

LILLIPUT HE

GAS/OIL FIRED CAST IRON SECTIONAL BOILERS

INSTALLATION, COMMISSIONING AND MAINTENANCE INSTRUCTIONS

IMPORTANT NOTE

THESE INSTRUCTIONS MUST BE READ
AND UNDERSTOOD BEFORE INSTALLING,
COMMISSIONING, OPERATING OR
SERVICING EQUIPMENT

Customer After Sales Services

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Technical Enquiries

To supplement the detailed technical brochures, technical advice on the application and use of products in the Hamworthy Heating range is available from our technical team in Poole and our accredited agents.

Site Assembly

Hamworthy offer a service of site assembly for many of our products in instances where plant room area is restricted. Using our trained staff we offer a higher quality of build and assurance of a boiler built and tested by the manufacturer.

Commissioning

Commissioning of equipment by our own engineers, accredited agents or specialist sub – contractors will ensure the equipment is operating safely and efficiently.

Maintenance Agreements

Regular routine servicing of equipment by Hamworthy service engineers inspects the safety and integrity of the plant, reducing the risk of failure and improving performance and efficiency. Maintenance agreements enable our customers to plan and budget more efficiently.

Breakdown service, repair, replacement

Hamworthy provide a rapid response breakdown, repair or replacement service through head office at Poole and accredited agents throughout the UK.

Spare Parts

A comprehensive spare parts service is operated from our factory in Poole, providing replacement parts for both current and discontinued products. Delivery of parts and components is normally from stock within seven days. However, a next day delivery service is available for breakdowns and emergencies.

LILLIPUT HE

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CAST IRON SECTIONAL
BOILERS**

**INSTALLATION, COMMISSIONING AND
MAINTENANCE INSTRUCTIONS**

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BEFORE ATTEMPTING TO INSTALL, COMMISSION, OPERATE
OR MAINTAIN THIS UNIT.**

**THE LILLIPUT BOILER IS INTENDED FOR USE AS A COMMERCIAL
APPLIANCE AND IS NOT CERTIFIED FOR USE IN DOMESTIC APPLICATIONS**

**GAS FIRED VARIANTS OF THE LILLIPUT BOILER RANGE ARE FOR USE
ON NATURAL GAS (2ND FAMILY) I_{2H} ONLY.**

**THE LILLIPUT BOILER RANGE HAS BEEN TESTED TO COMPLY WITH
THE REQUIREMENTS OF THE GAS APPLIANCE DIRECTIVE (90/396/EEC)**

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1. GENERAL

1.1 Description

The Lilliput HE boiler range consists of 2 gas or oil fired cast iron sectional boilers with outputs ranging from 66.3 kW (226,2700 Btu/h) to 87.2 kW (297,526 Btu/h). Refer to Section 2.1 for details.

Lilliput HE boilers can be used individually, or in a multiple boiler configuration, and are suitable for use on either open-vented or sealed low temperature hot water heating systems.

For hot water production they can be used in conjunction with calorifiers or indirect hot water cylinders.

Portland pressurisation units are available from Hamworthy Heating Ltd for sealed systems.

1.2 Construction

Lilliput HE sectional boilers are supplied with fully assembled heat exchangers, ready for immediate installation.

The heat exchanger assembly consists of:

- a. A front section
- b. Intermediate sections
- c. Special intermediate section(s)
- d. A rear section

These sections are connected to each other using nipples, and the complete assembly is held together by four 10mm diameter tie rods running the length of the heat exchanger.

The section to section flue gas seal is made by a mastic compound located in a groove around the perimeter of the mating face of each section.

The sections are cast with extended surface fins to increase the heat exchange area and thus enhance thermal efficiency in use.

Lilliput HE boilers have an operating efficiency of over 80% based on gross CV.

The heat exchanger assembly is completed by a hinged cast iron front door and rear combustion chamber plate, both of which are lined with ceramic insulation material. The smoke box/flue connector is bolted to the upper part of the rear section/rear combustion chamber plate.

The boiler stands on four legs, leaving access for cleaning beneath the heat exchanger.

The flow and return water connections are located at the rear of the boiler. Refer to Section 5 for

details.

The Lilliput HE boiler can be fitted with an on/off burner for operation on Class D (35 second) fuel oil or natural gas and LPG.

The boiler is supplied with a pre-wired control panel which contains:

- a. A power supply light.
- b. A burner on/off switch
- c. A pump on/off switch
- d. A boiler thermostat 60-90 deg. C
- e. A temperature limiter (overheat thermostat) - to shut down the boiler should the water temperature in the heat exchanger exceed 100 deg. C - with manual reset
- f. A water temperature thermometer (temperature gauge)
- g. A high low thermostat (not used with current burner options).

The boiler is housed in a sheet steel casing which is supplied flat-packed for on-site assembly. To prevent damage in transit or during assembly these panels may be protected by a plastic film on all painted surfaces. This film MUST be removed before first-firing the boiler. Refer to Section 7 for casing assembly procedure.

1.3 Testing

All Lilliput HE heat exchangers are hydraulically tested to 10 bar (145 psi) ensuring the Lilliput HE boiler is suitable for use on systems with maximum working pressures of up to 5 bar (73 psi).

2. TECHNICAL DATA

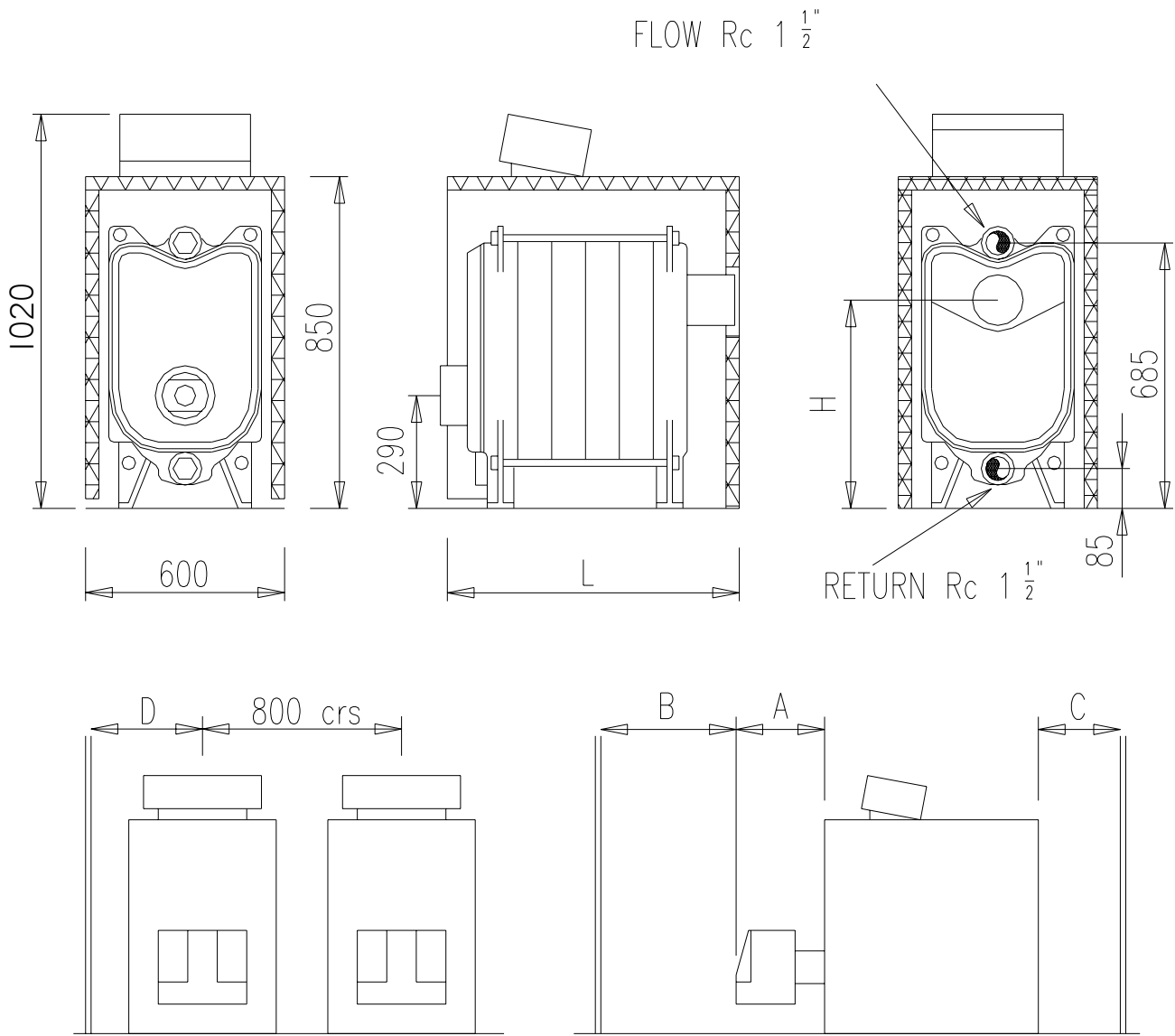
2.1 General

TABLE 1. Technical Data.

BOILER MODEL	LILLIPUT HE		65	90
No. OF SECTIONS			7	9
HEAT INPUT (Nett)	kW Btu/hx1000		70.2 239.5	92.7 316.2
HEAT OUTPUT	kW Btu/hx1000		66.3 226.2	87.0 351
INPUT RATE NATURAL GAS	m ³ /h ft ³ /h		7.27 258	9.60 339
INPUT RATE CLASS D OIL (35 sec)	l/h UKgal/h		7.4 1.63	9.8 2.16
COMBUSTION RESISTANCE (GAS & OIL)	mbar in.wg		0.20 0.08	0.30 0.12
FLUE GAS VOLUME AT NTP (OIL)	m ³ /h ft ³ /h		99.6 3517	130.8 4619
APPROX. FLUE GAS TEMP.(OIL)	deg.C	200		
FLUE GAS VOLUME AT NTP (NAT GAS)	m ³ /h ft ³ /h		90.0 3178	118.2 4174
APPROX. FLUE GAS TEMP. (NAT GAS)	deg. C	190		
FLUE DRAUGHT REQUIRED AT BOILER OUTLET	mbar in.wg		0.1 - 0.25 0.04 - 0.10	
WEIGHT (FILLED) WITHOUT BURNER	kg lb		260 573	330 727
WATER CONTENT	l UKgal		24.5 5.4	31.5 7.0
WATER CONNECTIONS FLOW & RETURN	Rc		1½	1½
MAXIMUM WATER PRESSURE	Bar g Psi g		5 73	5 73
FLUE CONNECTION O.D.	mm in.		180 7	180 7
MINIMUM GAS PRESSURE REQUIRED AT GAS TRAIN INLET	mbar in.wg		17.5 7	17.5 7
GAS CONNECTION(typical)	Nominal Bore		¾"	¾"
ELECTRICAL SUPPLY	240V ~ single phase fused and rated at 10 A			

NOTE! Gas input rate based on NGA (G20) gas with a Nett CV of 34.06 MJ/m³

2.2 Dimensions and Clearances - Fig. 1 Overall Dimensions and Clearances



BOILER MODEL	Lmm	Hmm	Amm Gas*	Amm Oil*	Bmm	Cmm	Dmm.min.
LILLIPUT HE 65	800	530	347	261	400	500	400
LILLIPUT HE 90	960	530	389	261	400	500	400

*Typical Dimensions based on Riello Burners.

3.0 **INSTALLATION REQUIREMENTS**

3.1 Gas Safety

It is the law that all gas appliances are installed by a competent person, i.e. a CORGI registered gas installer, in accordance with the requirements of all relevant current legislation and codes of practice - see below.

3.2 Legislation and Codes of Practice

Lilliput HE boilers should be installed in accordance with all relevant legislation, codes of practice and British Standards, including the following:

a. Legislation & Regulations

The Gas Safety (Installation and Use) Regulations 1984 .

The Gas Safety (Installation & Use) (Amendment) Regulations 1990.

The Health & Safety at Work Act.

Health & Safety Executive Guidance Note PM5.

The Building Regulations.

The IEE Wiring Regulations for Electrical Installations.

The Byelaws of the Local Water Undertaking.

Local Authority Regulations.

Local Gas Region Regulations.

Local Fire Authority Regulations.

Insurance Company Requirements.

b. British Standards Codes of Practice

BS.CP342 - Code of practice for centralised hot water supply. **Part 2:** Buildings other than individual dwellings.

BS.5410 - Code of practice for oil firing. **Part 1:** Installations up to 44 kW, and **Part 2:** Installations of 44 kW and above capacity for space heating, hot water and steam supply purposes.

BS.5440 - Code of practice for flues and air supply for gas appliances of rated input not exceeding 60kW **Part 1:** Flues; **Part 2:** Air supply.

BS.6644 - Specification for installation of gas fired hot water boilers of rated inputs between 60kW and 2MW.

BS.6798 - Specification for installation of gas fired hot water boilers of rated input not exceeding 60kW.

BS.6891 - Installation of low pressure gas pipework of up to 28mm in Domestic Premises.

BS.6700 - Design, Installation, testing and maintenance of services supplying water for domestic use.

BS.6880 - Code of practice for low temperature hot water heating systems of output greater than 45kW.

Part 1: Fundamentals & design considerations.

Part 2: Selection of equipment. **Part 3:** Installation, commissioning and maintenance.

c. British Gas Publications

IM/2 Purging procedures for non-domestic gas installations.

IM/5 Soundness testing procedures for industrial and commercial gas installations.

IM/11 Flues for commercial and industrial gas fired boilers and air heaters.

IM/16 Guidance notes on the installation of gas pipework, boosters and compressors in customers premises (excluding domestic installations of 25mm and below).

3.3 Boiler Location

The boiler location must permit the provision of a satisfactory flue system, and provide adequate space around the boiler for servicing and air circulation.

Sufficient space must be provided at the front of the boiler to allow the removal of the burner assembly for servicing/replacement, and at the rear for installation of pipes, valves and flue.

Sufficient clearance above the boiler must also be provided to allow access for servicing. Refer to Section 2.2 for recommended clearances.

The boiler room, or compartment, housing the boiler (s) - whether specifically constructed for the purpose, or a modification of an existing space - should be in accordance with the requirements of either BS.6644, BS.5410 Part 1, or BS.5410 Part 2, as appropriate.

Where a separate purpose built boiler room is not available, measures should be taken to protect the boiler or boilers from damage, and the boiler should be sited such that extraneous material cannot be stored next to, or against it.

The boiler should be installed on a non-combustible, level plinth of 50mm nominal height, capable of withstanding temperatures of 65 deg. C, and able to support the weight of the boiler (including pipework and ancillary equipment) when filled with water.

The plinth should end flush with the boiler casing front to prevent interference with the burner oil pipework or gas train and should be at least the width and length of the casing dimensions.

The compartment housing the boiler must have permanent air vents communicating directly with the outside air at both high and low level. Refer to Section 3.7 for details.

3.4 Gas Supply

The Gas Safety (Installation and Use) Regulations require that only competent persons, i.e. CORGI Registered gas installers, should install gas

appliances.

Failure to install gas appliances correctly may lead to prosecution. It is in your own interest, and that of safety, to comply with the law.

The local gas region should be consulted at the installation planning stage to either determine the feasibility of providing a gas supply, or, where there is an existing supply, to ensure that the meter capacity is adequate for the rated input of the proposed new boiler. An existing gas service pipe must not be used without prior consultation with the local gas region. A gas meter is connected to the service pipe by the local gas region, or the local gas region contractor.

Installation pipes should be fitted in accordance with British Gas publication IM/16. Pipework from the meter to the boiler must be of an adequate size to pass the maximum required gas rate without excessive pressure loss. Pipe of a smaller diameter than the burner gas connection should not be used. The complete installation must be tested as described in IM/16.

Where it is necessary to use a gas booster, the controls must include a low pressure cut-off switch fitted upstream of the booster. The cut-off pressure will be decided by the local gas region, who should be consulted before a gas booster is installed.

A manual shut-off valve must be fitted on the incoming gas supply pipe, in an easily accessible position, adjacent to the boiler and clearly identified.

3.5 Oil Supply

The oil storage and supply system should be designed and installed in accordance with BS.5410 Part 1 or 2, as appropriate. The following notes are given as guidance:-

Oil Storage Tank - The oil storage tank should be of sufficient capacity to permit economic deliveries of oil to be taken. Reference should be made to oil distributor for advice. The tank should be installed such that:

- a. The oil outlet should be higher than the top of the oil burner pump. If site conditions prevent this, then a suction lift (or 'two-pipe') fuel supply system must be used.
- b. The maximum head on the suction side of the oil pump should not exceed 4 metres (14 feet).
- c. The base should be sloped away from the outlet and towards a drain cock to allow draining of any water or sediment from the tank.
- d. It is sited outside, if possible, and complies fully with the requirements of the relevant British Standards and Local Authority Regulations.

Oil Supply Lines - The oil supply line(s) between storage tank and burner should be run in copper,

steel or aluminium pipe. Galvanised pipes and fittings should not be used. All pipework and fittings must be oil-tight, with any screwed joints made good with an oil resistant compound. The supply line should terminate adjacent to the burner with an isolating valve and metal bowl filter (with replaceable filter element).

Gravity Feed Supply - Where the delivery connection of the storage tank is above the level of the pump inlet on the burner a 'single pipe' gravity feed system can be used. At no point in this system should the supply pipework be higher than the lowest level of fuel in the tank.

Suction Lift Supply - where the delivery connection of the tank is below the level of the pump inlet on the burner a 'two-pipe' fuel supply system **MUST** be used. This system uses the burner pump to provide a circulation of oil to and from the tank. **N.B.** Burner pumps can be supplied ready for use on a 'single-pipe' system. For use on a 'two-pipe' system it may be necessary to fit the pump with a by-pass plug. Refer to technical information supplied with burner.

The return line should terminate within the oil tank at the same level as the suction line, in which case a non-return valve is not required. If the return line terminates above the fuel level, a non-return valve **MUST** be fitted.

3.6 Flue System

The flue system should be designed and installed in accordance with the requirements of BS.5440 Part 1, BS.5854, BS.6644 and British Gas publication IM/11. The following notes are given for your guidance.

The boiler should be connected to a single flue system in the case of a single boiler, or a common flue header in the case of a multiple boiler installation. Flue systems must be self supporting and contain access for cleaning.

The size of the flue must be such as to guarantee the efficient discharge of combustion products from the building and should not be less than the diameter of the flue outlet.

When designing the flue system, care must be taken to ensure that any condensate that may form within the system can be safely drained to a suitable waste point, and that the flue material used is resistant to the corrosive effects of that condensate.

The flue system should be designed such that the flue terminates at least 1 metre above the roof surface, or above the level of any nearby structure which is within 2.5 metres of the flue.

The flue should not terminate adjacent to any

openings which would allow combustion products to enter a building, e.g. openable windows, fresh air inlets or soil pipe terminations.

A terminal should be fitted to any flue of less than 200mm diameter.

The flue should not be closer than 50mm to any combustible material, except when it passes through the roof, wall, floor, ceiling or partition when it should be enclosed in a non-combustible sleeve with an air gap of not less than 25mm between the sleeve and the flue pipe.

The flue pipe should be located and, if necessary, shielded to ensure that there is no undue risk of either damage to the flue or danger to persons in or around the building.

Chimneys should be lined with a non-porous acid-resistant material in accordance with BS.5854, e.g. a flexible flue liner or similar British Gas Approved material. The internal diameter of the liner must not be less than the recommended flue size and the number of joints should be kept to a minimum. Any joint between the flexible liner and the flue pipe from the boiler should be made using a purpose made connector. Existing chimneys should be thoroughly swept before use and any register plates, dampers, or restrictors removed.

If the boiler(s) is not connected to a chimney system, but is connected directly to outside by a standard stainless steel flue (either single or twin wall) it is particularly important to ensure that the point at which it exits the building is fully weatherproofed.

3.7 Ventilation and Air Supply

The boiler house, or space, in which the boiler(s) is situated must have provision for an adequate supply of air for both combustion and ventilation. Detailed recommendations for natural or mechanical ventilation of such areas are given in:

BS.5440 Part 2 - for gas boilers of up to 60kW input.

BS.6644 - for gas boilers of input between 60kW and 2MW.

BS.5410 Part 1 - for oil boilers of up to 44 kW output.

BS.5410 Part 2 - for oil boilers of 44kW output and above.

The following notes are given as general guidance:

3.7.1 Air Supply by Natural Ventilation

The boiler room must have, or be provided with, permanent air vents directly to the outside air, at high level and at low level. For an exposed boiler house, air vents should be fitted preferably on all

four sides, but at least on two sides. Air vents should have negligible resistance and must not be sited in any position where they are likely to be easily blocked or flooded or in any position adjacent to an extraction system which is carrying flammable vapour. Grilles or louvres must be so designed that high velocity air streams do not occur within the space housing the boiler. For boilers installed below ground level, high and low level ventilation should not be provided by a single duct.

The air supplied for boiler house ventilation shall be such that the maximum temperatures within the boiler house shall be as follows:

a) At floor level (or 100mm above floor level) = 25°C.

b) At mid-level (1.5m above floor level) = 32°C.

c) At ceiling level (or 100mm below ceiling level) = 40°C.

Where both low and high level openings are used, the grilles shall have a total minimum free area of:-

Low Level (inlet) 540 cm² plus 4.5 cm² per kiloWatt in excess of 60kW total rated input.

High Level (outlet) 270 cm² plus 2.25 cm² per kiloWatt in excess of 60kW total rated input.

3.7.2 Air Supply by Mechanical Ventilation

Air supplied to the boiler room by Mechanical means should be as follows:

Mechanical Inlet with natural or mechanical extraction - Mechanical inlet and mechanical extract can be utilised provided that the minimum flow rates of air supplied and extracted are in accordance with Table 2.

Mechanical extract ventilation with natural inlet ventilation must not be used.

NOTE: For Mechanical ventilation systems, an automatic control should be provided to cut off the gas supply to the boiler, in the event of failure of air flow in either inlet or extract fans.

Table 2. Mechanical Ventilation Flow Rates

Forced Draught Boilers	Flow Rate per 1000 kW total rated heat input	
	Inlet air (Combustion Ventilation)	Extract air (Ventilation)
	m ³ /s	m ³ /s
Volume	0.9	0.6

4. WATER SYSTEM

Reference should be made to BS.6644, BS.6880 and CP.342 for detailed recommendations on heating water circulation systems. The following notes are given as guidance:

4.1 Pipework

The heating system should be thoroughly cleaned prior to the installation of the boiler(s). If there is any doubt regarding the cleanliness of an existing system, the inclusion of a coarse filter in the return pipe to the boiler(s) should be considered.

In the case of multiple boiler installations, irrespective of the type of system, it is important that the system design provides an even flow of water (of not less than the minimum rate specified) through each of the boilers in question. This can be achieved by connecting the boilers using the 'reverse return' method, providing an even flow through each boiler, and ensuring that the pressure drop across any number of boilers is never greater than that for a single boiler plus losses for the adjacent pipework and fittings.

The system should be designed to operate with a temperature drop of between 11 deg. C and 20 deg. C.

The design and minimum water flow rates, with the corresponding waterside pressure drop values, are given in the following table 3:

TABLE 3. Water Flow Rates and Pressure Drops.

BOILER MODEL	DESIGN FLOW RATE (11 deg. C temp. rise)				MINIMUM FLOW RATE (20 deg. C temp. rise)			
	FLOW RATE		PRESS. DROP		FLOW RATE		PRESS. DROP	
LILLIPUT	l/m	UKgal/m	m/bar	in.wg	l/m	UKgal/m	mbar	in.wg
HE65	86.3	19.0	23.8	9.6	47.7	10.5	7.3	2.9
HE90	113.5	25.0	34.5	13.9	62.5	13.8	10.5	4.2

4.2 Pumps

The pressure drop through both the boiler and the heating installation should be taken into account when selecting the circulating pump for the system. In the case of open-vented systems, it is essential that the pump does not 'pump over' (i.e. push water out of the open vent pipe) during normal operation.

Some installations may require the use of a shunt pump to maintain the temperature drop between boiler flow and return within the recommended range, and to provide an 'overrun' facility to dissipate residual heat and avoid nuisance shut down of the boiler(s) by the overheat thermostat.

Circulating pumps should be located in an accessible position and be fitted with two isolating valves to allow removal/replacement.

4.3 Open Vent Pipe

An open-vented system must have an open vent pipe, sized in accordance with BS.6644, running directly from the flow pipe adjacent to the boiler(s), rising continuously by the shortest route, to discharge into the feed and expansion tank above the overflow level.

No valve should be fitted in the open vent pipe, except on multiple boiler installations where any isolating valve fitted between the boiler and the open vent pipe should be a 3-way valve - venting the boiler to atmosphere through the third port when isolating the open vent pipe from the boiler.

4.4 Safety Valve

A pressure relief (safety) valve, of approved manufacture and sized to match the boiler(s) rating in accordance with BS.6644, should be installed in the flow pipe between the boiler(s) and open vent pipe connection. The safety valve discharge pipe should be self draining and terminate in a visible position where any discharge will not be a danger to personnel.

4.5 Pressure Gauge

The boiler(s)/heating system should be fitted with a water pressure gauge to indicate the pressure in the system in either metres of water or bars.

4.6 Thermometer (temperature gauge)

Each boiler control panel incorporates a temperature gauge, indicating the temperature of the boiler flow water in degrees Celsius.

4.7 Drain Valves

A drain valve (not supplied) should be fitted to allow complete draining of the boiler when necessary. Any parts of the system which are below the boiler should have a drain valve installed at the lowest point to allow the system to be totally drained when necessary. A plugged Rc½" connection is provided for a drain valve at the bottom of the front boiler section.

4.8 Feed Water Quality

If the boiler feed water has a high degree of hardness, it is recommended that the water be treated to prevent precipitation of scale or sludge in the boiler water passageways. Details of additives can be obtained from any reliable

manufacturer of water treatment products or the local water authority.

It should be noted however, that even if the boiler water is of average hardness, not requiring treatment, subsequent draining of the system for repair or constant make-up water due to an undetected leak will cause additional deposits and gradual build-up of scale. It is essential therefore, that leaks are attended to promptly and draining is kept to an absolute minimum.

It is recommended that the system be flushed out at least twice when hot before any water treatment is added. If any doubt exists regarding the internal cleanliness of an old system, consideration should be given to the fitting of a coarse filter in the return pipework to the boilers.

4.9 Minimum System Water Pressure

To comply with guidance note PM5 (Health and Safety Executive), the minimum pressure requirements at the boiler are given below as examples:-

a. Single installed boiler running at 82°C flow temperature. Minimum head required is not less than 2 metres or 0.2 bar.

b. Single installed boiler running at 95°C flow temperature. Minimum head required = 5.1 metres or 0.5 bar.

c. Multi boiler installation running at 82°C flow temperature and 11°C rise across system. Minimum head required = 4.3 metres or 0.42 bar.

d. Multi boiler installation running at 82°C flow temperature and 20°C rise across system. Minimum head required = 9.3 metres or 0.92 bar.

5. CONNECTIONS

5.1 Fuel

GAS - For burner gas train inlet connection sizes, refer to Section 2.1.

A manual shut-off valve must be fitted on the incoming gas supply pipe. It shall be adjacent to boiler, clearly identified and readily accessible.

OIL - All burners are supplied with flexible oil pipes to make the final connection between the oil supply pipe and burner. The oil supply line should terminate adjacent to the burner with an isolating valve and metal bowl filter.

5.2 Water

The flow and return water connections are located on the rear section of each boiler. These are tapped Rc 1½" (1½" BSP female tapered thread). Refer to Fig. 1(Page 3).

5.3 Electrical

WARNING: THIS APPLIANCE MUST BE EARTHED.

IMPORTANT: All wiring must be installed in accordance with the IEE Wiring Regulations for electrical installations, and any other local electrical regulations which apply.

A 240 volt 50 Hz single phase neutral and earth supply is required. Entry points for the electrical cable are located on the back casing panel.

To allow electrical isolation of the boiler when necessary the electrical supply should come from a double pole fused isolator (located in the boiler

room), having a minimum contact separation of 3mm on both poles.

The earth connection must never be omitted. All wiring should be in heat resistant PVC insulated cable, with the minimum cross section as specified in the technical information supplied with the burner.

The boiler control panel includes a terminal block for all electrical connections to the boiler. Refer to Fig. 2 below.

Wiring diagrams showing the electrical connection of burner to boiler, are given in Appendix A of these Installation Instructions.

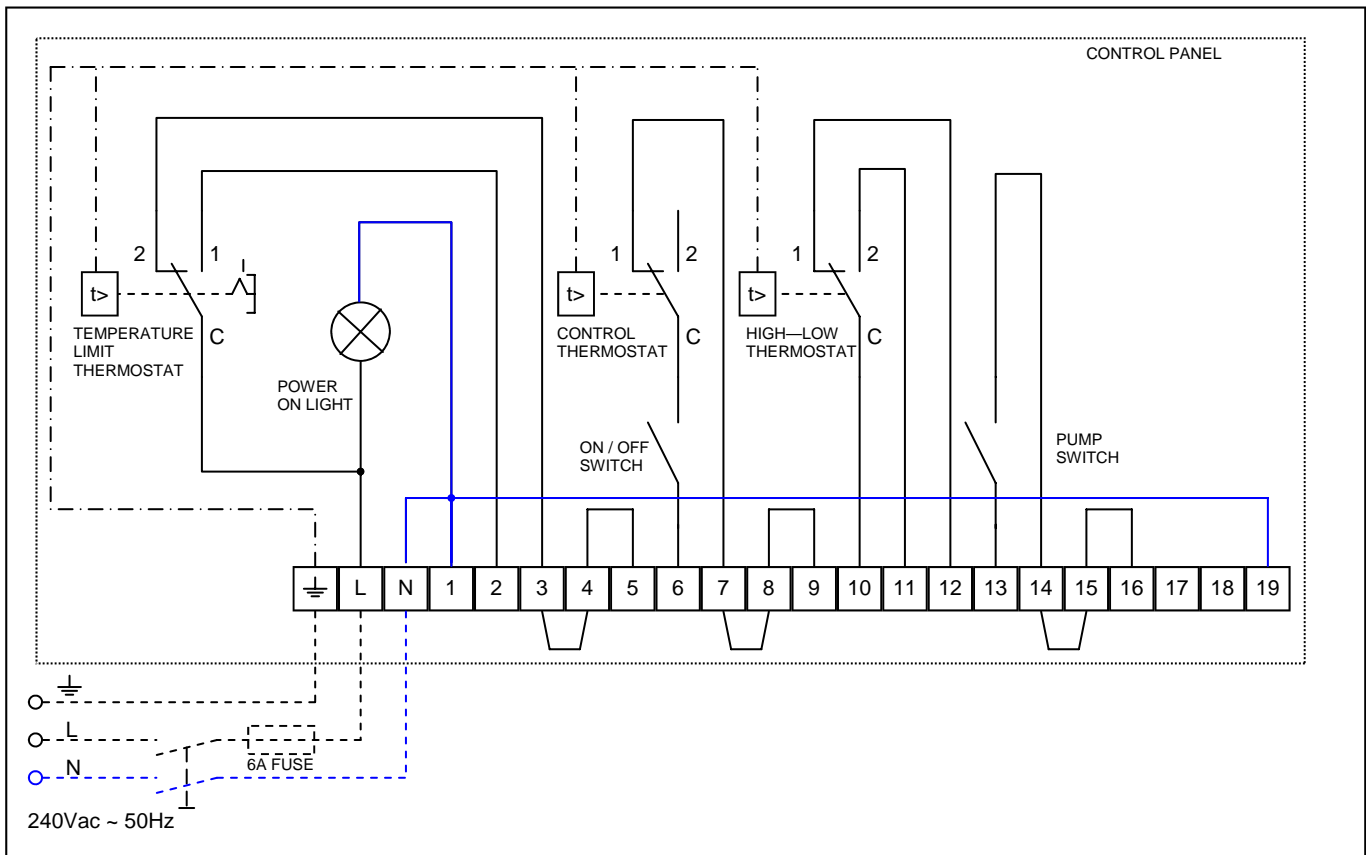


Fig. 2. Boiler Control Panel Wiring Diagram

TABLE 4.Composition of Sections within Heat Exchanger

BOILER	SECTION TYPE								
LILLIPUT HE 65	R	I	I	I	I	SI	F		
LILLIPUT HE 90	R	I	I	I	I	SI	SI	SI	F
No. FROM REAR	1	2	3	4	5	6	7	8	9

6. BOILER ASSEMBLY

6.1 Boiler Sections

The heat exchanger is made up from THREE or FOUR different types of section, each weighing around 32kg (70 lb), as follows:

- One rear section (R)
- One front section (F)
- Intermediate sections (I)
- Special intermediate sections (SI)

For the purposes of identification the 'Intermediate' sections have a joint face between the middle and upper part of the section, whereas the 'Special intermediate' sections do not.

These sections MUST be assembled in the correct sequence working from the rear of the boiler as detailed in table 4 above.

6.2 Assembly Procedure

If it has been necessary to dismantle the boiler for any reason, the following procedure should be adopted to re-assemble it:

- a. Position the rear section and thoroughly clean the nipple seatings (at both top and bottom of the section) and the mastic rope groove around the perimeter of the section.
- b. Taking two new nipples, smear them with suitable nipple sealant and insert them into their seatings - ensuring that they are at right angles to the face of the section. Fit new mastic rope into the groove around the section.

Should the mastic rope break during this operation the two ends must be overlapped and pressed together to avoid the possibility of leakage.

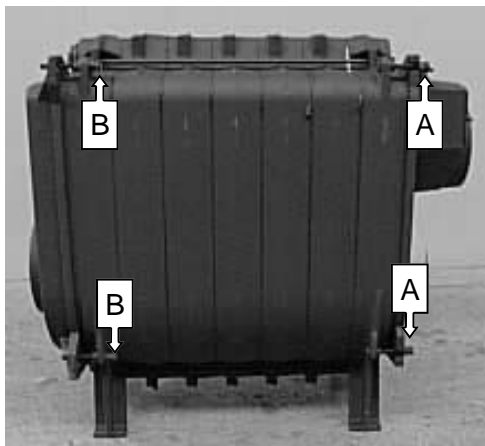
- c. Taking an intermediate section, thoroughly clean the four nipple seatings and the mastic rope grooves, and then carefully fit it to the rear section - locating the two nipples into their corresponding seatings.
- d. Repeat this operation for each of the remaining intermediate, special intermediate, and front section, using new nipples and mastic rope at each joint. The intermediate sections may need support on chocks to

- e. ensure they remain in position.
 - e. Remove the two reducing plugs - located at the top and bottom of the front section.
 - f. Fit the boiler assembly tools* - one through the flow (top) connection and the other through the return (bottom) connection and evenly compress the sections together.
 - g. Fit the four tie rods, tighten the tie rod nuts to a torque of 35 Nm (26 lbf.ft), and then carefully remove the two assembly tools. Replace the two reducing plugs in the front section and fit the thermostat pocket and drain valve in the top and bottom plugs respectively. Slide the stainless steel baffle plate into the roof of the combustion chamber (see item 24 Fig 4) locating the returned edges between the section fins.
 - h. Fit the front door and rear combustion chamber plate, together with ceramic insulation, and secure with the nuts provided.
- N.B.** The front boiler door may be hinged on either left or right side, as required.
- i. Fit flue box to rear section and secure using the screws provided.
 - j. On completion of assembly, the heat exchanger should be hydraulically pressure tested to 1.5 times the maximum system pressure operating for 30 minutes (BS779 - 1989, Amendment 1 - 1993).
- Boiler assembly tools are available on loan, from Hamworthy Heating Ltd.

7. CASING ASSEMBLY

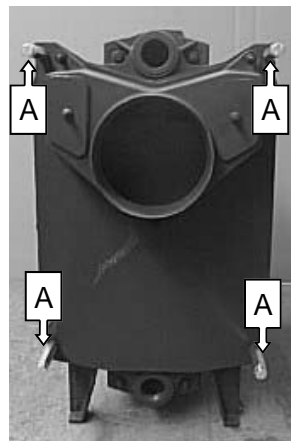
The boiler casing kit consists of:

- Side panel RH
- Side panel LH
- Top cover
- Front cover with insulation
- Rear plate RH
- Rear plate LH
- Boiler sections insulation jacket
- Rear insulation jacket
- Bag containing:-
 - 4 bolts M10x15
 - 15 screws 4x10
 - 4 spacers 80mm long
 - 1.5m of duct tape

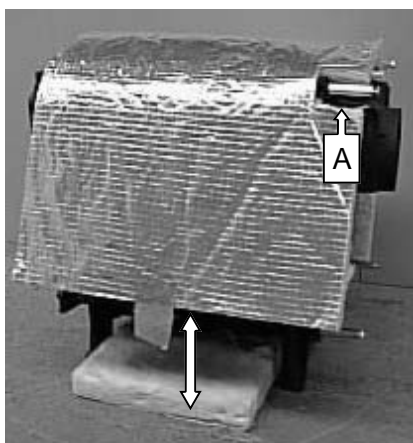


Remove the 4 locknuts from the tie rods at position A.

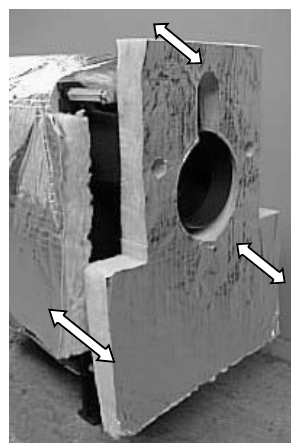
Loosen the 4 locknuts at position B and back off the nut to the end of the stud



Screw the four 80mm spacers on to the ends of the tie rods and partly screw in the four M10x15 bolts into the ends of the spacers.



Wrap the insulation jacket around the boiler sections. Check that the cut outs (A) are positioned around the rear spacers and secure in position with duct tape.

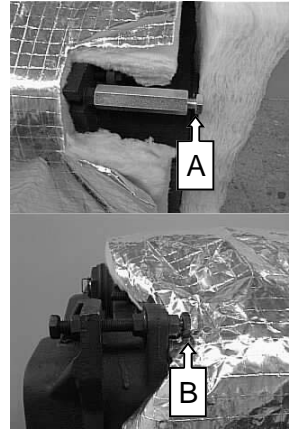


Fit the rear insulation jacket over the flue outlet. Secure the top and side edges of the rear jacket to the wrap using duct tape

Fig. 3. Bolier Casing Assembly



Hook the RH and LH side covers over the spacers and tie rods and secure using the nuts and bolts.

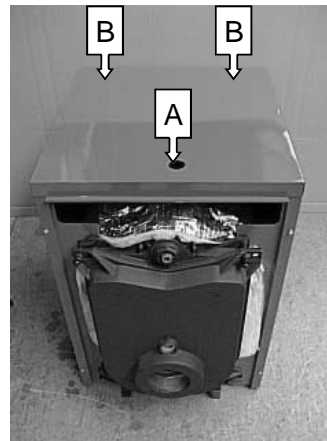


View showing the front (B) and rear (A) connection points for the side covers.

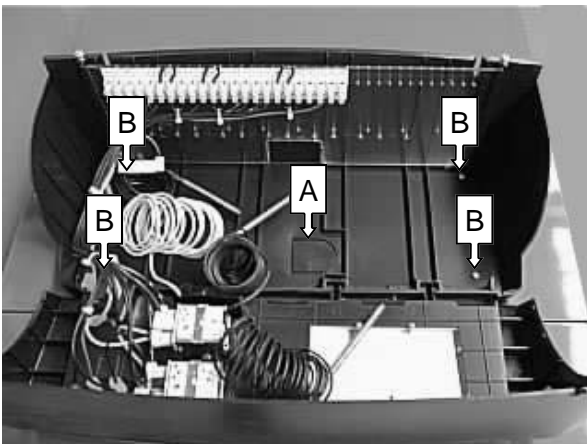
Note that the insulation jacket has to be pushed under the front location point to allow the cover to hook over.



Screw the RH and LH rear covers to the end of the side covers using the 4x10 self tapping screws.



Push the top cover onto the location studs in the top edge of the side cover. Making sure the cable entry hole (A) is at the front of the boiler. Secure the top cover to the rear cover using the 4x10 self tapping screws (B).



Remove the cable entry blanking plate (A) from the control console and screw the control panel to the top cover using the 4x10 self tapping screws (B).

Carefully push the thermostats and thermometer capillaries through the entry hole and locate bulbs in the pocket at the top front of the boiler.

Connect the power supply to the panel by running cable through a cable entry in the rear panel and through the hole into the control panel terminal block using the strain relief clamp provided and run cable to the burner.



Hook the front cover over the locating heads in the side panels

8. COMMISSIONING

The boiler should be commissioned by a competent person. The Gas Safety (Installation and Use) Regulations require that only Registered (i.e. CORGI Registered) gas personnel should install, commission and service gas fired equipment such as these boilers. **Failure to comply with these regulations may lead to prosecution.**

Before commencing the commissioning of the boiler, ensure that any personnel involved are aware of the action about to be taken.

8.1 Preliminary checks

BEFORE starting the boiler, check the following:

- a. Check that fuel supply is turned off.
- b. Check that electrical supply is isolated.
- c. Check that electrical installation conforms to the requirements of these Instructions, the IEE Wiring Regulations for electrical installations, and any other local Regulations which apply.
- d. Check that electrical connections are correctly made, e.g. no loose strands at terminals.
- e. Check that supply is correctly fused for the current rating of the installation.
- f. Check that electrical installation is correctly earthed (earth continuity between boiler, gas pipework and mains electrical supply).
- g. Check that installation is complete.
- h. Check boiler is standing level on an adequate base.
- i. Check boiler castings are undamaged and heat exchanger access plates are correctly fitted and sealed.
- j. Check all thermostat bulbs are correctly inserted in the appropriate pocket.
- k. Check for water leaks and ensure that both boiler and heating system is full of water and properly vented.
- l. Check that all drain cocks are closed, and that all isolating valves in flow and return pipework are open.
- m. Check that flue is unobstructed and conforms to the relevant Regulations, Code of Practice or British Standards. Refer to Section 3.6
- n. Check boiler house is adequately ventilated (refer to Section 3.7) and that ventilation grilles are unobstructed.
- o. **For OIL**; check that tank(s) have been filled and oil supply pipework between tank and burner has been primed.
- p. **For GAS**; check soundness of gas installation and that pipework is purged of air, as detailed in British Gas Publications IM/5 and IM/2 respectively.
Check that gas meter is operational and has been checked by the local region of British Gas.
Check that gas meter and supply pipework is

of sufficient size to meet the input rating of the burner/boiler. Refer to Section 2.1.

- q. Check that burner output is correct for size of boiler in question, referring to Section 2.1 and the manufacturer's technical information supplied with the burner.

8.2 Oil fired Boilers

- a. Check flexible oil lines are tightly jointed and are not twisted or kinked to form an obstruction.
- b. Check correct nozzle(s) is fitted to burner, and that it is tight.
- c. Check electrodes and ensure porcelain insulation is not cracked.
- d. Check electrodes are correctly positioned, and gap is correctly set, as specified in the manufacturer's technical information supplied with the burner.
- e. Check blast tube is correctly located, and securely fastened in place and internal combustion chamber baffle is correctly located.
- f. Check burner seats correctly onto burner mounting plate and is securely fastened in place.
- g. Set burner for the required fuel and air throughputs, as specified in the manufacturer's technical information supplied with the burner.
- h. Fit a pressure gauge on burner oil pump to check pump pressure is correctly set.
- i. Check that overheat thermostat manual reset is set, and that boiler control thermostat and control system are set to call for heat. Switch the boiler on and start the burner.
- j. The burner control will first operate the fan to pre-purge the boiler, then produce an ignition spark and finally open the oil solenoid valve and the flame should ignite.
- k. Purge air from oil pump through pressure gauge port.

IF BURNER LOCKS OUT WAIT 45 SECONDS BEFORE PRESSING RESET BUTTON ON BURNER CONTROL BOX.

- l. With burner firing, check the atomising pressure on gauge and adjust as necessary using the pressure regulator on burner oil pump. Refer to technical information supplied with burner.
- m. After allowing burner to reach stable firing conditions for approximately 15 minutes, carry out combustion gas check. Measure CO₂, CO, smoke number, flue gas temperature and circulating water temperature rise across the boiler. The readings obtained should be as follows:-

CO ₂	11-12%
CO	less than 100 ppm

Smoke Number less than 2
Flue gas exit temp. 200 deg. C
Temp. rise across boiler less than 20 deg. C

- n. Switch off boiler. Remove oil pressure gauge and replace sealing plug complete with gasket.
- o. Restart boiler and cycle it on and off several times to ensure reliable burner ignition and boiler operation.
Check for oil and water leaks.
Check all cleaning door, burner mounting and flue hood joints for flue gas leakage and tighten all fixings.
- p. Set boiler control thermostat to required setting, and check operation of heating control system.
- q. Fully familiarise the user with the boiler operating controls, the main component functions and the safety features.

THESE INSTALLATION AND SERVICING INSTRUCTIONS SHOULD BE LEFT WITH THE USERS OF THE BOILER FOR THEIR FUTURE REFERENCE.

8.3 Gas fired Boilers

- a. Check that ignition electrode and ionization probe are correctly positioned. Refer to manufacturer's technical information supplied with the burner.
- b. Check that ignition electrode and ionization probe leads are connected.
- c. Check blast tube is correctly located, and securely fastened in place, and internal combustion chamber baffle is correctly located.
- d. Check burner seats correctly onto burner mounting plate and is securely fastened in place.
- e. With firing head separate from burner adjust air and gas settings, as specified in the manufacturer's technical information supplied with the burner.
- f. Determine minimum burner gas pressure which corresponds to required burner output (boiler input), as follows:
From the manufacturer's technical information (supplied with the burner) take burner pressure corresponding to required burner output.
Add combustion resistance (in mbar), given in Section 2.1 for boiler in question, to obtain gas pressure value to be measured at burner test point.
- g. Open main isolating valve in gas supply to boiler. Check for leaks throughout gas train and pipework to burner.
- h. Adjust gas supply governor to achieve at least 17.5 mbar (7.0 in wg) at inlet to boiler gas

train. Ensure that maximum pressure of gas train governor is not exceeded.

- i. Adjust start and main output gas rates as detailed in the manufacturer's technical information supplied with the gas train.
- j. Check that overheat thermostat manual reset is set, and that boiler control thermostat and control system are set to call for heat.
- k. Close main isolating valve in gas supply, switch the boiler on and start the burner. The burner control will first operate the fan to pre-purge the boiler, then produce an ignition spark and attempt to ignite the burner. The flame should fail to ignite and the burner should go to lockout.
- l. Open main isolating valve in gas supply. If gas train has separate pilot gas line, open pilot gas isolating valve and close main gas isolating valve. Restart boiler/burner. The burner control will pre-purge, produce an ignition spark and ignite pilot flame. The main flame should fail to light, and burner will continue running on ignition flame only. The pilot gas rate can be checked and adjusted.

IF BURNER FAILS TO LIGHT, BOILER MUST BE PRE-PURGED BEFORE ATTEMPTING TO RESTART BURNER. IF BURNER REPEATEDLY FAILS TO LIGHT, A FULL INVESTIGATION TO FIND CAUSE SHOULD BE MADE.

- m. Stop boiler/burner. Open main gas isolating valve and restart burner. The burner will pre-purge, ignite pilot flame and, after a short delay of several seconds, the main flame will light.
- n. After allowing burner to reach stable firing conditions for approximately 15 minutes, carry out combustion gas check.
Measure CO₂, CO, flue gas temperature, and circulating water temperature rise across the boiler. The readings obtained should be as follows:

CO₂ 9-10%
CO Less than 100 ppm
Flue gas exit temp. 190° C
Temp. rise across boiler. Less than 20° C

- o. After all other adjustments have been made, set burner air pressure switch as instructed in manufacturer's technical information supplied with burner.
- p. Check gas pressure at burner head corresponds with value determined from burner manufacturer's technical information - as detailed in (f) above.
- q. Check gas flow rate at meter. Ensure that all other appliances served by the meter are isolated whilst flow rate is checked.
- r. Cycle boiler on and off several times to ensure reliable burner ignition and boiler operation. Check for gas and water leaks.

- s. Check all cleaning door, burner mounting and flue hood joints for flue gas leakage and tighten all fixings.
- t. Set boiler control thermostat to required setting, and check operation of heating control system.
- u. Fully familiarise the user with the boiler operating controls, the main component functions and the safety features.

THESE INSTALLATION AND SERVICING INSTRUCTIONS SHOULD BE LEFT WITH THE USERS OF THE BOILER FOR THEIR FUTURE REFERENCE.

9. SERVICING

The boiler should be serviced by a competent person. The Gas Safety (Installation and Use) Regulations require that only Registered (i.e. CORGI Registered) gas personnel should install, commission and service gas fired equipment such as these boilers. **Failure to comply with these Regulations may lead to prosecution.**

The boiler should be serviced at regular intervals, not exceeding SIX months for oil fired boilers, or TWELVE months for gas fired boilers.

When carrying out boiler servicing always consider both your own safety and that of others. The use of protective equipment (e.g. eye protection, face mask, protective gloves, etc.) is recommended where necessary.

9.1 Initial Inspection

- a. **a.** Operate boiler and check for any signs of unsatisfactory operation, water leaks, gas leaks, oil leaks or unusual noise from burner oil pump or motor.
- b. **b.** After allowing burner to reach stable firing conditions for approximately 15 minutes, carry out combustion gas check.
- c. Measure CO₂, CO, flue gas temperature, smoke number (for oil) and water temperature rise across the boiler. The readings obtained should be as given in Section 8 - Commissioning.
- d. **c.** Measure either gas pressure at burner head, or oil pressure at burner pump, as applicable, and check value is correct for size of boiler in question.
- e. **d.** Check operation of both boiler and heating system controls, then set boiler control thermostat to OFF.

9.2 Burner Service Procedure.

SWITCH OFF ELECTRICAL SUPPLY TO BOILER AT ISOLATOR AND SHUT OFF FUEL SUPPLY TO BOILER.

- a. **a. For oil installations:** Desludge oil storage tank and examine for leaks and signs of deterioration.
- b. Examine contents gauge for visibility and clean or recommend replacement as necessary.
- c. **b.** Disconnect electrical and fuel connections to burner, as necessary.
- d. Examine flexible oil line(s) for any signs of deterioration, leakage, damage, or hardening of inner tube.
- e. **c.** Disconnect burner from mounting flange and remove from front of boiler.
- f. **d. For oil burners:** Remove control box, check photocell is clean, check electrode rod contacts, check wires in base of control box and condition of electrical spring connectors. Wipe nozzle clean and inspect for spark erosion.
- g. **e.** Remove burner blast tube and clean thoroughly. Check combustion head settings are correct, as specified in the manufacturer's technical information supplied with the burner. Check diffuser disc slots are clean.
- h. **f.** Remove, clean, and check electrodes inspecting for any signs of deterioration or crazing in porcelain.
- i. Check electrode gaps are as specified in the manufacturer's technical information supplied with the burner.

9.3 Boiler Service Procedure

- a. **a.** After removing burner, remove boiler casing to gain access to front of boiler.
- b. **b.** Slacken the two nuts on the non hinge side of the front door of the boiler. Swing it open to gain access to the boiler combustion chamber and heat exchanger flueways and thoroughly clean using a suitable brush(es) and a vacuum cleaner.
- c. **c.** Access to rear of heat exchanger flueways and combustion chamber can be obtained by removing flue box, cover plate and insulation panels from rear of boiler. Check condition of all insulation and replace if necessary.
- d. **N.B.** Removal of the rear cover plate and flue box requires disconnection of flue.
- e. **d.** After cleaning, close front door of boiler ensuring that ceramic rope seal is both sound and correctly positioned. Evenly tighten the two nuts on the non-hinge side to secure the door.
- f. **e.** Refit boiler casing. For guidance, refer to Section 7.
- g. **f.** Refit burner. Reconnect fuel and electrical supplies.
- h. **g.** Turn on fuel supply and check soundness of fuel supply pipework.

- i. **h.** Check all flue joints for integrity.
- j. **i.** Check ventilation ducts/grilles to boiler room and ensure they are clear.
- k. **j.** Re-commission boiler as detailed in relevant parts of Section 8 - Commissioning.

10. SPARE PARTS LIST

10.1 Boiler Spares (refer to Fig. 4)

ITEM	DESCRIPTION	REF
1.	Front section	573405220
2.	Rear section	573405221
3.	Intermediate section	573405222
4.	Special intermediate section (Lilliput HE 65 & 90)	573405223
5.	Nipple	573405224
6.	Tie rod set - Lilliput HE 65	573405226
	Tie rod set - Lilliput HE 90	573405227
7.	Gasket (1½") 573405118	
8.	Hexagonal bush (1½" - ½" BSP).....	573405119
9.	Thermostat pocket	573405228
10.	Plug (½" BSP) 573405121	
11.	Door hinge	573405229
12.	Insulation - front door	573405230
13.	Insulation (front)	573405231
14.	Front door	573405232
15.	Sight glass	573405233
16.	Insulation (rear).....	573405234
17.	Insulation (rear).....	573405235
18.	Insulation - rear cover plate	573405236
19.	Rear cover plate	573405237
20.	Flue box - Lilliput HE65 & 90	573405239
21.	Access plate bolt.....	573405240
22.	Insulation - rear access plate	573405241
23.	Rear access plate	573405242
24.	Baffle - Lilliput HE 65	573405244
	Baffle - Lilliput HE 90	573405245
26.	Insulation	573405657

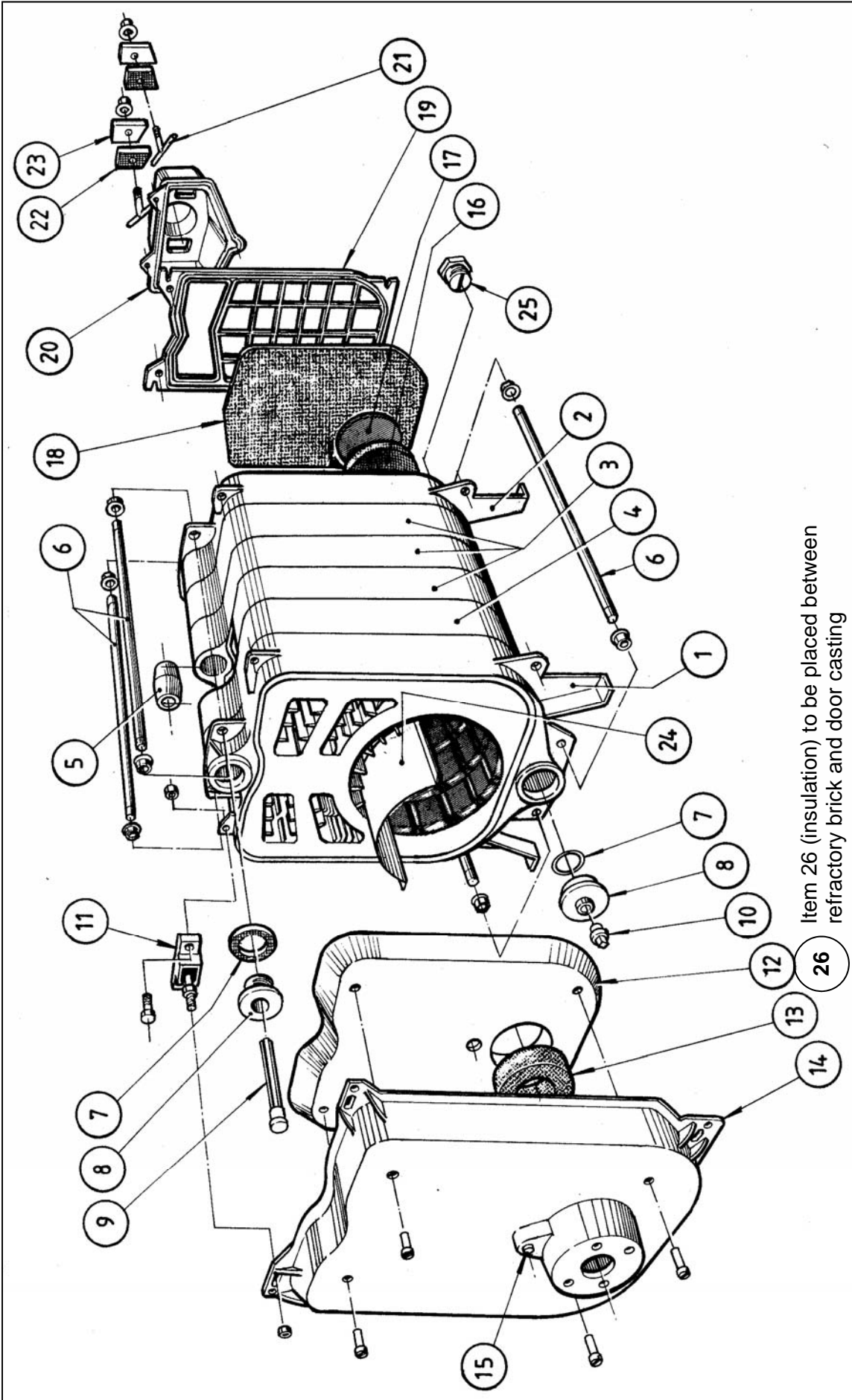


Fig. 4. Exploded View of Boiler

APPENDIX A. BOILER/BURNER WIRING DIAGRAMS.

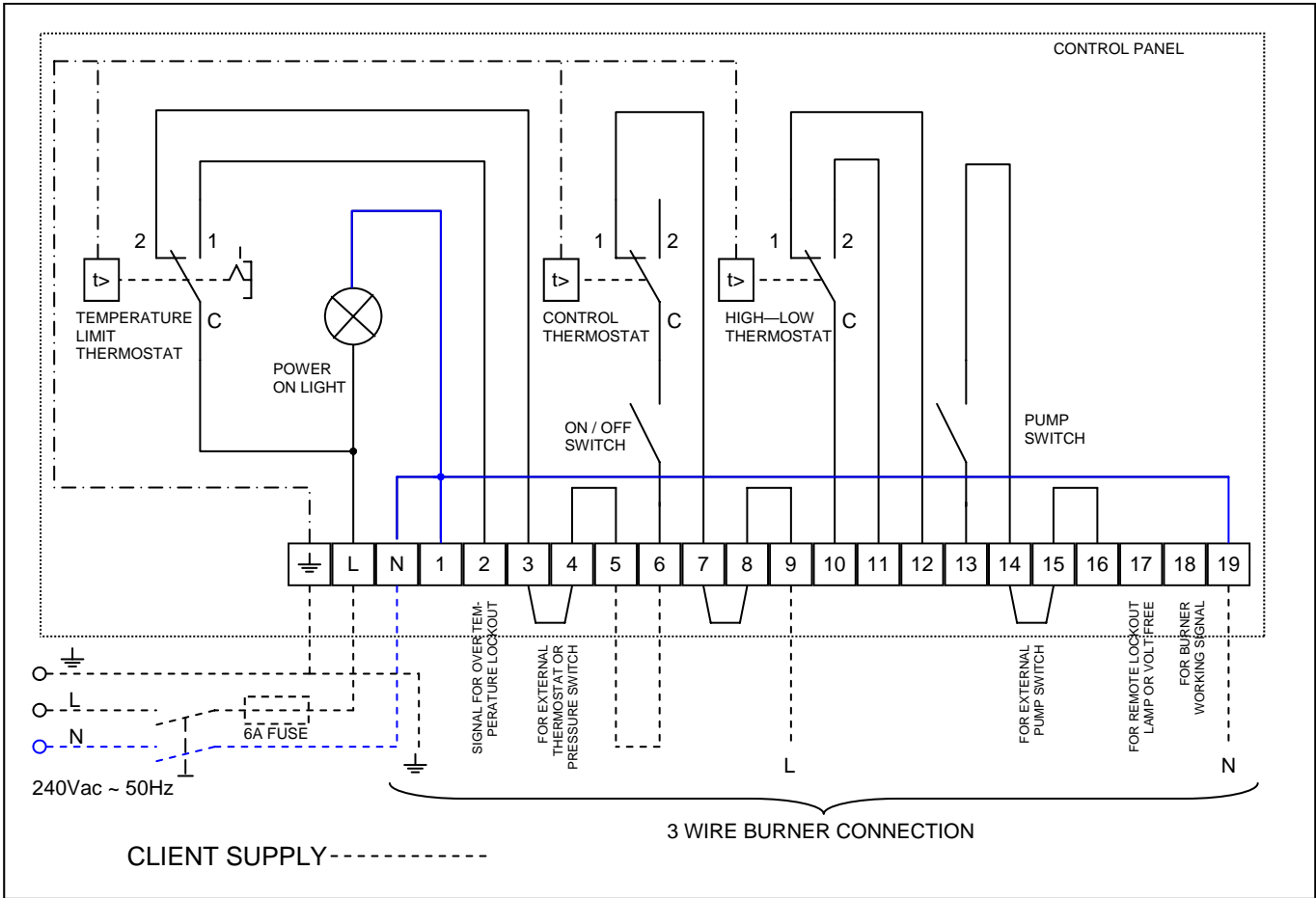


Fig. 5. Boiler Control Panel Wiring Diagram For 3 Wire Burner Connection.

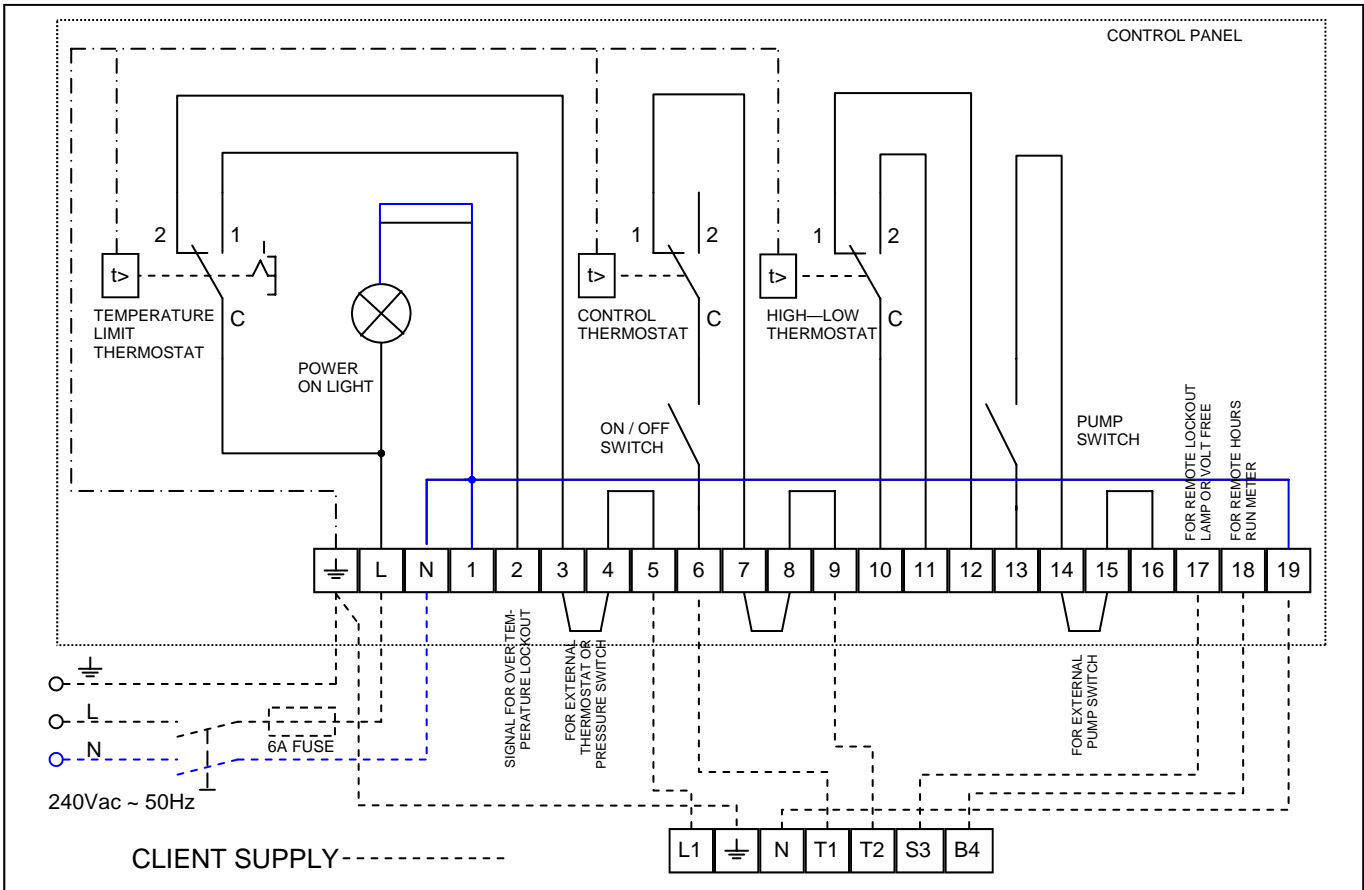
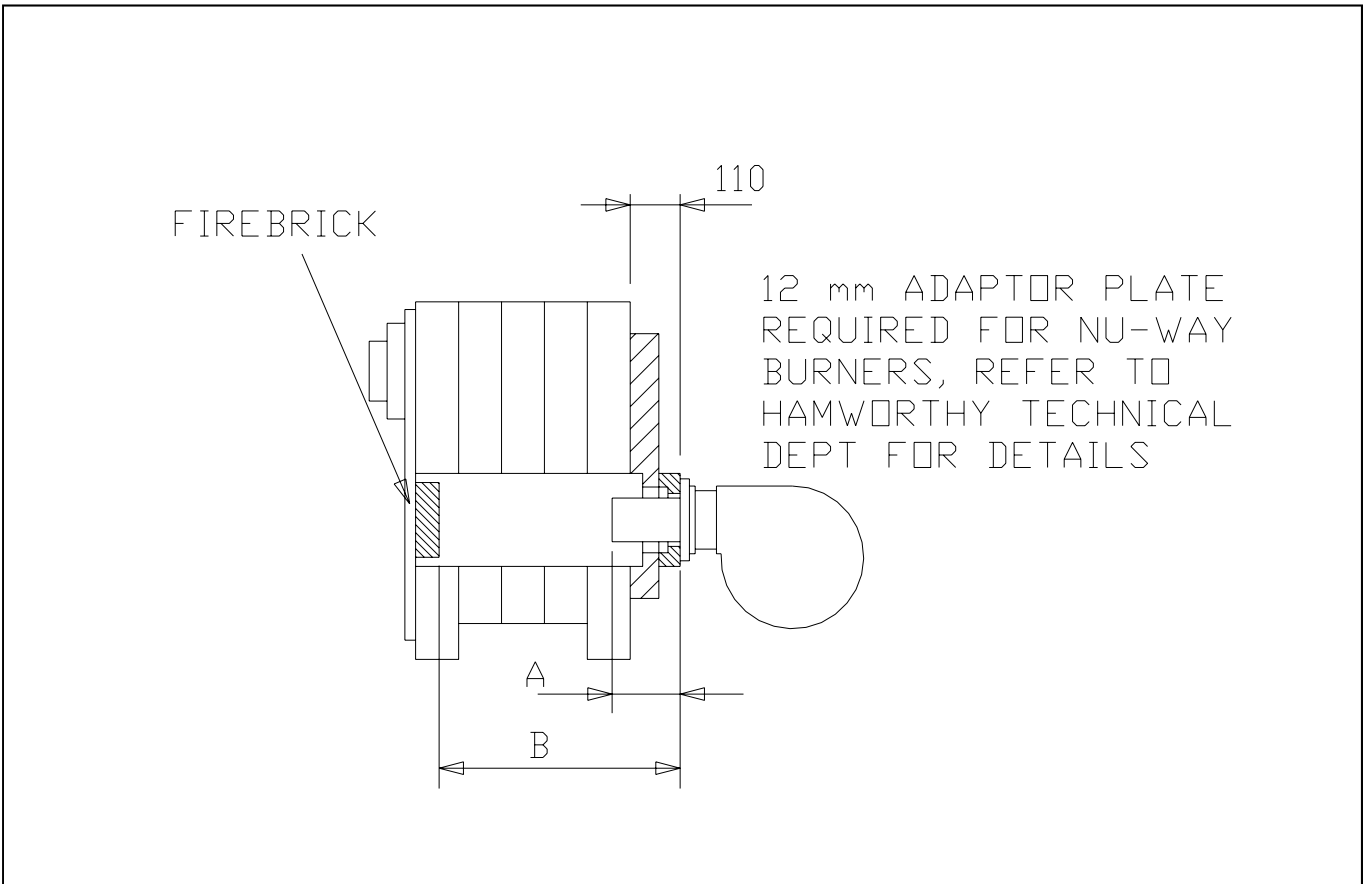


Fig. 6. Boiler Control Panel Wiring Diagram For 7 Pin Burner Plug



DESCRIPTION	LILLIPUT	
	HE 65	HE 90
Combustion Chamber Diameter (mm)	260	260
Combustion Chamber Length (mm)	616	776
Combustion Chamber Type	Reversed	
BURNER TYPE FOR GAS INSTALLATIONS		
Burner Manufacturer RIELLO	BURNER MODEL	
	40 GS10	40 GS10
Blast Tube Penetration Dimension 'A' (mm)	110	110
Burner Manufacturer NU-WAY	BURNER MODEL	
	STG 146/2	STG 146/2
Blast Tube Penetration Dimension 'A' (mm)	108	108

Fig. 7. Combustion Chamber And Burner Data

NOTES

INSTALLER	SITE ADDRESS
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BOILER TYPE	BOILER SIZE(S)	UNIT NO(S).	SERIAL NO(S).	FLUE
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