BENSON

OLYMPIC GAS FIRED CABINET HEATER RANGE

INSTALLATION, COMMISSIONING, SERVICING AND USER INSTRUCTIONS

CE

Certificate Number
FM 14923

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1.0 Compliance notices

The Olympic WH range of gas fired Cabinet Heaters detailed herewith is manufactured by Benson Environmental Limited within a strictly controlled quality environment within the parameters of ISO 9001.

The Olympic range has been independently tested and assessed, and has been found to meet The Essential Requirements of the following European Directives.

Gas Appliance Directive (90/396/EEC)

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)

Benson Environmental Limited, as a manufacturer, has taken reasonable and practical steps to ensure their Cabinet Heaters are safe and without risk when properly used. These heaters should therefore only be used in the manner and for the purpose for which they were intended, and in accordance with the recommendations detailed herewith. The 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 Environmental Limited 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 Environmental Ltd 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 Environmental Ltd, 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 Environmental Ltd has a commitment to continuous improvement, and therefore reserves the right to amend or change the specification of the Pakaway AH Cabinet Heater range subject to agreement from The Notified Body.

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 Olympic range of gas fired cabinet heaters conform to the following harmonised standards;

prEN 1020 - Requirements for non domestic gas fired forced convection air heaters for space heating incorporating a fan to assist transportation of combustion air and/or combustion products.

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, electric 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 Environmental Limited.

Notified Body PIN reference is 63AQ0533

1.2 General product information

The Olympic WH range of indirect gas fired forced convection heaters have an output range from approximately 60kW to 375kW and depending upon the specification are suitable for either floor mounting, or horizontal or down flow mounting, above ground level on purpose built steel supports.

The heaters can suit either ducted applications, or be used as free blowing units, and each unit 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 Olympic WH 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 gas service to the appliance carries the correct gas type and that the supply pressure is in accordance with the supply type and pressure stated on the appliance data plate.

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. (See sections 3 and 9).

Prior to installation the following points should be considered;

a) The position of the heater for the optimum efficient distribution and circulation of warm air

b) The position of the heater relative to the route of the flue

c) The position of the heater relative to the supply of gas

d) The position of the heater relative to the electrical services, and if appropriate, any additional controls.

e) The position of the heater relative to the supply of fresh air

f) The height (if applicable) at which the heater is to be mounted and potential stratification/ circulation problems.

g) The position of the heater relative to service and maintenance requirements.

Caution

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

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 gas supply and pressure

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 Environmental Ltd 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 Benson Environmental Ltd, and is subject to the terms detailed within the Benson Environmental Ltd *'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 Environmental Ltd

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 (5) installers name and address.

Faulty parts must be returned to the Knighton Spares Department, the address of which is provided on the back cover of this manual and section 10.8. 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 Cabinet Heater must be positioned and installed so as to comply with all the relevant standards and guidelines (see section 9.0), as well as meeting national and local fire regulations and insurance criteria, especially if it is proposed that that heater is to be installed within a special risk area (e.g. 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. Nor should the heater be positioned where the burner could be adversely affected by high winds or draughts.

The location chosen for the heater must allow for the fitting of an effective flue system. The location must also allow for adequate clearance for the air supply, return air circulation, gas supply, electrical supply, whilst also providing good and safe working access.

The heater must be installed on a flat and level surface made from non-combustible material, which is sufficiently robust to withstand the weight of the heater and any ancillary equipment. 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.

In areas where it is proposed that more than one heater is to be installed, a general scheme of circulation should be drawn up and maintained, thereby offering the best heat distribution.

All Olympic Cabinet Heaters are fitted with a pressure relief facility, on all models (except WH-375) this is incorporated into the design of the flue gas exit duct. On the WH-375 the pressure relief is designed to vent direct into the flue via the exit duct. Care should therefore be taken in siting service connections and controls well away from the pressure relief vent.

Warning

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

2.1 Gas supply

The Olympic WH range of cabinet heaters are all manufactured and pre-set for use with natural gas classified under the following categories, based upon the destination of the heater; I_{2H} I_{2L} I_{2E+} and I_{2E+R}

The heater must be compatible with the gas supply, and each heater must be installed with a separate approved isolating gas cock positioned adjacent to and upstream of the union between the service pipe and the heater.

The gas supplier should have been contacted to confirm that the supply feed (pipework and metering) is capable of delivering the required dynamic volume of gas, thereby ensuring that the minimum burner pressure can be achieved. Consideration should have also been given to the pressure drop on single and multiple heater installations, and the affect that such a phenomenon has upon other plant sharing the supply.

If it is necessary to fit a gas pressure booster, the controls must include a low pressure cut-off switch which must be fitted on the supply/inlet side of the booster. It is also a requirement that the gas supplier is contacted prior to the fitting of the unit.

Note

Reference to The Institute of Gas Engineers publication UP-1 and UP-2 together with BS 6891 is strongly advised.

Service and Installation pipework must be of a diameter equal to or greater than the inlet connection on the heater, all joints must be sealed using an approved sealing compound, and the system purged and tested for soundness.

2.2 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(s), furthermore, in the case of heaters wired for a three phase supply, the supply should only be used to serve the heater(s). The position of the isolation switch must be such that it is adjacent to the heater(s) and easily accessible at all times, additionally the isolator itself must have a contact separation of not less than 3mm (as per BS 5991 clause 20.2). The main isolator fuse ratings are detailed on the appliance data plate.

Warning

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

2.3 Air supply

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

It is a requirement that the area where the air 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.

The criteria necessary for establishing the minimum size of natural vents is detailed below;

Position of vent	Area of vent direct to outside
Low level (inlet)	$540cm^2 + 4.5cm^2$ per kW of rated input per heater
High level (outlet)	$270cm^2 + 2.25cm^2$ per kW of rated input per heater

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.

Caution

Systems of ventilation that employ mechanical extraction and natural inlet must **not** be used. Furthermore, where the air supply is by way of a mechanical means the inlet must be positioned at low level and be capable of providing a minimum throughput as detailed in section 8.1 of this manual. The natural extraction air vents must have a minimum area as per above, and it is strongly recommended that natural extraction vents are situated at high level. Additionally, an automatic control interlocked to the burner must be fitted to ensure burner shutdown in the event of air flow failure or restriction.

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

2.4 Minimum space requirements

The minimum space requirements for single and multiple heater applications are detailed in section 3.3 later within this manual.

2.5 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.

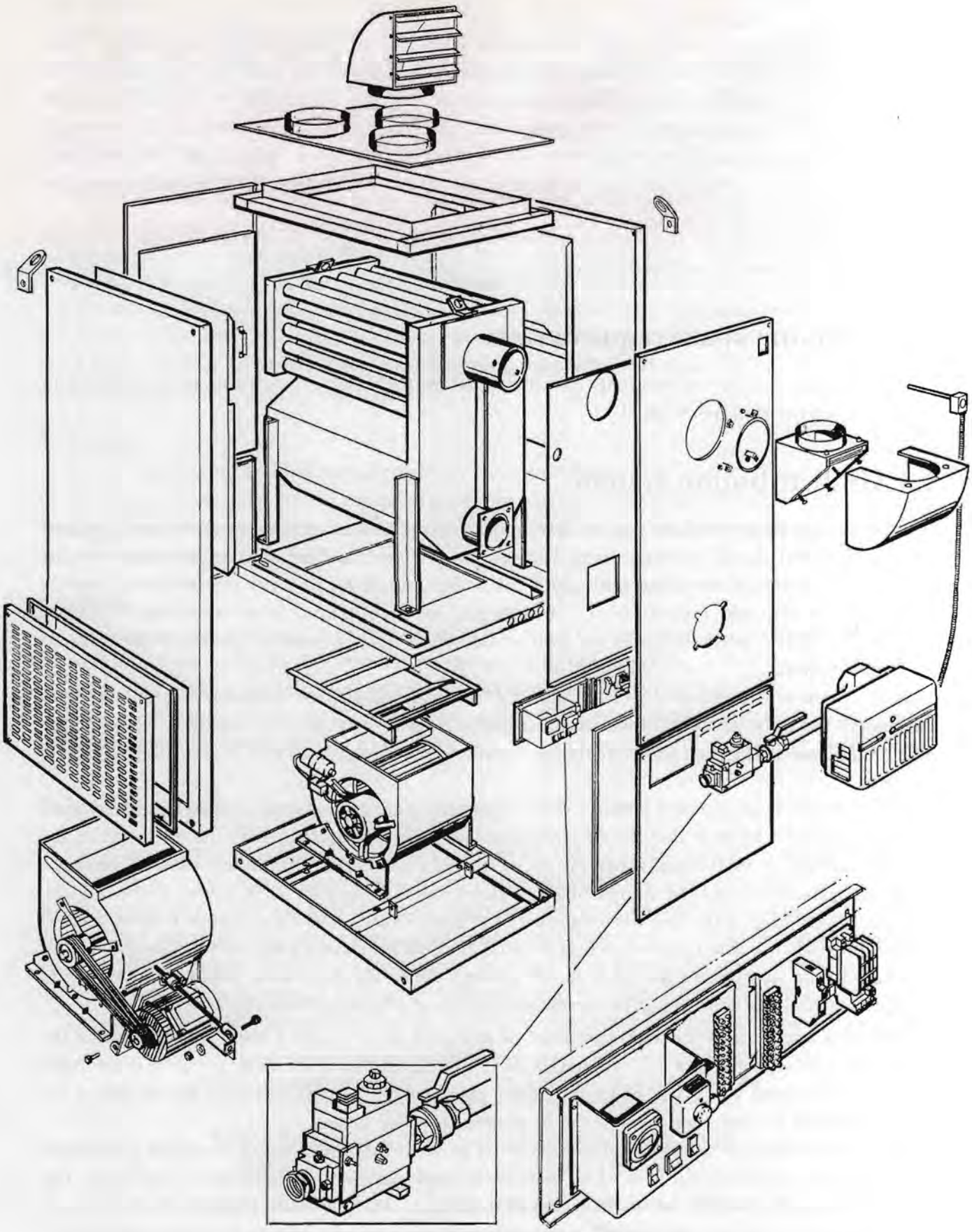
In installations where forced recirculation is a feature, a full and unobstructed return air path to the heater(s) must be provided, with return air grilles connected by ducting directly to the return air inlet on the heater. The limit for recirculation should not be greater than 85% recirculated air to 15% fresh air.

Where the heater is installed within a compartment or plant room the return air and discharge air arrangement must be such that the air circulation fan does not interfere with the operation of the flue. The return air intake and warm air outlet should therefore be fully ducted to and from the heater respectively, within the compartment or plant room. 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 to occur. The openings in the structure of the plant room, through which the duct work 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 8.1 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.

Fig 1



2.6 Flue system

Warning

It is essential that the products of combustion are flued to the outside of the building. Each heater must have its own separate flue, with a flue diameter of not less than is detailed in section 8.1 within this manual. The minimum vertical length of flue must not be less than 3m. 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. See figures 2 - 12.

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.

When designing the flue system the prevention of the formation and entrapment of condensation must be a key consideration. Twin wall or insulated systems are recommended as they tend to inhibit the formation of condensates. Where condensation is unavoidable traps should be included to encourage the condensates to flow freely to a point from which they may be released, prederably into a gully. The condensate pipe from the flue to the disposal point must be made from corrosion resistant pipe of not less than 25mm internal diameter.

If the flue passes through a wall, ceiling, or roof made from combustible material then it has to be sleeved so as to provide a minimum of a 25mm void between the exterior of the flue and the internal wall of the sleeve. The maximum permitted temperature of any adjacent combustible material is 65°C.

The position of the flue and its terminal should be such that it does not impair the combustion process. It should terminate in an exposed position so as to allow the escape and dissipation of the flue gases without risk of their re-entering the property through windows, ventilation ports, etc. The flue should extend to at least 1m above the height of any object within 3.5m of the terminal.

Flue terminals should be fitted on all flues with a diameter of 200mm or less. The terminal must be of the approved type, and have outlet grilles on all sides giving a total free area of at least double that of the flue.

Caution

It is imperative that the flue should be properly sealed where it passes through the roof, this can best be achieved by using the approved method of roof flashing plate and cravat.

Note

It should be noted that claims made under warranty and attributed to the ingress of water may not be considered especially if an approved method of sealing has not been used, or if the design of the flue has not made provision for possible condensation problems.

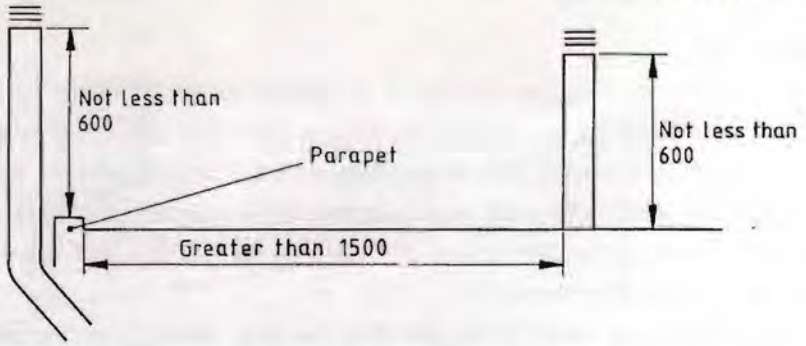


Fig 2. Flat roof, with parapet
All dimensions are in millimetres.

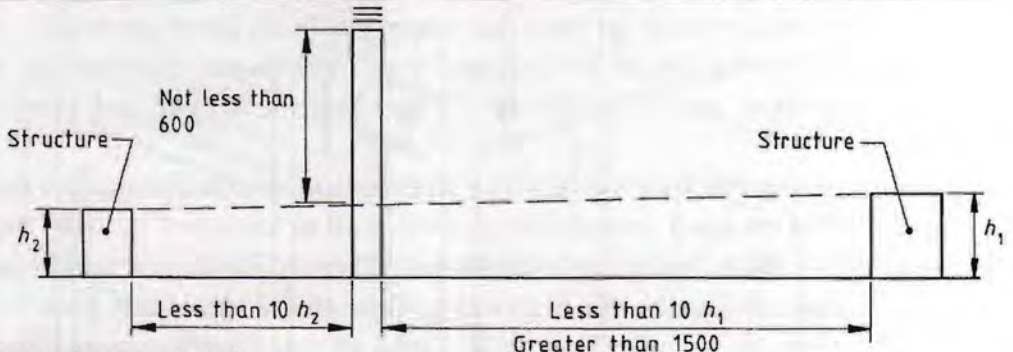


Fig 3. Flat roof, envelope method
All dimensions are in millimetres.

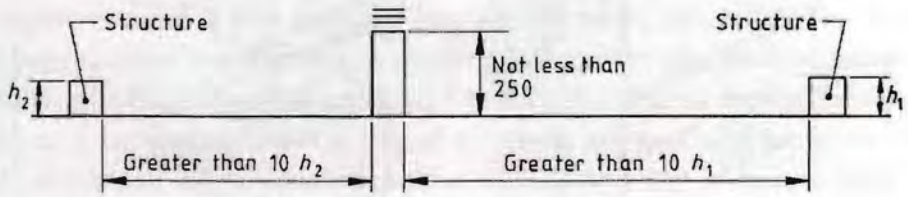


Fig 4. Flat roof, where the flue outlet is more than 10 heights *(h)* away from all structures
All dimensions are in millimetres.

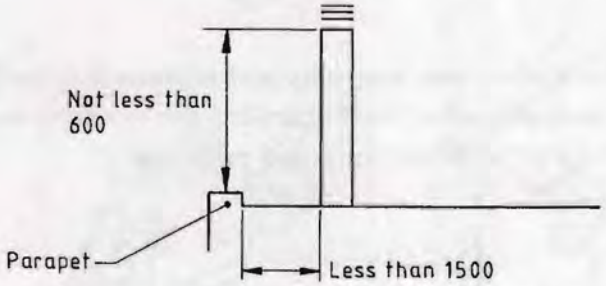


Fig 5. Flat roof, with flue close to parapet
All dimensions are in millimetres.

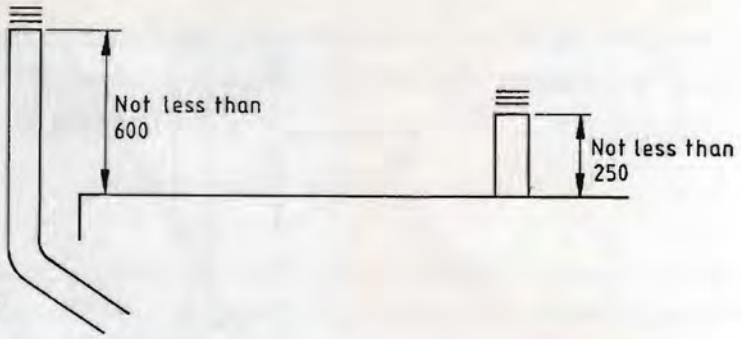


Fig 6. Flat roof, with no parapet
All dimensions are in millimetres.

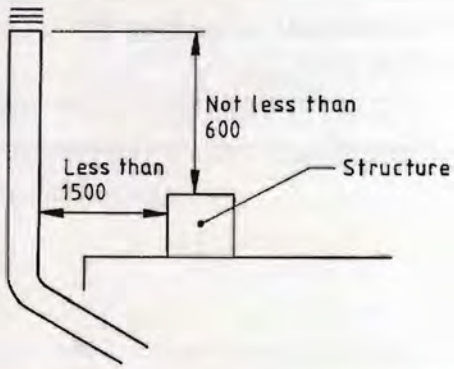


Fig 7. Flat roof, with structure close to flue outlet
All dimensions are in millimetres.

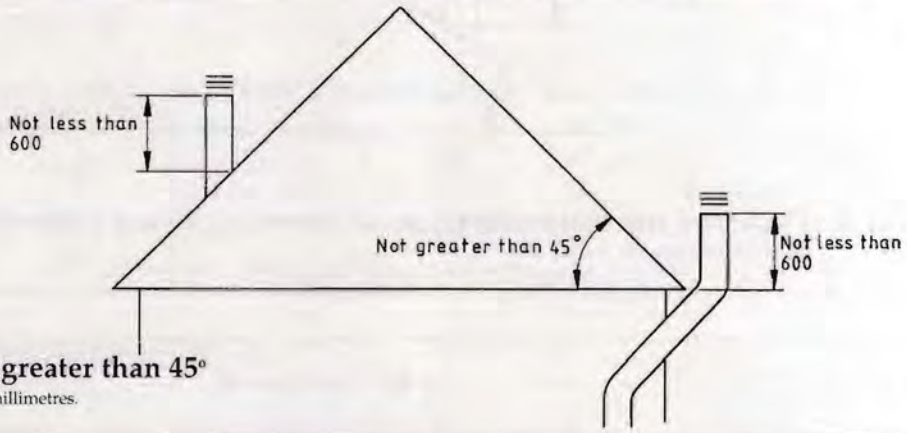


Fig 8. Pitched roof, not greater than 45°
All linear dimensions are in millimetres.

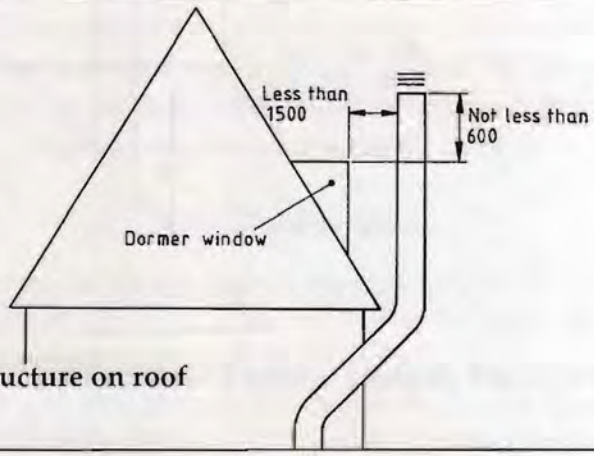


Fig 9. Pitched roof, within 1.5m of a structure on roof
All dimensions are in millimetres.

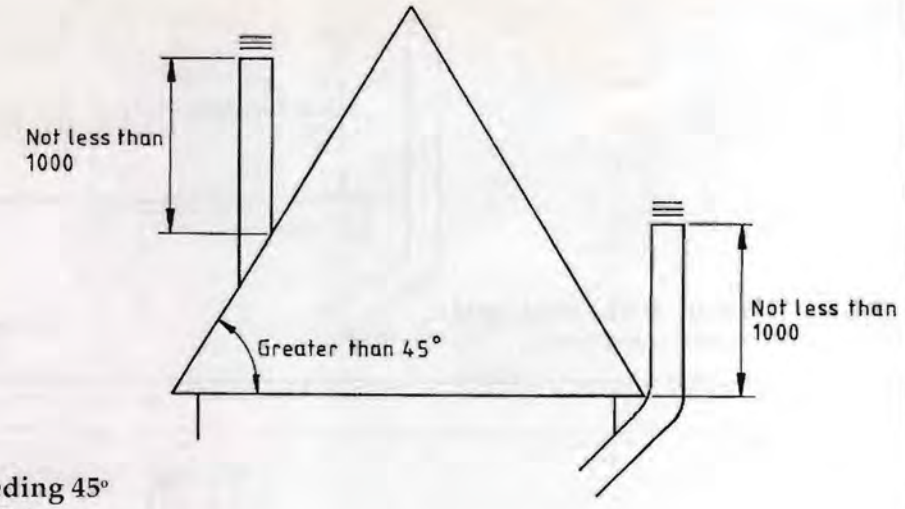


Fig 10. Pitched roof, exceeding 45°
All linear dimensions are in millimetres.

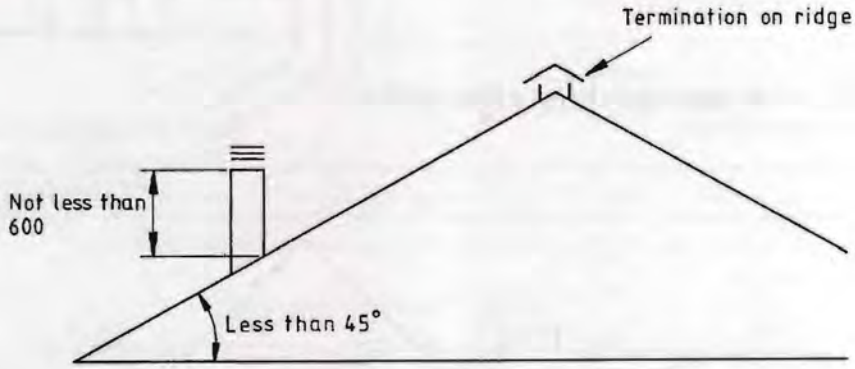


Fig 11. Pitch roof, internal route, pitch not exceeding 45° and ridge termination
All linear dimensions are in millimetres.

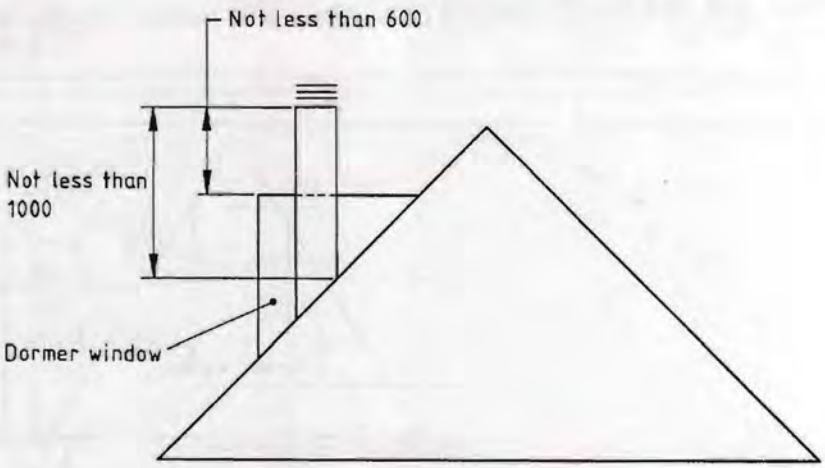


Fig 12. Pitch roof, chimney within 1.5m from dormer window measured horizontally
All dimensions are in millimetres.

3.0 Installation

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

3.1 Packaging/siting

The heater will usually be supplied wrapped in heavy gauge polythene, non-assembled parts will be supplied separately. Prior to installation, the assembly of the heater should be completed, it is advisable that this is undertaken in the area where the heater is scheduled to be sited.

Caution

It is strongly advised that when positioning the heater the lifting eyes are used, thereby reducing the risk of inadvertent damage being occasioned to the heater.

The heater will usually be supplied wrapped in heavy gauge polythene, with non-assembled parts (outlet nozzles, bonnet top, etc.) supplied separately. Prior to installation the heater must be correctly positioned before any final assembly work is completed. The bonnet top and outlet nozzles must be securely attached before installation can commence.

3.2 Flooring

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

3.3 Minimum clearances

The following minimum clearances (in metres) must be observed when installing the heater.

Model	top	lhs	rhs	front	back
WH 60 - 301	0.9	0.9	0.9	0.5	1.35
WH 375	2.0	0.9	0.9	2.0	2.0

3.4 Assembly

The following parts should be assembled to allow installation to continue.

(a) Vertical Nozzled Models

For free blowing applications it will be necessary to complete the final assembly before continuing with the installation. The bonnet top with nozzle spigots should be attached to the heater and secured. The nozzles should then be pushed home on the spigots and approximately positioned to provide the desired air flow. The nozzles must be securely fixed in their desired position upon completion of commissioning.

(b) Horizontal Nozzled Models

Remove packaging/wrapping and secure the 90° Duct Outlet to the outlet on the heater using the bolts supplied with the heater. Fasten the nozzle spigot plate to the duct outlet using the bolts and prevailing torque nuts provided. Fit the securing brackets to each of the outlet nozzles, and then lift the complete heater assembly and position on the pre-sited purpose built supports. Finish off the assembly by fitting and securing the outlet nozzles to the spigots by way of the previously fitted brackets.

3.5 Flue Installation

An integral flue spigot is fitted to all Cabinet Heaters thereby allowing the flue to connect directly to the heater. The design of the flue must ensure that it can be disconnected to allow for cleaning and servicing, furthermore, all of the flue section joint sockets must face upwards, and the seal between the sections achieved through mechanical joints or through the use of approved caulking string and grout. It is strongly advised that BS 5854 and BS 5440 parts 1 and 2 are referred to, see also figs 2 - 12.

Where condensation is likely to be a problem provision should be made preferably at the design stage (see section 2.5).

3.6 Gas Installation/connection

Service pipework must terminate at an approved gas cock, and be adjacent to the position of the heater. The connection to the heater can be made by way of either an approved flexible coupling, or rigid connection. Threaded connections must comply with ISO 228/1 or ISO 7/1, further information concerning the accepted practice in European countries is detailed in the June 1995 version of prEN 1020 Annex A7.

The diameter of the pipework from the cock to the burner connection must not be less than the diameter of the burner connection inlet. (See section 8). The installation must be purged and tested for soundness prior to commissioning.

3.7 Electrical Installation/connection

The various models are available either for 415C 50Hz 3PH or 230V 50Hz 1PH supplies and reference should be made to the wiring diagrams contained later in 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. The installer is strongly advised to consult the wiring diagrams contained within this manual prior to undertaking any electrical work.

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 (see section B).

Warning

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

3.8 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 air tight 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.

3.9 Warm Air Registers

In order that vertical temperature gradients are minimal thereby providing a more even heat distribution, it is preferable to install warm air registers at low wall levels or at floor level, with the size, number, and position commensurate with the requirement of the application. To minimise noise levels the registers should be set away from corners, a good seal between the register frame and the wall is important, particularly on high level positions, if unsightly staining through warm air/particulate deposition is to be avoided.

3.10 Heater Control Installation

Warning

Isolate heater from mains before undertaking any electrical work.

Models WH-60 through to WH-301 are manufactured with the following controls pre-wired and installed. See figs 13 and 14.

(a) On/off switch
(b) Ventilation/heat switch (summer/winter switch)
(c) Manual/automatic switch
(d) Thermostat
(e) Time clock
(f) Frost stat

All of the above controls are located on a removable panel which when separated from the heater can be re-positioned so as to offer a remote facility. However, to facilitate this, it is necessary to order and fit an electrical panel cover and front panel blanking plate to the heater in place of the control unit.

The WH-375 is manufactured without the above controls fitted, these may be supplied separately by way of the CP2 control panel from Benson Environmental Ltd, or by the installer to the customer's specification.

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 Cabinet 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 +/- 0.5% and maintained so that it is regularly calibrated.

Fig 13 - Heater Control Panel

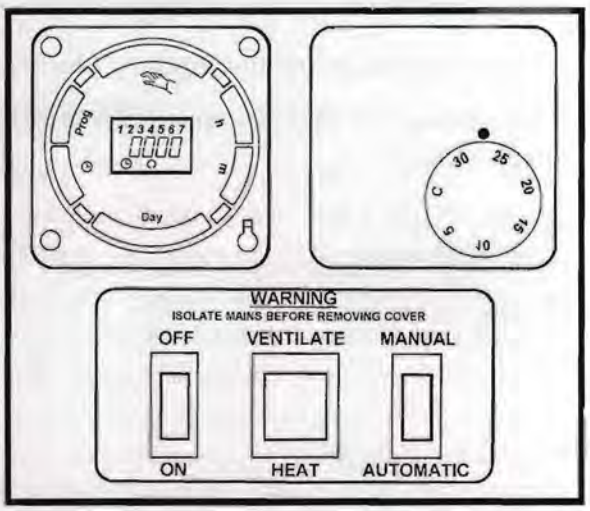
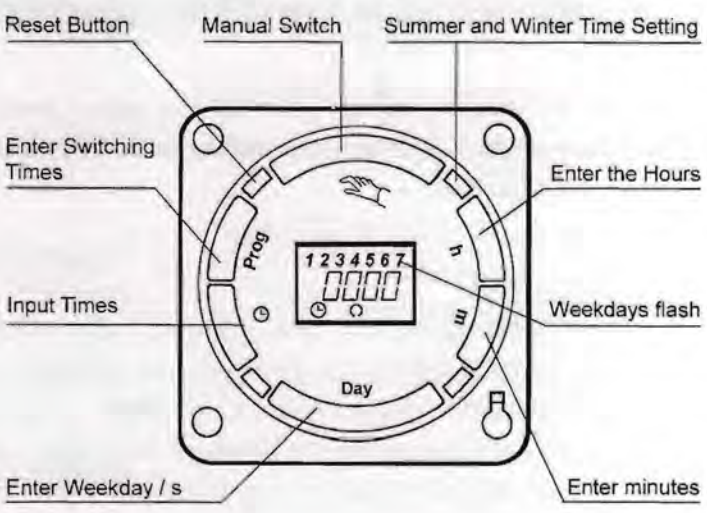


Fig 14 - Time Clock Controls



4.1 Commissioning - Pretest

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

(a) Ensure that the electrical supply is turned off.

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

(c) Check that all panels and fasteners are secure and in place.

(d) Check that the 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 condensate trap and drain facilities are adequate.

(j) Check that there is provision for flue gas sampling and that this sample point can be plugged and sealed after commissioning.

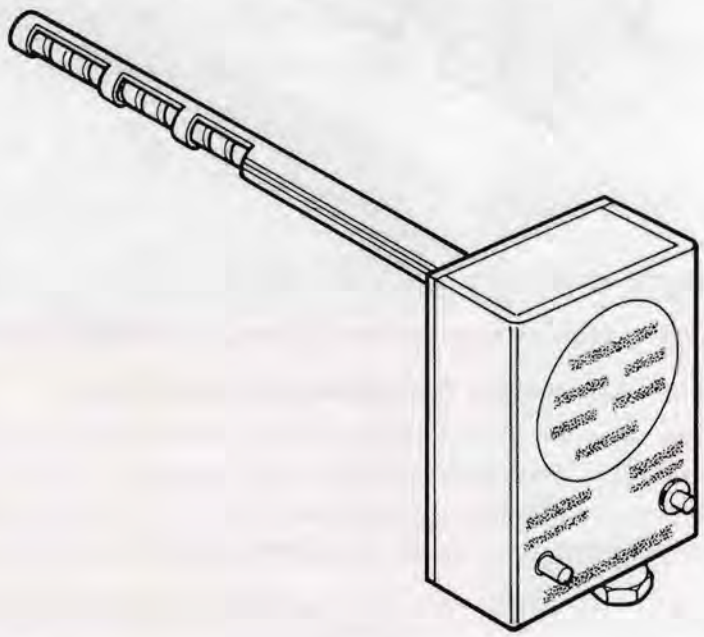
(k) Check that fan and limit stat settings have not been disturbed and are as follows

fan on	-	60°C
overheat limit	-	100°C
fan off	-	30°C

Also check that the white button (automatic) is pulled outward and that the red button (reset) is pushed inwards to the reset position. See fig 15.

(l) Remove lower panel and check motor and fan drive system for integrity of joints, check pulley alignment, fan rotation, and belt tension (see section 5.2 and figs 17 and 18).

Fig 15 - Fan and Limit Thermostat



Fan and Motor Assemblies

Fig 16

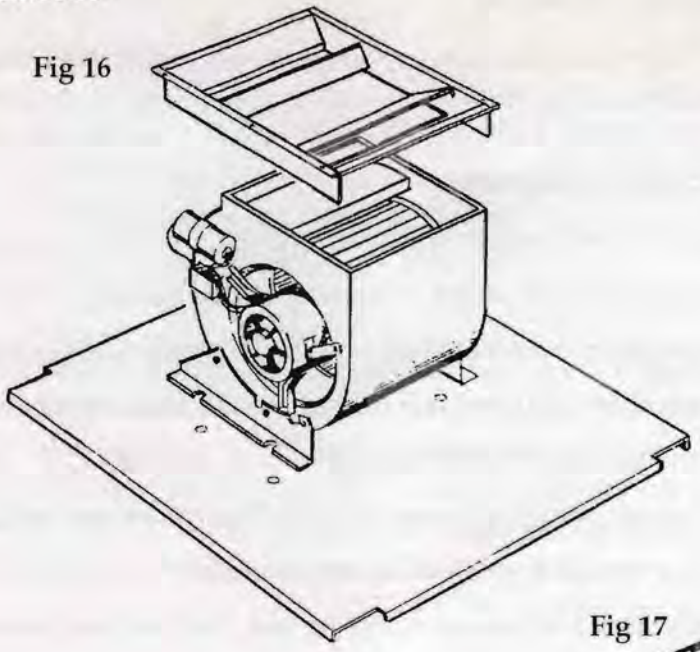


Fig 17

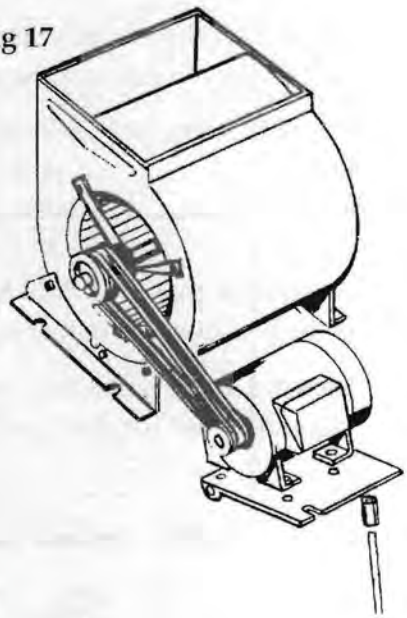
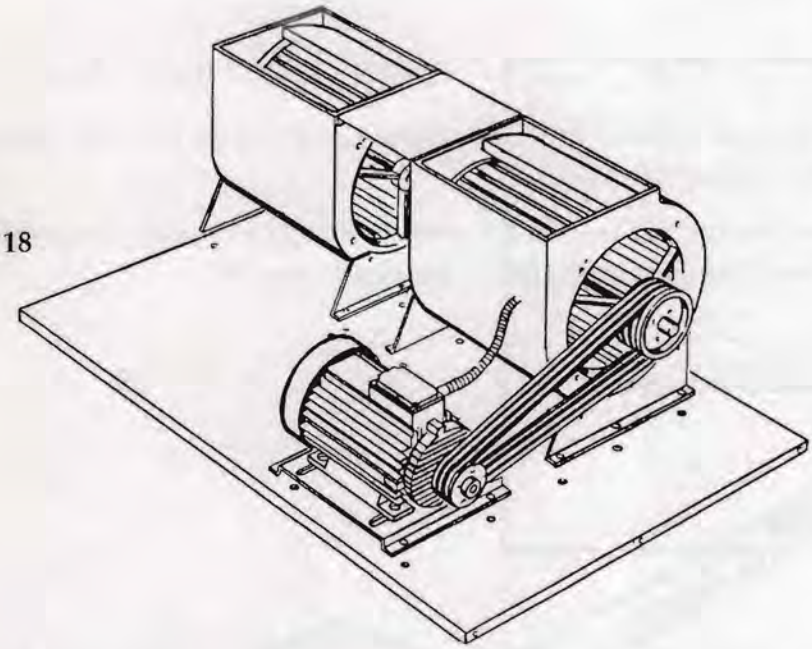


Fig 18



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

(n) Test for electrical earth continuity between the heater, gas pipework, and mains supply.

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

on/off	-	on
heat/ventilation	-	ventilation
manual/automatic	-	manual

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

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

(q) Set room thermostat and time clock to on positions.

4.2 Commissioing - 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 gas supply is turned off.

(c) Select the following switch settings on the heater

on/off	-	off
heat/ventilation	-	heat
manual/automatic	-	automatic

(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	<40s	Pilot valve opens, ignition transformer provides spark for pilot ignition. . .
		E I T H E R
3	>40s	Ignition fialure caused by gas starvation resulting in burner lock-out/shut-down. . .

(g) Clear burner lockout using burner reset function.

(h) Set heater control on/off switch to 'off' position.

(i) Open gas cocks and repeat steps 4.1 q, and 4.2 c,e,f.

		O R
3	>40s	Pilot ignition, Burner ignition. . .
4	<60s	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.

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 gas and electric supplies to it turned off at the gas cock 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: room thermostat, time clock, frost thermostat, sequential controller, and fan and motor.

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

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

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 ionisation probes
(c) Check overheat safety is operational

Bi-Annual Inspection

(a) As per quarterly inspection, plus. . .
(b) Combustion check

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) Gas supply
(i) Burner
(j) Air delivery system
(k) Flue
(l) Report

(j) Repeat steps 4.2 c,a,

(k) Re-check all connections and joints for gas soundness using an approved leak detection fluid.

(l) Remove burner cover and attach manometers to check burner pressure settings.

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

(n) Check burner pressure settings are in line with the data as per section 8.1 (if adjustment is necessary refer to separate burner information within section B).

Note (i)

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

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

(p) Gradually reduce the temperature setting on the room thermostat until the burner shuts down, and then gradually increase the temperature setting on the thermostat until heat is called for, and the burner automatically re-fires.

(q) Re-set time clock to a minimum off period, checking that the burner shuts down, and then automatically re-lights once the minimum off period has elapsed. (Separate information on the time clock is contained within section B of the information package).

(r) 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 3 minutes further checks should be made. These are as follows

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

(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-metalic strip nor its casing is damaged.

(s) Undertake flue gas analysis using approved and calibrated analysing equipment recording data on the commissioning card, ie, CO, CO_2, net and gross flue temperatures. Record mains gas pressure, burner head pressure, ambient temperature, barometric pressure, etc, and complete percentage efficiency calculation, using the formula detailed in section 8.

Note (ii)

The burner air and gas pressure settings should be only very finely adjusted to achieve a CO_2 reading of 9.3% ($^+/_-$ 0.1%) and 8.7% on WH 375 only. See also Note (i) above.

Note (iii)

The net efficiency level **must not** be lower than 79% for heaters fitted with a modulating or a high/low burner. In other cases the net efficiency level **must not** be lower than 84%.

Note (iv)

All Cabinet 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 Environmental Ltd Technical Department.

(t) 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 Environmental Ltd Service Department immediately after the satisfactory completion of commissioning, failure to do so can invalidate any subsequent warranty claim.

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

4.3 Commissioning - air delivery system

On free blowing applications the integrity of the fastenings on the bonnet top and outlet nozzles must be checked. If any final adjustment is necessary the fastenings must be secured upon completion.

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 Environmental Ltd 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.

(d) Section C 'User Instructions' should be left with the customer upon satisfactory completion of the commissioning and hand-over.

Note

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.

5.2 Servicing Procedure - Major Component Parts

Flue

A visual inspection should be carried out to ensure that the flue remains adequately supported, both internally as well as externally, and that the various joints are effectively sealed. Inspection covers, where fitted, should be removed and the flue checked to see whether cleaning is required. If inspection covers are not fitted the gas exit duct and flue spigot will provide not only an indication of the cleanliness of the flue, but will also enable access for cleaning. The 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 lubricatd 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 alternative 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 motor 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 cleaning are used to facilitate this. Access to the heat exchanger is gained through the removal of the rear upper 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.

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

(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.

Electrical Supply

All connections must be checked to ensure that they are secure, and free from corrosion. Terminals and connections should also be checked to ensure that no stray strands are bridging terminals. Electrical continuity should also be checked.

Gas Supply

The gas supply pipework and fittings should be inspected to ensure that it is free from corrosion, and to ensure that where brackets have been fitted these remain secure and offer adequate support. The system should be soundness tested in accordance with Institute of Gas Engineers recommendations detailed in UP-1 and UP-2.

Burner

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

Note

It is most important that the burner is serviced regularly and in accordance with the manufacturers instructions.

Air Delivery System

A visual inspection should be undertaken to ensure that the air delivery system is in good order, that it remains adequately supported and that the various joints are effectively sealed.

Report

A full and detailed service report should be prepared, it is advised that the report is not completed until the heater has been re-commissioned, where upon the completed report can then be run through with the user.

5.3 Service Re-commissioning

The heater must be re-commissioned as follows; as per section 4.1 through to section 4.4 inclusive. This must be regarded as a necessary part of the heater service by the servicing engineer.

6.0 Fault Diagnosis

Fig 19

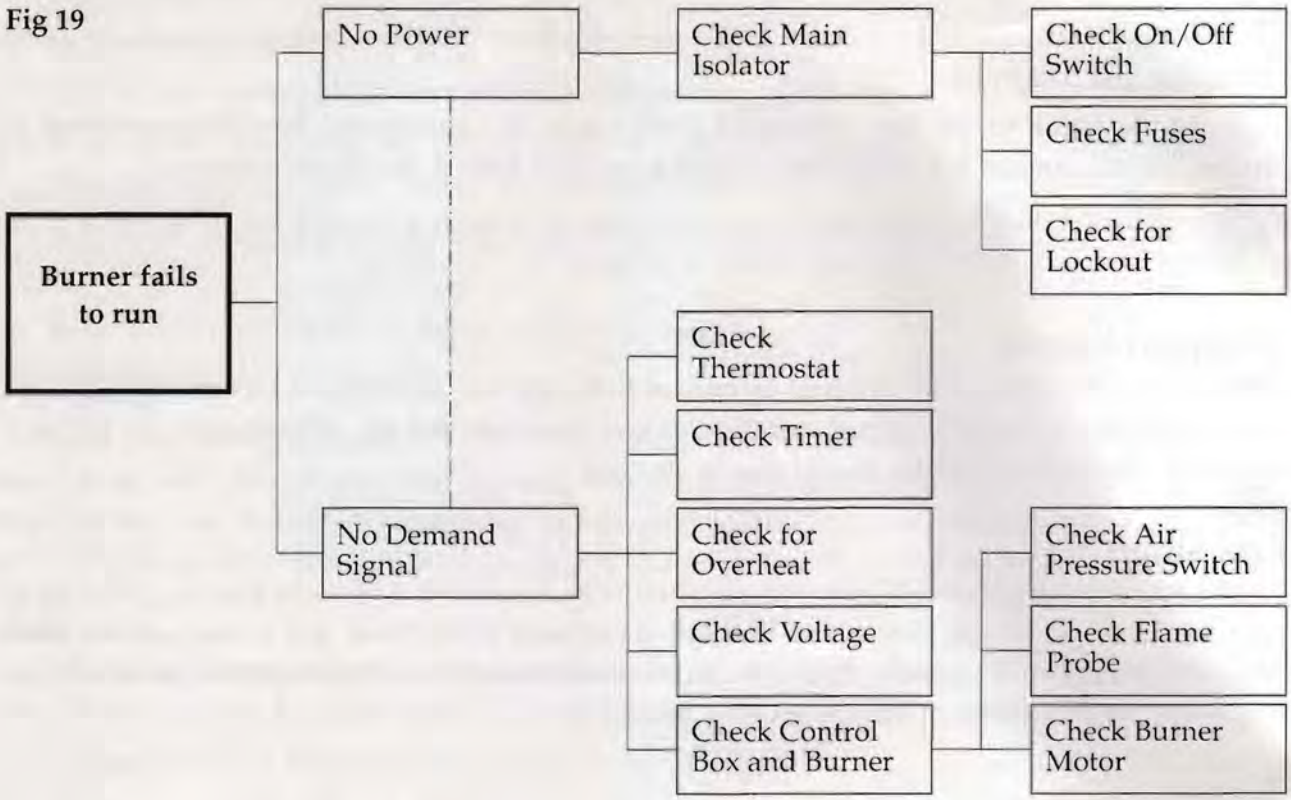


Fig 20

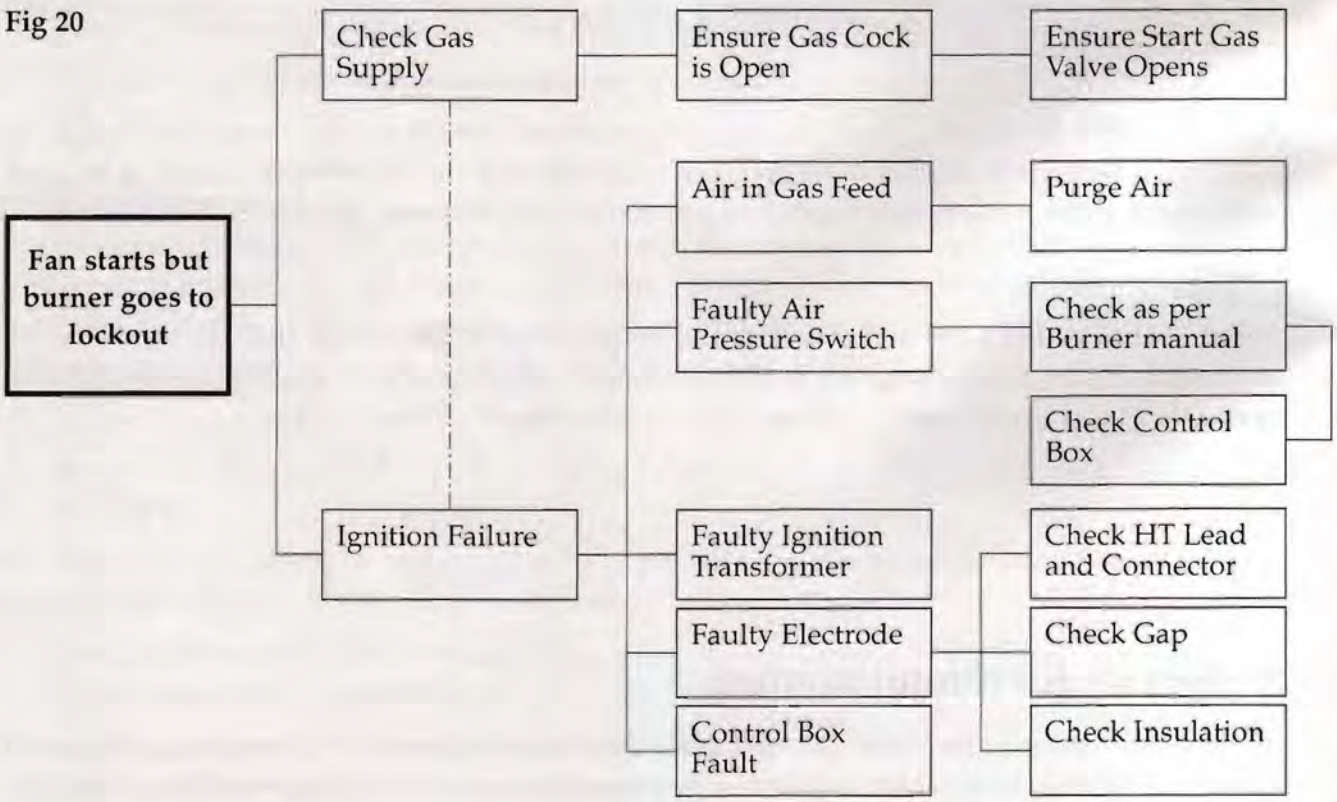


Fig 21

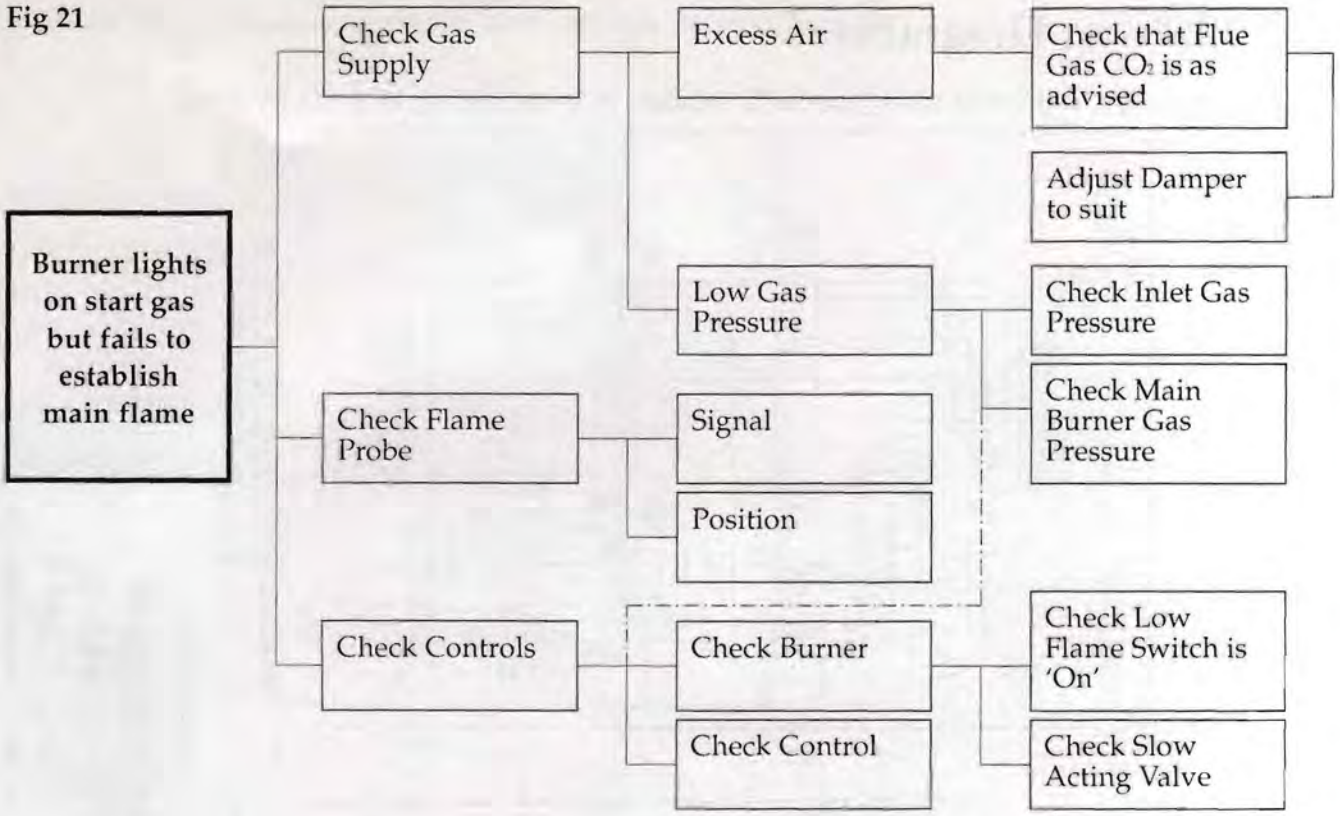
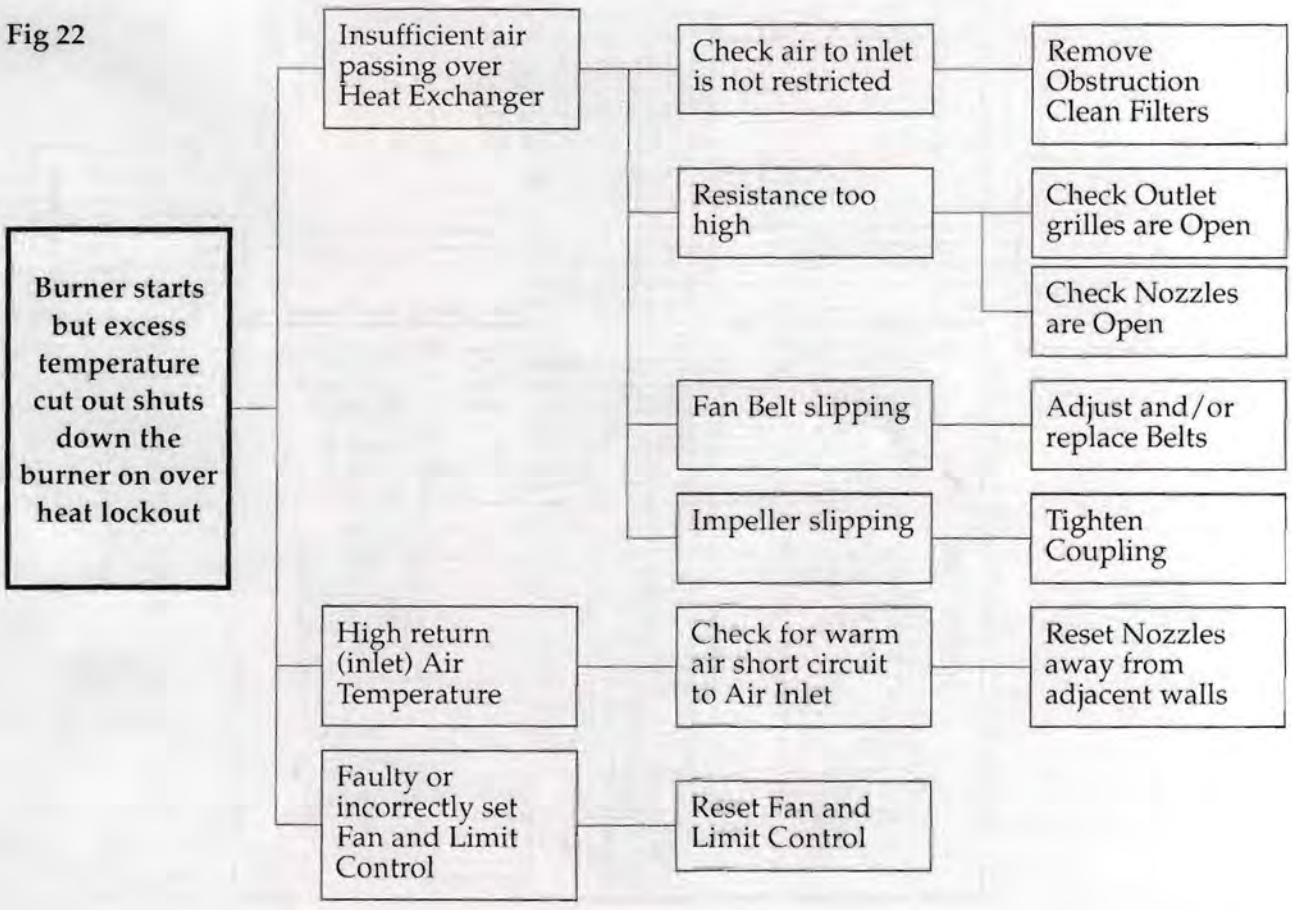
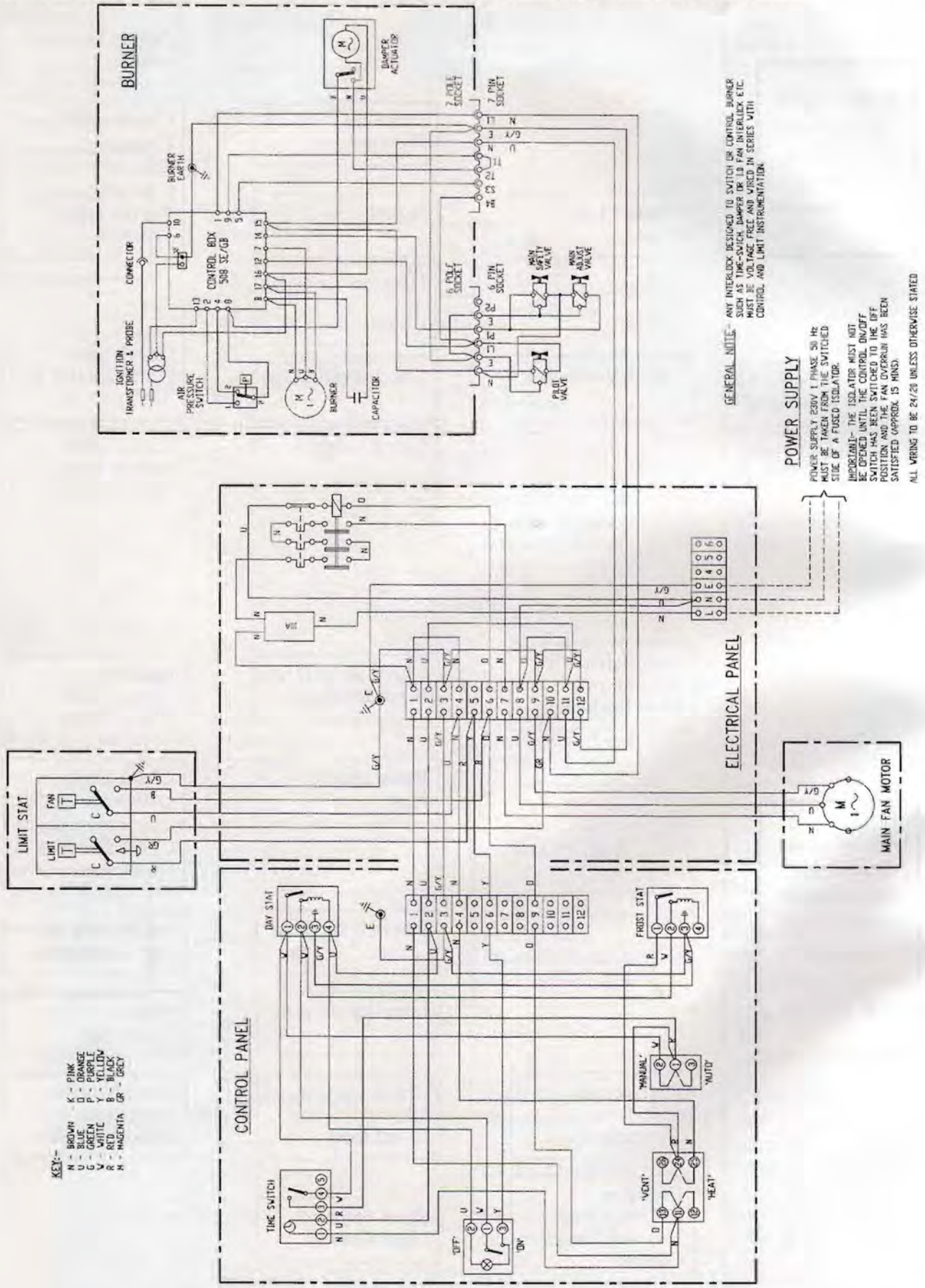

Burner lights on start gas but fails to establish main flame
Check Gas Supply
Excess Air
Check that Flue Gas CO_2 is as advised
Adjust Damper to suit
Low Gas Pressure
Check Inlet Gas Pressure
Check Flame Probe
Signal
Check Main Burner Gas Pressure
Position
Check Controls
Check Burner
Check Low Flame Switch is 'On'
Check Control
Check Slow Acting Valve

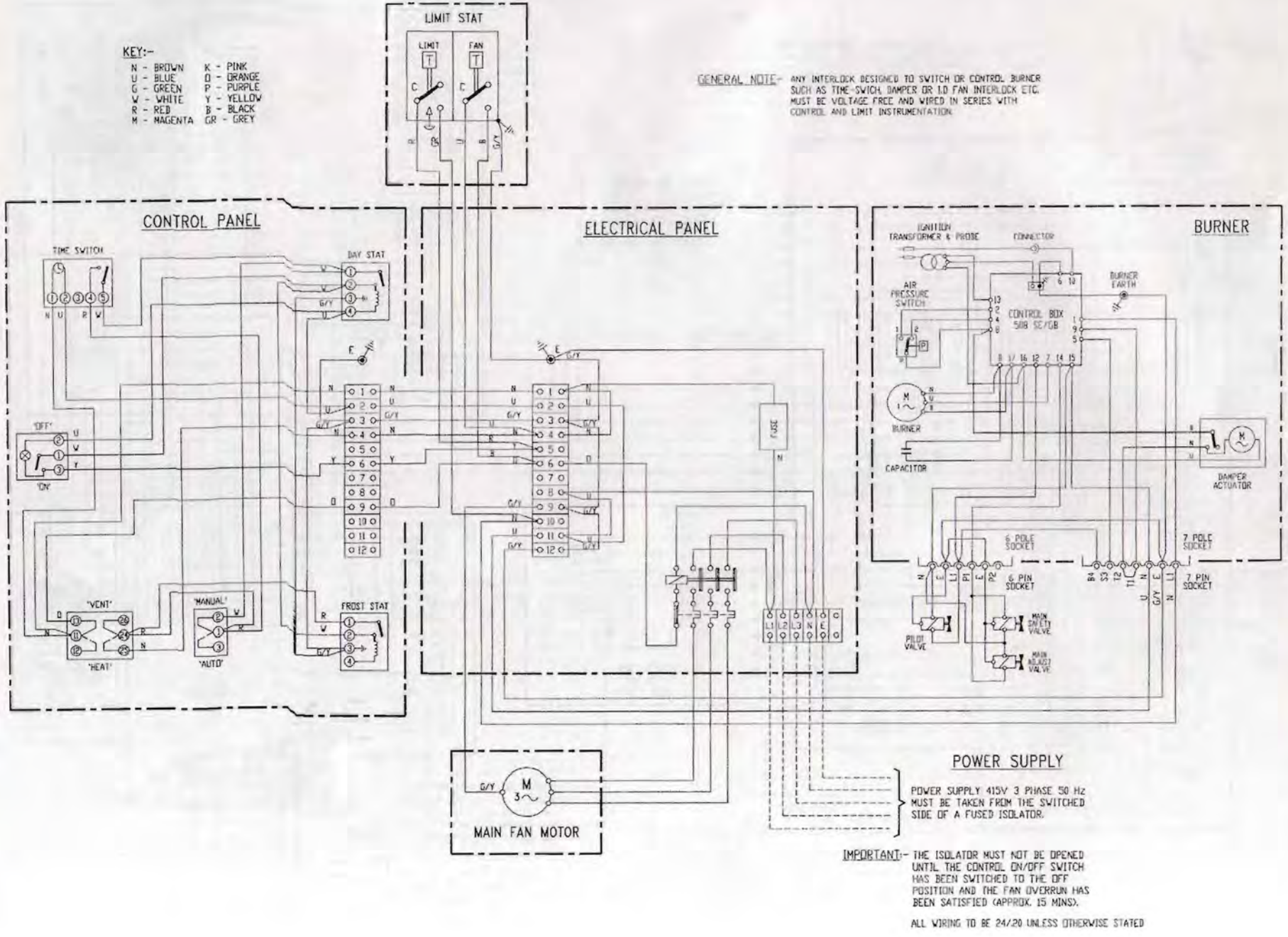
Fig 22

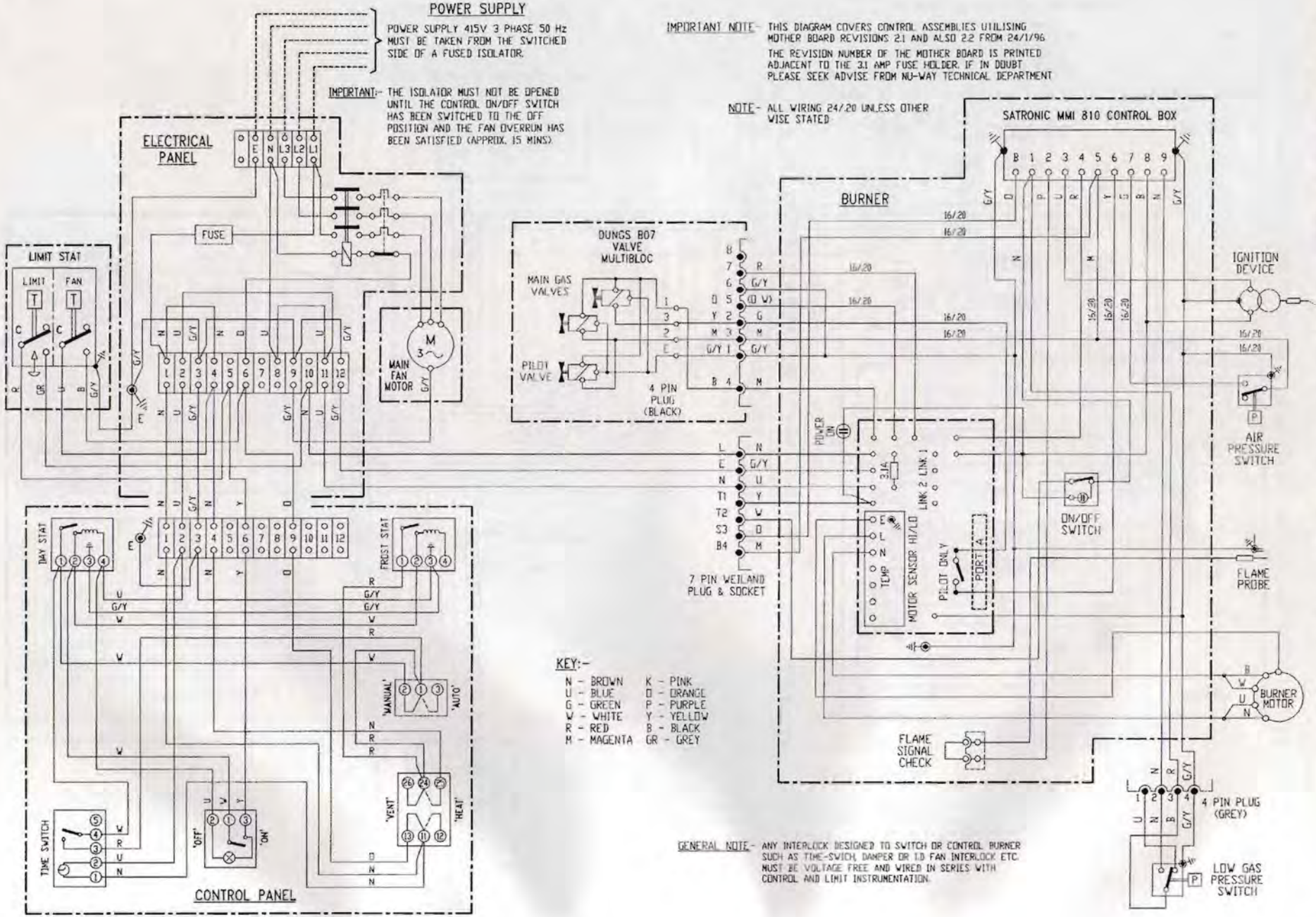

Burner starts but excess temperature cut out shuts down the burner on over heat lockout
Insufficient air passing over Heat Exchanger
Check air to inlet is not restricted
Remove Obstruction Clean Filters
Resistance too high
Check Outlet grilles are Open
Check Nozzles are Open
Fan Belt slipping
Adjust and/or replace Belts
Impeller slipping
Tighten Coupling
High return (inlet) Air Temperature
Check for warm air short circuit to Air Inlet
Reset Nozzles away from adjacent walls
Faulty or incorrectly set Fan and Limit Control
Reset Fan and Limit Control

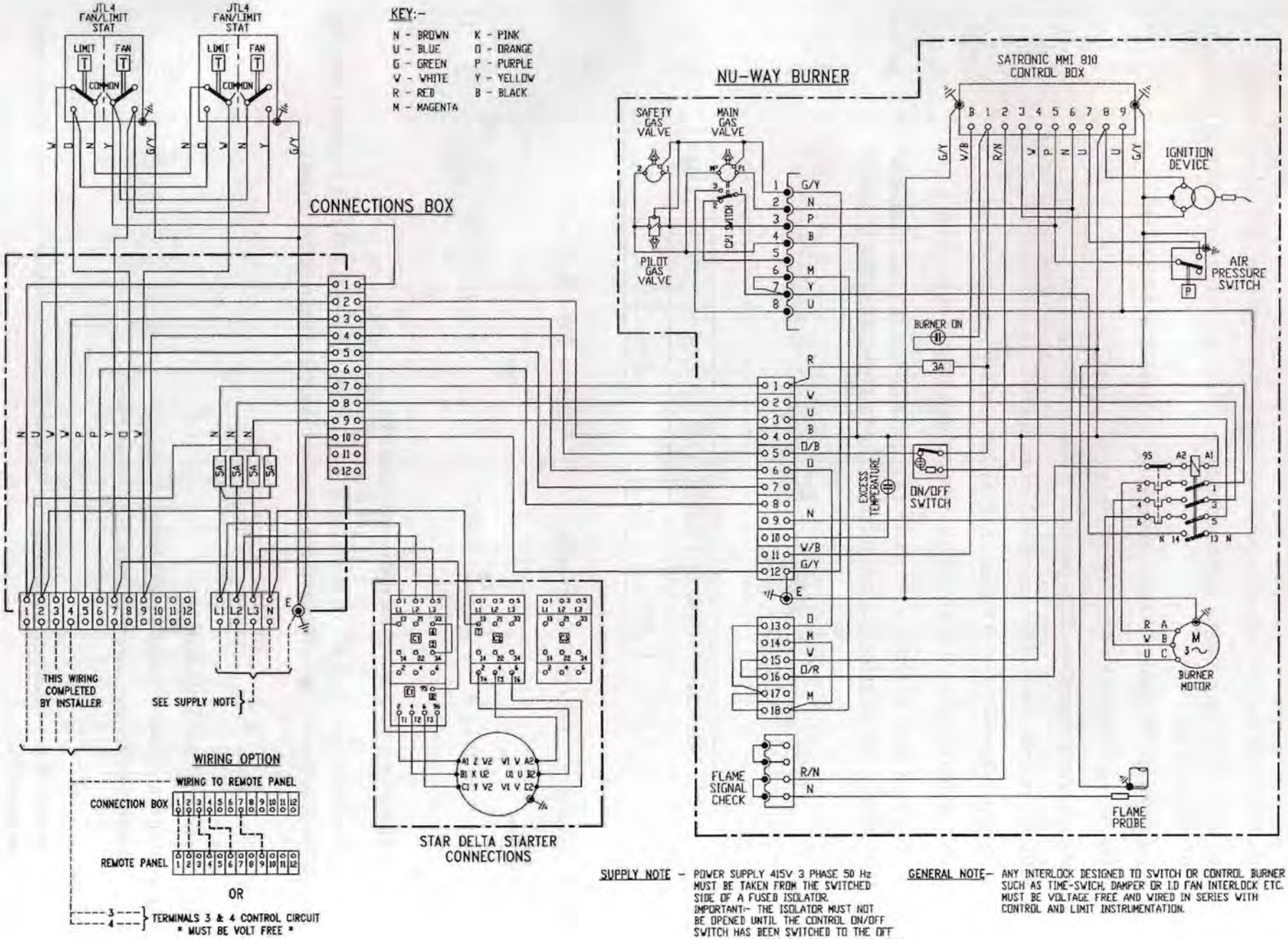
7.0 Wiring Diagrams

7.0.1 On/Off Gas Burner, 230V 1ph 50Hz Models WH-60, WH-88, WH-117, WH-150




KEY:-
N - BROWN
U - BLUE
G - GREEN
W - WHITE
R - RED
M - MAGENTA
K - PINK
O - ORANGE
P - PURPLE
Y - YELLOW
B - BLACK
GR - GREY
LIMIT STAT
LIMIT
FAN
GENERAL NOTE- ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME-SWICH, DAMPER OR I.D FAN INTERLOCK ETC. MUST BE VOLTAGE FREE AND WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTATION.
CONTROL PANEL
ELECTRICAL PANEL
BURNER
TIME SWITCH
DAY STAT
FROST STAT
'OFF'
'ON'
'VENT'
'HEAT'
'MANUAL'
'AUTO'
FUSE
IGNITION TRANSFORMER & PROBE
CONNECTOR
AIR PRESSURE SWITCH
CONTROL BOX 508 SE/GB
BURNER EARTH
BURNER
CAPACITOR
DAMPER ACTUATOR
6 POLE SOCKET
7 POLE SOCKET
6 PIN SOCKET
7 PIN SOCKET
PILOT VALVE
MAIN SAFETY VALVE
MAIN ADJUST VALVE
MAIN FAN MOTOR
POWER SUPPLY
POWER SUPPLY 415V 3 PHASE 50 Hz MUST BE TAKEN FROM THE SWITCHED SIDE OF A FUSED ISOLATOR.
IMPORTANT:- THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN OVERRUN HAS BEEN SATISFIED (APPROX. 15 MINS).
ALL WIRING TO BE 24/20 UNLESS OTHERWISE STATED


POWER SUPPLY
POWER SUPPLY 415V 3 PHASE 50 Hz MUST BE TAKEN FROM THE SWITCHED SIDE OF A FUSED ISOLATOR.
IMPORTANT:- THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN OVERRUN HAS BEEN SATISFIED (APPROX. 15 MINS)
IMPORTANT NOTE- THIS DIAGRAM COVERS CONTROL ASSEMBLIES UTILISING MOTHER BOARD REVISIONS 2.1 AND ALSO 2.2 FROM 24/1/96
THE REVISION NUMBER OF THE MOTHER BOARD IS PRINTED ADJACENT TO THE 3.1 AMP FUSE HOLDER. IF IN DOUBT PLEASE SEEK ADVISE FROM NU-WAY TECHNICAL DEPARTMENT
NOTE- ALL WIRING 24/20 UNLESS OTHER WISE STATED
ELECTRICAL PANEL
FUSE
LIMIT STAT
LIMIT
FAN
MAIN FAN MOTOR
DUNGS B07 VALVE MULTIBLOC
MAIN GAS VALVES
PILOT VALVE
4 PIN PLUG (BLACK)
7 PIN WEILAND PLUG & SOCKET
SATRONIC MMI 810 CONTROL BOX
BURNER
IGNITION DEVICE
AIR PRESSURE SWITCH
ON/OFF SWITCH
FLAME PROBE
BURNER MOTOR
FLAME SIGNAL CHECK
MOTOR SENSOR HI/LO
LINK 2 LINK 1
PILOT ONLY
PORT A
POWER ON
3.1A
4 PIN PLUG (GREY)
LOW GAS PRESSURE SWITCH
DAY STAT
FROST STAT
TIME SWITCH
'MANUAL'
'AUTO'
'OFF'
'ON'
'VENT'
'HEAT'
CONTROL PANEL
KEY:-
N - BROWN
U - BLUE
G - GREEN
W - WHITE
R - RED
M - MAGENTA
K - PINK
O - ORANGE
P - PURPLE
Y - YELLOW
B - BLACK
GR - GREY
GENERAL NOTE- ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME-SWICH, DAMPER OR I.D FAN INTERLOCK ETC. MUST BE VOLTAGE FREE AND WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTATION.



SUPPLY NOTE - POWER SUPPLY 415V 3 PHASE 50 Hz MUST BE TAKEN FROM THE SWITCHED SIDE OF A FUSED ISOLATOR. IMPORTANT:- THE ISOLATOR MUST NOT BE OPENED UNTIL THE CONTROL ON/OFF SWITCH HAS BEEN SWITCHED TO THE OFF POSITION AND THE FAN OVERRUN HAS BEEN SATISFIED (APPROX. 15 MINS).

GENERAL NOTE- ANY INTERLOCK DESIGNED TO SWITCH OR CONTROL BURNER SUCH AS TIME-SWICH, DAMPER OR I.D FAN INTERLOCK ETC. MUST BE VOLTAGE FREE AND WIRED IN SERIES WITH CONTROL AND LIMIT INSTRUMENTATION.

8.0 Technical Data

Formulae for calculating efficiency are detailed as follows; where

q_1 is the heat of the dry products of combustion (% of heat released per unit volume of gas)

q_2 is the heat of the water vapour contained in the products of combustion (% of heat released per unit volume of gas

C_1 is the mean specific heat of the dry products of combustion (in MJ / (m^3.K))

t_1 is the average combustion air temperature (in °C)

t_2 is the average temperature of the products of combustion (in °C)

H_i is the net calorific value of the gas at 1013 mbar and 15°C, dry (in MJ / m^3)

H_s is the gross calorific value of the gas at 1013 mbar and 15°C dry (in MJ / m^3)

V_f is the volume of dry products of combustion per unit volume of gas (in m^3)

V_f is calculated from the volume of CO_2 ($^V CO_2$) produced by the combustion of 1m^3 of gas (see table below), and from the CO_2 content of the products of combustion ($^V CO_2$.M)

$$V_f = \frac{V\ CO_2}{V\ CO_2.M} \times 100$$

Ref Gas	G110	G120	G20	G25	G30	G31
$^V CO_2$	0.26	0.32	1	0.86	4	3

The net efficiency, $E\ (net)$ (in %) is given by; $E\ (net) = 100 - (q_1 + q_2)$

where

$$q_1 = C_1 \times V_f \frac{t_2 - t_1}{H_i} \times 100$$

and

$$q_2 = 0.077 \frac{H_s - H_i}{H_i} (t_2 - t_1)$$

Note

The required net efficiency **must not** be less than 84%

On heaters that are fitted with a modulating or high/low burner the testing is carried out with the appliance adjusted to give the minimum rate, and the following formula is used.

$$E_{min} \geq E_n - \frac{10\ (Q_n - Q_{min})}{Q_n} \text{ in \%}$$

Q_n is the nominal heat input

Q_{min} is the minimum obtainable heat input

E_n is the net efficiency determined by the Notified Body

Note

The minimum net efficiency for appliances fitted with modulating or high/low burners **must not** be less than 79%.

MODEL		WH60	WH88	WH117	WH150	WH175	WH235	WH301	WH375
HEAT OUTPUT	kW/hr Btu/hr	60.2 205,400	85.2 290,600	119.3 407,000	148.0 505,000	176.0 600,500	237.0 808,600	301.0 1027,000	375.0 1279,500
HEAT INPUT (GROSS)	kW/hr Btu/hr	76.9 262,400	109.8 374,640	152.0 518,600	192.2 655,800	224.6 766,300	305.2 1041,300	385.9 1316,000	490.0 1671,800
GAS CONSUMPTION	m^3/hr ft^3/hr	7.2 255.1	10.3 364.0	14.3 503.4	18.0 636.0	21.1 742.0	28.6 1111.0	36.2 1277.0	46.0 1623.0
BURNER TYPE		Reillo 40 GS10	Riello 40 GS10	Riello 40 GS20	Riello 40 GS20	Nu-Way NGN9	Nu-Way NGN9/13	Nu-Way NGN13	Nu-Way NGN25
BURNER GAS PRESSURE at Zero Flue Resistance Burner cover fitted	mbar Ins WG	3.5 1.4	5.2 2.1	4.8 1.9	6.0 2.4	10.3 4.1	7.7 3.0	12.3 4.9	7.1 2.8
MINIMUM GAS INLET PRESSURE	mbar Ins WG	17.5 7	17.5 7	17.5 7	17.5 7	17.5 7	17.5 7	17.5 7	17.5 7
HEAD SETTING at Zero Flue Resistance	Number	2	4	2.5	3.5	-	-	-	-
AIR SHUTTER SETTING at Zero Flue Resistance	Number	3	6	3.2	6.0	-	-	-	-
GAS CONNECTION	BSP	½	½	¾	¾	1	1	1½	1½
AVAILABLE OUTLET PRESSURE	pa Ins WG	125 0.5	100 0.4	125 0.5	125 0.5	163 0.65	125 0.5	200 0.8	250 1.0

CO^2 reading to be 9.3%, burner air shutter setting may require adjustment during commissioning.

MODEL		WH60	WH88	WH117	WH150	WH175	WH235	WH301	WH375
NOZZLE DISCHARGE VELOCITY	m/sec ft/min	6.1 1200	6.1 1200	7.62 1500	8.8 1730	10.56 2080	6.75 1300	8.36 1650	10.3 2028
AIR THROW (approx)	m ft	16 60	18 52	21 70	23 75	27 90	25.3 80	30 100	45 150
AIR DELIVERY	m^3/hr ft^3/min	3,694 2,175	5,096 3,000	7,992 4,720	10,440 6,200	11,988 7,080	16,128 9,482	20,484 12,057	30,240 17,800
TEMPERATURE RISE THROUGH HEATER (nominal)	°C °F	50 90	50 90	50 90	50 90	50 90	50 90	50 90	50 90
SOUND LEVEL	Dba	69	72	72	74	76	78	80	81
COMBUSTION CHAMBER INTERNAL PRESSURE	mm	4	4	6	6	6	5	9	9
FLUE RESISTANCE T.B.A.	Min mbar Max mbar	-0.2 0.6	-0.2 0.6	-0.2 0.6	-0.2 0.6	-0.4 1.6	-0.4 1.6	-0.4 1.6	-0.4 0.6
GROSS FLUE TEMPERATURE (20°C AMBIENT)	°C	260	295	270	305	300	290	300	300
FLUE DIAMETER	mm	150	175	175	175	175	225	225	254
ELECTRICAL SUPPLY		230V 1ph 50Hz	230V 1ph 50Hz	415V 3ph 50Hz	415V 3ph 50Hz	415V 3ph 50Hz	415V 3ph 50Hz	415V 3ph 50Hz	415V 3ph 50Hz
RUNNING CURRENT	Amperes	6.0	7.2	3.9	4.9	7.6	8.5	11.2	14.0
RATED INPUT	kW	1.1	1.3	1.5	2.4	2.98	4.1	5.5	11.0
WEIGHT	kg lbs	254 558	257 567	362 797	370 814	436 960	630 1386	646 1421	1090 2400

9.0 Reference Information

Details of how to obtain copies of the publications listed below are available from:
The Standards Engineer, Engineering Department, Benson Environmental Ltd.

Doc / Ref	Title / Subject
prEN 1020	Non Domestic Gas Fired Forced Convection Air Heaters For Space Heating. . .
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 6891	1988 Installation of Pipework <28mm
BS5991	1989 Indirect Gas Fired Heaters <2MW
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
ISO 7/1	(See also BS 21) Specification for Metric Pipe Threads
ISO 228/1	(See also BS 2779 and BS 5380) Pipe Threads Seals and Couplings
UP/1	(Replaces IM/5 and IM/16) Installation of Gas Appliances
UP/2	(Replaces IM/7) Installation of Gas Appliances

9.1 Parts Listing

Part/Description	60 / 88	Notes	Part/Description	117 / 150	Notes
Heat exchanger assy	20-45-047		Heat exchanger assy	20-46-108	
Fan hood assy	20-45-048		Fan hood assy	20-46-048	
Base frame weld assy	20-45-055		Base frame weld assy	20-46-099	
Frame assy	20-45-057		Frame assy	20-46-055	
Diaphragm plate	20-45-051		Diaphragm plate	20-46-104	
Side panel	20-45-060		Side panel	20-46-102	
Heat shield side panel	20-45-063		Heat shield side panel	20-46-107	
Heat shield deflector	20-45-061		Heat shield deflector	20-46-110	
Heat shield front panel	20-45-062		Heat shield front panel	20-46-061	
Heat shield back panel	20-45-075		Heat shield back panel	20-46-062	
Front bottom panel	20-45-076		Front bottom panel	20-46-075	
Back bottom panel	20-45-074		Back bottom panel	20-46-087	
Electrical back plate	20-45-077		Electrical back plate	20-46-077	
Blanking piece back	20-45-080		Blanking piece back	20-48-085	
Stack box cover assy	20-45-094		Stack box cover assy	20-45-094	
Fan and limit stat	28-60-021		Fan and limit stat	28-60-021	
Fan and limit stat gasket	20-33-549		Fan and limit stat gasket	20-33-549	
Sight glass	20-30-061		Sight glass	20-30-061	
Sight glass holder	20-30-151		Sight glass holder	20-30-151	
Heat exchanger cover plate	20-30-207		Heat exchanger cover plate	20-31-036	
Front top pnl (V, H-DH1, R)	20-45-073		Front top pnl (V, H-DH1, R)	20-46-101	
Front top pnl (H-DH2)	20-45-066	*H* only	Front top pnl (H-DH2)	20-46-145	*H* only
Motorised fan - 1 phase	28-09-002		Motor - 1 phase	28-10-009	WH117 only
Motorised fan - 3 phase	20-32-042		Motor - 3 phase	28-10-008	WH117 only
Overload - 1 phase	28-11-056	WH60 only	Drive pulley	28-65-065	WH117 only
Overload - 3 phase	28-11-066	WH60 only	Driven pulley	28-65-093	WH117 only
Overload - 1 phase	28-11-055	WH88 only	V - belt	09-16-116	WH117 only
Overload - 3 phase	28-11-053	WH88 only	Overload - 1 phase	28-11-054	WH117 only
Contactor	28-11-057		Overload - 3 phase	28-11-053	WH117 only
Digital time clock	28-15-030		Contactor - 1 and 3 phase	28-11-057	WH117 only
Thermostat room/frost	28-16-031		Motor - 1 phase	28-10-016	WH150 only
Rocker switch - red neon	28-40-072		Motor - 3 phase	28-10-015	WH150 only
Rocker switch - dual	28-40-073		Drive pulley	28-65-063	WH150 only
Rocker switch	28-40-074		Driven pulley	28-65-092	WH150 only
12-way terminal block	A 20-09-136		V - belt - 1 phase	09-16-110	WH150 only
Fuse holder	28-07-050		V - belt - 3 phase	09-16-116	WH150 only
Fuse - 1 phase	28-07-049		Overload - 1 phase	28-11-089	WH150 only
Fuse - 3 phase	28-07-048		Overload - 3 phase	28-11-056	WH150 only
6-way terminal block	28-03-007		Contactor - 1 phase	28-11-088	WH150 only
Stackbox assy	31-24-074	WH66 only	Contactor - 3 phase	28-11-057	WH150 only
Stackbox assy	31-27-123	WH88 only	Digital time clock	28-15-030	
Access plate	20-30-225		Thermostat room/frost	28-16-031	
Stackbox gasket	31-27-121		Rocker switch - red neon	28-40-072	
Fan air restrictor	31-30-016		Rocker switch - dual	28-40-073	
Top weld assy (nozzled)	20-45-072	TBA	Rocker switch	28-40-074	
Nozzle assy	31-30-167	TBA	12-way terminal block	A 20-09-136	
Duct spigot assy	20-45-071		Fuse holder	28-07-050	
On/off burner & gas train	29-99-446		Fuse - 1 phase	28-07-049	
Manual - gas	20-45-056		Fuse - 3 phase	28-07-048	
			6-way terminal block	28-03-007	
			Stackbox assy	31-27-123	
			Access plate	20-30-225	
			Stackbox gasket	31-27-121	
			Top weld assy (nozzled)	20-46-116	TBA
			Nozzle assy	31-30-159	TBA
			Duct spigot assy	20-46-113	
			On/off burner & gas train	29-99-448	
			Manual - gas	20-45-056	

V = Vertical *H* = Horizontal *R* = Reverse flow (Common, unless otherwise indicated)

Part/Description	175	Notes
Heat exchanger assy	20-46-051	
Fan hood assy	20-46-048	
Base frame weld assy	20-46-049	
Frame assy	20-46-055	
Diaphragm plate	20-46-057	
Side panel	20-46-056	
Heat shield side panel	20-46-060	
Heat shield deflector	20-46-082	
Heat shield front panel	20-46-061	
Heat shield back panel	20-46-062	
Front bottom panel	20-46-075	
Back bottom panel	20-46-087	
Back top panel	20-46-088	
Electrical back plate	20-46-077	
Blanking piece back	20-48-085	
Stack box cover assy	20-45-094	
Fan and limit stat	28-60-021	
Fan and limit stat gasket	20-33-549	
Sight glass	20-30-061	
Sight glass holder	20-30-151	
Heat exchanger cover plate	20-31-036	
Front top pnl (V, H-DH1, R)	20-46-073	
Front top pnl (H-DH2)	20-46-098	*H* only
Motor - 3 phase only	28-10-026	
Fan	20-09-003	WDMB155
Drive pulley	28-65-061	
Driven pulley	28-65-092	
V - belt	09-16-116	
Overload - 3 phase	28-11-055	
Contactor - 3 phase	28-11-057	
Digital time clock	28-15-030	
Thermostat room/frost	28-16-031	
Rocker switch - red neon	28-40-072	
Rocker switch - dual	28-40-073	
Rocker switch	28-40-074	
12-way terminal block	A 20-09-136	
Fuse holder	28-07-050	
Fuse - 3 phase	28-07-048	
6-way terminal block	28-03-007	
Stackbox assy	31-27-123	
Access plate	20-30-225	
Stackbox gasket	31-27-121	
Top weld assy (nozzled)	20-46-072	TBA
Nozzle assy	31-30-159	TBA
Duct spigot assy	20-46-071	
On/off burner & gas train	29-99-437	
Hilo burner & gas train	29-99-441	
Manual - gas	20-45-056	

Part/Description	235 / 301	Notes
Cabinet casing assy	20-47-051	WH235 only
Cabinet casing assy	20-47-052	WH301 only
Front lower louvred panel	20-47-021	
Rear lower louvred panel	20-47-022	
Side lower louvred panel	20-47-039	
Burner gasket	20-47-066	
Electrical back plate	31-29-026	
Overload	28-11-111	
Contractor	28-11-057	
Fan and limit stat 200mm	28-60-023	
Fan and limit stat gasket	20-33-549	
Base frame sub assy	20-47-045	
Base frame sub assy	20-47-050	
Diaphragm panel	20-47-009	
Outlet frame weld assy	20-47-010	
Front panel	20-47-036	
Front panel heat shield	20-47-037	
Sight glass	20-30-061	
Sight glass holder	20-30-151	
Base frame weld assy	20-47-008	
Fan assembly	28-09-043	
Motor mounting plate	20-47-034	
Motor (5.5Hp 415V 3ph)	28-10-026	WH235 only
Motor (7.5Hp 415V 3ph)	28-10-021	WH301 only
Drive pulley - 85mm x 3	28-65-042	WH235 only
Drive pulley - 90mm x 4	28-65-073	WH301 only
Taper bush - 28mm	28-66-028	WH235 only
Taper bush - 38mm	28-66-038	WH301 only
Driven pulley - 180mm x 3	28-65-049	WH235 only
Driven pulley - 180mm x 4	28-65-054	WH301only
Taper bush (fan)	28-66-136	WH235 only
Taper bush (fan)	28-66-137	WH301 only
Motor adjusting screw	20-33-022	
Swivel bolt	20-27-048	
Side panel	20-47-017	
Side heat shield	20-47-018	
Heat exchanger weld assy	20-47-030	
Heat exchanger cover plate	20-33-039	
Rear panel	20-47-014	
Rear heat shield	20-47-015	
Gas exit duct cover assy	20-47-065	
Gas exit duct weld assy	20-27-048	
Cover plate gasket	31-29-045	
Cover plate	31-29-044	
Digital time clock	28-15-030	
Thermostat room/frost	28-16-031	
Rocker switch - red neon	28-40-072	
Rocker switch - dual	28-40-073	
Rocker switch	28-40-074	
12-way terminal block	A 20-09-136	
Fuse holder	28-07-050	
Fuse 6A	28-07-048	
Duct spigot weld assy	20-47-027	
Bonnet weld assy	20-47-024	
Nozzle assy	31-30-157	
Hilo burner & gas train	29-99-443	WH301 only
Hilo burner & gas train	29-99-442	WH235 only
On/off burner & gas train	29-99-439	WH301 only
On/off burner & gas train	29-99-438	WH235 only
Manual	20-45-056	

V = Vertical *H* = Horizontal *R* = Reverse flow (Common, unless otherwise indicated)

Part/Description	375	Notes
Main frame assy	20-27-074	
Main frame panel assy	20-27-075	
Rear panel	20-27-013	
Top rear heat shield	20-27-011	
Bottom rear heat shield	20-27-010	
Burner end panel	20-27-012	
Burner end heat shield	20-27-009	
Fan frame assy	20-27-305	
Fan frame panel assy	20-27-085	*V* only
Fan frame panel assy	20-27-124	*H* and *R*
Side panel	20-27-057	*V* only
Side panel	20-27-120	*H* and *R*
End panel	20-27-080	*V* only
End panel	20-27-118	*H* and *R*
End panel motor end	20-27-079	*V* only
End panel motor end	20-27-119	*H* and *R*
Motor access panel	20-27-078	
Motor mounting frame RH	20-27-318	
Motor mounting frame LH	20-27-319	
Fan unit	20-27-316	
Impellor	20-27-317	
Fan shaft	20-27-312	
Fan foot RH	20-27-321	
Fan foot LH	20-27-322	
Heat exchanger assy	20-27-073	
Gas exit duct assy	20-27-090	*V* only
Gas exit duct assy	20-27-092	*H* only
Gas exit duct assy	20-27-091	*R* only
Explosion relief door	20-27-020	
Outlet assy (nozzled)	20-27-094	*V* only
Outlet assy (nozzled)	20-27-148	*H* only
Outlet assy (nozzled)	20-27-138	*R* only
Outlet assy (ducted)	20-27-028	
Top plate	20-27-035	
Nozzle hood	20-27-034	*V* only
Nozzle hood	20-27-036	*H* and *R*
Electrical assy (nozzled)	20-27-621	
Electrical assy (ducted)	20-27-622	
Fan drive assy (nozzled)	20-27-526	
Fan drive assy (ducted)	20-27-527	
Motor (nozzled)	28-10-024	
Motor (ducted)	28-10-025	
Drive pulley (nozzled)	28-65-047	
Drive pulley (ducted)	28-65-053	
Driven pulley (nozzled)	28-65-049	
Driven pulley (nozzled)	28-65-054	
Taper lock bush-drive (nozzled)	28-66-013	
Taper lock bush-drive (ducted)	28-66-042	
Taper lock bush-driven (nozzled)	28-66-013	
Taper lock bush-driven (ducted)	28-66-019	
V-belt (3 off per heater)	09-16-126	
Penn control	28-60-012	
Hilo burner & gas train	29-99-444	
On/off burner & gas train	29-99-440	
Manual - gas	20-45-056	

V = Vertical *H* = Horizontal *R* = Reverse flow (Common, unless otherwise indicated)

BENSON

OLYMPIC GAS FIRED CABINET HEATER RANGE

Section C

BASIC USER INSTRUCTIONS

10.0 Introduction

The following information is relevant to the Olympic WH Cabinet Heater range manufactured by Benson Environmental Ltd. These heaters are manufactured within a strictly controlled quality system to ISO 9001.

All Benson Environmental Ltd gas fired Cabinet Heaters are CE marked, having been independently tested and found to satisfy the essential requirements of the following European Directives.

Gas Appliance Directive (90/396/EEC)

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)

Benson Environmental Ltd support all new products being supplied to their customers with a comprehensive information pack, and it is the responsibility of the owner, user, or hirer, of such products supplied by Benson Environmental Ltd to ensure that operators are provided with the operator manual, and that they are suitably instructed regarding the purpose of the manual and safety instructions. In addition to this, operators must also be suitably and adequately trained in the use of the product.

Contained with the text of this 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 a premature failure or damage being occasioned to the heater or its component parts.

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

10.1 Commissioning and hand over

Warning

As part of the commissioning programme, the commissioning engineer **must** go through the following with the operator.

(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 engineers.

Caution

After approximately 100 hours of running, the tension on the fan belts **must** be checked to ensure that it is correct, and that the belts have not stretched. It is strongly advised that this is undertaken by the commissioning engineer, and not the operator.

10.2 Servicing

Warning

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

Benson Environmental Ltd advise that the planned service schedule as detailed in section 5.1 of the Installation, Commissioning and Servicing Manual is adopted by the user. Further details are available from either Benson Environmental Ltd or from the commissioning engineer.

10.3 Start up proceedure

(a) Ensure that the gas cocks are open, and that the mains electrical supply is turned on
(b) Set time clock to an 'on' period
(c) Set room thermostat to demand heat
(d) Set heat/ventilation switch to 'heat'
(e) Set manual/automatic switch to 'automatic'
(f) Set on/off switch to 'on'
(g) Check for the following burner sequence

#	interval	operand
1	<5s	Combustion air damper actuated, burner fan motor initiates purge cycle. . .
2	<40s	Pilot valve opens, ignition transformer provides spark for pilot ignition. . .
3	>40s	Pilot ignition. . . and. . . Burner ignition. . .
4	<60s	Burner *ignition* start *cycle* complete.

Note

The time intervals within the ignition sequence may vary slightly between models.

(h) The burner will continue to fire until heat is no longer demanded.

10.4 Stop procedure

(a) Set on/off switch to 'off' position.
(b) The fan motor will continue to run until heat dissipation allows the fan and limit stat to shut down the fan.

Caution

Do not use the main electrical isolator to turn off the heater, to do so can cause damage to the heat exchanger and combustion chamber, and thereby invalidate the warranty.

10.5 Shut down procedure

(a) Follow steps 10.5 (a) and (b), when fan stops turn main electrical isolator off, and shut gas cocks.

10.6 Ventilation only

(a) Set heat/ventilate switch to 'ventilate'.
(b) Set on/off switch to 'on'.

10.7 Lockout situations

If either the burner or the fan and limit stat go to lockout, the lockout must be cleared manually before the ignition sequence can be re-initiated.

Caution

Repeated or frequent lockouts must be investigated and their cause determined by a qualified and competent engineer.

Warning

If a gas leak is suspected, all potential sources of ignition must be extinguished, gas supply cocks closed to isolate the leak, doors and windows opened to allow the dissipation of the gas to occur, and the gas supplier informed immediately.
Never search for gas leaks with a naked flame.

10.8 Contact information

Further information is available from :-

BENSON ENVIRONMENTAL LIMITED
LUDLOW ROAD, KNIGHTON, POWYS LD7 1LP
Telephone: 01547 528534 Facsimile: 01547 520399

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