JUPITER

COMPACT GAS FIRED HIGH EFFICIENCY
LOW NOx BOILERS
SINGLE UNIT OUTPUTS 100kW - 300kW

INSTRUCTIONS FOR INSTALLATION,
SERVICING & OPERATION

MHS
BOILERS

Index

1.0 general

1.1 general notes

These instructions are intended to assist the installer, commissioning engineer, maintenance engineer and user with the installation, maintenance and use of the Jupiter range of commercial gas fired boilers.

Please read this manual fully before commencing the installation of the appliance. MHS Boilers Ltd shall not be responsible for any damage resulting from failure to carefully observe the instructions given.

The Jupiter must only be installed by persons deemed to be competent i.e. Corgi Registered. This manual must be handed to the user following completion of the installation.

1.2 certification details

The Jupiter complies with all relevant European Directives and has been independently certified for use in GB and IE with Gas Categories I2H and I3P (Natural gas G20 @ 20 mbar inlet pressure, and Propane G31 at 37 mbar inlet pressure).

PI. No: 0063/AQ/6621

The flue classification is B23

2.0 product *description*

The Jupiter series of gas fired LTHW boilers are state of the art central heating appliances which combine high output and exceptional efficiency with very low NOx emissions, low noise and compact dimensions.

There are six models in the range with outputs from 100kW to 300kW.

Each appliance utilises a premix radiant burner, which releases heat energy within a cylindrical heat exchanger incorporating finned copper tubes.

Jupiter boilers may be operated in on/off, high/low or modulating mode and can be used singularly or in multiple/modular configuration to accurately meet varying system loads.

compact dimensions

Jupiter boilers are floor standing appliances with a common footprint for all models of 500mm wide by 520mm deep. Heights vary between 1310mm and 1550mm.

low installed weight

Varying between 196-2187kg, the Jupiter boiler provides high output at only a fraction of the weight of similar output traditional type appliances.

very high efficiency

The robust finned copper tube heat exchanger offers excellent heat transfer characteristics which, coupled with the very efficient nature of the 2.5:1 turn down premix combustion system, creates an appliance with full and part load efficiencies up to 94.2% net.

extremely low harmful emissions

The Jupiter boiler incorporates a radiant metal fibre burner with the capability of turn down from 100% to 40% output, which ideally matches the geometry of the combustion space within the cylindrical tubular heat exchanger. The burner type, coupled with the very low thermal surface loading which is fed with accurately proportioned premix gas and air, ensures very low combustion temperatures and extremely low emission of harmful substances. The Jupiter boiler emission of NOx is <57mg/kWh (40ppm DAF).

efficient heat transfer

The use of the excellent heat transfer properties of copper, in the form of finned tubes arranged radially around the burner ensures very high efficiency and low chimney losses. The heat exchanger is fabricated by using tubes in a cage form mounted vertically between upper and lower stainless steel water headers. The water tight sealing between tubes and collectors is achieved using Viton seals, which have excellent resistance to temperature and chemical attack.

The method of heat exchanger construction allows for tolerance to operational stresses and creates a fully serviceable core component.

2.0 product description (cont)

reduced maintenance

As standard, the Jupiter boiler includes an easy clean combustion air inlet filter. This important device not only protects the combustion system from contamination and thus maintains clean burning, but it also protects the entire internal environment within the boiler from dust and dirt contamination. This protection not only reduces regular maintenance time but also extends the service life of many of the components.

low noise

Incorporated into the air filter is a silencer pod. This device significantly reduces operational noise making the appliance suitable for most installation locations.

automatic minimum flow protection

Included as a standard feature, is a reliable water flow proving switch, which protects the appliance from operating should water flow fail or be inadequate.

Comprehensive control panel

The boiler control panel is factory fitted, functionally tested and includes:

- Status lamps to indicate run or faults
- Hours run counter
- Revolving drum type flow temperature thermometer
- Revolving drum type return temperature thermometer
- Control thermostat
- Manual reset water temperature high limit thermostat
- Double pole isolator
- Burner flame safeguard control box with illuminated reset button
- Blanked position for optional burner modulation controller

Fire mode options

As standard the appliance may operate either on/off or high/low when given 2 stage volt free external control input. The high to low turn down is 2.5 to 1 (100%>40%). Modulation of the burner output is also possible – see “optional additional items”.

Delivery

Each Jupiter boiler is delivered to site as a fully assembled and factory tested unit, firmly affixed to a sturdy crated pallet.

Optional additional items

If required, the Jupiter boiler may be supplied with an integral compact microprocessor modulating controller, which allows the power of the burner to operate in fully variable mode between 40% and 100% output. This ensures close correlation between boiler output and system load and returns increased seasonal efficiency.

For remote boiler status monitoring, optional volt free contact BMS relay panels may be included into the control centre of the boiler.

high full and part load efficiency

Model	HXCE 100	HXCE 135	HXCE 175	HXCE 215	HXCE 255	HXCE 300
Efficiency (Nett) at 100% Load	93.7%	93.6%	93.1%	92.6%	92.4%	91.3%
Efficiency (Nett) at Part Load (30%)	93.6%	93.6%	94.1%	94.3%	94.6%	94.8%

3.0 technical *details*

3.1 technical data

Model	Jupiter	HXCE 100	HXCE 135	HXCE 175	HXCE 215	HXCE 255	HXCE 300
Nominal Heat Output	kW	100	135	175	215	255	300
Nominal Heat Input (Nett) (Max)	kW	107.6	144.8	190	233.4	271.2	322
Input Rate Nat Gas G20 (max)	m^3/h	11.0	14.8	19.42	23.85	27.72	32.91
Input Rate LPG G31 (max)	m^3/h	4.4	6.0	7.9	9.8	11.4	13.4
Min/Max Gas Pressure G20	mbar	18/25	18/25	18/25	18/25	18/25	18/25
Min/Max Gas Pressure G31	mbar	25/45	25/45	25/45	25/45	25/45	25/45
Max Flue Gas Temperature	°C	90	135	150	158	156	170
Max Flue Gas Mass	kg/hr	181	219	325	420	472	561
Min/Max Chimney Depression	Pa	5/15	5/15	5/15	5/15	5/15	5/15
Max Working Pressure	bar	6	6	6	6	6	6
Max System Test Pressure	bar	10	10	10	10	10	10
Max Flow Temperature	°C	90	90	90	90	90	90
Min Return Temperature	°C	60	60	60	60	60	60
Power Supply	V	230	230	230	230	230	230
Max Electrical Loading	W	250	250	300	300	300	300
Water Content	L	13	13	13	13	14	14
Δt Min/Nom/Max	K	10/15/20	10/15/20	10/15/20	10/15/20	10/15/20	10/15/20
Water Flow Rate Max/Nom/Min	l/s	2.3/1.5/1.1	3.2/2.1/1.6	4.1/2.7/2.0	5.1/3.4/2.5	6.0/4.0/3.0	7.1/4.7/3.5
Weight Empty	kg	183	183	183	183	273	273
CE Product Indentification No.				0063/AQ/6621			

3.2 hydraulic diagram

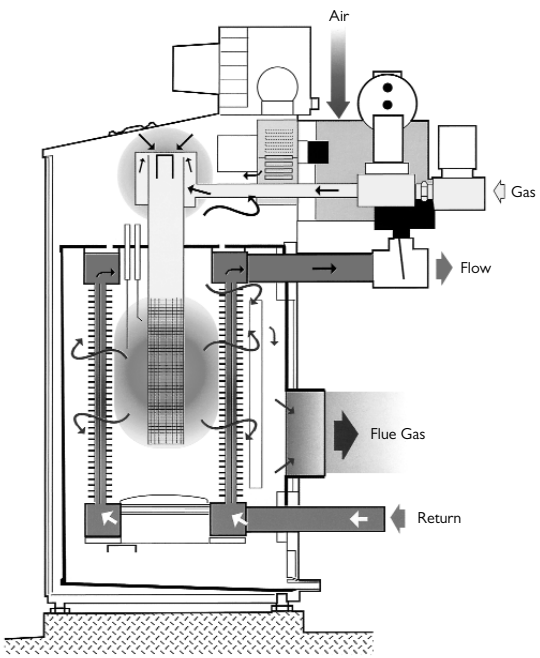


Fig 3.2

3.3 dimensional data

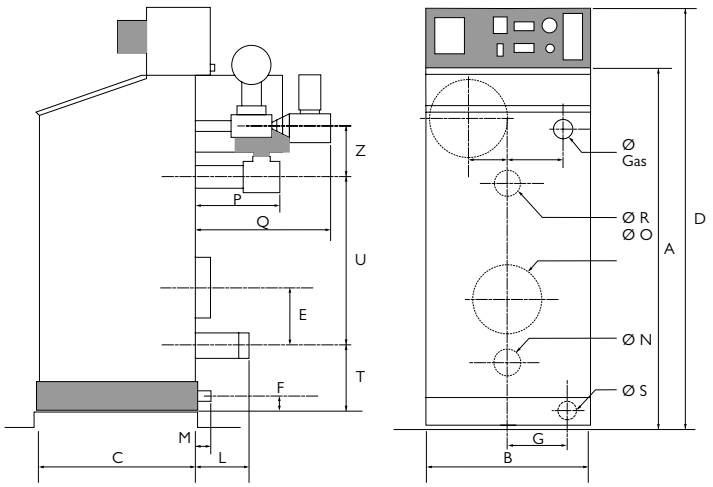
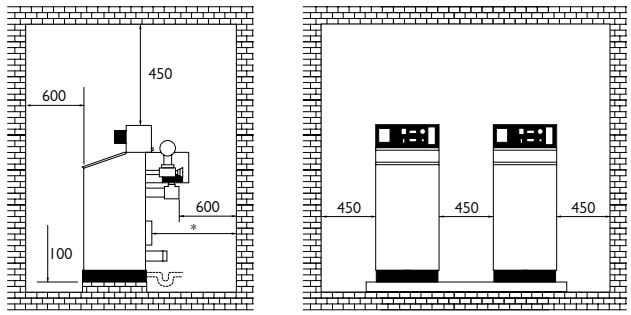


Fig 3.3

Model	HXCE 100	HXCE 135	HXCE 175	HXCE 215	HXCE 255	HXCE 300
Weight kg	183	183	183	183	273	273
A	1060	1060	1060	1060	1300	1300
B	500	500	500	500	500	500
C	520	520	520	520	520	520
D	1310	1310	1310	1310	1550	1550
E	205	205	205	205	245	245
F	52	52	52	52	52	52
G	180	180	180	180	180	180
I	118	118	118	118	118	118
J	165	165	165	165	165	165
L	190	190	190	190	190	190
M	55	55	55	55	55	55
Ø R Flow	2 1/2" F BSP	2 1/2" F BSP	2 1/2" F BSP	2 1/2" F BSP	2 1/2" F BSP	2 1/2" F BSP
Ø N Return	2 1/2" M BSP	2 1/2" M BSP	2 1/2" M BSP	2 1/2" M BSP	2 1/2" M BSP	2 1/2" M BSP
Ø O Flue	220	220	220	220	300	300
Ø S Condense Drain	1" M BSP	1" M BSP	1" M BSP	1" M BSP	1" M BSP	1" M BSP
P	265	265	265	265	265	265
Q	390	390	390	520	520	520
T	200	200	200	200	200	200
U	570	570	570	570	810	810
Z	170	170	170	170	170	170
Ø Gas G20 Nat Gas	1 1/2" F BSP	1 1/2" F BSP	1 1/2" F BSP	1 1/2" F BSP	2" F BSP	2" F BSP
Ø Gas G31 LPG	3/4" F BSP	3/4" F BSP	3/4" F BSP	3/4" F BSP	3/4" F BSP	3/4" F BSP

3.4 minimum clearances



* Flue systems important consideration see page 10

Fig 3.4

3.5 system guidance

The Jupiter boilers are designed to operate on a flow to return temperature drop of 10 to 20K (Δt 10 20°C) in conjunction with a low loss header or similar.

Systems must be sealed and pressurised to operate within the range 0.5bar to 5.3 bar.

The return water temperature should not be allowed to fall below 60°C for long periods otherwise condensation will result.

Detailed system guidance is given in section 4.5.

3.6 flue options

Jupiter boilers must be connected to a flue system designed to overcome its own resistance and provide a draught at the appliance flue connection of between 5 and 15 Pa.

Further guidance is given in section 4.3.

3.7 wiring diagram

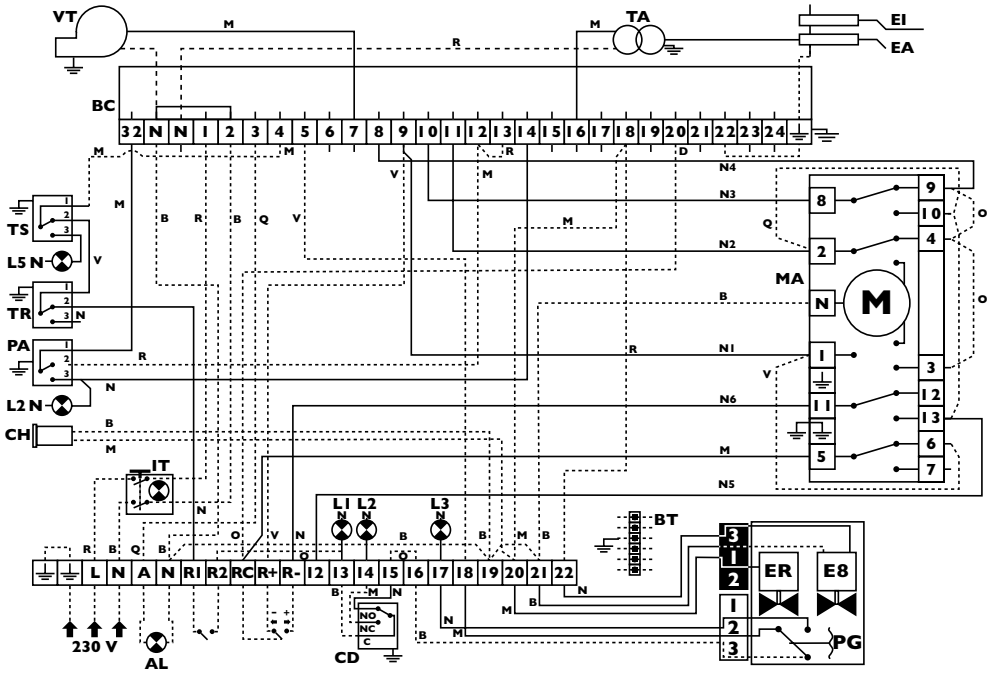


Fig 3.7a

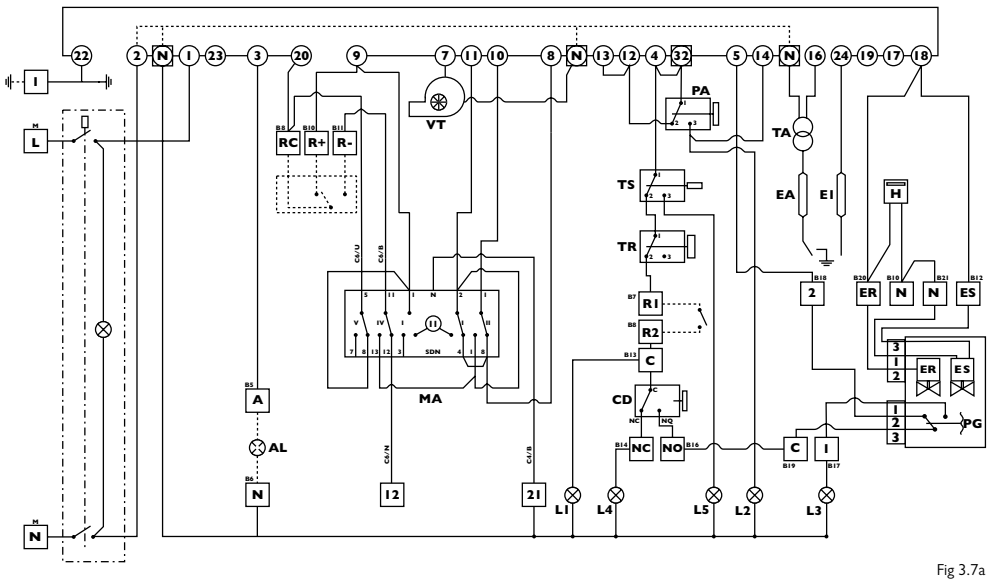


Fig 3.7a

1. regulation
2. regulator
AL external alarm
BA ignition burner
BC LFL control device
BR connection terminal board
BT earth connection terminal board
CD water flow switch
CH hour meter
EA ignition electrode
EI ionisation electrode
ER regulation electrovalve
ES safety electrovalve
L1 thermostats indicator light
L2 air pressure switch indicator light
L3 supply gas pressure indicator light
L4 water flow switch indicator light
L5 water overheating indicator light
MA air flap valve motor
PA air pressure switch
PG supply gas pressure switch (upon request)
TA ignition transformer
TR regulation thermostat
TS safety thermostat
VT fan

4.0 appliance *installation requirements*

4.1 statutory requirements

Gas Safety (Installation and Use) Regulations (Current Issue)

It is the law that all gas appliances are installed by a registered person, in accordance with the above regulations. Failure to install appliances correctly could lead to prosecution. It is in your own interest, and that of safety, to ensure that the law is complied with.

In addition to the above regulations, this appliance must be installed in accordance with the current IEE Wiring Regulations for electrical installation, (BS 7671), Local Building Regulations, the Building Standards (Scotland) (Consolidation) Regulations, Bye laws of the Local Water Undertaking and Health and Safety Document No.635 'The Electricity at Work Regulations 1989'.

It should also be in accordance with the relevant recommendations in the current editions of the following British Standards and Codes of Practice, plus any others that are relevant to the proposed installation: CP 342, CIBSE guide, sections B7, B11 and B13, BS6644, BS6880, IGE/UP/1, IGE/UP/2, IGE/UP/7,IGE/UP/10, and the Clean Air Act Memorandum on chimney heights.

Important Note: Manufacturers instructions must NOT be taken in any way as overriding statutory obligations.

4.2 boiler position

The following considerations must be observed when siting the Jupiter boiler.

The boiler is not suitable for external installation. The position selected for installation should be within the building, unless otherwise protected by a suitable enclosure, and MUST allow for adequate space for installation, servicing, operation and for adequate air circulation around it. (Refer to fig 3.4).

This position MUST allow for a suitable flue system (Refer to section 4.3).

The Jupiter must be installed on a flat horizontal floor capable of supporting the boiler and any ancillaries.

Air for combustion must not be contaminated with halogenated hydrocarbons.

The boiler room must be dry and frost free.

4.3 flue systems

Jupiter boilers must be connected to a flue system designed to overcome its own resistance and provide a draught at the appliance flue connection of between 5 and 15 Pa. If the draught is likely to exceed 15 Pa, suitable draught reducing/stabilising devices must be installed into the chimney system adjacent to the appliance.

For satisfactory operation, the first 500 to 1000mm of flue pipe connected to the appliance must be horizontal and straight.

Chimney systems should be insulated to protect the buoyancy of the flue gases and to reduce the tendency to produce condensation within the system.

Flue ducts must be gas and watertight and resistant to flue gas condensate and suitable for a working temperature of not less than 250°C. Flue termination position must meet the requirements of BS6644:1991 and the Clean Air Act Memorandum on Chimney Heights.

4.4 ventilation requirements

Under all circumstances, an adequate supply of fresh air for combustion and ventilation of the boiler house must be supplied in accordance with BS6644:1991 or IGE/UP/10.

The air supply should be achieved using either:

- Natural ventilation with low level and high level openings.
- Using a fan to supply air to a low level opening with natural discharge through a high level opening.
- Using a fan to supply air to a low level opening and a fan to extract air at a high level opening.

Where natural ventilation is used, suitable permanent openings connected directly to the outside air must be provided. The openings should be fitted with grilles that cannot be easily blocked or flooded or permit the entry of any foreign bodies.

4.4 ventilation requirements (contd)

The free area of the grilles should be as follows:-

Low Level (inlet) 540cm2 plus 4.5cm2 per kW in excess of 60kW Gross of total rated input.
High Level (outlet) 270cm2 plus 2.25cm2 per kW in excess of 60kW Gross of total rated input.

Note: Total rated input is the sum of the heat input of all gas appliances in the boiler room.
Alternative guidanceon ventilation provision may be found in IGE/UP/10.

4.5 hydraulic system design

The Jupiter boilers are designed to operate on a flow to return temperature drop of 10-20°C.

Systems must be sealed and pressurised and operate within the range 0.5 bar to 5.3 bar.

The system design should incorporate a pressure gauge, visible from the automatic pressurization unit to indicate the system water pressure.

A low system water pressure cut off device must be installed to prevent the boilers from operating when the system pressure is below 0.5 bar.

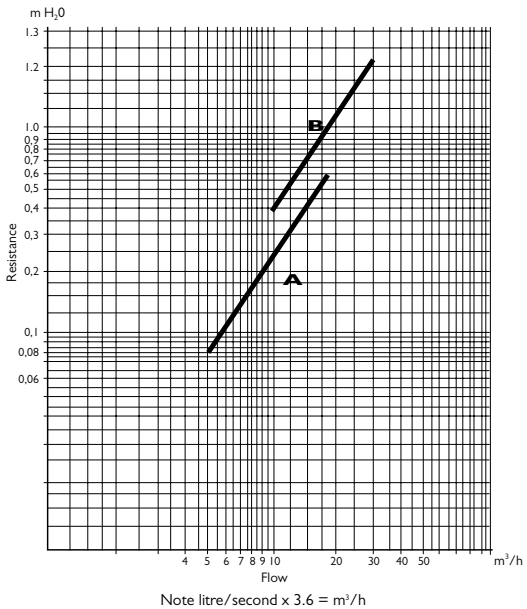
system water content

Jupiter boilers are high power appliances, which require a certain minimum water content to be available to the boiler under all operating conditions and being 0.9 l/kW of installed boiler power. This volume is required to absorb the heat generated and avoid excessive stop/start cycling. The content of the boilers may be taken into account when assessing system volumes. Jupiter boilers must always be installed in conjunction with a low loss header or similar type arrangement with a maximum velocity of 0.5m/s. If it is needed to increase the capacity of the system to meet the requirements for minimum continuously circulating water volume, then this may be achieved by the use of increased size pipework between boilers and headers or the inclusion of an inertial tank as a substitute for the low loss header.

Note: Where the boiler is equipped with the optional in-built modulating controller, then the system water content requirement may be based upon the minimum output of the boiler thereby reducing the minimum water content by 60%.

hydraulic resistance

The hydraulic resistance is shown in figure 4.5a.



Note litre/second x 3.6 = m³/h

A = HXCE 100; HXCE 135; HXCE 175; HXCE 215

B = HXCE 255; HXCE 300

Fig 4.5a

4.5 hydraulic system design (contd)

condensation prevention

Condensation production within the Jupiter boiler should be avoided and precautions must be taken to avoid that the temperature of the return water remains below 60°C for extended periods. One such way of condensation prevention is to install a bypass between the flow and return pipes as shown in figure 4.5b. Alternatively the control strategy should stage the introduction of secondary circuits depending upon return water temperature within the primary boiler circuit.

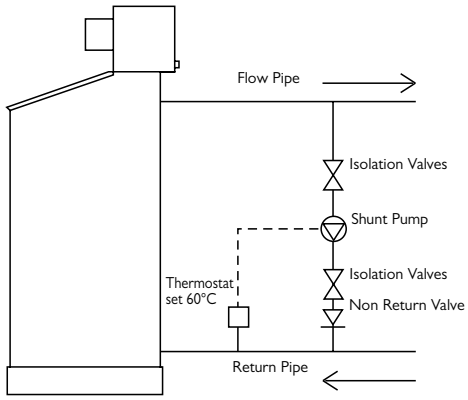


Fig 4.5b

Model		HXCE 100	HXCE 135	HXCE 175	HXCE 215	HXCE 255	HXCE 300
Anti-Condensation Shunt Pump Flow Rate	l/s	0.4	0.5	0.7	0.9	1.0	1.2

system water treatment

All systems must be thoroughly cleansed prior to the connection of the boiler. The system water must be treated to prevent general system corrosion and the deposition of scale or sludge in the boiler waterways. If installing the boiler onto an old system, it is recommended to install a spirotech or similar dirt arrester/filter. **(Failure to cleanse and water treat the system will render the appliance guarantee void. Water quality requirements must observe maximum hardness 100ppm, maximum turbidity 10mg/litre).**

If plastic pipes are used for the flow and return pipes, for radiators or under floor heating, a plate exchanger should be considered between the system water and the boiler water. If such a separator is not used, the MHS guarantee on all boiler parts will become null and void, unless it can be proved that the plastic pipes used have a vapour tight layer.

With regard to servicing, it is a requirement that isolation valves are installed on the system side of the pressure relief valve.

For specialist advice and water treatment products, contact:

Betz Dearborn
Widnes, Cheshire WA8 8UD
Tel: 0151 424 5351

Alpha Fry Technology
Tandem House
Marlowe Way, Croydon, CRO 4XS
Tel: 0208 665 6666

All systems must include a low water pressure cut off switch and a filter/strainer in the return to the boiler with a strainer mesh size of not larger than 0.5mm.

4.5 hydraulic system design (contd)

recommended system designs:

typical single Jupiter boiler installation

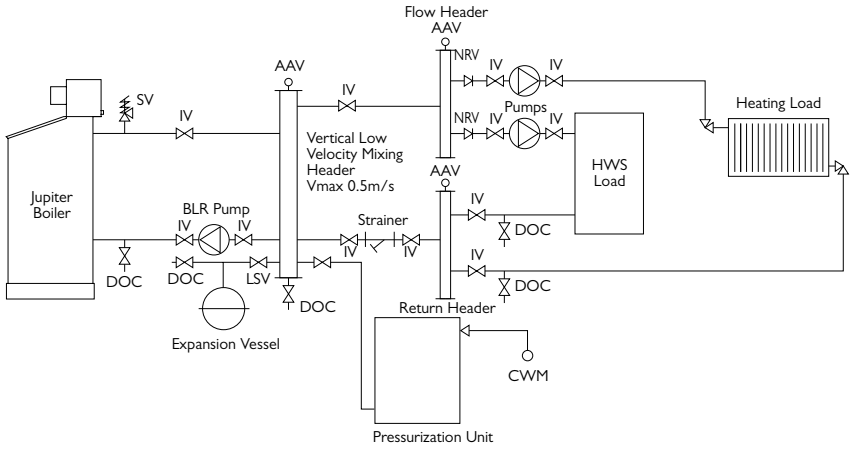


Fig 4.5c

typical multiple Jupiter boiler installation

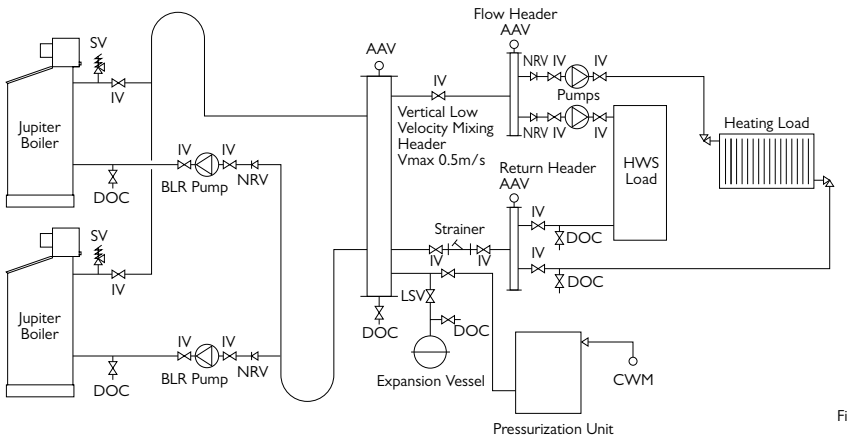


Fig 4.5d

4.6 filling the system

The initial filling of a sealed heating system, and subsequent refilling, must be by a method that has been approved by the Water Regulation Advisory Scheme (WRAS) for that type of heating system. ie. Non Domestic (Other than in-House) Fluid Category 4 (C-4). For Category 4 systems, the approved method of filling must comprise of the following components in the arrangement shown;

- Control valve
- Strainer
- Verifiable backflow device with reduced pressure zone (RPZ Valve). Incorporating a 'Type BA' air gap.
- Tundish
- Control valve

Further more, in accordance with BS6644, for boiler/s with an input greater than 60kW, an automatic pressurisation unit must be installed to automatically replenish any lost or evpourated water.

The pressurisation unit must comprise of the following components;

- A cistern fitted with a float operated valve incorporating either a 'Type AG' (C-3), or 'Type AF' (C-4) air gap.
- A presssure booster pump fitted with a single check valve
- A pressure reducing valve
- A pressure switch

For information on a comprehensive range of pressurisation units please contact MHS Sales.

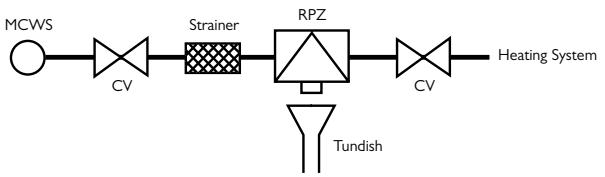


Fig 4.6

4.7 gas supply

The Jupiter boiler is designed and delivered ready for the gas group specified at the time of ordering. On site conversion is not normally possible. The Gas Supplier should be consulted at the installation planning stage in order to establish the availability of an adequate supply of gas.

An existing service pipe MUST NOT be used without prior consultation with the gas supplier. An existing meter and/or pipework should be of sufficient size to carry the maximum boiler input plus the demand of any other installed appliance. (BS6891:1988).

The governor at the meter must give a constant outlet pressure of 20 mbar (8 in.wg) when the appliance is running on natural gas (G20) or 37 mbar at the regulator when using LPG (G31).

The gas supply should be purged in accordance with IGE/UP/1. WARNING: Before purging open all doors and windows, also extinguish any cigarettes, pipes and any other naked lights.

4.8 electrical supply

A 240 Volt single phase 5 Amp supply must be present at the proposed boiler location.

Wiring external to the appliance must be in accordance with BS7671 (the current IEE Wiring Regulations) for electrical installation and any local regulations which apply.

WARNING: THIS APPLIANCE MUST BE EARTHED. (Failure to provide a satisfactory Earth connection would be a safety hazard and may also result in appliance malfunction).

The method of connection to the mains supply must facilitate complete electrical isolation of the appliance. A fused double pole switch having a 3mm contact separation in both poles and serving only the boiler (and its external controls) may be used.

5.0 installation instructions

5.1 unpacking the boiler

The boiler is delivered as a complete unit secured in a crated pallet. The appliance must be inspected immediately after delivery. Any damage to the consignment must be reported within 3 days.

5.2 positioning the appliance

The appliance should be positioned into the desired location prior to unpacking. Remove any packaging and undo the four pallet retaining bolts from under the base.

5.3 gas connection

Installation pipework should be fitted and checked for gas soundness in accordance with IGE/UP/1&2.

The appliance gas inlet connection is located on the rear of the appliance. (upper right hand side, as viewed from the front).

Details of the gas inlet pipe size are given in the technical data in section 3. It is essential that the use of an approved gas isolation valve is installed adjacent to the appliance with suitable provision made for disconnection.

5.4 LPG installations

If the appliance is required to operate on LPG it is important to ensure that an LPG model has been supplied. On site conversion is not possible.

5.5 CH water connections

The Jupiter range of appliances are only suitable for installation on sealed or pressurised systems.

All water systems must be thoroughly cleansed prior to connecting to the boiler, to prevent general system corrosion and the deposition of scale or sludge into the boiler waterways. Any inhibitor used should be suitable for the materials which make up the boiler (copper & stainless steel 316L).

Consult water treatment product stockists if in doubt (section 4.5).

The boiler flow pipe connection is located in the centre of the upper part of the back panel and is fitted with a water flow switch. The flow switch is interlocked with the operation of the appliance such that in the event of low water flow the boiler will shut down. The return pipe connection is located in the centre of the lower part of the back panel. The return pipework must include some method of filtering or straining, which must be fitted between isolation valves for ease of removal and cleaning. (Details of both pipe sizes are given in the technical data section 3.3).

A suitable safety relief valve must be fitted onto the flow pipe between the boiler and any isolation valve. Both water connections must include suitable isolation valves, and the provision for a drain connection must be included in the return pipework, between the boiler and the isolation valves.

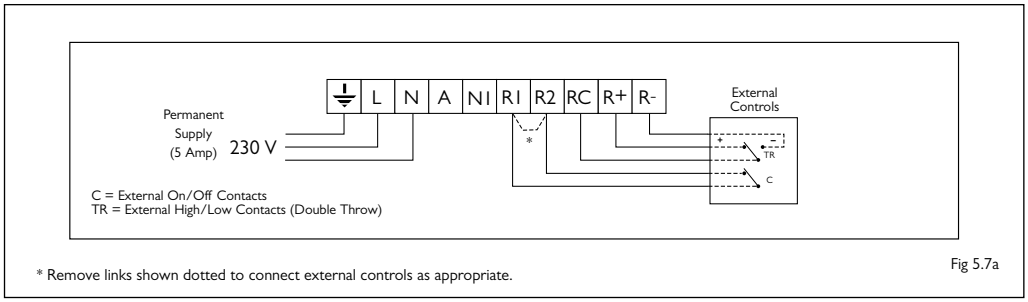
5.6 condensate waste connection

The condensate waste connection is located at the bottom right hand side (viewed from front) of the back panel.

The Jupiter HXCE Range of appliances are extremely efficient boilers. Under certain operational conditions if the heating return is less than 55°C the appliance is likely to produce condensation. If necessary a condensate waste pipe should be connected to the appliance and run to discharge into a suitable drain pipe. The waste pipe should include a method of disconnection for cleaning etc, should be fabricated from suitable plastic pipe and fittings, and should include a siphon with a 75mm or greater water seal. Please note, if the unit is allowed to produce condensate for extended periods, the life of the heat exchanger will be dramatically reduced and will not be covered by the appliance warranty. (see section 4.5. condensation prevention for guidance)

5.7 electrical connection

Remove the 4 screws securing the control panel cover (2 top/2 rear) and remove the panel. This allows full access to all electrical connection points within the appliance.



* Remove links shown dotted to connect external controls as appropriate.

Fig 5.7a

mains connection

The mains electrical supply must be wired direct to the boiler control box and must not be interrupted by any system controls.

ENSURE THE APPLIANCE IS ADEQUATELY EARTHED. The mains supply to the appliance must be wired through one of the spare cable clamps at the rear of the control box and into terminals, E, L and N of the connector strip (see diagram 5.7a)

The Jupiter range of appliances may be operated in 3 different modes:

- On/off: Where the external control must be a volt free contact connected across terminals R1-R2.
- High/low: Where in addition to stop/start operation as described (a) above, a double throw volt free contact set must be connected between Rc and R+, and Rc and R-. Continuity between Rc and R+ sets the burner output at 100%. Continuity between Rc and R- sets the burner output at 40%.
- Fully modulating: Where in addition to (a) above, an optional extra modulating control device is mounted into the boiler control panel. This allows full sliding output control between 40% to 100% to be achieved automatically as dictated by system load.

Note: For details of electrical connection when using an optional extra modulator, please refer to the instructions supplied with the modulator.

external alarm connection

Provision has been made on the terminal strip for connection to an external alarm with a maximum load of 1A.

The alarm connections provide a supply of 230V when the boiler command box goes into lockout. Connection terminal A.

As an optional extra, volt free contact B.M.S alarm relays can be installed into the boiler to allow remote monitoring or run, lockout and overheat to be achieved. Contact MHS for details.

5.8 flue connection

The flue connection is located at the rear of the appliance.

Suitable flue components must be connected to form a gas tight seal with the connection socket.

Flue pipes must not be smaller than the connection socket on the appliance and the design guidance given in section 4.3 should be observed.

6.0 commissioning *and testing*

6.1 general

A competent person (i.e. CORGI registered installer) **MUST** be responsible for commissioning this appliance.

Before attempting to commission the appliance checks must be carried out to ensure the correct installation of the appliance in accordance with the requirements detailed in this manual (refer to section 5).

The first start up procedure is a very important operation on which the correct operation and reliability of the entire system often depend. Before starting up, please check the following:-

- That the system is ready for operation, has been cleansed and filled with treated water and has been vented.
- That the static pressure of the system is between 1 and 4 bars.
- Suitably sized pressure relief valves are installed in the correct positions.
- That the boiler is connected to an adequate flue system.
- That the isolation valves are correctly positioned and are in the open position.
- That the circulation pump(s) work(s) and that any pump(s) start up prior to the appliance.
- That the gas type and the gas pressure correspond with the details indicated on the appliance data plate and in the technical specification section of this manual.
- That the gas isolation valve is correctly installed and is in the open position.
- That the gas supply has been thoroughly checked for gas soundness and has been purged in accordance with regulations.
- That a suitably sized gas meter and supply pipe has been fitted and that any dynamic gas pressure drop is not more than 1.0 mbar between the appliance and its meter. Consideration must be taken into account of any other appliances connected to the supply.
- That any electrical connections are correct and the appliance is efficiently earthed.
- That the plant room is correctly ventilated.

6.2 preparing the boiler for operation/setting up

The appliance is supplied factory fired and tested. However, it will be necessary to on-site regulate the combustion in order to adapt the appliance to the specific site conditions.

The following specialist instruments/pieces of test equipment will be required.

- At least one, but preferably two manometers capable of measuring differential pressure between the combustion air and the gas supply to the burner and the differential pressure between the combustion chamber and the combustion air.
- A manometer capable of measuring the inlet gas supply pressure.
- A combustion analyser capable of measuring O_2, CO_2 and CO.
- A single pole, double throw, test switch arrangement as per the diagram below:-

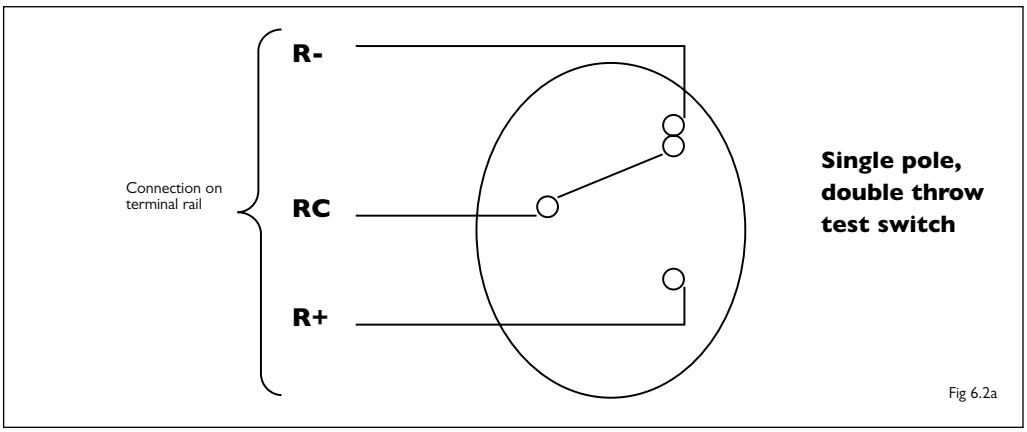


Fig 6.2a

Attach test switch arrangement to the boiler electrical connection terminal rail Rc, R+ and R-, and link terminals R1 and R2.

6.2 preparing the boiler for operation/setting up (contd)

Connection of manometers for boiler adjustment

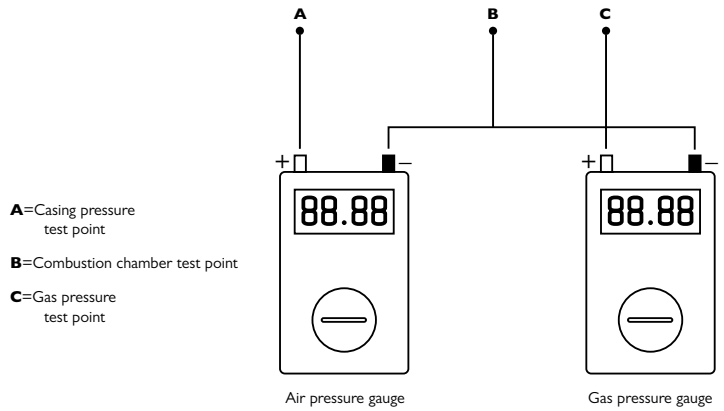


Fig 6.2b

Attach manometers to test points as shown above.

6.3 pre-regulation of the air pressure

- Ensure the appliance gas isolation valve is **closed**.
- Turn on the power supply to the appliance and turn on the on/off switch on the boiler control panel. If necessary push the burner lockout reset button on the burner flame safeguard control box and ensure that the control box sequence position indicator shows "◀ ". In this position the air control damper must be in the fully closed position. If necessary adjust via "camII" of the SQN damper motor, located at the rear righthand side of the boiler.
- The control box sequence position indicator will advance to position "▲" and the air damper should move to the necessary maximum opening position (pre-ventilation). Check the air pressure difference between points A & B (fig 6.2b) against the "Max" figure stated in the regulation table (page 17). If necessary, adjust the damper position via "camI".
- The control box sequence position indicator will advance to "▼" and the air damper will move to, and stop at the ignition position. Check the air pressure difference between points A & B against the "starting" figure stated in the regulation table (page 17). If necessary, adjust via "camIII" of the SQN damper motor.
- The ignition spark will start which should be observed via the viewing port in the casing, and then the flame safeguard control box will go into the "lockout" condition.
- If necessary, reset the control box by pressing the illuminated button on the front of the device and if necessary, repeat any/all of the above procedures, until the figures are correct.

6.4 first firing

- Turn on the gas supply.
- Set test switch assembly to give continuity between "Rc" and "R-".
- Reset the burner flame safeguard control box. The control box will cycle to the start position and then the start up sequence will begin.
- At the appropriate position the burner should ignite. If the appliance fails to ignite, the control box will lockout. Increase the "V" setting on the Kromschroder gas valve by approximately $^{1}/_{2}$ of an adjustment division and reset the control box. Repeat this procedure until appliance ignites.

Gas Valve

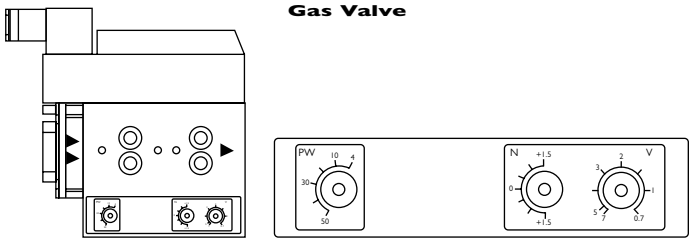


Fig 6.4

6.5 setting combustion

- Allow the appliance to burn for a few seconds and then set the burner output to a maximum by setting the test switch assembly to give continuity between "Rc" and "R+".
- Check the air pressure difference between test points A & B (fig 6.2b) against the "Max" figure stated in the regulation table and adjust if necessary using "cam I" in the SQN damper motor.
- Check the gas pressure to combustion chamber pressure difference between test points B & C (fig 6.2b) against the figure stated in the regulation table and adjust if necessary using screw "V" on the gas valve. Clockwise to increase value and anti clockwise to decrease.
- Insert sample probe of combustion gas analyser into prepared test point on flue system and check exhaust gas. Results should be consistent with the figures stated in the regulation table.
- Reduce the burner output to minimum by setting test switch assembly to give continuity between "Rc" and "R-".
- Check the air pressure difference between test points A & B against the figure stated for "Min" in the regulation table and adjust if necessary using "cam IV" in the SQN damper motor.
- Check the gas pressure to combustion chamber pressure difference between test points B & C against the "Min" figure stated in the regulation table and adjust if necessary using screw "N" on the gas valve.
- Check the exhaust gas analysis against the figures given for "Min" in the regulation table.
- Check the gas input rate by maximum and minimum burner output rates and if necessary adjust only by the SQN damper motor setting of "cam I" for maximum and "cam IV" for minimum throughput.
- Check flow to return temperature difference at maximum output which must be within the range of 10 to 20 deg C.
- Turn off the appliance and remove all test equipment/instruments.
- Tighten and check all test points for gas tightness.
- Set all controls to automatic and turn on appliance.

regulation table

			HXCE 135		HXCE 175		HXCE 215		HXCE 255		HXCE 300	
		units	G20	G31	G20	G31	G20	G31	G20	G31	G20	G31
Max	P air/combustion chamber (A-B)	mb	3.5	3.7	4.3	4.53	4.2	4.28	3.86	4.43	3.45	4.65
	P gas/combustion chamber (B-C)	mb	8.2	7.06	8.5	9.84	8.95	8.29	7.33	10.01	7.96	8.76
	CO_2	%	9.12	10.12	8.8	10.1	8.4	9.9	8.78	10.44	8.66	10.3
	CO	ppm	71.2	74.6	105	105	67.4	145	77.2	120	103	167
	Nox	ppm	35.5	36.7	40.4	21.6	17.0	38.2	26.8	46.4	27.0	52.4
	T° (exhaust fumes)	°C	130	115	157	137	158	164	156	155	170	174
Min	P air/combustion chamber (A-B)	mb	0.73	0.72	0.92	0.85	0.87	0.8	0.77	0.89	0.7	1.03
	P gas/combustion chamber (B-C)	mb	1.58	1.3	1.72	1.82	1.75	1.51	1.33	1.84	1.5	1.65
	CO_2	%	8.62	9.52	8.2	9.4	7.9	9.3	8.44	10.16	8.17	10.2
	CO	ppm	15.2	16.0	30.7	39.4	17.6	75.1	21.8	31.4	63	107.5
	Nox	ppm	19.5	20.3	22	28.1	11.3	39.0	20.2	38.9	20.2	38.9
	P air/combustion chamber on starting (A-B)		1	0.96	1.21	1.24	1.29	1.15	1.16	1.27	0.87	1.5

7.0 maintenance *and inspection*

7.1 maintenance procedure

Regular annual servicing is recommended to ensure trouble free operation and must be carried out by a suitably competent person. It is important to ensure that all components including any controls and safety features operate correctly. Consult with the responsible person to ascertain operating problems.

WARNING: - Before commencing with any work on the appliance, isolate all electrical supplies and turn off the gas service isolation valve to the appliance.

7.2 access to components

It is recommended that all procedures are carried out with the top panel and the front panel removed for easy access. It may also be necessary to gain access to the inside of the control box.

Note: – care must be taken during all procedures not to damage the insulating material of the internal sides of the appliance.

1. To remove the top panel undo the two fixing screws and lift away.
2. To remove the front panel, spring outwards the upper part of the side panels, whilst lifting the front panel out.
3. To remove the control box cover, remove the four fixing screws, where the cover then lifts off.

7.3 cleaning the burner/removal of burner assembly

1. Remove the top panel and front panel of the appliance as detailed in section 7.2.
2. To prevent unnecessary damage to thermostat pocket capillaries, it is recommended to remove the split pin from the thermostat pocket and remove the thermostat bulbs to a safe position.
3. Remove the earth lead, the HT lead and the ionisation lead from the electrodes.
4. Undo the 2 x 10mm compression nuts of the combustion air sensing tube and combustion chamber pressure pipe.
5. Remove the 3 nuts and bolts holding the gas inlet manifold flange to the burner assembly flange.
6. Remove the 4 burner assembly retaining nuts and carefully withdraw the burner assembly.
7. UNDER NO CIRCUMSTANCES SHOULD ANY ATTEMPT BE MADE TO CLEAN THE BURNER.
8. Inspect the burner thoroughly for any signs of damage. If any damage is evident, then replace the burner. (Refer to replacement of parts, section 9.3).

7.4 inspection/cleaning of the heat exchanger

1. With the burner assembly removed it is possible to assess the condition of the heat exchanger.
2. If there are any signs of damage, obstructions etc, then it is recommended that the complete heat exchanger is cleaned and assessed in detail. In order to carry out this procedure it will be necessary to remove the stainless steel top panel. Removing this panel will entail breaking a gas tight seal around the panel. When replacing the panel following the total inspection and cleaning of the heat exchanger it will be IMPORTANT to ensure that the panel is suitably resealed using a recommended sealant.
3. To clean the heat exchanger use only a soft brush, vacuum cleaner with brush adapter and/or compressed air to remove any debris. USE EXTREME CARE WHEN CLEANING. Suitable products are available on the market for cleaning the heat exchanger.
   ANY CLEANSER MUST BE COMPATIBLE WITH THE MATERIALS WHICH MAKE UP THE HEAT EXCHANGER, IF IN DOUBT SEEK FURTHER ADVICE FROM MHS TECHNICAL DEPARTMENT.
4. If the heat exchanger shows signs of excessive damage or any leaks, it must be repaired or replaced. Consult MHS Technical Department for further advice.

7.5 air inlet assembly

1. Remove the air filter (3 screws) to expose the silencer unit.
2. Clean the internal and external surfaces of the air filter using a brush and vacuum cleaner to remove all dust particles from the holes in the mesh type material.
3. Pull out the silencer unit from the fan inlet.
4. Assess the condition of the unit and clean the internal mesh filter with a soft brush if necessary.

7.5 air inlet assembly (contd)

5. It is possible to gain access to the fan rotor from the rear of the appliance after removing the silencer. Use a soft brush and vacuum cleaner with brush adaptor to remove any debris and dust. If the rotor shows signs of heavy deposits of dirt or any damage is evident, the complete fan assembly must be removed. (Refer to replacement of parts, section 9.7).

7.6 the flue system

1. The flue system should be checked for general condition and security of any joints.

7.7 ignition/detection assembly electrodes

1. With the burner assembly removed from the appliance check the condition of the 3 electrodes.
2. Clean the electrodes using a soft brush to remove any deposits.
3. If the electrodes show any signs of damage (i.e. ceramic cracking), they must be replaced. (See replacement of parts, section 9.4).
4. Before re-assembling the burner assembly it is important to ensure the position of the electrodes and the required gaps are correct. Refer to figure 7.7a and 7.7b.
5. Check the burner electrode viewing window for signs of cracks or breakage and replace if necessary.

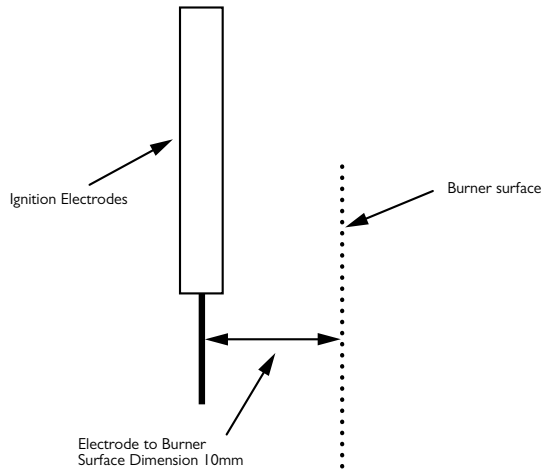


Fig 7.7a

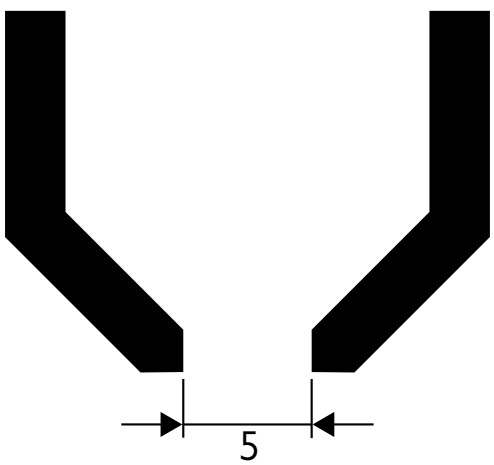


Fig 7.7b

7.8 injectors

1. The injectors can be inspected without the need to dismantle any part of the appliance, once the top panel has been removed.
2. If necessary, clean the injectors using a soft brush or vacuum cleaner. Take care not to allow any heavy dirt deposits into the burner assembly.

7.9 re-assembly

1. Reassemble the appliance in reverse order.
2. Any gas tight seals broken MUST be made good using suitable sealant or replacement gaskets where damage has occurred.
3. Care must be taken when reassembling the burner assembly to prevent any unnecessary damage to the electrodes.
4. Check all gas connections are tightened securely (particular attention should be made to the burner inlet manifold flange to burner assembly connection). **ENSURE THE RUBBER GASKET IS FITTED CORRECTLY.**
5. Before re-fitting the boiler casing panels, the seals must be checked and replaced if necessary.
6. Prior to re-fitting the top panel check the viewing glass is not cracked or broken. Replace if necessary. (See replacement of parts, section 9).
7. Re-commission and test the appliance as detailed in Section 6.

8.0 fault *diagnosis*

8.1 looking for the possible cause of malfunctions

The appliance control panel makes it possible to detect the majority of causes of malfunction and the status of the appliance by simply observing the indicator lights. See table 1 below.

Additionally, the LFL 1.333 flame safeguard control box dial will display a symbol representing the status of the appliance upon shutdown when in a lockout situation (neon illuminated). See table 2 on next page.

Table 1

Indicator neon status	Fault	Check:
ON/OFF switch NOT illuminated	• Electrical supply to appliance • Faulty switch	• Mains electrical supply is on and voltage at terminals L and N • Electrical supply to switch
Burner Flame Safeguard Control Box neon illuminated	• Ignition/burner Lockout	• Control Box display symbol (refer to table 2)
GREEN “burner enabled” neon NOT illuminated	• Burner extinguished • Flame not detected	• Gas supply turned on • Correct gas supply pressure • Ignition and flame sensing electrodes
GREEN “airflow proved” neon NOT illuminated	• Insufficient airflow to actuate the air pressure switch	• Air inlet for blockage • Fan operation • Operation of the damper, the actuator unit and the mechanism • The air pressure switch and sensing tube connections etc
ORANGE “low gas inlet pressure” neon illuminated	• Insufficient gas pressure	• Gas supply turned on • Correct gas supply pressure
ORANGE “water flow failure” neon illuminated	• Inadequate water flow rate within the boiler	• Pump operation • System water pressure • Flow switch operation • For any appliance or system leaks
RED “water temperature high limit” neon illuminated	• Water temperature through the appliance is excessive	• For air accumulation in the water system • Control thermostat operation • Water flow rate • Pump operation

8.1 looking for the possible cause of possible malfunctions (contd)

Table 2

Dial display/reading	Fault	Check:
"◀" with difficulty re-setting	• Electrical supply to appliance	• Mains electrical supply is on and voltage at terminals L and N
"P"	• Insufficient airflow to actuate the air pressure switch	• Air inlet for blockage • Fan operation • Operation of the damper, the actuator unit and the mechanism
"▼"	• Lack of air pressure upon start up	• Differential pressure between the air and combustion chamber • The air pressure switch and sensing tube connections etc
"I"	• This position indicates several possibilities of shutdown or boiler malfunction	• See table 1 for indicator neon status • If after completing all checks listed in the tables a fault is still recognized, CONSULT MHS

9.0 replacement *of parts*

9.1 warning

BEFORE CARRYING OUT WORK TO REPLACE ANY COMPONENT ISOLATE THE ELECTRICAL AND GAS SUPPLY AND SYSTEM CONNECTORS WHERE NECESSARY.

9.2 access to components

It is recommended that all procedures are carried out with the top panel and the front panel removed for easy access. It may also be necessary to gain access to the inside of the control box. **Note** – care must be taken during all procedures not to damage the insulating material of the internal sides of the appliance.

1. To remove the top panel undo the two fixing screws and lift away.
2. To remove the front panel spring outwards the upper part of the side panels whilst lifting the front panel out.
3. To remove the control box cover remove the four fixing screws. The cover then lifts off.

Each replaced component must be checked thereafter by carrying out the appropriate part of the commissioning procedure. See section 6: Commissioning & Testing.

9.3 burner replacement

1. Carry out procedures 1-7 inclusive of section 7.3: Maintenance and Inspection.
2. Undo the 3 retaining buts and bolts and detach the burner from the assembly.
3. Refit the burner in reverse order.
4. Damaged seals of gaskets must be replaced if showing signs of damage. Check all gas carrying components and broken joints for gas soundness. (Ensure the rubber flange gasket is fitted between the burner inlet manifold and the burner head assembly).
5. Re-commission and test the appliance as detailed in section 6.

9.4 ignition electrode/earth electrode/ionization electrode replacement

1. Carry out procedures 1-7 inclusive of section 7.3: Maintenance and Inspection.
2. Remove the 2 screws securing the electrode fixing plate and remove the plate.
3. Carefully withdraw the electrode.

9.4 ignition electrode/earth electrode/ionization electrode replacement (contd)

4. Replace and reassemble in reverse order. Check that the electrode is correctly positioned as detailed in figures 7.7a and 7.7b.
5. Re-commission and test the appliance as detailed in section 6.

Note: The ceramic of the electrode has a special profile which assist with the correct positioning of the probe when reassembled. This profile must engage around the fixing plate on re-assembly. Failure to do so will cause likely damage to the electrode and cause boiler malfunction. (See figure 9.4a below).

9.5 air inlet filter

1. The air inlet filter can be removed from the rear of the appliance without the need for removing any boiler panels.
2. Remove the 3 retaining screws and withdraw.
3. Replace and reassemble in reverse order.
4. Re-commission and test the appliance as detailed in section 6.

9.6 silencer unit replacement

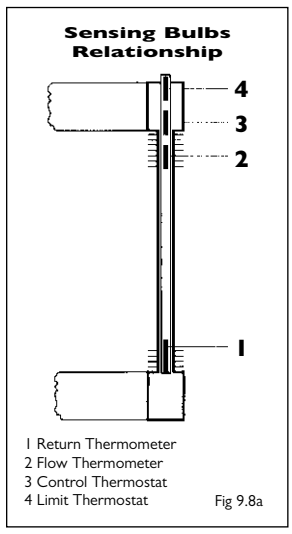
1. Remove air inlet filter (refer to section 9.5).
2. Withdraw the silencer unit from the fan inlet housing.
3. Replace and reassemble in reverse order ensuring the silencer pipe rubber 'O' ring is fitted correctly.
4. Re-commission and test the appliance as detailed in section 6.

9.7 fan replacement

1. Carry out procedures 1-7 inclusive of section 7.3.
2. Remove the air inlet filter (refer to section 9.5).
3. Remove the silencer unit (refer to section 9.6).
4. Undo the 4, M8 nuts on the rear of the appliance which secure the fan unit to the appliance (one of the fixings is located within the circumference of the air filter).
5. Remove the burner flame safeguard control box as detailed in section 9.16.
6. Disconnect the electrical connections from the terminals behind the control box and withdraw the wiring harness.
7. Withdraw the fan unit from the inner rear panel whilst carefully disengaging the air damper.
8. Using a 4mm hexagonal wrench, loosen the grub screw securing the fan rotor and withdraw from the spindle.
9. Remove the 2 nuts securing the fan motor to the air box unit and remove the motor.
10. Replace the necessary component(s) and reassemble in reverse order ensuring all gaskets and seals are fitted correctly. **Note** – the fan rotor must be refitted ensuring it is pushed fully to the base of the spindle and fixed securely using the grub screw.
11. Re-commission and test the appliance as detailed in section 6.

9.8 flow and return temperature thermometer replacement

1. Remove the boiler top panel and control box cover (refer to section 9.2).
2. Remove the split pin from the thermostat pocket.
3. Withdraw all the sensing bulbs from the pocket. IMPORTANT – note the positional relationship between the bulbs.
4. Carefully cut the retaining clips in order to free the relevant thermostat capillary.
5. From inside the control box, push through the relevant display unit from the fascia panel.
6. Carefully withdraw the thermometer unit.
7. Replace the thermometer unit in reverse order, ensuring that the correct bulb positioning is maintained (Refer to figure 9.8a).
8. Test the appliance to ensure correct operation of the replacement part.



1 Return Thermometer
2 Flow Thermometer
3 Control Thermostat
4 Limit Thermostat

Fig 9.8a

9.9 control thermostat replacement

1. Carry out procedures 1-3 of section 9.8.
2. Pull off the control thermostat knob.
3. Disconnect the 3 electrical connections at the rear of the unit within the control box.
4. Remove the retaining screw and withdraw the control unit from the fascia panel.
5. Carefully with draw the capillary and the thermostat bulb.
6. Replace the control thermostat in reverse order, ensuring that the correct bulb positioning is maintained (refer to figure 9.8a).
7. Test the appliance to ensure correct operation of the replacement part.

9.10 high limit thermostat replacement

1. Carry out procedures 1-3 of section 9.8.
2. Unscrew the protective cover of the limit thermostat to expose the reset button.
3. Remove the reset button retaining nut and withdraw the unit from the fascia panel.
4. Disconnect the 4 electrical connections at the rear of the unit within the control box.
5. Carefully withdraw the capillary and the thermostat bulb.
6. Replace the high limit thermostat in reverse order, ensuring that the correct bulb positioning is maintained (refer to figure 9.8a)
7. Test the appliance to ensure correct operation of the replacement part.

9.11 air pressure switch replacement

1. Carry out the procedure to remove the control box panel (refer to section 9.2).
2. Disconnect the 3 electrical connections to the switch.
3. Disconnect the 2 sensing tubes.
4. Remove the 2 retaining screws and remove the switch.
5. Replace the air pressure switch in reverse order. Ensure electrical connections and sensing tubes are in correct position.
6. Test the appliance to ensure correct operation of the replacement part.

9.12 hours run counter replacement

1. Carry out the procedure to remove the control box panel (refer to section 9.2)
2. Remove the 2 electrical connections from the rear of the counter.
3. Push out forwards from inside control box to remove the unit.
4. Reassemble in reverse order.
5. Check operation.

9.13 on/off switch replacement

1. Carry out procedure to remove the control box panel (refer to section 9.2).
2. Disconnect the 4 electrical connections from the rear of the switch.
3. Push the switch out of the fascia panel from inside control box.
4. Reassemble in reverse order.
5. Check operation.

9.14 indicator neon replacement

1. Carry out procedures to remove the control box panel and top panel of appliance (refer to section 9.2).
2. Unscrew the plastic neon retaining nut from inside the control box.
3. Disconnect the 2 electrical connections at the terminal strip.
4. Withdraw the neon complete with wires.
5. Replace in reverse order ensuring correct electrical connections (refer to section 3.7, wiring diagram).
6. Check operation.

9.15 ignition transformer replacement

1. Carry out procedures to remove the control box panel and top panel of appliance (refer to section 9.2).
2. Disconnect the HT lead and electrical connector plug from the transformer.
3. Undo the two retaining nuts from the underside of the control box and withdraw the unit.
4. Replace in reverse order.
5. Check operation.

9.16 burner flame safeguard control box (LFL 1.333) replacement

For replacement of this component it is not necessary to remove any other part of the appliance.

1. Undo the 2 screws and pull unit away from the fascia panel.
2. Replace the unit and check the operation.

9.17 ignition HT lead replacement

1. Carry out the procedures to remove the top panel and the control box cover (refer to section 9.2).
2. Disconnect the HT lead from the electrode on the burner assembly.
3. Disconnect the lead from the ignition transformer unit within the control box.
4. Withdraw the lead and replace in reverse order.
5. Check operation.

9.18 ionization lead/earth lead replacement

1. Carry out the procedure to remove the top panel only (refer to section 9.2).
2. Disconnect the lead from probe on the burner assembly.
3. Remove the burner control box unit (detailed in 9.16).
4. Disconnect the lead from the terminal strip located behind the burner control box unit.
5. Replace the lead ensuring correct electrical connection to the terminal strip (refer to section 3.7, wiring diagram).
6. Reassemble in reverse order.
7. Check operation.

9.19 gas valve replacement

1. It is not necessary to remove any boiler panels. The gas valve is totally accessible from the rear of the appliance.
2. Unscrew the gas/air sensing tubes from the underside of the front of the valve.
3. Remove the 2 electrical power supply plugs from the rear of the valve (screw fix).
4. Remove the 4 allen screws at each end of the valve.
5. Withdraw the valve to one side to remove.
6. Before replacing the valve ensure all 'O' ring seals of the flanges are present and in good condition.
7. Replace the valve in reverse order.
8. Re-commission and test the appliance as detailed in section 6.

9.20 water flow switch replacement

1. It is not necessary to remove any boiler panels. The flow switch is totally accessible from the rear of the appliance.
2. Isolate the appliance water connections at the valves and drain down the appliance.
3. Undo the 4 screws securing the protective cap and remove.
4. Disconnect the electrical connections within the switch.
5. Unscrew the water flow switch housing from the flow pipe.
6. Replace the water flow switch in reverse order, using a suitable jonting compound or PTFE tape.
7. Refill the appliance with water, check for soundness and ensure no air exists in the system by venting.
8. Check operation.

9.21 air damper actuator replacement

1. The air damper actuator is located on the rear of the unit (top right hand side as viewed from the front).
2. Remove the actuator cover.
3. Disconnect and remove the electrical connections within the box.
4. Remove the top panel of the appliance (refer to section 9.2).
5. Using a 2.5mm hexagonal wrench loosen the grub screws securing the damper arm to the spindle.

6. Withdraw the damper arm.
7. From inside the appliance, remove the 3 nuts retaining the actuator box and remove.
8. Replace the air damper actuator in reverse order.
9. Copy the cam settings from the old unit onto the new unit.
10. Re-commission and test the appliance as detailed in section 6.

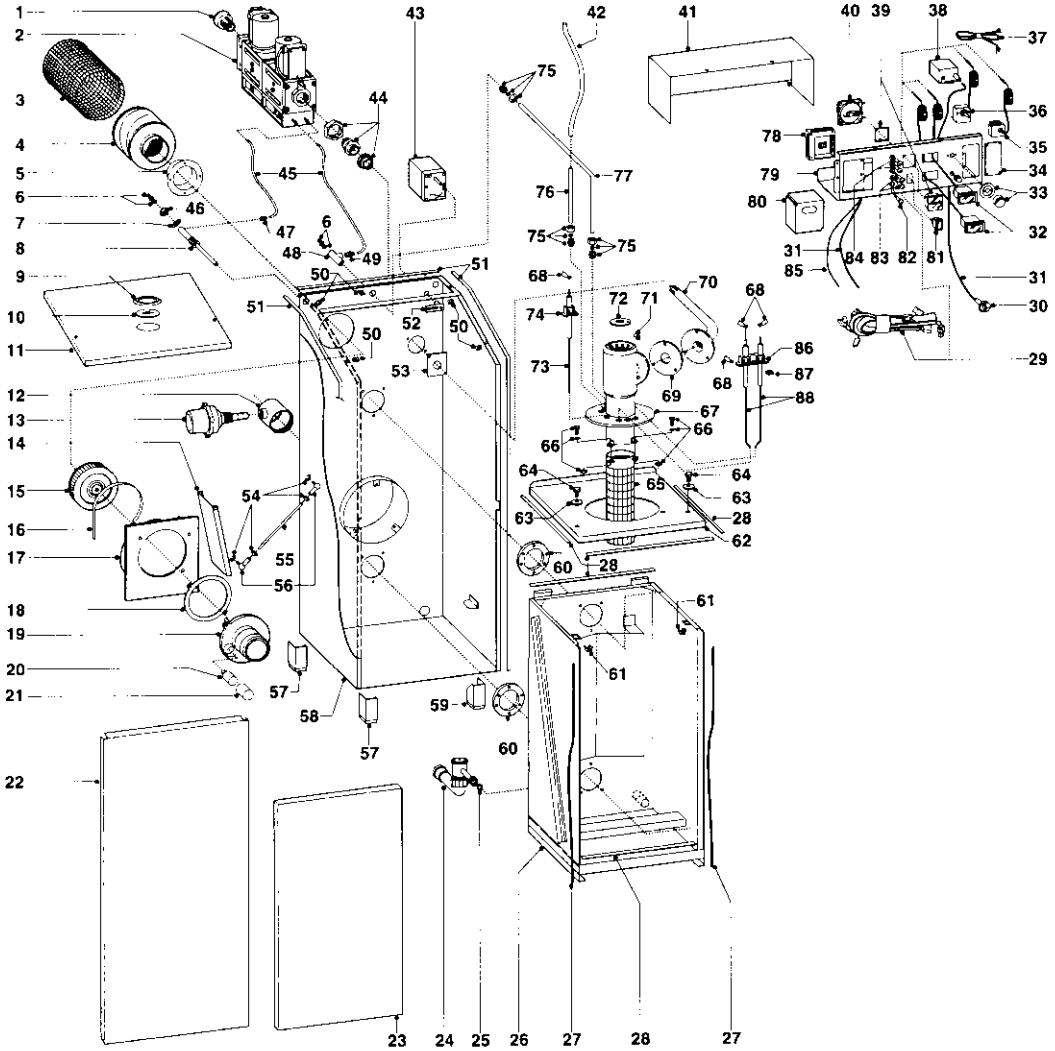
10.0 guarantees

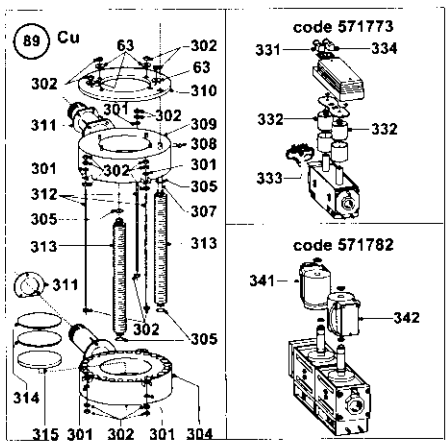
The boiler body and exhaust system both carry a five year material guarantee.

The burners, all electrical components and other component parts carry a one year guarantee.
This guarantee only applies if correct regular maintenance has been carried out.
In addition, no guarantee is made for damages which have arisen from:

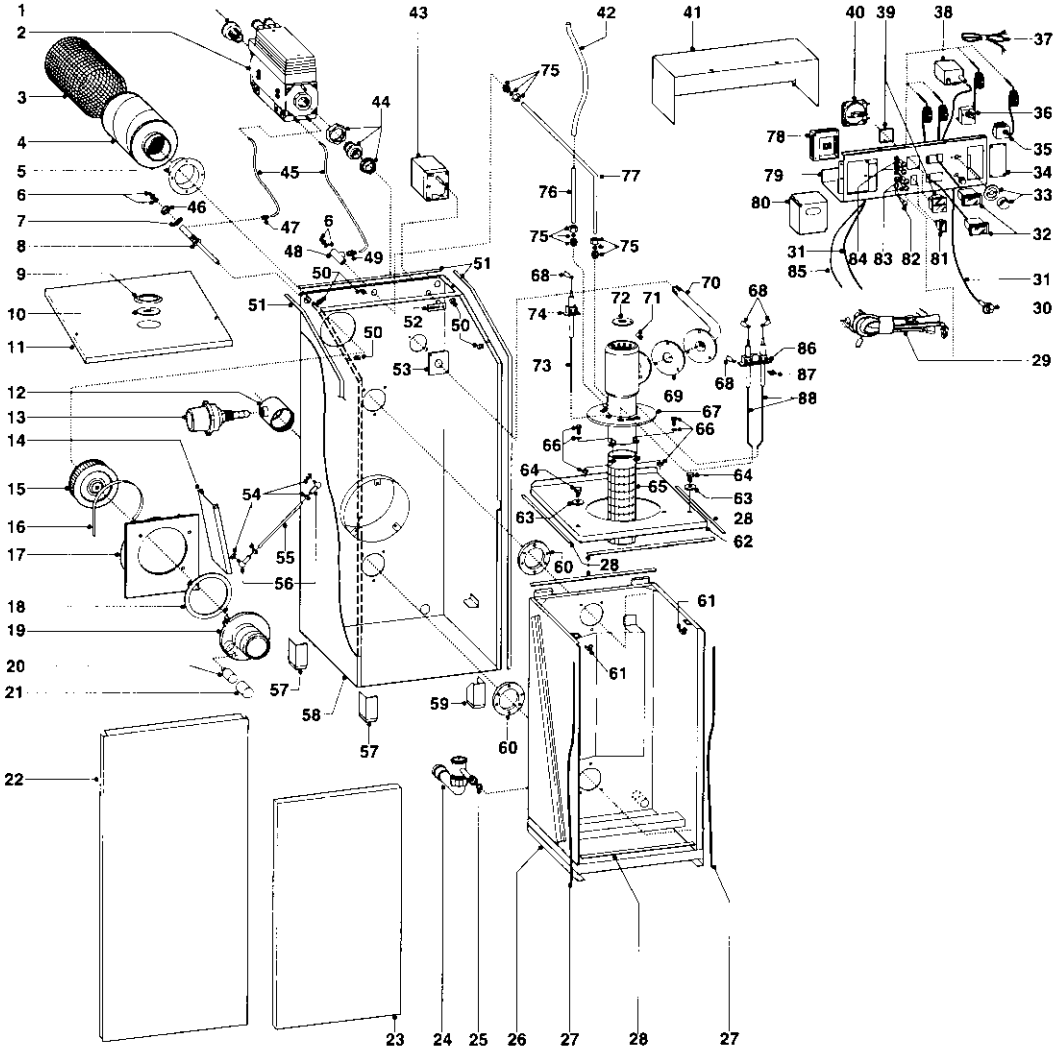
- Unsuitable and inappropriate use
- Erroneous assembly and/or commissioning by unqualified persons
- Erroneous or careless treatment
- Incorrect burner adjustment
- Lack of, or unsuitable water treatment additives
- Non-observance of the installation, commissioning and maintenance instructions
- Inappropriate modifications or repair work carried out by the customer or third parties
- Contaminated combustion air
- Waterside contamination (fouling, scaling etc)

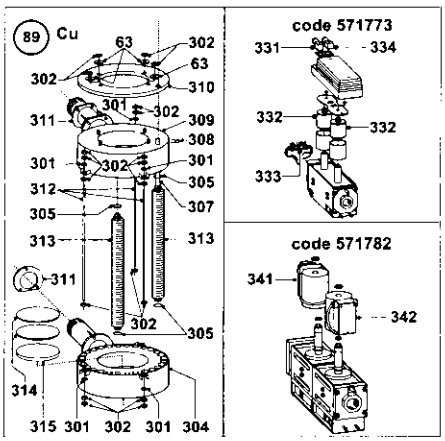
11.0 exploded views
models HX255 & HX300





11.0 exploded views
models HX100 - HX215





JUPITER

QW/1201/4557

MHS BOILERS

A member of the Modular Heating Group Plc

35 Nobel Square, Burnt Mills Industrial Estate, Basildon, Essex SS13 1LT Tel: 01268 591010 Fax: 01268 728202

www.mhsboilers.com

This publication is issued subject to alteration or withdrawal without notice.
The illustrations and specifications are not binding in detail. All offers and sales are subject to the Company's current terms and conditions of sale.

An ARISTON Product