued to the outside of the building. Each HM/FP unit must have its own separate flue, with a flue diameter of not less than the flue spigot fitted to the HM/FP unit. The minimum vertical length of

flue must not be less than 1m. The flue must be constructed using the appropriate products and

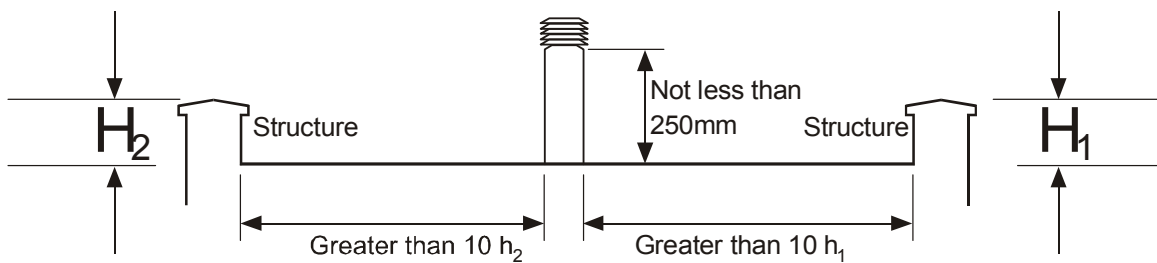
**HM/FP RANGE GAS FIRED**  
must rise vertically, and terminate with an approved cowl.



Flat roof with parapet

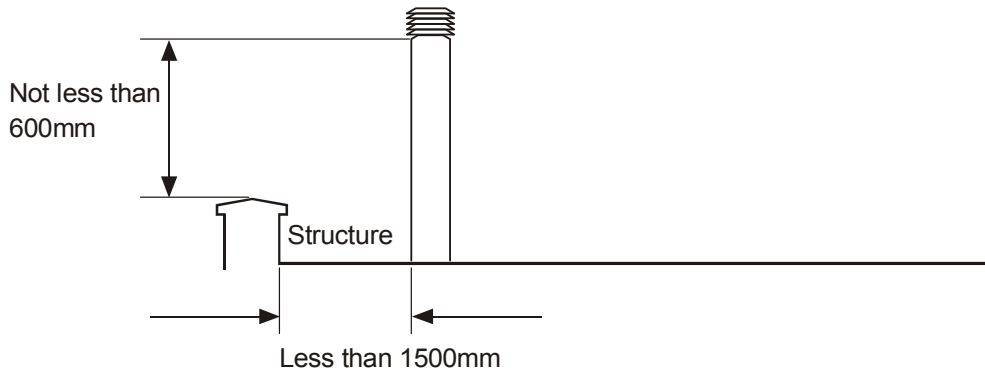


Flat roof envelope method

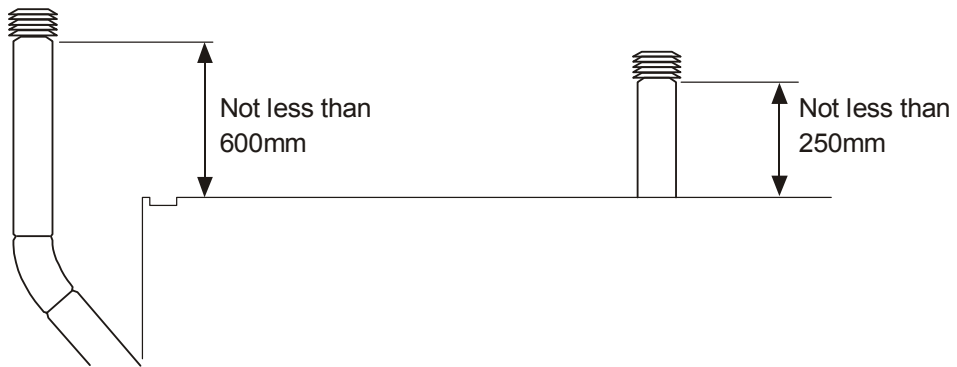


Flat roof where the flue height is more than 10 Heights (H) away from all structures

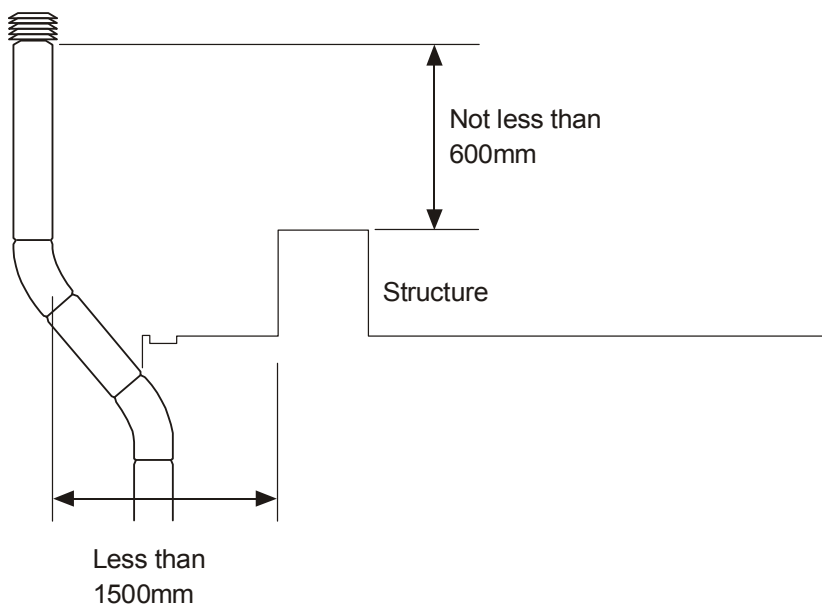
**HM/FP RANGE GAS FIRED**



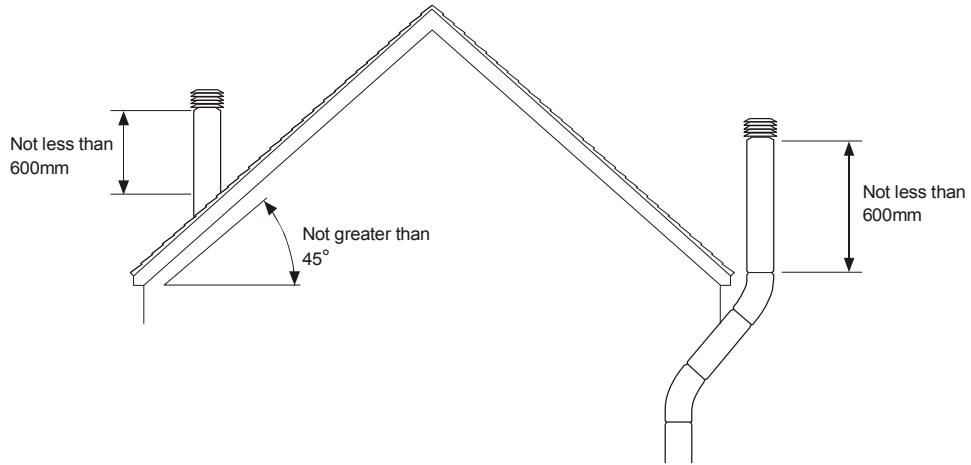
Flat roof with flue close to parapet



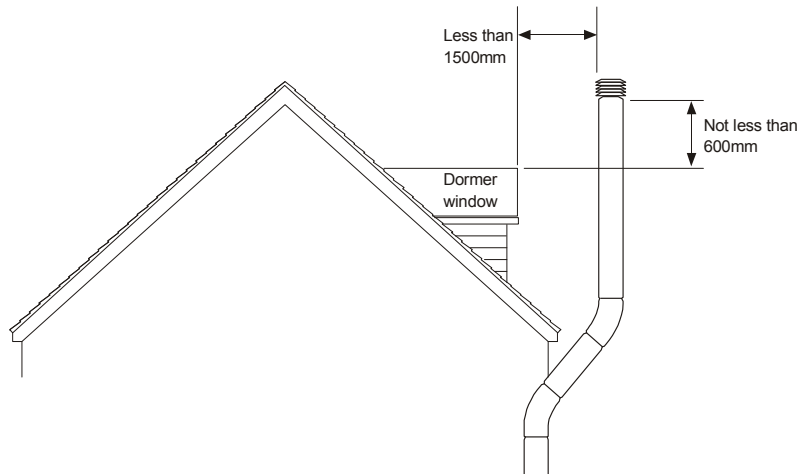
Flat roof with no parapet



Flat roof with structure close to flue outlet



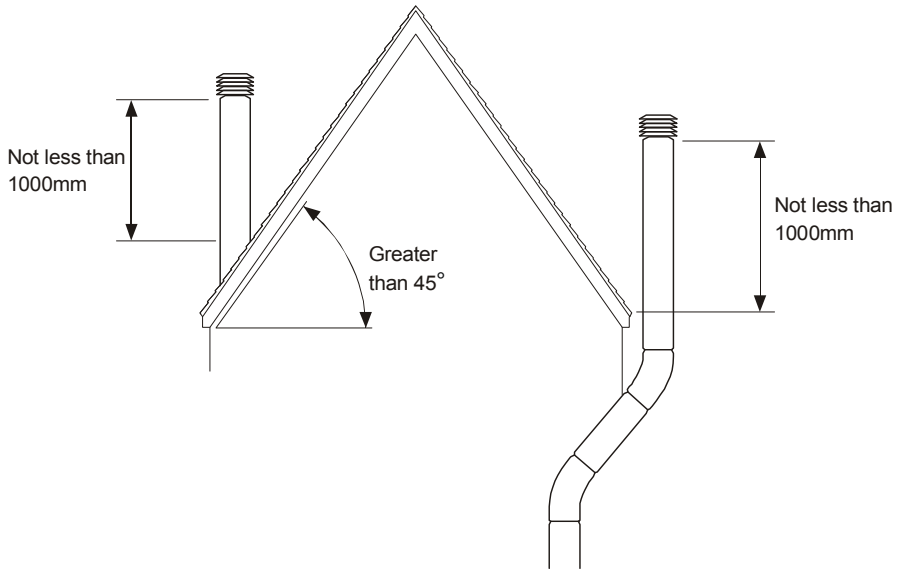
Pitched roof not greater than 45°



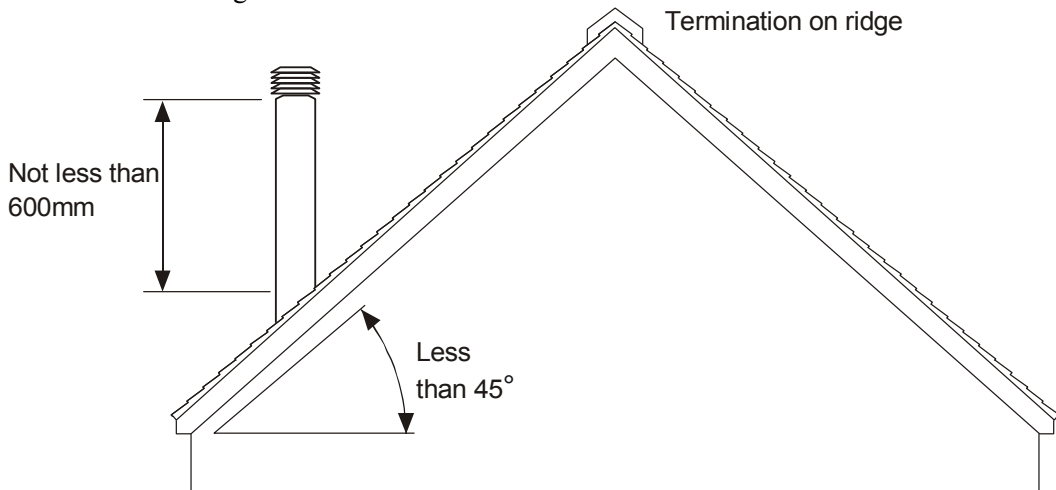
Pitched roof chimney within 1.5m from dormer window measured horizontally



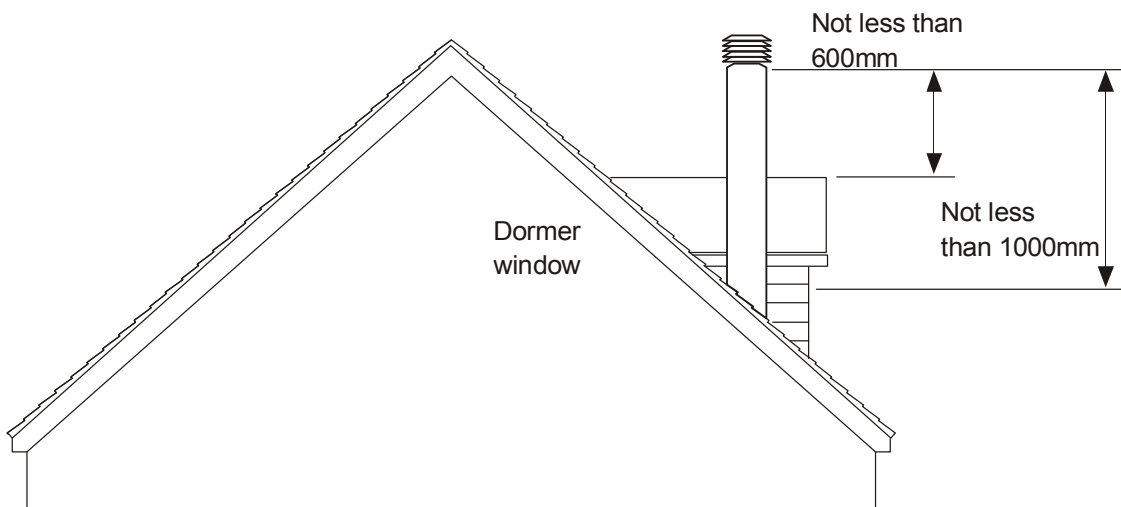
**HM/FP RANGE GAS FIRED**



Pitched roof exceeding 45°



Pitched roof internal route not exceeding 45° and ridge termination



Pitched roof chimney within 1.5m from dormer window measured horizontally

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.

<b>Combustion Chamber Internal Resistance</b>	
HM/FP117 - HM/FP175	0.6 mbar
HM/FP 200	0.8 mbar
HM/FP225 - HM/FP265	0.9 mbar
HM/FP300	0.6 mbar
HM/FP375	0.9 mbar
HM/FP400	0.6 mbar
HM/FP500 - HM/FP600	0.7 mbar
HM/FP700-HM/FP800	1.1 mbar
HM/FP 1000	1.3 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 HM/FP unit must be installed on a level non combustible surface capable of supporting the weight of the HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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**

### **HM/FP RANGE GAS FIRED**

The electrical supply must be as specified and suitable for the HM/FP unit, and must be run within conduit to a point adjacent to the HM/FP unit, and be terminated to provide an isolation point that will prevent remote or inadvertent use. All HM/FP 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 HM/FP 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 HM/FP unit when despatched.

#### **Warning**

Always isolate from mains electrical supply before commencing work on the HM/FP unit.

### 3,9 HM/FP unit Control Installation

All HM/FP 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 HM/FP 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 HM/FP unit.

## HM/FP RANGE GAS FIRED

### 4,0 Commissioning

The air delivery system must have already been fully commissioned and balanced prior to the commissioning of the HM/FP 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.

Airflow Volumes (m <sup>3</sup> /h)	min	max
HM/FP117	6382	20000
HM/FP 150	8180	20000
HM/FP 175	9545	23000
HM/FP 200	10909	23000
HM/FP 225	12273	30000
HM/FP 265	14455	30000
HM/FP 300	16364	40000
HM/FP 375	20455	40000
HM/FP 400	21818	50000
HM/FP 500	27273	50000
HM/FP 600	32727	72000
HM/FP 700	38182	72000
HM/FP 800	43636	110000
HM/FP 1000	54545	110000

#### 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 allowed for and programmed in.

#### Note

In applications where fire alarm systems are integrated with the AHU/HM/FP controls it should be noted that when these fire systems are

activated they usually cut power to the AHU and HM/FP 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 HM/FP 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 HM/FP unit, the HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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

**HM/FP RANGE GAS FIRED**

- (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 HM/FP 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 HM/FP 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.

<b>Time interval</b>	<b>Operation</b>
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><b>either</b></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 HM/FP 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><b>or</b></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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP unit, and can also invalidate any warranty claim.

**5,1 Planned Servicing**

## HM/FP RANGE GAS FIRED

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 HM/FP 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 HM/FP 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 HM/FP 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 HM/FP 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

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

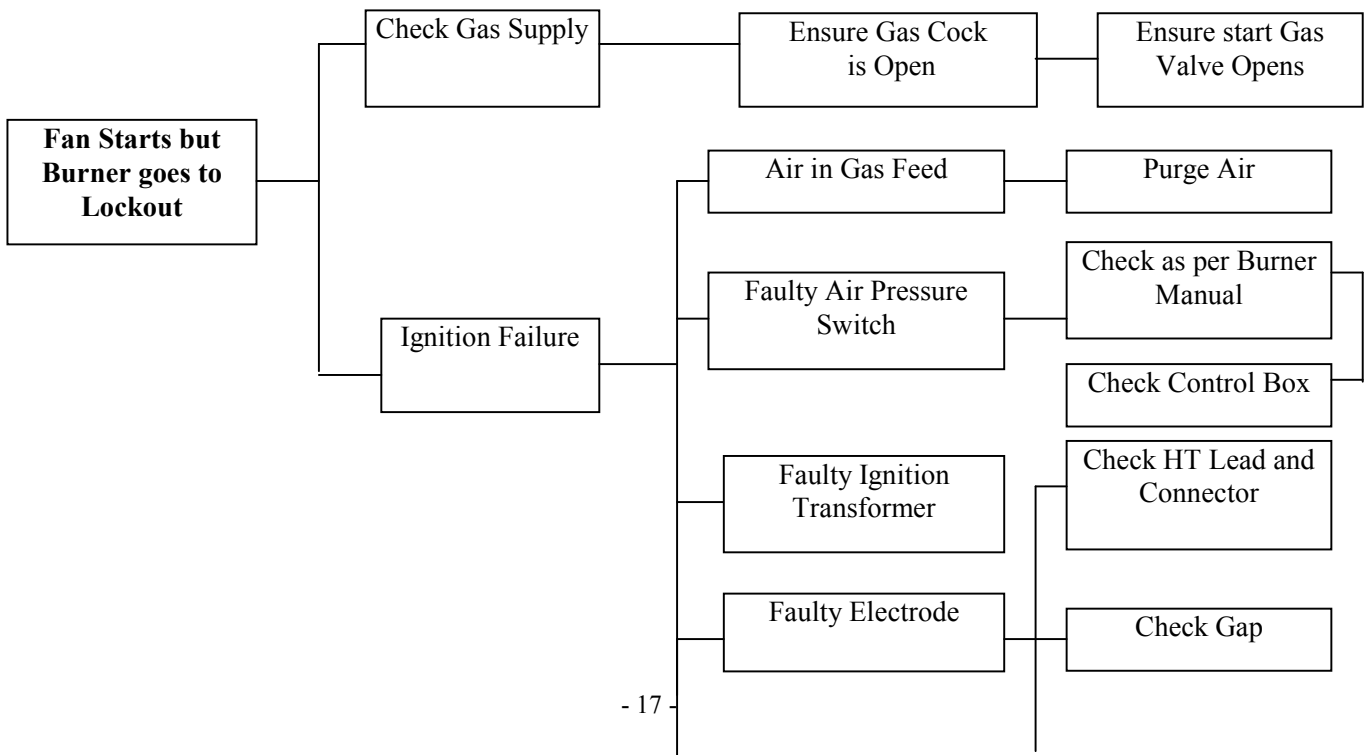
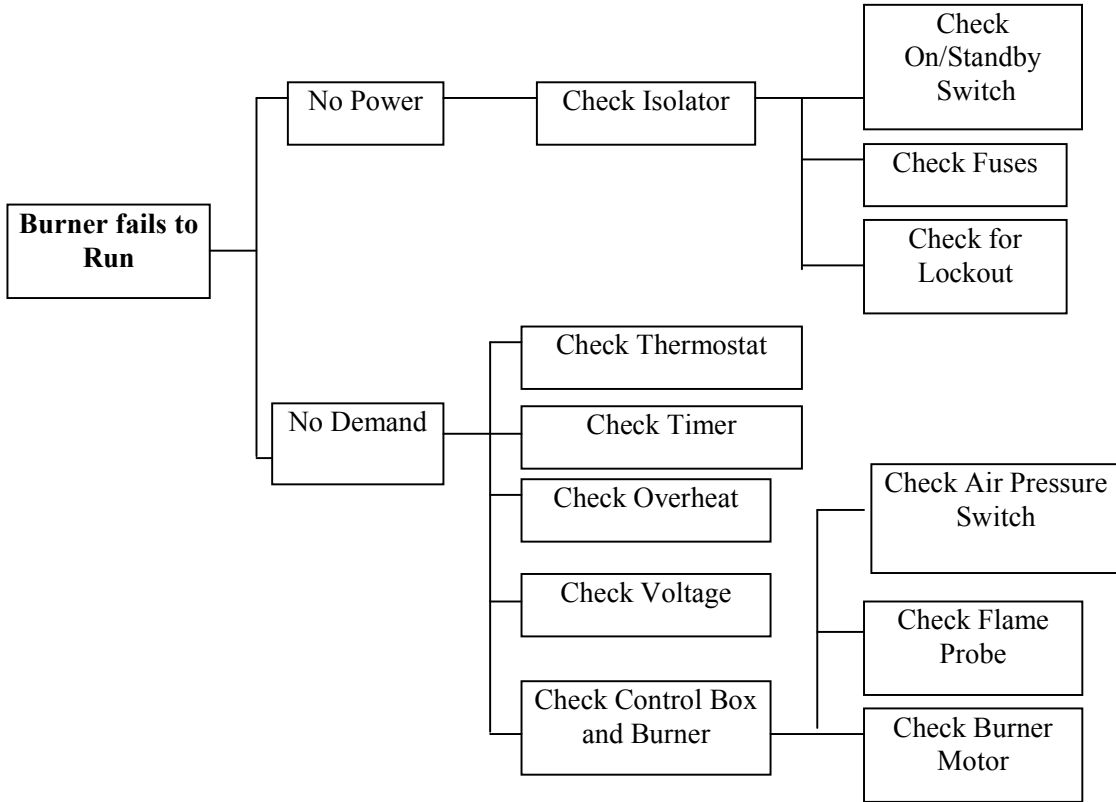
Technical support is available through contact via The Service Dept at Benson Heating (Telephone + 44 (0) 1547 528 534).

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

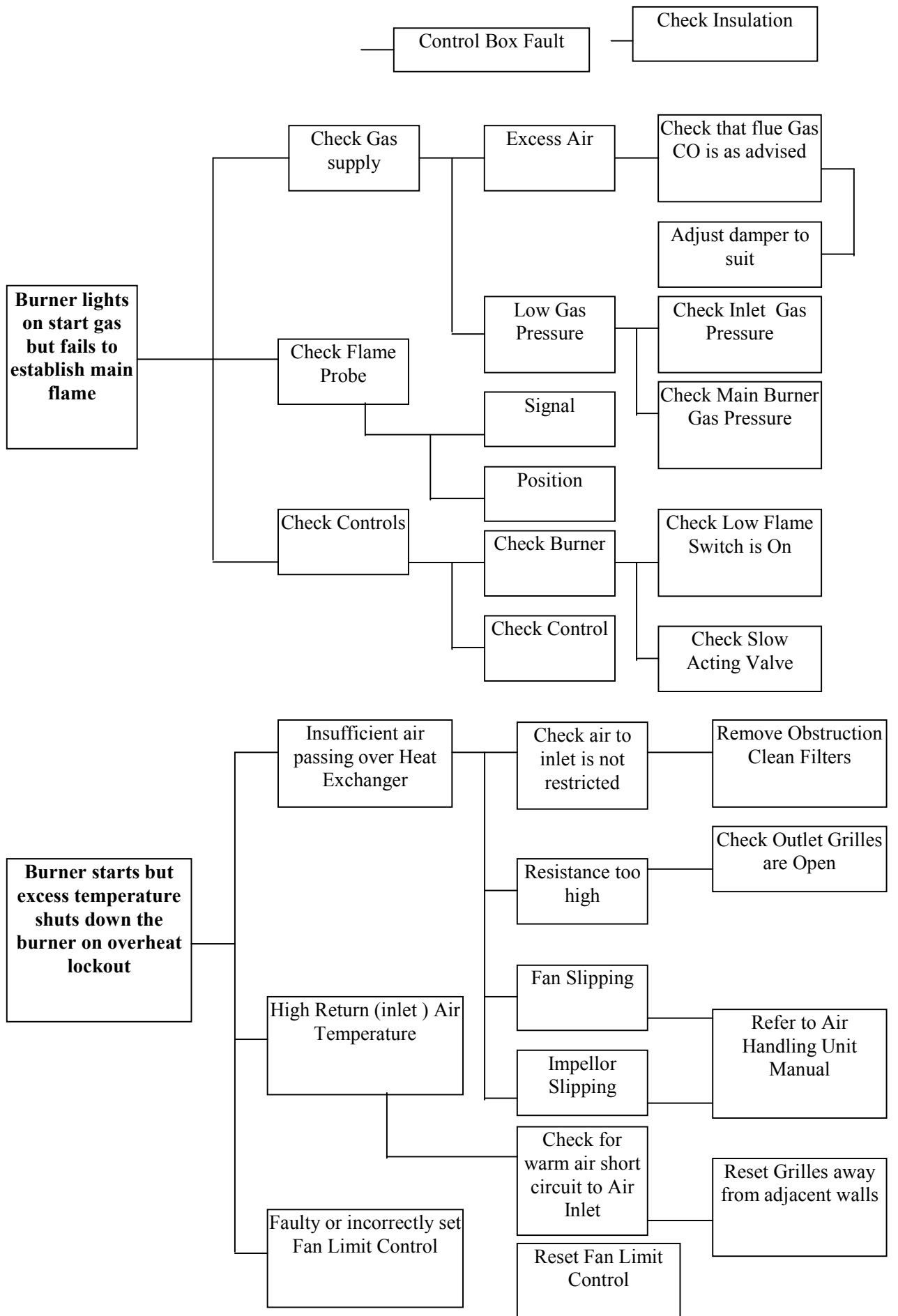
The following fault diagnosis chart is therefore only an initial guide.



6,0 Fault Diagnosis



**HM/FP RANGE GAS FIRED**



## Wiring Diagrams

**8.0 Technical Data (\* Information refers to Modulating Burners Only)**

**HM/FP RANGE GAS FIRED**

<b>MODEL</b>		<b>HM/FP117</b>	<b>HM/FP150</b>	<b>HM/FP175</b>	<b>HM/FP200</b>
Heat Output ( Maximum)	kW/hr	117	150	175	200
Heat Input (Gross)	kW/hr	151.0	193.5	213.5	260.0
Gross Efficiency Full Load	%	77.5	77.5	78.5	76.9
Gross Efficiency Min Load *	%	85.3	84.7	87.2	85.4
Net Efficiency Full Load	%	86.0	86.0	87.1	85.4
Net Efficiency Min Load *	%	94.6	94.0	96.8	94.8
Gas Consumption G20	m <sup>3</sup> /h	14.1	18.1	20.0	24.3
Gas Consumption G31	kg/hr	10.1	12.9	14.3	17.4
Burner Type	RIELLO	RIELLO	RIELLO	RIELLO	RIELLO
Burner R 40	On/Off	GS 20	GS 20	GS 20	RS 28.1
Burner R 40	Hi/Lo	GS 20	GS 20	GS 20	RS 28
Burner RS	Modulating	GS 20 M	GS 20 M	GS 20 M	RS 28 M
Max Gas Inlet Press G20	m/bar	100	100	100	350
Min Gas Inlet Press G20	m/bar	17.5	17.5	17.5	17.5
Max Gas Inlet Press G31	m/bar	100	100	100	350
Min Gas Inlet Press G31	m/bar	37.5	37.5	37.5	37.5
Head Setting On/Off Hi/Lo (zero flue resistance)	Number				
Air Setting On/Off Hi/Lo (zero flue resistance)	Number				
Gas Connection	BSP	3/4	3/4	1	1.1/4
Press Drop @ Maximum Air	Pascals	408.35	408.35	231.99	231.99
Press Drop @ Minimum Air	Pascals	41.58	68.34	39.36	52.19
Maximum Air Volume	m <sup>3</sup> /h	20000	20000	23000	23000
Minimum Air Volume	m <sup>3</sup> /h	6382	8182	9545	10909
Maximum Temperature Rise	Deg C	55	55	55	55
Sound Level @ 1Mtr	DbA	72	72	72	68
Comb Chamber Resistance	m/bar	0.6	0.6	0.6	0.8
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	175	200	200
Modulation Controls Input	Vdc	0 – 10	0 - 10	0 - 10	0 – 10
Modulating Turn Down	Ratio	3 : 1	3 : 1	3.5 : 1	4 : 1
Electrical Supply	Standard	230-1-50	230-1-50	230-1-50	230-1-50
Fuse Rating Internal	Amps	6.3	6.3	6.3	6.3
Burner Running Current	Amps	1.3	1.3	1.3	2.1
Burner Motor Current Start	Amps	3.9	3.9	3.9	4.8
Cable Size	mm <sup>2</sup>	0.75	0.75	0.75	0.75
Wiring Diagram Modulating*	Number	20-50-082	20-50-082	20-50-082	20-51-102
Wiring Diagram On / Off	Number	20-50-080	20-50-080	20-50-080	20-51-100
Wiring diagram Hi / Lo	Number	20-50-081	20-50-081	20-50-081	20-51-101
CO (max )	Ppm	10	10	10	10
CO <sub>2</sub>	%	9.3	9.3	9.3	9.3
Flue Gas Vol @ Full load	m <sup>3</sup> /hr	291	406	440	528
Flue Gas Temp	@ 20 <sup>o</sup> C Ambient	290	340	300	320
Oxygen	%	4.5	4.5	4.5	4.5
Weight (HM)	Kg	305	305	360	360
Weight (FP)	Kg	290	290	345	345

**HM/FP RANGE GAS FIRED**

<b>MODEL</b>		<b>HM/FP225</b>	<b>HM/FP265</b>	<b>HM/FP300</b>	<b>HM/FP375</b>
Heat Output ( Maximum)	kW/hr	225	265	300	375
Heat Input (Gross)	kW/hr	287.5	347.5	385.0	480.0
Gross Efficiency Full Load	%	78.3	76.3	77.9	78.1
Gross Efficiency Min Load *	%	86.9	84.7	86.6	86.8
Net Efficiency Full Load	%	86.9	84.6	86.5	86.7
Net Efficiency Min Load *	%	96.4	94.0	96.1	96.2
Gas Consumption G20	m <sup>3</sup> /h	26.8	32.4	36.0	44.8
Gas Consumption G31	kg/hr	19.1	23.1	25.7	32.0
Burner Type	RIELLO	RIELLO	RIELLO	RIELLO	RIELLO
Burner RS	On/Off	RS 28.1	RS 28.1	RS 28.1	RS 38.1
Burner RS	Hi/Lo	RS 28	RS 28	RS 28	RS 38
Burner RS	Modulating	RS 28M	RS 28M	RS 28M	RS 38M
Max Gas Inlet Press G20	m/bar	100	100	100	350
Min Gas Inlet Press G20	m/bar	17.5	17.5	17.5	17.5
Max Gas Inlet Press G31	m/bar	100	100	100	350
Min Gas Inlet Press G31	m/bar	37.5	37.5	37.5	37.5
Head Setting On/Off Hi/Lo (zero flue resistance)	Number				
Air Setting On/Off Hi/Lo (zero flue resistance)	Number				
Gas Connection	BSP	1 1/4	1 1/4	1 1/4	1 1/2
Press Drop @ Maximum Air	Pascals	343.2	343.2	254.55	254.55
Press Drop @ Minimum Air	Pascals	57.44	79.67	42.6	66.56
Maximum Air Volume	m <sup>3</sup> /h	30000	30000	40000	40000
Minimum Air Volume	m <sup>3</sup> /h	12273	14455	16364	20455
Maximum Temperature Rise	Deg C	55	55	55	55
Sound Level @ 1Mtr	DbA	68	68	68	70
Comb Chamber Resistance	m/bar	0.9	0.9	0.6	0.9
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	225	225	250	250
Modulation Controls Input *	Vdc	0 - 10	0 - 10	0 - 10	0 - 10
Modulating Turn Down *	Ratio	4 : 1	4 : 1	4 : 1	4 : 1
Electrical Supply	Standard	230-1-50	230-1-50	230-1-50	415-3-50
Fuse Rating Internal	Amps	6.3	6.3	6.3	6.3
Burner Running Current	Amps	2.1	2.1	2.1	2.9
Burner Motor Current Start	Amps	4.8	4.8	4.8	11.1
Cable Size	mm <sup>2</sup>	0.75	0.75	0.75	1.5
Wiring Diagram Modulating*	Number	20-51-102	20-51-102	20-51-102	20-53-081
Wiring Diagram On / Off	Number	20-51-100	20-51-100	20-51-100	20-53-082
Wiring Diagram Hi / Lo	Number	20-51-101	20-51-101	20-51-101	20-53-080
CO (max)	Ppm	10	10	10	10
CO <sub>2</sub>	%	9.3	9.3	9.3	9.3
Flue Gas Vol @ Full load	m <sup>3</sup> /hr	558	728	769	1006
Flue Gas Temp	@ 20 <sup>o</sup> C Ambient	295	340	310	340
Oxygen	%	4.5	4.5	4.5	4.5
Weight (HM)	Kg	410	410	580	580
Weight (FP)	Kg	390	390	550	550

**HM/FP RANGE GAS FIRED**

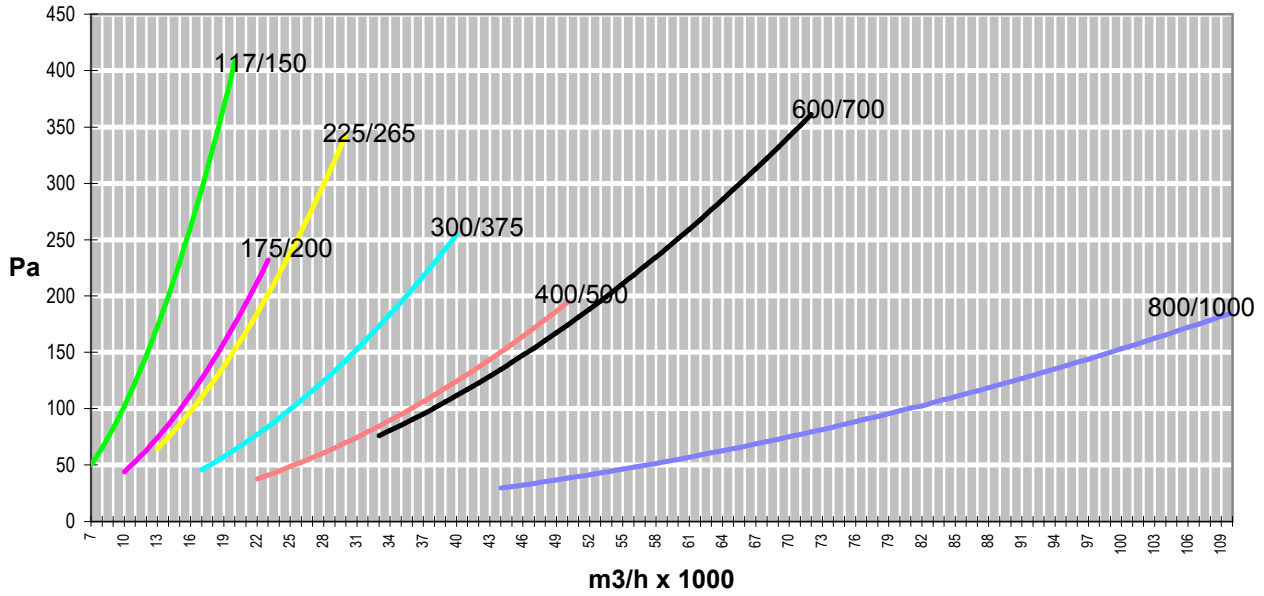
<b>MODEL</b>		<b>HM/FP400</b>	<b>HM/FP500</b>	<b>HM/FP600</b>	<b>HM/FP700</b>
Heat Output ( Maximum)	kW/hr	400	500	600	700
Heat Input (Gross)	kW/hr	523.0	653.0	750.3	875.8
Gross Efficiency Full Load	%	76.5	76.6	80.0	80.0
Gross Efficiency Min Load *	%	84.7	84.9	87.2	87.2
Net Efficiency Full Load	%	84.9	85.0	88.8	88.7
Net Efficiency Min Load *	%	94.0	94.2	96.8	96.8
Gas Consumption G20	m <sup>3</sup> /h	48.8	61.0	70.0	82.0
Gas Consumption G31	kg/hr	34.9	43.6	50.0	58.4
Burner Type	RIELLO	RIELLO	RIELLO	RIELLO	RIELLO
Burner On/Off	On/Off	N/A	N/A	N/A	N/A
Burner RS Hi/Lo	Hi/Lo	RS 50	RS 50	RS 70	RS 100
Burner RS Modulating	Modulating	RS 50M	RS 50M	RS 70M	RS 100M
Max Gas Inlet Press G20	m/bar	100	100	100	350
Min Gas Inlet Press G20	m/bar	17.5	17.5	17.5	17.5
Max Gas Inlet Press G31	m/bar	100	100	100	350
Min Gas Inlet Press G31	m/bar	37.5	37.5	37.5	37.5
Head Setting On/Off Hi/Lo (zero flue resistance)	Number				
Air Setting On/Off Hi/Lo (zero flue resistance)	Number				
Gas Connection	BSP	2	2	2	2
Press Drop @ Maximum Air	Pascals	194.23	194.23	361.38	361.38
Press Drop @ Minimum Air	Pascals	36.98	57.79	74.67	101.63
Maximum Air Volume	m <sup>3</sup> /h	50000	50000	72000	72000
Minimum Air Volume	m <sup>3</sup> /h	21818	27273	32727	38182
Maximum Temperature Rise	Deg C	55	55	55	55
Sound Level @ 1Mtr	DbA	72	72	75	77
Comb Chamber Resistance	m/bar	0.6	0.7	0.7	1.1
Flue Pressure Max m/bar	Max m/bar	+ 0.6	+ 0.6	+ 0.6	+ 1.6
Flue Pressure Min m/bar	Min m/bar	- 0.2	- 0.2	- 0.2	- 0.4
Flue Diameter I/D	mm	300	300	350	350
Modulation Controls Input *	Vdc	0 - 10	0 - 10	0 - 10	0 - 10
Modulating Turn Down *	Ratio	4 : 1	4 : 1	4 : 1	4 : 1
Electrical Supply	Standard	415-1-50	415-1-50	415-1-50	415-1-50
Fuse Rating Internal	Amps	6.3	6.3	6.3	6.3
Burner Running Current	Amps	3	3	2.8	3.4
Burner Motor Current Start	Amps	13.8	13.8	14.6	16.0
Cable Size	mm <sup>2</sup>	1.5	1.5	1.5	1.5
Wiring Diagram Modulating *	Number	20-53-081	20-53-081	20-53-081	20-53-081
Wiring Diagram On / Off	Number	N/A	N/A	N/A	N/A
Wiring Diagram Hi / Lo	Number	20-53-080	20-53-080	20-55-086	20-55-086
CO (max)	Ppm	10	10	10	10
CO <sub>2</sub>	%	9.3	9.3	9.3	9.3
Flue Gas Vol @ Full load	m <sup>3</sup> /hr	971	1280	1393	1721
Flue Gas Temp	@ 20 <sup>o</sup> C Ambient	270	300	270	300
Oxygen	%	4.5	4.5	4.5	4.5
Weight (HM)	Kg	970	970	1250	1250
Weight (FP)	Kg	940	940	1210	1210

**HM/FP RANGE GAS FIRED**

<b>MODEL</b>		<b>HM/FP800</b>	<b>HM/FP1000</b>		
Heat Output ( Maximum)	kW/hr	800	1000		
Heat Input (Gross)	kW/hr	1026.6	1290.0		
Gross Efficiency Full Load	%	77.9	77.5		
Gross Efficiency Min Load *	%	85.9	85.3		
Net Efficiency Full Load	%	86.5	86.0		
Net Efficiency Min Load *	%	95.3	94.7		
Gas Consumption G20	m <sup>3</sup> /h	96.0	120.4		
Gas Consumption G31	kg/hr	68.4	86.0		
Burner Type	RIELLO	RIELLO	RIELLO		
Burner	On/Off	N/A	N/A		
Burner RS	Hi/Lo	RS 100	RS 130		
Burner RS	Modulating	RS 100M	RS 130M		
Max Gas Inlet Press G20	m/bar	100	100		
Min Gas Inlet Press G20	m/bar	17.5	17.5		
Max Gas Inlet Press G31	m/bar	100	100		
Min Gas Inlet Press G31	m/bar	37.5	37.5		
Head Setting On/Off Hi/Lo (zero flue resistance)	Number				
Air Setting On/Off Hi/Lo (zero flue resistance)	Number				
Gas Connection	BSP	2	2		
Press Drop @ Maximum Air	Pascals	185.32	185.32		
Press Drop @ Minimum Air	Pascals	29.16	45.57		
Maximum Air Volume	m <sup>3</sup> /h	110000	110000		
Minimum Air Volume	m <sup>3</sup> /h	43636	54545		
Maximum Temperature Rise	Deg C	55	55		
Sound Level @ 1Mtr	DbA	77	79		
Comb Chamber Resistance	m/bar	1800	1800		
Flue Pressure	Max m/bar Min m/bar	+ 0.6 - 0.2	+ 0.6 - 0.2		
Flue Diameter I/D	mm	400	400		
Modulation Controls Input *	Vdc	0 - 10	0 - 10		
Modulating Turn Down *	Ratio	4 : 1	4 : 1		
Electrical Supply	Standard	415-3-50	415-3-50		
Fuse Rating Internal	Amps	6.3	6.3		
Burner Running Current	Amps	3.4	5.1		
Burner Motor Current Start	Amps	16.0	33.2		
Cable Size	mm <sup>2</sup>	1.5	2.5		
Wiring Diagram Modulating *	Number	20-53-081	20-53-081		
Wiring Diagram On / Off	Number	N/A	N/A		
Wiring Diagram Hi / Lo	Number	20-55-086	20-55-086		
CO (max)	Ppm	10	10		
CO <sub>2</sub>	%	9.3	9.3		
Flue Gas Vol @ Full load	m <sup>3</sup> /hr	2085	2792		
Flue Gas Temp	@ 20 <sup>o</sup> C Ambient	320	360		
Oxygen	%	4.5	4.5		
Weight (HM)	Kg	1800	1800		
Weight (FP)	Kg	1760	1760		



HM & FP Heat Exchange Modules  
Pressure drop / air volume graph



HM & FP Heat Exchange Modules  
Temperature rise / air volume graph

