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(56-42)Xh1

January 1974

INSTALLATION AND MAINTENANCE INSTRUCTIONS

AVON

OIL-FIRED BOILERS

Potterton

AVON OIL FIRED BOILERS
WITH NU-WAY OR SELECTOS BURNERS
INSTALLATION AND MAINTENANCE INSTRUCTIONS

January 1974

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INTRODUCTION

Avon boilers are delivered to site cartoned and crated with the exception of the waterway sections which are supplied loose. All small parts such as bolts, nuts, etc., are contained in polythene packs. These are contained in two cardboard boxes and are each identified by a letter for easy reference.

SECTION 1. BOILER INSTALLATION

SITE REQUIREMENTS

Access There must be adequate access to the boiler site for boiler sections each measuring approximately 50 in. x 24 in. x 5 in. (1270 mm x 610 mm x 127 mm) and weighing approximately 3-1/2 cwt. (178 kg).

Clearances Minimum clearances required for erection and maintenance are 18 in. (457 mm) at the rear of the boiler (measured from the rear boiler plate), full waterway length in front of the boiler and at least 18 in. (457 mm) on either side.

Boiler Base A smooth level floor is necessary, capable of bearing the weight of the boiler being installed (see Table 1). The base of the boiler is water-cooled and no special insulation is needed other than that specified by Building Regulations 1965 or local authorities.

Flue and Air Supply Proper evacuation of flue products is essential. British Standards Code of Practice CP.342 should be consulted and the flue designed to give a draught of 0.02 in.w.g. (0.05 mbar) in excess of boiler requirements.

The stabiliser fitted is capable of dealing with excess draught of up to 0.2 in.w.g. (0.5 mbar) where the flue is equivalent in size to that of the boiler flue outlet. Both fluepipe and chimney stack should be insulated where exposed, especially where this is likely to result in excessive condensation.

There must be an air supply to the boiler house for combustion and ventilation at all times. There should be 50 sq.in. (322 cm²) per 100,000 Btu/h (105.5 MJ/h or 29 kW) free air inlet to the boiler room for combustion and low level ventilation. On boilers with forced ventilation, the amount of air required is 75 cfm @ stp (0.03 m³/s) per 100,000 Btu/h (105.5 MJ/h or 29 kW). See Table 2 for minimum fresh air requirements.

ERECTION

Before erecting the boiler check that all the parts shown on the packing sheets are available on site.

Identification of Sections

The front waterway section has the water flow flange on top and the burner aperture at the front. The rear section has the two water return flanges facing rearwards. The lower half of the rear section forms the water-cooled back of the

combustion chamber. The remaining sections are all intermediate.

The cast arrows on each side of these sections (next to the second and third cross tubes from the bottom) indicate the flat sides of the cross tubes and also assist in the correct assembly of the sections (see Figure 2-Assembly of Sections).

Erecting the Waterway Sections (see Figures 2 and 3)

1. Lay the two boiler length foundation strips (Pack B) on the concrete base at 21-1/2 in. (546 mm) centres to form a level track for the waterway sections.
2. Remove the protective covering from the water ports on the rear section and clean the machined faces with abrasive paper.
3. Stand the rear section upright in its working position on the track and prop it up with a plank. The two return flanges should be facing rearwards. Metal shims may be used for final levelling.
4. Apply 2 or 3 dabs of adhesive (Pack C) to each water port face and place a joint ring (Pack C) in position on each, a 4 in. (102 mm) ring at the top and two 3 in. (76 mm) rings at the bottom. It is important that no adhesive is allowed to get on to the exposed faces of the joint rings.
5. Clean the first intermediate section and stick the joint rings on the side facing the front of the boiler — the cast arrow next to the third cross tube from the bottom should point to the rear and mate with the arrow on the rear section pointing towards the front (see Figure 2-Assembly of Sections). Prop the section in position and secure it to the rear section by passing a 3/8 in. Bsw x 7-3/8 in. (187 mm) long assembly rod (Pack D) through the lower hole in each of the double-drilled lugs at the corners of the sections. Use 3/8 in. Bws nuts and washers (Pack D) but only hand tighten at this stage.
6. Check that both sections are vertical and that the water ports are lined up correctly. Use shims under the section feet if necessary.
7. Fully tighten the nuts on the assembly rods.
8. Prepare and assemble the second intermediate section with the cast arrow on the side mating up with the arrow on the first intermediate section. With these three sections assembled the boiler becomes free-standing and the props may be removed.
9. Seal the gaps across the combustion chamber wall between the section up to immediately above the level of the lower water ports with the white boiler cement supplied. Force the cement well in between the sections.
10. The target wall consists of two halves, upper and lower with an additional rear insert (all packed in the crate). Fit the lower half up against the back of the combustion chamber (the lower half of the rear waterway section) and place the rear insert on the ledge directly

below the lower cross tube. Place the upper half of the target wall up against the rear insert with the chamfered edge uppermost and facing forwards. See Figure 4 — Assembly of Front and Rear Walls.

11. Fill in the gaps between the target wall and the sides of the combustion chamber with white boiler cement, pressing it well home.
12. Prepare and assemble the remaining intermediate sections and the front waterway section making sure that the cast arrows on the sides mate correctly.
13. Take the six 5/8 in. Bsw tie rods (Pack B) and screw 5/8 in. Bsw nuts and washers (Pack E) to four of them. To the remaining two rods screw 5/8 in. Bsw special long nuts and washers (Pack E).
14. Pass the tie rods with the long nuts through the large lugs under the front waterway section (these are approximately 6 in. (150 mm) from each boiler foot). The nuts should be at the front of the boiler.
15. Similarly pass two of the remaining tie rods through the large lugs approximately 8 in. (200 mm) up from the floor on each side of the boiler and the final two through the lugs on each side of the boiler next to the flow ports at the top.
16. Place 5/8 in. Bsw nuts and washers (Pack E) on the rear ends of the six tie rods and tighten progressively diagonally, using a torque spanner. Starting at 50-60 lb/ft. (67-81 N/m) tighten in 20 lb/ft. (27 N/m) stages to a final torque of 90-100 lb/ft. (121-135 N/m) on each tie rod. After tightening, slacken off the assembly bolts, or remove them if preferred.
17. Fit the combined flow outlet (packed in crate) to the front waterway section. Screw four 5/8 in. Bsw x 2-1/2 in. (64 mm) long studs (Pack F) in the flanged water port on top of the front waterway section and place a 3 in. counterflange gasket (Pack F) over the hole. Place the combined flow outlet over the studs and secure with 5/8 in. Bsw nuts and washers (Pack F). 3 in. Bsp counterflanges (packed in crate) are supplied for connecting to the water system and should be fitted together with gaskets (Pack F) to the entries on the top and rear of the combined flow outlet. Use 5/8 in. Bsw studs, nuts and washers to make the connections.
18. Similarly screw four 5/8 in. Bsw studs into each of the flanged water ports in the rear waterway section and connect to the system using the counterflanges, gaskets, studs, nuts and washers supplied in Pack F.
19. Fit the 1 in. Bsp drain cock (packed in crate) into one of the two tappings at the bottom of the rear waterway section. Use the 1 in. Bsp plug (packed in crate) to seal off the unused tapping.
20. Fit the thermostat pocket (contained in burner carton) into the 1/2 in. Bsp tapping on the front of the combined flow outlet.
21. The boiler is now ready for testing for leaks and the method adopted should be the one most convenient

to the situation. If the water system is ready, connect up to the flow and return outlets and fill the boiler by the main stop valves. Connect a pressure pump on the boiler side of the valve.

An alternative method is to fit a blanking flange to the rear flow port on the combined flow outlet and two blanking flanges to the return ports. Fit a flange tapped 1 in. Bsp and valved for venting on the top flow port on the combined flow outlet and plug any remaining tappings. Fill the boiler through the drain cock.

The applied test pressure for the assembled boiler should be one and a half times the working head of the installation plus 20 lb./sq.in. (1380 mbar) if the working pressure is above 40 lb/sq.in. (2760 mbar), or twice the working pressure if this is below 40 lb/sq.in. (2760 mbar) see British Standard Code of Practice CP.341.300. The normal working head of the installation should not exceed 140 ft.w.g. (4180 mbar).

22. Test the boiler for leaks.
23. Seal between the waterway sections externally down each side from the top waterway port to the bottom using buff boiler cement.

Fitting the Flue Adaptor and Draught Stabiliser (see Figure 5)

1. Take the five 3/8 in. Bsw x 1-1/2 in. (38 mm) long studs and the two 3/8 in. Bsw x 1-3/4 in. (45 mm) long studs and screw them into the rear waterway section around the flue offtake flange. The two longer studs are the end ones and are used to secure the boiler casing. Place the flue adaptor (packed in crate) over the seven studs and check that it lines up correctly. Secure with 3/8 in. Bsw nuts and washers, which together with the studs are contained in Pack G. Seal around the gap with asbestos string and buff boiler cement.
2. Screw four 1/4 in. Bsw x 1 in. (25 mm) long studs into the bottom of the flue adaptor and place the stabiliser (packed in crate) over them with the studs towards the boiler. Secure with 1/4 in. Bsw nuts and washers. Fit the gate assembly into the V-shaped lugs at each side of the stabiliser assembly. Studs, nuts and washers are contained in Pack G.

Fitting the Front and Rear Boiler Plates (see Figure 3)

1. Screw three 3/8 in. Bsw x 1-1/2 in. (38 mm) long studs (Pack H) into the rear waterway section immediately below the flueway aperture and fit the support plate (packed in crate) over them. Secure with 3/8 in. Bsw nuts and washers (Pack H) but only hand tighten at this stage.
2. Screw three 3/8 in. Bsw x 1-1/2 in. (38 mm) long studs (Pack H) into the rear waterway section down each side of the flueway aperture. Rest the rear upper boiler plate (packed in crate) on the support plate and hold it in position by placing a clamping strip (packed in crate) over the three studs on each

side. Secure these with 3/8 in. Bsw wing nuts and washers (Pack H) but only hand tighten at this stage.

3. Lift the support plate and boiler plate so that the upper edge touches the flue adaptor and tighten all the nuts securely.
4. Screw two 3/8 in. Bsw x 1 in. (25 mm) long studs (Pack H) with the front waterway section immediately under the flueway aperture and fit the angled shelf (packed in crate) in position over them. Secure with 3/8 in. Bsw nuts and washers (Pack H) but only hand tighten.
5. Screw three 3/8 in. Bsw x 1-1/2 in. (38 mm) long studs (Pack H) into the front waterway section down each side of the flueway aperture. Rest the front upper boiler plate (packed in crate) on the angled shelf and hold it in position by placing a clamping strip (packed in crate) over the three studs on each side. Secure these with 3/8 in. Bsw wing nuts and washers (Pack H) but only hand tighten at this stage.
6. Raise or lower the boiler plate and shelf until the flueway aperture is completely covered and tighten all the nuts securely.
7. Run a fillet of buff boiler cement into the recess around the outside of the combustion chamber aperture. Take the pre-formed front wall (packed in crate) and position it in the aperture with the five cut-outs around its inner edge fitting over the corresponding lugs on the front waterway section. See Figure 4 — Assembly of Front and Rear Walls.
8. Screw six 3/8 in. Bsw x 1-1/2 in. (38 mm) long studs (Pack J) into the tappings around the combustion chamber aperture and fit the lower front boiler plate (packed in crate) over them. Secure with 3/8 in. Bsw nuts and washers (Pack J) and smooth off any surplus boiler cement around the plate.

Fitting the Boiler Thermostat (see Figure 3)

Fit the boiler thermostat (packed in burner carton) into its pocket in the combined flow outlet. The mineral insulated cable attached to the thermostat should be down the right-hand side of the boiler. The junction box connected to the other end of the cable is left hanging free until the casing has been erected.

Fitting the Boiler Code Badge

Fit the boiler code badge (Pack L) to the outlet flange at the top of the front waterway section using the two No.4 type "U" hammer screws x 3/16 in. (5mm) long (Pack L).

Erecting the Casing (see Figure 6)

The boiler casing with all its screws, nuts, washers etc., is packed in a carton together with the apron and cleaning tools. The method of assembly is as follows:—

1. Fit two adjustable feet with covers to each of the side panel sub-assemblies and rest these against the sides of the boiler in their correct positions.
2. Take the top panel sub-assembly and place it in position with the slot around the combined flow

outlet and the edges resting on the top of the two side panels.

3. Secure the top panel to the side panels with 1/4 in. Bsw hex head screws x 1/2 in. (13 mm) long and fit the strengthening angle piece on the front of the top panel using No.10A self tapping pan head screws x 3/8 in. (10 mm) long. At the top front corners fit gussets using No.10Z self tapping pan head screws x 1/2 in. (13 mm) long.
4. Fit the rear panel to the side panels with No.10Z self tapping pan head screws x 1/2 in. (13 mm) long, and above this, secure the side panels to the flue offtake flange by means of the two fixing brackets. These are secured to the side panels with 1/4 in. Bsw round head screws x 3/8 in. (10 mm) long and 1/4 in. Bsw square nuts, and to the outer studs on the flue offtake flange with 3/8 in. Bsw nuts.
5. Remove the cross rail from the lower front panel sub-assembly and secure it to the bottom front corners of the two side panels with 1/4 in. Bsw round head screws x 5/8 in. (16 mm) long.
6. Fit the lower front panel assembly to the cross rail and also to the side panels using 1/4 in. Bsw round head screws x 5/8 in. (16 mm) long. At this stage, fit the boiler junction box which is hanging on the mineral insulated cable. Secure it to the lower front panel behind the square hole on the right-hand side. Fit the cover on the outside and pass the fixing screws through the front panel into the junction box itself.
7. Fit the upper front panel sub-assembly by locating the two pegs in the holes in the lower panel and securing at the top corners with 1/4 in. Bsw chromium plated mushroom head screws x 1-1/4 in. (32 mm) long and washers.
8. Fit the boiler apron with 1/4 in. Bsw chromium plated mushroom head screws x 1/2 in. (13 mm) long.

SECTION 2. BURNER INSTALLATION AND COMMISSIONING

The Avon boiler is supplied with a Nu-Way or Selectos burner as detailed below:—

Avon 241-501	Nu-Way ZL2D or Selectos JSS.1
Avon 541-581	Nu-Way ZL2D or Selectos JSS.2

The Nu-Way burner is fitted with an Elesta control box, the Selectos with the Landis and Gyr LAB.1. Before installing the burner, check that the correct type has been supplied.

Each burner is packed in a cardboard carton which also contains the oil filter, flexible oil pipe, burner adaptor ring and asbestos gasket, and the various studs, screws, nuts and washers required for assembly to the boiler.

Before installing the burner, carry out the following checks:—

(a) Nu-Way ZL2D burner

Check that the front face of the flame stabiliser is

flush with the end of the draught tube $\pm 1/16$ in. (2 mm). Check also that the face of the nozzle block is $1-1/4$ in. (32 mm) $\pm 1/16$ in. (2 mm) behind the end of the draught tube. Both of these dimensions are shown in Figure 7. If adjustment is necessary, loosen the screws on the burner tube flange and slide the flame stabiliser and draught tube assembly in or out as required.

Selectos JSS.1 and JSS.2 burners

The burner is supplied with the flame stabiliser fitted flush with the end of the draught tube to avoid damage in transit. The correct distance between the front face of the flame stabiliser and the nozzle holder is $7/8$ in. (22 mm) and the flame stabiliser must be re-positioned by undoing the screws securing the draught tube, moving it back into the fan housing and securing the retaining screws. The adjusted dimension between the front face of the flame stabiliser and the end of the draught tube should be as shown in Figure 8 (Dimension A).

- (b) Check that the nozzle (Pack L) is the correct size (see Table 3) and fit it into the nozzle block on the burner.
- (c) Check the relative position of the electrodes and the nozzle. The extreme tips of the electrodes should be in line with the nozzle face and $1/2$ in. (13 mm) above its centre line. If adjustment is necessary, remove the nozzle and electrode assembly from the burner as describes in Section 3. Maintenance.
- (d) Check that the nozzle is central in the draught tube.

Fitting the Burner

1. Place the burner adaptor ring (packed in carton) together with its gasket in position over the burner aperture in the lower front boiler plate. Secure with four $5/16$ in. Bsw hex. head screws x 1 in. (25 mm) long and washers (Pack K).
2. Screw two $1/2$ in. Bsw studs x 2 in. (51 mm) long (Pack K) into the adaptor ring.
3. Push the burner through the adaptor ring and locate the burner tube flange over the two studs. Make sure that the burner flange gasket is in its place between the flange and the adaptor ring. Secure the burner to the adaptor ring using $1/2$ in. Bsw nuts and washers (Pack K).

Connecting the Oil Supply and Filter

Run the oil supply pipe, minimum size $3/8$ in. Bsp, so that it terminates next to the burner. Fit the $3/8$ in. Bsp oil filter (packed in burner carton) to the supply line and connect it to the burner using the length of flexible hose supplied (packed in burner carton).

On a two-pipe system, remove the plug from the port at the bottom of the pump and fit the by-pass plug supplied in a plastic container attached to the burner, screwing it fully home. Run the return pipe into the port. In two-pipe systems, a spring-loaded non-return valve should be fitted in the return pipe as close as possible to the oil pump, and a foot valve on the suction pipe in the oil tank (see British

Standard Code of Practice CP.3002 Part 1.1961- Installation Burner Class D Fuel Oil). It is recommended that a hand valve, not supplied, be fitted at the inlet to the filter.

If a return pipe is fitted, this should be connected with flexible hose. A separate isolating valve may be fitted for easy removal of the burner equipment.

Electricity Supply

Check that the mains supply is switched off before making any connections.

The electricity supply required is 220-240 volts a.c. 50 Hz single phase and the cable should be run on the same side of the boiler as the oil supply line. The final 24 to 30 inches (610 to 760 mm) of the cable should be enclosed in flexible conduit for easy movement during maintenance and a double-pole isolating switch and suitable HRC fuse should be incorporated in the electricity supply line. ?

Note:— all isolating switches, fuses etc., must be supplied by the installer. They are not supplied by Thomas Potterton Ltd.

Wiring

All on-site electrical wiring should conform to the I.E.E. Regulations for buildings and local authorities requirements. The supply connections should be terminated at the burner as follows:—

(a) Nu-Way Burner Elesta control box (Wiring Diagram WDC.7322)

1. Live to terminal 2.
2. Neutral to terminal 1.
3. Earth to terminal E.

(b) Selectos burner-Landis and Gyr LAB.1 control box (Wiring Diagram WDC.722)

1. Live to terminal L.
2. Neutral to terminal N.
3. Earth to terminal E.

In addition to the above it will be necessary for site connections to be made between the burner control box and the boiler junction box (connections to thermostat), see Installers Wiring Diagrams. Where other controls such as time switches are involved some alteration may be required to the burner wiring as supplied. For further details see "Optional Controls".

Control Box

Control boxes fitted to Avon boilers conform to BSS.799. Timing sequences are shown below:—

Control box	Lockout from start	Pre-ignition	Post ignition	Safety time	Flame reaction
Elesta	15 secs	none	none	15 secs	0.3 secs
Landis & Gyr LAB.1	15 secs	15 secs	15 secs	10 secs	0.3 secs

Optional Controls

Where applicable, the following installation instructions should be carried out:—

- (a) **Clock Control.** This should be wired in the main supply to the boiler control box (see Installers Wiring Diagrams).
- (b) **Pump.** No provision is made in the control box for controlling the water circulating pump. In cases where there is no gravity circulation, it is necessary to keep the pump running for a time after the boiler has shut down in order to dissipate any residual heat in the boiler fabric and so prevent an excessive temperature rise and possible cutting out of the limit thermostat.

A method of ensuring that the pump operates after the boiler has shut down is to wire in parallel with the time switch contact controlling the pump, a thermostat whose contact breaks circuit on a fall in temperature. This thermostat can be of the clamp-on or immersion type and should be fitted in the system flow header as close to the boiler as possible. Control details are shown in the Schematic Wiring Diagrams.

- (c) **Low Limit Protection.** These controls should be wired in parallel with the clock control, see Schematic Wiring Diagrams. When the clock is off it will be overridden by the low limit controls and temperature control will be on the boiler thermostat. A method of low limit control is to have an outdoor thermostat set at approximately 35°F (2°C) wired in parallel with the clock contact in the pump starter circuit. When the outdoor temperature falls, the pump will start running. An immersion type thermostat sensing the water temperature in the return main, set at approximately 40°F (4°C), is wired in parallel with the clock contact. When the temperature falls, the burner will fire and both pump and burner will be operating.
- (d) **Remote Indication.** If desired, a remote lockout light can be connected by the installer, and provision is made for such a connection within the boiler control boxes. The connection on the Elesta box is terminal 3 and on the Landis and Gyr LAB.1 box, terminal 8. The rating of these connections should not exceed 1 amp at 240 volts. Similarly, a remote indication of high limit condition can also be connected by the installer to terminal 2 of the limit thermostat. Current rating for this connection is 1 amp at 240 volts.

Inspection of Controls

The photocell should be inspected to ensure that it is clean and facing the flame. The boiler thermostat should be set at the required operating temperature, the limit thermostat to at least 10°F (6°C) above this and the re-set button, next to the thermostat dial, operated to ensure that the controls are made.

Finally, check that all other controls (clock, thermostats) are calling for heat.

Inspection of Oil Supply Line

The oil supply line should be inspected as follows:—

- (a) **One Pipe System.** Disconnect the flexible hose from the pump, open the stop valve(s) on the oil line and run off a minimum of half-a-gallon (1.9 litres) of oil. Close the stop valve and re-connect the flexible hose to the pump.
- (b) **Two Pipe System.** Break the oil connection to the pump and hand prime the suction line. Make the oil connection to the pump. The foot valve at the oil tank end of the suction line will prevent the oil from running back into the tank.

Firing and Purging

Carry out the following procedure:

- (a) **Nu-Way Burners.** Use the shutter setting screw at the bottom of the air inlet housing to set the spring-loaded air shutter approximately half open.
Selectos Burners. Release the two clamping screws and rotate the air control shutter until it is half open. Tighten the clamping screws.
- (b) Remove the plug from the purging port on the oil pump. If the pump is fitted with the port underneath, place a can under it to catch any dripping oil. If the pump is fitted with the port on top, a short length of pipe should be inserted to carry out the oil to the can.
- (c) Fire the burner and allow it to run through to lockout. Repeat this process at least three times until the oil is clear and free from air. This operation will also check the lockout mechanism of the control box.
- (d) Fit a pressure gauge into the purging port.
- (e) Switch on the burner (Selectos burners will light after a 13-15 second delay period). Allow it to run until a stable flame is established.
- (f) Switch the burner off and check that no after-spurting occurs on cut-off.
- (g) Re-start the burner and adjust the oil pressure in accordance with Table 3 by turning the pressure regulating screw on the pump with a suitable socket wrench (turn clockwise to increase the pressure and anti-clockwise to reduce it).
- (h) Check that the flame is central and that there is no impingement. Should this be observed, adjust as described earlier in this manual.
- (i) Open or close the air shutter until a bright orange flame is established. A brilliant white flame indicates excessive air while a smoky flame indicates too little air.

Move the adjustable weight on the draught stabiliser until the required flue draught is obtained. Move the flap manually to its fully open position and release it when it should return to the controlling position.

Final Adjustment

To obtain a true analysis of the flue gas sample, suitable smoke and CO₂ measuring equipment must be used. A sampling hole is provided, normally plugged, on the left-hand side of the flue offtake. Insert the gas sampling probe to a depth of about 4 inches (102 mm). Switch the boiler on for about 30 minutes. Check the readings and adjust the air shutter until satisfactory results are obtained. A smoke number under 3 on the Bacharach scale should be aimed at, a good average is 0-1. The CO₂ optimum level should be 12%, the flue gas temperature from 500-550°F (260-288°C) and the draught at the flue outlet 0.03 in.w.g. (.07 mbar).

Lock the air shutter when satisfactory figures have been obtained.

SECTION 3. MAINTENANCE

The operating efficiency of the boiler depends on satisfactory chimney conditions, adequate air supply and correct burner adjustment. If the boiler has been initially commissioned as described in Section 2 of this manual, then service visits should not be necessary more than twice a year.

Before carrying out any maintenance, switch off the electricity supply at the mains isolating switch and close the isolating valves in the oil supply line. Then proceed as follows:—

Servicing the Burner

Remove the burner from the boiler by undoing the nuts on either side of the burner tube flange where the burner enters the boiler. Removal is limited only by the length of flexible hose.

Remove the nozzle and electrode assembly and the photocell as follows:—

Nu-Way

Withdraw the photocell from the right-hand side of the burner. Undo the screw on the right-hand side of the transformer and swing it open on its hinge. Undo the two screws in the retaining plate on the right-hand side of the burner and disconnect the oil line from the solenoid valve. Withdraw the nozzle and electrode assembly from the burner tube.

Selectos

Undo the retaining screw in the fixing plate on the right-hand side of the burner and remove the photocell and its housing. Remove the knurled thumbscrew from the curved access plate on top of the burner and lift off the plate. Remove the clamping nut on the left-hand side of the burner housing. Disconnect the transformer leads from the nozzle and electrode assembly and the oil line from the solenoid valve. Withdraw the nozzle and electrode assembly from the burner tube.

Remove the nozzle from the nozzle and electrode assembly and dismantle and clean as follows:—

1. Make sure that the nozzle face is free from carbon deposits. Use a sharpened match to clear any obstruction from the orifice.

2. Clean the tangential slots with the edge of a piece of clean hard paper.
3. Make sure that all dirt is removed from the gauze.

Carefully re-assemble the nozzle. **If there is any doubt at all that the nozzle is not absolutely perfect then it should be discarded and a new one fitted.**

Examine the electrode tips and clean off any carbon deposits that may be found. Check that the spark gap between the electrodes measures 1/8 in. (3 mm), if not, adjust with a pair of pliers. The tips of the electrodes should be 1/2 in. (13 mm) above the centre line of the nozzle; if necessary, adjust as before. The electrodes should be positioned in line with the nozzle face and any adjustment made by loosening the round head screws in the tripod. Check the connections between the transformer and the electrodes.

Re-assemble the nozzle and electrode assembly in the burner tube. Check the photocell by cleaning and examining the glass. If this is cracked, fit a new photocell. When replacing the photocell make sure that the glass faces the flame.

Finally, clean the flame stabiliser and make sure that there is no distortion. Check the position of the flame stabiliser and nozzle holder as described in Section 2. Burner Installation and Commissioning.

Lightly oil the bearings on the burner motor with two or three drops of lubricating oil. Inspect the burner fan and if cleaning is necessary, undo the two set bolts, remove the motor and fan assembly and clean the impeller with a clean paint brush.

Cleaning the Boiler

Before re-fitting the burner to the boiler, clean and inspect the flueways. To do this effectively, an industrial type vacuum cleaner will be needed together with the tools supplied with the boiler. Proceed as follows:—

1. Cover the burner with a cloth to protect it from dirt
2. Remove the upper casing panel by unscrewing the chromium plated screws and lifting it upwards so that the tongues at the bottom of the panel lift clear of the slots in the cross brace.
3. Loosen the wing nuts in the clamping strips securing the front boiler plate. Move the strips outwards and lift off the boiler plate to expose the flueways.
4. Clean all the flueways using the brush, scraper and vacuum cleaner. Start with the bottom cross tubes and scrape and brush off all foreign matter paying particular attention to the vertical surfaces between the cross tubes. One end of the scraper has been bent to a suitable angle for cleaning these surfaces.
5. After each row of cross tubes has been cleaned, brush all the deposits down into the combustion chamber and remove them through the lower front boiler plate with the vacuum cleaner.
6. Using a torch, examine the target wall at the rear of the combustion chamber through the burner aperture.

in the lower front plate. If any repairs are necessary, remove the apron from around the burner aperture. Undo the nuts securing the lower front plate and remove it. Lift out the pre-cast insulating wall to gain access to the combustion chamber and target wall. Repair any cracks with white boiler cement.

7. Re-fit the pre-cast insulating wall. Run a fillet of buff boiler cement around the edge of the lower front boiler plate and re-fit it over the studs. Secure with nuts and washers and replace the apron.
8. Remove the casing side panels and examine the joints between the boiler sections. If the boiler cement is cracked, it should be scraped out and fresh cement forced between the joints. Replace the panels.

Refit the burner to the boiler and secure. Open the oil isolating valve(s). Remove the plug from the purging port on the oil pump and fit a pressure gauge into it. Switch on the electricity supply at the mains switch. The boiler will light if the boiler thermostat, clock etc., are calling for heat.

To obtain a true analysis of flue gas samples, a suitable pump and CO₂ test equipment must be used. A sampling hole is provided on the left-hand side of the flue offtake. Remove the plug and insert the gas sampling probe horizontally to a depth of over 4 inches (100 mm) after the boiler has been running for at least 30 minutes. Check the readings and adjust the air shutter until the figures obtained are as follows:—

1. A smoke number preferably between 0 and 1 and no higher than 3 on the Bacharach scale.
2. CO₂ optimum level of 12%.
3. Flue gas temperature of 500 to 550°F (260 to 288°C).
4. Draught at flue outlet 0.03 in.w.g. (0.07 mbar).

Lock the air shutter when the correct figures have been obtained. Inspect the main oil filter and clean if necessary. If the filter is of the paper element type, fit a new one. Inspect the oil pump filter and clean if necessary. Hand operate the fire valve and check that it works properly.

SECTION 4. FAULT FINDING

The following chart lists the faults which are most likely to occur and the methods of rectifying them. Make sure that the isolating switch is off before making any adjustments to the burner.

CONDITION	POSSIBLE CAUSE	REMEDY
1. Burner fails to start.	<ul style="list-style-type: none"> (a) One of the instruments in the control circuit is not making contact e.g. control or limit thermostats, time switch etc. (b) Photo-electric cell flame failure device energised by light from source other than flame. (c) Red warning light showing in control panel. 	<ul style="list-style-type: none"> (a) Check that all instruments are functioning correctly and check all electrical connections. (b) Check that light from outside source cannot get to photocell. (c) See next section.
2. Burner starts up but fails to light and then locks out showing red warning light.	<ul style="list-style-type: none"> (a) No spark at electrode points. (b) Spark fails to ignite oil. (c) No oil. <ul style="list-style-type: none"> (i) Oil level in tank below supply pipe opening. (ii) Oil lines may be restricted. (iii) Nozzle may be blocked. (iv) Pump coupling failed due to overload. Faulty pump. (v) Air in supply pipe. Air may be drawn into the supply pipe, particularly on suction lift, in which case the pump will be noisy. (vi) Gravity head may be insufficient for single pipe system or, if already on a two-pipe system, suction lift may be too great, or by-pass plug may not have been fitted. Foot valve or non-return valve may be letting by. 	<ul style="list-style-type: none"> (a) Check setting of electrodes. Check that busbars are making contact with transformer terminals. Check electrode and transformer insulator for crack or tracking. Clean. (b) Check setting of electrodes. A partly blocked or damaged nozzle will cause uneven spray. Check nozzle and change if necessary. Low oil pressure will cause narrow coarse spray (see section on Low Oil Pressure). (c) See below:— <ul style="list-style-type: none"> (i) Check that tank has sufficient oil in it. (ii) Check stop valves, filters, foot valve and fire valve. Check grade of oil being used. (iii) Check and clean nozzle if necessary. (iv) Check and renew if necessary. (v) Check all joints at filters, valve glands, pump shaft gland, pump cover and pipe joints. (vi) Check that head is adequate. Check that by-pass plug has been fitted. Check foot and non-return valve: NOTE:— It is ESSENTIAL to have a return oil line back to the tank when an internal by-pass plug is fitted.

CONDITION	POSSIBLE CAUSE	REMEDY
2 contd.	(d) Photocell may be faulty and remaining on its "dark" contact. This may be due to the cell being dirty or the amplifier or wiring being faulty.	(d) Check wiring and clean photocell. Check amplifier in control box and fit a new one if necessary. If still faulty, change photocell.
3. Low oil pressure.	(a) Pressure regulating valve on pump requires adjustment or is sticking.	(a) Free the valve and set to pressure specified in Table 3.
4. High oil pressure.	(a) Pressure regulating valve on pump incorrectly set or is sticking. (b) Restriction in return oil line. (c) Internal by-pass plug fitted to pump without return line to tank.	(a) Free the valve and set to pressure specified in Table 3. (b) Check and clear restriction if any. (c) Remove by-pass plug or fit return pipe whichever is applicable. NOTE: — considerable damage to pump, motor or coupling may result from (b) and (c).
5. Small, sparky flame.	(a) Partly blocked nozzle (producing uneven flame). (b) Too much air.	(a) Check and clean nozzle. (b) Check CO ₂ and adjust air supply.
6. Smoky flame.	(a) High oil pressure (producing very large flame). (b) Swirler loose in nozzle or whole nozzle loose in adaptor (producing very large flame). (c) Worn nozzle (producing very large flame). (d) Insufficient air. (e) Inadequate draught due to air leaks.	(a) See section on 'High oil pressure'. (b) Check nozzle and fit a new one if necessary. (c) as above. (d) Check CO ₂ and adjust air supply. (e) Check flues and chimney for air leaks. Check that chimney is high enough to avoid down draught.
7. Blow back on lighting, fumes in boiler house, oil and soot on combustion head and in draught tube.	(a) Delayed ignition (see 2(a) and (b)). (b) Restriction in flues and stack. (c) I.D. fan not working.	(a) See 2(a) and (b). (b) Examine flues and stack and remove restriction if found. (c) Examine and check that fan works when burner is switched on.
8. Noisy burner.	(a) Restriction in oil supply or air leak into supply line causing pump noise.	(a) See 2(b).

CONDITION	POSSIBLE CAUSE	REMEDY
8 Cont.	(b) Suction lift too great, causing pump noise. (c) Loose burner fan or out of alignment. (d) Worn or dry motor bearing. (e) Defective pump coupling.	(b) Check that oil supply system is suitable. (c) Tighten or re-align if possible. (d) Lubricate bearings. Change if worn. (e) Change coupling.

TABLE 1. Approximate Weights

AVON	No. of Sections	Output		Weight empty		Water Content		Total Weight	
		Btu/h	kW	lb.	kg.	lb.	kg.	lb.	kg.
241	4	240,000	70	1520	689	224	102	1744	791
261	4	260,000	76	1520	689	224	102	1744	791
301	5	300,000	88	1800	816	280	127	2080	943
341	5	340,000	100	1800	816	280	127	2080	943
381	6	380,000	111	2080	943	336	152	2416	1095
421	6	420,000	124	2080	943	336	152	2416	1095
461	7	460,000	135	2360	1070	392	177	2752	1247
501	7	500,000	147	2360	1070	392	177	2752	1247
541	8	540,000	158	2640	1197	448	203	3088	1400
581	8	580,000	170	2640	1197	448	203	3088	1400

TABLE 2. Firing rate, products of combustion, air requirements

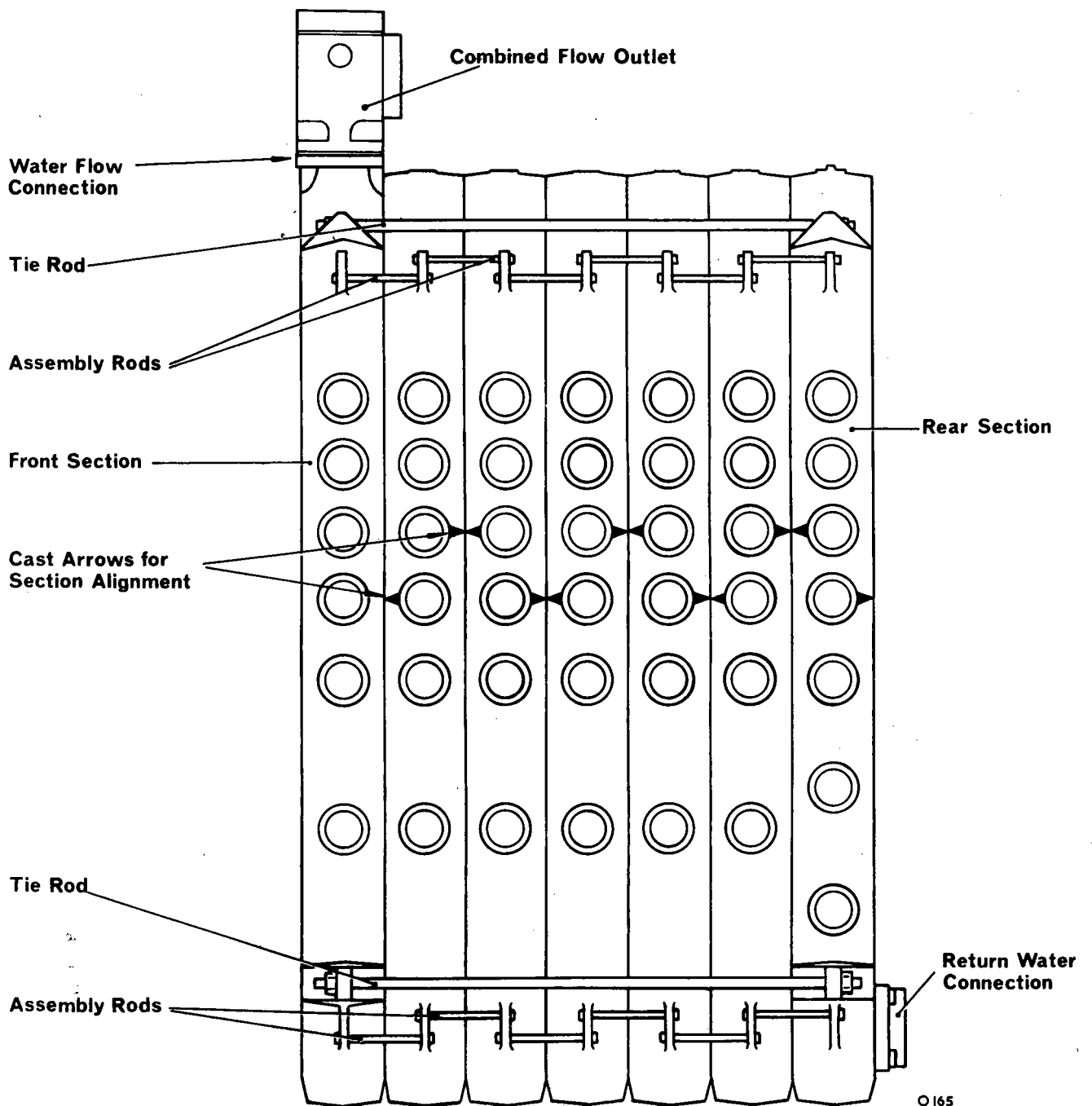
AVON		241	261	301	341	381	421	461	501	541	581
FIRING RATE	Imp.gal/h	1.80	1.95	2.25	2.55	2.85	3.19	3.49	3.81	4.12	4.49
	l/h	8.17	8.85	10.20	11.60	12.95	14.50	15.85	17.30	18.70	20.02
	lb/h	15.02	16.25	18.75	21.30	23.80	26.60	29.20	31.80	34.40	37.50
	kg/h	6.83	7.39	8.52	9.68	10.81	12.09	13.25	14.42	15.61	17.01
QUANTITY OF COMBUSTION PRODUCTS	lb/h	297	318	367	417	466	521	571	623	674	734
	kg/h	135	144	167	189	212	236	259	283	308	333
	cfm @ stp	65.6	73.0	84.3	95.6	107.0	119.5	131.0	143.0	154.5	168.5
	m ³ /s @ stp	.03	.03	.04	.05	.05	.05	.06	.07	.07	.08
MINIMUM FRESH AIR REQUIREMENTS	cfm @ stp	199	206	238	270	302	338	369	403	436	475
	m ³ /s @ stp	.09	.10	.11	.12	.14	.15	.17	.19	.21	.22
	sq.in.	120.0	123.6	142.8	162.0	181.2	202.8	221.4	241.8	261.6	285.0
	cm ²	775	798	920	1045	1170	1310	1430	1560	1685	1840

TABLE 3. Burner Data

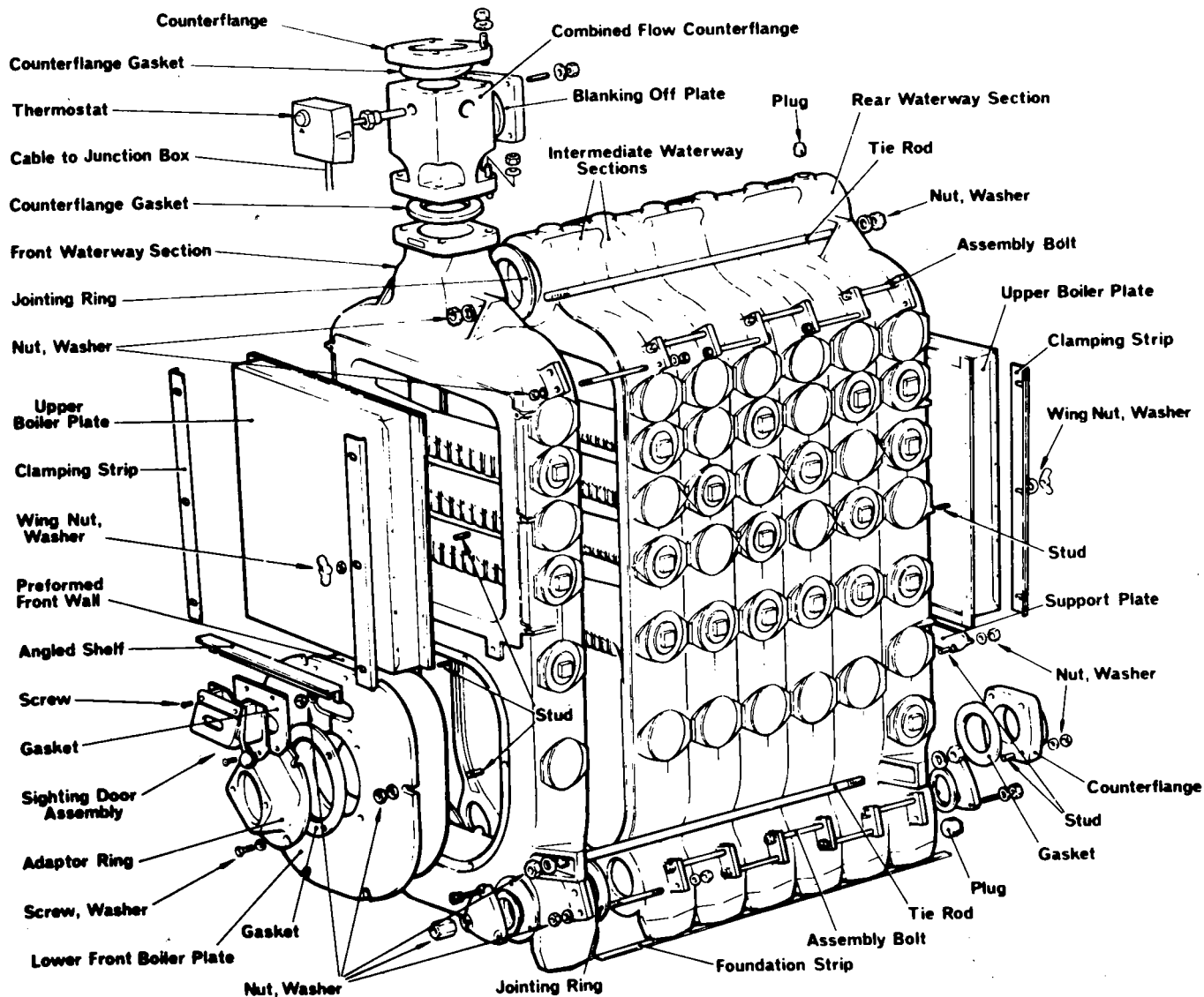
NU-WAY	Avon	241	261	301	341	381	421	461	501	541	581
Monarch nozzle Size	U.S.gal/h l/h	2.0 7.55		2.5 9.45		3.0 11.30		4.0 15.10		4.5 17.00	
Monarch nozzle spray angle		60° R						45° PLP			
Pump Pressure	lb/in ² mbar	140 9650	175 12040	125 8620	165 11390	130 8960	165 11390	110 7580	135 9310	140 9650	175 12040
Choke Ring dia.	in. mm	3-1/4 82				3-1/2 89		3-5/8 92			

SELECTOS	Avon	241	261	301	341	381	421	461	501	541	581
Monarch nozzle Size	U.S.gal/h l/h	2.0 7.55		2.5 9.45		3.0 11.30		4.0 15.10		5.0 18.90	
Monarch nozzle spray angle		60°R		80°R		60°PLP				45°PLP	
Pump Pressure	lb/in ² mbar	140 9650	175 12040	130 8960	180 12410	140 9650	180 12410	120 8280	140 9650	100 6900	120 8280
Choke Ring dia.	in. mm	2-5/8 67				3-1/4 82					

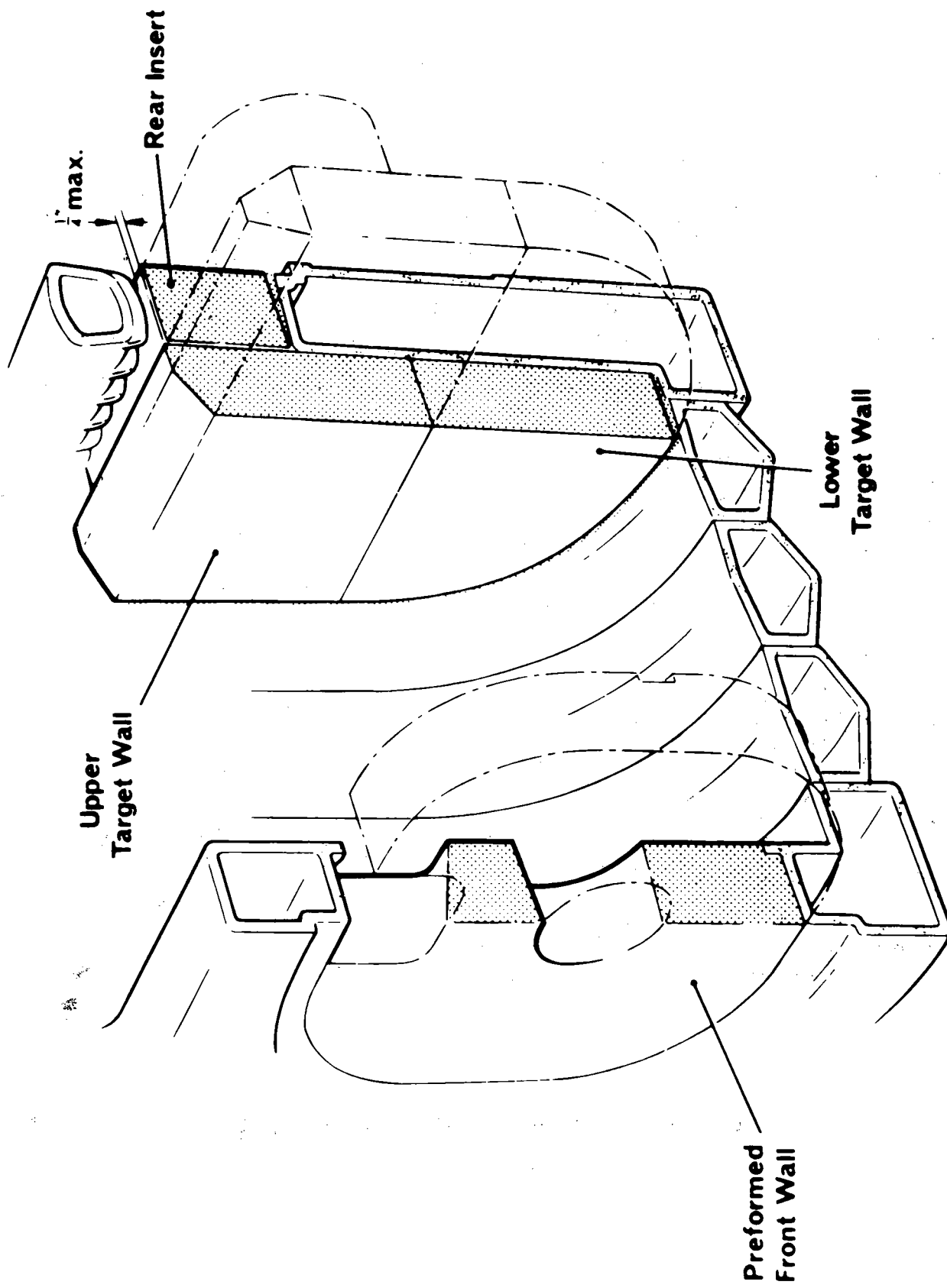




ASSEMBLY OF SECTIONS
 Figure 2

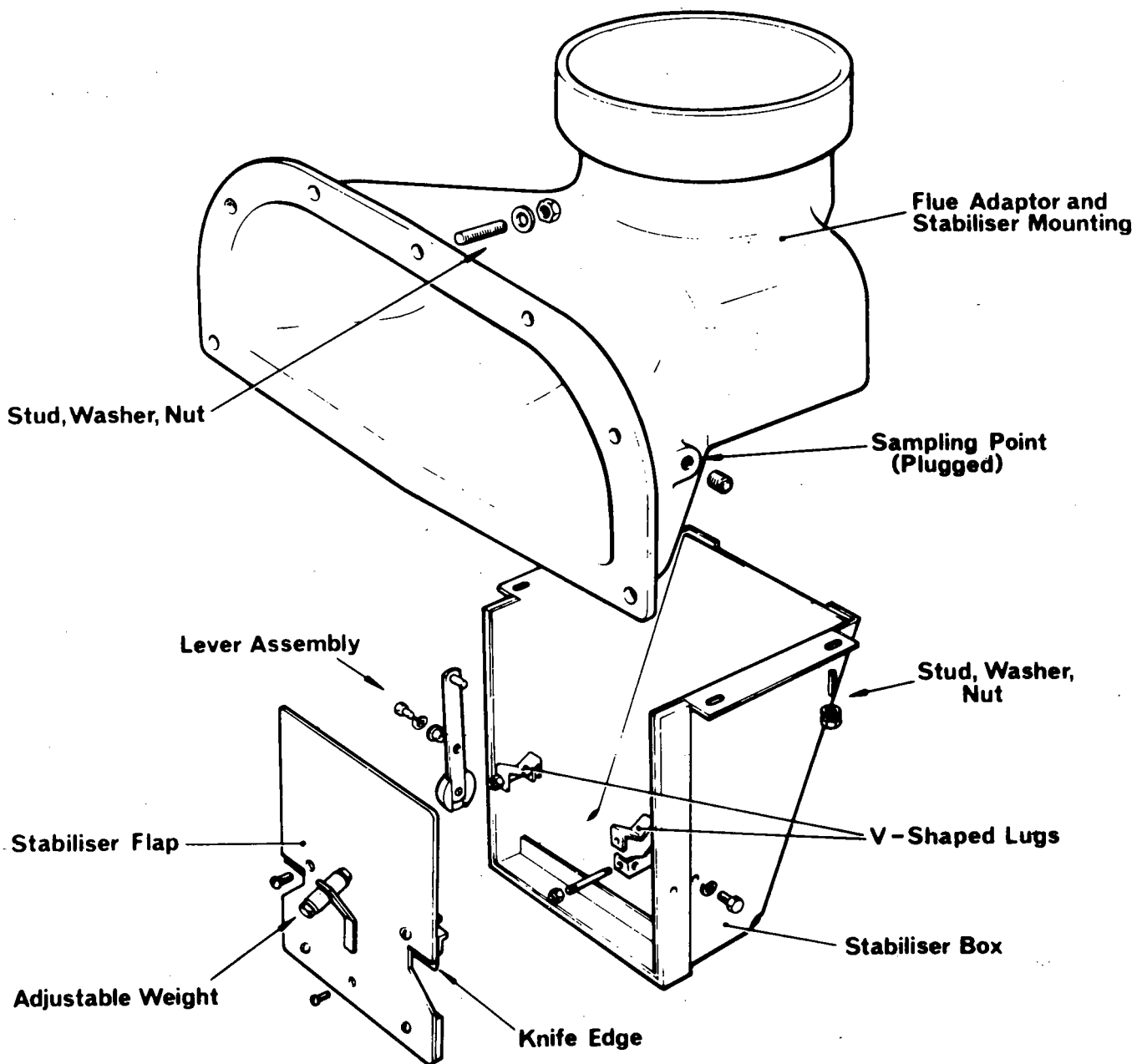


WATERWAYS AND PLATEWORK ASSEMBLY
Figure 3

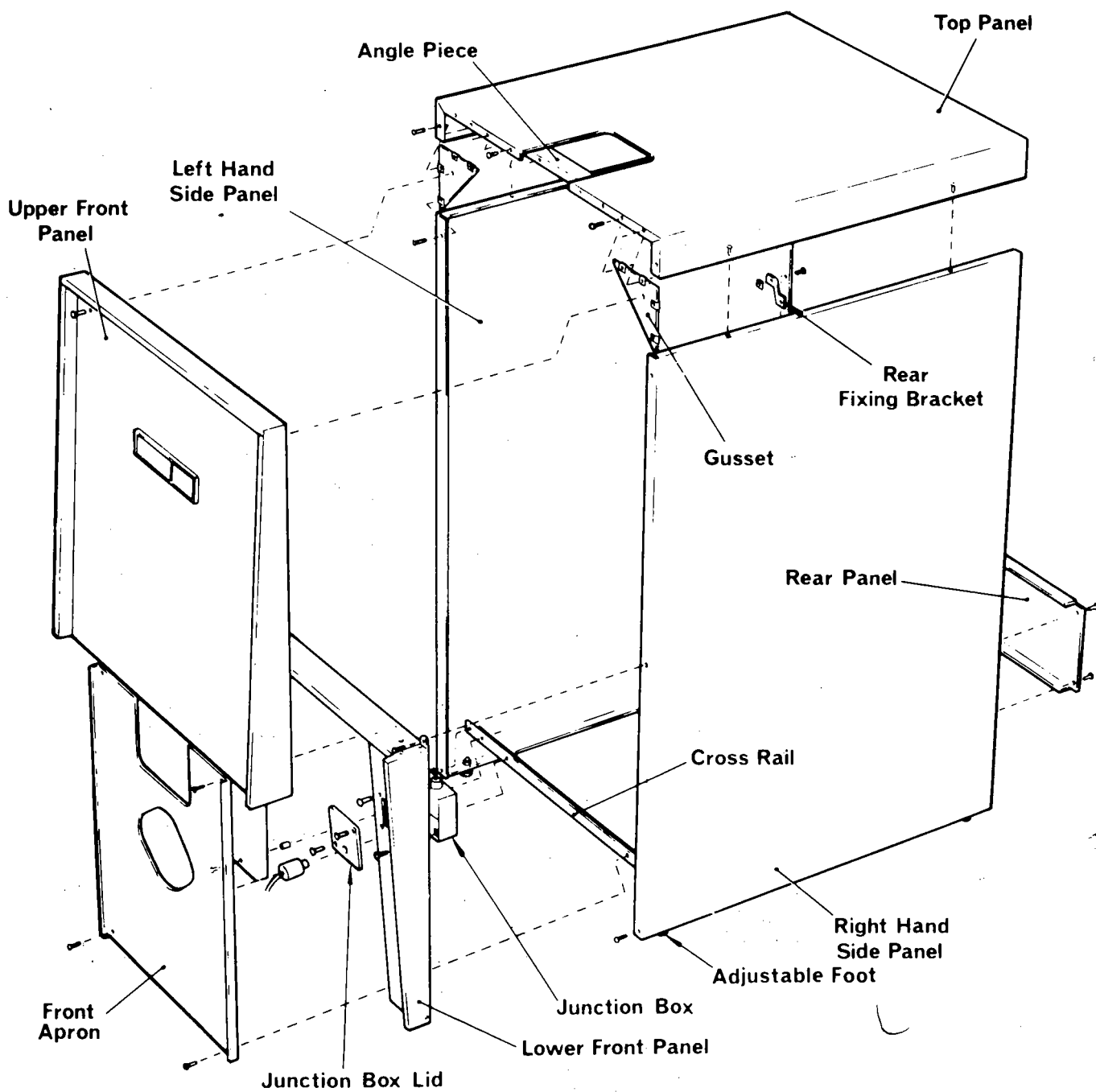


ASSEMBLY OF FRONT AND REAR WALLS

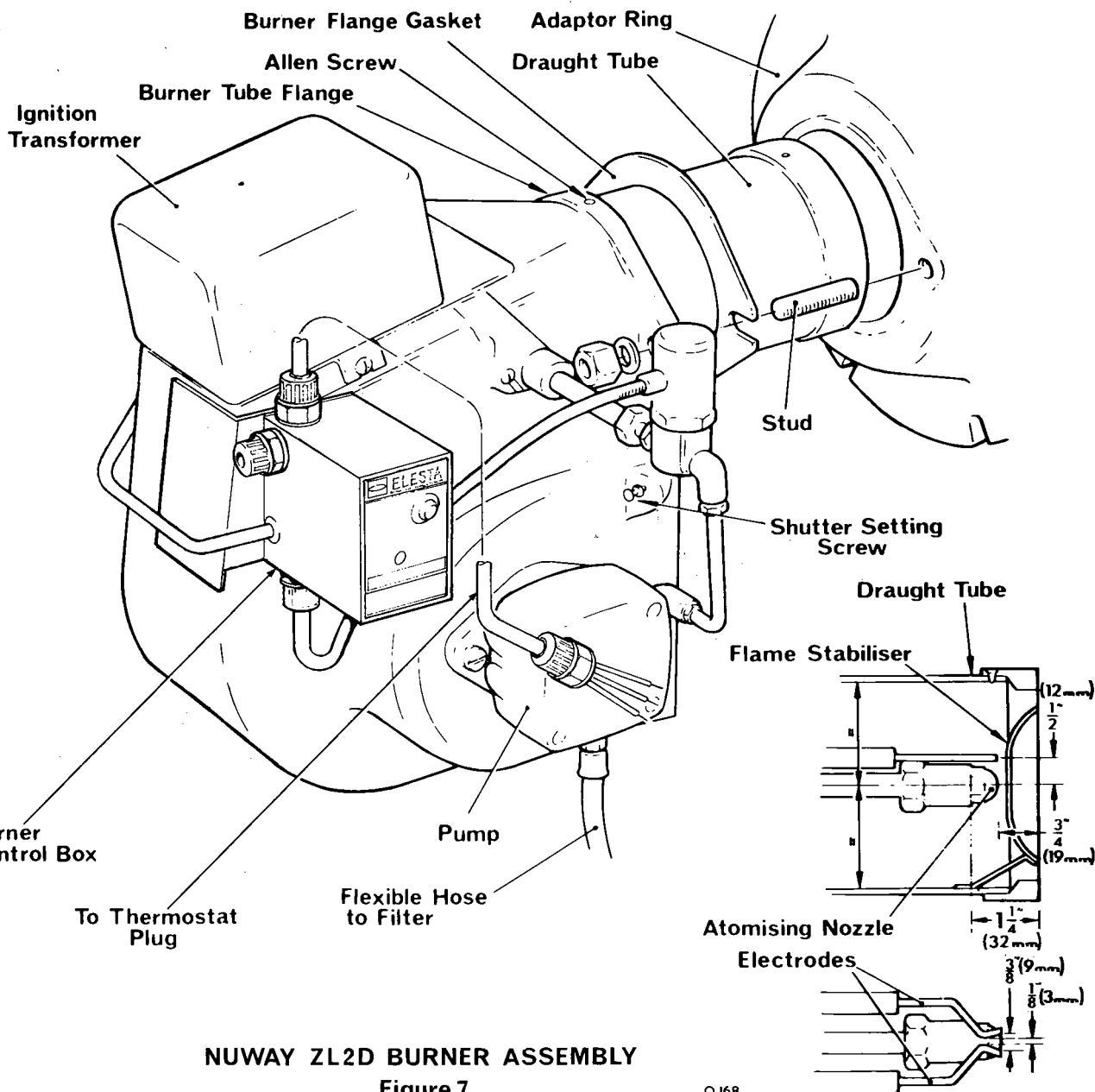
Figure 4

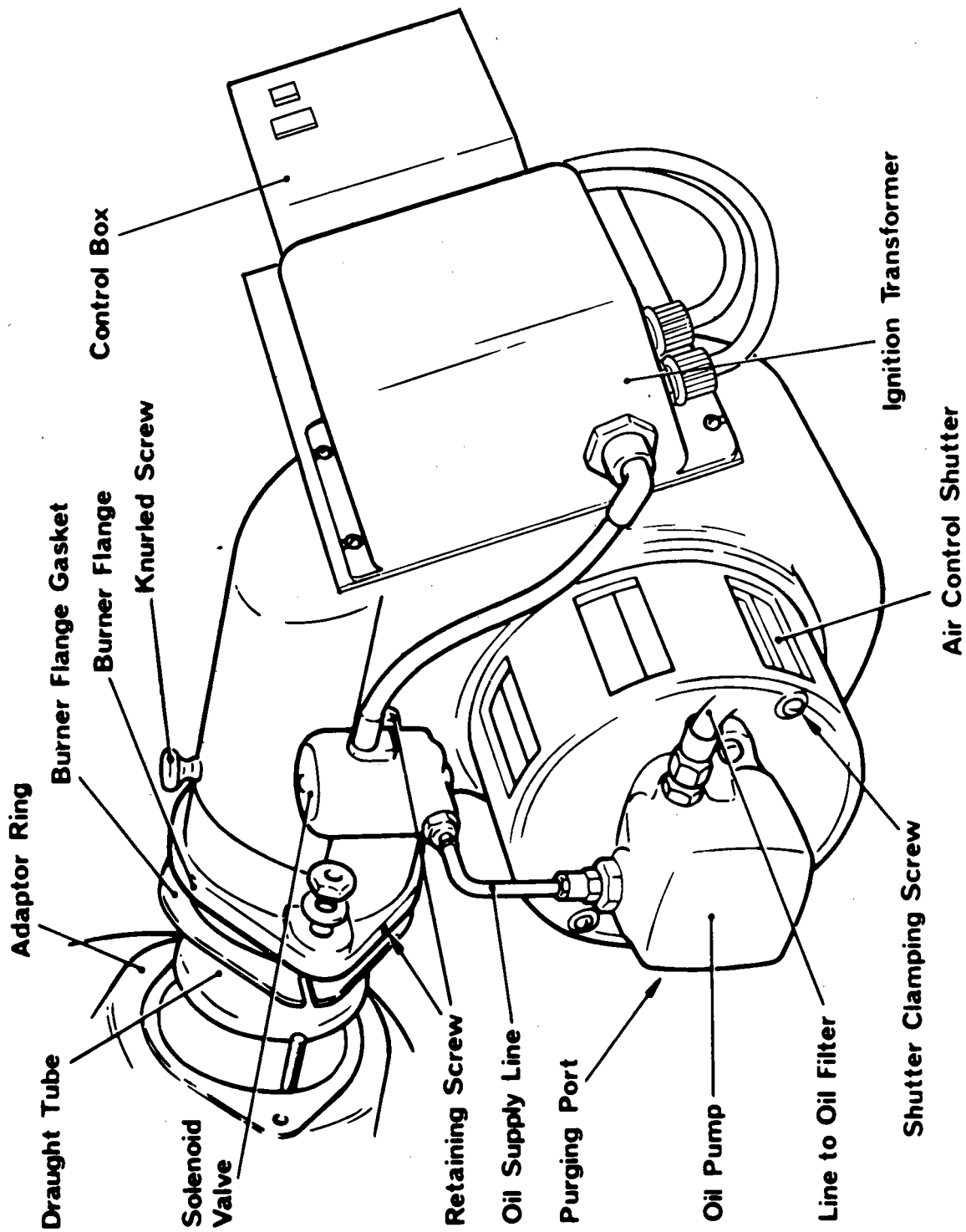


FLUEHOOD ASSEMBLY
Figure 5



CASING ASSEMBLY
Figure 6

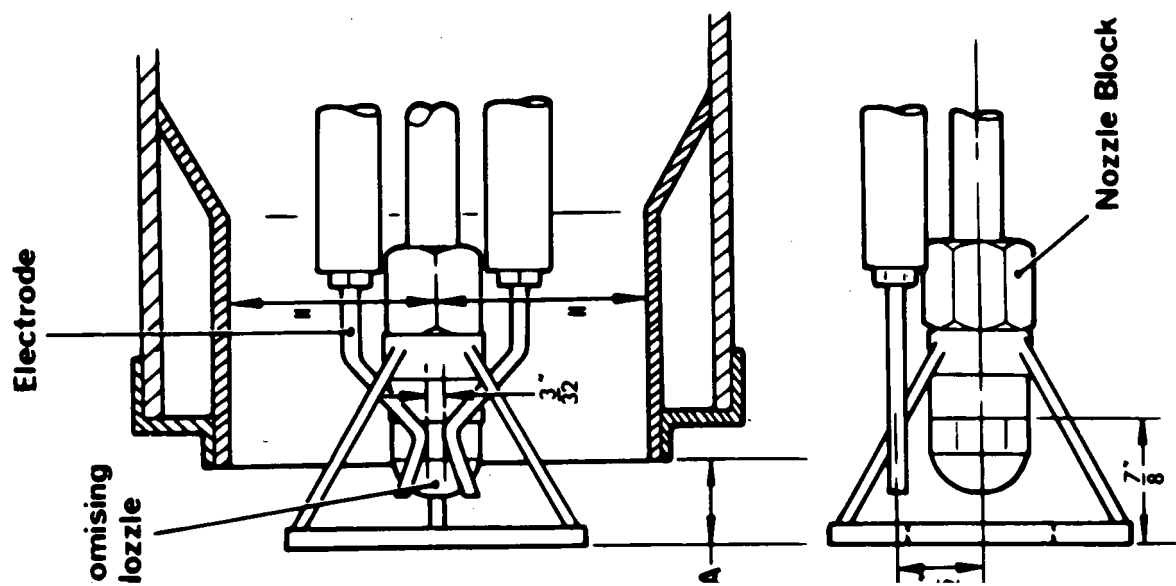




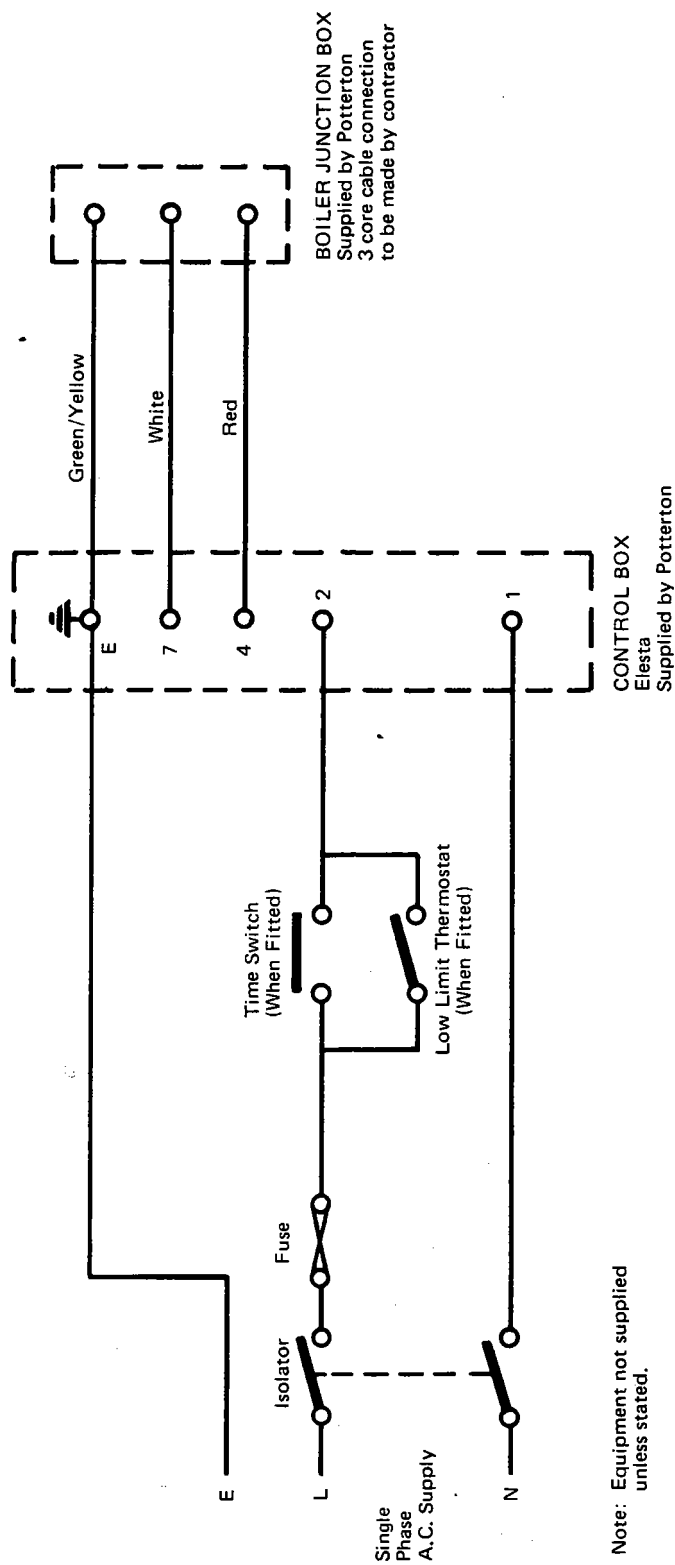
SELECTOS JSS2 BURNER ASSEMBLY

Figure 8

0.167

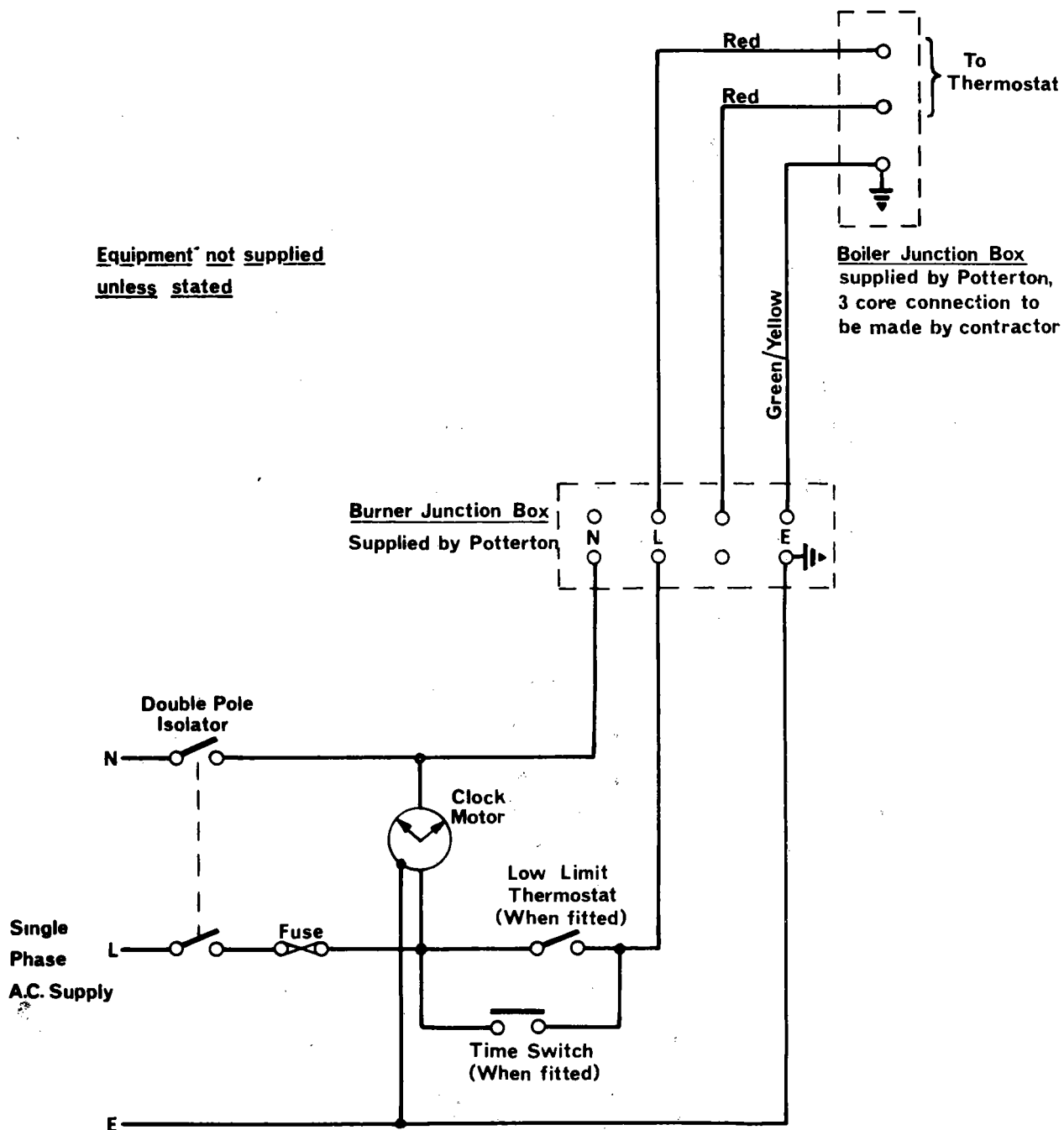


No. of Boiler Sections	4	5	6	7,8
Dimension A	1 1/4 4	1 1/2 2	3 1/2 12 mm	5 1/8 9 mm
	15 mm	15 mm	15 mm	15 mm



INSTALLERS WIRING WDC 7322
AVON BOILER ZL2D BURNER

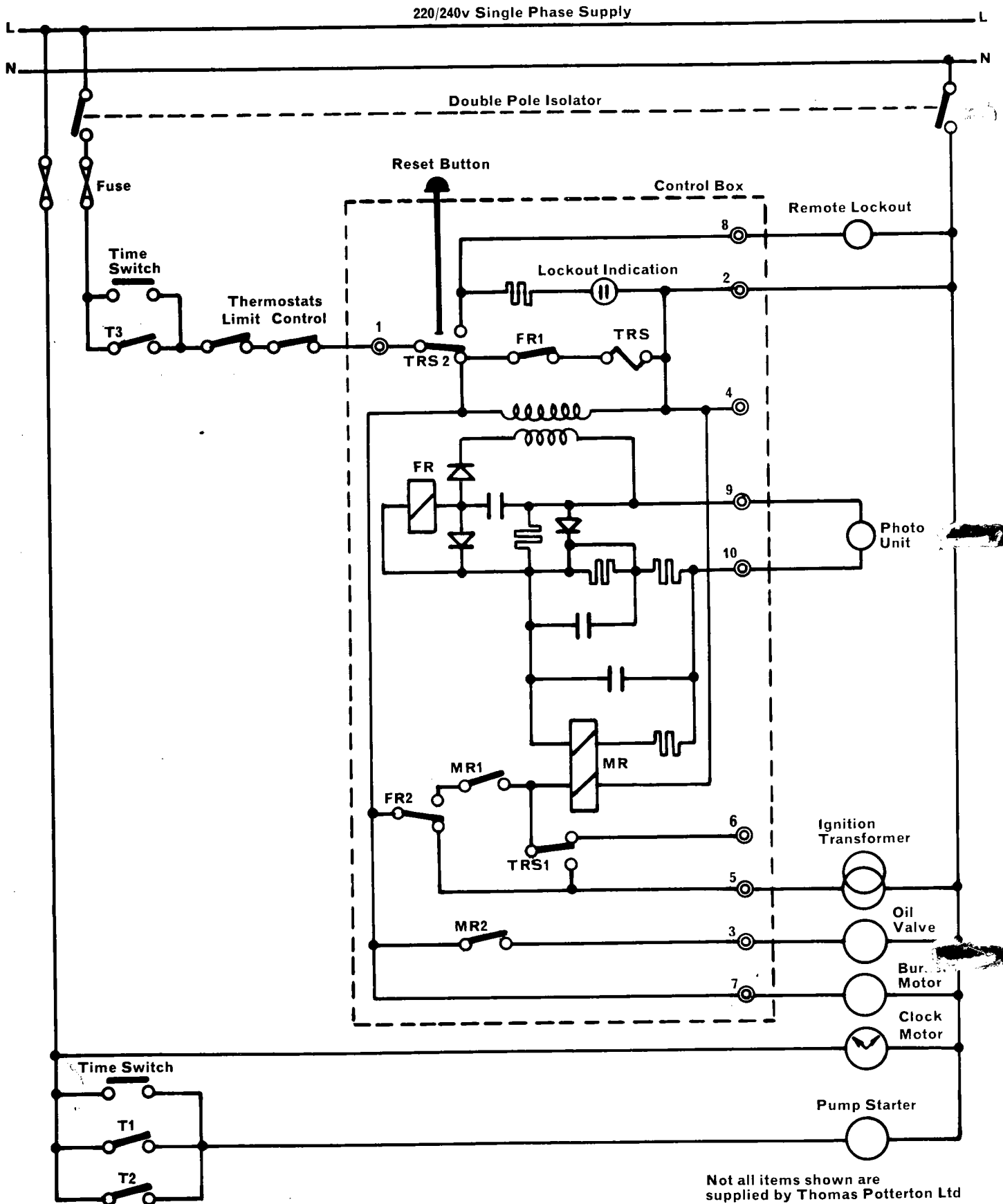
Equipment not supplied
unless stated



INSTALLERS WIRING WDC 722
AVON BOILER JSS1 & JSS2 BURNERS

O123A

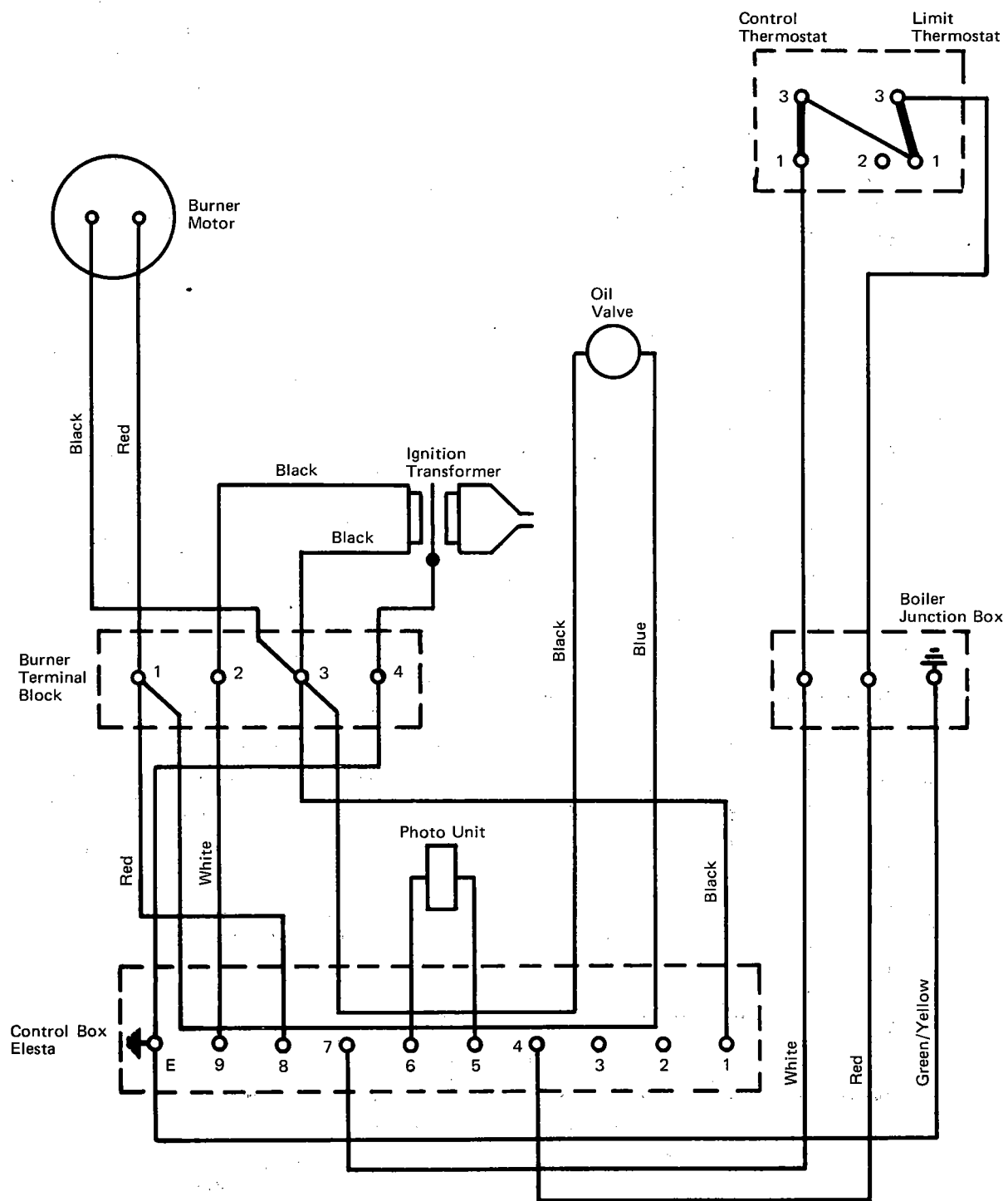
**TYPICAL SCHEMATIC WIRING WDC 7324
AVON BOILER ZL2D BURNER**



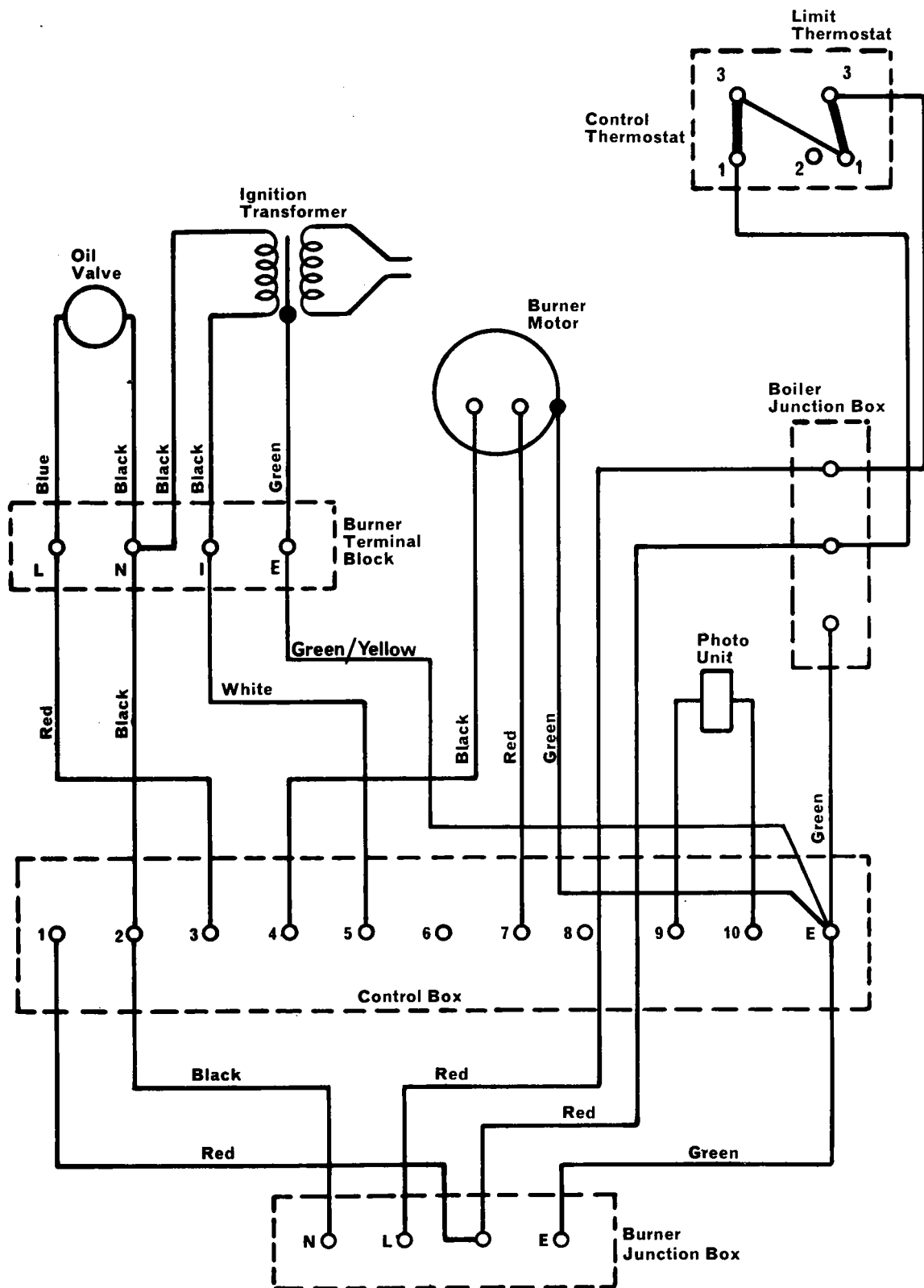
KEY:
 T1 Low Limit Air Thermostat (Break on rise)
 T2 Pump Delay Thermostat (Break on fall)
 T3 Low Limit Immersion Thermostat (Break on rise)
 MR Control Relay
 FR Flame Relay
 TRS Timer

SCHEMATIC WIRING WDC 724
 AVON BOILER JSS1 & JSS2 BURNERS

O 122A



BOILER WIRING WDC 7323
AVON BOILER ZL2D BURNER



BOILER WIRING WDC 726
AVON BOILER JSS1 & JSS2 BURNERS

O121A