

Natural Gas

50 kW
and
70 kW

LP Gas

50 kW
and
70 kW

Clyde Alkon

Wall hung condensing boilers



- **Fully modulating burner and efficiency of up to 107.3% ncv**
- **Modulating integral pump and integral safety valve**
- **Cascade of up to 8 boilers in back-to-back frames**
- **Ultra slim profile - only 266 mm deep**
- **Integral flue condensate drain connection**
- **Aluminium/silicon/magnesium heat exchanger resists corrosion**
- **Counter flow heat exchange maximises heat transfer & thermal efficiency**

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Engineering Data Sheet 813/1

April 2010

General information

Operating principles

The Alkon is a wall-mounted condensing boiler with a counter flow heat exchanger with heat exchange pins that ensure a constant rate of heat transfer through the aluminium body. It has a fully-modulating, down-firing pre-mix gas burner (refer Figs 1 and 2). When operating in condensing mode with a flow of 50°C and a return of 30°C, it will give efficiencies of up to 107.3% (ncv). The combustion air fan and venturi (11) accurately control the volumes of gas and air and mix them in a sealed chamber prior to ignition. This ensures that there is optimum combustion at any point in the modulation range of the boiler. A small flame is held on the entire surface of the plaque burner.

An integral boiler circulation pump (3) ensures an even and constant flow through the heat exchanger - refer page 8. This pump modulates to match flow rate to heat output and increases the overall operating efficiency of the Alkon boiler.

System circulating pumps should be hydraulically separated from the boiler(s) by a low velocity header.

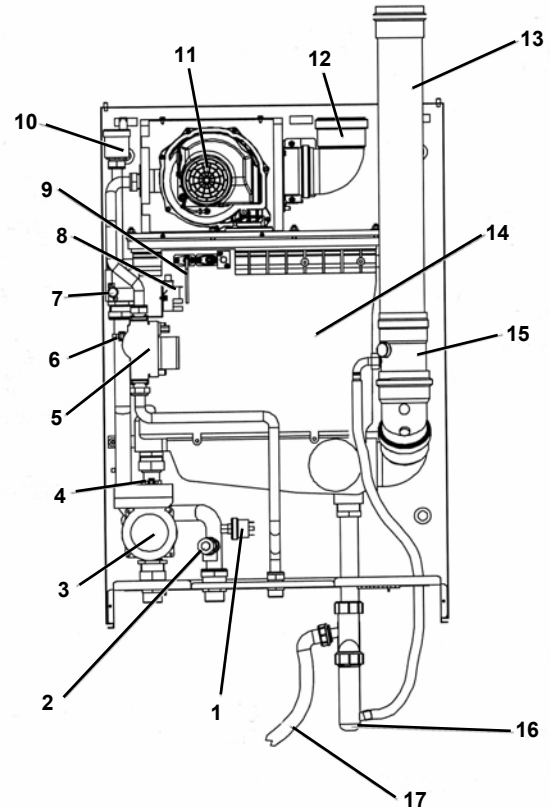
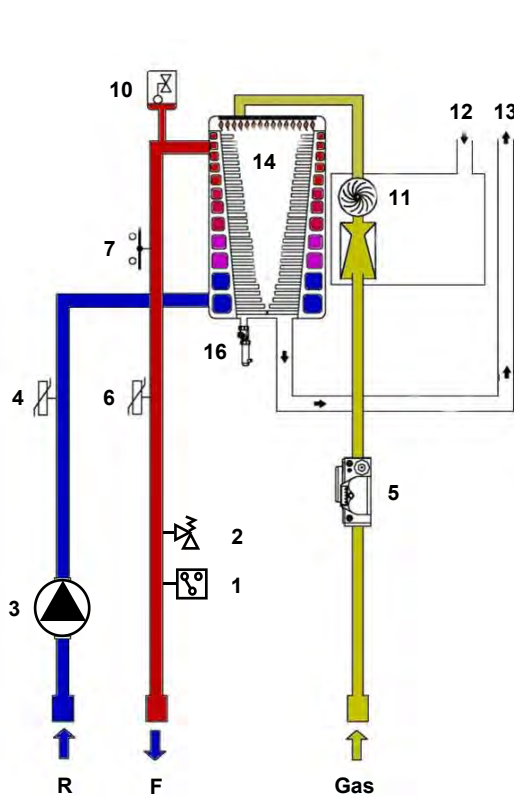


Fig 1 Diagram of operating principles

Fig 2 Component identification for Alkon boiler

Key to Figs 1 & 2

- | | | | |
|---|-------------------------------|----|--|
| 1 | Minimum water pressure switch | 10 | Automatic air vent |
| 2 | Safety valve - 6 bar | 11 | Combustion air fan and venturi |
| 3 | Modulating pump | 12 | Air intake (80 mm diameter) |
| 4 | Return temperature sensor | 13 | Exhaust gas outlet (80 mm diameter) |
| 5 | Gas valve | 14 | Heat exchanger |
| 6 | Flow temperature sensor | 15 | Exhaust gas sampling point and flue condensate drain point |
| 7 | Limit thermostat | 16 | Condensate trap |
| 8 | Ignition transformer | 17 | Condensate drain |
| 9 | Ignition electrode | | |

General information

Application

Alkon boilers are manufactured and tested in accordance with the Gas Appliances Directive 90/396/EEC, the Boiler Efficiency Directive 92/42/EEC, the Low Voltage Directive 2006/95/EC, the Electromagnetic Compatibility Directive 2004/108/EC, EN 483, EN 625, and EN 677 and CE marked accordingly. They are suitable for use in LTHW heating systems with a maximum operating pressure of 6.0 bar and a maximum working temperature of 90°C (see Technical data).

Alkon 50 and 70 boilers are suitable for use with Group H second family gases (eg natural gas, G20), and Group P third family gases (eg propane, G31), and Butane/Propane mix (G30).

The boiler is suitable for use in pressurised (sealed) or open vented heating systems with a minimum static head of 0.5 bar. It is not suitable for use as a direct water heater. Where potable water is required, a matching calorifier or plate heat exchanger must be provided in the system. Both models in the range are suitable for use with a concentric balanced flue.

Statutory requirements

The installation and commissioning of the boiler must be carried out by a qualified engineer in accordance with the instructions provided.

Gas supplies and gas burners must be installed, serviced and commissioned by a qualified person, eg. a Gas Safe registered engineer.

Handling

Offloading, dry storing and placing of equipment in the boiler room is the responsibility of the installer.

Equipment must be dry stored and protected from frost. Cartons must not be crushed or otherwise damaged.

Commissioning

Clyde undertake commissioning of boilers. Commissioning charges do not include servicing during the guarantee period, although this may be carried out under service contract or to specific order. Boilers should be commissioned in line with CIBSE Commissioning Code B.

Servicing

The importance of regular maintenance cannot be over-emphasised if maximum efficiency is to be maintained. Customers are strongly advised to place the equipment under service contract immediately commissioning is complete.

Guarantee

Subject to correct handling, installation and operation, all equipment is guaranteed for twelve months from the date of despatch. Boiler heat exchangers are guaranteed for a period of two years from the date of manufacture.

The guarantee is not valid if the boiler is not installed in accordance with these instructions (please refer to page 5), becomes blocked with debris and/or carbonate deposits from the system water and/or there is no documented evidence of commissioning by Clyde or their appointed engineer.

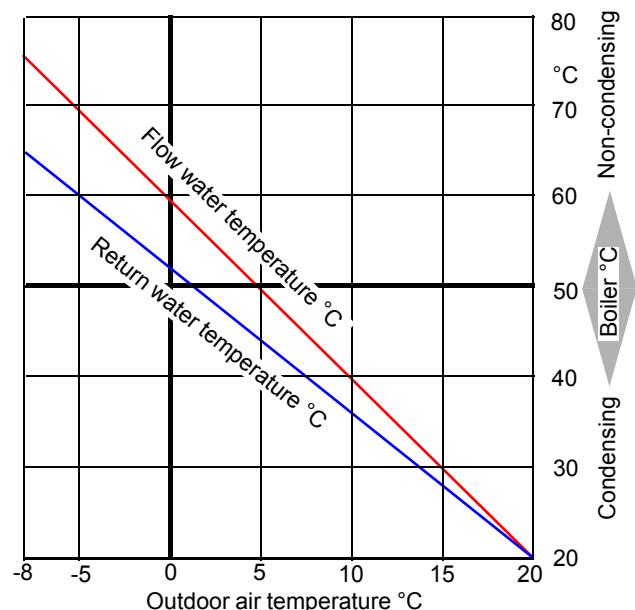
Boiler Log book

A boiler log book that provides a permanent record of commissioning and servicing data and measurements is supplied with every boiler. It is recommended that the owner ensures that this log book is kept safe and brought up to date on every occasion that routine or emergency work is carried out on the boiler.

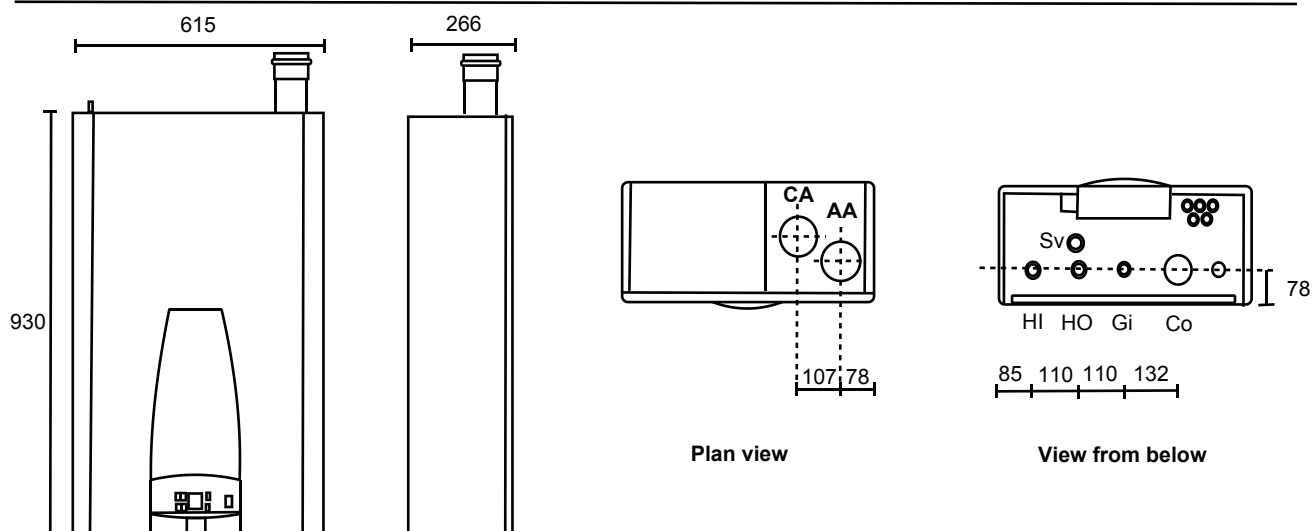
Emitter sizing (radiators)

The boiler will operate in condensing mode whenever the return water is below 50°C and will reach its full potential if the flow water temperature is also below 50°C. However, the latter condition will mainly occur when the boiler is heating an underfloor heating scheme or transiently when recharging a DHW storage tank from cold. By careful design of a traditional heating system with radiators, and with weather compensating control in operation, the return water temperature can be held below 50°C for most of the heating season, only rising above this figure when outdoor temperatures are below zero.

For optimum performance, calculate heat losses on the basis of a 20°C internal temperature and a -8°C outdoor air temperature. With no added factors, size the radiators on the basis of published EN 442 data ($\Delta T50$) and size the system pump for a 20°C temperature drop. In most cases this will ensure that the boiler begins to operate in condensing mode when the outdoor air temperature rises above 1°C and becomes fully condensing when the temperature is above 5°C. For heating schemes in buildings where the occupants have special needs, different environmental conditions may apply and further advice must be sought.



Dimensions and technical data



Dimensions

| | | | | |
|--------------------------|----|----|-------|--------|
| Boiler model / output | | kW | 50 | 70 |
| Boiler flow connection | HO | | R1 | R1 1/4 |
| Boiler return connection | HI | | R1 | R1 1/4 |
| Condensate outlet | Co | mm | 25 | |
| Gas Inlet | GI | | R 3/4 | R 3/4 |
| Flue connection | AA | mm | 80 | 80 |
| Combustion air inlet | CA | mm | 80 | 80 |
| Boiler depth | L | mm | 266 | 266 |
| Boiler height | H | mm | 930 | 930 |

Technical data

Flow 50°C / Return 30°C

| | | | | |
|-------------------|-----|----|--------|--------|
| Heat output (ncv) | Max | kW | 49.3 | 68.5 |
| Heat output (ncv) | Min | kW | 10.3 | 10.3 |
| Heat input (ncv) | Max | kW | 48.5 | 67.5 |
| Efficiency (ncv) | 100 | % | 101.62 | 101.51 |
| Efficiency (ncv) | 30 | % | 107.33 | 107.33 |

Flow 80°C / Return 60°C

| | | | | |
|--|-----|-------------------|-----------------|-------|
| Heat output (ncv) | Max | kW | 47.2 | 65.5 |
| Heat output (ncv) | Min | kW | 9.1 | 9.1 |
| Heat input (ncv) | Max | kW | 48.5 | 67.5 |
| Efficiency (ncv) | 100 | % | 97.29 | 97.06 |
| Efficiency (ncv) | 30 | % | 94.9 | 94.9 |
| Flue gas temperature at full load | | °C | 43.6 | 51.3 |
| Flue gas mass flow | | kg/s | 0.021 | 0.031 |
| CO ₂ in flue gas (1) | | % | 9 | |
| CO in flue gas (0% of O ₂) | Max | mg/kWh | 71.5 | 98.7 |
| Nodensate volume at max rate | | kg/h | 7.8 | 10.87 |
| Natural gas consumption (gross cv) (2) | | m ³ /h | 5 | 6.9 |
| N0x Emissions | | mg/kWh | 33.9 | 34.68 |
| Boiler seasonal efficiency (3) | | % | 95.71 | 95.7 |
| Dry weight | | kg | 50 | 50 |
| Water volume | | l | 3.9 | 3.9 |
| Maximum allowable temperature | | °C | 90 | |
| Maximum hydraulic working pressure | | bar | 6 | |
| CE Registration number | | | CE 1312 BQ 4306 | |
| Electrical protection | | | X4D | |
| Max electrical power consumption | | W | 172 | 290 |

Notes : (1) Measured at the flue gas adaptor (2) Based on GCV 38.76 MJ/m³

(3) Calculated from the non-domestic heating and cooling compliance guide for conformance with ADL2A and ADL2B 2006 using the formula $\eta_{\text{seasonal}} = 0.81\eta_{30\%} + 0.19\eta_{100\%}$

Water flow rates and hydraulic resistances

| | | | |
|---|-----|-------|------|
| Water flow rate at 20°C temp. rise | l/s | 3.86 | 5.4 |
| Hydraulic resistance at 20°C temp. rise | kPa | 15.68 | 29.4 |

Installation requirements

Regulations governing installation

Alkon boilers should be installed in accordance with all prevailing regulations and codes of practice, including the Building Regulations, Health and Safety Regulations PM5, Water Bylaws and the current Gas Safety (Installation and Use) Regulations. Detailed relevant guidance will also be found in;

| | |
|---|--|
| BS 6644 :2005 | Installation of appliances exceeding 70 kW net input |
| BS 5440-2 | Ventilation for appliances not exceeding 70 kW net input |
| BS 6891 | Low pressure gas installation pipework of up to 28mm (R1) |
| BS 5449 | Forced circulation hot water central heating systems for domestic premises |
| CIBSE AM14: 2010 | Non-domestic hot water heating systems |
| CIBSE Guides B and C and Commissioning Code B | Institution of Gas Engineers Utilization Procedures 1, 1A, 2, 4, 7 and 10. |

Water treatment

Alkon boilers have an aluminium/silicon/magnesium alloy heat exchanger and care must be exercised to ensure that the system water and any water treatment is compatible. Whenever a new boiler is connected to an existing system, the pipework must be thoroughly cleaned and flushed. This is to remove debris, rust particles, carbonate deposits and any existing water treatment that might be incompatible with the heat exchanger. New systems must also be thoroughly flushed to remove debris and flux deposits. Clyde recommend that a permanent means of filtration be fitted into the return pipework, such as a sludge trap, hydrocyclone or full flow duplex filters. The boiler guarantee will be invalid if waterways are blocked by debris or carbonate deposits.

The pH value of the system water should be measured to ensure that it is between 6.5 and 8. Temporary hardness (calcium carbonate and magnesium carbonate) can be removed by boiling and its effects limited by preventing ingress of fresh, untreated water. Permanent hardness must not exceed 15° FR (150 mg/litre calcium carbonate). The boiler guarantee will be invalidated by the use of incorrect or incompatible water treatment. Specialist advice should be obtained, eg from;

Fernox Tel. 01483 793200

For full information on cleaning, flushing and protecting hot water systems, refer to BSRIA Application Guide AG 1/2001.

Deaeration

It is a condition of warranty that there is effective air separation and removal from the system. The air separator should be fitted at the hottest part of the system.

Boiler condensate

Alkon boilers have a 25mm flexible condensate drain that is compatible with standard plastic waste pipe. Do not use other materials, as they will corrode. The pipe size must not be reduced and there must be a continuous fall to drain. As a further precaution against freezing, condensate pipes should be run internally whenever possible and lagged when run externally.

Pressurisation of systems

Alkon boilers should be installed as part of a pressurised (sealed) or open vented system with a minimum pressure of 0.5 bar. The maximum allowable pressure for the boilers is 6 bar. They are not to be used with a gravity circulation system.

Boiler location

Alkon boilers must not be installed external to a building. The boiler must be mounted on a sound internal wall, capable of supporting its weight, or on a support frame supplied as an optional extra by Clyde. The boiler location must be frost-free and adequately ventilated (see below). Contamination of the combustion air by inflammable vapours, high dust levels or halogenated hydrocarbons will constitute a safety hazard and will damage the boiler. The following minimum clearances around the boiler should be observed;

| | |
|-------|--|
| Front | 500 mm |
| Sides | 20 mm |
| Below | 100 mm |
| Above | 350 mm (subject to flue installation requirements) |

Air supply and ventilation

Adequate air for combustion and ventilation is essential to the safe operation of a boiler. For a single 50 kW or 70 kW boiler with a Type B powered flue, the ventilation requirements of BS 5440-2:2009 apply, and they are partly summarised in Table 1. For ventilation direct to outside air, the requirement is for 5 cm² per kW net rated heat input above 7 kW.

| Appliance | Ventilation direct to outside air |
|-----------|-----------------------------------|
| Alkon 50 | 208 cm ² |
| Alkon 70 | 303 cm ² |

Table 1 Ventilation for single boiler installations complying with BS 5440-2:2009

When the installation comprises multiple boilers above 70 kW net input with Type B flues, the ventilation requirements of either BS 6644:2005 or IGEN/UP/10 must be met. Table 2 shows the requirements of BS 6644:2005. This standard requires natural ventilation at both high and low levels to the outside air, and is based on the net input of the boilers.

If the boiler installation totals more than 70 kW net input and uses a Type C balanced flue, BS 6644:2005 calls for minimum ventilation of 2 cm² free area per kW net input at both high and low level unless the ambient temperature of the plant room ceiling exceeds 40°C.

| Ventilation direct to outside air | Total kW input (net) |
|-----------------------------------|---|
| Low level | 4 cm ² per kW of total rated net input |
| High level | 2 cm ² per kW of total rated net input |

Table 2 Ventilation for multiple boiler installations in a boiler room complying with BS 6644:2005

Installation requirements

Heat exchanger hydraulic resistance

The Alkon boiler has a high resistance heat exchanger. The boilers should be hydraulically separated from the heating distribution system by either a low velocity header or a plate heat exchanger. With this arrangement, the boiler pump can be located in the return (where water temperature is lowest) regardless of the location of the system distribution pumps.

The boiler is supplied with an integral modulating pump that will ensure flow through the heat exchanger and low velocity header. The advantage offered by a modulating pump over a constant volume circulator is that the ΔT between flow and return is maximised at all times by the control of mass flow, thus increasing heat exchanger efficiency.

Low velocity headers

Low velocity headers are used to separate hydraulically the boilers from the rest of the system. In addition to helping maintain a minimum flow through the boiler, they create a low velocity region for system dirt to be deposited and separation of air from the system water. Used in conjunction with a system filter (refer page 5), they are invaluable when connecting a new boiler to an existing system.

Low velocity headers should always be vertical and sized for a maximum water velocity of 0.5 m/s. Alkon low velocity headers are designed to ensure a water velocity of 0.2 m/s or less and for $\Delta T_{10 / 20}$, so will be suitable for most systems. Fig 3 shows dimensions for the low velocity header supplied by Clyde, and Table 3 shows dimensions for a $\Delta T_{10 / 20}$ system.

If the heating distribution system has been designed for $< \Delta T_{20}$ and a low velocity header has not been installed, the boiler(s) will not provide heat into the system at their rated heat output.

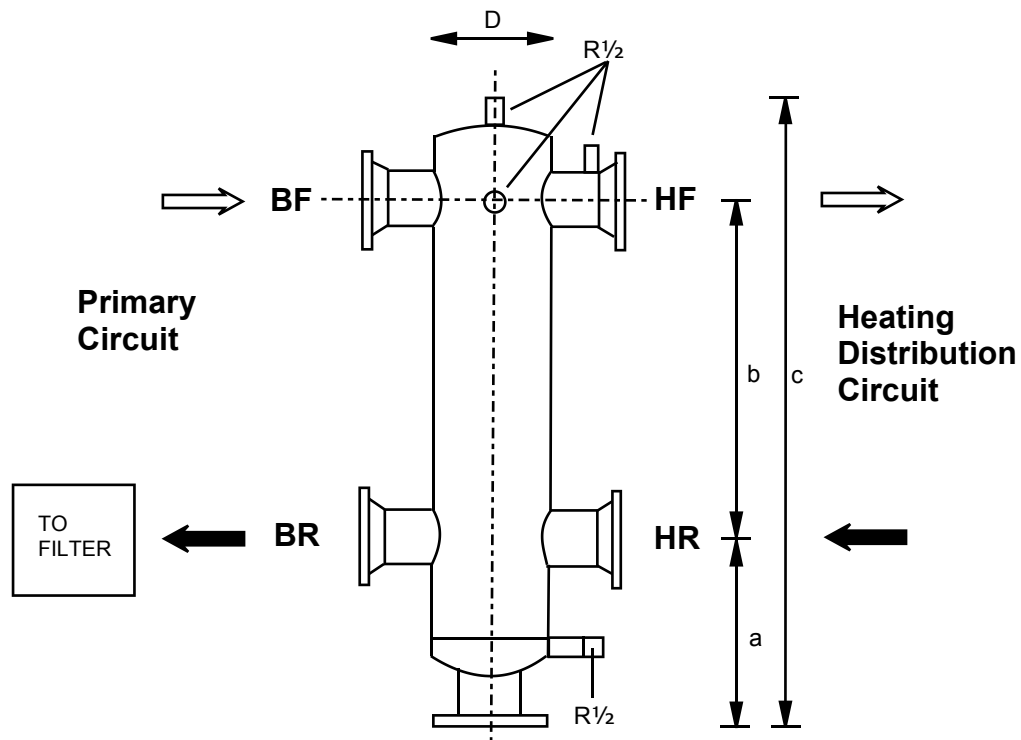


Fig 3 Design for a low velocity header

| Number of boilers in cascade | D mm $\Delta T_{10 / 20}$ | Boiler Flow / Boiler Return $\Delta T_{10 / 20}$ | Heating Flow / Heating Return $\Delta T_{10 / 20}$ | a mm | b mm | c mm |
|------------------------------|------------------------------|---|---|------|------|------|
| 1 | DN 100 | DN 50 | DN 50 | 502* | 260 | 712 |
| 2 | DN 125 | DN 65 (PN 16) | DN 65 (PN 16) | 500 | 1000 | 1740 |
| 3 | DN 125 | DN 65 (PN 16) | DN 65 (PN 16) | 500 | 1000 | 1740 |
| 4 | DN 200 | DN 100 (PN 16) | DN 100 (PN 16) | 500 | 1000 | 1740 |

* For a single boiler, this is the dimension above FFL when supplied with Clyde's pipework kit

Table 3 Low velocity header dimensions for $\Delta T_{10 / 20}$ system

Boiler wiring diagram

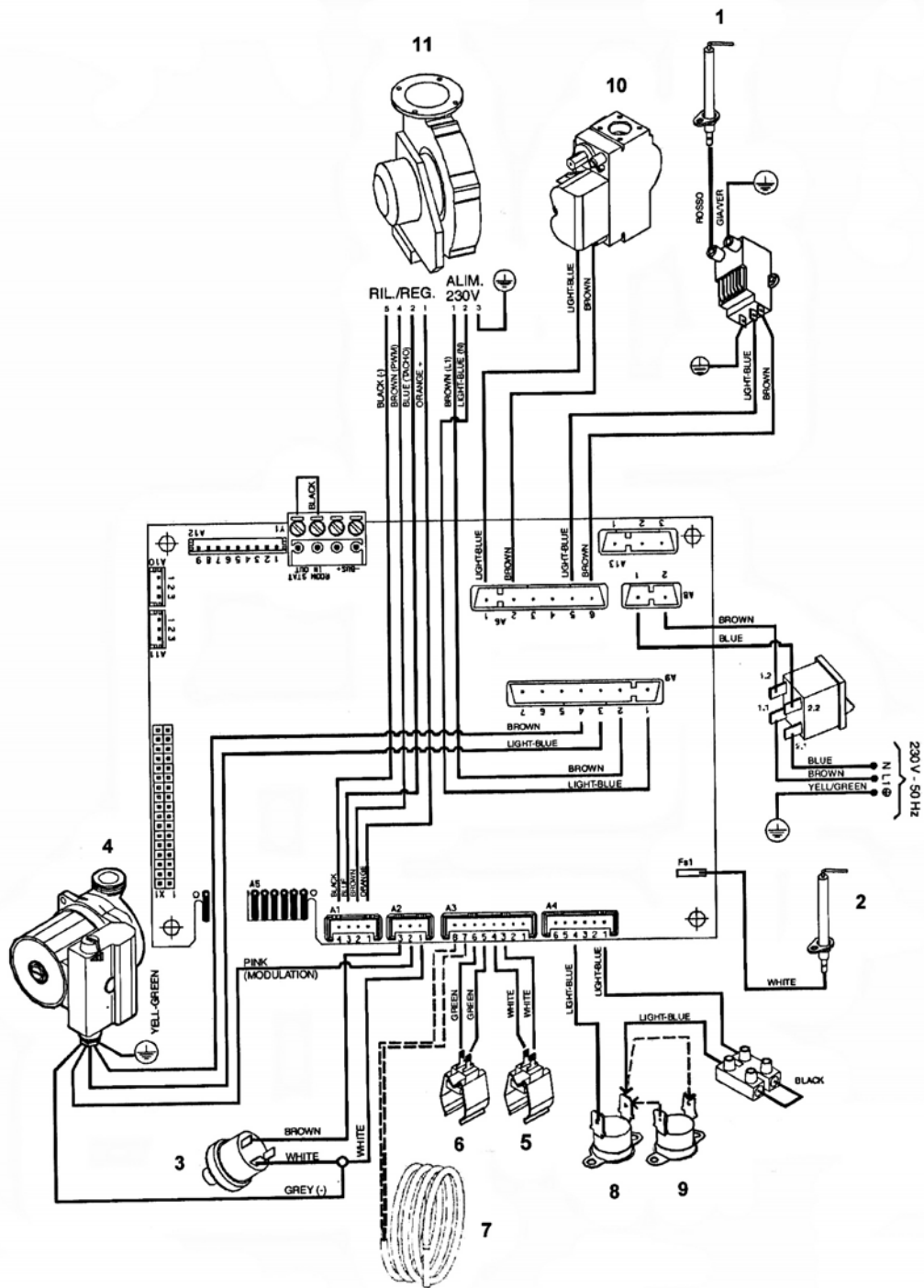


Fig 4 Schematic wiring diagram

Key to Fig 4

- 1 Ignition electrode assembly
- 2 Ionisation electrode
- 3 Minimum water pressure switch
- 4 Modulating pump
- 5 Flow temperature sensor
- 6 Return temperature sensor
- 7 DHW temperature sensor (optional)
- 8 Limit thermostat
- 9 Flue gas temperature limit thermostat (optional)
- 10 Gas valve
- 11 Modulating fan speed control

Flue systems

General

Alkon boilers can be supplied with a range of purpose made stainless steel and plastic flue systems.

Standard items available from Clyde are;

Type C concentric balanced flue for horizontal termination.

Type C concentric flue for vertical termination through a flat or pitched roof.

Also available to special order are;

Type C twin tube flue for horizontal or vertical termination.

Type B powered flue for vertical termination (ie combustion air is taken from within the boiler room, so ventilation must comply with either BS 5440-2:2009,

BS 6644:2005 or IGEM/UP/10 as appropriate - refer page 5).

Type C concentric flues

The standard horizontal and vertical flue kits are 80/125 mm - refer Figs 5 and 6. Additional straight lengths of 1m and 2m, plus 45° and 90° bends are available to complete the system. All additional lengths and fittings are supplied with the necessary sealing collars. The straight lengths can be cut with a hacksaw at the plain end.

Horizontal flues should have a slight fall (3°) back to the boiler. A condensate drain point for the flue is incorporated in the boiler (see fig 2, page 2).

The EL (Equivalent Length) pressure drop of the flue lengths, fitting and terminals must not exceed 100 Pa.

An 80 mm diameter adaptor is supplied with the flue package to take it to 80/125 mm concentric - see fig 5.

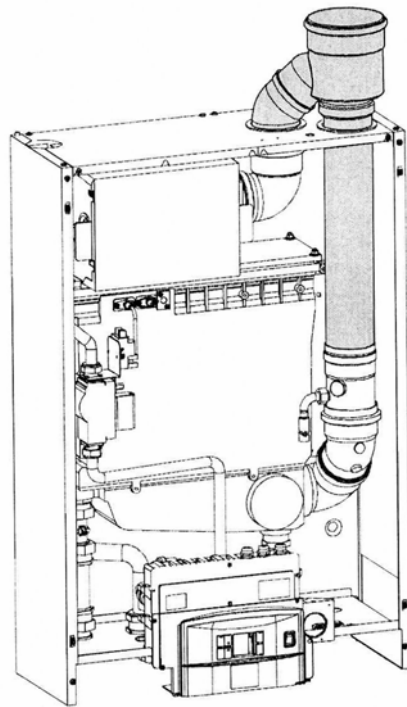


Fig 5 80/125 adaptor fitted to boiler

Concentric horizontal type C13 - fig 6a

The 80/125 horizontal is adequate for short runs and ideal for horizontal termination through an adjacent wall. The maximum EL is 5m, having taken into account the resistance of the terminal and bend off the top of the boiler. Any additional bends will reduce the EL by 1m.

Concentric vertical type C33 - fig 6b

The maximum EL for an 80/125 concentric flue with vertical terminal is 7m, with each additional bend reducing the EL by 1m.

Twin pipe flue type C53

An alternative flue arrangement is with separate 80 mm diameter exhaust gas and combustion air intake ducts. The maximum EL for this is 30m ie 15m for each duct.

Type B powered flues

A 160 mm diameter PPS material multiple boiler flue arrangement for boilers mounted on frames in cascade is optionally available from Clyde, together with all the fittings required to complete the flue installation - refer to figs 8 to 11 and the current Clyde Alkon boilers price list for details.

Flue systems

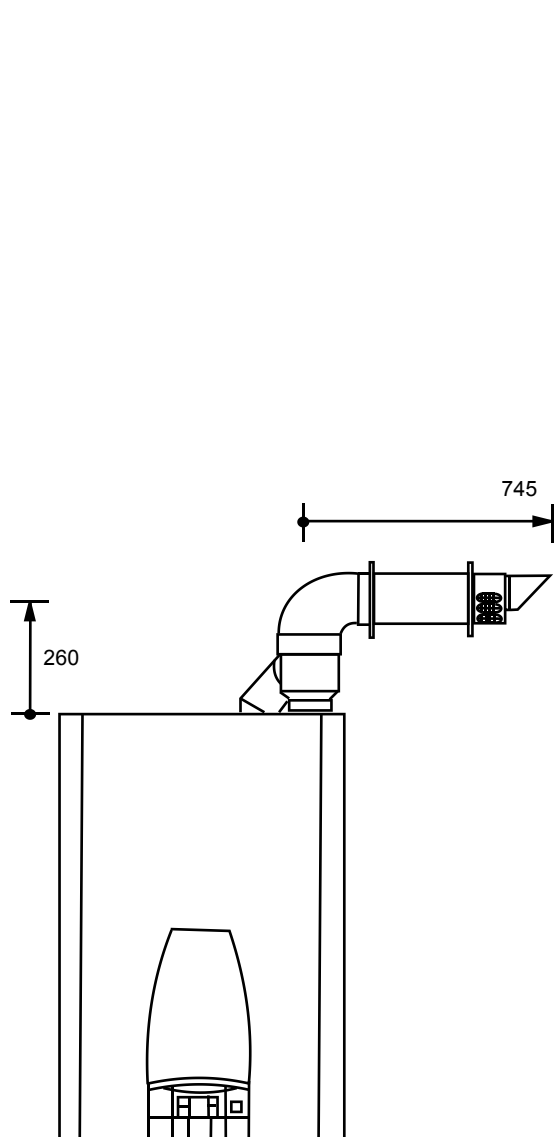


Fig 6a 80/125 horizontal flue terminal kit

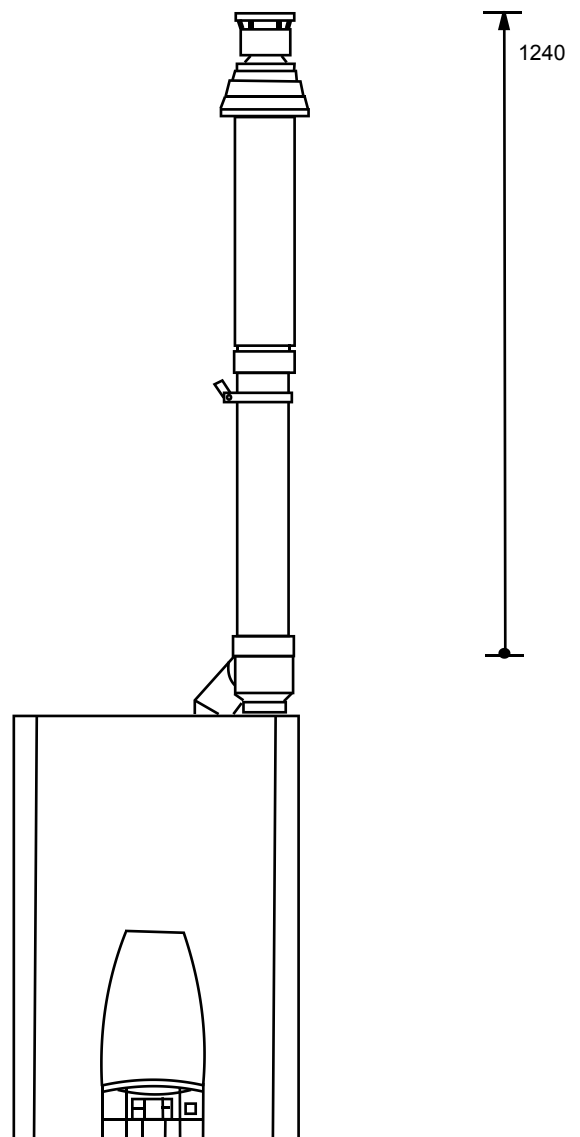


Fig 6b 80/125 vertical flue terminal kit

Flue systems

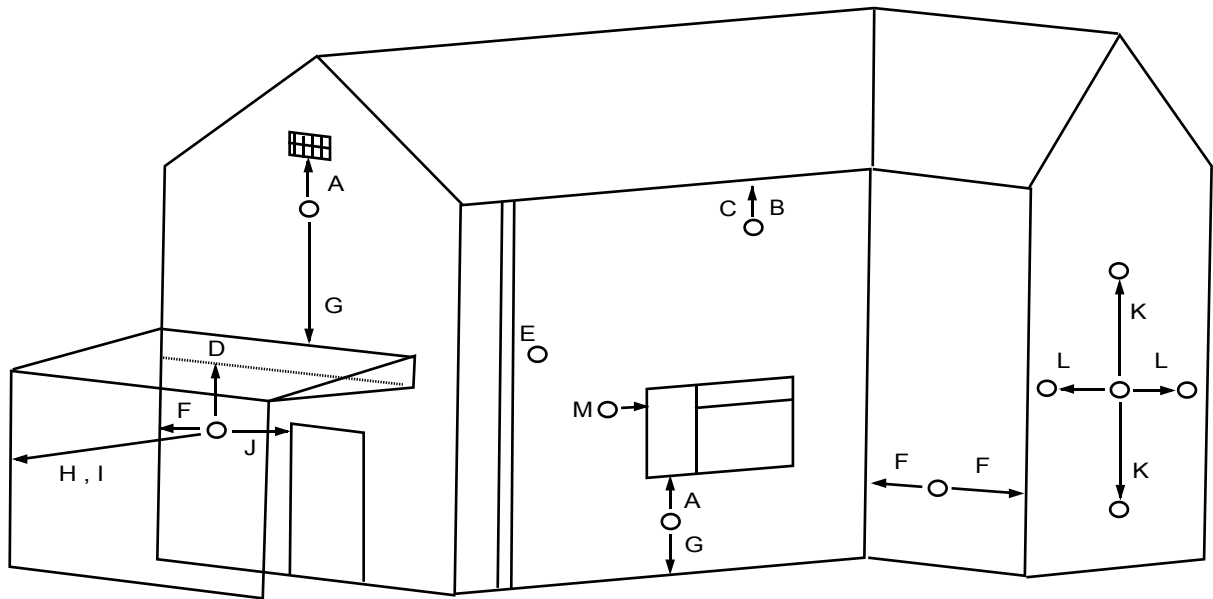


Fig 7 Location of concentric balanced flue terminals

Key to Fig 7

| | | |
|---|---|---------|
| A | Directly below an opening | 300 mm |
| B | Below gutters, soil pipes or drain pipes | 75 mm |
| C | Below soffit / eaves | 200 mm |
| D | Below balconies or car port roof | 200 mm |
| E | From a vertical soil pipe or drain pipe | 75 mm |
| F | From an internal or external corner | 300 mm |
| G | Above ground, roof or balcony level | 300 mm |
| H | From a surface facing the terminal | 600 mm |
| I | From a terminal facing the terminal | 1200 mm |
| J | From an opening in the car port | 1200 mm |
| K | Vertically from a terminal on the same wall | 1500 mm |
| L | Horizontally from a terminal on the same wall | 300 mm |
| M | Horizontally from an opening | 300 mm |

For further information, refer to BS 5440-2:2009

Where boilers with a total output of 150 kW or more are to have horizontal terminals on the same wall, reference should be made to the Clean Air Act to determine whether dispensation should be sought.

Hydraulic system design and control

Mains connection

Each Alkon boiler requires a permanent mains supply of 230V 50Hz, protected by a 3 Amp fuse. The electrical supply to the boiler must be installed in accordance with current IEE (BS 7671) Regulations. A separate supply and isolating switch is required for each boiler, with at least 3 mm separation for both the phase and neutral poles.

Individual boiler operation

Alkon boilers can operate independently of external controls, controlled by their internal flow and return thermostats. To control boiler operation with a basic room thermostat, programmable room thermostat or time clock, remove the link between terminals 1 and 2 on the boiler Y1 terminal board and connect to these.

Cascade control, weather compensation and DHW control

The addition of an E8 heating controller, connected to terminals 3 and 4 of the Y1 terminal board, will provide the following functions;

- Cascade control of up to 8 boilers
- DHW generation via a calorifier with loading pump, giving DHW priority
- Temperature control of one or two heating circuits. The options are one directly controlled index circuit with a mixer for a secondary circuit, or direct control of the DHW circuit as the index, with two mixers for the two heating circuits
- Weather compensation
- Integration of a solar thermal system

The E8 controller can be built into a plant room control panel, mounted on the wall, or supplied with an optional wall mounting box that also serves as a boiler controls wiring centre. An E8 controller is supplied as part of the frame and pipework kit for 2, 3 and 4 boiler cascades, and as an optional extra for single-boiler configurations if DHW control, temperature control of more than one heating zone or weather compensation is required.

Outside air sensor, DHW temperature sensor and heating circuit sensors are supplied with the E8 controller. A DHW complete wiring kit is also available. Refer to the Alkon Installation manual for full details and schematics.

Building and Energy Management Systems

A single E8 controller will be required if one or more boilers are to be controlled by a 0 - 10V signal from a BMS or EMS. If the overall control is by a Modbus Network, The E8 controller should be replaced with a single Boiler Communications Module (BCM) as the controlling interface. Refer to the Alkon Installation manual for full details and schematics.

Key to figs 8 to 11

Items supplied as part of standard boiler frame and pipework kits

| | |
|----|--|
| 1 | Boiler support frame |
| 1a | Boiler support frame extension piece |
| 2 | Manifold pipe kit |
| 5 | Low velocity header |
| 6 | Low velocity header connection pipework |
| 7 | E8 controller (not shown) is standard for 2, 3 and 4 boiler cascades, and optional for single boiler installations (see above) |
| 9 | Modulating boiler pump |
| 11 | Set of blanking flanges |

Items supplied as optional extras to standard boiler frame and pipework kits

| | |
|----|--|
| 3 | Safety device manifold |
| 4 | Safety device kit comprising limit temperature thermostat, maximum pressure switch, manometer, thermometer and individual boiler expansion vessel |
| 8 | 160 mm PPS Type B common flue header - a range of 160 mm bends and flue lengths is available to complete the flue installation (see current Clyde Alkon boiler price list) |
| 8a | Type B common flue header extension piece |
| 10 | CGCPU Pressurisation unit (not shown) |
| 12 | DHW control wiring kit (not shown) |
| 13 | Concentric Type C 80/125 horizontal and vertical flue Kits (not shown) |
| 14 | BCM (Boiler Communications Module - not shown) |

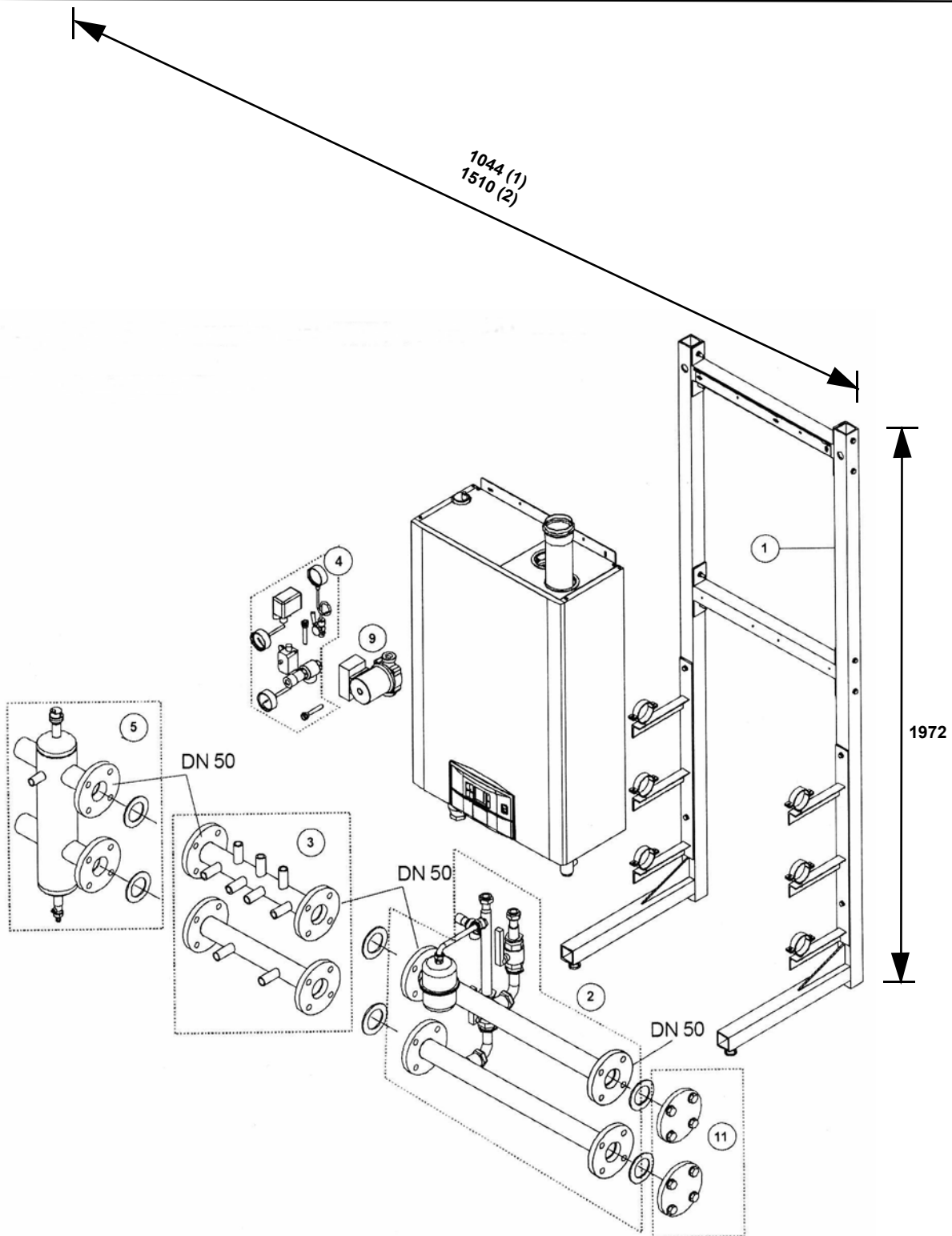


Fig 8 1-boiler frame and pipework

Notes;

(1) Overall length of the standard frame and pipework kit, which does not include items 3 and 4.

(2) This is the overall length including items 3 and 4. These two items are a safety device kit and a mounting manifold. The safety devices are limit temperature thermostat, maximum pressure switch, manometer, thermometer and individual boiler expansion vessel. These are optional items only and must be specifically ordered if required.

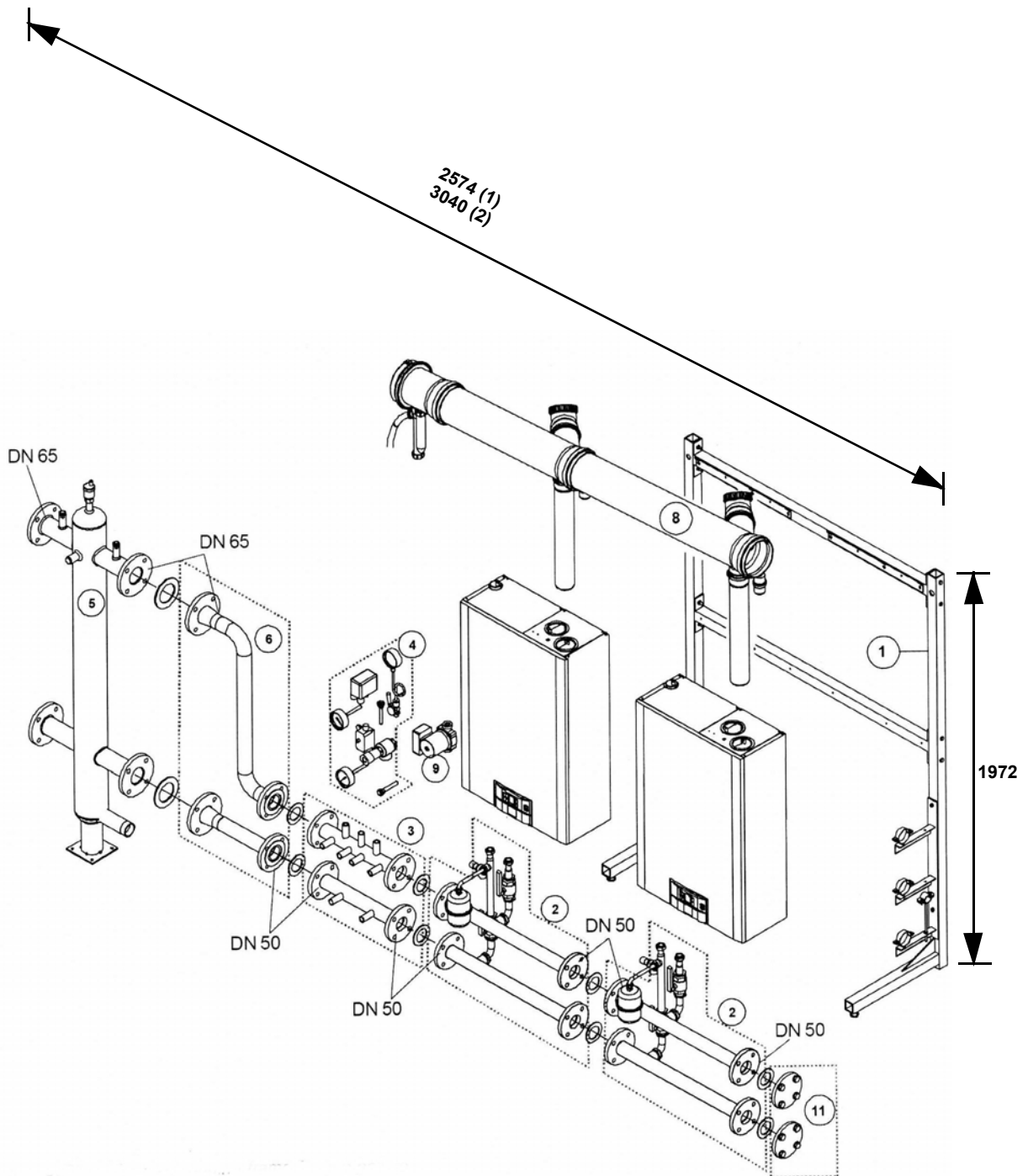


Fig 9 2-boiler frame and pipework

Notes;

(1) Overall length of the standard frame and pipework kit, which does not include items 3 and 4.

(2) This is the overall length including items 3 and 4. These two items are a safety device kit and a mounting manifold. The safety devices are limit temperature thermostat, maximum pressure switch, manometer, thermometer and individual boiler expansion vessel. These are optional items only and must be specifically ordered if required.

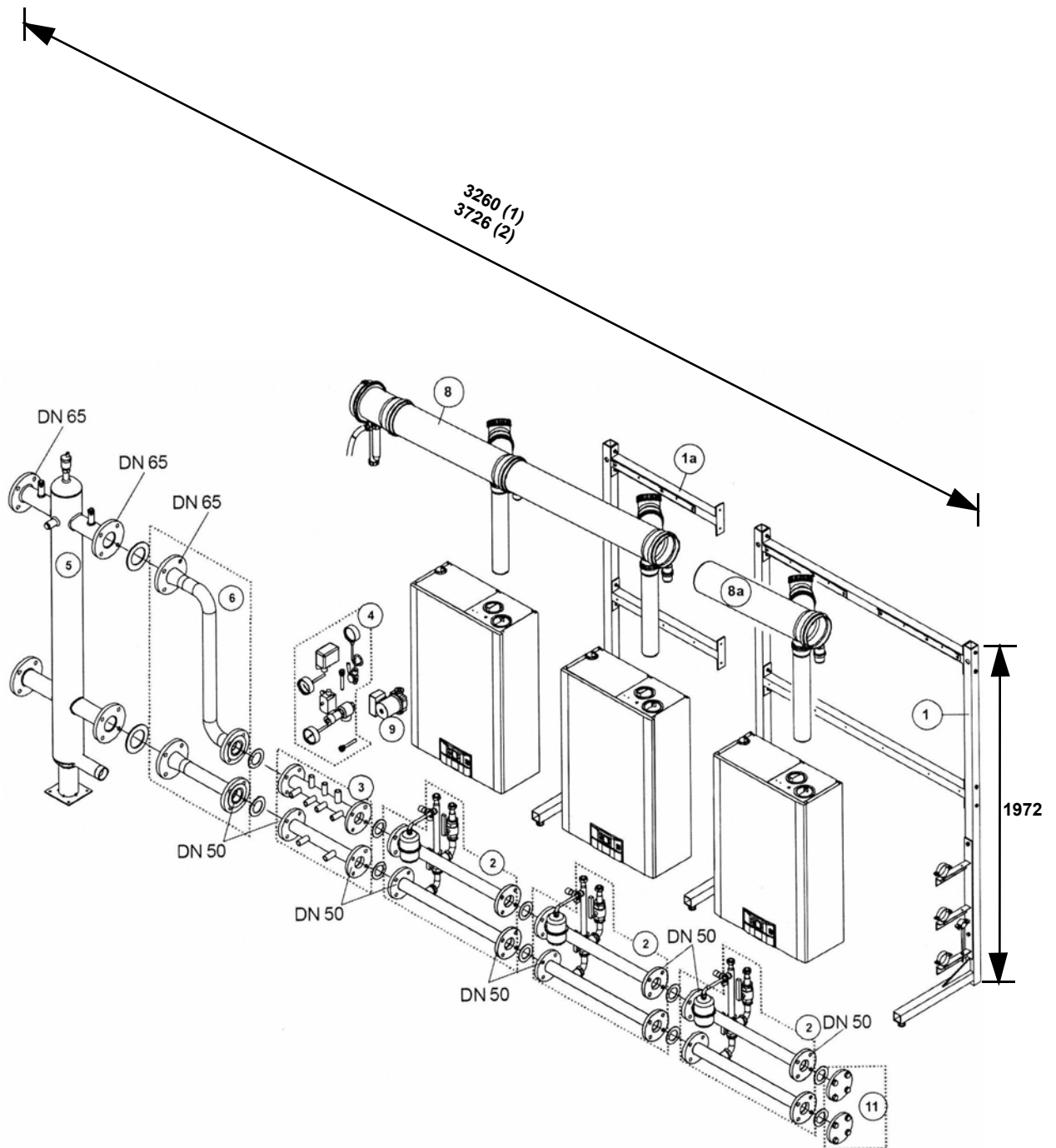


Fig 10 3-boiler frame and pipework

Notes;

(1) Overall length of the standard frame and pipework kit, which does not include items 3 and 4.

(2) This is the overall length including items 3 and 4. These two items are a safety device kit and a mounting manifold. The safety devices are limit temperature thermostat, maximum pressure switch, manometer, thermometer and individual boiler expansion vessel. These are optional items only and must be specifically ordered if required.

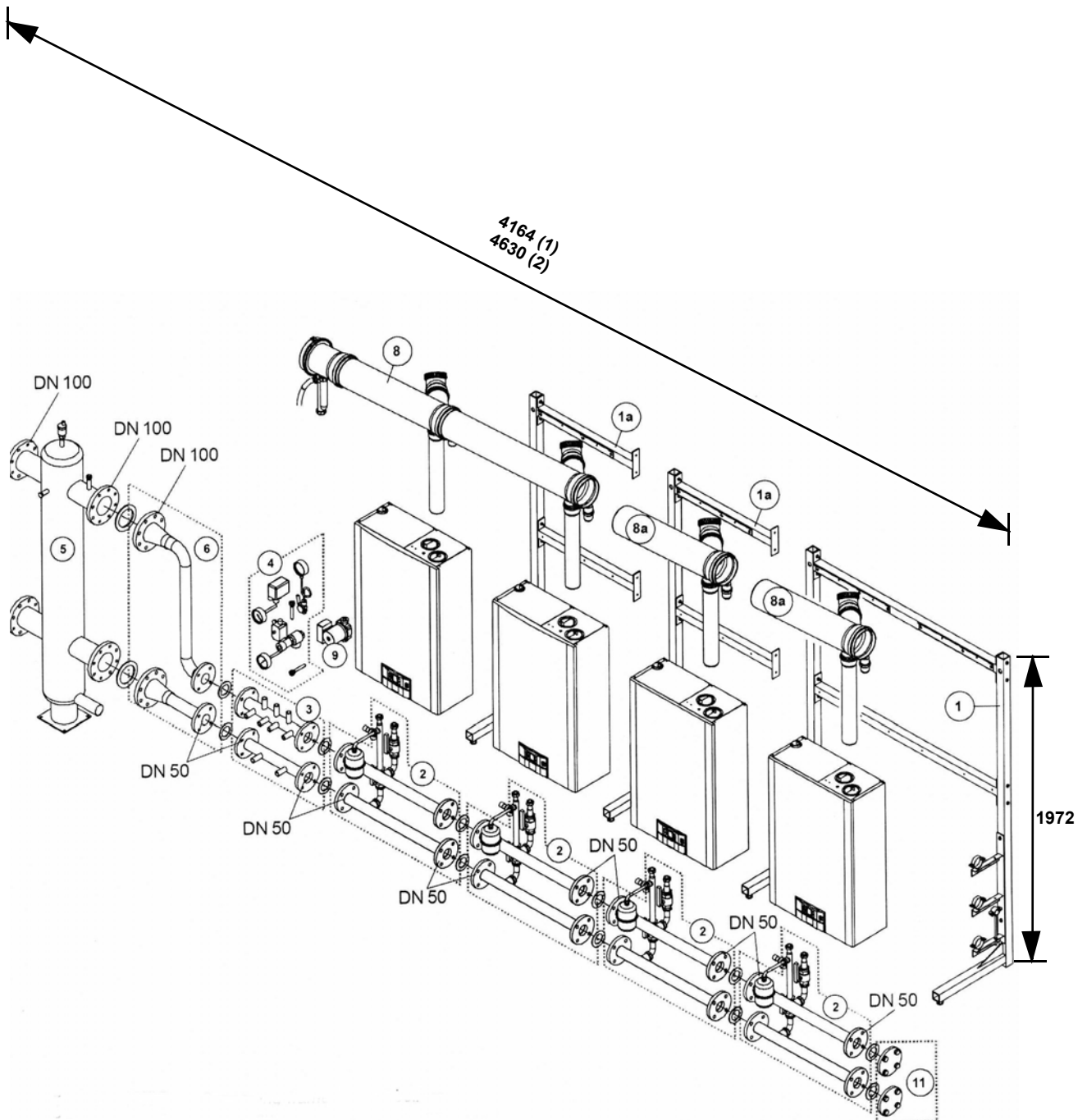


Fig 11 4-boiler frame and pipework

Notes;

(1) Overall length of the standard frame and pipework kit, which does not include items 3 and 4.

(2) This is the overall length including items 3 and 4. These two items are a safety device kit and a mounting manifold. The safety devices are limit temperature thermostat, maximum pressure switch, manometer, thermometer and individual boiler expansion vessel. These are optional items only and must be specifically ordered if required.

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