

# **BENSON MH300**

**( OIL FIRED MARQUEE HEATER )**

**INSTALLATION COMMISSIONING  
SERVICING  
USER INSTRUCTIONS**



**BENSON  
HEATING**



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## 1.0 Compliance notices

The Benson MH 300 oil fired Heater detailed herewith is manufactured by Benson Heating within a strictly controlled quality environment within the parameters of ISO 9001.2000

The Benson MH 300 has been tested and assessed for compliance with the following European Directives.

- Machinery Directive (89/392/EEC)
- Low Voltage Directive (73/23/EEC & 93/68/EEC)
- Electromagnetic Compatibility Directive (89/336/EEC & 91/31/EEC)
- Product Liability Directive (65/374/EEC)

The manufacturer has taken reasonable and practical steps to ensure that Benson MH 300 Heaters are safe and without risk when properly used. These heaters should therefore only be used in the manner and purpose for which they were intended, and in accordance with the recommendations detailed herewith. The heaters 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 the appropriate sections of the information pack accompanying the heater, prior to installation or use.

Benson Heating supports all new products being supplied to their customers with a comprehensive information pack; this clearly defines mandatory instructions for the safe installation, use, and maintenance, of the appliance(s).

Where proprietary items are incorporated into Benson Heating products, detailed information and instructions are also provided as part of the information pack.

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 therefore reserves the right to amend or change the specification of the MH 300 Heater subject to compliance with the appropriate European, national, and local regulations.

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

**Caution** is used when failure to follow or implement the instruction(s) can lead to premature failure or damage to the heater 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.

The Benson MH 300 Oil fired heaters conform to the following harmonized standards;

BS EN 292 - Part 1 : 1991  
Safety of Machinery - Basic Concepts, General Principles for Design Basic terminology, methodology

BS EN 292 - Part 2 : 1991  
Safety of Machinery - Basic Concepts, General Principles for Design Technical Principles and Specifications

BS EN 60204 - Part 1 : 1993  
Safety of Machinery - Electrical Equipment for Machines Specification for General Requirements

BS EN 60335 - Part 1 : 1988  
Safety of Household and Similar Electrical Appliances General Requirements

BS EN 55014 - 1993  
Limits and methods of measurement of radio disturbance characteristics of electrical motor-operated and thermal appliances for household and similar purposes, electrical tools and similar electric apparatus

prEN 50165 - 1995  
Electrical Equipment of non-electric heating  
appliances for household and similar purposes,  
safety requirements

### **1.1 Certificates of conformity**

Certificates are available from the Quality Control  
Department at Benson Heating.

### **1.2 General product information**

The Benson MH 300 model has an output of  
300kW.

The MH 300 units can suit either ducted  
applications, or be used as free blowing units, but  
each heater must be connected to its own  
individual open flue.

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

#### **Note**

Neither asbestos nor soft soldered joints are used  
in the construction or manufacture of the Benson  
range of Cabinet Heaters. The materials selected  
for use can withstand the mechanical, chemical,  
and thermal stresses which they will be subject to  
during foreseen normal use when installed in  
accordance with the manufacturers  
recommendations.

### **1.3 General requirements**

#### **Caution**

Ensure that the fuel supply is in accordance with  
the manufacturer's recommendations and is as  
stated on the appliance 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.

#### **Note**

To ignore the warning and caution notices, and to  
ignore the advice from the manufacturer on  
installation, commissioning, servicing, or use, will  
jeopardise any applicable warranty, moreover,  
such a situation could also compromise the safe  
and efficient running of the appliance itself, and  
thereby constitute a hazard.

The installation of the appliance must meet all the  
relevant European, National, and Local criteria.

#### **Caution**

The heater must not be installed 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,

### **1.4 Delivery and pre-installation checks**

The heater is supplied wrapped in heavy duty  
protective polythene. On receipt of the heater, the  
following checks should be carried out;

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

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

## 1.5 Warranty

The heater is supplied with a 2 year warranty made up as follows; first year covering parts and labour, and second year covering parts only. In addition to this there is also a 10 year time related warranty on the combustion chamber/heat exchanger. The warranty commences from the date of dispatch from the manufacturer, and is subject to the terms detailed within the Benson Heating 'conditions of business'.

### Note (i)

The warranty may be invalidated if –

- a) The warranty registration/commissioning card has not been completed and returned to Benson Heating
- b) The installation is not in accordance with the general requirements of this manual
- c) The flue arrangement and air supply for the heater are not in accordance with the manufacturers recommendations, codes of practice, or similar standards
- d) Air flow through the heater is not in accordance with the manufacturers technical specifications
- e) Internal wiring on the heater has been tampered with or unauthorised service/repairs undertaken
- f) The main electrical supply input to the heater has been interrupted during the heating mode
- g) The heater has been subject to and affected by the ingress of water in any form
- h) The heater is not operated at the rating(s) laid down in the manufacturers technical specifications
- i) The heater has not been operated or used within the normal scope of its intended application
- j) The manufacturer's recommended minimum service requirements have not been complied with

### Note (ii)

All warranty claims must contain the following

information to enable processing to take place;

- (1) Heater model
- (2) Heater serial number
- (3) Order reference/date of order, together with full installation details (name and address)
- (4) Details or symptoms of fault

Faulty parts must be returned to the Knighton Spares Department, the address of which is provided on the rear cover of this manual. Any such parts will undergo inspection to verify the claim. Replacement parts supplied prior to this may be charged, and a credit supplied upon subsequent validation of the warranty claim. Consumable items are specifically not included within the scope of the warranty.

### Note (iii)

Notification is required immediately a fault is suspected.

**The manufacturer will not accept responsibility for any additional damage that has been caused, expense incurred, or consequential loss resulting from any failure of the heater(s).**

## 2.0 Location/Positioning

### Warning

All of the basic criteria must be satisfied prior to commencing installation and commissioning, additionally, the Heater must be positioned and installed so as to comply with all the relevant standards and guide lines (see section 9.0), as well as meeting national and local fire regulations and insurance criteria, especially if it is proposed that the heater is to be installed within a special risk area (e.g. proximity to where petrol engined vehicles are stored or parked, where cellulose spraying takes place, where woodworking machinery is operated, etc.). Indirect fired heaters must not be located in hazardous areas, however, it is permissible for the heater to supply air to such areas.

The heater must not be installed within an environment where there is a high concentration of chlorides, fluorides, salts, or other aggressive or volatile chemicals/compounds.

The location must also allow for adequate clearance for the air supply, return air circulation, oil supply, electrical supply, whilst also providing good and safe working access.

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

### **Warning**

## **TRANSPORTATION**

**The heater should be kept in a HORIZONTAL position at all times when being transported by fork lift truck or other mechanical devices**

### **2.1 Fuel supply - general**

The Benson MH 300 of oil fired heater are all manufactured and pre-set for use with 35 second gas oil delivered to the burner via a suitable piped system from the oil storage tank.

The constraints of the application will, to a large extent, determine whether it is preferable to use a single pipe gravity feed system, or whether the two pipe pumped system is more appropriate.

All pipe work must be constructed and installed so that it does not permit the ingress of air.

The construction, size, and position of the oil storage tank must take account of the current regulations, as well as suiting the requirements of the installation.

### **Caution**

On pumped systems always check that the pump is correctly set up prior to running, and always ensure that valves are open allowing a free flow of oil through the system.

### **2.2 Fuel**

In order to promote trouble free operating it is necessary that the oil within the storage tank and oil line does not fall below the cold filter plugging point (cfpp), in this country and with class D fuel (also referred to as gas oil). The critical temperature is -4°C for this summer grade. The cfpp critical temperature for the winter grade is

-12°C.

If summer grade fuel is stored for winter use in areas prone to severe frosts and low temperatures it will be necessary to insulate or even heat the supply tank and pipe work.

### **Warning**

The pump pressure must not exceed a maximum of 0.4 bar, this is because beyond this point gas is liberated from the oil.

### **2.3 Storage tank**

It is advisable to leave the tank unpainted on the inside, but to paint the outside with a proprietary grade of anti-corrosive paint.

**A galvanised or open topped tank is strictly not allowed.**

If a medium density polyethylene oil tank is to be used then it must be OFTEC certified to OFS T-100.

Local, National, European and Fire regulations must also be complied with.

### **2.4 Single pipe system (gravity feed)**

For installations where the oil tank is 300mm or more above the level of the fuel pump the principle of gravity feed may be used.

The draw off point for the supply to the burner must not be positioned any lower than 100mm above the bottom of the tank.

Where a return valve is fitted this must be tamper proof to prevent inadvertent operation.

### **Caution**

If the valve is closed when the pump is running the oil pressure can be increased sufficiently so as to cause damage to the seals within the pump.

The return oil should preferably be discharged through an elbow onto a tank plate situated within the tank, this should be positioned so as not to introduce air or air bubbles into the draw off pipe.

## 2.5 Two pipe system

This is used where the oil storage tank is lower than the pump.

Access for the fuel feed to the burner should be via a suitable tapping made in the top of the tank, and the fuel feed pipe should extend to not less than 100mm above the bottom of the tank.

A non return valve with a metal to metal seat should be fitted, especially if the return pipe work is terminated at a level above the draw off tube.

The non return valve must be removable for service and maintenance purposes, and the return pipe from the pump must therefore be extended down into the tank to the same level as the suction pipe.

The presence of a tamper proof isolating valve fitted within the return pipe is only required if there is a risk that oil will siphon out of the tank if the return pipe is disconnected at the pump during maintenance or servicing and if the non return valve has been omitted.

## 2.6 Pipe work and fittings

### Caution

Galvanised pipe work and fittings must not be used. All joints must be sealed properly, if necessary using PTFE tape or other approved sealing media.

The pipe work must be effectively sealed so as to prevent the ingress of air.

It is advisable to check all pipe work prior to installation to ensure that there is no loose debris or scale present.

Black iron pipes can be hammered to assist in the removal of these contaminants.

### Note

The oil feed to each heater must be fitted with a fire check valve and isolating valve.

The fire check valve must be operated by way of a fusible link positioned so that it is above the burner.

## 2.7 Oil Installation/connection

The oil tank must be positioned so that there is a fall of 7.5mm (+/- 2.5mm) for every 30mm away from the outlet and towards the sludge/drain valve, which must be sited at the lowest point in the tank. If the tank is positioned on supports then there must be an adequate protective layer between tank and support

to prevent damage or deterioration through corrosion

It is strongly suggested that reference is made to BS 5410 ; part 2 ; 1978.

It is also suggested that the installer is familiar with the detail and requirements contained within sections 2.1 through to section 2.6 of this manual prior to commencing installation.

### Warning

Prolonged exposure and contact with Gas Oil can result in the natural oils being removed from the skin, sensitisation can result in dermatitis.

**Always ensure that the appropriate personal protective equipment is used.**

## 2.8 Electrical supply

Wiring external to the cabinet heater must be installed in accordance with any local, national, and European regulations, as well as meeting the appropriate requirements of IEE regulations.

The means of connection to the main electrical supply must allow for complete electrical isolation of the heater, furthermore, in the case of a unit wired for a three phase supply, the supply should only be used to serve the heater itself and no other plant or equipment.

### Warning

Ensure that the electric and oil supplies are turned off before any electrical work is carried out on the heater.

Ensure that wiring cannot make contact with any surfaces liable to be subject to high temperatures or where the insulation of the wiring could be impaired as a result of such contact.

**All Benson cabinet heaters must be earthed.**

### Caution

The main electrical supply must not be switched off or disconnected as a method for stopping the heater, 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.

Claims for damage will not be considered if they

have resulted from incorrect wiring or the incorrect use of the heater.

## 2.9 Air supply

Provision must be made for the existence of an air supply in order to satisfy both combustion and ventilation criteria.

It is a requirement that the area where the air heater 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.

### Note

It is strongly recommended that BS 6230 : 1991 is referred to for further information concerning ventilation requirements

Where mechanical ventilation is used it is a requirement that the inlet is of the mechanical type, and the outlet is either mechanical or natural.

### 2.9.1 Heaters installed within the heated space

Where heaters are installed within the space to be heated (e.g. not a plant room separate room, or compartment then

Combustion and general ventilation **is not required if**

The combustion air intake is ducted to atmosphere (i.e. Room Sealed Appliance)

#### OR

The design air change rate of the building is more than 0.5 air changes per hour and the volume of the space is greater than  $4.7\text{m}^3$  per kilowatt of the total rated heat input

Combustion and general ventilation **is required if**

The appliance is not provided with combustion ductwork e.g. the air for combustion is taken from the space being heated

### And

The building design air change rate is less than 0.5 air changes per hour and the volume of the space is greater than  $4.7\text{m}^3$  per kilowatt then low level ventilation is required

Where combustion air ventilation is required as dictated by the previous criteria then that ventilation can be via permanent ventilation openings / grilles situated at low level (i.e. below the flue takeoff spigot ) and with the free area of such grilles as :-  
For heaters with a rated input of less than 60 kW —  $4.5\text{ cm}^2$  per kW of heat input  
For heaters with a rated input of more than 60 kW —  $270\text{ cm}^2$  plus for each kW of rated input over the 60 kW threshold an additional  $4.5\text{ cm}^2$

Or by mechanical input (**not extract**) ventilation in association with either mechanical or natural extract and with a ventilation flow rate of  $1.08\text{m}^3/\text{h}$  per kW of total rated input

Where mechanical extract is used to complement the above then the extract rate shall be  $2.16\text{m}^3/\text{h}$  per kW of rated heat input  
Mechanical ventilation systems where fitted must be provided with safety interlocks to prevent heater operation in the event of airflow failure.

### 2.9.2

#### Heaters installed Within a Plant Room

Where the heater is installed within a plant room ,separate room or compartment then combustion and general ventilation

#### **is always required**

Where the combustion air intake is ducted to atmosphere (i.e. Room Sealed Appliances) Then that ventilation can be via a permanent ventilation / grille situated at both low level (inlet) and high level (outlet) and with the free area of such grilles as :-

#### **Low level (Inlet)**

For heaters with a rated input of less than 60 kW —  $4.5\text{ cm}^2$  per kW of heat input

For heaters with a rated input of more than 60 kW —  $270\text{ cm}^2$  plus for each kW of rated input over the 60 kW threshold an additional  $2.25\text{ cm}^2$

### High Level (Outlet)

For heaters with a rated input of less than 60 kW — 4.5 cm<sup>2</sup> per kW of heat input

For heaters with a rated input of more than 60 kW — 270 cm<sup>2</sup> plus for each kW of rated input over the 60 kW threshold an additional 2.25 cm<sup>2</sup>

Alternatively mechanical input (not extract) ventilation may be used in association with either mechanical or natural extract and with a ventilation flow rate of 2.16m<sup>3</sup>/h per kW of total rated input.

Mechanical ventilation systems where fitted must be provided with safety interlocks to prevent heater operation in case of air flow failure

Where the combustion air intake **is not ducted to atmosphere** heater installed in flue only configuration then ventilation can be via a permanent ventilation opening / grille situated at both Low level (Inlet) and high Level (Outlet) and with the free area of such grilles as :-

### Low level (Inlet)

For heaters with a rated input of less than 60 kW — 9.0 cm<sup>2</sup> per kW of heat input

For heaters with a rated input of more than 60 kW — 540 cm<sup>2</sup> plus for each kW of rated input over the 60 kW threshold an additional 4.5 cm<sup>2</sup>

### High Level (Outlet)

For heaters with a rated input of less than 60 kW — 4.5 cm<sup>2</sup> per kW of heat input

For heaters with a rated input of more than 60 kW — 270 cm<sup>2</sup> plus for each kW of rated input over the 60 kW threshold an additional 2.25 cm<sup>2</sup>

Alternatively mechanical input (not extract) ventilation may be used in association with either mechanical or natural extract, and with a ventilation flow rate of 3.24m<sup>3</sup>/h per kW of total rated input

Where mechanical extract is used to complement

the above then the extract rate shall be 2.06m<sup>3</sup>/h per kW of rated heat input

Mechanical ventilation systems where fitted must be provided with safety interlocks to prevent heater operation in case of air flow failure

### 2.9.3 Ventilation Openings and Grilles

Ventilation openings and grilles must communicate directly with the outside air, be of negligible resistance and shall be sited so that they cannot easily be blocked or flooded

### Caution

Additionally, an automatic control interlocked to the burner must be fitted to ensure burner shutdown in the event of airflow failure or restriction.

### 2.10 Air distribution system

All materials used within the construction of the delivery and return air ducts must not represent a fire hazard and should be made from thermally inert materials.

The selection of materials must take account of the environment into which the heater and its air delivery system is expected to work, it must also take account of the stresses and loadings placed upon it during its normal working life.

Where interjoist spaces are used to route ducting these must be lined with fire resistant insulation material.

In installations where forced recirculation is a feature, a full and unobstructed return air path to the heater(s) must be provided, with return air grilles connected by ducting directly to the return air inlet on the heater.

The limit for recirculation should not be greater than 85% re-circulated air to 15% fresh air.

If the inlet air is ducted to the outside, then the lowest edge of the inlet air duct must be at least 500mm above the outside floor or ground level, it must also be fitted with an access point(s) to allow for cleaning and servicing.

The openings in the structure through which the ductwork passes must be of fire resistant material and constructed to prevent the likelihood of any fire from spreading.

In ducted applications the ductwork must be designed so as to give a static pressure within the limits stated in section 8 of this manual.

It should be noted that if the static pressure is too high, nuisance shut-down will occur when the heater goes out on the overheat limit thermostat, if the static pressure is too low, then damage can be caused to the fan motor.

Warm air outlets on ducted applications must be such that they cannot be closed or become blocked, which again would lead to an increase in static pressure and nuisance shut-down.

The outlets must not be sited so that warm air can be discharged onto combustible materials, if necessary, guard rails should be used to ensure that effected areas are kept clear.

Return air intakes must not be located so that potentially harmful or hazardous contaminated air can be drawn into the system.

## 2.11 Flue system

### Warning

Each heater must have its own separate flue, with a flue diameter of not less than **225mm**. The minimum vertical length of flue must not be less than 1m.

The flue should rise vertically, and the number of bends should be kept to a minimum.

It is strongly advised that BS 5854; 1980, and BS 5440; parts 1 and 2, are used as consultative documents when considering flue requirements.

Care should be taken to ensure that the flue terminal is not situated in a high-pressure area, the proximity of buildings and other obstacles which will influence this must be taken into account, preferably at the design stage.

Provision must be made for the disconnection of the flue for inspection and service requirements, and it is strongly advised that where bends are fitted inspection covers are included.

The materials from which the flue is constructed must be non-combustible, resistant to internal and external corrosion, and be capable of withstanding the stresses and loadings associated with normal use.

## 3.0 Installation

### 3.1 Electrical Installation/Connection

Benson MH 300 cabinet heaters are 415V 50Hz 3PH NEUTRAL & EARTH

It is recommended that reference is made to the wiring diagrams contained within section 7 of this manual prior to installation or connection to the supply.

The electrical supply must be as specified and suitable for the heater, and must be run within conduit to a point adjacent to the heater, and be terminated to provide an isolation point that will prevent remote or inadvertent activation.

Cables, conduit, and fittings that are used to make the connection between the isolator and the heater must conform to the appropriate IEE regulations. All heaters are supplied fused and pre-wired, all must be earthed.

Final connections for any additional external controls must be completed on site, and must be carried out according to IEE regulations.

Separate user information is provided for the time control unit and the burner, and forms part of the product information pack which accompanies every heater when dispatched.

### Warning

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

**Always ensure that the appropriate personal protective equipment is used.**

### 3.2 Air Distribution Installation

The materials selected must be of low heat capacity, and it is preferable that all warm air ductwork is thermally insulated.

Where ducting may be subject to deterioration from exposure to moisture or high humidity material selection and insulation are prime considerations. Joints and seams must be airtight and fastened securely and designed to remain so, even when operating at high temperatures.

Adequate support must be designed into the layout of the ductwork to ensure that the integrity of the seams and joints is maintained.

The support must be independent and separate

from the heater and the ducting, to allow for free movement during expansion and contraction.

Where ducting passes through walls or partitions sufficient clearance must be left, irrespective of any fire stop requirement, to allow for expansion and contraction.

Failure to adhere to these latter two points can result in the generation and transmission of excess noise.

Where ducting is installed in concrete flooring a permanent membrane must be used to isolate the ducting from the corrosive effect of the alkaline salts within the concrete.

Care should be taken to ensure that soft insulation material does not become compressed and thereby lose its effectiveness.

### 3.2 Heater Control Installation

#### Warning

Isolate heater from mains before undertaking any electrical work.

- (a) Ventilation/Heat switch (summer/winter switch)
- (b) Burner High/Low switch
- (c) Remote Thermostat Connection
- (d) Phase selection Switch
- (e) Bulkhead Light Switch

### 4.0 Commissioning

#### Note

It is a requirement that only suitably qualified and competent personnel are allowed to undertake the commissioning of the heater.

It is also strongly recommended that prior to commissioning the engineer familiarises himself with; the information contained within the information pack that accompanies the heater, the heater itself, and with the specific requirements of the installation/application. The following checks should be carried out after the familiarisation process.

#### Warning

All Heaters undergo a rigorous test programme prior to being dispatched, whilst such a programme does involve pre-commissioning

and setting up the heater to operate efficiently and well within its designed operational limits, this does not mean that on site commissioning is less important than might otherwise be the case. The idiosyncrasies of each installation can only ever be allowed for, through the use of thorough on site commissioning carried out by trained and experienced personnel equipped with the correct tools and apparatus.

#### Note

It is strongly recommended that equipment used for the sampling and analysis of flue gases is accurate to within +/- 0.1% and maintained so that it is regularly calibrated.

### 4.1 Commissioning - Pretest

Check to ensure electrical safety, and inspect and check the oil installation, testing for leaks.

- (a) Ensure that the electrical supply is turned off.
- (b) Ensure that the oil supply is turned off.
- (c) Check that all panels and fasteners are secure and in place.
- (d) Check that the heater is installed so that it is square and that the support is adequate.
- (e) Ensure that warm air delivery outlets are open and that ducting is adequately supported.
- (f) Ensure that if filter assemblies are fitted that they are secure and correctly located.
- (g) Check that air inlets are clear and that return air paths are adequate.
- (h) Ensure that the flue is secure, adequately supported, and that the various joints are properly sealed.
- (i) Check that there is provision for flue gas sampling and that this sample point can be plugged and sealed after commissioning.
- (j) Check that fan and limit stat settings have not been disturbed and are as follows

- Fan on - 60°C
- Fan off - 30°C
- Overheat limit - 100°C

Also check that the white button (automatic) is pulled outward and that the red button (reset) is pushed inwards to the reset position.

(k) Ensure that the burner is securely attached to the heater.

(l) Test for electrical earth continuity between the heater, oil pipe work, and mains supply.

(m) Turn on main electrical supply, select the following switch settings

**Heat/Ventilation - Ventilation**

The fan will start enabling fan direction etc to be verified. Reset on/off switch to off position.

(n) Turn mains electrical supply to off, replace and secure lower louver panel covering fan and motor assembly.

(o) Set thermostat to 'demand' position.

**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 off.

(b) Ensure that the oil supply is turned off.

(c) Select the following switch settings on the heater

**Heat/Ventilation - Heat**

(d) Turn on main electrical supply.

(e) Select 'on' position for heater on/off switch.

(f) Check for the following burner sequence

Interval	Operand
1 <5s	Combustion air damper actuated, burner fan motor initiates purge cycle...
2 <15s	Solenoid valve opens ignition transformer provides spark for burner ignition...

**E I T H E R -----**

3 >15s	Ignition failure caused by oil starvation resulting in burner lock-out/shut-down...
--------	---

(g) Set heater on/off switch to off position

(h) Attach oil manifold (bleed screw and pressure gauge)

(i) Open oil supply valves and bleed air from pipe work and adjust burner oil pressure as per detailed in burner manual Repeat steps 4.1 q, and 4.2 c,e,f.

**----- O R -----**

4 >15s	Burner ignition.flame detection...
--------	------------------------------------

5 <20s	Burner ignition cycle complete
--------	--------------------------------

**Note**

It is strongly recommended that the separate manual concerning the operational details of the burner supplied with the heater as part of the information package is studied prior to commissioning. Time intervals within the ignition sequence will vary slightly from one model to another.

**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 of this manual.

(k) Repeat steps 4.2 c,a,

(l) Repeat steps 4.2 d,e,f, allowing the heater to reach thermal equilibrium.

(m) Adjust thermostat to its highest setting, and allow the heater to continue to fire.

(n) Gradually reduce the temperature setting on the thermostat until the burner shuts down, (@ < ambient and then gradually increase the temperature setting on the thermostat until heat is called for, (@ > ambient) and the burner automatically re-fires.

(o) Check fan and limit stat by depressing and holding in the fan motor overload re-set button, located on the heater electrical panel. The time between the fan stopping and burner shut down should be noted, once the burner has shut down the overload on the motor should be released.

If the time interval between fan stop and burner shut down is greater than 90 seconds further checks should be made.

These are as follows

(i) Check settings on fan and limit stat are correct, ie, fan on 60oC, fan off 30oC, limit 100oC.

(ii) Check that the position of the unit is correct, ie, equi-distant between heat exchanger body and heat shield panel.

(iii) Check integrity of unit, ensuring that neither the bi-metallic strip nor its casing is damaged.

(p) Undertake flue gas analysis using approved and calibrated analysing equipment recording data on the commissioning card, ie, CO, CO<sub>2</sub>, net and gross flue temperatures.

Record burner oil pump pressure, ambient temperature, barometric pressure, and smoke reading (0 - 1 Baccarach scale).

#### **Note (i)**

The burner air and oil pressure settings should be only very finely adjusted to achieve a CO<sub>2</sub> reading of 12.5% (+/- 0.5%).

#### **Note (ii)**

The gross efficiency must be approximately 80%.

#### **Note (iii)**

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

- \* Re-check all readings and calculations.
- \* Adjust burner as per manufacturers

instructions.

- \* Consult Benson Technical Department.

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

The completed commissioning card must be returned to Benson Heating Service Department immediately after the satisfactory completion of commissioning, failure to do so can invalidate any subsequent warranty claim.

(s) Set all controls to the requirements of the user.

### **4.3 Commissioning - air delivery system**

#### **Caution**

On ducted applications it is necessary that the system is balanced in order to optimise the efficiency of the heater and the air distribution and delivery system

Failure to balance the system can result in fan motor overloading and premature component failure, it can also result in an inefficient heating/ventilation system.

(a) Check that the amount of fan produced air volume is in accordance with the heater specification; if the volume is too great the fan can be overloaded.

Ensure that the running current is as per that stated on the heater data plate.

Alternatively, the static pressure should be measured at the start of the ductwork to confirm that it is within the permissible tolerance.

(b) If the current drawn is greater than the stated running current, in most probability this will be caused by insufficient static pressure within the ductwork, in which case system resistance should be increased through the introduction of a damper placed as close to the start of the ductwork as possible, thereby resulting in a reduction in drawn current. The damper should be adjusted until the current is in accordance with that stated on the data plate.

(c) If the current drawn is too low the duct outlet grilles will require opening to reduce static pressure and increase air volume, if this is not the case overheat cut outs can be caused.

#### **4.4 Commissioning - hand over**

(a) Upon full and satisfactory completion of commissioning, a record of commissioning information

(contact, date, etc) should be left with the heater, a copy of which must also be forwarded to Benson Heating Service Department.

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

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

(i) Lighting, shutdown, and operational information.

(ii) Safety features, data plate, and labelling.

(iii) The requirement for regular inspection - especially if the heater is within a more demanding environment - and the need for regular servicing carried out by competent and qualified persons.

#### **Caution**

After approximately 100 hours of running, the tension of the fan belts must be checked to ensure that they are correct and that they have not stretched. See section 5.2 for further instructions.

### **5.0 Servicing**

#### **Warning**

Servicing must be carried out on a regular basis, the maximum interval between services being 1 year. 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 heater must be shut down and allowed to cool, and have the oil and electric supplies to it turned off at the supply valve and isolator respectively.**

#### **Caution**

Certain component parts are factory sealed and are designed so as to be tamper proof. Usually such items do not require servicing, and therefore should not be tampered with.

Failure to comply with this can invalidate any warranty, and can also lead to premature failure.

The following parts fall within this category: thermostat, fan and motor.

Additionally, the fan and limit stat has been factory set, and must not be re-set without formal consent from the manufacturer.

Reference should be made to the separate information covering the operational details of the burner .

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

### **5.1 Planned Servicing**

In order to maintain the efficient operation of the heater it is recommended that the following planned servicing and preventative

maintenance programme is adopted by the user.

### **Quarterly Inspection**

- (a) Visual inspection of the burner
- (b) Clean and check spark electrode
- (c) Clean and check photocell
- (d) Check overheat safety is operational

### **Bi-Annual Inspection**

- (a) As per quarterly inspection, plus...
  - (b) Combustion check
  - (c) Smoke test

### **Annual Inspection**

- (a) As per half year inspection, plus...
  - (b) Heat exchanger and cleaning
  - (c) Electrical connections
  - (d) Main fan motor
  - (e) Main fan assembly
  - (f) Pulleys
  - (g) Fan belts
  - (h) Oil supply including filter
  - (i) Burner
  - (j) Air delivery system
  - (k) Flue
  - (l) 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 flue 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 presence of the flue terminal should be checked.

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.

### **Main Fan Motor**

Remove access panel. Dust and other foreign matter should be cleaned by blowing over with compressed air and through the use of a soft bristle brush and cloth.

Solvent wipes may be used to remove heavy soiling from the motor casing.

Traces of surplus lubricants spreading from the bearings should also be cleaned away.

Where motors are fitted with grease nipples bearings should be lubricated with the correct grade of lubricant. Motors which do not have grease nipples feature sealed bearings which are lubricated during manufacture for their life.

The electrical connections should be checked as follows.

The cover to the terminal box should be removed by undoing the screws which secure it.

Check connections for signs of corrosion, tightness, and ensure that there are no stray strands which could form a short circuit.

Clean, tighten, and replace as necessary.

Replace cover and secure.

### **Main Fan**

Remove dust and other foreign matter by blowing off with compressed air or through the use of a soft bristle brush.

Check that the bearings do not show signs of excessive wear.

It should be noted that these bearings do not require lubricating.

If the bearings require replacing the following procedure should be followed.

- (a) Remove belt(s).
- (b) Loosen set screw on eccentric collar and tap collar in the opposite direction to fan rotation.
- (c) Remove collar and bearing.
- (d) Check shaft for alignment and straightness.
- (e) Locate the bearing in its seat and place on the shaft with the cam facing outwards.

- (f) Fit the eccentric collar and engage the cams.
- (g) Tighten initially by rotating, and then by tapping in the direction of the fan rotation.
- (h) Replace fasteners and secure.
- (i) Turn by hand to ensure free fan rotation.

### **Pulleys**

Check pulleys for alignment using a straight edge, if necessary reposition either or both of the pulleys and the fan motor.

Check for excessive wear within the root and sides of the grooves, and check for any other signs of wear or damage, if necessary replace the pulley as follows.

- (a) Release tension on belts and remove.
- (b) Release the taper locks by slackening the securing screws by several complete turns.
- (c) Fully remove one screw from the taper lock, and having oiled it, insert into the threaded jacking point.
- (d) Tighten screw until the taperlock is free.
- (e) Remove taperlock and pulley.
- (f) Fit taperlock in new pulley, and provisionally position on the shaft.
- (g) Remove the screw from the jacking point, and tighten both screws in their clamping points until the pulley can just be moved on the shaft by hand.
- (h) Align pulleys using a straight edge, and by gradual alternate tightening of the screws clamp in position.
- (i) Refit belts and check for the correct amount of tension.

### **Fan Belts**

Check belts for signs of wear.

Frayed or split belts must be replaced using belts with a common batch code.

Belt tension must be checked, and if on multi-belt units it is found that one belt contains more slack than its accompanying belts, then all the belts on the unit must be replaced, again using a common batch code.

Replacement and tensioning is carried out as follows.

### **Note**

The maximum displacement at the mid point of the top edge of the belt must not be greater than 16mm per metre of span, when a force of 3kg is applied in a plane perpendicular to the belt.

- (a) Loosen fan motor securing bolts on chassis.
- (b) Loosen fan motor slide adjustment bolt.
- (c) Slide fan towards fan to slacken belts.
- (d) Replace belts, pull fan motor away from fan until belts are tight.
- (e) Tighten adjustment bolt to hold motor.
- (f) Tighten fan securing bolts ensuring that the fan is square and the pulleys aligned.
- (g) Check belt tension, making final adjustments as necessary.
- (h) Tighten and clamp fasteners to hold fan motor in position.

### **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 be used to facilitate this.

Access to the heat exchanger is gained through the removal of the Front panel and heat shield.

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 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 heater 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.

**If the condition of the heat exchanger gives cause for concern the Service Department at Benson Heating should be advised pending a more detailed examination.**

### **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.

### **Oil Supply**

The oil supply pipe work, tank, and fittings should all 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 oil filter should be replaced with a new one, and the system should be checked for leaks.

If the oil level is such to allow removal of any sludge or other contaminants from the tank this too should be undertaken, particularly if there

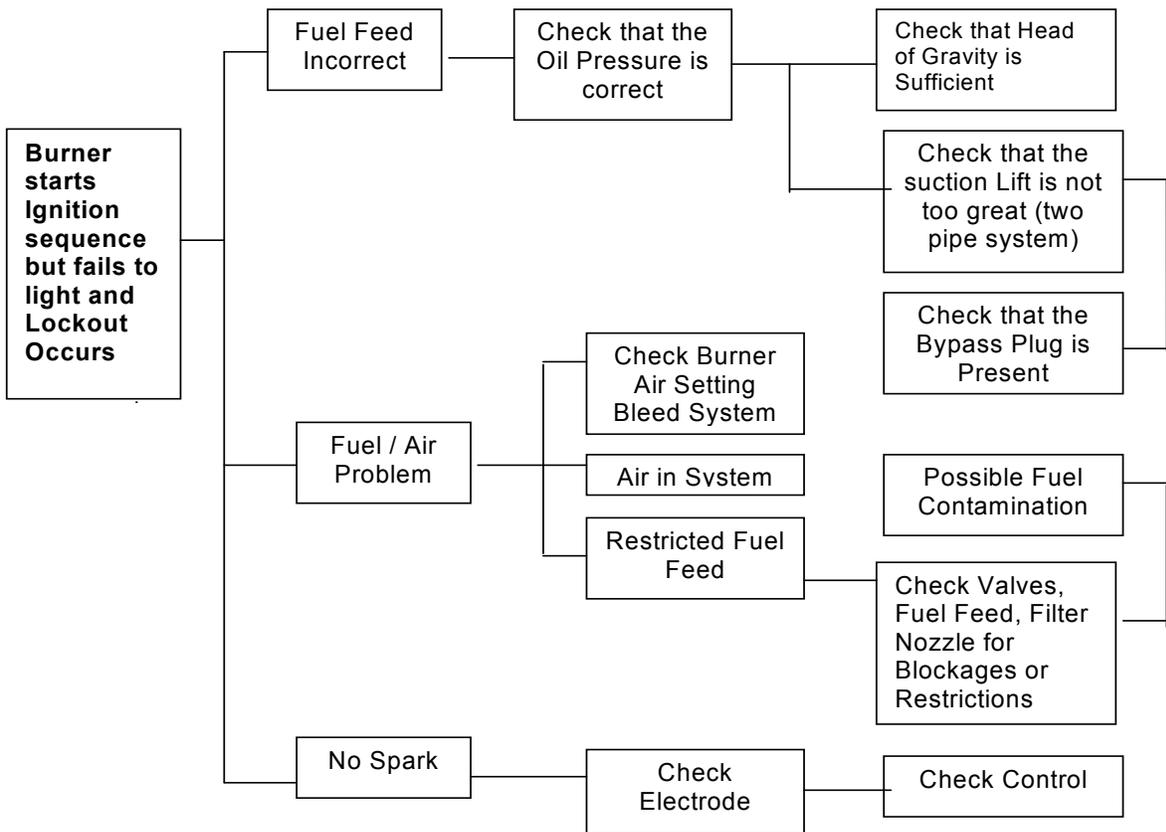
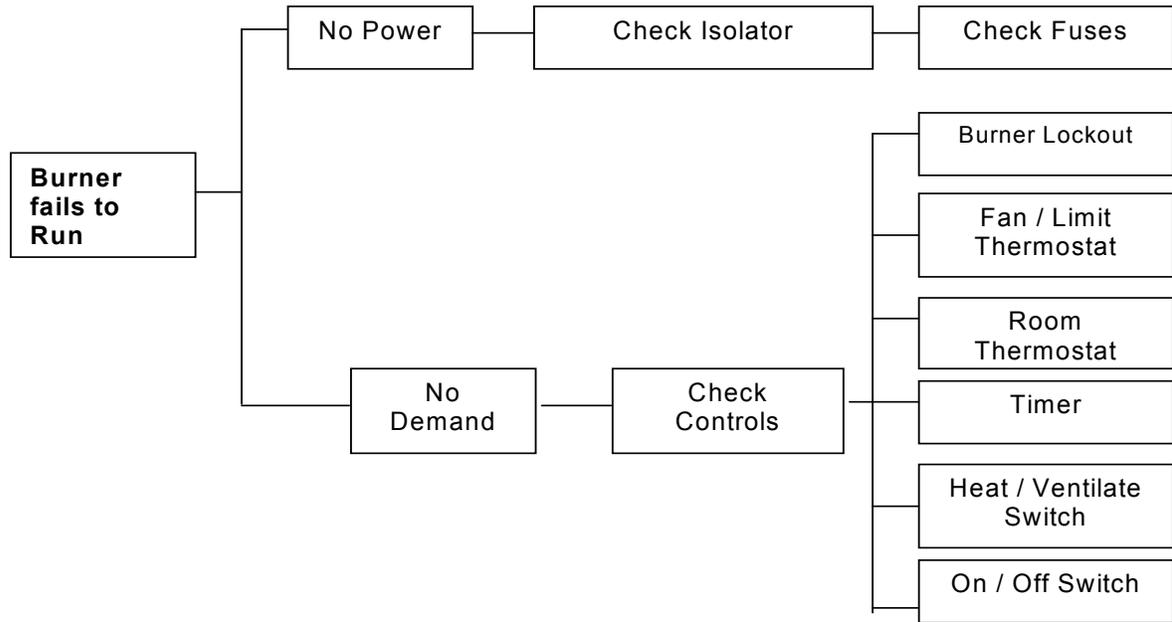
have been problems of poor firing associated with contaminants reaching the burner.

#### **Note**

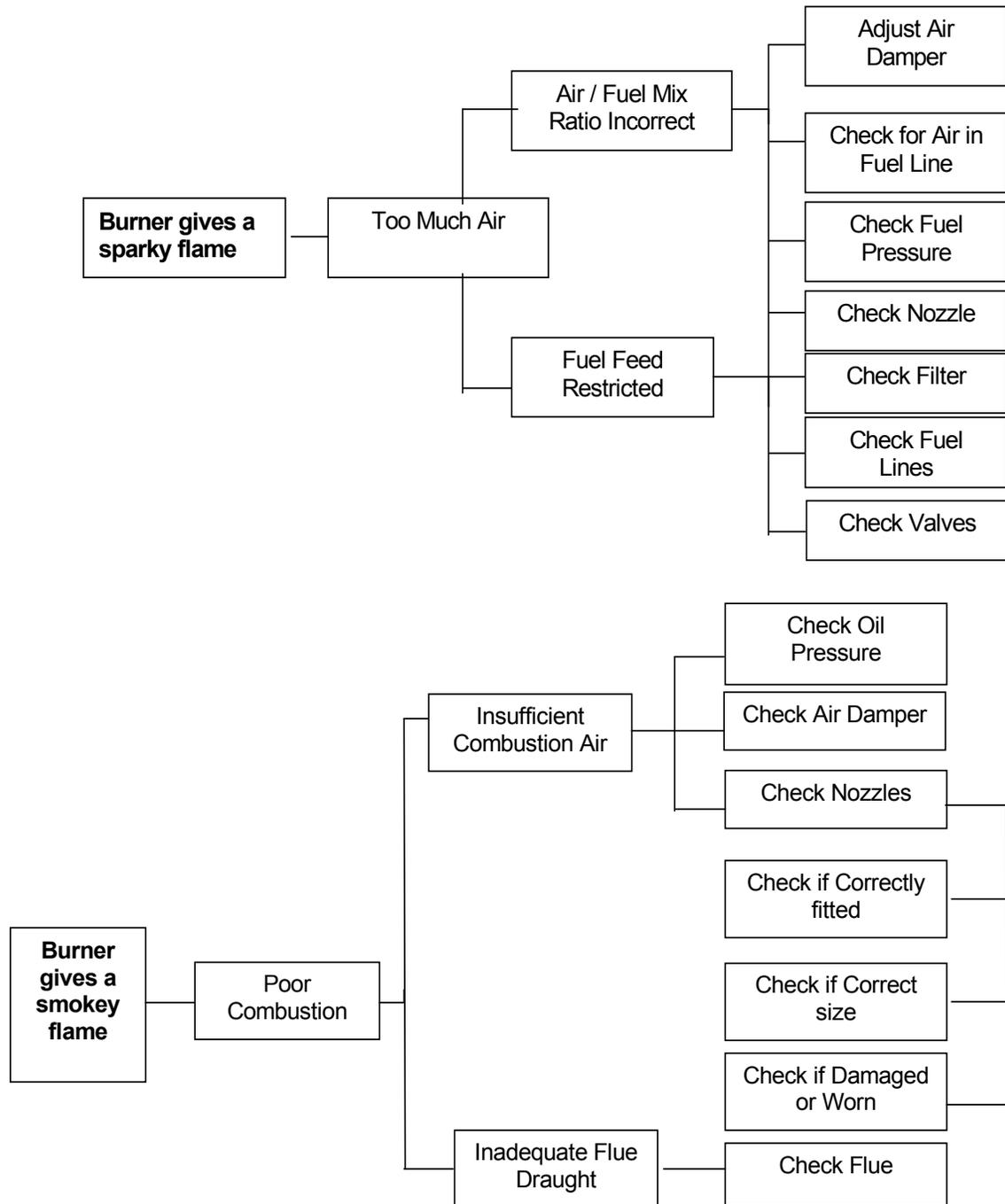
**Any waste oil or sludge must be disposed of correctly. Never dispose of it by dumping or tipping it down drains or into water courses where ground water can become polluted and environmental damage caused.**

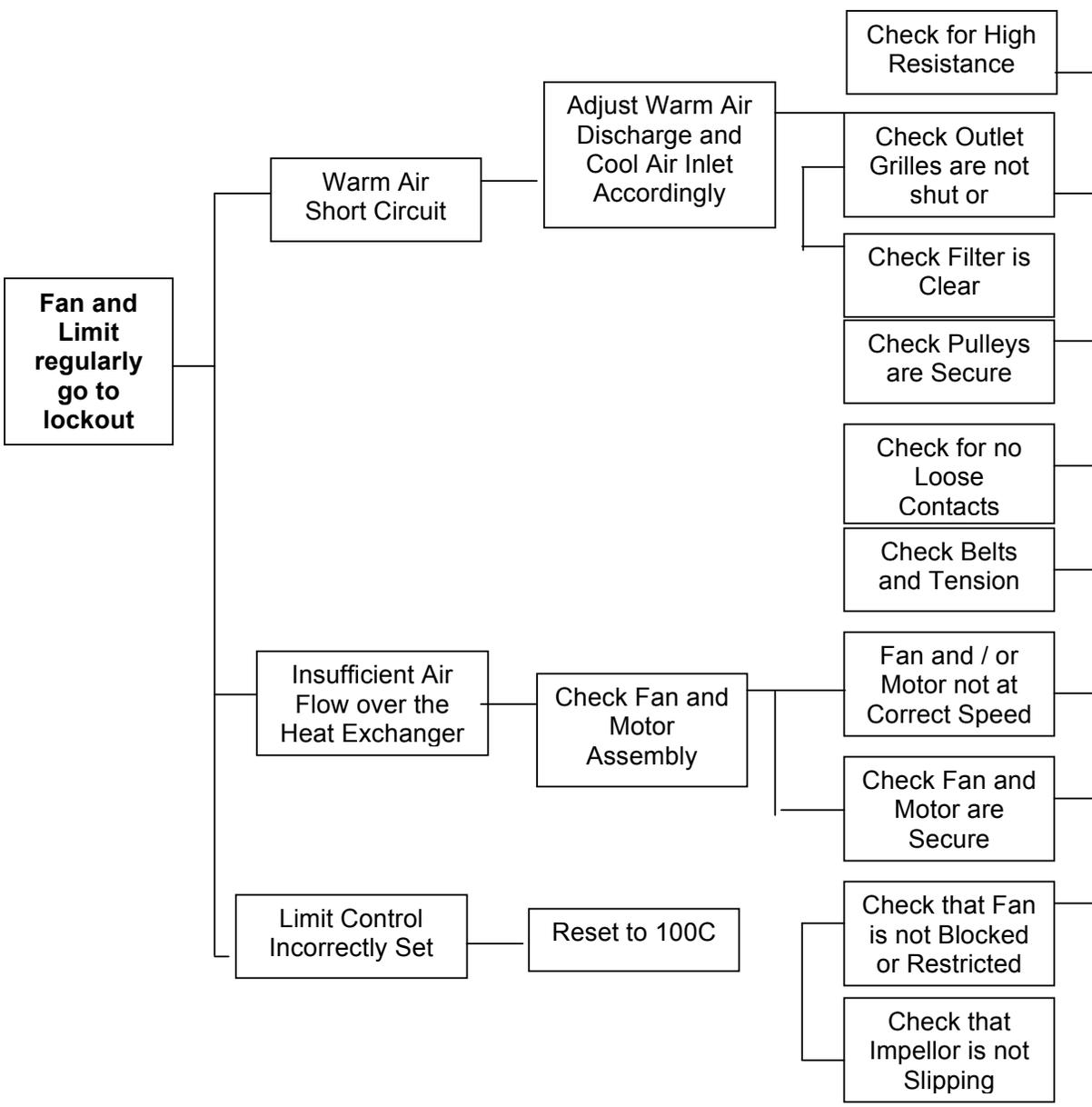
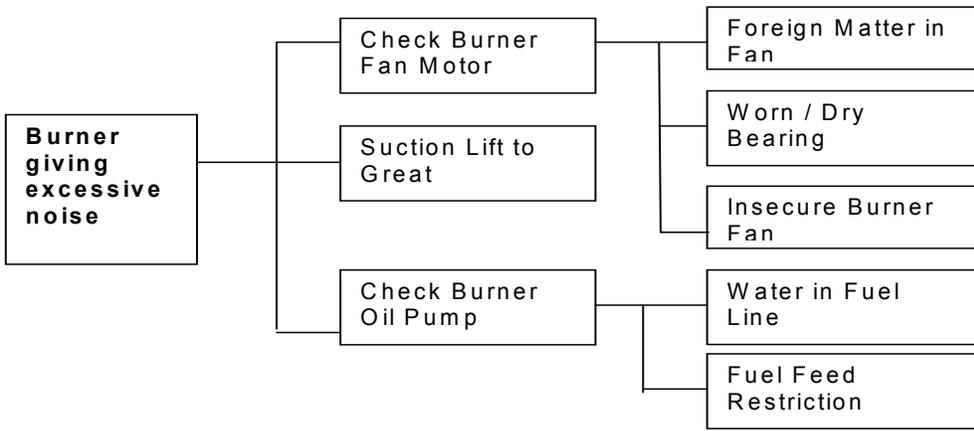
#### **Burner**

Service requirements for the burner fitted to the heater are covered in the separate manual prepared by the burner manufacturer.

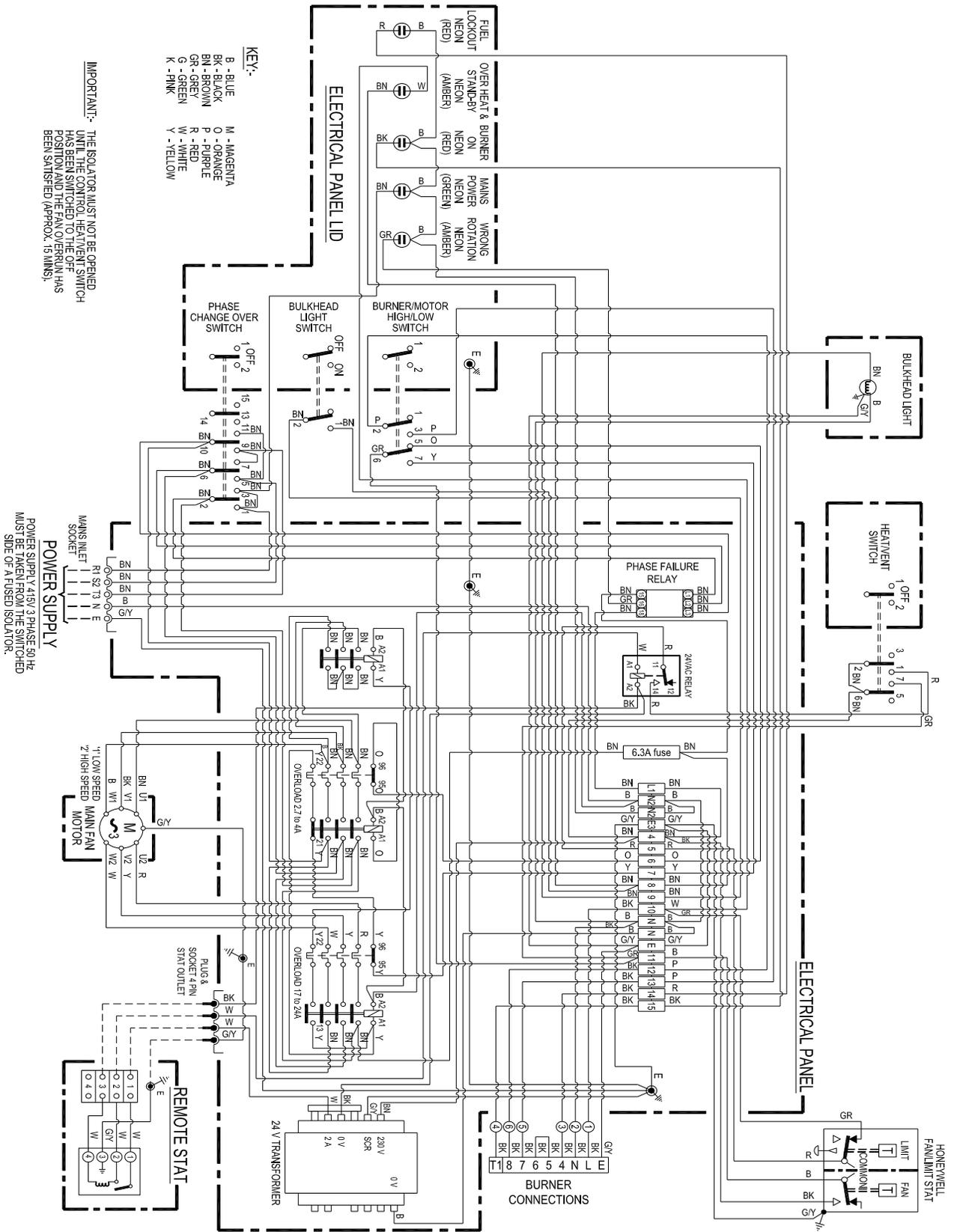


## 6.0 Fault Finding





# Wiring Diagram 20-49-146



## 8.0 MH300 TECHNICAL DATA

Heat Input full load	kW	375
Heat output full load	kW	300
Nett efficiency full load	%	85.4
Gross efficiency full load	%	80
Fuel consumption full load	L/hr	34.1
Oil pressure full load	Psi	150
Running current full load	Amps / ph	18
Flue temp full load	°C	320
Air volume full load	M <sup>3</sup> /s	6
Temperature rise full load	°C	50
Static pressure full load	pa	750
Discharge velocity full load	M/s	19.5
Noise level full load	DbA @1 m	< 90
Heat Input part load	kW	225
Heat output part load	kW	180
Nett efficiency part load	%	90.5
Gross efficiency part load	%	84.9
Fuel consumption part load	L/hr	26.1
Oil pressure part load	Psi	150
Running current part load	Amps / ph	18
Flue temp part load	°C	220
Air volume part load	M <sup>3</sup> /s	2.65
Temperature rise part load	°C	56.6
Static pressure part load	pa	480
Discharge velocity part load	M/s	8.5

### MH300 TECHNICAL DATA

Duct diameter	mm	630
Maximum duct length	m	100
Burner type		RL28
Burner control		HI/Lo
Nozzle specification		3.5/3.0
Oil connection size	Bsp	1/4"
Fuel specification		35 sec
Head setting		5
Air shutter Hi / Lo		70 / 28
Electrical supply	V/Hz/Ph	415/50/3
Fuse Size	Amps	6
Maximum running current	Amps	16
Flue diameter	mm	225
Overheat thermostat setting	°C	100
IP Rating		44
Weight	kg	1200
Height	mm	2350
Width	mm	1180
Length	mm	3600

## 9.0 Reference Information

<b>Doc/Ref</b>	<b>Title/Subject</b>
BS 5410 Part 1 ; 1977 and Part 2 ; 1978	Code of Practice for oil firing
BS EN 292 Parts 1 and 2; 1992	Safety of Machinery
BS EN 60204 Part 1; 1993	Safety of Machinery - Electrical
BS EN 60335 Part 1; 1988	Safety of Electrical Appliances
BS EN 55014 1993	Electromagnetic Compatibility
BS EN 50165 1995	Safety of Electrical Equipment
BS 5854 1980	Code of Practice - Flues/Flue Structures
BS 799 Part 5 ; 1987	Oil Burning Equipment - oil tanks
OFTEC OFS T-100	Polyethylene oil storage tanks
BS 715 1993	Metal Flue Pipes and Fittings
BS 5440 Part 1 ; 1990	Specification/Installation of Flues
BS 5440 Part 2 ; 1989	Ventilation Requirements Gas Appliances
BS 779 Part 2 ; 1991	Oil burning equipment - burners
ISO 228/1 See also BS 2779 and BS 5380)	Pipe Threads Seals and Couplings



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