

GENUS 27 PLUS



Installation Instructions Type C Boilers

G.C.N: 47-116-11

LEAVE THESE INSTRUCTIONS
WITH THE END USER



*The code of practice for the installation,
commissioning & servicing of central heating systems*

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1. GENERAL INFORMATION

This manual is an integral and essential part of the product. It should be kept with the appliance so that it can be consulted by the user and our authorised personnel.

Please carefully read the instructions and notices about the unit contained in this manual, as they provide important information regarding the safe installation, use and maintenance of the product.

For operating instructions please consult the separate User's Manual.



1.1 General Information

Read the instructions and recommendations in these Installation Instructions carefully to ensure proper installation, use and maintenance of the appliance.

Keep this manual in a safe place. You may need it for your own reference while our Servicing Centre technicians or your installer may need to consult it in the future.

This is a combined appliance for the production of central heating (C.H.) and domestic hot water (D.H.W.).

This appliance **must be used only** for the purpose for which it is designed. The manufacturer declines all liability for damage caused by improper or negligent use.

No asbestos or other hazardous materials have been used in the fabrication of this product.

Before connecting the appliance, check that the information shown on the data plate and the table on pages 4-5 comply with the electric, water and gas mains of the property. You will find the data plate on the reverse of the control panel. The gas with which this appliance operates is also shown on the label at the bottom of the boiler.

Do not install this appliance in a damp environment or close to equipment which spray water or other liquids.

Do not place objects on the appliance.

Do not allow children or inexperienced persons to use the appliance without supervision.

If you smell gas in the room, **do not turn on** light switches, use the telephone or any other object which might cause sparks.

Open doors and windows immediately to ventilate the room.

Shut the gas mains tap (on the gas meter) or the valve of the gas cylinder and call your Gas Supplier immediately.

If you are going away for a long period of time, remember to shut the mains gas tap or the gas cylinder valve.

Always disconnect the appliance either by unplugging it from the mains or turning off the mains switch before cleaning the appliance or carrying out maintenance.

In the case of faults or failure, switch off the appliance and turn off the gas tap. Do not tamper with the appliance.

For repairs, call your local Authorised Servicing Centre and request the use of original spare parts. For in-guarantee repairs contact MTS (GB) Limited

Check the following at least once a year:

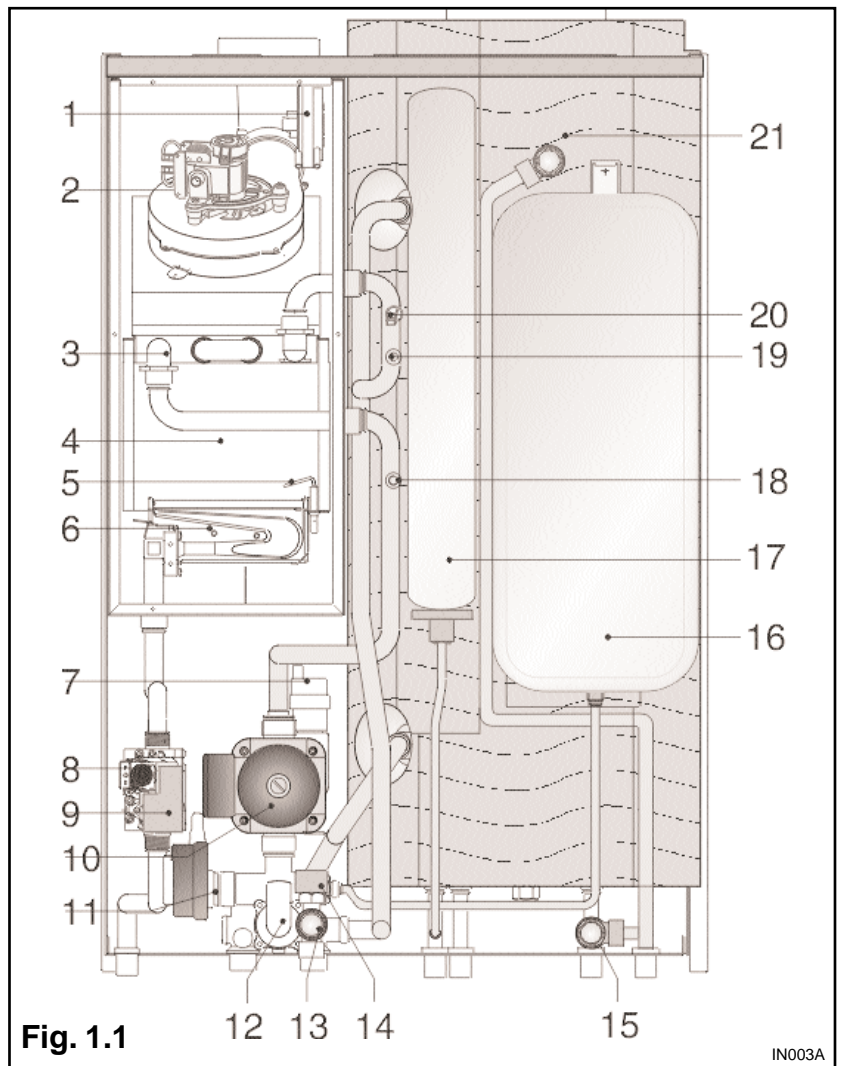
- 1 - Check the seal of water connections, replacing the gaskets if necessary.
- 2 - Check the seal of the gas connections, replacing the gaskets if necessary.
- 3 - Check the general condition of the appliance and of the combustion chamber visually.
- 4 - Visual check of the combustion: clean burners if necessary.
- 5 - With reference to point 3, dismantle and clean the combustion chamber if necessary.

- 6 - With reference to point 4, dismantle and clean the injectors if necessary.
- 7 - Visual check of the primary heat exchanger:
 - check for overheating of the exchangers fins;
 - clean the exhaust side of the exchanger and fan if necessary.
- 8 - Regulate the gas pressure, ignition pressure, partial flame, maximum flame.
- 9 - Check proper operation of the heating safety system:
 - maximum safety temperature;
 - maximum safety pressure.
- 10 - Check the proper operation of the gas safety system:
 - gas or flame safety device;
 - gas valve safety device.
- 11 - Check that the electrical connections have been made in compliance with the instructions shown in the Installation Instructions.
- 12 - Check the efficiency of the hot water supply (flow and temperature).
- 13 - Check pressure in the Domestic Expansion Vessel and top up as necessary.
- 14 - Check manually by turning the test knob the Temperature & Pressure Relief Valve.
- 15 - Check manually by turning the test knob the Expansion Relief Valve.
- 16 - Check discharge pipes from both the central heating and domestic hot water for obstructions.
- 17 - Check general operation of the appliance.
- 18 - Check the exhaust system for the combustion products.

1.2 Overall View

Legend:

1. Air Pressure Switch
2. Fan
3. Main Heat Exchanger
4. Combustion Chamber
5. Ignition Electrodes and Detection Electrodes
6. Burner
7. Automatic air release valve
8. Gas Valve
9. Spark Generator
10. Circulation Pump
11. Motorised Valve with by-pass
12. Main Circuit Flow Switch
13. Safety Valve (3 bar)
14. Low pressure switch
15. Expansion relief valve (6 bar)
16. C.H. expansion Vessel
17. D.H.W. expansion Vessel
18. Drain point
19. C.H.W. Probe
20. Overheat Thermostat
21. D.H.W. Storage with insulation shell



2. INSTALLATION

The technical information and instructions provided herein below are intended for the installer so that the unit may be installed correctly and safely.

2.1 Reference Standards

WATER REGULATIONS

These regulations ensure a good supply of wholesome water, and that only approved materials, pipes and fittings are used to convey water.

BUILDING REGULATIONS

These are a statutory document and take priority over all other regulations and recommendations. The installation of an unvented hot water storage cylinder is classified as a "Controlled Service" and Regulation G3 applies. To meet the requirements of the Regulation, installation of an unvented system should be undertaken by a "competent installer".

All installations of unvented hot water storage systems having a capacity of more than 15 litres should be notified to the relevant Local Authority by means of building notice or by the submission of full plans. It is important to note that it is a criminal offense to install an unvented hot water storage system without notifying the Local Authority.

The installation and initial startup of the boiler must be by a CORGI Approved Installer in compliance with the installation standards currently in effect, as well as with any and all local health and safety standards i.e. CORGI.

The installation of this appliance must be in accordance with the relevant requirements of the current Gas Safety (installation & use) Regulations, the Local Building Regulations, the current I.E.E. Wiring Regulations, the byelaws of the local water authority, and in Scotland, in accordance with the Building Standards (Scotland) Regulation and Health and Safety document No. 635 "Electricity at work regs. 1989". Installation should also comply with the following British Standard Codes of Practice:

BS 7593:1992	Treatment of water in domestic hot water central heating systems
BS 5546:1990	Installation of hot water supplies for domestic purposes
BS 5440-1:1990	Flues
BS 5440-2:1989	Air supply
BS 5449:1990	Forced circulation hot water systems
BS 6789:1987	Installation of gas fired hot water boilers
BS 6891:1989	Gas installations
BS 7671:1992	IEE wiring regulations
BS 4814:1990	Specification for expansion vessels
BS 5482:1994	Installation of LPG

2.2 Siting the Appliance

The appliance may be installed in any room or indoor area, although particular attention is drawn to the requirements of the current I.E.E. Wiring Regulations, and in Scotland, the electrical provisions of the Building Regulations applicable in Scotland, with respect to the installation of the combined appliance in a room containing a bath or shower.

Where a room-sealed appliance is installed in a room containing a bath or shower the boiler and any electrical switch or appliance control, utilising mains electricity should be situated so that it cannot be touched by a person using the bath or shower.

The location must permit adequate space for servicing and air circulation around the appliance as indicated in paragraph 2.4.

The location must permit the provision of an adequate flue and termination.

For unusual locations special procedures may be necessary.

BS 6798-1987 gives detailed guidance on this aspect.

A compartment used to enclose the appliance must be designed specifically for this purpose. No specific ventilation requirements are needed for an installation within a cupboard

This appliance is not suitable for outdoor installation.

The type C appliances (in which the combustion circuit, air vent intake and combustion chamber are air-tight with respect to the room in which the appliance is installed) can be installed in any type of room.

There are no limitations with respect to ventilation and the volume of the room itself. The boiler must be installed on a solid, permanent wall to prevent access to the electrical parts (when live) through the aperture on the back frame.

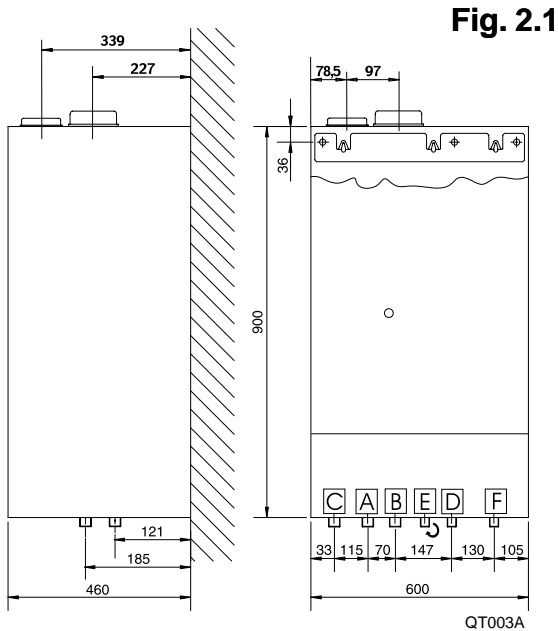


Fig. 2.1

2.3 Overall Dimensions

Legend:

- A = Central Heating Return (3/4")
- B = Central Heating Flow (3/4")
- C = Gas Inlet (3/4")
- D = Domestic Hot Water Outlet (1/2")
- E = Secondary return (1/2")
- F = Domestic Cold Water Inlet (1/2")

2.4 Clearances

In order to allow for access to the interior of the boiler for maintenance purposes, the boiler must be installed in compliance with the clearance requirements indicated in the diagram below.

2.5 Mounting the Appliance

Fasten the boiler in place using the template and anchors supplied with the unit. It is highly recommended that a spirit level be used to position the boiler so that it is perfectly level. For additional information, please consult the instructions contained in the connection kit and the flue kit.

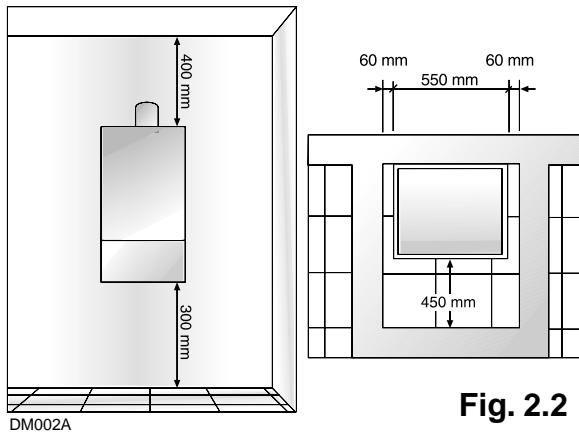


Fig. 2.2

2.6 Electrical Connection

For safety purposes, have a competent person carefully check the electrical system in the property, as the manufacturer will not be held liable for damage caused by the failure to earth the appliance properly or by anomalies in the supply of power. Make sure that the residential electrical system is adequate for the maximum power absorbed by the unit, which is indicated on the rating plate. In addition, check that the section of cabling is appropriate for the power absorbed by the boiler.

The boiler operates with alternating current, as indicated in the technical data table (7), where the maximum absorbed power is also indicated. Make sure that the connections for the neutral and live wires correspond to the indications in the diagram. The appliance electrical connections are situated on the reverse of the control panel (see the servicing manual for further information)

Important!

In the event that the power supply cord must be changed, replace it with one with the same specifications. Make the connections to the terminal board located within the control panel, as follows:

- The yellow-green wire should be connected to the terminal marked with the earth symbol; make sure to re-use the ferrule mounted on the other supply cord;
- The blue wire should be connected to the terminal marked "N";
- The brown wire should be connected to the terminal marked "L".

Note: The diagrams for the electrical system are indicated in section 2.11.

Warning, this appliance must be earthed.

External wiring to the appliance must be carried out by a qualified technician and be in accordance with the current I.E.E. Regulations and applicable local regulations. The Genus range of boilers are supplied for connection to a 230 V \sim 50 Hz supply.

The supply must be fused at 3 A.

The method of connection to the electricity supply must facilitate complete electrical isolation of the appliance, by the use of a fused double pole isolator having a contact separation of at least 3 mm in all poles or alternatively, by **means of a 3 A** fused three pin plug and

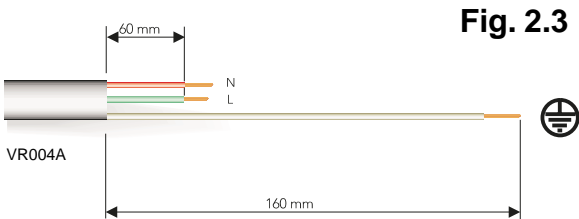


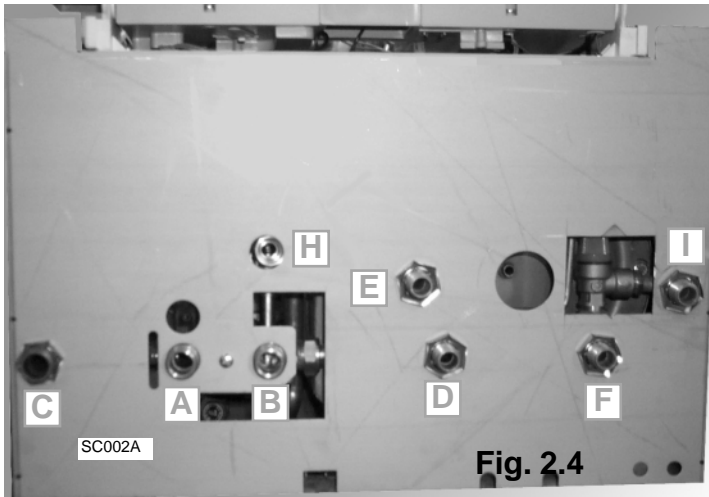
Fig. 2.3

unswitched shuttered socket outlet both complying with BS 1363.
The point of connection to the Electricity supply must be readily accessible and adjacent to the appliance unless the appliance is installed in a bathroom when this must be sited outside the bathroom.

2.7 Gas Connection

The local gas region contractor connects the gas meter to the service pipe.
If the gas supply for the boiler serves other appliances ensure that an adequate supply is available both to the boiler and the other appliances when they are in use at the same time.
Pipe work must be of an adequate size. Pipes of a smaller size than the boiler inlet connection should not be used.

2.8 Water Connections



View of the Boiler Connections

Legend:

- A = Central Heating Return (3/4")
- B = Central Heating Flow (3/4")
- C = Gas Inlet (3/4")
- D = Domestic Hot Water Outlet (1/2")
- E = Secondary return (1/2")
- F = Domestic Cold Water Inlet (1/2")
- H = Central Heating Discharge
- I = Domestic Hot Water Discharge

Fig. 2.4

Central Heating

Detailed recommendations are given in BS 6798:1987 and BS 5449-1:1990, the following notes are given for general guidance.

Pipe Work:

Copper tubing to BS EN 1057:1996 is recommended for water pipes. Jointing should be either with capillary soldered or compression fittings.

Where possible pipes should have a gradient to ensure air is carried naturally to air release points and water flows naturally to drain taps.

The appliance has a built-in automatic air release valve, however it should be ensured as far as possible that the appliance heat exchanger is not a natural collecting point for air.

Except where providing useful heat, pipes should be insulated to prevent heat loss and avoid freezing.

Particular attention should be paid to pipes passing through ventilated spaces in roofs and under floors.

By-pass:

The appliance includes an automatic by-pass valve, which protects the main heat exchanger in case of reduced or interrupted water circulation through the heating system, due to the closing of thermostatic valves or cock-type valves within the system.

System Design:

This boiler is suitable only for sealed systems.

Drain Cocks:

These must be located in accessible positions to permit the draining of the whole system. The taps must be at least 15mm nominal size and manufactured in accordance with BS 2870:1980.

Safety Valve Discharge:

The discharge should terminate facing downwards on the exterior of the building in a position where discharging (possibly boiling water & steam) will not create danger or nuisance, but in an easily visible position, and not cause damage to electrical components and wiring.

The discharge must not be over an entrance or a window or any other type of public access.

Discharge pipework

- 1) The tundish must be installed directly below the discharge outlet connection of the boiler. The tundish must also be in a position visible to the occupants, and positioned away from any electrical devices. The discharge pipe from the tundish should terminate in a safe place where there is no risk to persons in the vicinity of the discharge and to be of metal.
- 2) Discharge pipes from the temperature & pressure relief are expansion relief valve are joined together within the appliance.
- 3) The pipe diameter must be at least one pipe size larger than the nominal outlet size of the safety device unless it's total equivalent hydraulic resistance exceeds that of a straight pipe 9m long.
I.e. Discharge pipes between 9m and 18m equivalent resistance length should be at least 2 sizes larger than the nominal outlet size of the safety device. Between 18m and 27m at least 3 sizes larger, and so on.
Bends must be taken into account in calculating the flow resistance.
See fig. 2.4.1 and Table 1.
- 4) The discharge pipe must have a vertical section of pipe at least 300mm in length, below the tundish before any elbows or bends in the pipework.
- 5) The discharge pipe must be installed with a continuous fall.
- 6) The discharge must be visible at both the tundish and the final point of discharge, but where this is not possible or practically difficult; there should be clear visibility at one or other of these locations. Examples of acceptance are:
 - i) Ideally below a fixed grating and above the water seal in a trapped gully.
 - ii) Downward discharges at a low level; i.e. up to 100mm above external surfaces such as car parks, hard standings, grassed areas etc. These are acceptable providing that where children may play or otherwise come into contact with discharges, a wire cage or similar guard is positioned to prevent contact, whilst maintaining visibility.
 - iii) Discharges at high level; I.e. into a metal hopper and metal down pipe with the end of the discharge pipe clearly visible (tundish visible or not). Or onto a roof capable of withstanding high temperature discharges of water 3m from any plastic guttering systems that would take such a discharge (tundish visible).
 - iv) Where a single pipe serves a number of discharges, such as in blocks of flats, the number served should be limited to not more than 6 systems so that any installation can be traced reasonably easily. The single common discharge pipe should be at least one pipe size large than the largest individual discharge pipe to be connected. If unvented hot water storage systems are installed where discharges from safety devices may not be apparent I.e. in dwellings occupied by the blind, infirm or disabled people, consideration should be given to the installation of an electronically operated device to warn when discharge takes place.

Note: The discharge will consist of scalding water and steam. Asphalt, roofing felt and non-metallic rainwater goods may be damaged by such discharges.

Warning
The outlet from the temperature & pressure relief valve must not be used for any other purpose.

The temperature & pressure relief valve must not be removed in any circumstances. Any of the above will totally invalidate the warranty.

Note
The discharge from the central heating and domestic hot water systems may be joined together after the tundish.

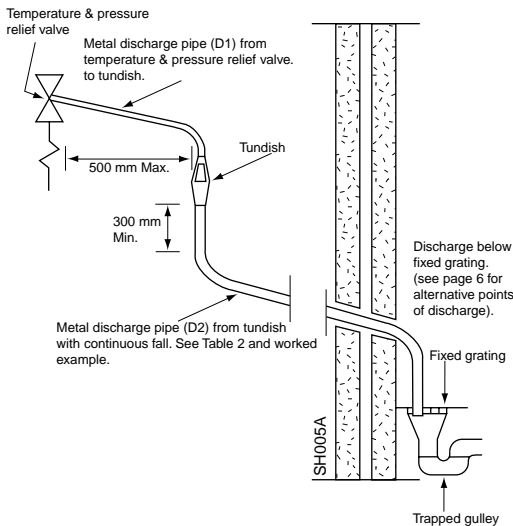


Fig. 2.4.1

Table 1. Sizing of copper discharge pipe "D2" for common temperature valve outlet sizes.

Valve outlet size	Minimum size of discharge pipe D1*	Minimum size of discharge pipe D2* from tundish	Maximum resistance allowed, expressed as a length of pipe (i.e. no elbow or bends)	Resistance created by each elbow or bend
G 1/2	15 mm	22 mm	Up to 9 m	0.8 m
		28 mm	Up to 18 m	1.0 m
		35 mm	Up to 27 m	1.4 m
G 3/4	22 mm	28 mm	Up to 9 m	1.0 m
		35 mm	Up to 18 m	1.4 m
		42 mm	Up to 27 m	1.7 m
G 1	28 mm	35 mm	Up to 9 m	1.4 m
		42 mm	Up to 18 m	1.7 m
		54 mm	Up to 27 m	2.3 m

WORKED EXAMPLE

The example below is for a G 1/2 Temperature & Pressure Relief valve with a discharge pipe (D2) having 4 no. elbows and length of 7m from the Tundish to the point of discharge. From Table 1

Maximum resistance allowed for a straight length of 22mm copper discharge pipe (D2) from G 1/2 T & P valve is 9m.

Subtract the resistance for 4 no. 22mm elbows at 0.8m each = 3.2m.

Therefore the maximum permitted length equates to: 5.8m.

As 5.8m is less than the actual length of 7m therefore calculate the next largest size.

Maximum resistance allowed for a straight length of 28mm pipe (D2) from G 1/2 T & P valve equates to: 18m.

Subtract the resistance for 4 no. 28mm elbow at 1.0m each = 4m.

Therefore the maximum permitted length equates to: 14m

As the actual length is 7m, a 28mm (D2) copper pipe will be satisfactory.

Air Release Points:

These must be fitted at all high points where air naturally collects and must be sited to facilitate complete filling of the system.
 The appliance has an integral sealed expansion vessel to accommodate the increase of water value when the system is heated.
 It can accept up to 7 l (1.5 gal) of expansion water. If the heating circuit has an unusually high water content, calculate the total expansion and add an additional sealed expansion vessel with adequate capacity.

Mains Water Feed - Central Heating:

There must be no direct connection to the mains water supply even through a non-return valve, without the approval of the Local Water Authority.

Filling:

A temporary method for initially filling the system and replacing lost water during servicing and initial filling (complying to current water regulations) must be provided. The flexible hose must be removed once the system has been filled. The D.H.W. inlet valve on the connection kit has two positions, one for winter and one for the summer. This enables the flow-rate through the appliance to be adjusted so that a sensible D.H.W. temperature may be achieved throughout the year.

Domestic Water

The domestic water must be in accordance with the relevant recommendation of BS 5546:1990. Copper tubing to BS EN 1057:1996 is recommended for water carrying pipe work and must be used for pipe work carrying drinking water.

Note: This appliance is capable of producing domestic hot water of up to 70°C. For extra security against scalding a thermostatic blending valve may be installed on the domestic hot water outlet.

Secondary Return

The secondary return can be used as an option. A Non Return Valve (not supplied) must be fitted to prevent back flow and a Bronze Pump will be needed in conjunction with a Pipe Thermostat to circulate the hot water (both not supplied).

Residual Head of the Boiler

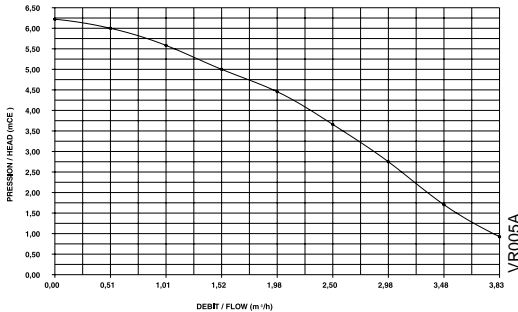
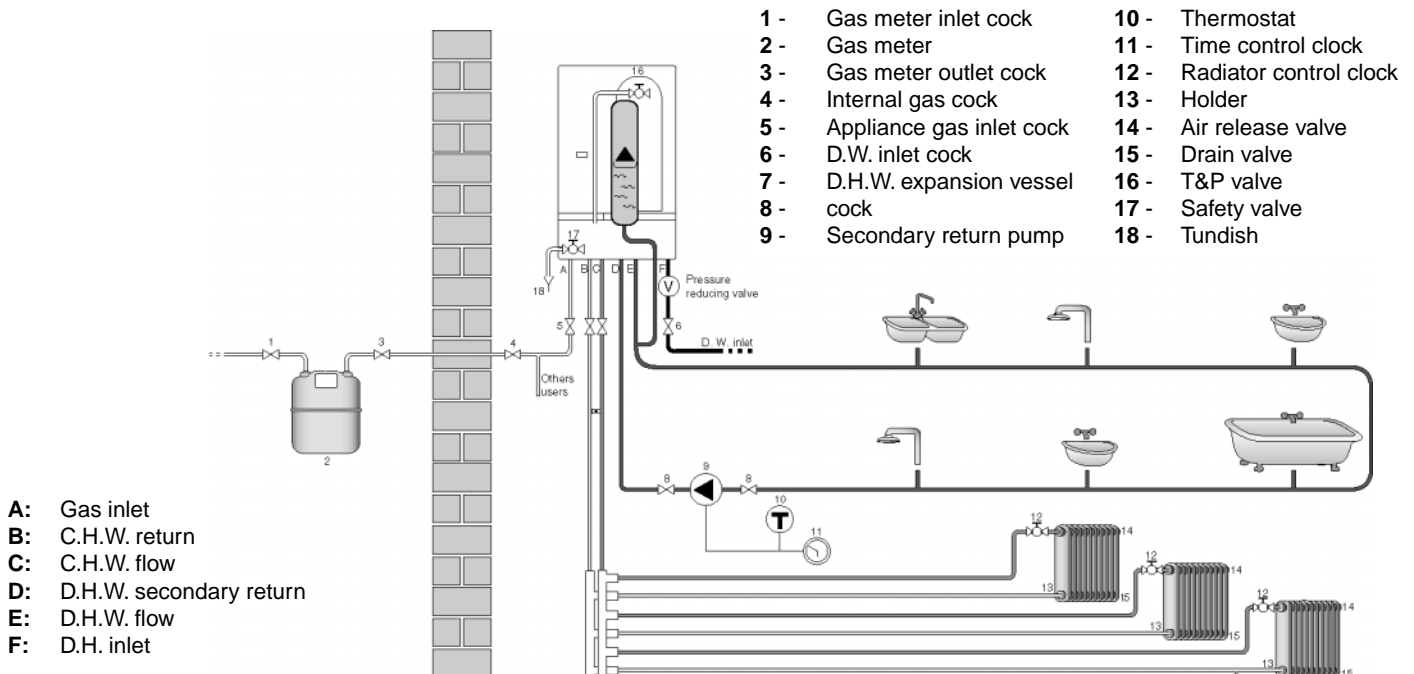


Fig. 2.5



- A: Gas inlet
- B: C.H.W. return
- C: C.H.W. flow
- D: D.H.W. secondary return
- E: D.H.W. flow
- F: D.H. inlet

- 1 - Gas meter inlet cock
- 2 - Gas meter
- 3 - Gas meter outlet cock
- 4 - Internal gas cock
- 5 - Appliance gas inlet cock
- 6 - D.W. inlet cock
- 7 - D.H.W. expansion vessel
- 8 - cock
- 9 - Secondary return pump
- 10 - Thermostat
- 11 - Time control clock
- 12 - Radiator control clock
- 13 - Holder
- 14 - Air release valve
- 15 - Drain valve
- 16 - T&P valve
- 17 - Safety valve
- 18 - Tundish

Fig. 2.5.1

2.9 Flue Connections

Flue System

The provision for satisfactory flue termination must be made as described in BS 5440-1.

The appliance must be installed so that the flue terminal is exposed to outdoor air.

The terminal must not discharge into another room or space such as an outhouse or lean-to.

It is important that the position of the terminal allows a free passage of air across it at all times.

The terminal should be located with due regard for the damage or discolouration that might occur on buildings in the vicinity.

In cold or humid weather water vapour may condense on leaving the flue terminal.

The effect of such "steaming" must be considered.

If the terminal is less than 2 metres above a balcony, above ground or above a flat roof to which people have access, then a suitable terminal guard must be fitted. When ordering a terminal guard, quote the appliance model number.

A suitable terminal guard is available from:

TOWER FLUE COMPONENTS

Morley Road

Tonbridge

Kent TN9 1RA

The minimum acceptable spacing from the terminal to obstructions and ventilation openings are specified in Fig. 2.6

The boiler is designed to be connected to a coaxial flue discharge system.

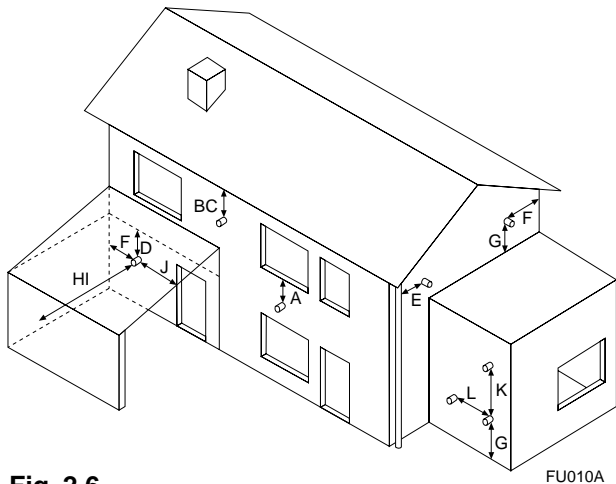
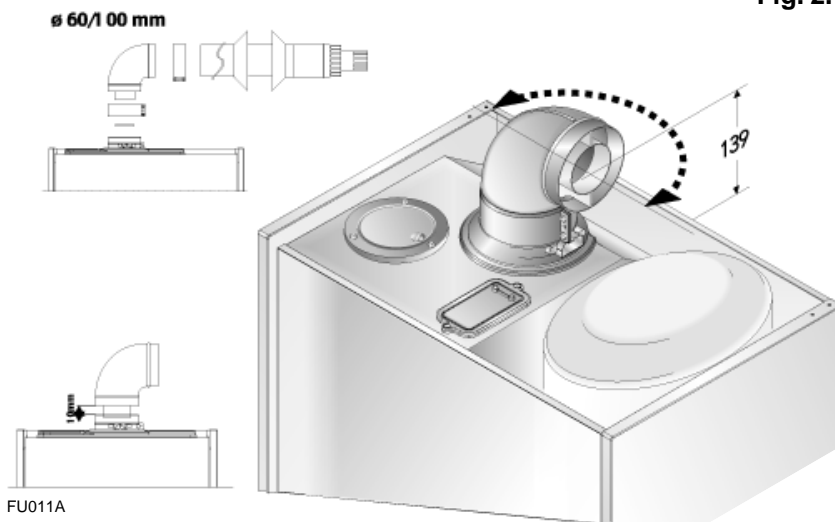


Fig. 2.6

FU010A

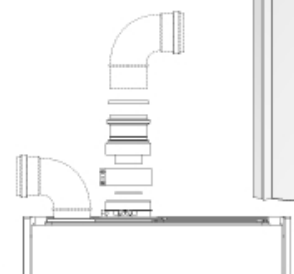
TERMINAL POSITION	mm
A - Directly below an open window or other opening	300
B - Below gutters, solid pipes or drain pipes	75
C - Below eaves	200
D - Below balconies or car-port roof	200
E - From vertical drain pipes and soil pipes	75
F - From internal or external corners	300
G - Above ground or below balcony level	300
H - From a surface facing a terminal	600
I - From a terminal facing a terminal	1200
J - From an opening in the car port (e.g. door, window) into dwelling	1200
K - Vertically from a terminal in the same wall	1500
L - Horizontally from a terminal in the same wall	300

Fig. 2.7



FU011A

In addition, it is also possible to use a split system by fitting a special adapter to the flue discharge collar and using one of the apertures for the air vent intake located on the top part of the combustion chamber (A).



FU012A

Fig. 2.8

FU013A

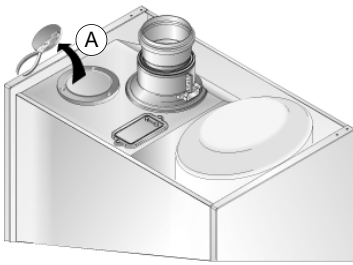


Fig. 2.9

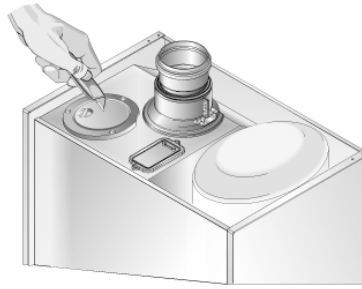


Fig. 2.10

- This procedure must be done as follows:
- 1 - Remove the air vent intake in the area indicated in Fig. 2.9, by breaking the perforated ring.
 - 2 - Use a tool to grasp the lid and remove it completely.
 - 3 - Clean any burrs or sharp edges with a knife or an appropriate tool.

In Fig. 2.11 below, several different types of flue systems are shown. For additional information regarding the flue accessories, please consult the Flue Pipe Accessories manual.

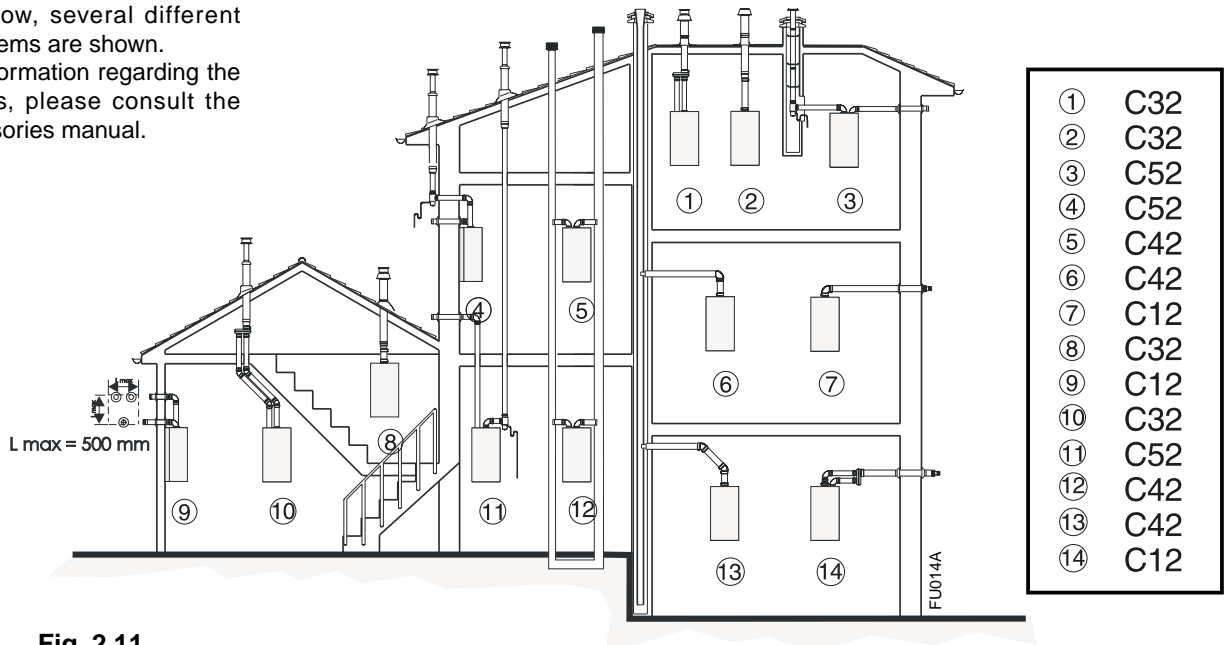


Fig. 2.11

	Exhaust Type	Maximum Extension Exhaust/Air	Diameter of Pipes (mm)	Use of \varnothing 42 mm Restrictor on Delivery Side	Risk of Condensation Forming
Coaxial System	C12 (xx)	4 m	\varnothing 60 /100	NO	
	C32 (xx)	4 m	\varnothing 60 /100	NO	
	C42 (xx)	4 m	\varnothing 60 /100	NO	
Split Systems	C12 (xy)	34 m	\varnothing 80	L < 4.5 m	L > 6.6 m
	C32 (xy)	34 m	\varnothing 80	L < 4.5 m	L > 6.6 m
	C42 (xy)	34 m	\varnothing 80	L < 4.5 m	L > 6.6 m
	C52 (xy)	56 m	\varnothing 80	L < 8 m	L > 5.8 m

(*) L = Length of Piping

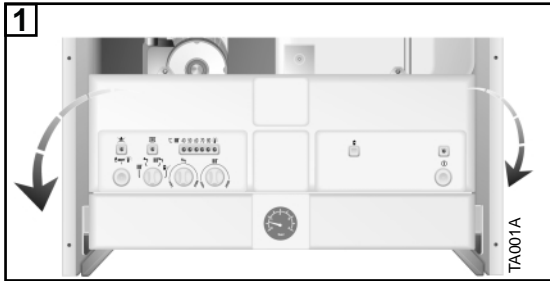
In calculating the lengths of the pipes, the maximum length must also take into consideration the values for the exhaust/air intake end terminals, as well as 90° elbows for coaxial systems.

The C52 types must comply with the following requirements:

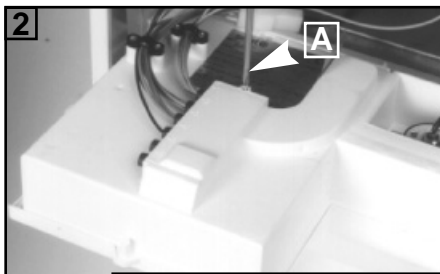
1. The discharge/intake vent pipes must have the same diameter of \varnothing 80 mm.
2. If an elbow is inserted into the discharge/ventilation system, the calculation of the overall extension must take into consideration the values for each curve, as indicated in the table.
3. The exhaust pipe must extend at least 0.5 m above the ridge of the roof if it is located on a side other than that for the air intake (this is not obligatory if the exhaust and air intake pipes are located on the same side of the building).

2.10 Room Thermostat Connection

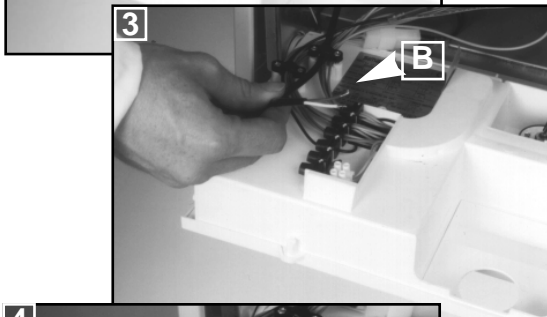
In order to perform this procedure, remove the boiler casing as indicated in section 3.2. Then proceed as follows:



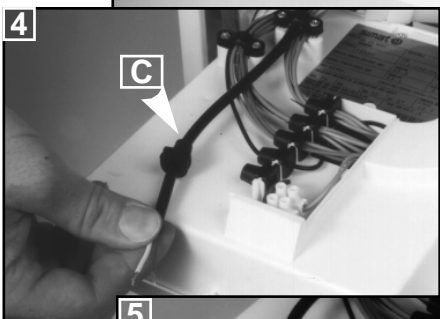
1 Rotate down the control panel.



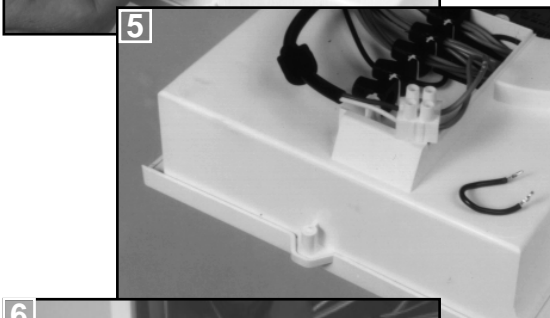
2 Open the cover "A" on the left hand side of the compartment.



3 Insert the wire for the connection of the room thermostat into the cable clamp "B", as indicated in photo 3.



4 Remove the grommet "C" shown in the photo 4, make a hole in it and pass the room thermostat wire through.



5 Remove the link located in the terminal block and connect the wire.



6 Replace the grommet and the terminal block to their original positions, close the cover on the grommet compartment and fasten the wire-clamp "B" in place.

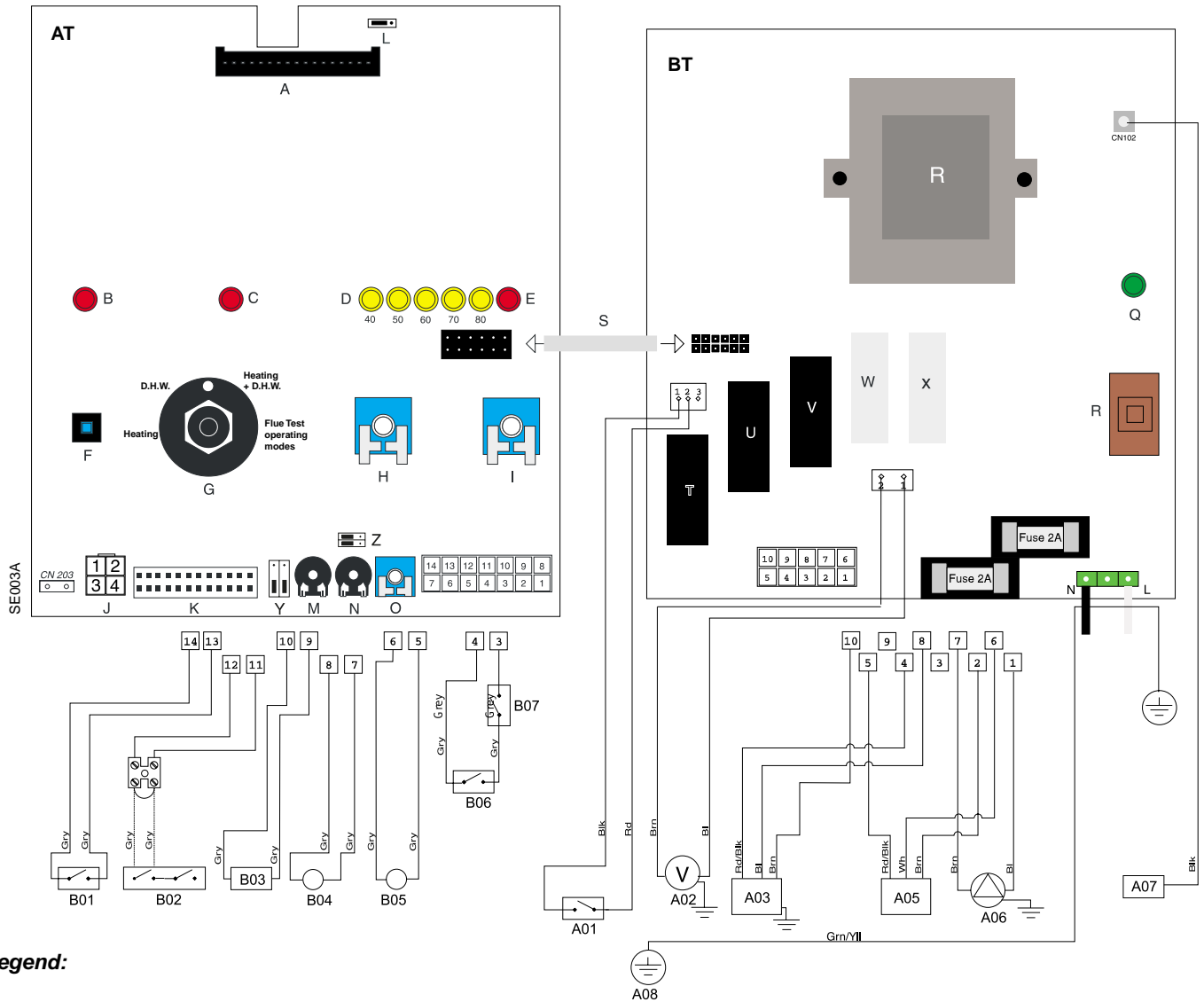
7 If a remote time clock is to be fitted, disconnect the integral time clock plug from the P.C.B.

8 Using a volt-free switching time clock, connect the switching wires from the time clock following points 1-6 above.

9 If using a time clock and room thermostat, these must be connected in series as per points 1-8 above.

Note: Only a two-wire type room thermostat can be used.
An anti-frost device is built-in to the appliance's electronic regulation system.

2.11 Electrical Diagram



Legend:

AT = High Voltage P.C.B.
 BT = Low Voltage P.C.B.

A = Remote Connector Kit
 B = Flame Failure L.E.D.
 C = Insufficient Water Pressure L.E.D.
 D = Water Temperature Indicator L.E.D.s
 E = Overheat Thermostat Warning L.E.D.
 F = System Reset Button
 G = Selector Knob for Operating Mode
 H = Domestic Hot Water Temp. Adjustment
 I = Central Heating Temp. Adjustment
 J = Wire Connector for Room Thermostat
 K = Connector for Total Check System
 L = Selector for Local/Remote Control
 M = Anti-cycling Device Adjustment for Heating
 N = Soft-light Adjustment
 O = Max Heating Temperature Adjustment
 P = Time Clock Connection
 Q = On/Off L.E.D.
 R = On/Off Switch
 S = Interface Wire for P.C.B.s
 T = Relay Motorised Valve
 U = Ignitor Relay
 V = Gas Valve Relay
 W = Fan Relay
 X = Circulation Pump Relay
 Y = Selector TCS2
 Z = Link for Continuous Pump Run

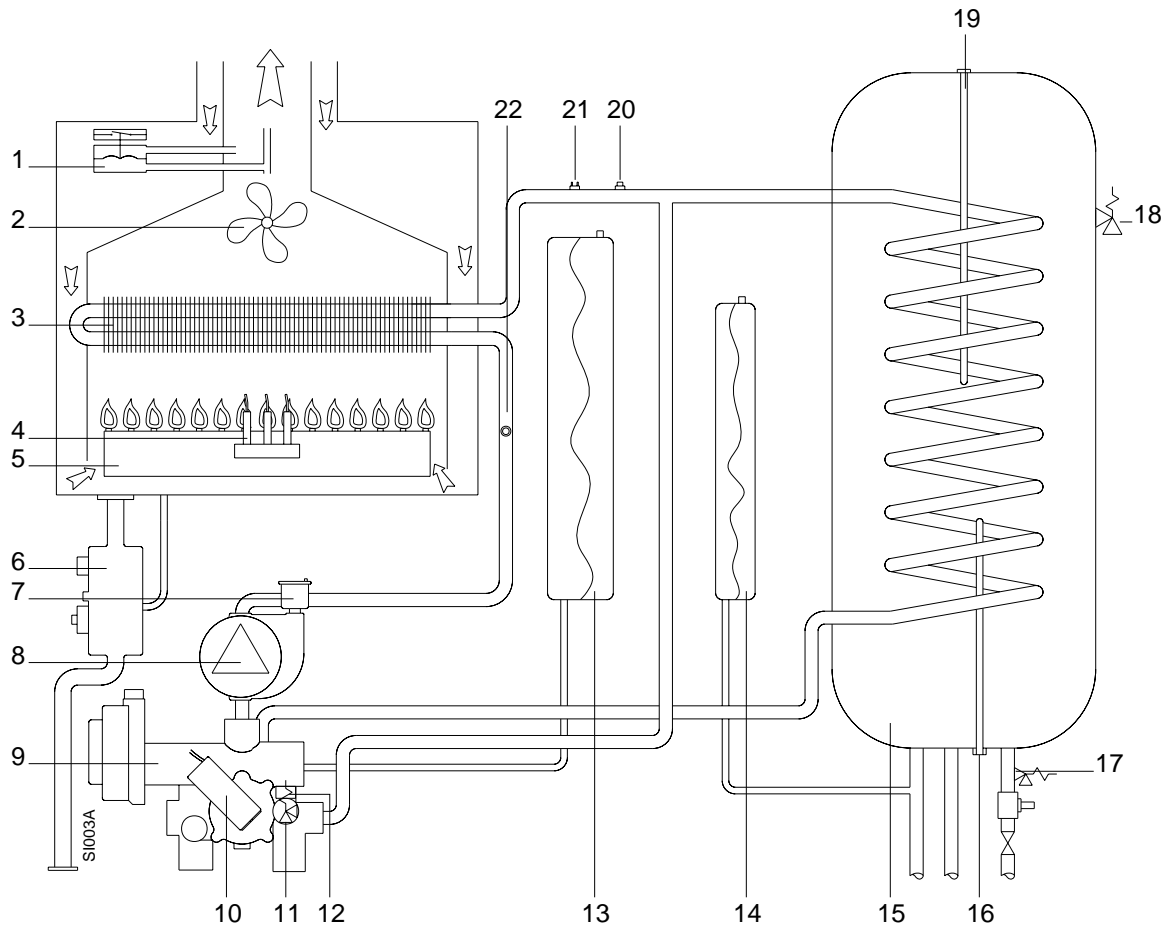
A01 = Air Pressure Switch
 A02 = Fan
 A03 = Gas Valve
 A05 = Motorised Valve
 A06 = Circulation Pump
 A07 = Flame Detector
 A08 = Earth Terminal

B01 = Over Heat Thermostat
 B02 = External Thermostat
 B03 = Gas Valve Modulator
 B04 = D.H.W. Probe Sensor Cylinder
 B05 = Heating Sensor
 B06 = Pressure Switch for Heating Circuit
 B07 = Minimum pressure switch

Colours

Gry = Grey
 Rd = Red
 Bl = Blue
 Grn/Yll = Yellow/Green
 Wh = White
 Brn = Brown
 Blk = Black
 Wh/Rd = White/Red

2.12 Water Circuit Diagram



Legend:

1. Air Pressure Switch
2. Fan
3. Main Heat Exchanger
4. Ignition Electrodes and Detection Electrodes
5. Burner
6. Gas Valve
8. Spark Generator
7. Automatic air release valve
8. Circulation Pump
9. Motorised Valve with by-pass
10. Main Circuit Flow Switch
11. Safety Valve (3 bar)
12. Low pressure switch
13. C.H. expansion Vessel
14. D.H.W. expansion Vessel
15. D.H.W. Storage with insulation shell
16. D.H.W. Probe
17. Expansion relief valve (6 bar)
18. Temperature/Pressure relief valve (7bar)
19. Magnesium anode
20. C.H.W. Probe
21. Overheat Thermostat
22. Drain point

3. COMMISSIONING

3.1 Initial Preparation

MTS (GB) Limited support the *benchmark* initiative. Within the information pack you will find a copy of the *benchmark* logbook. It is important that this is completed in the presence of your customer, they are shown how to use it, and it is signed by them. Please instruct your customer that they must have their *benchmark* logbook with them whenever they contact a service engineer or us.

Preliminary electrical system checks to ensure electrical safety must be carried out by a competent person i.e. polarity, earth continuity, resistance to earth and short circuit.

Filling the Heating System:

Remove the panels of the case and lower the control panel (see point 3.2. for further information). Open the central heating flow and return cocks supplied with the connection kit. Unscrew the cap on the automatic air release valve one full turn and leave open permanently. Close all air release valves on the central heating system. Gradually open valve(s) at the filling point (filling-loop) connection to the central heating system until water is heard to flow, do not open fully. Open each air release tap starting with the lower point and close it only when clear water, free of air, is visible.

Purge the air from the pump by unscrewing anticlockwise the pump plug and also manually rotate the pump shaft in the direction indicated by the pump label to ensure the pump is free.

Close the pump plug.

Continue filling the system until at least 1.5 bar registers on the pressure gauge. Inspect the system for water soundness and remedy any leaks discovered.

Filling of the D.H.W. System:

Close all hot water draw-off taps.

Open the cold water inlet cock supplied with the connection kit.

Open slowly each draw-off tap and close it only when clear water, free of bubbles, is visible

Gas Supply:

Inspect the entire installation including the gas meter, test for soundness and purge, all as described in BS 6891:1988.

Open the gas cock (supplied with the connection kit) to the appliance and check the gas connector on the appliance for leaks.

When the installation and filling are completed turn on the central heating system (sect. 3.4) and run it until the temperature has reached the boiler operating temperature. The system must then be immediately flushed through.

The flushing procedure must be in line with BS 7593:1992 Code of practice for treatment of water in domestic hot water central heating systems.

During this operation, we highly recommend the use of a central heating flushing detergent (Ferox Superfloc or equivalent), whose function is to dissolve any foreign matter that may be in the system.

Substances different from these could create serious problems to the pump or other components.

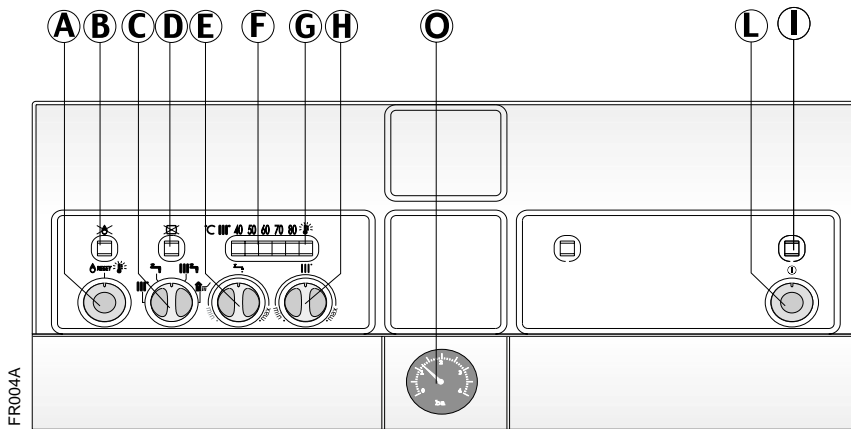
The use of an inhibitor in system such as Ferox MB-1 or equivalent is strongly recommended to prevent corrosion (sludge) damaging the boiler and system.

Failure to carry out this procedure may invalidate the appliance warranty.

3.2 Removing the Casing



3.3 Control Panel



Legend:

- A** Ignition Failure Reset/Safety Thermostat Reset
- B** L.E.D. for Ignition Failure
- C** Selector Knob for Summer/Winter/Flue Test Modes
- D** L.E.D. for Insufficient System Pressure
- E** Domestic Hot Water Temperature Control
- F** Central Heating Temperature Indicating Leds
- G** L.E.D. for Safety Thermostat (overheating)
- H** Heating Temperature Adjustment Knob
- I** L.E.D. for ON/OFF Switch
- L** ON/OFF Switch
- O** Heating System Pressure Gauge

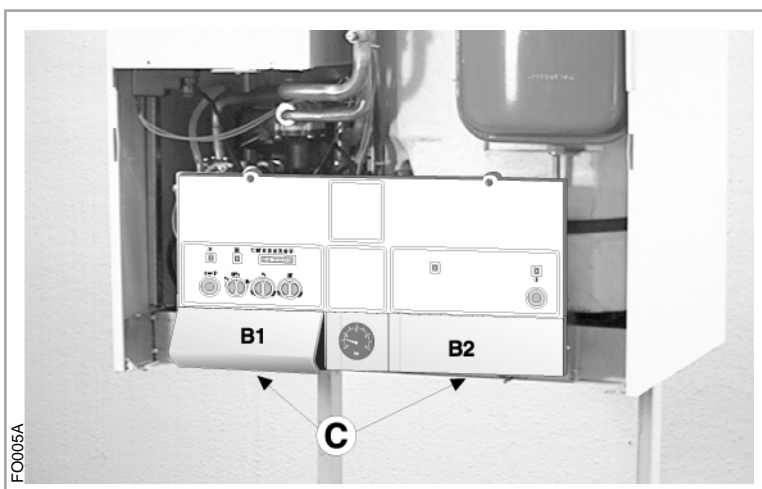
* Warning the flue analysis mode must only be selected by a qualified service engineer.

3.4 Initial Start-up

The checks to be run before initial start-up are as follows:

1. Make sure that:
 - the screw on the automatic air valve has been loosened when the system is full;
 - If the water pressure in the system is below 1.5 bar, bring it up to the appropriate level;
 - Check to see whether the gas cock is closed;
 - Make sure that the electrical connection has been made properly and that the earth wire is connected to an efficient earthing system;
 - Supply power to the boiler by pressing the On/Off switch <L> - the L.E.D. "I" will turn on - turn the selector knob "C" to the <winter> setting. This will start the circulation pump. After 7 seconds, the boiler will signal a shut-down due to failure ignition. Leave the boiler as it is until all of the air has been bled from the lines.
 - Loosen the cap on the head of the pump to eliminate any air pockets;
 - Repeat the procedure for bleeding the radiators of air;
 - Open the taps for a brief period;
 - Check the system pressure and, if it has dropped, open the filling loop again to bring the pressure back up to 1.5 bar.
2. Check the exhaust flue for the fumes produced by combustion.
3. Make sure that all gate valves are open;
4. Turn on the gas cock and check the seals on the connections, including the one for the burner, making sure that the meter does not signal the passage of gas. Check the connections with a soap solution and eliminate any leaks.
5. Press the reset button "A" for the lighting system; the spark will light the main burner. If the burner does not light the first time, repeat the procedure.
6. Check the minimum and maximum pressure values for the gas going to the burner; adjust it if needed using the values indicated in the table in section 4. (See sect of the servicing manual).

3.5 Operational Adjustments



The boiler was designed to make regulation easy. To access the adjustment and control area, simply remove the cover by unscrewing the screws "A" and "C" and lift up the small service panels "B1" and "B2" respectively.

The first provides access to the control (low voltage) P.C.B., while the second makes it possible to work on the power supply P.C.B. The service panel "B2" also provides access to:

- the power supply cord connector;
- the fuses;
- the selector knob for continuous operation of the circulation pump.

The service panel "B1" also provides access to:

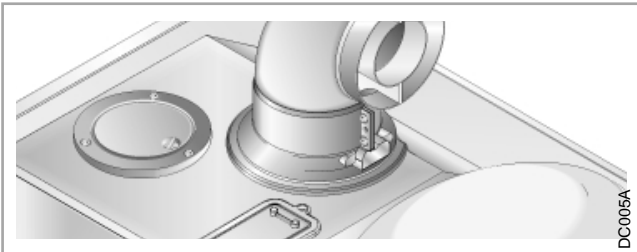
- the potentiometer for regulating the ignition delay (anti-cycling) feature, which can be set from 0 to 2 minutes (factory set at 1 minute);
- the potentiometer for regulating the soft-light feature, the set-

ting for which can range from the minimum thermal power to the maximum:

G20	5 mbar
G30-31	19 mbar

- the potentiometer for the maximum thermal power for the heating system, maximum thermal power setting (factory set at the maximum value, unless indicated otherwise on the adhesive sticker located in proximity to the potentiometer);
- The connection to the diagnosis device (TCS).

3.6 Combustion Analysis

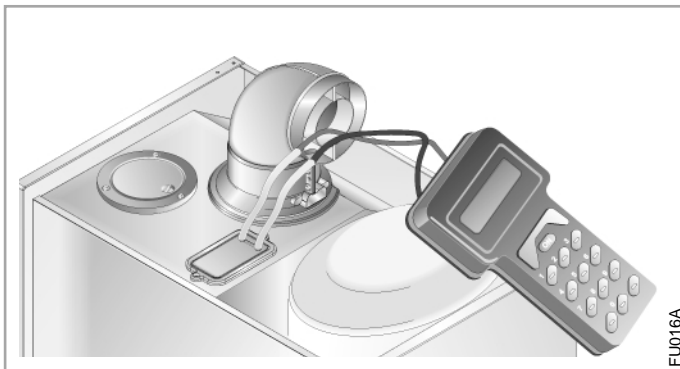


The boiler is designed to make it easy to analyse the combustion by-products.

Using the especially designed apertures, readings can be taken on the temperature of the combustion by-products and of the combustion air, as well as of the concentrations of O₂ and CO₂, etc.

The best maximum-power test conditions for the heating system are when the selector "C" is turned to the flue analysis setting.

3.7 Fume Discharge Monitoring



The discharge/ventilation of the exhaust fumes can be monitored to check for losses in general pressure in the system. This is done to eliminate the cause of lighting failure with the main burner not indicated by a shutdown status.

With a differential manometer connected to the test socket on the combustion chamber, the DP value for the air pressure switch can be taken. The measured value should not be less than 10 mbar under maximum thermal power conditions (with the knob "C" on the flue test setting) in order for the unit to function properly and without interruption.

3.8 Boiler Safety Systems

The boiler is equipped with the following safety systems (see section 3.3 for references):

1. - Ignition Failure

This control signals an ignition failure on the burner 7 seconds after a lighting failure. The L.E.D. "B" will turn on to signal the shutdown status.

The system can be reset by pressing and releasing the button "A" after checking to make sure that the gas valve is open. Repeat this process until the burner lights.

2. - Circulation Failure

This control signals that the safety pressure switch on the primary circuit has not sensed a pressure of at least 1.5 bar within 40 seconds of the activation of the circulation pump, it shuts off the boiler and lights the L.E.D. "D". The system can be reset (after the pressure has been brought up to the proper level) by using the On/Off switch "L".

3. - Overheating

This control shuts off the boiler in the case where the primary circuit reaches a temperature in excess of 110°C. The L.E.D. "G" will come on to signal this shut-off status. After the system has been allowed to cool, the system can be reset by pressing the button "A".

4. - Anti-frost Device

The boiler is equipped with a device that automatically lights the main burner when the temperature in the delivery line to the system drops below 5°C. The boiler will continue to operate until the temperature in question reaches about 58°C.

This device is activated on a properly operating boiler if:

- the system pressure is between the acceptable values;
- the power supply to the unit is on;
- the unit is supplied with gas.

This feature is enabled also when the boiler is in summer operating mode.

5. - Safety Shut-off

At the start of every lighting phase, the P.C.B. performs a series of internal controls. If a malfunction occurs, the boiler will shutdown until the problem has been resolved.

3.9 Draining the System

Draining the heating system.

The heating system must be emptied as follows:

- Turn off the boiler;
- Open the drain valve for the system and place a container below to catch the water that comes out;
- Empty the system at the lowest points (where present). If you plan on not using the heating system for an extended period of time, it is recommended that you add antifreeze with an ethylene glycol base to the water in the heating lines and radiators if the ambient temperature drops below 0°C during the winter.

This makes repeated draining of the entire system unnecessary.

Draining the domestic hot water system.

Whenever there is the danger of the temperature dropping below the freezing point, the domestic hot water system must be drained as follows:

- Turn off the general water valve for the household plumbing system;
- Turn on all the hot and cold water taps;
- Empty the remaining water from the lowest points in the system (where present).

4. GAS ADJUSTMENTS

CATEGORY II2H3+		Methane Gas G20	Liquid Butane Gas G30	Liquid Propane Gas G31
Lower Wobbe Index (15°C;1013mbar)	MJ/m ³ h	45.67	80.58	70.69
Nominal Delivery Pressure	mbar	20	30	37
Minimum Delivery Pressure	mbar	17	20	25
GENUS 27 BFFI PLUS				
Main Burner: n. 15 jets (∅)	mm	1.25	0.72	0.72
Consumption (15°C; 1013mbar)	m ³ /h	3.16	----	----
Consumption (15°C; 1013mbar)	Kg/h	----	2.35	2.32
Gas Cock Outlet Pressure max - min	mbar	11.0- 2.0	(*) - 5.0	(*) - 7.0

(1mbar = 10,197column of water)

The outlet pressure of the gas cock is obtained by completely loosening the screw on the solenoid. The maximum pressure of the gas to the burner will be equal to the nominal delivery pressure minus the head loss within the gas valve.

4.1 Changing the Type of Gas

The boiler can be converted to use either methane (natural) gas (G20) or LPG (G30 - G31) by an Authorised Service Centre.

The operations that must be performed are the following:

1. Replace the jets on the main burner (see table in section 4);
2. Adjust the maximum and minimum thermal capacity values for the boiler (see table in section 4);
3. Replace the gas rating plate;
4. Adjust the maximum thermal power setting;

CATEGORY II2H3+	Methane Gas G20	Liquid Butane Gas G30	Liquid Propane Gas G31
Recommended Soft-light Pressure (mbar)	5-5.4	13.4	13.4

5. Adjust the soft-light feature;
6. Adjust the delayed lighting feature for the heating system (can be set from 0 to 2 mins.).

5. MAINTENANCE

It is recommended that the following checks be made on the boiler at least once a year:

- 1 - Check the seals for the water connections; replacement of any faulty seals.
- 2 - Check the gas seals; replacement of any faulty gas seals.
- 3 - Visual check of the entire unit.
- 4 - Visual check of the combustion process and cleaning of the burners if needed.
- 5 - If called for by check no. 3, dismantling and cleaning of the combustion chamber.
- 6 - If called for by check no. 4, dismantling and cleaning of the injectors.
- 7 - Visual check of the primary heat exchanger:
 - check for overheating in the blade assembly;
 - clean the exhaust fan if needed.
- 8 - Adjustment of the flow rate of the gas: flow rate for lighting, partial load and full load.
- 9 - Check of the heating safety systems:
 - safety device for maximum temperature;
 - safety device for maximum pressure.
- 10 - Check of the gas safety systems:
 - safety device for lack of gas or flame ionisation (detection electrode);
 - safety device for gas cock.
- 11 - Check of the electrical connection (make sure it complies with the instructions in the manual).
- 12 - Check of domestic hot water production efficiency (delivery rate and temperature)
- 13 - Check pressure in the Domestic Expansion Vessel and top up as necessary.
- 14 - Check manually by turning the test knob the Temperature & Pressure Relief Valve.
- 15 - Check manually by turning the test knob the Expansion Relief Valve.
- 16 - Check discharge pipes from both the central heating and domestic hot water for obstructions.
- 17 - Check of the general performance of the unit.
- 18 - General check of the discharge/ventilation of the combustion by products.

6. TECHNICAL INFORMATION

		GENUS 27 BFFI PLUS
CE Certification		
Thermal Capacity	max/min kW	29.8/12.0
Thermal Power	max/min kW	27.4/10.3
Efficiency of Nominal Thermal Capacity	%	92.1
Efficiency at 30% of Nominal Thermal Capacity	%	88.8
Heat Loss to the Shell ($\Delta=50^{\circ}\text{C}$)	%	1.1
Flue Heat Loss with Burner Operating	%	6.8
Flue Heat Loss with Burner Off	%	0.4
Maximum Discharge of Fumes (methane)	Kg/h	56.9
Residual Discharge Head	mbar	1.3
Consumption at Nominal Capacity (G20-G25)	m ³ /h	3.16
(15°C, 1013 mbar) (G30-G31)	Kg/h	2.35/2.32
Temp. of exhaust fumes at nominal capacity with methane	°C	136.9
CO ₂ Content	%	7.27
O ₂ Content	%	7.45
CO Content	ppm	55
Minimum Ambient Temperature	°C	+5
Heating Temperature	max/min °C	82/42
Stored D.H.W. Cylinder Capacity	l	60
Stored D.H.W. min/max Temperature	max/min °C	40/70
Specific flow rate* (IN 10' $\Delta T=30^{\circ}\text{C}$)	l/min	18
D.H.W. Expansion Vessel	l	3
Pressure of Domestic Hot Water	max/min bar	0.2/6
Expansion Vessel Capacity	l	7
Preload Charge	bar	1
Maximum Water Content in System	l	145
Maximum Heating Pressure	bar	3
Nominal Pressure Natural Gas (G20)	mbar	20
Liquid Gas (G30/G31)	mbar	30-37
Voltage/Frequency of Power Supply	V/Hz	230 / 50
Total Electrical Power Absorbed	W	200
Protection Grade of Electrical System	IP	X4D
Internal Fuse Rating		2A
Weight	Kg	86
GC Number		47-116-11

*BS EN 625

Manufacturer: **Merloni TermoSanitari SpA - Italy**

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Technical Service Hot Line: (01494) 539579

GENUS 27 PLUS

Servicing Instructions Type C Boilers

G.C.N: 47-116-11

LEAVE THESE INSTRUCTIONS
WITH THE END USER



*The code of practice for the installation,
commissioning & servicing of central heating systems*

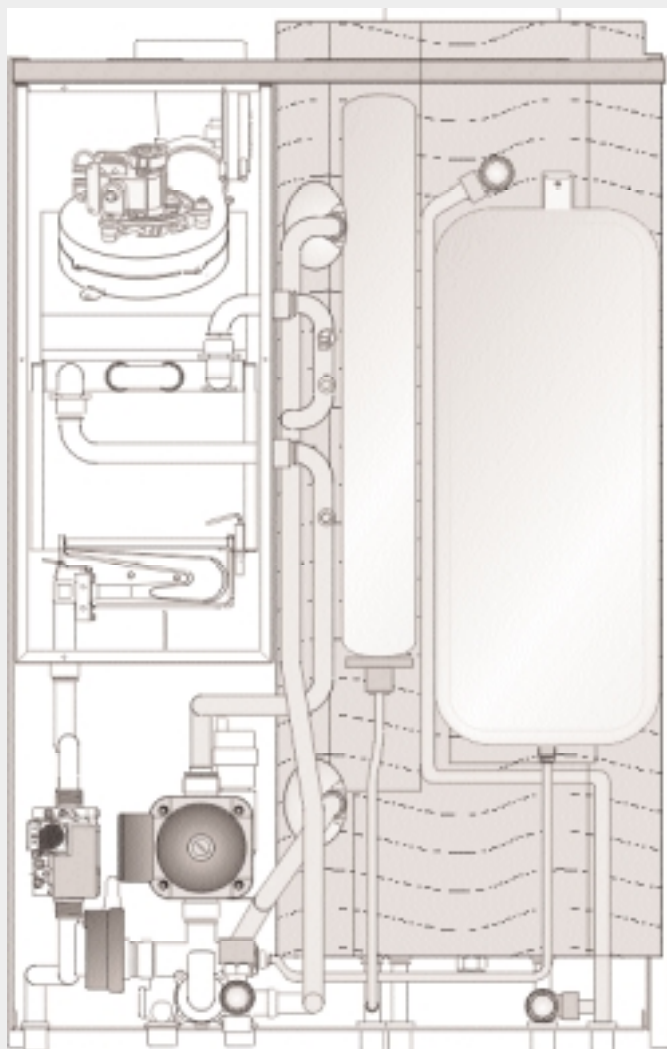


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2. FAULT FINDING

2.1 Fault Finding Guide (Flow-chart)

3. ELECTRICAL DIAGRAMS

4. SHORT SPARE PARTS LIST

1. SERVICING INSTRUCTIONS

To ensure efficient safe operation, it is recommended that the boiler is serviced annually by a competent person.

Before starting any servicing work, ensure both the gas and electrical supplies to the boiler are isolated and the boiler is cool.

Before and after servicing, a combustion analysis should be made via the flue sampling point (please refer to the Installation Manual for further details).

After servicing, preliminary electrical system checks must be carried out to ensure electrical safety (i.e. polarity, earth continuity, resistance to earth and short circuit).

1.1 Replacement of Parts

The life of individual components vary and they will need servicing or replacing as and when faults develop.

The fault finding sequence chart in chapter 2 will help to locate which component is the cause of any malfunction, and instructions for removal, inspection and replacement of the individual parts are given in the following pages.

1.2 To Gain General Access

All testing and maintenance operations on the boiler require the control panel to be lowered. This will also require the removal of the casing.

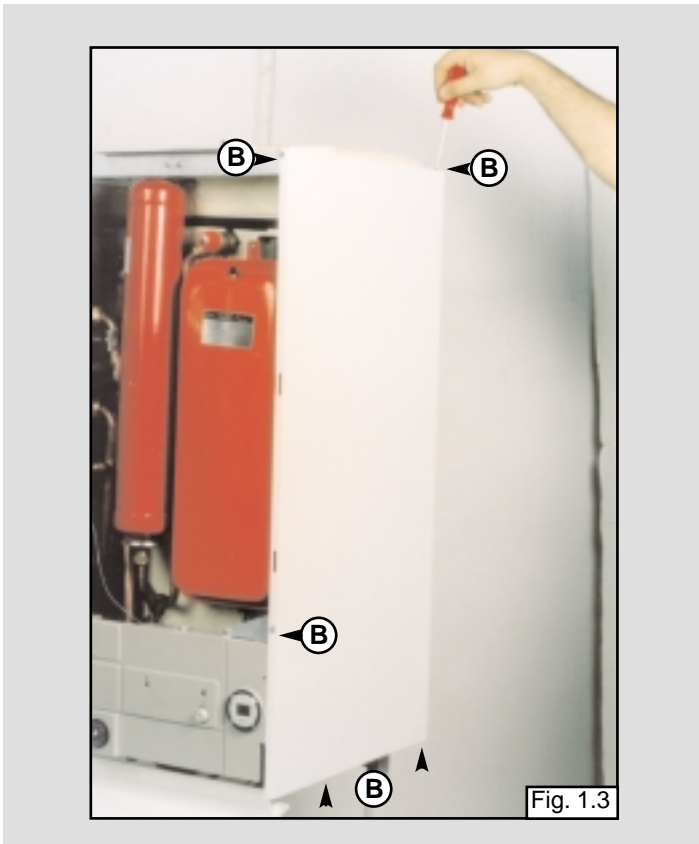
1.2.1 Removing the front panel:

1. Remove the screw "A" from the centre of the top edge of the front panel and remove the panel by lifting upward (see fig. 1.1);
2. Remove the front panel from the rest of the casing (see fig. 1.2).



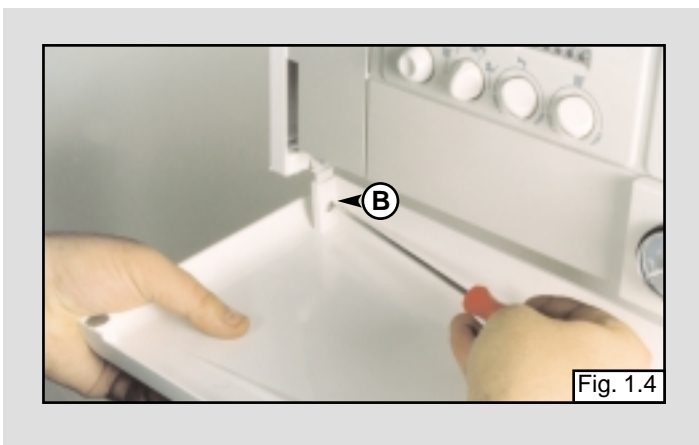
1.2.2 Removing the side panels:

1. Remove the screws "B" lift outward at the base and then lift off the locating lugs(see fig. 1.3);



1.2.3 Removing the control panel door :

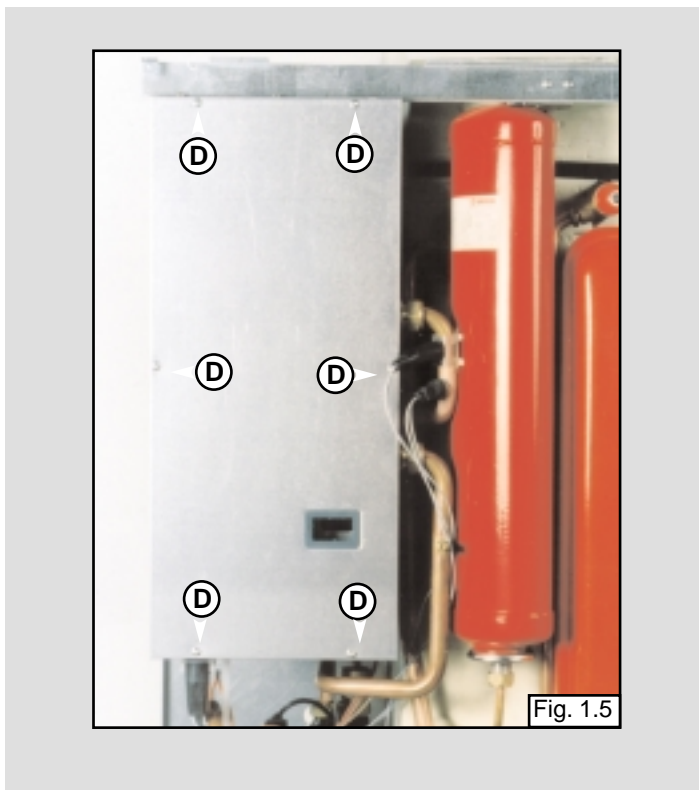
1. Open the control panel door and remove screws "C" (see fig. 1.4);



1.3 Access to the Combustion Chamber

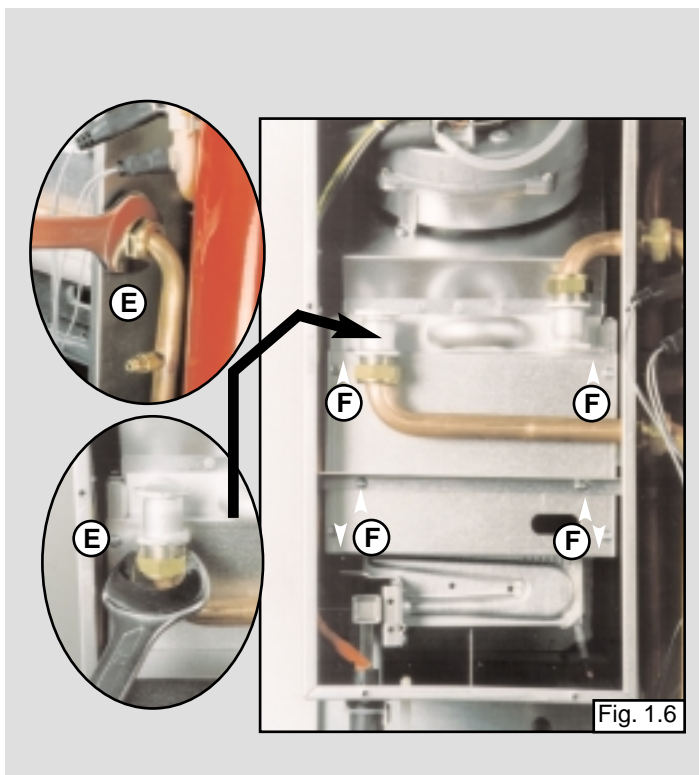
1.3.1 Removing the sealed chamber front cover

1. Remove the screws "D" (see fig. 1.5)



1.3.2 Removing the combustion cover

1. Release the two connection nuts "E";
2. Remove the six screws "F" (see fig. 1.6);
3. Pull forward and remove.



1.3.3 Removing the burner and the injectors

1. Undo the nut "G" of the gas pipe (see fig. 1.7) ;
2. Lift up the main burner to free the main gas connection and pull forward very carefully (see fig. 1.8);
3. Remove the injectors (see fig. 1.9);

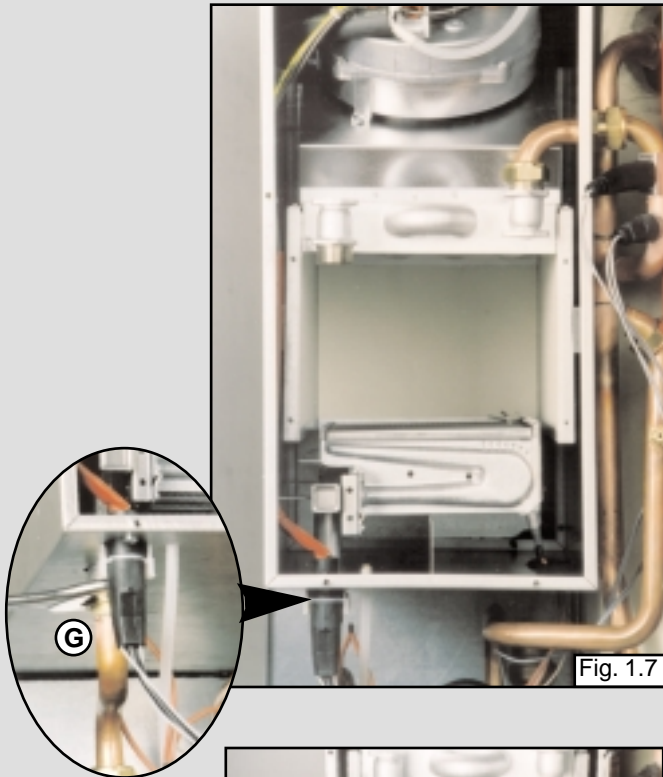


Fig. 1.7

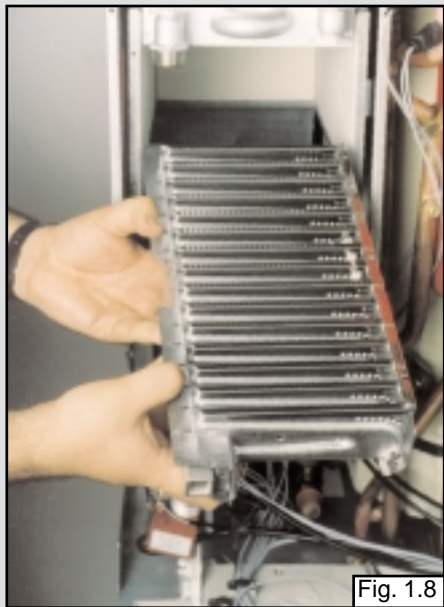


Fig. 1.8

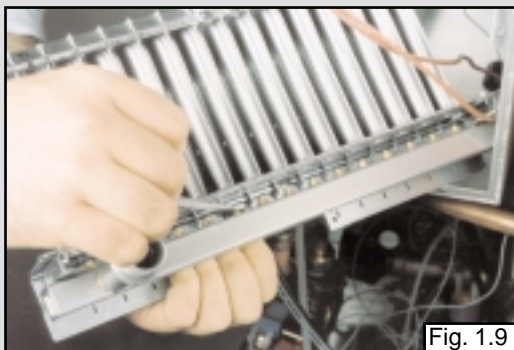


Fig. 1.9

1.3.4 Removing the electrodes

1. Remove the burner (see fig. 1.10);
2. Remove the screws "H" and disconnect the electrode cables slide the electrodes gently downwards (see fig. 1.11-1.12);
3. Disconnect the detection electrode cable at its only connection point close to the P.C.B. (see fig. 1.13);



Fig. 1.10

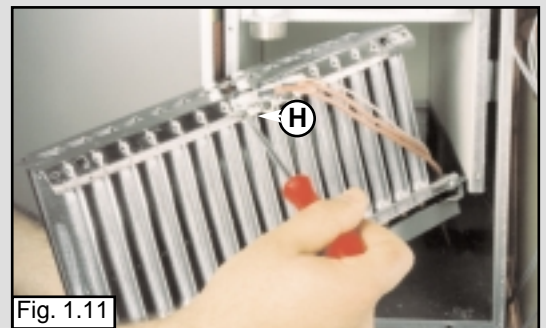


Fig. 1.11

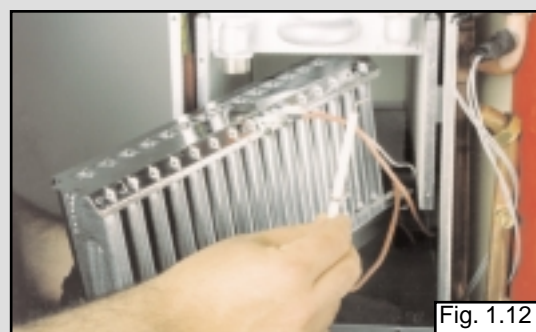


Fig. 1.12

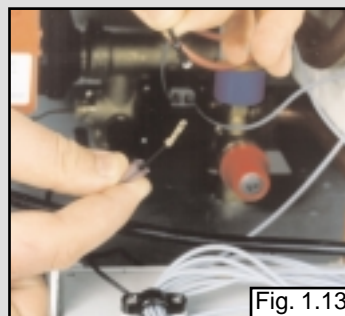


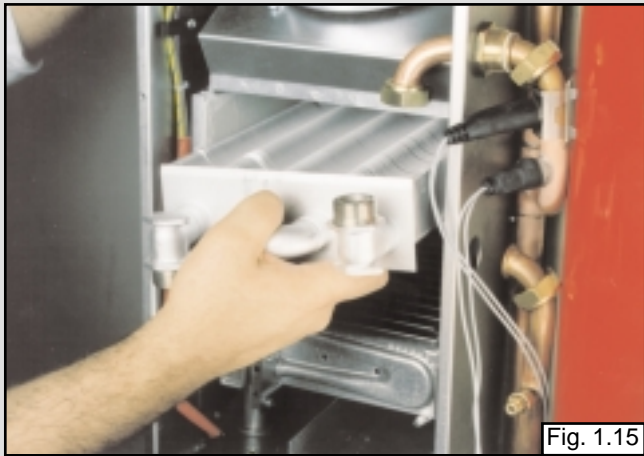
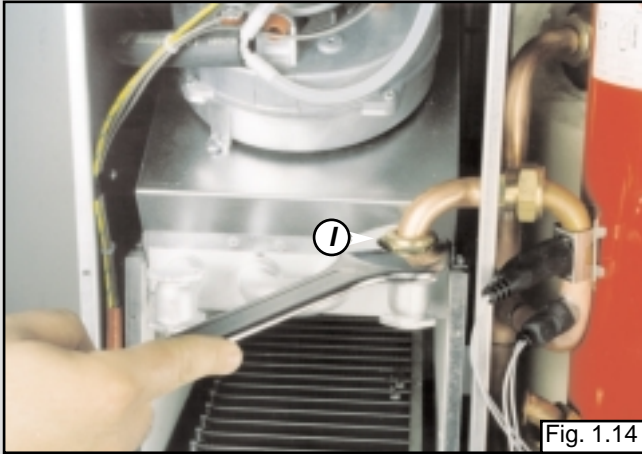
Fig. 1.13

To replace, repeat the steps in reverse order, paying particular attention to the following:

- a - Centre the electrode in the locating hole carefully, otherwise the electrode may break;
- b - Check that the cables have been connected correctly.

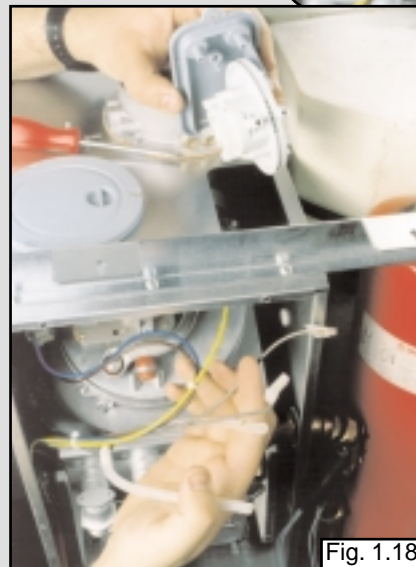
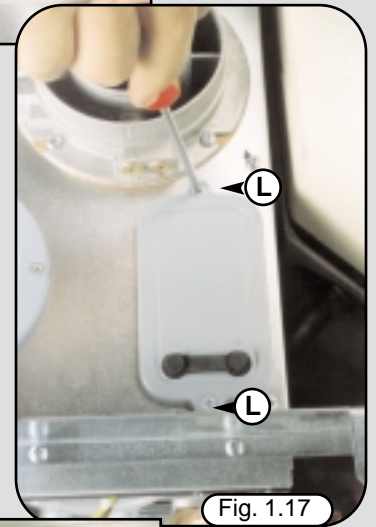
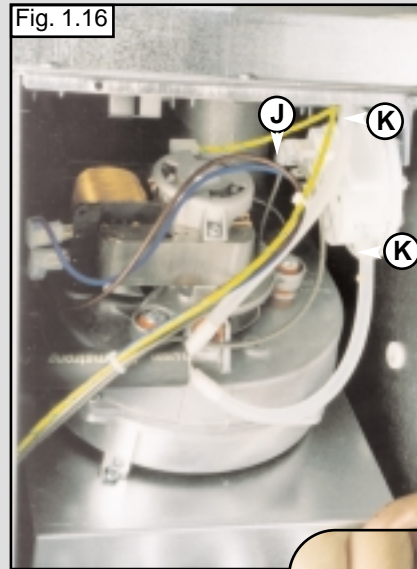
1.3.5 Removing the main heat exchanger

1. Drain the boiler of water;
2. Release the connection nut "I" connecting the exchanger to the flow pipes (see fig. 1.14);
3. Lower the heat exchanger at its front end and lift forward clear of the ledge at the rear (see fig. 1.15)
4. Pull it straight out.



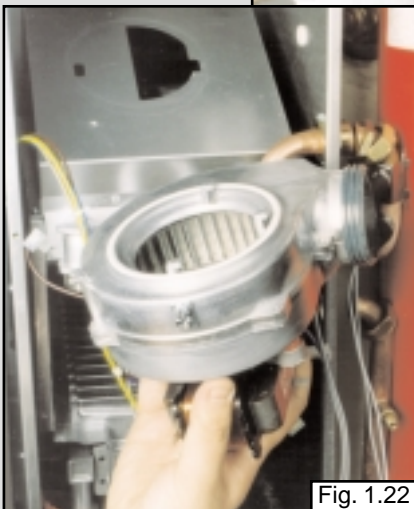
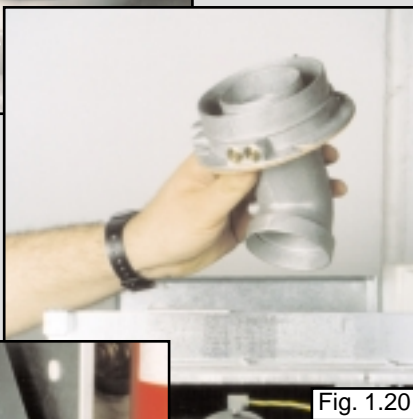
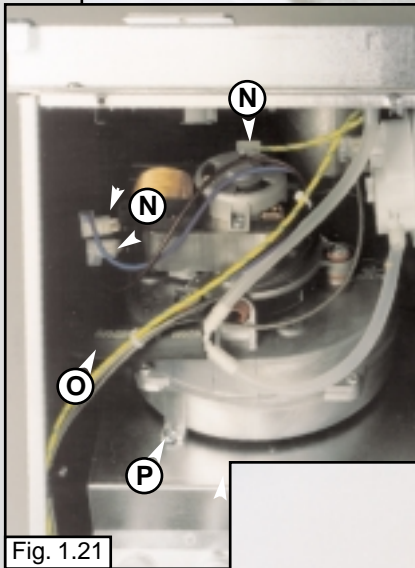
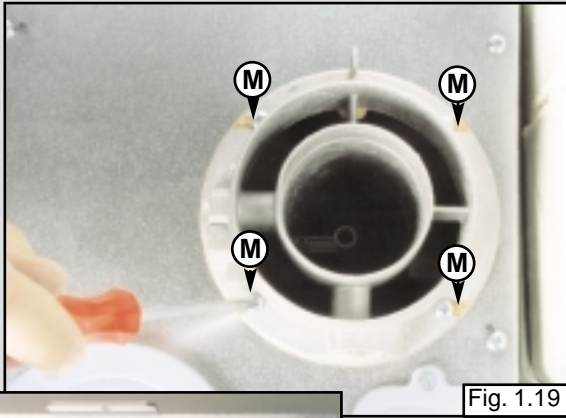
1.3.6 Removing the air pressure switch

1. Remove screws "L" on the top of the sealed chamber (see fig. 1.17);
2. Pull upwards the plastic support plug (see fig. 1.18)
3. Disconnect the electrical connections "J" and silicone pipes "K" from their connection points (see fig. 1.16);



1.3.7 Removing the fan

1. Remove the screws "M" (see fig. 1.19);
2. Remove the collar for flue discharge (see fig. 1.20);
3. Disconnect electrical connections "N", the silicone pipe "O" and remove screw "P" (see fig. 1.21);
4. Pull fan and remove (see fig. 1.22);



1.4 Servicing and Removal of the Gas Valve

1.4.1 Setting gas pressures

Setting the minimum and the maximum power of the boiler

1. Check that the supply pressure to the gas valve is a minimum of 20 mbar for natural gas.
2. To do this, remove the screw "A" (Fig. a).
Fit the pipe of the pressure gauge to the pressure connection of the gas valve "B".
When you have completed this operation, replace the screw "A" securely into its housing to seal off the gas.
3. To check the pressure supplied by the gas valve to the burner, remove the screw "C" (Fig. b). Fit the pipe of the pressure gauge to the pressure outlet of the gas valve "D".
Disconnect the compensation pipe either from the gas valve or from the sealed chamber.
4. Set the On/Off button to position < I > and the "summer/winter" switch to the flue test position.
Turn on the hot water tap and allow the hot water tap to run at full rate.
Adjust nut "E" (Fig. c) on the modureg to set the maximum gas pressure (displayed on the pressure gauge) turn the screw clockwise to increase the pressure and counter-clockwise to decrease, corresponding to the maximum power (see table "A" page 8).
5. To set the minimum power, disconnect a supply lead from the modureg and adjust screw "F" (Fig. d) whilst holding the outer nut.
Turn the screw clockwise to increase the pressure and counter-clockwise to decrease the pressure (displayed on the pressure gauge) corresponding to the minimum power (see table "A" page 9).
6. When you have completed the above operations, turn off the hot water tap, re-connect the supply terminal to the modureg on the gas valve and replace the cap on the screw of the modureg.

Setting the maximum heating circuit power

7. To set the maximum heating circuit power, place the On/Off button to position < I > and the "summer/winter" switch to winter position.
Turn the knob of the heating thermostat clockwise to maximum;
8. Remove the left hand inspection panel of the P.C.B. and fit a small cross-head screwdriver in to the right hand potentiometer. Turn clockwise to increase the pressure or counter-clockwise to reduce the pressure. Adjust the setting to the required heating pressure value (displayed on the pressure gauge), as indicated in the diagrams shown in page 9.
9. Turn off the boiler by placing the main switch to the "Off" position.

Setting pressure for soft ignition.

Disconnect the detection electrode connection from the P.C.B. (see fig. 1.13).

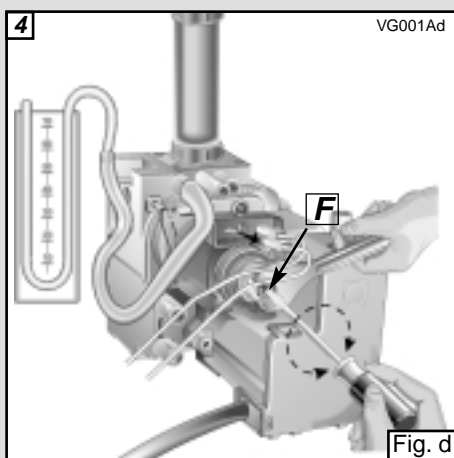
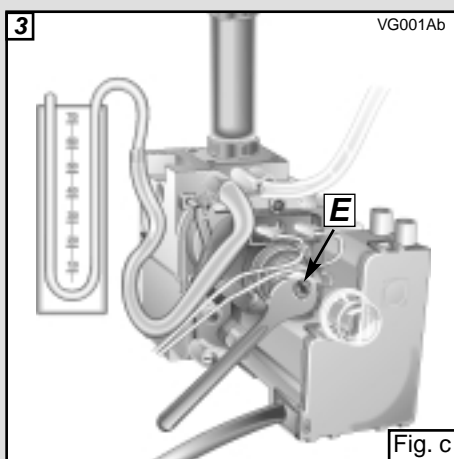
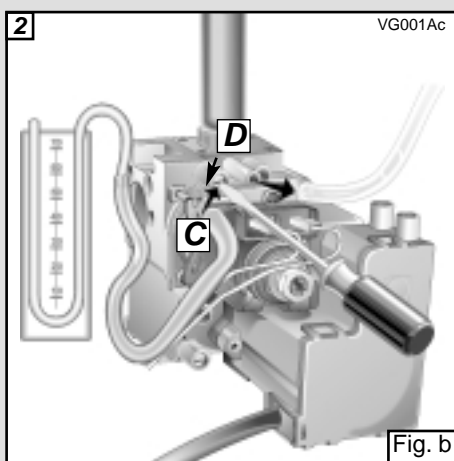
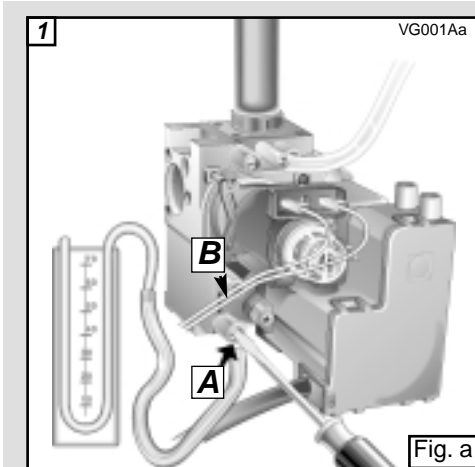
Start the boiler and during the ignition sequence adjust the centre potentiometer until the gas pressure reads the required gas pressure as per the table below.

Once the gas pressure is set turn off the boiler and reconnect the connection to the P.C.B.

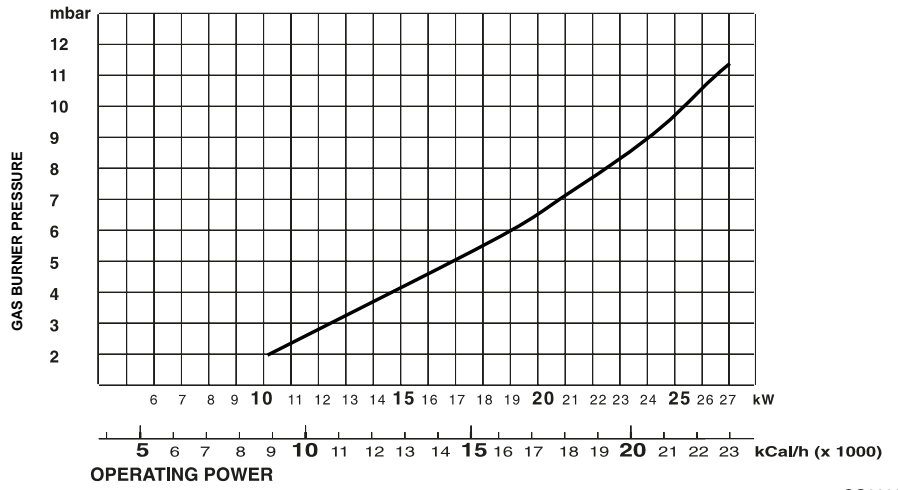
NB.: It may be necessary to reset the flame failure reset a number of times during this operation.

	NATURAL GAS (G20)	BUTANE GAS (G30)	PROPANE GAS (G31)
Recommended pressure for slow ignition	5 mbar - 1.95 in w.g.	18 mbar - 7.0 in w.g.	19 mbar - 7.4 in w.g.

TB001A

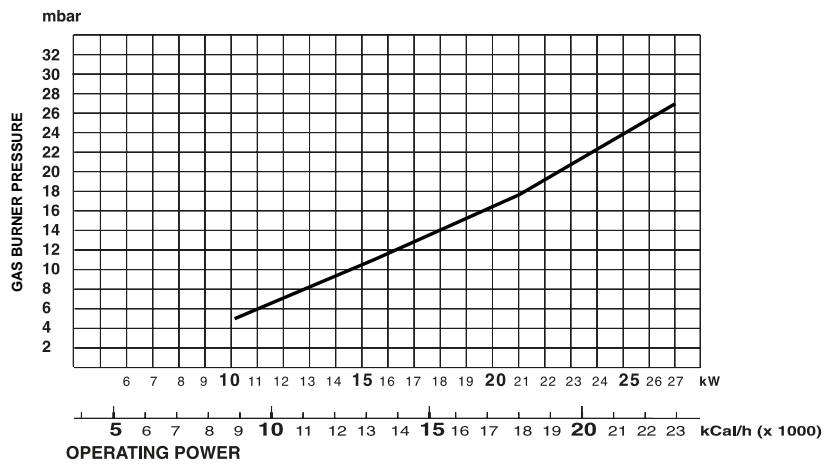


Regulating the heating power for natural gas (G20)



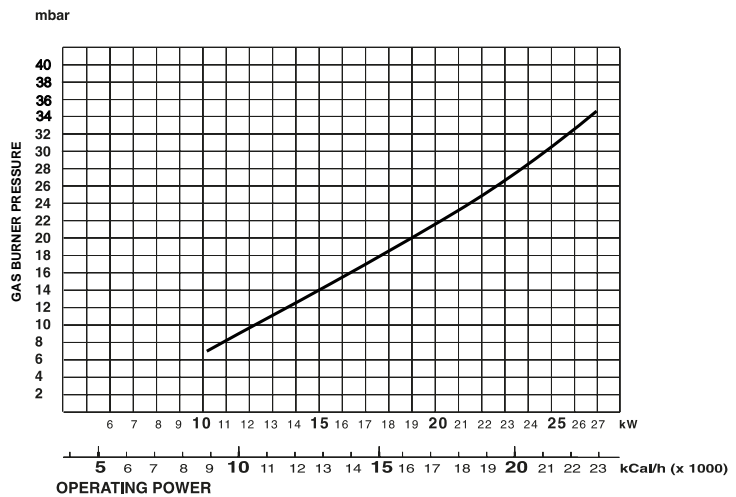
CG003A

Regulating the heating power for butane gas (G30)



CG002A

Regulating the heating power for propane gas (G31)

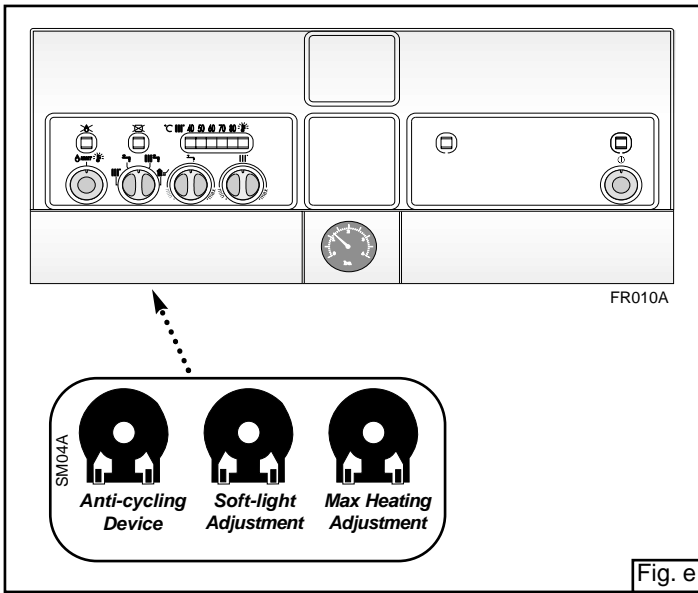


CG003A

TABLE "A"

GAS REQUIREMENTS		NATURAL GAS (G20)		BUTANE GAS (G30)		PROPANE GAS (G31)	
Gas rate	max	3.0 m ³ /h	106.0 ft ³ /h	0.88 m ³ /h	31.1 ft ³ /h	1.15 m ³ /h	40.6 ft ³ /h
Gas rate	min	1.2 m ³ /h	42.3 ft ³ /h	0.35 m ³ /h	12.3 ft ³ /h	0.46 m ³ /h	16.2 ft ³ /h
Inlet pressure		20 mbar	7.8 in w.g.	28 mbar	10.9 in w.g.	37 mbar	14.4 in w.g.
Burner pressure	max	12.3 mbar	4.8 in w.g.	28 mbar	10.9 in w.g.	37 mbar	14.4 in w.g.
Burner pressure	min	2.0 mbar	0.8 in w.g.	5.1 mbar	2.0 in w.g.	7.0 mbar	2.7 in w.g.
Burner injectors	GENUS 27 BFFI PLUS	15 x 1.25		15 x 0.72		15 x 0.72	

TB002A



10. Remove the pipe from the pressure gauge and connect screw "C" to the pressure outlet in order to seal off the gas.
11. Carefully check the pressure outlets for gas leaks (valve inlet and outlet).
12. Reconnect the compensation tube to the gas valve.

IMPORTANT!

Whenever you disassemble and reassemble the gas connections, always check for leaks using a soap and water solution.

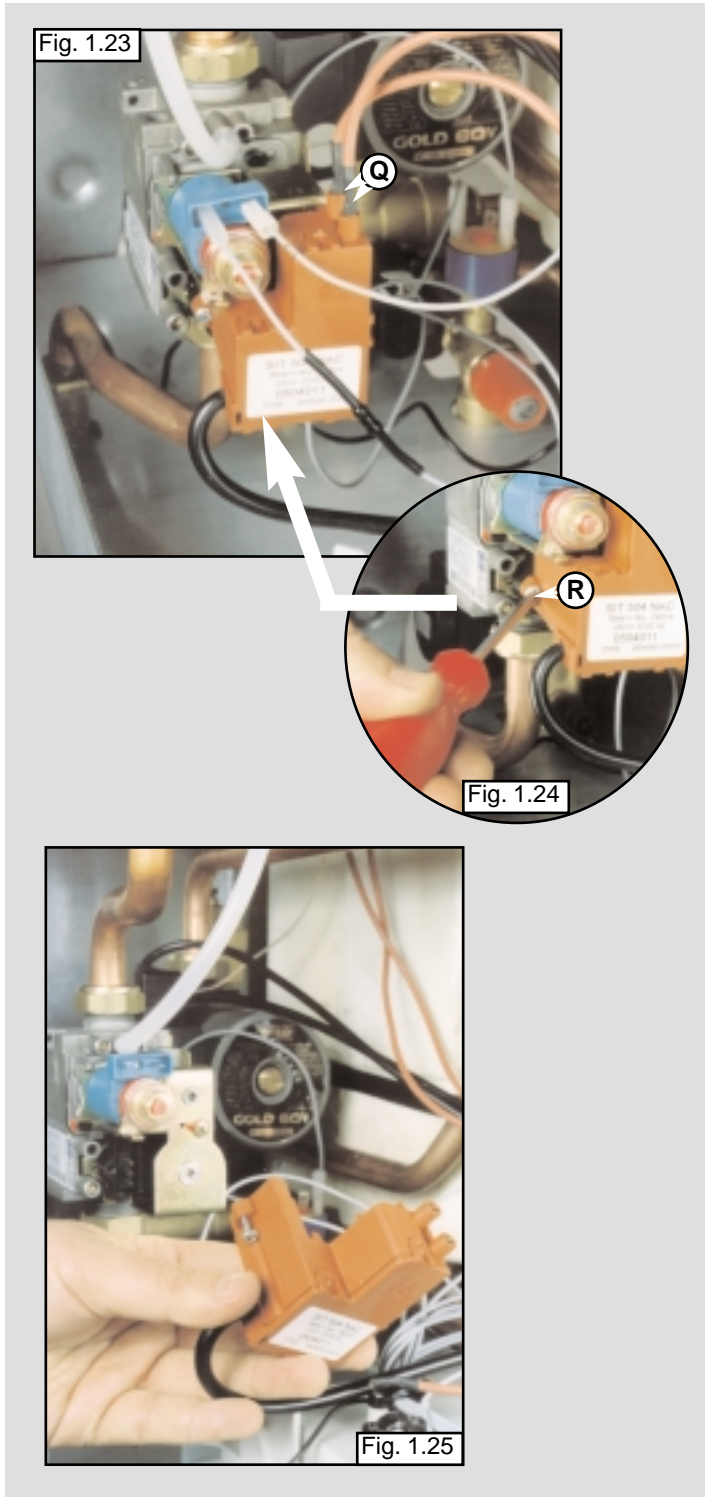
Setting the anti-cycling device

This appliance is equipped with a potentiometer which delays the ignition of the heating control and is situated on the P.C.B. (see the electrical diagrams).

By adjusting the potentiometer, it is possible to change the time interval between the burner shutting down and its next ignition. It is preset at 1 minute and can be adjusted from 0 to 2 minutes. Use this control in particular situations where continuous shutting down and ignition of the main burner occurs.

1.4.2 Removing the spark generator

1. Disconnect ignition leads "Q" by pulling upwards (see fig. 1.23);
2. Remove the screw "R" (see fig. 1.24) with a Pozidrive No. 2 star tip screwdriver;
3. Remove the spark generator by pulling forwards (see fig. 1.25);

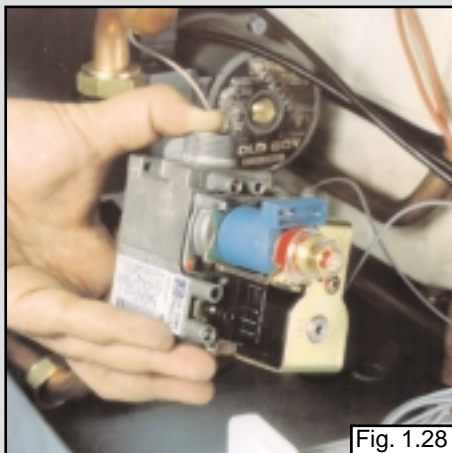
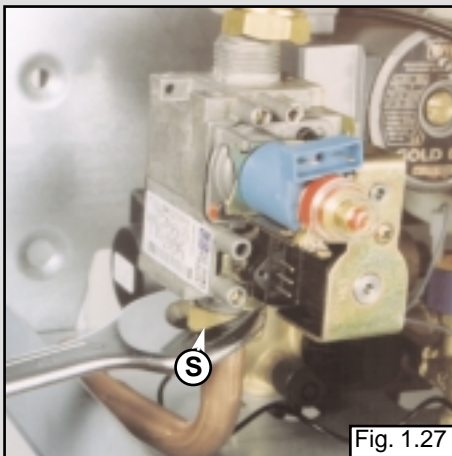
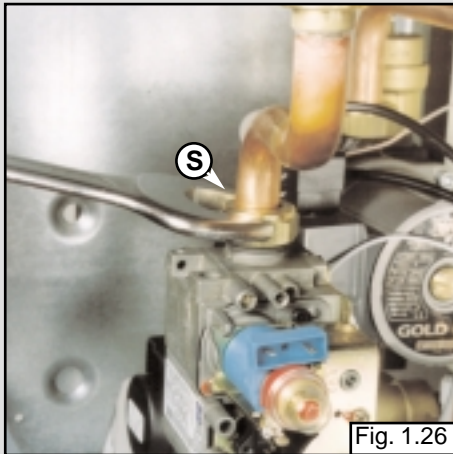


1.4.3 Removing the gas valve

Important. ensure gas supply to boiler is turned off.

Removing the gas valve

1. Disconnect the cables from the solenoid and modureg;
2. Remove the spark generator (see section 1.4.2);
3. Release the nuts "S" using a 30 mm open ended spanner (see fig. 1.26 - 1.27);
4. Remove the gas valve (see fig. 1.28).

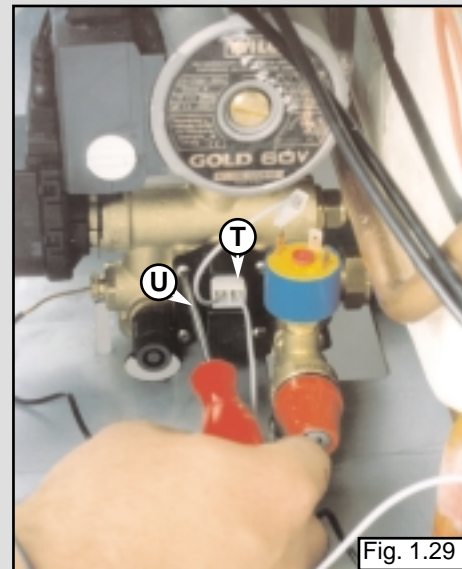


1.5 Access to the Water Circuit

Important! Before any component is removed, the boiler must be drained of all water.

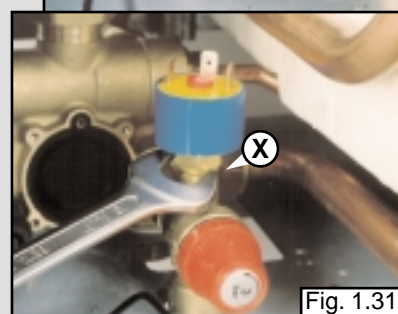
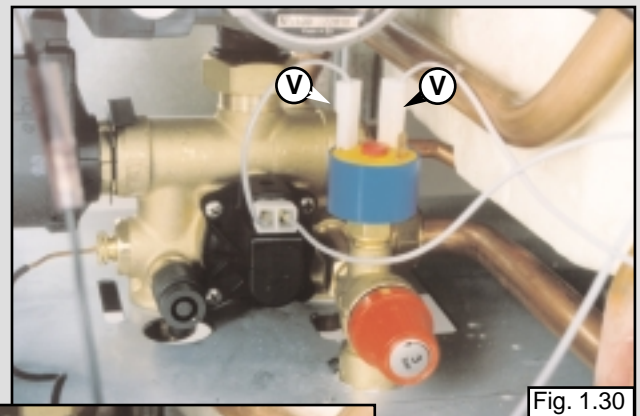
1.5.1 Removing the "main circuit flow switch"

1. Remove the cable of the main circuit flow switch "T" (do not pull the wires);
2. Remove the screws "U" (see fig. 1.29);
3. Remove the main circuit flow switch.



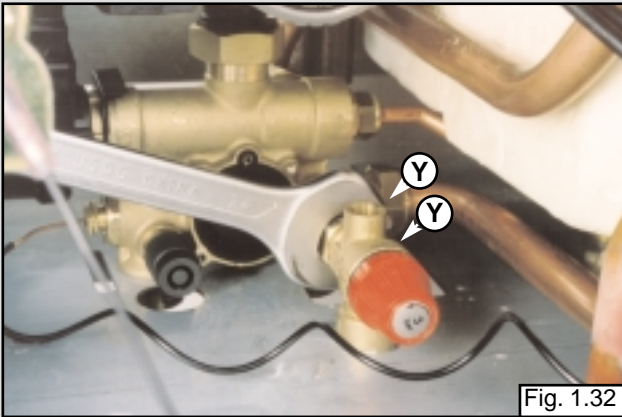
1.5.2 Removing the pump pressure switch

1. Remove the cable of the pump pressure switch "V" (see fig. 1.30)
2. Unscrew the pump pressure switch by using a spanner on the nut "X" (see fig. 1.31);
3. Remove the pump pressure switch.



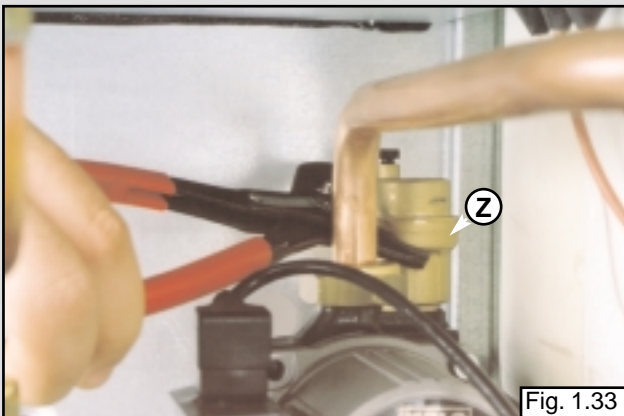
1.5.3 Removing the safety valve

1. Remove the pump pressure switch (see section 1.5.2)
2. Loosen nut "Y" disconnect the safety discharge pipework from under the boiler (see fig. 1.32);
3. Remove the valve.



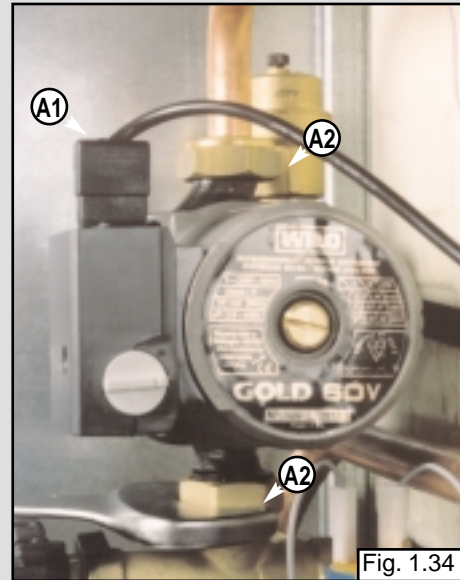
1.5.4 Removing the automatic air vent

1. Remove the automatic air vent "Z" by unscrewing from the pump (see fig. 1.33);



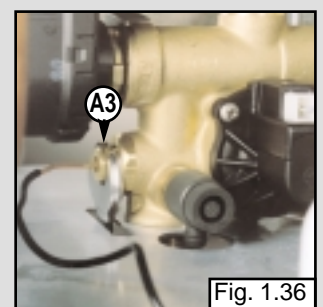
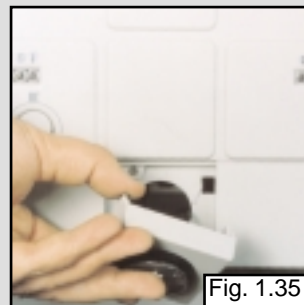
1.5.5 Removing the pump

1. Remove electrical connection "A1" (see fig. 1.34).
2. Disconnect the two nuts "A2" (see fig. 1.34);
3. Remove the pump.



1.5.6 Removing the pressure gauge

1. Remove the pressure gauge cover by pulling (see fig. 1.35);
2. Release coupling "A3" using a 14 mm open ended spanner (see fig. 1.36);
3. Push the pressure gauge through the control panel from the rear (see fig. 1.37).



1.5.7 Removing the domestic expansion vessel

Important. Turn off the domestic cold water and drain the storage cylinder.

1. Remove nut "A4" away from the expansion vessel (see fig. 1.38);
2. Remove screws "A5" (see fig. 1.39);
3. Remove expansion vessel (see fig. 1.40).

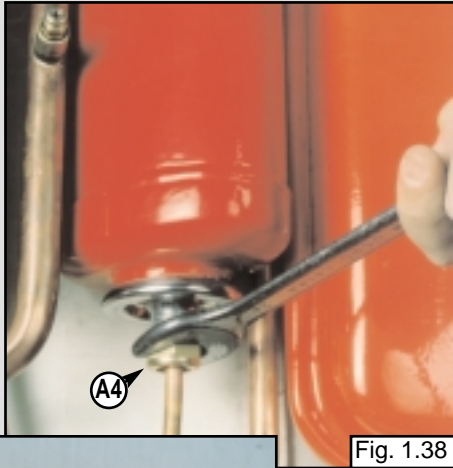


Fig. 1.38

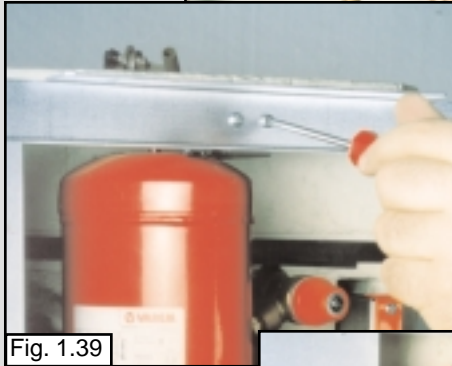


Fig. 1.39



Fig. 1.40

1.5.8 Removing the overheat thermostat

1. Remove the electrical connector from the overheat thermostat (see fig. 1.41);
2. Pull off the thermostat connections. Then remove the thermostat from the pipe by releasing its securing clip.

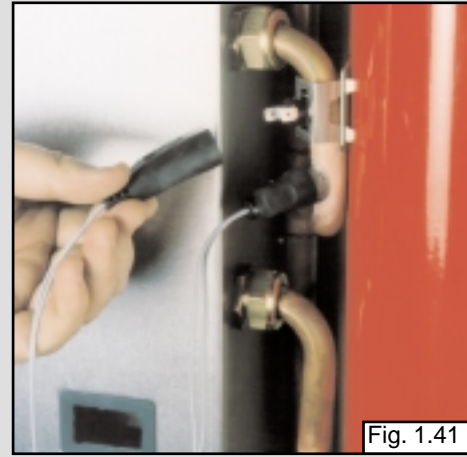


Fig. 1.41

1.5.9 Removing the heating temperature sensor (N.T.C.)

1. Remove the electrical connector by pulling off the thermostat connections (see fig. 1.42) and unscrewing the sensor probe with a 14 mm open ended spanner (see fig. 1.43).

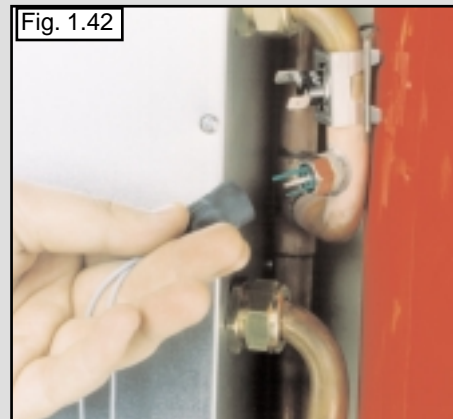


Fig. 1.42

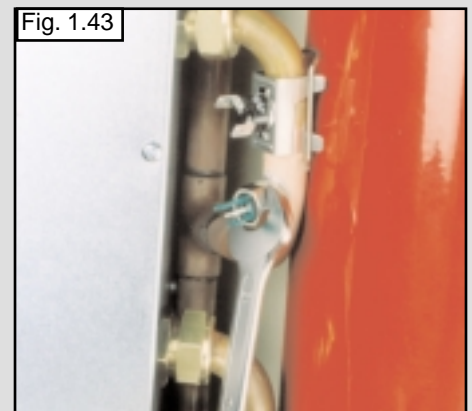
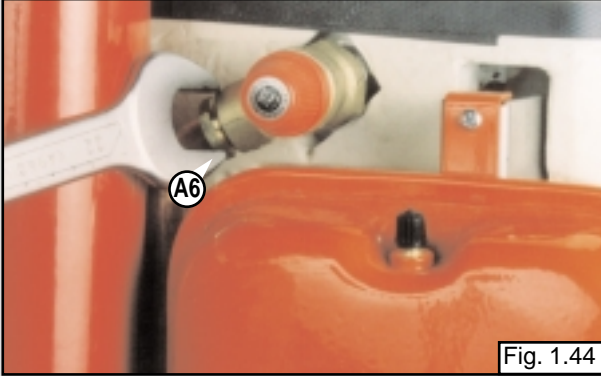


Fig. 1.43

1.5.10 Temperature and pressure relief valve

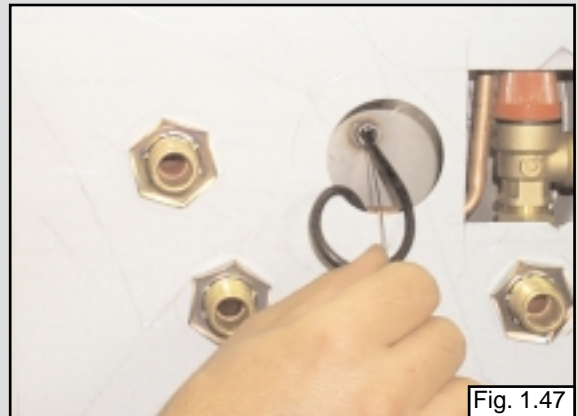
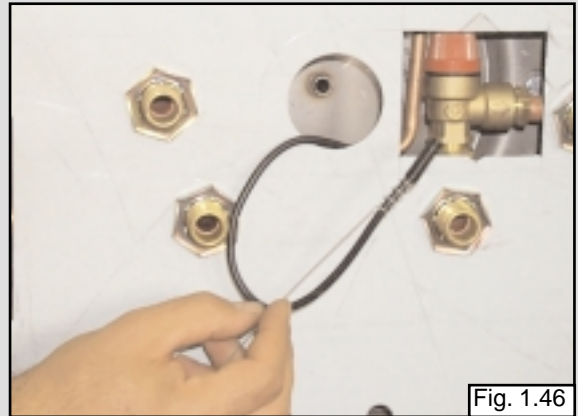
1. Ensure electricity is switched off at main isolator;
2. Drain domestic water from cylinder;
3. Loosen nut "A6" and remove the 1/2" nipple (see fig. 1.44);
4. Remove the valve by unscrewing in an anticlockwise direction (see fig. 1.45);



1.5.11 Removing the D.H.W. probe

This operation is possible with boiler fully assembled. The D.H.W. probe access, is at the bottom right side of the boiler:

1. Ensure electricity is switched of at main isolator.
2. Hold the D.H.W. probe spring and pull downwards (see fig. 1.46)
3. Remove the spring (see fig. 1.47)
4. Disconnect the probe;
5. Replace with new D.H.W. probe;
6. Mount the spring;
7. Introduce new probe into its housing pushing upwards;
8. Ensure the probe has reached the end of the housing pushing firmly again.



1.5.12 Removing the diverter valve

1. Remove the circlip and pull the diverter valve to the left.
(see fig. 1.48);
2. Remove electrical connection by pulling.

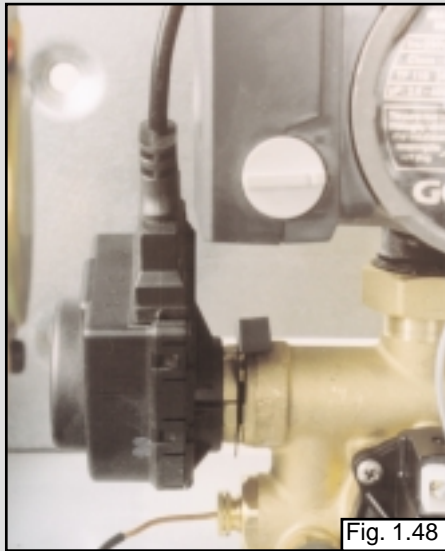


Fig. 1.48

1.6.2 Removing the time clock

1. Remove electrical connections "A7" of the clock
(see fig. 1.51);
2. Unscrew the screws "A8" and remove (see fig. 1.52).

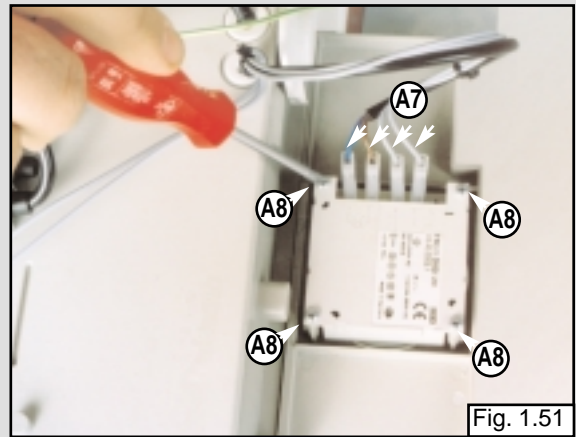


Fig. 1.51

1.6 Access to the Control System

1.6.1 Checking fuse

1. Remove the right hand inspection cover (see fig. 1.49);
2. Remove fuse from the P.C.B. (see fig. 1.50).



Fig. 1.49

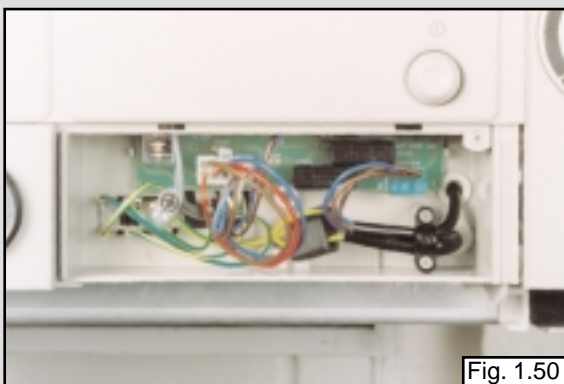


Fig. 1.50

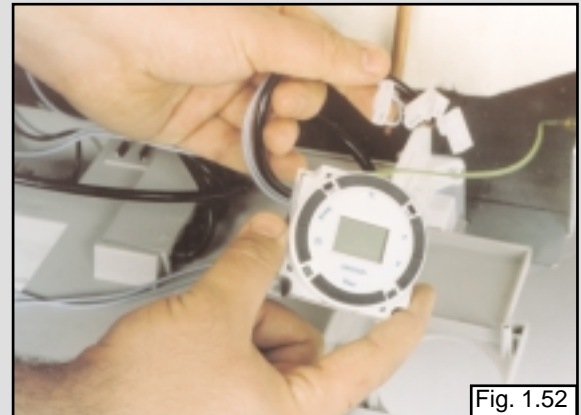


Fig. 1.52

N.B.: It is possible to by-pass the time clock in the event of failure by simply unplugging the electrical connection from the P.C.B.. This will revert control of the central heating to the room stat connection on the reverse of the control panel.

1.6.3 Removing the P.C.B.s

1. Isolate electricity;
2. Remove the front cover of the boiler;
3. Remove both left and right inspection panels by remove the screws "A9" (see fig. 1.51);
4. Remove the pressure gauge cover;
5. Remove the five screws retaining the fascia panel;
6. Disconnect the connection cable "A10" (see fig. 1.52);
7. To remove the 24V P.C.B.: remove the electrical plug connectors and screws "A11" (see fig. 1.53);
8. To remove the 240V P.C.B.: remove the electrical plug connectors and screws "A12" (see fig. 1.53);
9. Replace either P.C.B. in reverse order.

Fig. 1.51

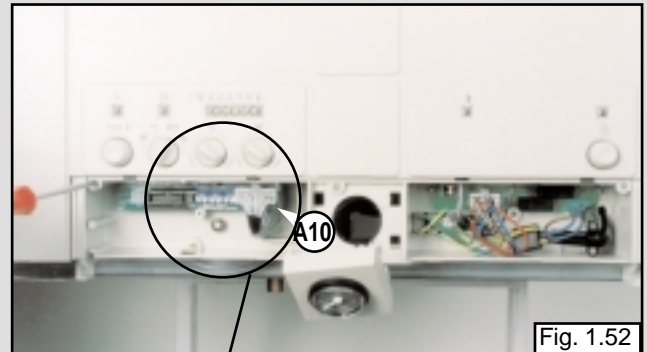
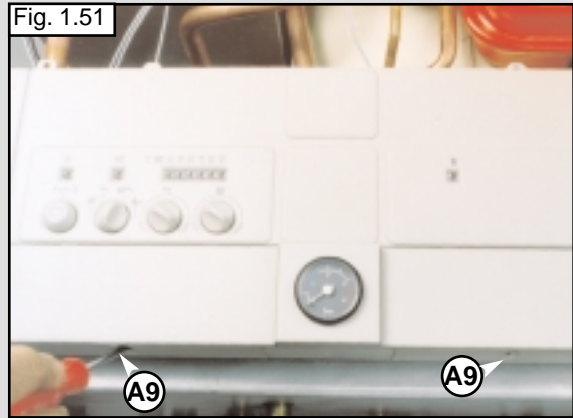


Fig. 1.52

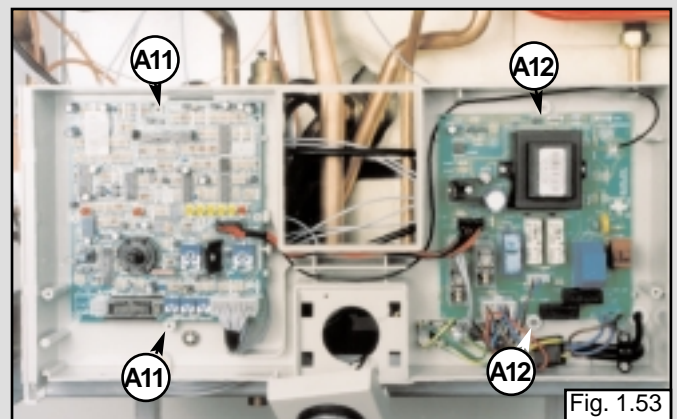
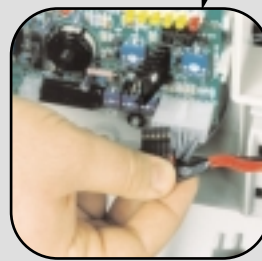
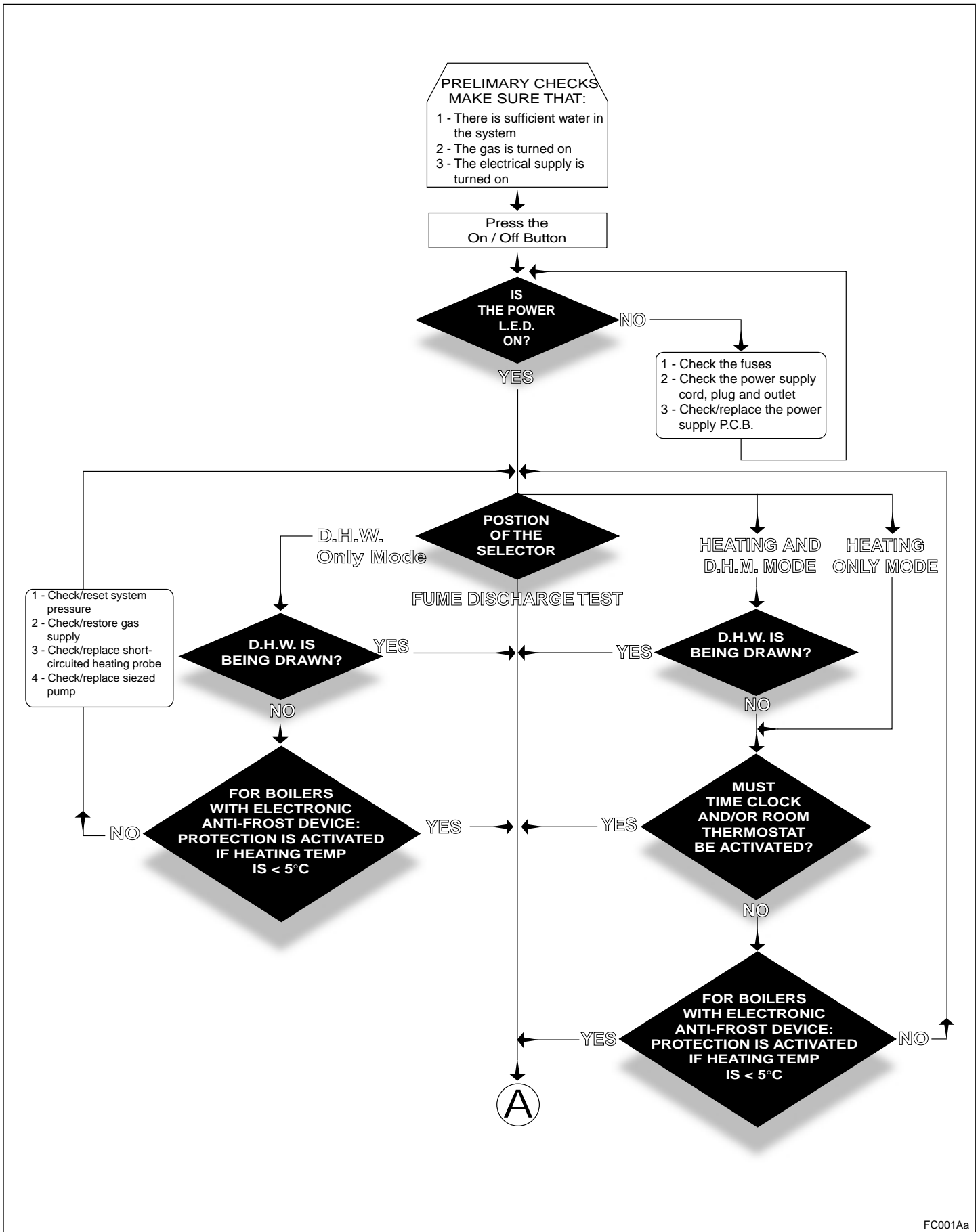


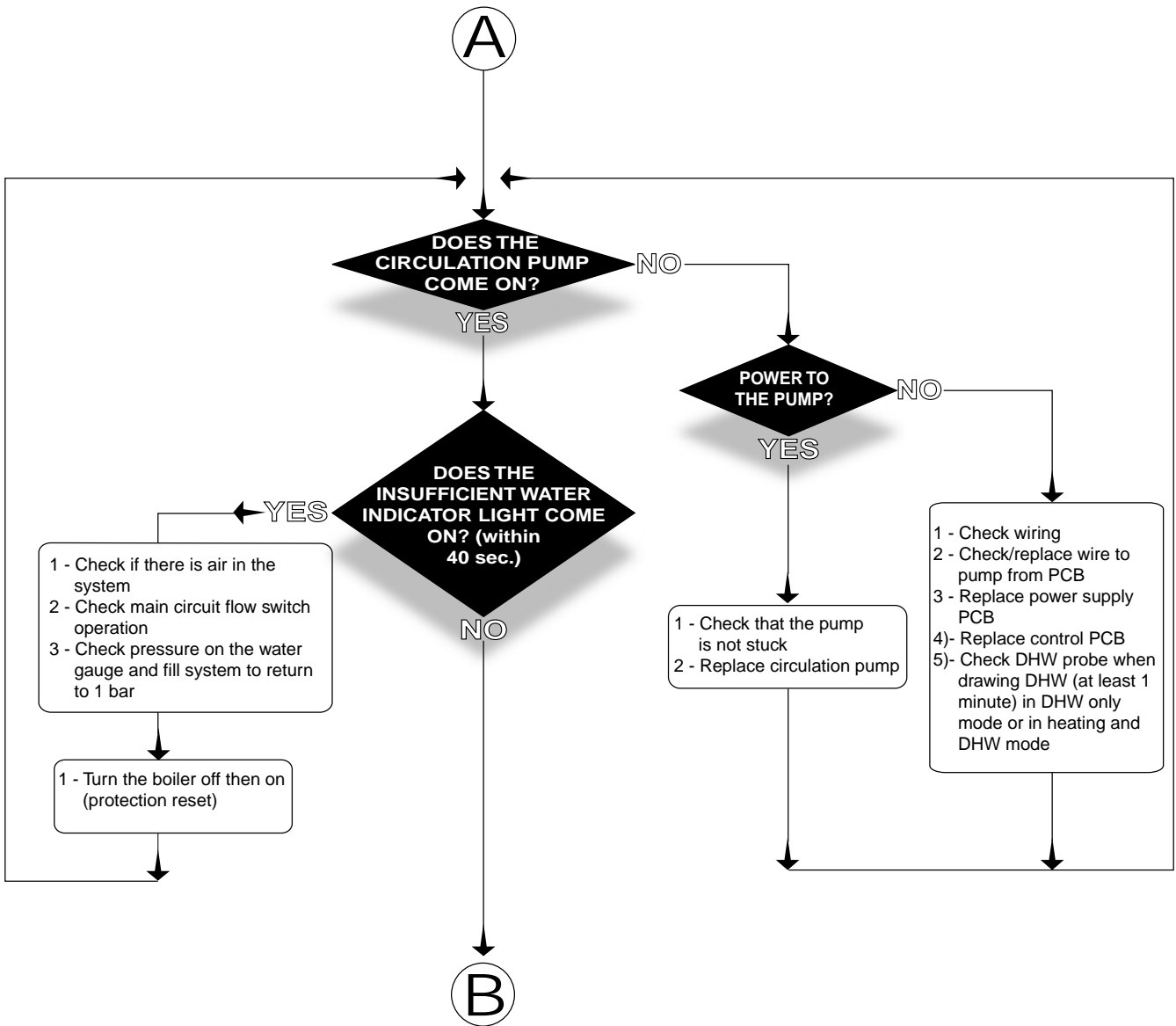
Fig. 1.53

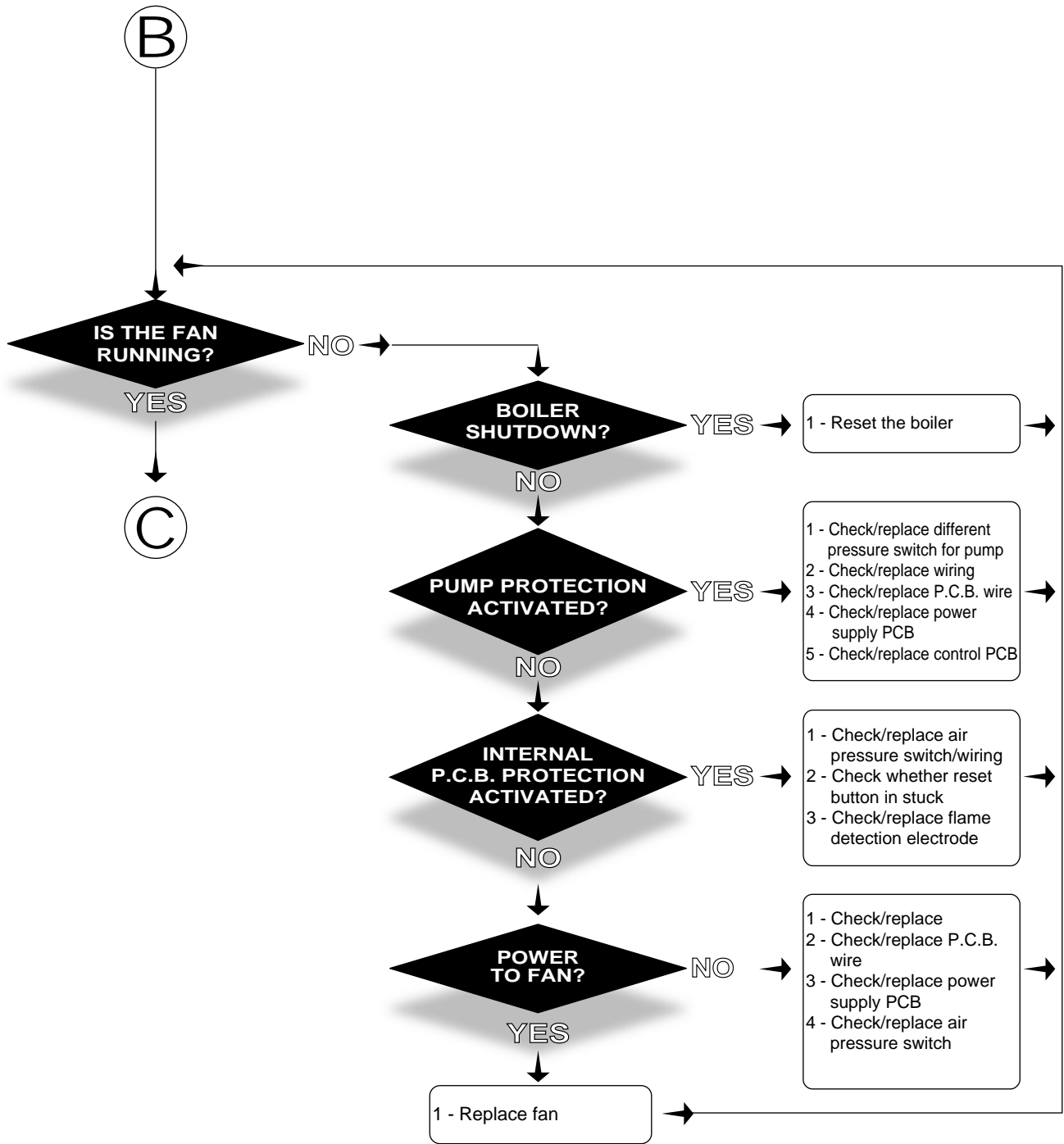
2. FAULT FINDING

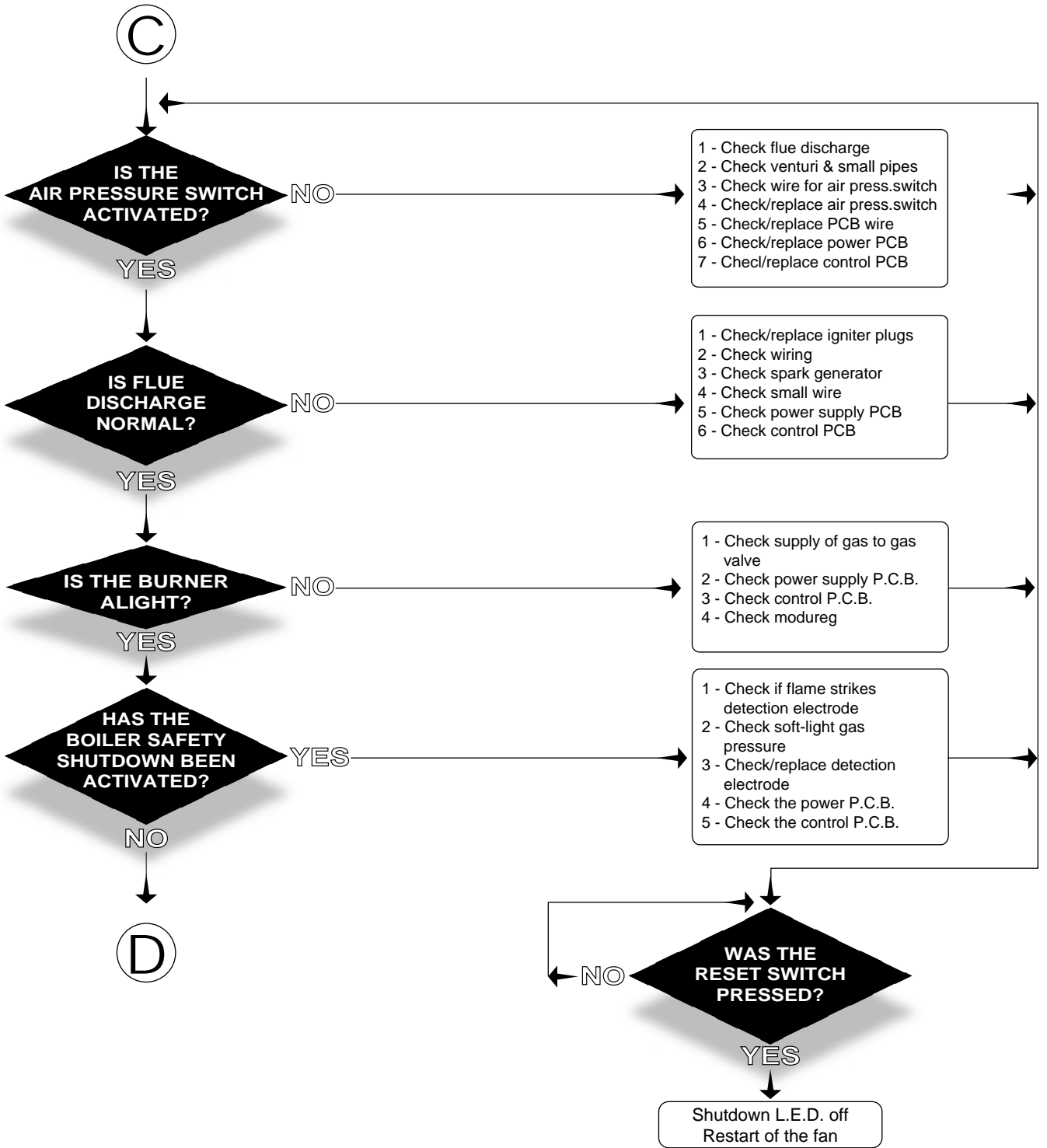
1.7 Fault finding guide (flow-chart)

It is possible to detect and correct any defect by using the standard fault finding diagrams described in this chapter

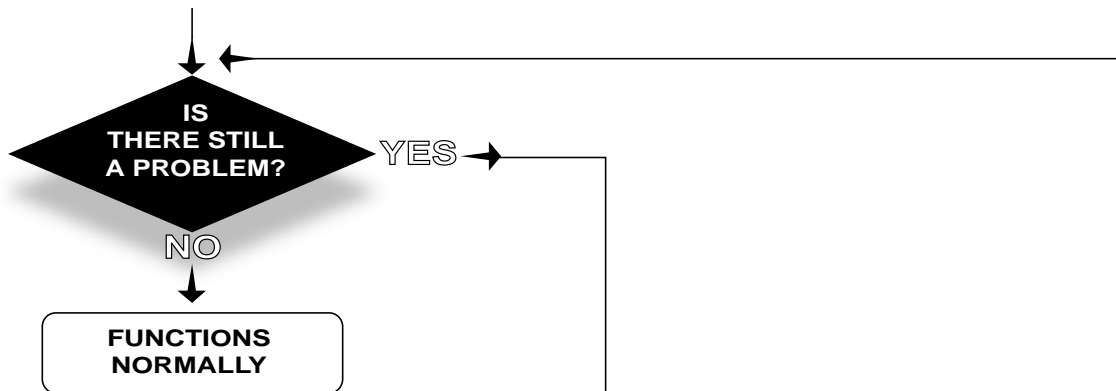








D



	<i>LIST OF PROBLEMS</i>	<i>POSSIBLE CAUSES</i>
1	Delivery of hot water for domestic use: when the tap is turned on, the burner goes out.	- air in secondary heat exchanger - faulty main circuit flow switch - faulty D.H.W. probe
2	Delivery of hot water for domestic use: the radiators are heated in summer mode	- faulty 3-way valve
3	Delivery of hot water for domestic use: water temperature is not satisfactory.	- check sensor for domestic and heating water - check gas settings and regulation - check water flow rate - check DHW storage
4	Delivery of hot water for domestic use: noisy operation.	- primary exchanger is defective - low water pressure in heating system - check gas settings and regulation - check D.H.W. probe
5	Drop/increase in pressure in primary circuit.	- check for leaks in heating circuit - defective water filling loop - check DHW storage - expansion vessel is empty
6	Repeated shutdowns.	- faulty detection electrodes - check gas settings and regulation - check electric circuit for flame detection
7	Safety thermostat is triggered repeatedly.	- Faulty (contacts) ntc sensor-heating/hot water - Defective (poorly calibrated) safety thermostat - Presence of air in the primary water circuit
8	Temperature of radiators not satisfactory.	- check ntc sensor for heating - check by-pass - check gas settings and regulation

3. ELECTRIC DIAGRAMS

Legend:

AT = High Voltage P.C.B.
 BT = Low Voltage P.C.B.

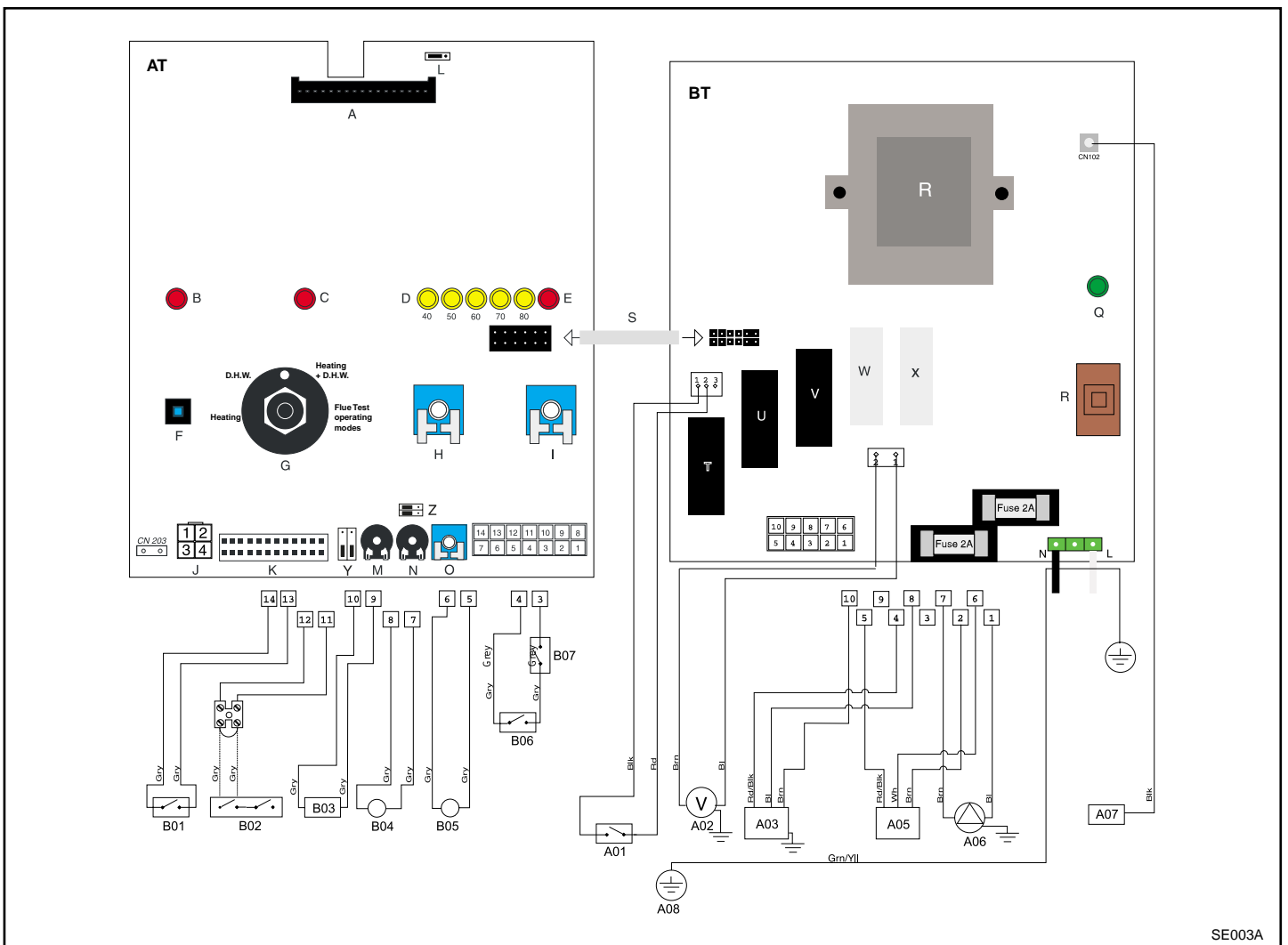
A = Remote Connector Kit
 B = Flame Failure L.E.D.
 C = Insufficient Water Pressure L.E.D.
 D = Water Temperature Indicator L.E.D.s
 E = Overheat Thermostat Warning L.E.D.
 F = System Reset Button
 G = Selector Knob for Operating Mode
 H = Domestic Hot Water Temp. Adjustment
 I = Central Heating Temp. Adjustment
 J = Connector for Time Clock
 K = Connector for Total Check System
 L = Selector for Local/Remote Control
 M = Anti-cycling Device Adjustment for Heating
 N = Soft-light Adjustment
 O = Max Heating Temperature Adjustment
 Q = On/Off L.E.D.
 R = On/Off Switch
 S = Interface Wire for P.C.B.s
 T = Relay Motorised Valve
 U = Ignitor Relay
 V = Gas Valve Relay
 W = Fan Relay
 X = Circulation Pump Relay

Y = Selector TCS2
 Z = Link for Continuous Pump Run

A01 = Air Pressure Switch
 A02 = Fan
 A03 = Gas Valve
 A05 = Motorised Valve
 A06 = Circulation Pump
 A07 = Flame Detector
 A08 = Earth Terminal
 B01 = Over Heat Thermostat
 B02 = External Thermostat
 B03 = Gas Valve Modulator
 B04 = D.H.W. Probe Sensor Cylinder
 B05 = Heating Sensor
 B06 = Pressure Switch for Heating Circuit
 B07 = Pump pressure switch

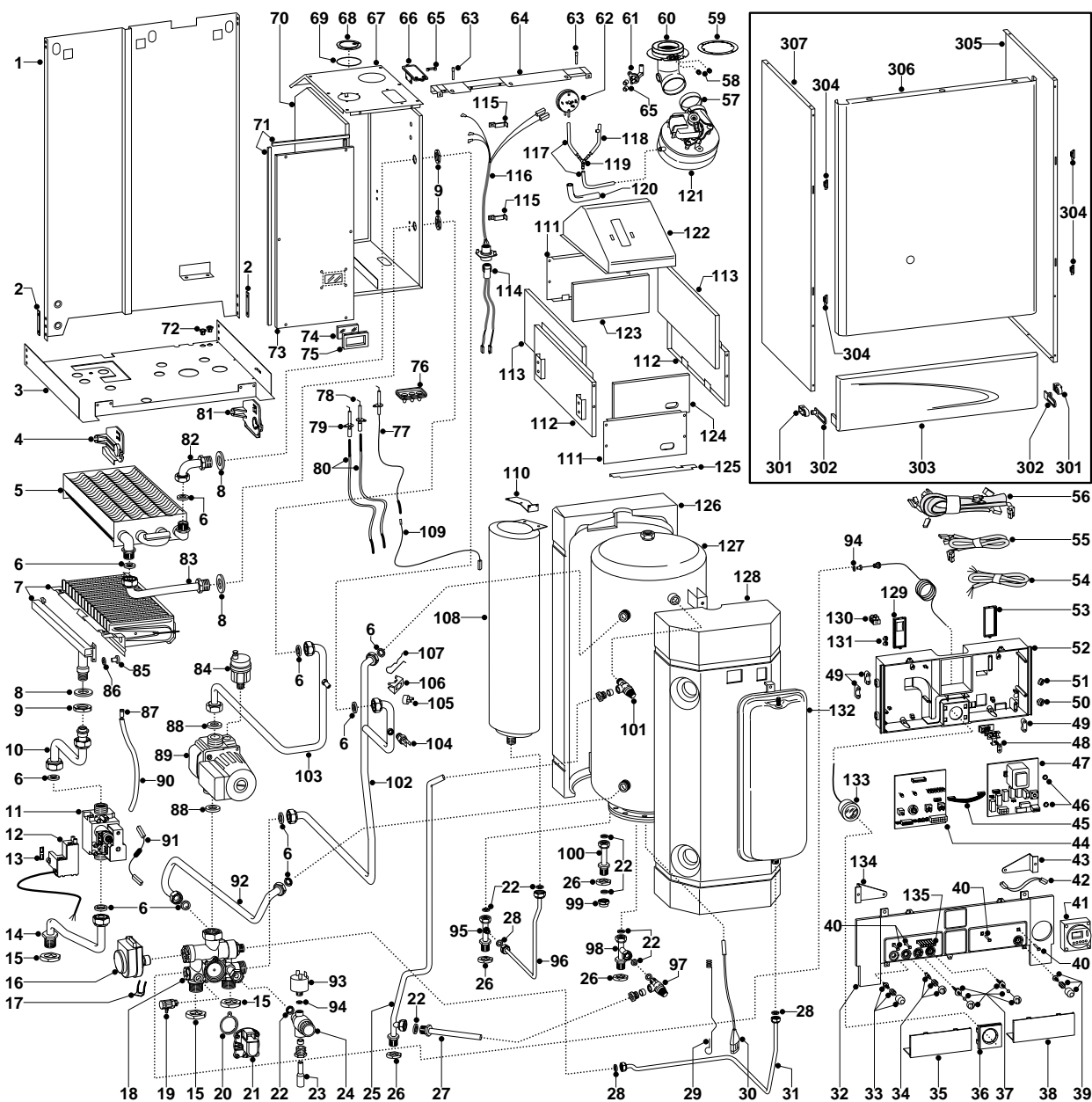
Colours

Gry = Grey
 Rd = Red
 Bl = Blue
 Grn/Yll = Yellow/Green
 Wh = White
 Brn = Brown
 Blk = Black
 Wh/Rd = White/Red

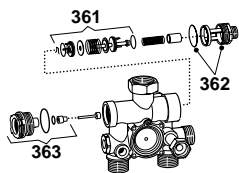


4. SHORT SPARE PARTS LIST

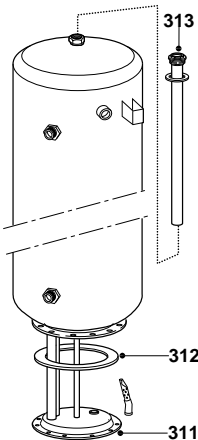
GENUS 27 BFFI PLUS



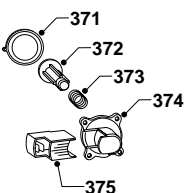
Code 998799



Code 573127



Code 998099



MODELS	CHARACTERISTICS	SERIAL NO: VALIDITY	REF.
GENUS 27 BFFI PLUS	METHANE	2320010200001	A
GENUS 27 BFFI PLUS	LPG	2320010200001	B

ER2000210020001001

Manufacturer: **Merloni TermoSanitari SpA - Italy**

Commercial subsidiary: **MTS (GB) LIMITED**

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E-mail: info@mtsgb.ltd.uk

Technical Service Hot Line: (01494) 539579

23 99 84 1518 111

GENUS 27 PLUS



Users Manual



*The code of practice for the installation,
commissioning & servicing of central heating systems*

Dear Customer,

Thank you for choosing an ARISTON boiler.

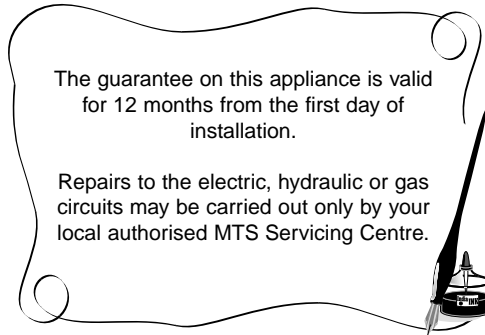
We guarantee that your boiler is a reliable and technically sound product.

This User's Manual provides detailed instructions and recommendations for proper installation, use and maintenance.

Remember to keep this manual in a safe place for future reference i.e. by the gas meter.

Your local MTS Servicing Centre is at your complete disposal for all requirements.

MTS (GB) Limited



Every attempt has been made to avoid errors of any kind in this User's Manual, the Management invites customers to inform of any inaccuracies which they may find. This will help to improve our service

IMPORTANT

Please read this manual carefully.

For additional information, please consult the "Installation and Servicing Instructions."

Please ensure manuals provided are kept with the appliance so that they can be used by the end-user, installer or our authorised engineer.

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2) OPERATING INSTRUCTIONS	page 4
3) TIME CLOCK	page 7
4) USEFUL INFORMATION AND TROUBLESHOOTING	page 10

1. GENERAL INFORMATION

MTS (GB) Limited support the *benchmark* initiative. Your installer will give you, and show you how to use, a logbook which will give you important information about your boiler, and heating system. Please have this logbook to hand whenever you contact a service engineer or us.

All CORGI Registered Installers carry a CORGI ID card, and have a registration number. Both should be recorded in your boiler Logbook. You can check your installer is CORGI registered by calling CORGI direct on :- (01256) 372300.

This is a combined appliance for the production of central heating (C.H.) and domestic hot water (D.H.W.). This appliance **must be used only** for the purpose for which it is designed. The manufacturer declines all liability for damage caused by improper or negligent use.

Do not allow children or inexperienced persons to use the appliance without supervision.

If you smell gas in the room, **do not turn on** light switches, use the telephone or any other object which might cause sparks.

Open doors and windows immediately to ventilate the room.

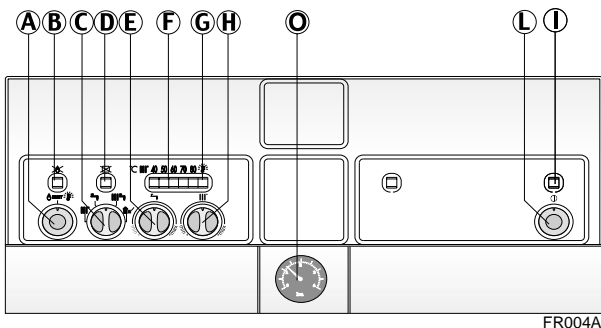
Shut the gas mains tap (on the gas meter) or the valve of the gas cylinder and call your Gas Supplier immediately.

If you are going away for a long period of time, remember to shut the mains gas tap or the gas cylinder valve.

Before any intervention within the boiler it is first necessary to cut off the electrical power supply by turning the external switch to "OFF".

This manual may be kept in the front panel of the boiler.

CONTROL PANEL



Legend

- A) Ignition Lockout Reset Button/Safety (Overheat)Thermostat Reset
- B) Ignition Lockout L.E.D.
- C) Selector Knob for Summer/Winter/Flue Analysis Modes
- D) Low System Water Level L.E.D.
- E) Temperature Adjustment Knob for Domestic Hot Water
- F) Heating System Thermometer
- G) Safety (Overheat)Thermostat Intervention L.E.D.
- H) Adjustment Knob for Heating Temperature
- I) On/Off L.E.D.
- L) On/Off Switch
- O) Heating System Pressure Gauge

2. OPERATING INSTRUCTIONS

CAUTION

Installation, start-up, adjustments and maintenance must be performed by a competent person only, in accordance with the current Gas Safety (Installation & Use) Regulations and the instructions provided. Improper installation may cause damage or injury to individuals, animals and personal property, for which the manufacturer will not be held liable.

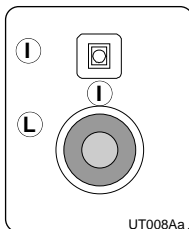
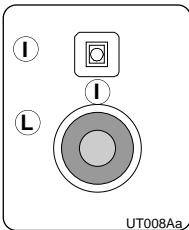
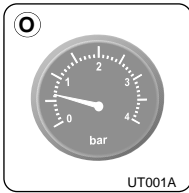
To ensure efficient and safe operation it is recommended that the boiler is serviced annually by a competent person.

If it is known or suspected that a fault exists on the appliance, it must not be used until the fault has been corrected by a competent person.

HELPFUL SUGGESTIONS

To get the most out of your boiler, we have provided you with some useful advice on the proper use and maintenance:

- Periodically check the system pressure using the pressure gauge "O", make sure that the pressure at 1.5 bar (the blue part on the gauge) when the system is off and cool. The warning L.E.D. "D" will indicate if the pressure is below the minimum recommended value. Consult your installer for checking and refilling the system.
- The outer panels of the unit's case must only be cleaned with a damp cloth. Do not use abrasive cleaners. The Control panel can be wiped with either a damp or dry cloth. Spray polishes must not be used on the control panel surface or knobs. Care must be taken in preventing any liquid entering the appliance.
- If the water is exceptionally hard, install a water softener so that the efficiency of the unit remains the same over time, as this will consume less gas.
- To improve comfort and take full advantage of the heat produced by the boiler, it is recommended that an external thermostat be installed.
- If the boiler is not going to be used for an extended period of time, turn off the supply of electricity to the unit by pressing the On/Off switch "L".
- The green L.E.D. "I" will turn off. Then turn off the supply of gas to the unit itself.
- It is good practice to clean and service the appliance and central heating system every year.
- Call an Authorised Service Centre.



START-UP PROCEDURE LIGHTING

Before starting the unit, check the following:

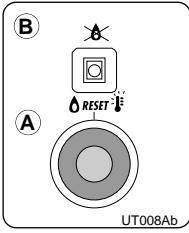
- The water pressure on the pressure gauge "O";
- That the gas cock and the inlet for domestic water are open.

These models are equipped with electronic ignition which utilises contact ionisation.

To make the boiler operational, simply press the On/Off switch "L".

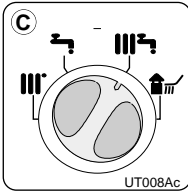
The green L.E.D. "I" will then turn on.

At this point the boiler is ready for use: a centralised electronic control unit will automatically light the main burner when needed. If the burner



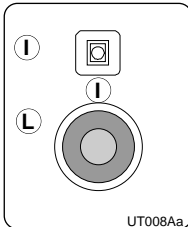
does not light within the pre-set safety time limit, the red “B” L.E.D. will light up. To reset the ignition system, the reset button “A” must be pressed. Should the system fail to light a second time, check to make sure that the gas cock is open. If the problem persists, contact one of our Authorised Service Centres for assistance.

WINTER AND SUMMER OPERATING MODES



The boiler is fitted with a selector knob “C” which allows you to switch between winter < III' 2' > and summer < 2' > and also heating only < III' > operating modes and vice versa. When the knob is set to < III' 2' >, the boiler can serve the dual purpose of providing heat and/or hot water for domestic use.

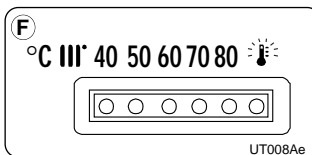
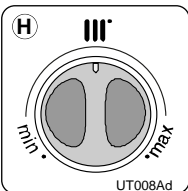
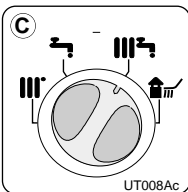
The supply of hot water for domestic use always takes precedence over heating. When the knob is set to < 2' >, the boiler cuts out the heating system and only provides hot water for domestic use (when needed).

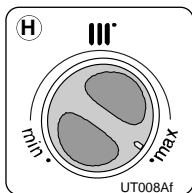


TURNING ON THE CENTRAL HEATING

Installation without a room thermostat :

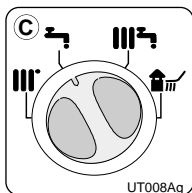
- Turn on the power supply to the boiler by pressing the On/Off switch “L”; the green L.E.D. “I” will then turn on;
- Turn the “C” selector knob to < III' 2' > or < III' > (in this position no domestic hot water is produced);
- Regulate the temperature of the water in the boiler by turning the “H” knob. The temperature can vary between 42°C and about 82°C;
- Check the boiler temperature on the thermometer with the yellow L.E.D.s “F”. With this type of installation, the ambient temperature does not influence the operation of the boiler and the circulation pump always remains in operation.





Installation with a room thermostat:

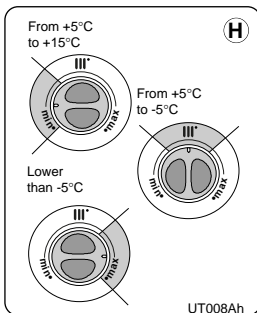
- Turn the “C” selector knob to < III' 2 >;
- Turn on the power supply to the boiler by pressing the On/Off switch “L”; the green L.E.D. will then turn on;
- Turn the thermostat knob “H” to the highest temperature setting.
- With this type of installation, the boiler is controlled by a room thermostat
- Therefore, it runs until the ambient temperature has reached the temperature setting on the thermostat. At that point, the main burner will turn off and the circulation pump will stop.



TURNING OFF THE CENTRAL HEATING

Installation without a room thermostat:

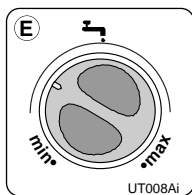
To turn off the heating, turn the “C” selector knob to < 2 >. The boiler will still provide hot water for domestic use.



ADJUSTING THE HEATING TEMPERATURE

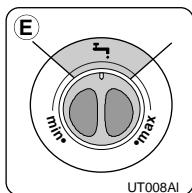
To economise on consumption while achieving the highest level of comfort, the temperature adjustment knob is designed with three different heating zones based on the temperature outside the home. Rotate the knob “H” as shown below.

PRODUCTION OF HOT WATER FOR DOMESTIC USE

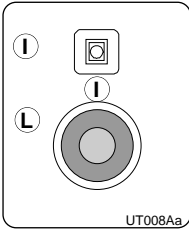


- Turn on the power to the boiler by pressing the On/Off switch “L”;
- Turn the “C” selector knob to < III' 2 > or < 2 > (in this position no central heating is produced);
- Turn the “E” knob to select the temperature for the hot water (between 40°C and about 70°C).

ADJUSTING THE TEMPERATURE OF WATER FOR DOMESTIC USE



It is recommended that the temperature for the hot water should not be set to high temperatures and then mixed with cold water. Setting the thermostat to medium temperatures is preferable (see figure).

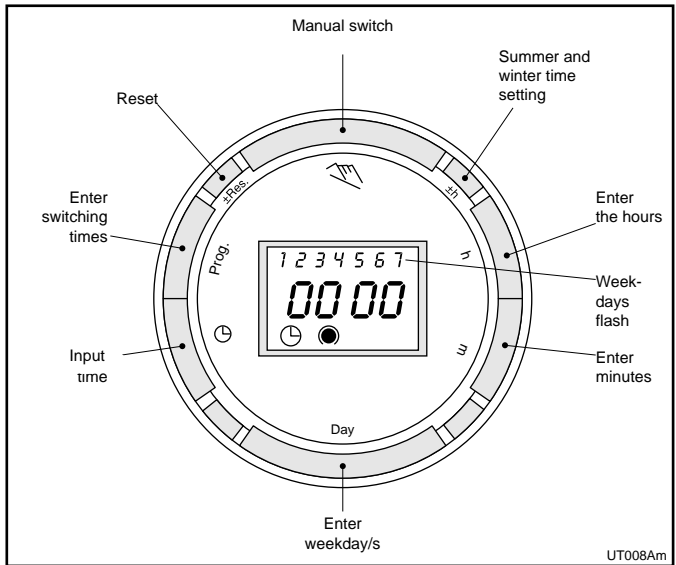


SHUTDOWN PROCEDURE

To turn off the main burner, simply press the On/Off switch “L”; the green L.E.D. “I” will also turn off.

As a precautionary measure, it is recommended that the gas cock located on the bottom of the boiler be turned off as well.

3. TIME CLOCK



Operating the time switch

The step marked with the symbol “▶” are necessary to carry out a switching program.

Preparing for Operation

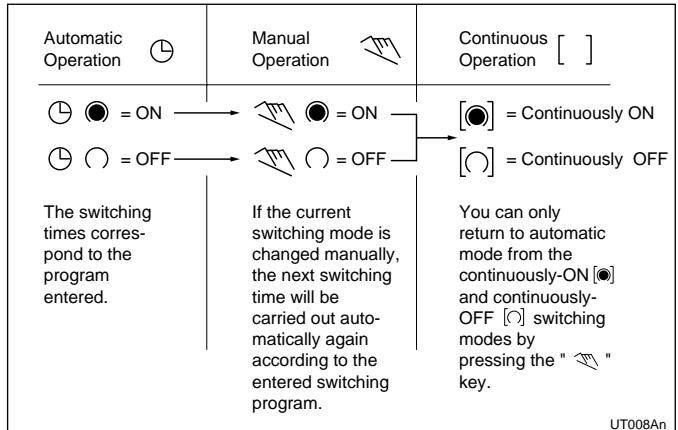
▶ Activate the “Res” switch (=RESET) to reset the time switch to its default setting (activate using a pencil or similar pointed instrument). Do this:

- every time you wish to “reset” the time switch
- to erase all switching times and the current time of day.

After approximately two seconds the following display appears:

▶ Enter current time and weekday

- Keep the “⌚” key pressed down
- During the summer time period press the +/- 1h key once.
- Enter the hour using the “h” key
- Enter the minutes using the “m” key
- Enter the day using the “Day” key
- 1 = “Monday”.....7 = Sunday
- Release the “⌚” key.





► Entering the switching times

You have 20 memory locations available. Each switching time takes up one memory location.


Keep pressing the "Prog" key until a free memory location is shown in the display "--:--".

Programme ON or OFF with the " " key:

"" = OFF; "" = ON

Enter the hour using "h"

Enter the minutes using "m"

If a switching command is to be carried out every day (1 2 3 4 5 6 7) then store using the " " key, otherwise select the day(s) it is to be carried out by using the "Day" key.


When the day selection is left blank, the programmed switching instruction operates at the same time every day

1 2 3 4 5 6 = Monday – Saturday



1 2 3 4 5 = Monday – Friday

6 7 = Saturday – Sunday


Selection of single days: 1 = Mon. 2 = Tues.

Save the switching time with the " " key.

The time switch enters the automatic operating mode and displays the current time of day.

Begin any further entry of a switching time with the "Prog" switch. If your entry is incomplete, the segments not yet selected will blink in the display. After programming is completed, and you return the time clock to the current time display with the " " key, the time clock will not activate any switching instruction required for the current time. You may need to manually select the desired switching state with the " " key. Thereafter, as the unit encounters further switching instructions in the memory in real time, it will correctly activate all subsequent switching instructions.

Manual Override Switch " "

With the " " you can change the current setting at any time. The switching program already entered is not altered.

Reading the programmed switching times

Pressing the “Prog” key displays the programmed switching times until the first free memory location appears in the display “-- : --”.

If you now press the “Prog” key once again, the number of free memory locations will be displayed, e.g. “FR 18”. If all memory locations are occupied, the display “FR 00” appears.

Changing the programmed switching times

Press the “Prog” key repeatedly until the switching time you want to change is displayed. You can now enter the new data. See point “**Entering the switching times**”.

Notes on storing switching times:

If you end your entry of the switching times by pressing the “Prog” key, then the switching time you have entered will be stored and the next memory location displayed. Entry of further switching times is also carried out as described in point 4.3.

In addition, a complete switching command is stored **automatically** after around 90 seconds provided **no other** key is pressed. The time switch then enters the automatic operating mode and displays the current time again.

Deleting individual switching times

Press the “Prog” key repeatedly until the switching time you wish to delete is shown in the display. Then set to “- -” using the “h” or “m” key and keep the “⏻” key pressed down for around 3 seconds. The switching time is now erased and the current time is displayed.

AM / PM time display

If you press the “+/-1h” and “h” keys at the same time, the time display switches into the AM/PM mode (mostly used in English-speaking countries).

Technical data

Connection	see unit imprint
Switching capacity	see unit imprint
Ambient temperature	-10°C to +55°C
Running reserve	5 h at + 20°C
Memory locations	20
Shortest switching time	1 min.
Programmable	every minute

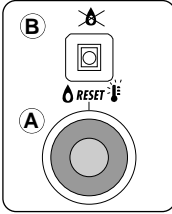
4. USEFUL INFORMATION AND TROUBLESHOOTING

BOILER SHUTDOWN

The boiler unit is equipped with safety devices which intervene in certain situations to shutdown the boiler.

Some of these situations are signalled by the unit and can be corrected by the user.

SHUTDOWN DUE TO THE FAILURE OF THE BURNER TO LIGHT AUTOMATICALLY



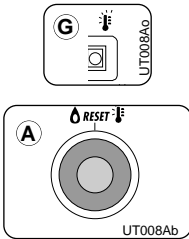
This anomaly is indicated by the red “B” L.E.D.

To reset the unit, press and then release the “A” button.

At this point, the electronic ignition system will attempt to light the burner again.

If lighting failure occurs repeatedly, it is recommended that you contact one of our Authorised Service Centres.

SHUTDOWN DUE TO OVERHEATING



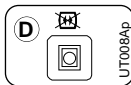
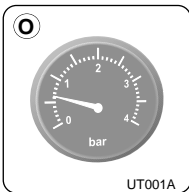
This anomaly is signalled by the red “G” L.E.D.

The boiler shuts off because the safety thermostat detected that the boiler temperature has reached the temperature limit.

To reset the unit, wait until the boiler has cooled and then press the “A” button.

If the safety thermostat shuts off the unit on a frequent basis, contact one of our Authorised Service Centres for assistance.

SHUTDOWN DUE TO INSUFFICIENT WATER CIRCULATION



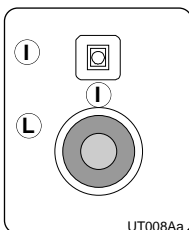
This anomaly is indicated by the red “D” L.E.D.

One of the possible causes of this shutdown situation could be the lack of water in the boiler or water circulation failure in the primary heating circuit.

Check the system pressure on the pressure gauge “O” and, if it is less than 0.5 bar, consult your installer for checking and refilling the system.

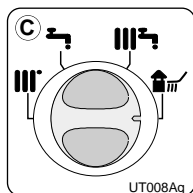
Then reset the unit by turning the boiler off and then back on with the On/Off button “L”.

If this situation persists, contact one of our Authorised Service Centres.



FLUE TEST FEATURE

(only for authorised personnel)



The “C” Summer/Winter/Flue Test selector knob can be set to < III > to bypass temperature adjustment on the heating circuit for the purpose of analysing the fumes produced by combustion.

To access this mode, open a water tap or taps so that the flow rate is no less than 8 litres per minute.

Then press the “C” selector knob in and turn it from < III > or < I > to the < II >.

WARNING!

The flue test feature eliminates the slow-light feature.

This mode must only be selected by a qualified service engineer.

Manufacturer: **Merloni TermoSanitari SpA - Italy**

Commercial subsidiary: **MTS (GB) LIMITED**

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Internet: <http://www.mtsgb.ltd.uk>

E-mail: info@mtsgb.ltd.uk

Technical Service Hot Line: (01494) 539579