



bmm heaters
LIMITED

Air Heater Manuals

User/Installation/Serviceing

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BMM HEATERS REFERENCES

Heater Models	Description
BMG	Horizontal Heater for ducted or AHU applications suitable for natural gas.
BMVG	Vertical heater for ducted or AHU applications suitable for natural gas.
BMGVF	Free standing nozzle head heater with force draught gas burner.
BMGDF	Free standing ducted heater with force draught gas burner.
BMGF	Horizontal ducted heater with force draught gas burner.
BMGDD	Downward discharge heater with force draught gas burner.

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Model:

Serial Number:

Section 1: Introduction

The instructions refer to appliances designed to operate in the UK and Ireland.

Appliances designed for other countries can be provided on request.

This appliance must be installed in accordance with the local and national codes in force and used only in a sufficiently ventilated space, as specified in these instructions.

Before installation, check that the local gas distribution systems, nature of gas and pressure, and adjustment of the appliance are compatible.

Indirect Fired

The term 'Indirect Fired' indicates that the products of combustion are kept isolated from the main supply air stream. The burner fires into a combustion chamber, the resultant products of combustion are directed into a heat exchanger and from there to an external flue, which discharges into the atmosphere.

Factory Test

All heaters produced by BMM Heaters Ltd will be subjected to various tests before they are dispatched. Each heater is individual so the data will differ between each unit. The relevant data can be found on the data plate attached to the heater.

External Heaters

The construction of the unit will consist of double skin panels and be fully water proof; the burner compartment will be adequately ventilated via two combustion air grills.

Burner and Fuel

These appliances will be fitted with either a Force Induced Natural Gas Burner or Pressure Jet Oil Burner.

Burner Type

BMM Heaters Ltd use two main manufacturers; Reillo or Weishaupt, which are available for on/off, high/low or fully modulating appliances.

Oil Burners are available for on/off or high/low control.

Section 2: Heater Safety

The Installation of this appliance must be done by a registered installer/contractor suitably qualified in the installation and service of gas fired heating equipment.

WARNING!

Improper installation, adjustment, alteration, service or maintenance can result in death, injury or property damage. Read the installation, operation and service manual thoroughly before installing or servicing this appliance.

Note:

To Installer: Please take the time to read and understand these instructions prior to any work servicing or installing this appliance.

Installers must leave a copy of this manual with the end user/owner.

To Owner: This manual must be kept in a safe place in order to provide necessary information for service engineers at a later date.

Section 3: Installers Responsibilities

- ◆ To install the heater, as well as the gas and electrical supplies, in accordance with applicable specifications and codes. BMM Heaters recommends the installer contact a local Building Inspector, Fire Officer or Insurance Company for guidance.
- ◆ To use the information given in the manual together with the local and national codes to perform the installation.
- ◆ To install the heater in accordance with the Clearances to Combustibles of this heater.
- ◆ To plan for the installation of supports, flues and air intakes.
- ◆ To provide access to burners for servicing.
- ◆ To provide the owner with a copy of this installation, commissioning, operation and service manual.
- ◆ To never use heater as support for ladder.
- ◆ To ensure that there is sufficient ventilation in the area to comply with the requirements of all relevant local and national codes.

Section 4: General Technical Table 1.

CV=10.35 kwh/m³

Model	Min Air flow m ³ /sec	Max Air flow m ³ /sec	Heat Input kW	Heat Output kW	Max Start Gas Rate m ³ /hr	Gas Flow Rate m ³ /hr	Flue Spigot Nominal Ø mm	Flue Size Ø mm	Weights External Heater Kg	Weights Internal Heater Kg
12	.37	.75	15	12	0.30	1.29	154	150	75	66
15	.37	.75	19	15	0.39	1.61	154	150	75	66
18	.37	.75	23	18	0.47	1.93	154	150	75	66
23	.47	.75	30	23	0.60	2.47	154	150	75	66
30	.75	.75	38	30	0.79	3.22	154	150	75	66
44	.82	1.55	57	44	1.17	4.72	154	150	207	192
59	1.13	1.55	75	59	1.57	6.33	154	150	207	192
88	1.55	1.55	113	88	2.30	9.45	154	150	207	192
117	2.11	2.58	150	117	3.12	12.56	204	200	246	228
147	2.58	2.58	188	147	3.90	15.78	204	200	246	228
176	3.19	5.17	225	176	4.70	18.89	204	200	420	384
205	3.75	5.17	263	205	5.4	22.00	254	250	420	384
235	4.23	5.17	300	235	6.25	25.23	254	250	420	384
264	4.75	5.17	338	264	7.0	28.34	254	250	420	384
293	5.17	5.17	376	293	7.85	31.45	254	250	420	384
352	6.23	6.23	451	352	9.40	37.79	304	300	1704	1364
440	8.46	10.34	537	440	11.80	47.24	304	300	1704	1364
513	9.40	10.34	658	513	13.70	55.07	304	300	1704	1364
586	10.34	10.34	752	586	15.50	62.91	354	350	1704	1364
733	13	16.53	939	733	19.60	78.69	406	400	2304	2160
880	15.35	16.53	1127	880	23.40	94.47	406	400	2304	2160
952	16.53	16.53	1221	952	25.00	102.20	406	400	2304	2160

Each appliance has been range rated; burner pressures can be found on the data plate and the burner pressure once commissioned must be entered in the actual.

Section 5: Heater Installation

Before installation, check that the local distribution conditions, nature of gas pressure and adjustment of the appliance are compatible.

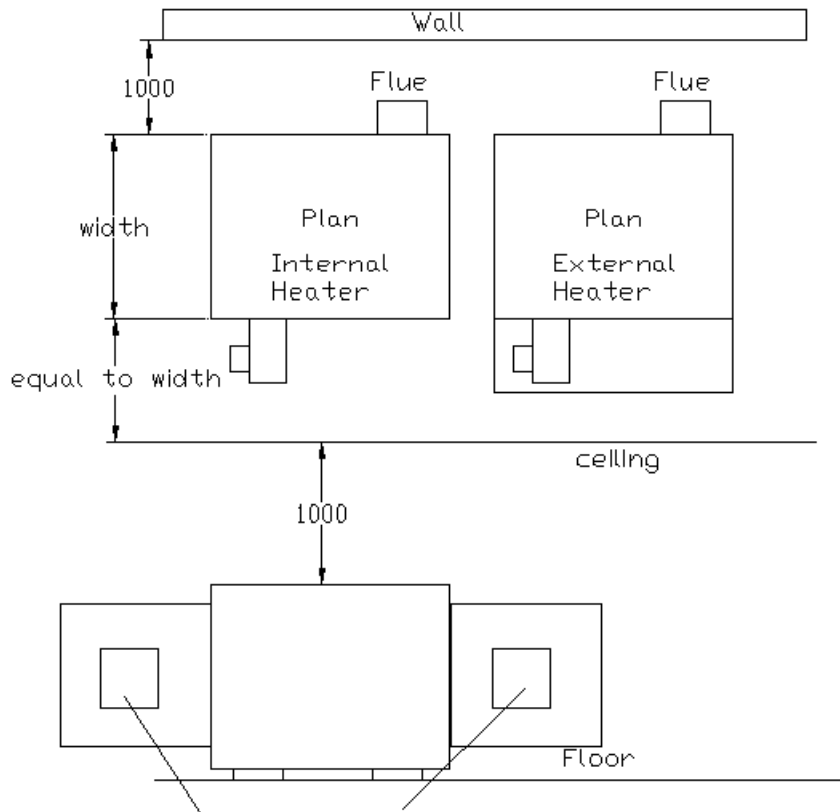
The air heater must be installed in accordance with the rules in force and the relevant requirements of any fire regulations or insurance company's requirements appertaining to the area in which the heater is located, particularly where special risks are involved, such as areas where petrol vehicles are housed, where cellulose spraying is carried out, in wood working departments etc.

Clearances and Positioning:

The following clearances for installation and servicing must be observed.

To the front	Equal to the depth of the heater.
To the rear	1.0m
To at least one side	1.0m
Above the heater	1.0m

Clearances fig.1



Access doors fitted both up and downstream of the heater for servicing and inspections.

Clearances

A minimum of 500mm upstream and downstream must be allowed for, due to the radiant heat. Filters must be fireproof, if fitted and a motor shield is required over the main supply fan motor if directly in front of the heater.

When installing the heater, minimum clearance is required around the heater.

If the heater is to be fitted at a height, then the structure of the gantry must be capable of the heaters weight (which can be found in section 4, table 1), also a safe working platform and access must be allowed for; to enable easy and safe working access.

Note: The front of the heater is the side on which the burner is fastened.

When designing a system, allowance must be made so equipment can be serviced after installation and for the fitting of any spares, which may be required. The BMG is designed to be installed within an Air Handling Unit or ductwork.

The appliance is designed to work in a maximum ambient temperature of 40°C. The Air Heaters are mounted direct on the floor and do not need any fixing. The base on which the heater is positioned should not be less than 150mm (6 inches) thick and must be constructed of non-combustible material.

Any combustible material adjacent to the heater and the flue system must be placed or shielded as to ensure that its temperature does not exceed 65°C.

WARNING!

No air heater shall be installed where there is a foreseeable risk of flammable particles, gases, vapours or corrosion inducing gases or vapours being drawn into either the heated air stream or the air for combustion. In such cases installation may only proceed if the air to be heated and the air for combustion are ducted to the heater from an uncontaminated source, preferably outside the building.

If this heater is to be suspended then weight in table 1 in section 4 must be taken into account.

Section 6: Air Supply

Ductwork

All delivery and return air ducts, including air filters, jointing and any insulation or lining must be constructed entirely of materials, which will not contribute to a fire, are of adequate strength and dimensionally stable for the maximum internal and external temperatures to which they are to be exposed during commissioning and normal operation. In the selection of materials, account must be taken of the working environment and the air temperatures which will result when the overheat limit thermostat is being commissioned. Where inter-joint spaces are used as duct routes, they should be suitably lined with fire-resisting material.

A full and unobstructed return air path to the air heater must be provided.

If the air heater is to be installed in a plant room, the return air and warm air discharge arrangements must be such as to avoid interference with the operation of the flue by the air circulation fan. The return air intake and the warm air outlet(s)

should therefore be fully ducted, in the plant room, to and from the heater, respectively. The openings in the structure of the plant room through which the ducting passes must be fire stopped.

In addition, where there is a risk of combustible material being placed close to the warm air outlets, suitable barrier rails should be provided to prevent any combustible material being within 900mm (3 ft) of the outlets.

Air flow

It is essential that the correct amount of air is provided through the heater and should be evenly distributed when entering the heater. All pressure calculations/resistances for air are ambient with the Heater in the 'off' position.

Adjustable by pass plates

BMG models fitted into larger cabinets for internal or external use should be fitted with adjustable air balancing plates or a simple restriction damper. If the work is not going to be carried out by BMM Heaters Ltd then we recommend that the installer ensures that it can be altered to give guaranteed minimum equal air over the combustion chamber/heat exchanger (see minimum and maximum air flow volumes in section 4 table 1).

Section 7: Overheat Protection Device

Overheat protection is fitted in case the air flow falls below the minimum necessary for safe operation of the heater, which may be caused by failure of the supply fan motor or belt failure, dirty filters or inlet damper failure. If the air flow falls too low, the high limit will trip out and will require manually resetting. If this happens on a regular basis it must be investigated by a competent registered engineer as this could cause serious damage to the heater.

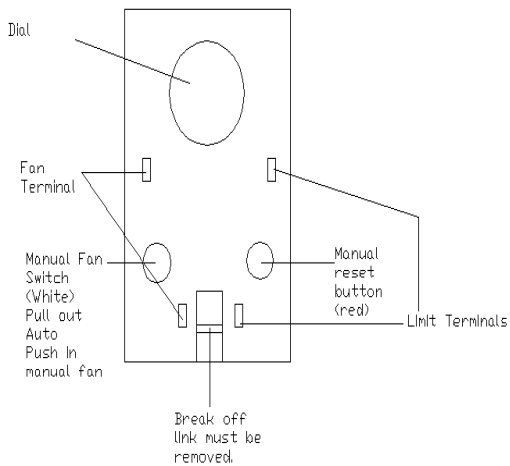
WARNING!

If the heater has a Honeywell combined thermostat installed then the jumper link must be removed from the replacement thermostat.

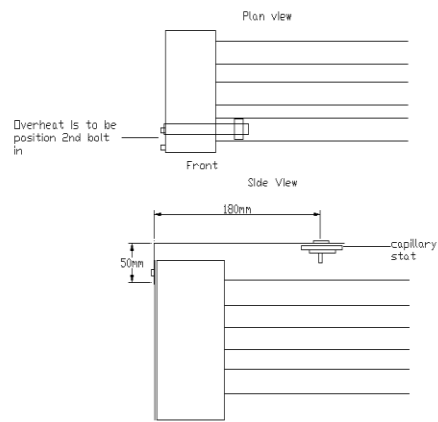
Heat exchanger damage may be the result.

Failure to follow these instructions can result in death, injury, property damage or product damage.

Honeywell overheat stat Fig 2



Overheat Position Fig 3



Ensure that the fan and limit settings are as follows:-

Fan On 35°C

Fan Off 25 °c

Limit 20 °c above normal running temperature no greater than 100 °c

Section 8: Flue System

The flue system must be made to the following specifications:

- Mechanically robust.
- Resistant to internal and external corrosion.
- Non-combustible and durable under the conditions to which they are to be subjected.
- Stainless steel flue is recommended.

Design

When designing a flue system for the appliance the designer must take into account the following points.

- The flue gases exiting the appliance can be as great as 350 °c and as low as 70 °c on modulating burners.

- b) Prevention of condensation within the flue and the management of drainage from the flue; for example the use of twin wall flue will minimise the condensation.
- c) Flue must be a type acceptable to current standards.
- d) Facilities should be made for the disconnection of the flue from the heater to aid servicing and inspection.
- e) This appliance does not require a draught diverter.
- f) BMM Heaters recommend that a 90° Tee condensate piece is connected directly onto the heater spigot, from this point the flue must then rise vertically with no horizontal runs of flue pipe or 90° bends. If there is an unavoidable obstruction then the use of 45° bends will be permitted. **(Please contact BMM Heaters if more than two 45° bends are used).**
- g) The flue should terminate in a freely exposed position and must be situated as to prevent the products of combustion entering the building via any opening.
- h) A Flue terminal must be fitted.
- i) The flue installation must be designed to the latest gas regulations and any local environmental standards.
- j) Where a flue passes through a combustible roof, ceiling or floor, the flue pipe should be surrounded with a metal sleeve, the size of which should be sufficient to provide a space not less than 25mm between the flue pipe and the sleeve when positioned.

Note! Flue connection sizes can be found in section 4 table 1

Minimum and maximum flue heights

Internal: 600mm above the apex is the minimum height above the building if within 1.5 metres of the surface, **see drawings Figure 1 & 2.** Maximum height is no more than 25 metres, if this exceeded please consult BMM Heaters or consideration should be given for a fan assisted flue.

External: Minimum flue height is 1 metre above appliance roof. Maximum height is no more than 25 metres, if this exceeded please consult BMM Heaters or consideration should be given for a fan assisted flue.

Flue terminal

A flue terminal (must be approved) needs to provide an extraction effect under virtually all wind conditions, the free area of outlet openings should be at least twice the nominal area of the flue. Outlet openings should be provided preferably all round, or at least on opposite sides.

It is important for the terminal of an individual open flue system to be located so that it is not likely to be subjected to wind pressures which could restrict or reverse the flow of combustion products through the flue.

The ideal position is above the highest point on the roof. It is absolutely essential that the terminal is positioned outside the building so that it is freely exposed to any wind and is not shielded by any roof structure or object to such a degree that they create undesirable pressure regions around the terminal.

Preferred positions are:

- At or above the ridge of a pitched roof by means of a roof terminal.
- Above the intersection with a pitched roof.

The pitch or angle of the roof will determine the required flue height from the base of the terminal. See Table 2 below:

Table 2

RECOMMENDED LOCATIONS OF ROOF TERMINALS:

Type of roof	Location not within 1.5m of a vertical surface* on the roof		Location within 1.5m of a vertical surface* of a structure on the roof
	Internal route		External route
	On ridge	Not on ridge	
			Internal route External route

Pitched	Pitch exceeding 45°	At or above roof level (see figure 4)	1m above flue/ roof intersection (see figure 3)	See figure 3	The base of the terminal to be 600mm above the level of the top of the structure (see figures 2, 5, 9 and 11)
	Pitch not exceeding 45°		600mm above flue/roof intersection (see figure 4)	The base of the terminal to be 600mm above the level of the adjacent roof edge (see figures 1, 6 and 10)	
Flat	With parapet	Not applicable	600mm above flue roof intersection (see figure 6)+		
	Without parapet		250mm above flue/roof intersection (see figure 10)		

*For example: a chimney stack dormer window; tank room; lift motor room; parapet, etc.

+When the flue outlet is at a horizontal distance greater than 10 times the height of the parapet or structure, the terminal outlet height need be only 250mm above the roof.

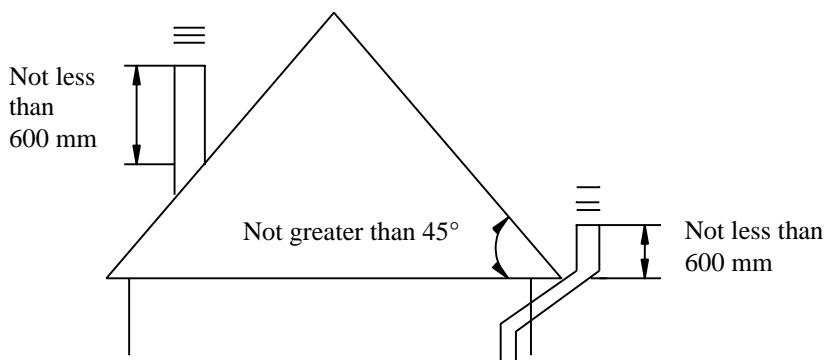


Fig 1. Pitched roof, not greater than 45°

Terminals must not be positioned within 1.5m of the wall surface

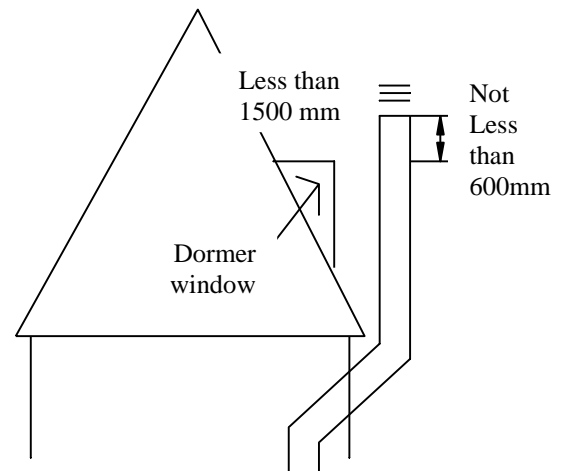
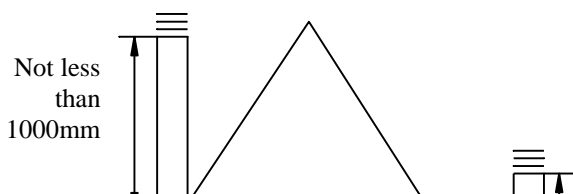


Fig 2. Pitched roof, within 1.5 m of a structure on roof



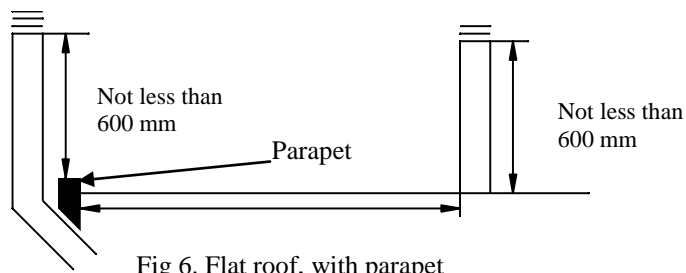


Fig 6. Flat roof, with parapet

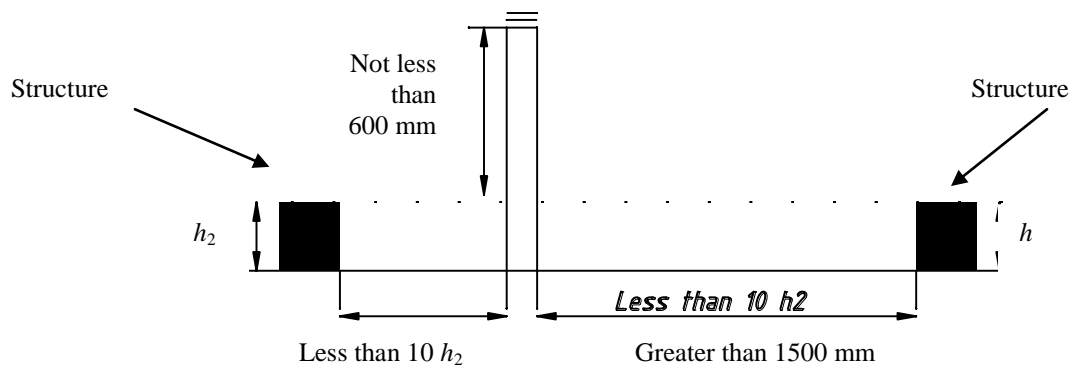


Fig 7. Flat roof, envelope method

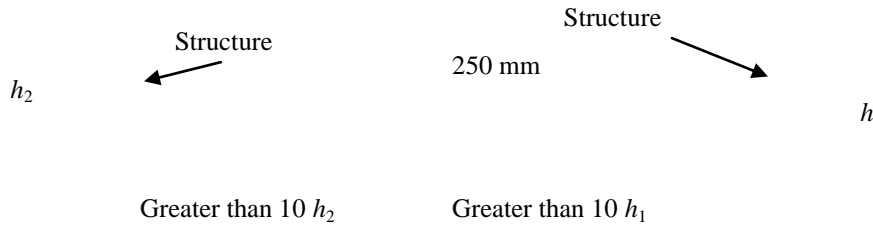


Fig 8. Flat roof, flue outlet more than 10 heights (h) away from all structures

Not less than 600 mm

Not less than 600

Not less than 250 mm

Fig 10. Flat roof, with no parapet

Less than 1500 mm

Parapet

Fig 9. Flat roof, with flue close to parapet

Less than 1500 mm

Not less than 600 mm

Structure

Fig 11. Flat roof, with structure close to flue outlet

Section 9: Ventilation Requirements

Where the heater is to be installed in a plant room, the heater requires the plant room housing to have permanent air vents communicating directly with the outside air, at a high level and at a low level. Where communication with the outside air is possible only by means of high level air vents, ducting down to floor level for the lower vent(s) should be used. Air vents should have negligible resistance and must not be sited in any position where they are likely to be easily blocked or flooded, or in any position adjacent to an extraction system, which is carrying flammable vapour.

Grilles or louvers should be designed so that high velocity air streams do not occur within the plant room.

The ventilation should be installed to in accordance with local and national codes.

Ventilation Requirements:

The space in which the heater is situated must be adequately ventilated, see below for the minimum ventilation area at low and high levels.

Low Level: 540cm² plus 4.5cm² per kW after 60kw.

High Level: 270cm² plus 2.25cm² per kW after 60kw

Section 10: Gas Piping

<p>All Gas Pipe-work to the appliance should be installed in accordance with current regulations, local and national codes and must be connected with an</p>

acceptable gas isolation valve and union, so that the burner maybe removed to aid servicing and inspection of the burner.

Size and Connection

The following considerations are to be taken into account:

- a) Pipe work smaller than the inlet gas connection should not be used.
- b) The gas supply pipe is adequately sized to carry correct volume of gas from the gas meter to the heater(s).
- c) The heat input and gas flow rates for each heater can be found in section 4 table 1 to aid in the design of gas supply pipe work.
- d) All gas pipe work and electrical connections must be adequately supported and must not support any of the heaters weight or rely on the strength of the burner gas pipe work.
- e) Unless the heater is suspended or movement is apparent, the BMM Heater must be connected with medium, heavy or copper pipe; otherwise the use of an approved flexible connection between the isolating valve and the heater can be used. We recommend that the flexi hose is one size bigger than the heater connection to reduce any pressure loss.

The minimum inlet gas pressure for natural gas should be 20 mbar.

Please note: We require a minimum of 17.5mbar at the inlet when running and a maximum of 75mbar, if this is exceeded then a governor must be fitted.

Important: The complete installation must be purged and tested for gas soundness in accordance with local, national codes and a registered engineer.

Gas Connection Size

Model	Weishaupt Burner 4:1	Riello Burner 4:1	Riello Burner 2:1
--------------	-----------------------------	--------------------------	--------------------------

12	½" BSP	N/A	N/A
15	½" BSP	N/A	N/A
18	½" BSP	N/A	½" BSP
23	½" BSP	N/A	½" BSP
30	½" BSP	N/A	½" BSP
44	½" BSP	½" BSP	½" BSP
59	¾" BSP	¾" BSP	¾" BSP
88	¾" BSP	¾" BSP	¾" BSP
117	1" BSP	¾" BSP	¾" BSP
147	1" BSP	¾" BSP	¾" BSP
176	¾" BSP	1¼" BSP	1" BSP
205	¾" BSP	1¼" BSP	1" BSP
235	1" BSP	1¼" BSP	1¼" BSP
264	1" BSP	1¼" BSP	1¼" BSP
293	1" BSP	1¼" BSP	1¼" BSP
352	1" BSP	1½" BSP	1½" BSP
440	1½" BSP	1½" BSP	1½" BSP
513	2" BSP	2" BSP	2" BSP
586	2" BSP	2" BSP	2" BSP
733	DN 65	2" BSP	2" BSP
880	DN 65	2" BSP	2" BSP
952	DN 65	2" BSP	2" BSP

Further Information regarding pipe work to the burner can be found in the burner manual attached to this document.

Section 11: Condensate Drains

On models where larger turndowns are required, there will be a 1” BSP condensation drain, which must have a trap fitted and then pipe/drain accordingly (by others). The condensate pipe work must not be installed below 1” BSP.

WARNING!

Do not use plastic connections, as the temperature may be high at the outlet to the drain. Copper pipe must not be used.

Important

Condensing heaters may be subject to local regulations with respect to the discharge of condensate.

Section 12: Electrical Connections

All external wiring must be in accordance with current IEE Regulations and local regulation which apply.

The method of connection to the mains electricity supply should allow complete electrical isolation of the heater and the supply should serve the heater only. The mains isolator should be provided adjacent to the heater in an easily accessible position. The isolator must have contact separation of at least 3 mm on all poles.

The electric and controls terminations are located on the front of the Heater housed in an interface panel. All heaters are compatible for inter-facing with building management systems and 0-10v DC is required as standard on Modulating heaters.

All wiring and control cables must be ran in conduit and correct size glands used etc.

All appliances must be earthed.

Each heater manufacture is individually made to suit the customer so a dedicated circuit will be attached to this manual. BMM Heaters will also attach a circuit within the interface panel.

Table 3: Electrical Data

Model	Motor size Three phase	Motor size Single phase	Motor rated supply fuse (Three phase)	Motor rated supply fuse (Single Phase)	Riello Voltage	Weishaupt Voltage
18	750w	550w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
23	750w	550w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
30	750w	550w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
44	750w	550w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
59	750w	550w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
88	750w	750w	10 Amps	10 Amps	240v 1ph 50Hz	240v 1ph 50Hz
117	1.5kw	N/A	15 Amps	15 Amps	240v 1ph 50Hz	240v 1ph 50Hz
147	2.2kw	N/A	15 Amps	15 Amps	240v 1ph 50Hz	240v 1ph 50Hz
176	5.5kw	N/A	20 Amps	30 Amps	240v 1ph 50Hz	240v 1ph 50Hz
205	5.5kw	N/A	20 Amps	30 Amps	240v 1ph 50Hz	240v 1ph 50Hz
235	7.5kw	N/A	30 Amps	30 Amps	240v 1ph 50Hz	240v 1ph 50Hz
293	7.5kw	N/A	30 Amps	30 Amps	240v 1ph 50Hz	240v 1ph 50Hz
440	2 x 5.5kw	N/A	30 Amps	30 Amps	415v 3ph 50Hz	240v 1ph 50Hz
513	2 x 7.5kw	N/A	30 Amps	30 Amps	415v 3ph 50Hz	415v 3ph 50Hz
586	2 x 7.5kw	N/A	30 Amps	30 Amps	415v 3ph 50Hz	415v 3ph 50Hz
733	Special	Requirements	On application	-	415v 3ph 50Hz	415v 3ph 50Hz
880	Special	Requirements	On application	-	415v 3ph 50Hz	415v 3ph 50Hz
952	Special	Requirements	On application	-	415v 3ph 50Hz	415v 3ph 50Hz

Controls: BMM Heaters can supply controls for these heaters upon request. Please confirm with us the type of controls prior to connecting to check compatibility.

The Burner wiring diagrams can be found in the burner supplement provided with this manual.

Note: All heaters have been electrically tested at BMM Heaters factory.

Section 13: Heater Controls

The heater can be used with most Building Management Systems.

2:1 Turndown Burner:

. Burner 7 pin plug/socket terminal connections:

1. 240v & N supply
2. T1 & T 2 is the enable, T1 & T2 must break when up to temperature, all interlocks to be wired in series with T1 & T2. (The burner must be interlocked with the supply fan).
3. Terminal S3-240v burner lockout indication if required.
4. Terminal B4-240v burner lockout indication if required.

Burner 3 pin plug/socket terminal connections:

1. L-10v dc modulating signal connection
2. N-0v dc modulating signal connection

Please supply 15 minutes supply fan over run on burner shutdown

If you require any further information or you have any special requirements please do not hesitate to contact our Technical Department.

For ON/OFF Control Only, Omit 3 Pin Burner Plug

4:1 Turndown Burner:

Burner 7 pin plug/socket terminal connections:

1. 240v & N supply
2. T1 & T 2 is the enable, T1 & T2 must break when up to temperature, all interlocks to be wired in series with T1 & T2. (The burner must be interlocked with the supply fan).
3. Terminal S3-240v burner lockout indication if required.
4. Terminal B4-240v burner lockout indication if required.

Burner 3 pin plug/socket terminal connections:

5. L-10v dc modulating signal connection
6. N-0v dc modulating signal connection

Please supply 15 minutes supply fan over run on burner shutdown.

If you require any further information or you have any special requirements, please do not hesitate to contact our Technical Department.

WARNING!
Electrical Shock Hazard

Use extreme caution while working on this appliance.
Failure to follow these instructions can result in death or electric shock.
Only competent engineer should carry out work on this appliance.

Section 14: Commissioning.

Commissioning ON/OFF

COMMISSIONING MUST BE CARRIED OUT BY A COMPETENT REGISTERED ENGINEER (GAS SAFE), ALSO TO BE USED WITH BURNER COMMISSIONING DETAIL SEE BURNER INSERT.

1. Visually check full system to see if it is in accordance with our manual and to current / GAS SAFE legislation and IEE regulations and to this manual.
2. Check combustion air is adequate in plant room or surrounding area.
3. Check contractors electrical wiring is correct & terminated tight and fuse ratings are correct.
4. Ensure that the gas pipe work is sized correctly and relative documents for soundness & purging are available. It is the responsibility of the commissioning engineer to check for soundness from the main inlet to servicing stop tap on inlet of valve.
5. Ensure that the inlet gas pressure is no greater than 75mb static and no less than 17.5mb running.
6. Make sure that all dampers are set and diffuser outlets are open to give correct air flow and that the correct number of air by-pass blades have been removed to by-pass the air in excess of our maximum amount of air through our heater, which can be found in Section 'Minimum and Maximum Air Volumes' of this Manual.
7. Check with the controls engineer that he has an interlock with the supply fan & burner so that the burner can not run without the supply fan e.g. Air pressure switch across supply fan in series with our Enable circuit between T1 & T2. The controls must keep the supply fans running on for 15 minutes after burner shut down, on a shut down condition. The terminals 1 & 2 are also used to wire stats and time switches in series to switch the burner on and off.
8. Make sure that the stat, which is wired between terminals 1 & 2, is closed and turn the main gas on to make the gas pressure switch and turn the commissioning stop tap off. Switch the burner on, the burner should run through its cycle and after the ignition spark goes out the burner should lockout on flame failure on the burner control box.

9. Before opening the commissioning stop tap ensure that the burner air damper is open. The main valve has to be disconnected and the pilot is to be left connected, then open the commissioning tap and switch the burner on. The burner should go through its sequence and fire but stay on. At this point in time you have to check the start gas rate which should be no greater than 20% of the total output. This is preset in the factory and should be checked.
10. When satisfied with the pilot pressure, switch the burner off and reconnect the main valve, turn the main gas valve and turn the gas valve throttle to minimum and switch the burner back on. Now the burner should fire and go to full fire, then set the head pressure in accordance to the rating plate. The governor must be throttled down until it takes control of the head pressure and left there. The main gas valve throttle can be locked in to position when the gas head pressure is set. When you are satisfied with the gas settings then the CPI switch requires setting, on the SKP valves they are integral, which are factory set. For further information please see burner insert in this manual.
11. Carry out full emission checks with a flue gas analyser. The parameters are to be set as specified in this manual by the adjustment of the burner air damper, which, when satisfied must be locked off securely.
12. The high and low air pressure switch must be set after the damper has been locked off. The low air pressure switch is set by turning it up until it locks out and moving it back 1.2mb on the pressure switch then setting the high air pressure switch to 1.2mb above the lockout pressure.
13. The low gas pressure switch will be pre-set in the factory to 10mb.
14. You are then required to check the strength of the flame sensing device by removing the link on the burner which connects the flame probe to the control box and put your multi-meter in series, which should give you a reading in uA. The signal strength should be a least 70uA for U.V. and 6uA on flame rectification.
15. After running the unit for a period of one hour you will be able to get a running temperature from the fan limit side of the stat. When you have this you must set the over heat to 20°c above the running temperature. The supply fans should be shut down once, when the burner is running, to try the overheat protection device and the fans must be switched on as soon as it locks out on over heat.

16. All gas nipples are to be replaced and checked for tightness and checked with leak detection fluid.
17. A leak detection test is to be done with leak detection fluid and electronic leak detector on the gas train while the burner is running, to see if there are any leaks in the burner gas train and a soundness test is to be done on all gas work.
18. Finally make a full record of combustion data on commissioning sheet provided; a copy is to be presented to the customer and to BMM Heaters on completion of work. The commissioning sheet should include the following:-
 - (a) Model and serial numbers.
 - (b) Heater running temperature and over heat settings.
 - (c) Full thermal input.
 - (d) Governor pressure settings (pilot for start gas and main for full fire).
 - (e) Gas flow rates for full fire.
 - (f) Burner damper setting and pressure switch settings.
 - (g) Flame signal strength on full fire.
 - (h) Exhaust gas O², CO², CO and temperature.
19. After setting all air pressure switches and valves etc, you must mark the position or lock off if possible.

Please note BMM Heaters provide a full commissioning service if required. Also if you require further information call BMM Heaters technical department.

TYPICAL FLUE GAS READINGS

O² - 4% to 5%

CO² - 9.5% to 10%

CO – up to 100 PPM (Typical approx 20 PPM)

Flue Stack Temperature – Up to 330°c Nett

Commissioning High/Low

COMMISSIONING MUST BE CARRIED OUT BY A COMPETENT REGISTERED ENGINEER (GAS SAFE), ALSO TO BE USED WITH BURNER COMMISSIONING DETAIL SEE BURNER INSERT.

1. Visually check full system to see if it is in accordance with our manual and to current/GAS SAFE legislation and IEE regulations and to this manual.
2. Check combustion air is adequate in plant room or surrounding area.
3. Check contractors electrical wiring is correct & terminated tight and fuse ratings are correct.
4. Ensure that the gas pipe work is sized correctly and relative documents for soundness and purging are available. It is the responsibility of the commissioning engineer to check for soundness from the main inlet to servicing stop tap on inlet of valve.
5. Ensure that the inlet gas pressure is no greater than 75mb static and no less than 17.5mb running.
6. Make sure that all dampers are set and diffuser outlets are open to give correct air flow and that the correct number of air bypass blades have been removed to bypass the air in excess of our maximum amount of air through our heater, which can be found in the section 'Minimum and Maximum Air Volumes' in this Manual.
7. Check with the controls engineer that he has an interlock with the supply fan and burner so that the burner can not run without the supply fan e.g. air pressure switch across supply fan in series with our enable circuit between 1 & 2. The controls engineer must keep the supply fans running on for 15 minutes after burner shutdown, on a shutdown condition. The terminals 1 & 2 are also used to wire stats and time switched in series to switch the burner on and off. Terminals 6 & 7 are required for high/low operation and is fixed air turndown, when the circuit is made it is high and when it is broken it is low.

8. Make sure that the stat, which is wired between terminals 1 & 2 is closed and turn main gas on to make the gas pressure switch and turn the commissioning stop tap off. Switch the burner on, the burner should run through its cycle and after the ignition spark goes out, the burner should lockout on flame failure on the control box.
9. Before opening the commissioning stop tap ensure that the burner air damper is open. The main valve has to be disconnected and the pilot is to be left connected, then open the commissioning tap and switch the burner on. The burner should go through its sequence and fire but stay on. At this point in time you have to check the start gas rate which should be no greater than 20% of the total output. This is preset in the factory and should be checked.
10. When satisfied with the pilot pressure, switch the burner off and reconnect the main valve, turn the main gas valve and turn the gas valve throttle to minimum and switch the burner back on and make the high/low circuit. Now the burner should fire and go to full fire, then set the head pressure in accordance to the rating plate, now break the circuit between 6 & 7 so that the valve goes to low fire and set it in accordance to the rating plate pressure. The governor must be throttled down until it takes control of the head pressure and left there. The main gas valve throttle can be locked in to position when the gas head pressure is set. When you are satisfied with the gas settings then the CPI switch requires setting on the SKP valves, they are integral, which are factory set. For further information please see burner insert in this manual.
11. Carry out full emissions check with a flue gas analyser. The parameters are to be set as specified in this manual by the adjustment of the burner air damper, which, when satisfied must be locked off securely. Then the burner requires setting 50% turndown, which can be done by breaking the circuit between 6 & 7, when you break this circuit you must check the emissions are okay. They will be approximately 10% to 11% O₂ on low fire and CO emissions should be below 100 PPM. Note the air damper is not altered between high and low, it is set on high.
12. The high and low air pressure switch must be set after the damper has been locked off. The low air pressure switch is set by turning it up until it locks out and moving it back 1.2mb on the pressure switch then setting the high air pressure switch to 1.2mb above the lockout pressure.
13. The low gas pressure switch will be pre-set in the factory to 10mb.

14. You are then required to check the strength of the flame sensing device by removing the link on the burner, which connects the flame probe to the control box and put your multi-meter in series, which should give you a reading in uA. The signal strength should be a least 70uA for U.V. and 6uA on flame rectification.
15. After running the unit for a period of one hour you will be able to get a running temperature from the fan limit side of the stat. When you have this you must set the over heat to 20°C above the running temperature. The supply fans should be shut down once, when the burner is running to try the overheat device and the fans must be switched on as soon as it locks out on overheat.
16. All gas nipples are to be replaced and checked for tightness and checked with leak detection fluid.
17. A leak detection test is to be done with leak detection fluid and electronic leak detector on the gas train while the burner is running to see if there are any leaks in the burner gas train and a soundness test is to be done on all gas work.
18. Finally make a full record of combustion data on commissioning sheet provided; a copy is to be presented to the customer and to BMM Heaters on completion of work. The commissioning sheet should include the following:
 - (a) Model and Serial Numbers.
 - (b) Heater running temperature and overheat settings.
 - (c) Full thermal input.
 - (d) Governor pressure setting (pilot for start gas and main for full fire).
 - (e) Gas flow rates for full fire.
 - (f) Burner damper setting and pressure switch settings.
 - (g) Flame signal strength on full fire.
 - (h) Exhaust gas O², CO², CO and temperature.After setting all air pressure switches and valves etc, you must mark the position or lock off if possible.

TYPICAL FLUE GAS READINGS

O ² - 4% to 5%

CO ² - 9.5% to 10%

CO – up to 100 PPM (Typical approx 20 PPM)
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Flue Stack Temperature – Up to 330°C Nett

Commissioning High Turndown

COMMISSIONING MUST BE CARRIED OUT BY A COMPETENT REGISTERED ENGINEER (GAS SAFE), ALSO TO BE USED WITH BURNER COMMISSIONING DETAIL SEE BURNER INSERT.

1. Visually check full system to see if it is in accordance with our manual and to current/GAS SAFE legislation and IEE regulations and to this manual.
2. Check combustion air is adequate in plant room or surrounding area.
3. Check contractors electrical wiring is correct and terminated tight and fuse ratings are correct.
4. Ensure that the gas pipe work is sized correctly and relative documents for soundness and purging are available. It is the responsibility of the commissioning engineer to check for soundness from the main inlet to servicing stop tap on inlet of valve.
5. Ensure that the inlet pressure is no greater than 75mb static and no less than 17.5mb running.
6. Make sure that all dampers are set and diffuser outlets are open to give correct air flow and the correct number of air bypass blades have been removed to bypass the air in excess of our maximum amount of air through our heater, which can be found in the section 'Minimum and Maximum Air Volumes' in this Manual.
7. Check with the controls engineer that he has an interlock with the supply fan and burner so that the burner can not run without the supply fan eg air pressure switch across supply fan in series with our enable circuit between 1 & 2. The controls engineer must keep the supply fans running on for 15 minutes after burner shutdown, on a shutdown condition. The terminals 1 & 2 are also used to wire stats and time switches in series to switch the burner on and off. The unit also requires a 0-10v DC signal from the controls to modulate the burner from 100% to 25%.

8. Make sure that the stat, which is wired between terminals 1 & 2, is closed and turn the man gas on to make the gas pressure switch and turn the commissioning stop tap off. Switch the burner on, the burner should run through its cycle and after the ignition spark goes out the burner should lockout on flame failure on the burner control box.
9. Open the commissioning tap and switch the burner on. The burner will start on full air and the pilot will only open. When the pilot has established then the pilot will go out and switch to the gas air ratio valve the output of the burner will then be decided on the 0-10v dc signal. When commissioning we would advise that you modulate the burner by moving the low setting up to the same as the maximum setting and unplug the 0-10v dc signal, then you can just turn the low speed down or up to modulate burner. We would advise that you set the highest point of the burner to the head pressure on the rating plate and adjust the air on the inverter by high speed setting to get the correct combustion readings of about between O_2 : 4.0 & 5.0. After setting the top end then set the bottom end of the burner by turning the low speed down. The burner fan should slow down and the output should decrease, now set the burner to the low head pressure and adjust the low setting to match the air for combustion, the readings should be the same. For further information see insert or inverter manual for inverter setting in this manual.
10. Now plug the burner 0-10v dc back in and connect the 0-10v dc signal back in. Now try the modulation, 0v dc will be 25% of the burner output and 10v dc will be 100% burner output. Please note, you must check emissions right throughout the range 0-10v and make sure gas and air match each other. The emissions should be approx the same throughout.
11. The high and low air pressure switch must be set on low speed. The low air pressure switch is set by turning it up until it locks out and moving it back 1.2mb on the pressure switch, then setting the high air pressure switch to 1.2mb above the lockout pressure.
12. The low gas pressure switch will be preset in the factory to 10mb.
13. You are then required to check the strength of the flame sensing device by removing the link on the burner which connects the flame probe to the control box and put your multi-meter in series, which should give you a reading in uA. The signal strength should be at least 70uA for U.V. and 6uA on flame rectification.

14. After running the unit for a period of one hour you will be able to get a running temperature off the fan limit side of the stat. When you have this you must set the overheat to 20°C above the running temperature. The supply fans should be shut down once, when the burner is running to try the overheat protection device and the fans must be switched on as soon as it locks out on overheat.
15. All gas nipples are to be replaced and checked for tightness and checked with leak detection fluid.
16. A leak detection test is to be done with leak detection fluid and electronic leak detector on the gas train while the burner is running to see if there are any leaks in the burner gas train and a soundness test is to be done on all gas work.
17. Finally make a full record of combustion data on commissioning sheet provided; a copy is to be presented to the customer and to BMM Heaters on completion of work. The commissioning sheet should include the following:-
 - (a) Model and serial number.
 - (b) Heater running temperature and overheat settings.
 - (c) Full thermal input.
 - (d) Governor pressure settings (pilot for start gas and main for full fire).
 - (e) Gas flow rates for full fire.
 - (f) Burner damper setting and pressure switch settings.
 - (g) Flame signal strength on full fire.
 - (h) Exhaust gas O₂, CO₂, CO and temperature.
18. After setting all air pressure switches and valves etc., you must mark the position or lock off if possible.

Please note, BMM Heaters provide a full commissioning service if required. Also if you require further information call BMM Heaters technical department.

TYPICAL FLUE GAS READINGS

O₂ - 4% to 5%

CO₂ - 9.5% to 10%

CO – up to 100 PPM (Typical approx 20 PPM)

Flue Stack Temperature – Up to 330°C Nett

Section 15: Servicing

INSTRUCTION FOR THE HEAT HEATER

PLEASE NOTE SERVICING MUST ONLY BE CARRIED OUT BY A COMPETENT REGISTERED ENGINEER (GAS SAFE)

BEFORE CARRYING OUT ANY WORK ON THE UNIT SEE THAT THE ISOLATING SWITCH IS IN THE 'OFF' POSITION AND THE GAS SUPPLY IS SHUT OFF.

BMM HEATERS ONLY RECOMMEND THE USE OF PARTS SUPPLIED OR RECOMMENDED BY OURSELVES.

INFORMATION IS FOR GUIDANCE OF QUALIFIED SERVICE ENGINEERS ONLY

Note: We recommend that the Heater is fully serviced every year and recommissioned. If the flue gas passages in the heat exchanger, the combustion chamber, or in the flue chamber are blocked, the Heater can overheat causing the unit to shut down on the overheat thermostat.

To clean the Heat exchanger:

The heat exchanger must be cleaned from the front and rear of the appliance after first removing the following items:

- (a) The burner assembly

Burner Removal (With gas and electrical supply isolated):

1. Disconnect the electrical supply to the burner by removing the multi-pin plug from the socket on the Heater interface panel.
2. Disconnect gas valve plugs.
3. Unscrew gas union assembly at inlet to gas train and at entry into burner mounting flange and remove gas train assembly.
4. Remove four fixing screws holding burner to heater front and lift away burner.

5. Fully service burner and replace electrodes, if required

- (a) The fan limit thermostat
- (b) The front outer case panel
- (c) Remove and support flue
- (d) Remove Rear panel
- (e) The heat exchanger cover plate, front and rear.
- (f) Brush any deposits from all of the flue ways using a brush. Also brush down the heat exchanger tubes.
- (g) Remove any soot from the bottom of the combustion chamber with a vacuum cleaner.
- (h) Inspect soundness of combustion chamber/heat exchanger.
- (i) Replace all items in reverse order.

NOTE: Fit new gasket or seal to gas exchanger box, cleaning door where necessary.

Note: Regarding External Heaters

If the heater is housed within an Air Handling Unit, there will be sufficient room to allow servicing. Servicing as per our standard internal procedures.

Please note in extreme weather conditions, always ensure any electrical connections etc are protected and do not allow water onto them.

If stand alone external heater, there will be a door, which is hinged up over to allow protection to the engineer from weather conditions; an illustration of the external heater can be found in **section 5 Fig 1**.

Wet Conditions

If it is found that the area in which the heater is installed has become wet/flooded, the heater must be electrically isolated immediately and an investigation to find out if any water has penetrated into the heater controls. If so, ensure they are dried out properly before re-installing the electric supply.

Burner Maintenance:

Refer to the Burner Supplement supplied with the heater.

Servicing Heat Exchanger:

Heat Exchanger of multi-tube construction with removable access clean out doors at either end. Access plates are secured by brass nuts, sandwiching glass wool webbing type gasket material between the heat exchanger flange and the access doors. When removing the doors it is important to inspect the gasket material and replace if necessary.

It is important that the tubes should be inspected and swept out if necessary, replacing Gasket Material – the material is of glass wool webbing 25mm x 3mm thick in strip form. The method of securing it is to have strips overlapping, and to cut through both surfaces with a sharp knife to give an exact join. Self adhesive webbing is easier to secure (available from BMM Heaters).

Recommended intervals:

Weekly check:

Check that there are no apparent leaks.

Clean air filters if fitted, if of the washable type, or replace where necessary.

Quarterly check:

As weekly check, and also:

Check the tension of the main fan belt(s).

Check the flue for condensation.

Remove the Burner Inner Assembly – clean and replace.

Annual Inspection:

Clean heat exchanger surface.

Inspect and align fan and motor pulleys. Check the tightness of the motor bolts.

Adjust fan belts for tension.

Inspect and adjust electrical connections.

Check all wiring and tube connections.

Remove the burner inner assembly – clean and replace.

Start the Heater and check CO readings, stack temperature efficiency and CO level.

Check the combustion air supply and check the smoke reading.

Overheat/Limit control:

The limit control provides protection for the heater, should the temperature rise above a safe level. If an overheat condition occurs, the limit control will shut down the burner and hold it off until the manual reset button is pressed.

NOTE: If the limit requires re-setting more than once after first re-set, then a competent engineer must be called to investigate further.

Fan setting - 35°C ON (If required)
- 25°C OFF

High Limit - 20°C above normal running temperature no greater than 100°C

Important: When integrated with building management system, the fan will be operated via their controls and all interlocks must be fitted to ensure the burner cannot start until the supply fan is running. On burner shutdown the supply fan overrun will continue running for 10 – 15 minutes to dissipate residual heat.

Fan Assembly:

Inspect the fan blades to see they are not damaged and that there is no excessive building up of deposits that could give an imbalance via access panel on the side of the heater. If necessary clean the fan blades.

The main fan bearings are permanently sealed and do not require lubrication.

Check belts for signs of wear and replace if required.

Gas control valves maintenance:

No regular maintenance is required on these devices. Please refer to section 16 for removal or replacement of parts.

WARNING!
Replace faulty gas valve with genuine BMM Heater replacement part; failure to do so could result in death, injury and damage to property.

Note! Check all gas pipes and joints to ensure there are no cracks or gas leaks. Any cracks in the pipe work or joint must be repaired.

Fan control:

The burner should start its safety sequence and then fire up. When the heater achieves 35°C the supply fan will cut in and your heater is up and running. When the space is up to temperature the burner will stop and the supply fans will run on until the fan control reaches 25°C and then the supply fan will shut down. The heater will then switch on and off as required via the day thermostat and time clock. If your heater fails to start, check burner lockout and high limit resets as referred to in fault findings, if any further investigation is required or the heater repeatedly locks out then a Gas Safe registered engineer must be called to investigate further.

Please Note: You must not electrically isolate the heater when in full fire, always wait until the burner stops and the supply fan over runs to dissipate the heat before electrically isolating.

For summer ventilation switch on/off switch to off and set fan switch from auto to manual.

Cleaning Of Heater:

The heater can be cleaned externally using a damp cloth with a light detergent. Please note: this is on the outer panel only, away from all of the electrics. No substance can be used that will cause harm to the surface of the metal, or remove paint etc.

Please Note: You must not use water on unpainted galvanised finished surfaces.

Section 16: Removal and Replacement Parts

Note! Please refer also to the burner supplement supplied with this Manual.

Multi-Block gas valve

1. Isolate electric and gas.
2. Remove Din Plugs by using a terminal screwdriver to undo locking screw.
3. Undo valve flanges with 13mm spanner (up to 500 model), 17mm spanner (above 500 model). Lift out valve assembly.
4. Replace and re-assemble in reverse order, taking care that the O rings are in position.
5. Check for gas soundness and re-commission heater.

Fan and limit stat

1. Isolate electric supply.
2. Remove outer casing and disconnect wires. The wires are held in by spring terminals which will release by pushing a small screwdriver into the slot next to the wiring termination.
3. Remove fixing screws, which secure stat to front of panel, carefully withdraw stat from heater and remove casing.
4. Re-assemble in reverse order and check settings, adjust if required to fan on 35°, fan off 25°, high limit 90°.

Supply Fan

1. Isolate electric supply.
2. Remove front lower access panel.
3. To remove fan belt, slacken both adjustment bolts on motor plate by turning anti-clockwise.
4. Remove rear panels (opposite side to burner).
5. Undo x 4 bolts and remove shelf assembly.
6. Undo x 4 bolts on the fan assembly and then the fan can be withdrawn.
7. Re-assemble as reverse.

Main Supply fan

1. Isolate electric supply.
2. Remove front lower access panel.
3. To remove fan belt, slacken both adjustment bolts on motor plate by turning anti-clockwise.
4. Disconnect fan motor electrics.
5. Remove motor on motor plate and undo x 4 bolts, Note, you will require x 4 locking nuts on replacement.
6. Re-assemble in reverse order.
7. Re-tighten the supply fan belt until 12mm movement is obtained.
8. Check fan rotation is correct.

Recommend Tools to be used.

- a) Spanner 10mm, 13mm and 17mm
- b) Screwdriver – Terminal, medium flat blade and philips medium
- c) Stillsons – 14” and 18”
- d) Allen keys – standard metric set, 1.5mm – 10mm
- e) Side cutters/pliers
- f) Multi-meter
- g) Manometer
- h) Flue – brush 3” head for exchanger tubes

Section 17: Spare Parts

Spares List:

Item	Part No.
Fan and Limit Control	JTL 13A or Honeywell
Spark Electrode	101
Flame Probe	102

**Please refer to gas burner supplement supplied with this manual.
All components can be purchased from BMM Heaters.**

<p style="text-align: center;">WARNING</p> <p>Only use parts recommended by BMM Heaters or other wise stated in this manual.</p> <p>You must first contact BMM Heaters if you want to use alternative parts.</p>

Section 18: Troubleshooting

Note!

Please refer to burner supplement supplied with this manual where more specific troubleshooting will be found.

Fault	Cause	Check
Burner Lockout	Burner fault, check sector lockout occurred on controls box	Refer to burner supplement finding chart
Overheat trip	Dirty filters, low supply air	Filters, supply fan belts, damper operations
Burner held off	No enable signal	Check BMS/Controls back via T1 & T2 in heater interface panel
Main fan runs continuously	Electrical	Summer/Winter switch set to summer(Manual) Fan thermostat set to low Fault Fan/Limit stat
Main fan Fails to run	Electrical	Fan Motor faulty Fan/Limit stat faulty Contactor faulty Motor on overload

Section 19: Users Instructions

WARNING!

If you smell gas:

- 1. Open all windows and door.**
- 2. DO NOT try to light any appliance.**
- 3. DO NOT use electrical switches.**
- 4. DO NOT use any telephone in your building.**
- 5. Leave the building.**
- 6. Immediately call your local gas supplier after leaving the building; follow the gas supplier's instructions**
- 7. If you cannot reach your gas supplier, call the fire department**

USERS INSTRUCTIONS

Once the controls have been fully installed and proved with the Heater (all interlocks proved etc), the supply air has been balanced and only when the Heater has been fully commissioned by a qualified registered engineer (Gas Safe), you are now able to use your Heater safely.

Easy Lighting and Shutting Off Instructions

Burner Start up

1. Ensure Burner and Heater On/Off Switch is on.
2. Fan switch is in auto position. If the heater is controlled via a BMS then the supply fan should be running before the burner can start.
3. Make sure the time clock and thermostats are calling for heat or that the BMS is giving enable signal to terminals 1 & 2 in our interface panel.

Burner Shut down

1. Ensure Burner and Heater On/Off Switch is off.
2. Fan switch is in auto position. The fans should run on for at least 10 min or till the fan limit is below 25°C to cool heat exchanger.
3. Make sure the time clock and thermostats are not calling for heat or that the BMS is not giving enable signal to terminals 1 & 2 in our interface panel.

WARNING!

In Emergency only! Use electrical isolator and the gas isolation valve to isolate the appliance.

Do not use electrical isolator to switch this appliance off in normal use, as the fan is required to run on to cool the heat exchanger failure to do so will cause damage to this appliance.

Simple Fault Finding

Some possible reasons for the heater not operating are:

1. Gas supply not turned ON.
2. Electrical Supply not turned ON.
3. The time and/or Thermostats may not be ON.
4. The Limit stat may have operated due to an interruption of electrical supply or fault with the distribution fan.

WARNING!

If the limit thermostats persistently operate, there is a fault which must be investigated by a qualified engineer registered with Gas Safe. This Heater should not be electrically isolated during normal operation; doing so without a fan run on for 10 min will cause serious damage to the heater.

Simple Fault Finding (burner faults)

If the burner fails to ignition for any reason, it will go to lockout. This will be indicated by the red light on the burner or digitally shown on a display screen.

Press in and release the lockout reset button; call a registered engineer if this does not rectify the problem.

Lockout should not occur during normal operation of the heater and indicates there is a fault condition which must be corrected.

WARNING!

Do not store or use petrol or other flammable vapours and liquids in the vicinity of this or any other appliance.

Some objects will catch fire or explode when placed close to the heater.

Failure to follow these instructions can result in death, injury or property damage.

