

WOSS 830/4

British Railways Board

Director of Mechanical and Electrical Engineering

Combustion Heater

Smith

WORKSHOP OVERHAUL STANDARD SPECIFICATION



WOSS 830/4

REVISION RECORD

This Specification will be updated when necessary by the issue of amended pages accompanied by revision letters. The amended or additional part of re-issued pages will be marked with a vertical black line.

If you consider that an amendment is necessary, complete BR Form 14298 and pass it to the local BRB Resident Engineer or Area Quality Engineer. Submission of a form does not authorise the proposed amendments.

Revision No.	Re-issued Page Nos	Date	Inserted by	Revision	Re-issued Page Nos	Date	Inserted by

© Director of Mechanical & Electrical Engineering
British Railways Board
The Railway Technical Centre
London Road
Derby
DE2 8UP

First published - July 1987

This is a proprietary specification of the Director of Mechanical & Electrical Engineering, British Railways Board. The specification (including the data and information relating thereto) is not to be used, disseminated, reproduced, copied or adapted, either in whole or in part, without the express written approval of the Electrical Equipment Engineer at the above address.

Should any query arise regarding the contents of this document telephone 0332 42442 Ext. 3516, BR Code is 056 3516, or write to the above address.

This Specification applies to equipment fitted to the vehicles indicated 'X' below, but it is only to be implemented when authorised by an appropriate maintenance/overhaul document.

LOCOMOTIVES

03
08
09
20
25
26
27
31
33
37
43
45
47
50
56
58

73
81
85
86
87
88
89
91

DMU's

101	X
104	X
107	X
108	X
110	X
111	X
114	X
115	X
116	X
117	X
118	X
119	X
120	X
122	X
123	X
128	X
140	
141	
142	
143	
144	
150	
151	
155	
156	

EMU's

302
303
304
305
307
308
309
310
311
312
313
314
315
317
318
319
504
507
508

411
412
413
414
415
416
419
421
422
423
432
455
485
486
487
488
489
491

RAILCAR.CO.UK

DEMU's

204
205
207
210

COACHING STOCK

Mk 1
Mk 2, 2a-c
Mk 2d-e
Mk 2f
Mk 2 DBSO
Mk 3a
Mk 3b
Mk 3 (HST)
Mk 3 SLE and SLEP
Non Passenger

COMBUSTION HEATER

Smith

CONTENTS

Reference Documents
Tools and Materials
Section 1 Repair Procedure
 1 Dismantling
 2 Cleaning and Examination
 3 Glow Plug
 4 Fuel Solenoid Valve
 5 Resistor Box
 6 Motor
 7 Fuel Pump
 8 Temperature Control Equipment
 9 Heat Exchanger
 10 Casing
 11 Harness & Cables
 12 Reassembly
 Figure 1 Side View
 Figure 2 Sectioned View
 Figure 3 Solenoid valve
 Figure 4 Flame Detection Rod Device
 Figure 5 Resistor Boxes
 Figure 6 Motor
 Figure 7 Fuel Pump
 Figure 8 Harnesses
 Figure 9 Connection Diagram
 Figure 10 Flame Ring Extractor
 Figure 11 Atomiser Cup Setting Gauge
 Figure 12 Fuel Delivery Pipe Setting Gauge
Section 2 Test Specification
Section 3 Technical Data
 Table 1 Vehicle Classes and Heater Types
 Table 2 Fault finding chart for heater test.
Section 4 Additional Procedures
 AP1 Armature Rewind
 Figure 13 Winding Details
 AP2 Fitting of Rod and Microswitch Assembly

REFERENCE DOCUMENTS

WOSS 501/1 Hot Water/ Detergent Cleaning

TOOLS AND MATERIALS	BR Cat. No.
Fuel oil class A.BS2869	27/12001
Sodium metasilicate BR Spec. 612/3	7/67035
Solvent SBP11	7/68268
Refined Burning Oil (Paraffin)	27/6900
Fine Grinding Paste	1/10451
Lithium Based Grease to BR.673/3	27/1350
Esso Beacon 325 Grease	27/2050
1" masking tape (Scotch Tape No.472)	7/60605
Sealing wax (Chatterton's No.4 compound)	7/18009
Jointing compound ("Hermetite" Red Paste)	7/60180
Autostic	7/1600
Sealing wax	7/18009
1" sealing tape	7/60605.
Soft jointing compound	27/31828
Grinding paste	1/10451
Air-drying varnish, Sterling (B.8)	28/76035
Silicone RTV	7/60116
Wire brush	5/4167
Flame ring extractor	Figure 11
Atomiser Cup Setting Gauge	Figure 12
Fuel Delivery Pipe Setting Gauge	Figure 13
Flame ring setting screws (Smith's tool CBH1900)	

'Vacu-blast' plant with compressed air supply at 45 p.s.i

Glass shot for 'Vacu-blast' plant size 45 -75 microns

Sodium metasilicate Bosch plant

Argon arc welding supply

Press and adaptors for bearing extraction

Data tags

Fuel solenoid blanking plugs

Blanking plate W.A.T. 1492

SECTION 1 REPAIR PROCEDURE

NOTE:

Where an item is first mentioned in the text it is followed by a number in brackets. The first part of the number, before the full stop, refers to the figure on which the item is identified. The second part of the number, after the full stop, is the number of the item as it appears on the figure. Items lists associated with figures use the full number. If an item is identified on more than one figure then the items list for each figure will give the alternative number.

All components and sub-assemblies are interchangeable between heaters except the fuel pump piston assembly, which comprises piston (8.24), cylinder (8.26) and bearing plate (8.25). These fuel pump items must be identified and kept in a matched set.

1 Dismantling

- 1.1 Lightly grip the air fan (2.18), loosen the collet nut (2.17) and withdraw the fan from the motor shaft.
- 1.2 Remove the air inlet tube (2.23).
- 1.3 Remove the nut and short union (2.25).
- 1.4 Remove the long union (2.28).
- 1.5 Remove the solenoid valve cover (1.27), undo the nut at the male adapter elbow (1.19) and the solenoid valve (1.24). Remove the pipe assembly (1.17) and withdraw the fuel inlet union (1.18).
- 1.6 Disconnect the solenoid valve connectors (1.28), unscrew the two bolts (1.22) and remove the solenoid valve (1.24).
- 1.7 Disconnect and remove the glow plug (1.15). Remove the shield (1.14).
- 1.8 Remove the terminal block cover (1.1) and disconnect the wiring from the main terminal block (1.3). Separate thermistor leads by releasing snap-on connectors.
- 1.9 Remove the cable bracket (1.31), harness (Figure 9) and grommet (1.32).
- 1.10 Flame Detection Equipment
 - 1.10.1 If thermistors are fitted, withdraw them complete with PTFE leads attached and discard.
 - 1.10.2 If a rod and microswitch is fitted, disconnect and discard the microswitch (4.1).
- 1.11 Disconnect the resistor box (1.8) from the terminal block moulding on the outer case. Remove the lid (5.13).

- 1.12 Disconnect the bayonet connectors to the motor (6.17, 6.18).
- 1.13 Unscrew the nuts and remove the rear steady casting (2.14).
- 1.14 Withdraw the fuel pump and motor unit (2.19) complete with the heat exchanger (2.32).
- 1.15 Unscrew the bolts (2.15) on the motor yoke and remove the rear steady casting.
- 1.16 Remove the nuts (2.16) and separate the motor (2.19) from the fuel pump (2.20).
- 1.17 Remove the nuts and lockwashers (2.9) and separate the heat exchanger from the fuel pump.
- 1.18 Remove the flame ring (2.31) from the heat exchanger using an extractor (Figure 10).
- 1.19 Lift the tongues which secure the strips (2.6, 2.30). Remove and discard the strips.

2 Cleaning, Examination & Repair

- 2.1 On the outer case secure loose leads and protect the terminal pillars with appropriate nuts before cleaning.

- 2.2 Clean the following items using a 'Vacu-blast' plant or in accordance with WOSS 501/1. Alternatively a Bosch plant may be used, followed by a water rinse.

Air fan, inlet and exhaust tubes, fuel pipe and fittings, outer case, rear steady casting, fuel solenoid cover, terminal block cover, resistor box lid, flame ring

- 2.3 Wipe the Harness assembly with a cloth damped in solvent.

- 2.4 Discard the fan if fractured.

- 2.5 Discard the air inlet tube if the taper thread is damaged. Check by screwing it into a re-conditioned pump.

- 2.6 Discard the exhaust tube if the 3/32" outward swage at the bottom end is damaged.

- 2.7 Discard the fuel inlet union and male adapter elbow if fractured or if the threads are damaged.

- 2.8 Discard the fuel pipe assembly if fractured or if the union taper and nut are damaged.

- 2.9 Discard the glow plug cap and cover plate if fractured.

3 Glow Plug

- 3.1 Clean the element in solvent.
- 3.2 Examine the element for fracture, corrosion or distortion. If the element is defective proceed as in 3.6.
- 3.3 Wipe the glow plug body using a clean fluffless cloth and solvent.
- 3.4 Ensure that the element is in position and check the insulation to frame by Megger testing at 240/250 V. If the reading is less than 5 M Ω proceed as in 3.6.4.
- 3.5 Renew any damaged washers and sealing rings.
- 3.6 If defects were found in 3.2 proceed as follows.
 - 3.6.1 Remove the element and the ceramic base in which the element is secured. Discard the element.
 - 3.6.2 Wipe the ceramic base with a clean fluffless cloth damped in solvent. Renew the base if damaged.
 - 3.6.3 If the spindle is free from distortion clean the glow plug body in solvent. Renew the glow plug complete if there is distortion.
 - 3.6.4 Dismantle the glow plug and renew any of the following items which are damaged:-
 - glow plug body
 - spindle
 - washers and sealing rings (ceramic, copper and rubber)
 - 3.6.5 Make a new element using 19 SWG Kanthal 'A' wire to make a 5 turn coil of 7 mm former diameter. secure to the glow plug by centrepunching and re-assemble the glow plug complete.
 - 3.6.6 Test the insulation resistance as detailed in section 3.3.
 - 3.6.7 Using a brush (BR Cat. 5/2396) insulate the space behind the ceramic washer with a light coating of Autostic. 24 hours should be allowed for the Autostic to dry before the glow plug is used.

4. Fuel Solenoid Valve

- 4.1 Remove the locking screw and lockwasher (3.11), locking plate (3.10) and spacer (3.9).
- 4.2 Unscrew the filter adapter (3.17) and valve seat adjuster (3.15). Discard the O ring (3.14).
- 4.3 Withdraw the bobbin (3.13) and spring (3.12) from the valve body (3.1).
- 4.4 Clean all components in solvent.
- 4.5 Renew the filter adapter if the gauze is damaged.
- 4.6 Renew the sealing washer (3.16) if damaged.
- 4.7 Renew the valve body if fractured or distorted. To renew the body remove the nut and lockwasher (3.6) and coil and casing (3.4), renew the valve body and reassemble.
- 4.8 Renew any damaged connector (3.7). The centre connection is male and the two outer connections are female.
- 4.9 Discard the spring if fractured or weakened.
- 4.10 Use new items for those discarded.
- 4.11 Assemble the fuel solenoid valve without the locking plate.
- 4.12 Set the valve as follows:-
 - 4.12.1 Connect the fuel solenoid valve to a 24 volt dc supply and screw up the valve seat adjuster until the bobbin is heard to strike the pole piece. Note this position.
 - 4.12.2 Continue screwing in the valve seat adjuster while repeatedly de-energising and energising the coil.
 - 4.12.3 The striking noise will become less pronounced until it ceases completely. This is the position of zero 'air gap'.
 - 4.12.4 Unscrew the valve seat adjuster to the position noted in 4.12.1. This must be at least one third turn from the position of zero 'air gap'.
 - 4.12.5 Disconnect the valve from the supply.
 - 4.12.6 Test the valve in accordance with Section 2.

5. Resistor Box

5.1 Clean using clean dry compressed air.

5.2 Examine the resistors, cables and relays for damage. If damaged, dismantle the regulator as detailed in 5.10 and renew damaged components.

5.3 Discard cap if damaged and fit an insulating bush (14/2349).

5.4 Connect the resistor box in series with an overhauled glow plug. Connect a 20-30 V dc supply with the positive connected to the input terminal of the tapped resistor, R3, and the negative to the glow plug spade terminal.

5.5 Place the box horizontally with the cover opening upwards.

5.6 Adjust the input to 20 V and measure the voltage across the glow plug. This must not be less than 3.7 V. Adjust the variable resistor R3 if defective. Check that the regulator relay does not operate.

5.7 Increase the voltage slowly and note the glow plug voltage at which the regulator relay operates. This should be between 4.6 and 4.8 V. Adjust the relay to suit.

5.8 When the relay operates the voltage across the glow plug should fall to between 4.1 and 4.3 V. If not adjust the variable resistor R3 (with regard to the minimum low voltage set out in 5.6 above). If the correct value still cannot be obtained check the wiring and if correct dismantle the regulator and check as detailed in 5.10.

5.9 Increase the input to 30 V. The voltage across the glow plug must not exceed 5 V.

5.10 If the Resistor box is damaged or the adjustments set out in 5.6 - 5.9 cannot be made, proceed as follows:-

5.10.1 Disconnect the resistor cables.

5.10.2 Disconnect the insulation strips (5.3) and remove the resistors complete with insulated strips from their housing.

5.10.3 Remove the relay (5.17).

5.10.4 Renew any fractured or burnt resistors (5.4, 5.6, 5.8, 5.14). Spread any touching coils. Tighten any loose or missing fixing screws. Check that the tapping collar is tight on resistor R4.

- 5.10.5 Remove the relay cover.
- 5.10.6 Renew the relay if fractured or burnt. Resolder any dry joints.
- 5.10.7 Fit the relay cover.
- 5.10.8 Renew or repair the lid and case if fractured or damaged.
- 5.10.9 Assemble the regulator and test as detailed in item 5.4 - 5.9.

6. Motor

- 6.1 Remove the two screws and lockwashers (6.1) and the cover (6.2).
- 6.2 Lift the brushes (6.4). Discard any brush less than 11mm long.
- 6.3 Remove the rear clamp plate (6.3) and front clamp plate (6.14).
- 6.4 Remove the nuts from the O.C.E. of the fixing studs (6.7).
- 6.5 Withdraw the armature (6.12) complete with front housing (6.13). Remove the spring (6.9).
- 6.6 Separate the front housing from the armature.
- 6.7 Hold in a vice each bearing locking nut (6.10) and remove them from the armature spindle.
- 6.8 Use press and adaptors to remove the bearings (6.11) from the armature. Discard the bearings.
- 6.9 Armature
 - 6.9.1 Change the armature if burnt.
 - 6.9.2 Skim the commutator if worn. Change the armature if this results in a commutator of less than 27 mm ϕ .

Defective armatures are to be rewound in accordance with Section 4 AP 1.

- 6.10 If the field coils are burnt rewind in accordance with WOSS 501/2.
- 6.11 Use new items for those discarded.

6.12 Reassemble in reverse order carrying out the following operations:-

- 6.12.1 fit the bearings using press and adaptors to ensure that they are correctly fitted and run true. Fill each bearing approx. 2/3 full of Beacon grease.
- 6.12.2 Use silicon RTV to fill the interstice where the motor leads pass into the body of the motor.
- 6.12.3 Seal the cover to the stator pack with 1" sealing tape.
- 6.12.4 Seal the rear clamp plate to the stator pack using soft jointing compound.

6.13 Test in accordance with Section 2.

6. Fuel Pump

- 6.1 Remove the two screws and lockwashers (7.39) and the fuel delivery pipe (7.40). Discard the neoprene washer (7.36).
- 7.2 Remove the anti-radiation disc (7.41), adaptor (7.1), atomiser cup (7.2), shims (7.3, 7.4) and fan (7.5) from the driving shaft (7.8).
- 7.3 Remove the ring seal (7.6) and sealing washer (7.20).
- 7.4 Unscrew the nuts and lockwashers (7.7) and remove the rear casting (7.18) and forward casting (7.37).
- 7.5 Remove the cylinder cover (7.28), outer gasket (7.29), spring (7.31) and washer (7.31). Discard outer gasket.
- 7.6 Remove the cylinder (7.26), gate piece (7.22) and piston (7.24) complete. Withdraw the gate-piece and piston from the cylinder.
NOTE: The piston, cylinder and gate piece must be kept as a matched set during repair. They are identified by a number stamped on the cylinder and gate piece for this purpose.
- 7.7 Remove the bearing plate (7.25) and eccentric shaft (7.34). Discard the inner gasket (7.21).
- 7.8 Examine the inside of the pump body (7.11). If there is no grease the driving shaft bearing bush is defective. Dismantle the bearing assembly as detailed in item 7.20.

7.9 Clean the following components in 'Vacu-blast' plant.

forward casting, rear casting, anti-radiation disc, atomiser cup fan.

7.10 Remove the dummy plug in the pump body and clear the worm gear housing of grease. Clean this and all other components by wiping with a clean fluffless cloth damped in paraffin.

7.11 Clean other components in accordance with WOSS 501/1. Alternatively solvent may be used. Care must be taken not to scratch or damage the piston cylinder and gate piece.

7.12 Renew the rear casting if fractured. Renew any damaged studs and tighten any which are loose.

7.13 Examine the lugs on the forward casting and Argon-arc weld any that are fractured.

7.14 Discard the ring seal if damaged.

7.15 Renew the anti-radiation disc if distorted.

7.16 Ensure that the cleaning process has dislodged all carbon in the enclosed area of the atomiser cup by tapping on a hard surface.

7.17 Fasten down the locating tongues of loose fan blades. Renew the fan if any blades are excessively distorted.

7.18 Ensure that the fuel delivery pipe is clear by blowing through with clean dry compressed air.

7.19 Examine the lugs on the pump body casting. Argon-arc weld any which are fractured.

7.20 Insert a feeler gauge between the worm and pump body to check the longitudinal play in the driving shaft. If the play exceeds 0.08mm or the lateral play is excessive, OR the bush was found to be defective as a result of examination in 7.8, dismantle the pump and renew the bush as follows:-

7.7.1 Remove the flexible drive (7.15) and mills pins (7.9, 7.10).

7.7.2 Withdraw the driving shaft (7.8) and worm (7.12).

7.7.3 Press out the bushes and discard.

7.7.4 Reassemble using new bushes.

- 7.21 Examine the flexible drive (7.15). If the flexibility has deteriorated, remove the pin (7.17) and renew the coupling using a new pin.
- 7.22 Renew the studs (7.14) if damaged.
- 7.23 Renew the connecting nipple (7.36) if damaged.
- 7.24 Examine the pivot spindle on the cylinder for excessive wear. Ensure that the cylinder pivots freely when the spindle is inserted in the bearing plate. Check the spindle bores in the bearing plate and cylinder cover for concentricity. Discard the assembly if defective.
- 7.25 Examine the bearing surface between the cylinder and bearing plate. If there is no fuel leakage the bearing surface should appear as a complete circular band on the bearing plate, with no high or low spots or scoring. If defective apply a small quantity of fine grinding paste to B.R. Cat. No. 1/10451 to the cylinder bearing surface, and bed in until the bearing surface is an even matt finish. Remove all traces of grinding paste using paraffin.
- 7.26 Discard the gate piece (7.22) if worn.
- 7.27 Discard the cylinder if worn.
- 7.28 Remove the Mills pin (7.32) and withdraw the wheel (7.33). Discard the wheel if worn. Discard the oil seal (7.23).
- 7.29 Discard the eccentric shaft if worn at the oil seal.
- 7.30 Fit the oil seal, wheel and mills pin using new items for those discarded.
- 7.31 Discard the thrust washer (7.13) if worn.
- 7.32 Pack the pump body with grease to B.R. Cat. No. 27/1350.
- 7.33 Use new items for those discarded. All rubbing surfaces MUST be wetted with fuel oil. This is to provide a lubricating film for running in when the pump is run without a fuel supply.
- 7.34 Fit the inner gasket, eccentric shaft and thrust washer, bearing plate, piston, bearing plate assembly, cylinder, spring, outer gasket, washer and cylinder cover.
- 7.35 Fit the forward casting and rear casting to the pump body. Ensure that the air inlet (rear casting), fuel delivery nozzle (pump) and delivery pipe cutaway (forward casting) are aligned.

- 7.34 Fit an overhauled motor to the rear casting. (This is primarily for test purposes but once attached, the pump and motor must remain assembled as a matched set.)
- 7.35 Screw the adaptor onto the driving shaft and fit the anti-radiation disc.
- 7.36 Test in accordance with Section 2.
- 7.37 Slide the fan and atomiser cup on to the driving shaft.
- 7.38 Fit the atomiser cup setting gauge to the forward casting so that it seats on to the ring seal flange.
- 7.39 Add shims (7.3, 7.4) until the gap between the lip of the atomiser cup and the cross-bar of the setting gauge is only just visible.
- 7.40 Insert feeler gauges to measure the gap. This must not exceed 0.8 mm. Adjust the thickness/number of shims if incorrect. Remove the setting gauge.
- 7.41 Remove the atomiser cup and fan and fit the fuel delivery pipe.
- 7.42 Fit the fan and a dummy atomiser cup (with a 120° segment removed) on the driving shaft. Use the fuel delivery pipe setting gauge to set a normal gap of 2 mm between the dummy atomiser cup and the nozzle of the fuel delivery pipe. The nozzle must be central in the groove of the dummy atomiser cup. See Figure 12.
- 7.43 Slacken off the fuel delivery pipe and change the dummy atomiser cup for the service cup, taking care not to knock the delivery pipe which is critically set. Secure the fuel delivery pipe.
- 7.44 Ensure that the atomiser cup rotates concentrically and does not foul the fuel delivery pipe.

8. Temperature Control Equipment

8.1 Flame Detection and Overheat Unit (where fitted).

8.1.1 Remove and discard.

8.1.2 Fit a rod and microswitch unit in accordance with Section 4 AP2. This will require the heat exchanger to be changed if it is not of a modified type.

8.2 Webasto Thermostat (where fitted)

8.2.1 This equipment requires no maintenance. If found defective on test it is to be discarded and a rod and microswitch unit fitted in accordance with Section 4 AP2. This will require the heat exchanger to be changed if it is not of a modified type.

8.3 Rod and Microswitch Unit (where fitted)

8.3.1 Renew the rod (4.6) if distorted.

9. Heat Exchanger

9.1 Renew the flame ring if fractured or badly damaged. Reform any minor distortion in the blades.

9.2 Renew the heat exchanger if badly distorted or if the baffle in the combustion chamber portion is oval instead of circular.

9.3 Dislodge the carbon deposits by shaking and lightly tapping the exterior and using a compressed air supply.

9.4 Clean the heat exchanger in solvent.

9.5 Place the heat exchanger on its end, pump end upwards, and fill the combustion chamber with cold water almost up to the glow plug port, taking care not to spill any down the circulating air jacket around it. Examine the area around the four radial ports for water seeping through into the circulation air jackets. If the heat exchanger is of the later type with fillet welded radial ports, it must be renewed if leaking. Earlier types with feather welded radial ports are to be repaired as follows.

9.5.1 Grind off the feather weld seam on the forward end of the combustion chamber and remove the inner chamber.

9.5.2 Weld the defective radial port using argon-arc or other approved method.

9.5.3 Position the inner chamber in the outer chamber and argon-arc weld.

9.5.4 Test for leaks as detailed above.

10 Casing

- 10.1 Renew the outer case if fractured or badly damaged. Dress out any minor dents.
- 10.2 Renew the grommets (1.4, 1.32) if damaged.
- 10.3 Renew any damaged terminal block or connecting tubes.
- 10.4 Examine the rear steady casting bosses on the yoke which supports the motor. Argon arc weld any fractures on the yoke.
- 10.5 Renew any damaged covers.

11 Harness and Cables

- 11.1 Examine the plug (8.1) for fractures and distortion to the case and moulding and damaged pins. Dismantle the plug and repair or renew if defective.
- 11.2 Renew the outer sleeve (8.2) if torn.
- 11.3 Examine the outer sleeve/plug clip and ensure that it is nipping but not biting into the insulation. Renew damaged components and refit if defective.
- 11.4 Renew any damaged cables. Renew any damaged male or female connectors in accordance with WOSS 560/4.

12. Reassembly

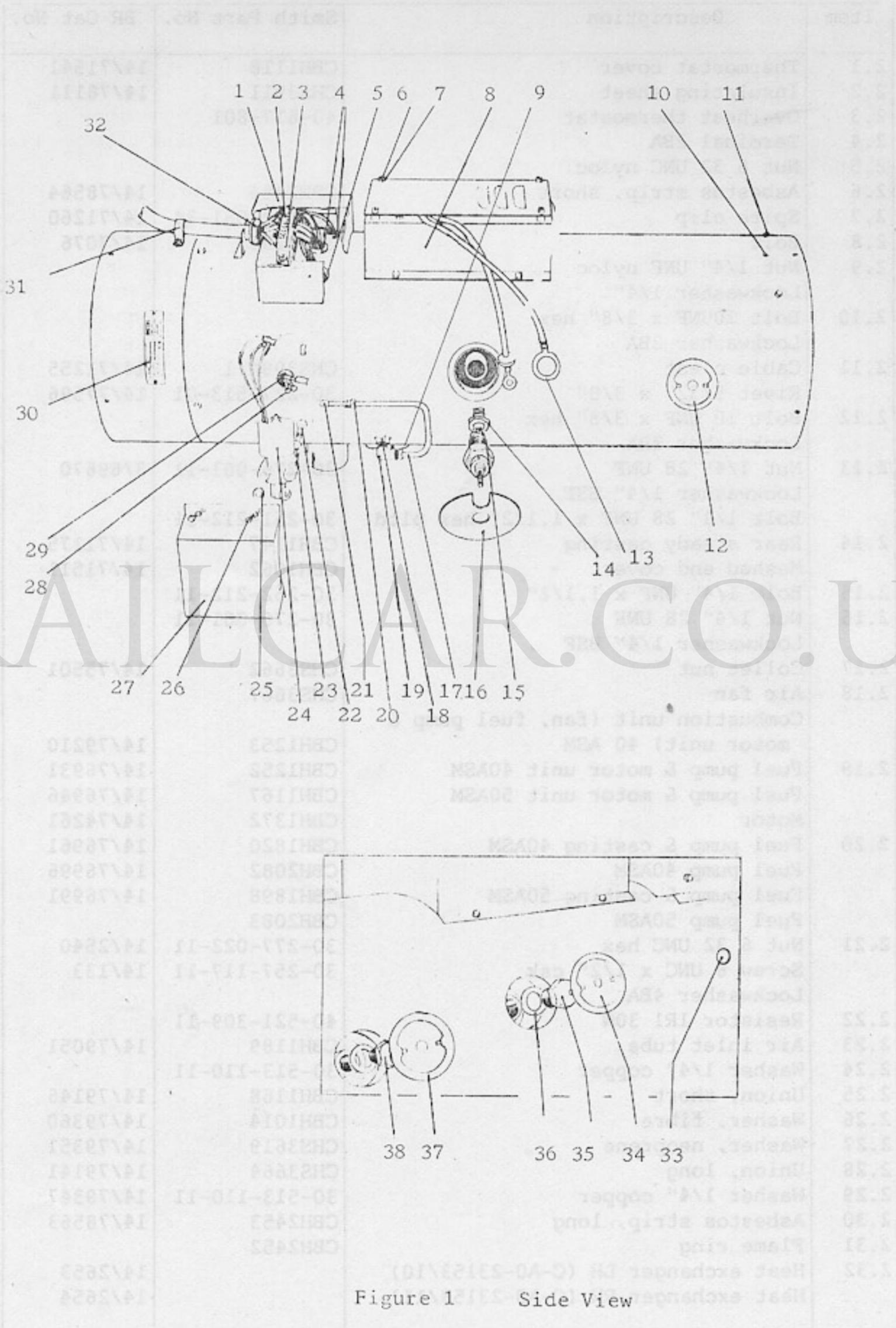
- 12.1 Use new items for those discarded.
- 12.2 Remove the blanking plug (1.35) and washer (1.36) from the heat exchanger and insert the screw setting gauges, (Smith's tool CBH1900) into the glow plug positions of the heat exchanger.
- 12.3 Fit the flame ring into the combustion chamber by aligning it radially so that the cutaways correspond to the glow plug position and press into the chamber until the annular ring plate seats on the extension pins of the screw setting gauge. If the flame ring is not a good fit remove and spread the lip periphery with a hide mallet. With the ring correctly located remove the screw setting gauges. Fit the blanking plug and washer.
- 12.4 Fit the pump and motor assembly to the heat exchanger Ensure that the air inlet on the rear casting of the pump is aligned with the fuel drain hole on the heat exchanger.
- 12.5 Fit the rear steady casting to the assembly.
- 12.6 Carefully lower the assembly into the outer casing and fit the outer casing to the rear steady casting.

- 12.7 Fit the exhaust tube, fuel drain union, male adaptor elbow and air inlet tube. Attach the air inlet baffle to the inlet tube so that the vanes are in line with the axis of the heater.
- 12.8 Fit the fuel inlet union into the pump casting using new washers (2.26) and (2.27).
- 12.9 Connect the resistor box leads to the terminal block moulding on* the outer case.
- 12.10 Fit the resistor box to the outer case.
- 12.11 Fit glow plug and cover plate. Connect the terminal from the resistor box and attach the glow plug cap.
- 12.12 Flame Detection Equipment
 - 12.12.1 Fit the rod and thermostat (if fitted) and connect the thermostat and microswitch.
- 12.13 Fit the harness assembly and connect to the terminal block. Fit the main terminal block cover.
- 12.14 Fit the fuel solenoid to the fuel solenoid cover, connect the three cable connectors and fit the fuel solenoid cover to the outer case. Connect the fuel pipe assembly to the male adaptor elbow and fuel solenoid outlet.
- 12.15 Fit the fan.
- 12.16 Test in accordance with Section 2.
- 12.17 Tighten the three nuts securing the pump to the heat exchanger.
- 12.18 Fit a blanking plug to the fuel inlet of the solenoid valve.
- 12.19 Stamp an overhaul date tag with the month and year and attach it to the heater.
- 12.20 Place the heater in a cardboard container (BR.1949).

RAILCAR.CO.UK

WOSS 830/4
Items List for Figure 1

Item	Description	Smith Part No.	BR Cat No.
1.1	Terminal block cover	CBH1163	14/71711
1.2	Screw 10 UNF x 5/16"	30-253-703-18	
1.3	Terminal block moulding or baseplate termate strip	CBH1151	14/70581
	Screw 10 32 UNF x 5/8"	30-253-206-11	142474
	Shakeproof washer 2BA		
1.4	Grommet 1" ϕ	30-781-311	14/72641
1.5	Grommet	30-781-351	14/72741
1.6	Screw 2BA x 5/8" ch		
1.7	Lockwasher 2BA		
1.8	Resistor box assy Mk 2	CBH1098	14/70731
	Resistor box assy Mk 2A onwards	CBH1327	14/70736
	Terminal block 4 way	40-718-529	
1.9	Locknut 1/4" UNF brass	30-276-610-11	14/75805
	Exhaust tube	CBH1720	14/79111
1.10	Screw 6 32 UNC x 1"	30-257-121-11	14/2340
	Lockwasher 2BA		
1.11	Bolt	CBH1122	14/70661
1.12	Thermostat hole cover	CBH1174	14/71471
1.13	Crimp, uninsulated (5.12)	CHS3958	14/78851
1.14	Shield		14/2806
1.15	Glow plug , Hefac (KLG)		14/76851
	Insulating bush C-A4-21947		14/2394
	Glow plug cap	CBH1693	14/71087
1.16	Blanking plate, glow plug	CHS3769	14/76666
1.17	Fuel pipe assembly RH	CBH1172	14/76361
	Fuel pipe assembly LH	CBH1737	14/76341
1.18	Fuel inlet union	CBH1154	14/79191
1.19	Elbow, male adaptor	80-286-241-43	8/25829
1.20	Tube nut 1/4" BSP	80-286-103-43	8/44870
1.21	Tube sleeve	80-286-101-43	8/45301
1.22	Bolt 1/4" BSF x 1.5/8" hex		
1.23	Lockwasher 1/4"		
1.24	Solenoid valve	CBH1075/2	14/79261
1.25	Spacing collar	CBH1086	14/71306
1.26	Bolt 10 UNF x 3/8" hex	30-251-166-11	
	Lockwasher 2BA		
1.27	Valve cover RH	CBH1085	14/71661
	Valve cover LH	CBH1085/1	14/71663
1.28	Connector, female		54/17469
	Connector, male		54/17208
1.29	Grommet	30-781-351	14/72741
1.30	Label	CBH2350	
1.31	Cable bracket	30-615-402	14/70749
	Bolt 10 UNF x 3/8"	30-251-166-11	
	Lockwasher 2BA		
1.32	Grommet	30-781-380	14/72781
1.33	Plaque button	20-242-101-01	
1.34	Blanking plug cover plate	CHS3780/1	14/76661
1.35	Blanking plug, alt. glowpug posn.	CHS3684	14/76781
1.36	Blanking plug washer	30-513-114	14/79355
1.37	Thermostat hole cover	CBH1174	14/71471
1.38	Blanking plug	CBH2257	14/76759



Items List for Figure 2

Item	Description	Smith Part No.	BR Cat No.
2.1	Thermostat cover	CBH1118	14/71541
2.2	Insulating sheet	CHS3911	14/78111
2.3	Overheat thermostat	40-617-801	
2.4	Terminal 2BA		
2.5	Nut 6 32 UNC nyloc		
2.6	Asbestos strip, short	CBH2454	14/78564
2.7	Spire clip	30-272-061-34	14/71260
2.8	Bolt	CBH2193	14/7076
2.9	Nut 1/4" UNF nyloc		
	Lockwasher 1/4"		
2.10	Bolt 10UNF x 3/8" hex		
	Lockwasher 2BA		
2.11	Cable cleat	CHS3994/1	14/71255
	Rivet 5/32" x 3/8"	30-227-513-01	14/77596
2.12	Bolt 10 UNF x 3/8" hex		
	Lockwasher 2BA		
2.13	Nut 1/4" 28 UNF	30-276-001-11	3/69670
	Lockwasher 1/4" BSF		
	Bolt 1/4" 28 UNF x 1.1/2" hex pltd	30-251-212-11	
2.14	Rear steady casting	CBH1147	14/71175
	Meshed end cover	CBH1062	14/71511
2.15	Bolt 1/4" UNF x 1.1/2"	30-252-212-11	
2.16	Nut 1/4" 28 UNF	30-276-001-11	
	Lockwasher 1/4" BSF		
2.17	Collet nut	CHS3662	14/75501
2.18	Air fan	CHS3667	
	Combustion unit (fan, fuel pump & motor unit) 40 ASM	CBH1253	14/79210
2.19	Fuel pump & motor unit 40ASM	CBH1252	14/76931
	Fuel pump & motor unit 50ASM	CBH1167	14/76946
	Motor	CBH1372	14/74261
2.20	Fuel pump & casting 40ASM	CBH1820	14/76961
	Fuel pump 40ASM	CBH2082	14/76996
	Fuel pump & casting 50ASM	CBH1898	14/76991
	Fuel pump 50ASM	CBH2083	
2.21	Nut 6 32 UNC hex	30-277-022-11	14/2540
	Screw 6 UNC x 1/2" csk	30-257-117-11	14/133
	Lockwasher 4BA		
2.22	Resistor 1R1 30W	40-521-309-11	
2.23	Air inlet tube	CBH1189	14/79051
2.24	Washer 1/4" copper	30-513-110-11	
2.25	Union, short	CBH1168	14/79146
2.26	Washer, fibre	CBH1014	14/79360
2.27	Washer, neoprene	CHS3619	14/79351
2.28	Union, long	CHS3664	14/79141
2.29	Washer 1/4" copper	30-513-110-11	14/79347
2.30	Asbestos strip, long	CBH2453	14/78563
2.31	Flame ring	CBH2452	
2.32	Heat exchanger LH (C-A0-23153/10)		14/2653
	Heat exchanger RH (C-A0-23153/11)		14/2654

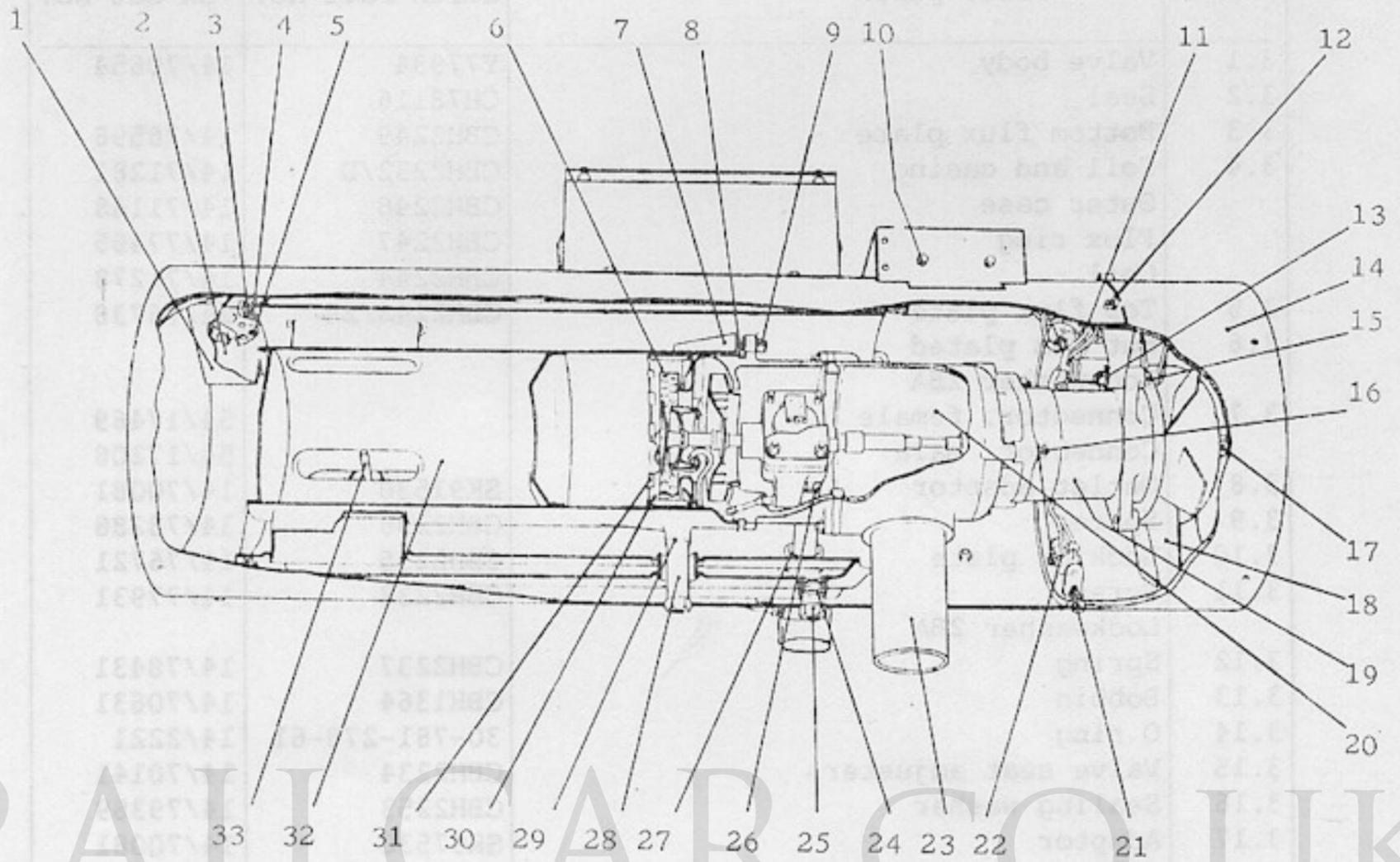


Figure 2 Sectioned View

Items List for Figure 3

Item	Description	Smith Part No.	BR Cat No.
3.1	Valve body	Y77934	14/70654
3.2	Seal	CH78116	
3.3	Bottom flux plate	CBH2249	14/76598
3.4	Coil and casing	CBH2232/D	14/71281
	Outer case	CBH2246	14/71148
	Flux ring	CBH2247	14/77455
	Coil	CBH2244	14/71278
3.5	Top flux plate	CBH2248/24	14/76738
3.6	Nut 2BA plated		
	Lockwasher 2BA		
3.7	Connector, female		54/17469
	Connector, male		54/17208
3.8	Outlet adaptor	SK97530	14/70081
3.9	Spacer	CBH2296	14/78286
3.10	Locking plate	CBH2235	14/76721
3.11	Screw	CBH2238	14/77931
	Lockwasher 2BA		
3.12	Spring	CBH2237	14/78431
3.13	Bobbin	CBH1364	14/70631
3.14	O ring	30-781-278-61	14/2221
3.15	Valve seat adjuster	CBH2234	14/70141
3.16	Sealing washer	CBH2253	14/79369
3.17	Adaptor	SK97530	14/70081
	Filter	CBH2233	14/72381

WOSS 830/4

Items List for Figure 3

Item No.	BR Part No.	Description	QTY
1	C-41-21153A	Microswitch	1
2	C-41-21153B	Terminal	1
3	C-41-21153C	Terminal MS	1
4	C-41-21153D	Washer	1
5	C-41-21153E	Washer	1
6	C-41-21153F	Washer	1
7	C-41-21153G	Washer	1
8	C-41-21153H	Washer	1
9	C-41-21153I	Washer	1
10	C-41-21153J	Washer	1
11	C-41-21153K	Washer	1
12	C-41-21153L	Washer	1
13	C-41-21153M	Washer	1
14	C-41-21153N	Washer	1
15	C-41-21153O	Washer	1
16	C-41-21153P	Washer	1
17	C-41-21153Q	Washer	1

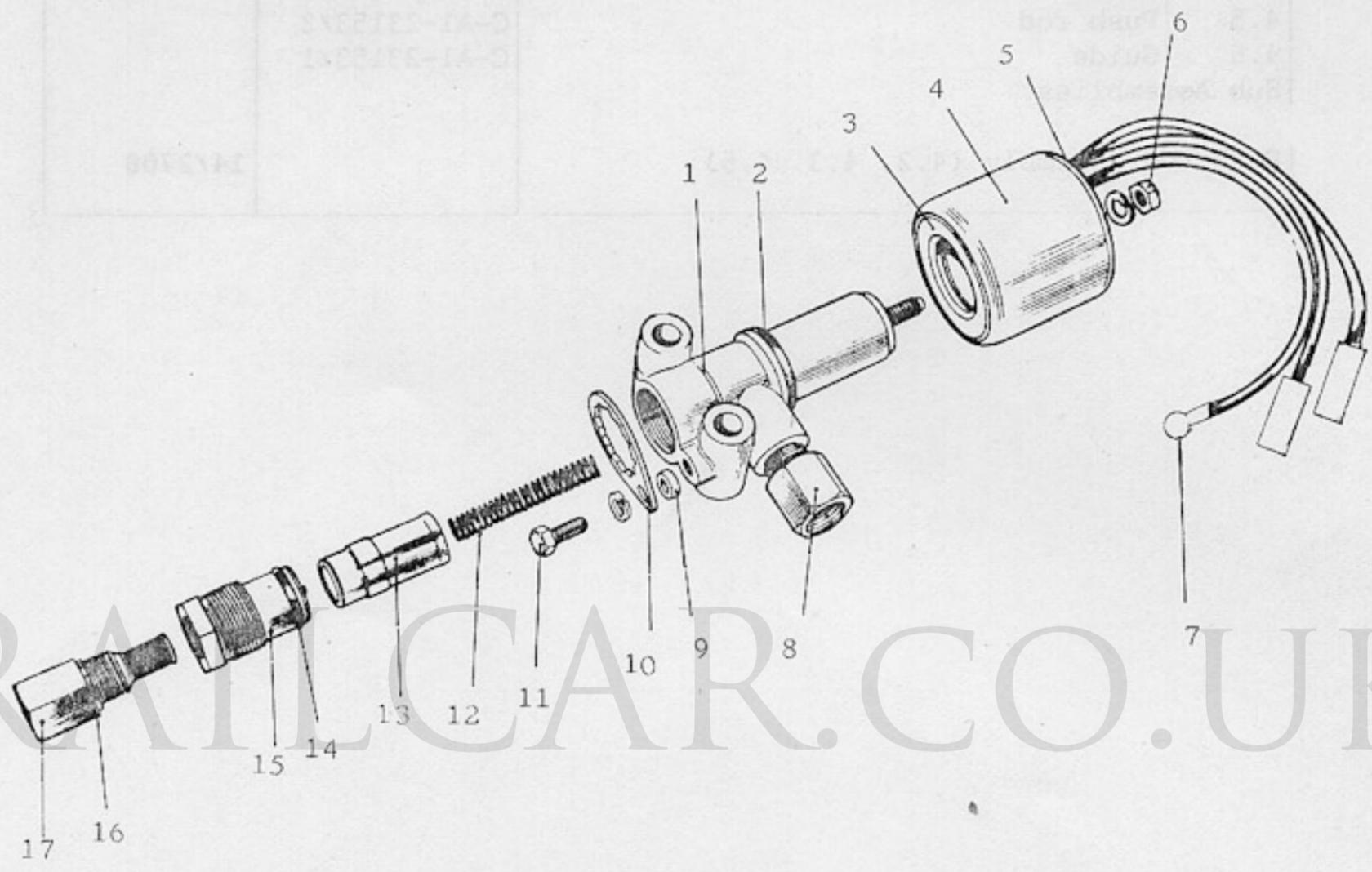


Figure 3 Solenoid Valve

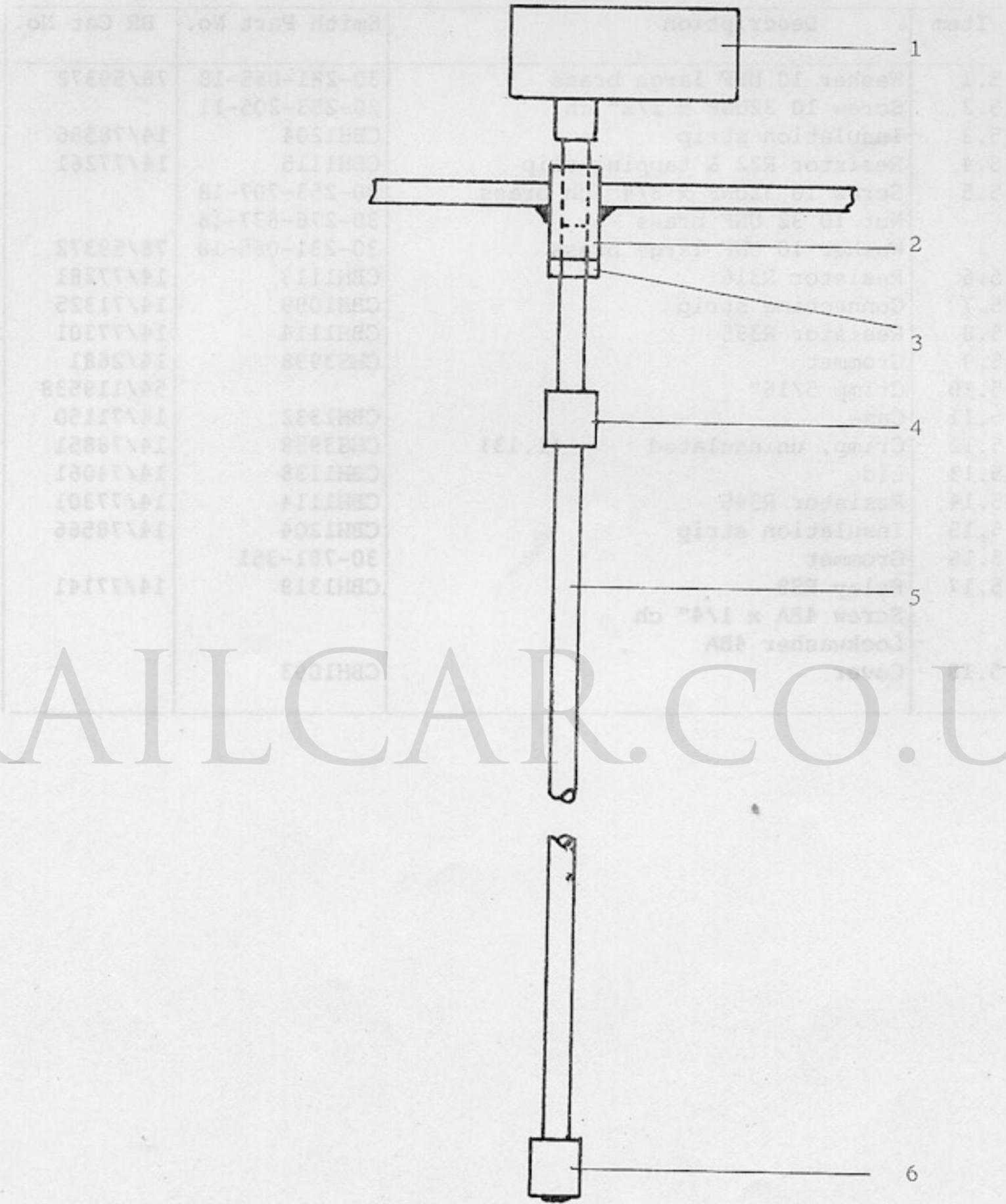
WOSS 830/4

Items List for Figure 4

Item	Description	BR Drg. No.	BR Cat No.
4.1	Microswitch		14/469
4.2	Ferrule	C-A1-23153/4	14/2885
4.3	Locknut M6	C-A1-23153/5	
4.4	Guide	C-A1-23153/3	
4.5	Push rod	C-A1-23153/2	
4.6	Guide	C-A1-23153/1	
Sub Assemblies			
	Push rod assembly (4.2, 4.3, 4.5)		14/2708

RAILCAR.CO.UK

WOSS 830/4
 Item List for Figure 4



BR Car No.	Smith Part No.	Item
14V7561	CBH118	1 Washer 10 1/2" I.D. I.D. 1/2"
14V7566	CBH1204	2 Screw 10 1/2" I.D. 1/2"
14V7561	CBH118	3 Insulation strip
14V7566	CBH1204	4 Resistor R25 & 1/2"
14V7561	CBH118	5 Nut 10 1/2" I.D. 1/2"
14V7566	CBH1204	6 Resistor R25 & 1/2"
14V7561	CBH118	7 Resistor R25 & 1/2"
14V7566	CBH1204	8 Resistor R25 & 1/2"
14V7561	CBH118	9 Resistor R25 & 1/2"
14V7566	CBH1204	10 Resistor R25 & 1/2"
14V7561	CBH118	11 Resistor R25 & 1/2"
14V7566	CBH1204	12 Resistor R25 & 1/2"
14V7561	CBH118	13 Resistor R25 & 1/2"
14V7566	CBH1204	14 Resistor R25 & 1/2"
14V7561	CBH118	15 Resistor R25 & 1/2"
14V7566	CBH1204	16 Resistor R25 & 1/2"
14V7561	CBH118	17 Resistor R25 & 1/2"
14V7566	CBH1204	18 Resistor R25 & 1/2"
14V7561	CBH118	19 Resistor R25 & 1/2"
14V7566	CBH1204	20 Resistor R25 & 1/2"
14V7561	CBH118	21 Resistor R25 & 1/2"
14V7566	CBH1204	22 Resistor R25 & 1/2"
14V7561	CBH118	23 Resistor R25 & 1/2"
14V7566	CBH1204	24 Resistor R25 & 1/2"
14V7561	CBH118	25 Resistor R25 & 1/2"
14V7566	CBH1204	26 Resistor R25 & 1/2"
14V7561	CBH118	27 Resistor R25 & 1/2"
14V7566	CBH1204	28 Resistor R25 & 1/2"
14V7561	CBH118	29 Resistor R25 & 1/2"
14V7566	CBH1204	30 Resistor R25 & 1/2"
14V7561	CBH118	31 Resistor R25 & 1/2"
14V7566	CBH1204	32 Resistor R25 & 1/2"
14V7561	CBH118	33 Resistor R25 & 1/2"
14V7566	CBH1204	34 Resistor R25 & 1/2"
14V7561	CBH118	35 Resistor R25 & 1/2"
14V7566	CBH1204	36 Resistor R25 & 1/2"
14V7561	CBH118	37 Resistor R25 & 1/2"
14V7566	CBH1204	38 Resistor R25 & 1/2"
14V7561	CBH118	39 Resistor R25 & 1/2"
14V7566	CBH1204	40 Resistor R25 & 1/2"
14V7561	CBH118	41 Resistor R25 & 1/2"
14V7566	CBH1204	42 Resistor R25 & 1/2"
14V7561	CBH118	43 Resistor R25 & 1/2"
14V7566	CBH1204	44 Resistor R25 & 1/2"
14V7561	CBH118	45 Resistor R25 & 1/2"
14V7566	CBH1204	46 Resistor R25 & 1/2"
14V7561	CBH118	47 Resistor R25 & 1/2"
14V7566	CBH1204	48 Resistor R25 & 1/2"
14V7561	CBH118	49 Resistor R25 & 1/2"
14V7566	CBH1204	50 Resistor R25 & 1/2"
14V7561	CBH118	51 Resistor R25 & 1/2"
14V7566	CBH1204	52 Resistor R25 & 1/2"
14V7561	CBH118	53 Resistor R25 & 1/2"
14V7566	CBH1204	54 Resistor R25 & 1/2"
14V7561	CBH118	55 Resistor R25 & 1/2"
14V7566	CBH1204	56 Resistor R25 & 1/2"
14V7561	CBH118	57 Resistor R25 & 1/2"
14V7566	CBH1204	58 Resistor R25 & 1/2"
14V7561	CBH118	59 Resistor R25 & 1/2"
14V7566	CBH1204	60 Resistor R25 & 1/2"
14V7561	CBH118	61 Resistor R25 & 1/2"
14V7566	CBH1204	62 Resistor R25 & 1/2"
14V7561	CBH118	63 Resistor R25 & 1/2"
14V7566	CBH1204	64 Resistor R25 & 1/2"
14V7561	CBH118	65 Resistor R25 & 1/2"
14V7566	CBH1204	66 Resistor R25 & 1/2"
14V7561	CBH118	67 Resistor R25 & 1/2"
14V7566	CBH1204	68 Resistor R25 & 1/2"
14V7561	CBH118	69 Resistor R25 & 1/2"
14V7566	CBH1204	70 Resistor R25 & 1/2"
14V7561	CBH118	71 Resistor R25 & 1/2"
14V7566	CBH1204	72 Resistor R25 & 1/2"
14V7561	CBH118	73 Resistor R25 & 1/2"
14V7566	CBH1204	74 Resistor R25 & 1/2"
14V7561	CBH118	75 Resistor R25 & 1/2"
14V7566	CBH1204	76 Resistor R25 & 1/2"
14V7561	CBH118	77 Resistor R25 & 1/2"
14V7566	CBH1204	78 Resistor R25 & 1/2"
14V7561	CBH118	79 Resistor R25 & 1/2"
14V7566	CBH1204	80 Resistor R25 & 1/2"
14V7561	CBH118	81 Resistor R25 & 1/2"
14V7566	CBH1204	82 Resistor R25 & 1/2"
14V7561	CBH118	83 Resistor R25 & 1/2"
14V7566	CBH1204	84 Resistor R25 & 1/2"
14V7561	CBH118	85 Resistor R25 & 1/2"
14V7566	CBH1204	86 Resistor R25 & 1/2"
14V7561	CBH118	87 Resistor R25 & 1/2"
14V7566	CBH1204	88 Resistor R25 & 1/2"
14V7561	CBH118	89 Resistor R25 & 1/2"
14V7566	CBH1204	90 Resistor R25 & 1/2"
14V7561	CBH118	91 Resistor R25 & 1/2"
14V7566	CBH1204	92 Resistor R25 & 1/2"
14V7561	CBH118	93 Resistor R25 & 1/2"
14V7566	CBH1204	94 Resistor R25 & 1/2"
14V7561	CBH118	95 Resistor R25 & 1/2"
14V7566	CBH1204	96 Resistor R25 & 1/2"
14V7561	CBH118	97 Resistor R25 & 1/2"
14V7566	CBH1204	98 Resistor R25 & 1/2"
14V7561	CBH118	99 Resistor R25 & 1/2"
14V7566	CBH1204	100 Resistor R25 & 1/2"

RAILCAR.CO.UK

Figure 4 Rod and Microswitch Assembly

WOSS 830/4

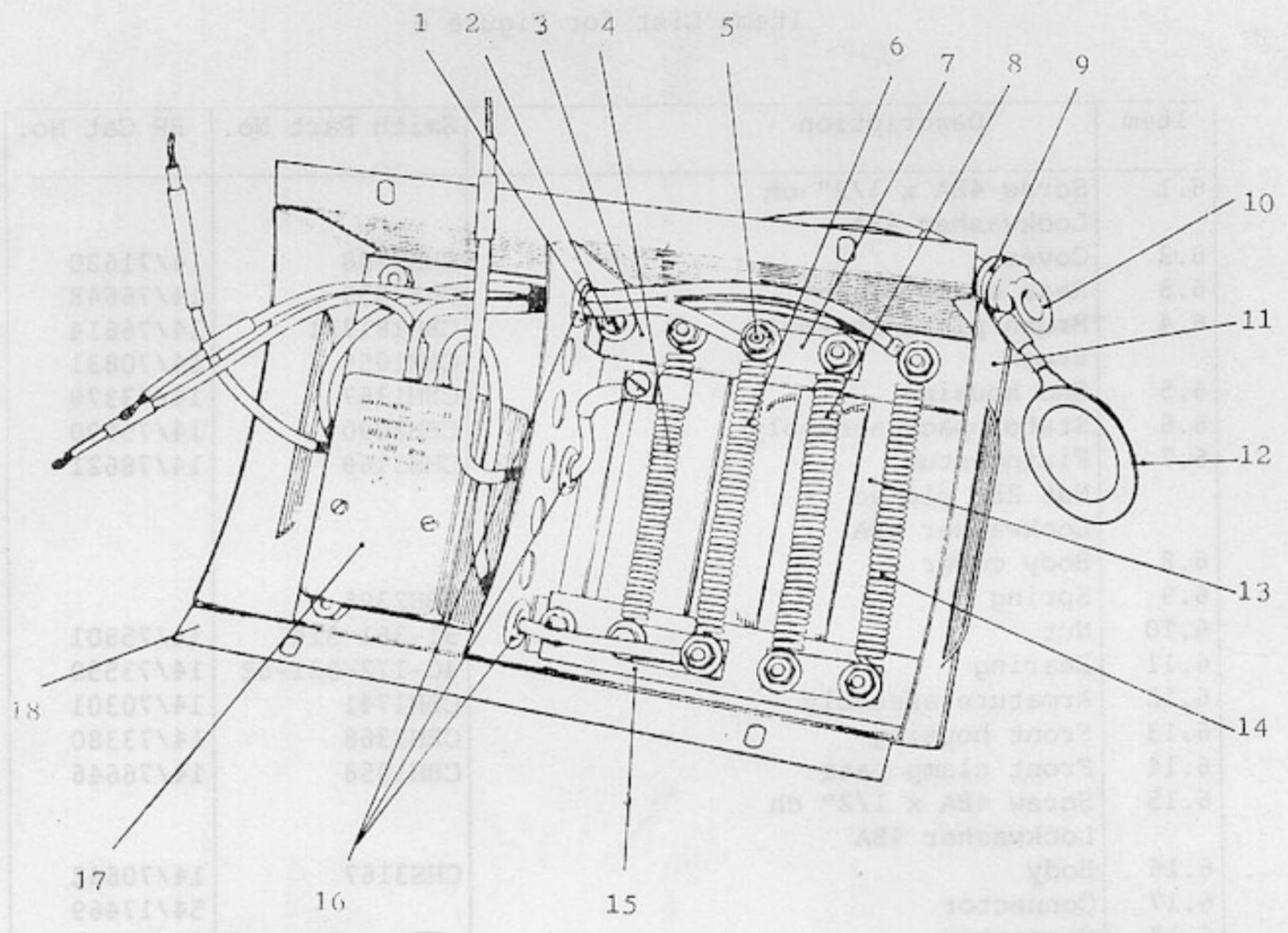
Items List for Figure 5

Item	Description	Smith Part No.	BR Cat No.
5.1	Washer 10 UNF large brass	30-281-065-18	78/59372
5.2	Screw 10 32UNF x 1/2" ch	30-253-205-11	
5.3	Insulation strip	CBH1204	14/78566
5.4	Resistor R22 & tapping clip	CBH1115	14/77261
5.5	Screw 10 32UNF x 3/4" ch brass	30-253-707-18	
	Nut 10 32 UNF brass	30-276-637-18	
	Washer 10 UNF large brass	30-281-065-18	78/59372
5.6	Resistor R316	CBH1113	14/77281
5.7	Connecting strip	CBH1099	14/71325
5.8	Resistor R395	CBH1114	14/77301
5.9	Grommet	CHS3998	14/2681
5.10	Crimp 5/16"		54/119538
5.11	Case	CBH1332	14/71150
5.12	Crimp, uninsulated (1.13)	CHS3958	14/78851
5.13	Lid	CBH1138	14/74061
5.14	Resistor R395	CBH1114	14/77301
5.15	Insulation strip	CBH1204	14/78566
5.16	Grommet	30-781-351	
5.17	Relay RS9	CBH1318	14/77141
	Screw 4BA x 1/4" ch		
	Lockwasher 4BA		
5.18	Cover	CBH1093	

RAILCAR.CO.UK

Figure 4 - Rod and Microswitch Assembly

Issue 1
Aug 87



RAILCAR.CO.UK

Figure 5 Resistor Box

Items List for Figure 6

Item	Description	Smith Part No.	BR Cat No.
6.1	Screw 4BA x 1/2" ch Lockwasher 4BA		
6.2	Cover	CHS3708	14/71620
6.3	Rear clamp plate	CHS3859	14/76648
6.4	Brush plate assembly Brush	CBH1817/1 CBH1059	14/76614 14/70831
6.5	End housing	CBH1367	14/73379
6.6	Stator pack assembly	CBH2090	14/75990
6.7	Fixing stud Nut 2BA plated Lockwasher 2BA	CHS3169	14/78621
6.8	Body cover		
6.9	Spring	CBH2395	
6.10	Nut	31-361-314	14/75801
6.11	Bearing	40-172-021-02	14/73550
6.12	Armature assembly	CBH1741	14/70301
6.13	Front housing	CBH1368	14/73380
6.14	Front clamp pate	CBH1058	14/76646
6.15	Screw 4BA x 1/2" ch Lockwasher 4BA		
6.16	Body	CHS3167	14/70642
6.17	Connector		54/17469
6.18	Connector		54/17208
6.19	Nut 2BA plated Lockwasher 2BA		
6.20	Brush box plate Terminal post	CBH1083 CBH1084	14/76620 14/78896
6.21	Brush base	CHS3714	14/70373
6.22	Screw 6BA x 1/4" ch brass Lockwasher 6BA		
6.23	Brush box	CBH1082	14/70703
6.24	Spring	CHS3179	14/78331
6.25	Brush spring post	CHS3178	14/76865

Items List for Figure 6

Item	Description	BR Cat No.	Serial Part No.
1.1	Adapter		CHR1581
1.2	Atomizer cup	14V71831	CHR3594
1.3	Atomizer disk	14V78141	CHR1818
1.4	Atomizer chain	14V78145	CHR1819
1.5	Atomizer	14V73780	CHR3593
1.6	Seal ring	14V75599	CHR1580
1.7	Nut 10 UNF		
1.8	Lockwasher 2BA		
1.9	Driving shaft	14V78040	CHR1500
1.10	Impeller assembly	14V71711	CHR1501
1.11	Impeller	14V71711	CHR1502
1.12	Impeller nut	14V71711	CHR1503
1.13	Impeller washer	14V78371	CHR1504
1.14	Impeller gasket	14V78371	CHR1505
1.15	Impeller pin 3/32"	14V78371	CHR1506
1.16	Impeller pin 1/4" x 1/2"	14V78371	CHR1507
1.17	Impeller pin 1/4" x 1/2"	14V78371	CHR1508
1.18	Impeller pin 1/4" x 1/2"	14V78371	CHR1509
1.19	Impeller pin 1/4" x 1/2"	14V78371	CHR1510
1.20	Impeller pin 1/4" x 1/2"	14V78371	CHR1511
1.21	Impeller pin 1/4" x 1/2"	14V78371	CHR1512
1.22	Impeller pin 1/4" x 1/2"	14V78371	CHR1513
1.23	Impeller pin 1/4" x 1/2"	14V78371	CHR1514
1.24	Impeller pin 1/4" x 1/2"	14V78371	CHR1515
1.25	Impeller pin 1/4" x 1/2"	14V78371	CHR1516
1.26	Impeller pin 1/4" x 1/2"	14V78371	CHR1517
1.27	Impeller pin 1/4" x 1/2"	14V78371	CHR1518
1.28	Impeller pin 1/4" x 1/2"	14V78371	CHR1519
1.29	Impeller pin 1/4" x 1/2"	14V78371	CHR1520
1.30	Impeller pin 1/4" x 1/2"	14V78371	CHR1521
1.31	Impeller pin 1/4" x 1/2"	14V78371	CHR1522
1.32	Impeller pin 1/4" x 1/2"	14V78371	CHR1523
1.33	Impeller pin 1/4" x 1/2"	14V78371	CHR1524
1.34	Impeller pin 1/4" x 1/2"	14V78371	CHR1525
1.35	Impeller pin 1/4" x 1/2"	14V78371	CHR1526
1.36	Impeller pin 1/4" x 1/2"	14V78371	CHR1527
1.37	Impeller pin 1/4" x 1/2"	14V78371	CHR1528
1.38	Impeller pin 1/4" x 1/2"	14V78371	CHR1529
1.39	Impeller pin 1/4" x 1/2"	14V78371	CHR1530
1.40	Impeller pin 1/4" x 1/2"	14V78371	CHR1531
1.41	Impeller pin 1/4" x 1/2"	14V78371	CHR1532

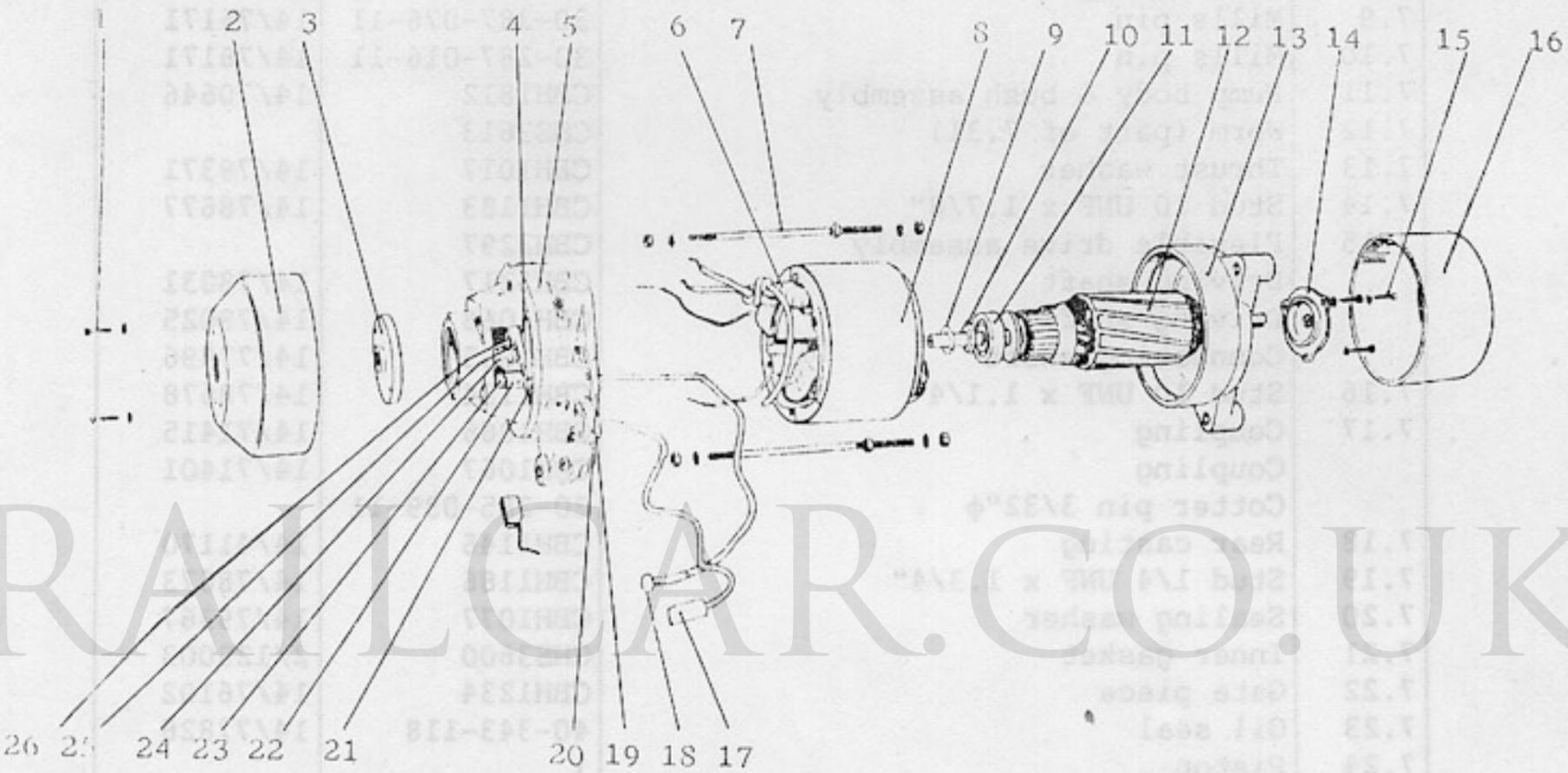


Figure 6 Motor

WOSS 830/4
Items List for Figure 7

Item	Description	Smith Part No.	BR Cat No.
7.1	Adaptor	CBH2201	
7.2	Atomiser cup	CHS3694	14/71831
7.3	Shim, thick	CBH1818	14/78141
7.4	Shim, thin	CBH1819	14/78146
7.5	Fan	CHS3622	14/72300
7.6	Seal ring	CHS3628	2/125699
7.7	Nut 10 UNF Lockwasher 2BA		
7.8	Driving shaft	CBH2200	14/78040
7.9	Mills pin	30-287-076-11	14/76171
7.10	Mills pin	30-287-016-11	14/76171
7.11	Pump body & bush assembly	CBH1812	14/70646
7.12	Worm (part of 7.31)	CHS3613	
7.13	Thrust washer	CBH1017	14/79371
7.14	Stud 10 UNF x 1.7/8"	CBH1183	14/78677
7.15	Flexible drive assembly Driving shaft Driving shaft Connecting shaft	CBH2297 CBH1217 CBH1063 CBH1065	14/78031 14/78025 14/77996
7.16	Stud 10 UNF x 1.1/4"	CBH1184	14/78678
7.17	Coupling Coupling Cotter pin 3/32"φ	CBH1066 CBH1067 30-285-039-11	14/71415 14/71401
7.18	Rear casting	CBH1146	14/41170
7.19	Stud 1/4 UNF x 1.3/4"	CBH1186	14/78673
7.20	Sealing washer	CBH1077	14/79367
7.21	Inner gasket	CHS3600	2/123003
7.22	Gate piece	CBH1234	14/76102
7.23	Oil seal	40-343-118	14/77826
7.24	Piston)	
7.25	Bearing plate) - CBH1239	
7.26	Cylinder)	
7.27	Nut 10 32 UNF Lockwasher 2BA		
7.28	Cylinder cover	CHS3633	14/71630
7.29	Outer gasket	CHS3599	2/123004
7.30	Washer	CHS3874	
7.31	Spring	CHS3686	14/78319
7.32	Mills pin 0.062"φ x 1/2"	30-287-006-11	
7.33	Wheel (part of 7.12)		
7.34	Eccentric shaft 40ASM Eccentric shaft 50ASM	CBH1251 CBH1078	14/78071 14/78081
7.35	Thrust washer	CHS3648	14/79365
7.36	Fuel inlet union Connecting nipple Washer neoprene	CBH1087 CBH2597 CHS3785	14/79181 14/74863 14/79341
7.37	Forward casting	CBH1144	14/71161
7.38	O ring	30-781-201-61	10/48290
7.39	Screw 10 UNF x 3/8" ch Lockwasher 2BA	20-253-204-11	
7.40	Fuel delivery pipe Drain connection	CBH1159 CBH1205	14/76421 14/79081
7.41	Anti-radiation disc	CHS3699	14/71921

WOSS 830/4

Item List for Figure 8

Item	Description	Stock Part No.	BR Cat. No.
1.1	Ring	40-143-119	1472391
1.2	Outer sleeve	1837-261	
1.3	Insulating sleeve 14 x 32 mm	30-761-663-15	
	Harness assembly	GB12304	1472888

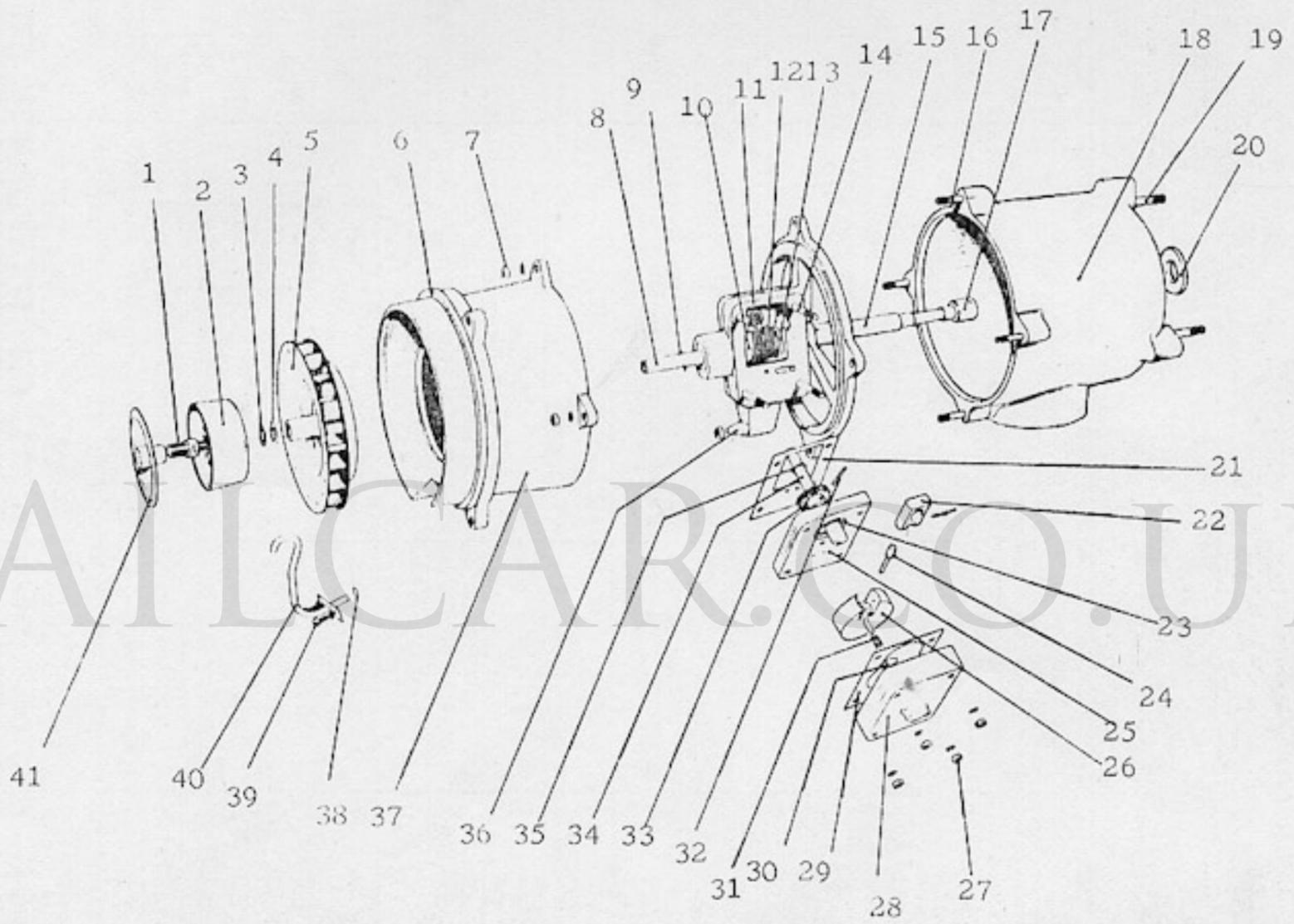


Figure 7

Fuel Pump

WOSS 830/4

Items List for Figure 8

Item	Description	Smith Part No.	BR Cat No.
8.1	Harness assembly (cable & plug)	CBH1621	14/72991
8.2	Plug	40-743-118	
8.3	Outer sleeve	1837-261	
8.3	Insulating sleeve 14 φ x 32 mm	30-783-662-15	
	Harness assembly	CBH2304	14/72898

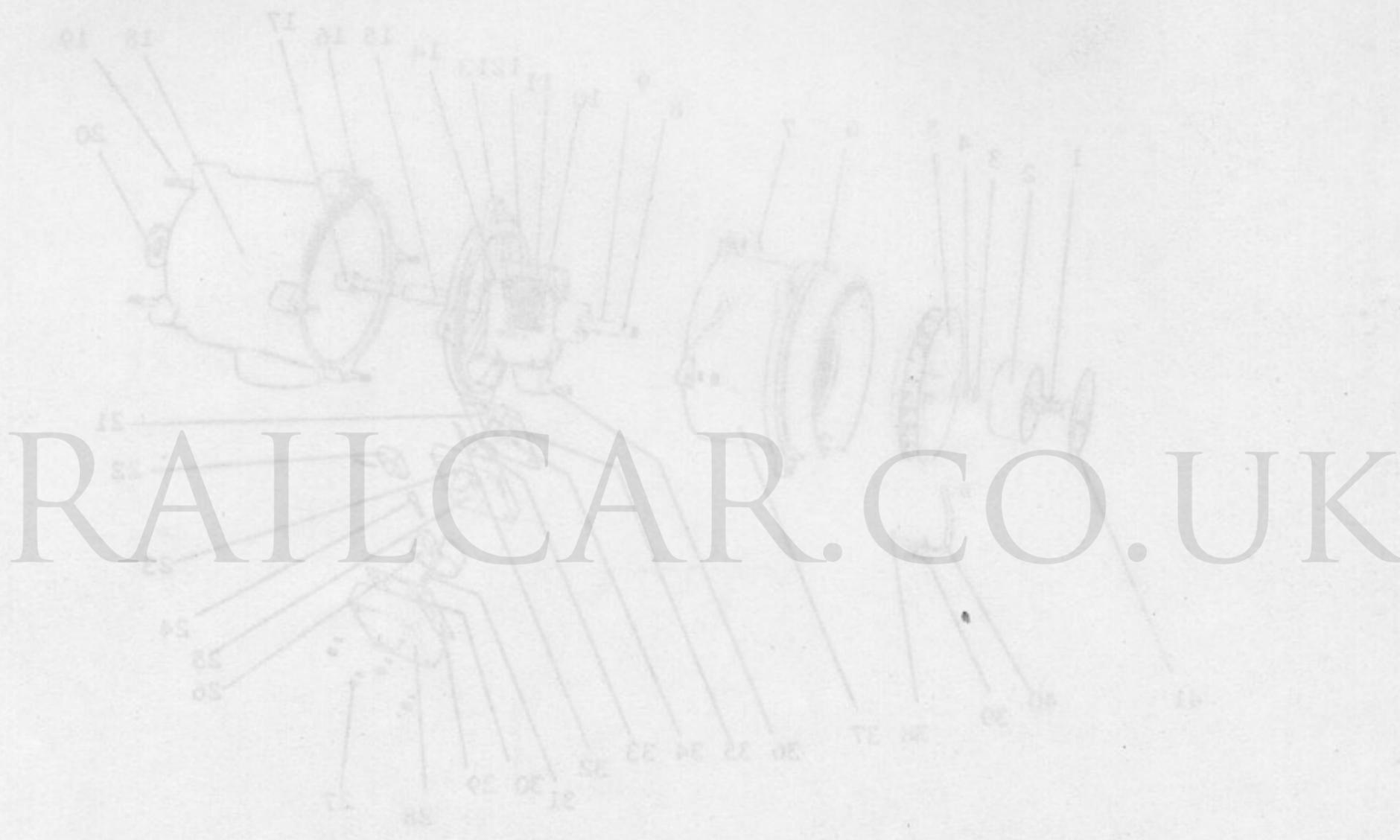
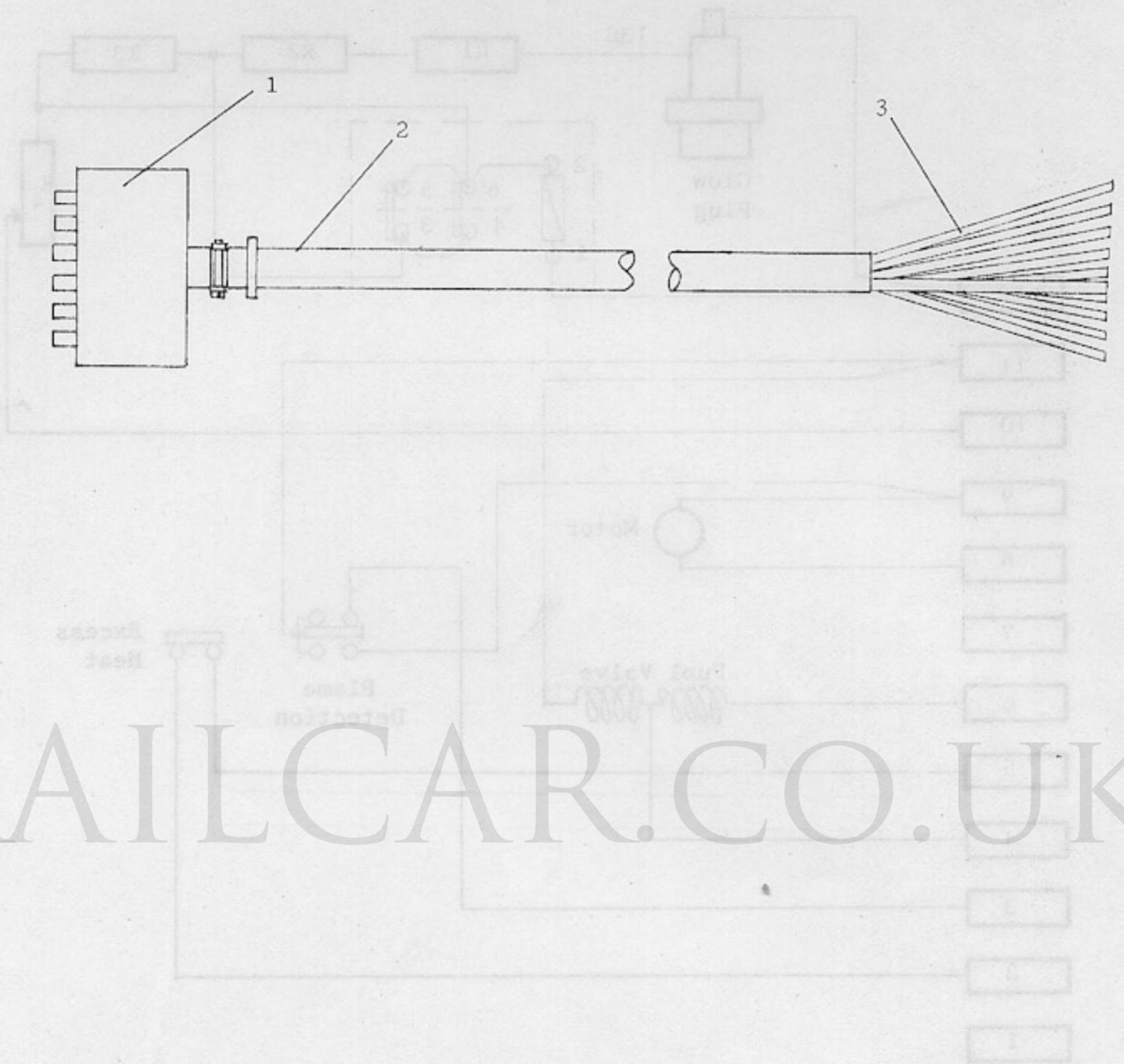


Figure 8 Fuel Pump



RAILCAR.CO.UK

Figure 8 Harness

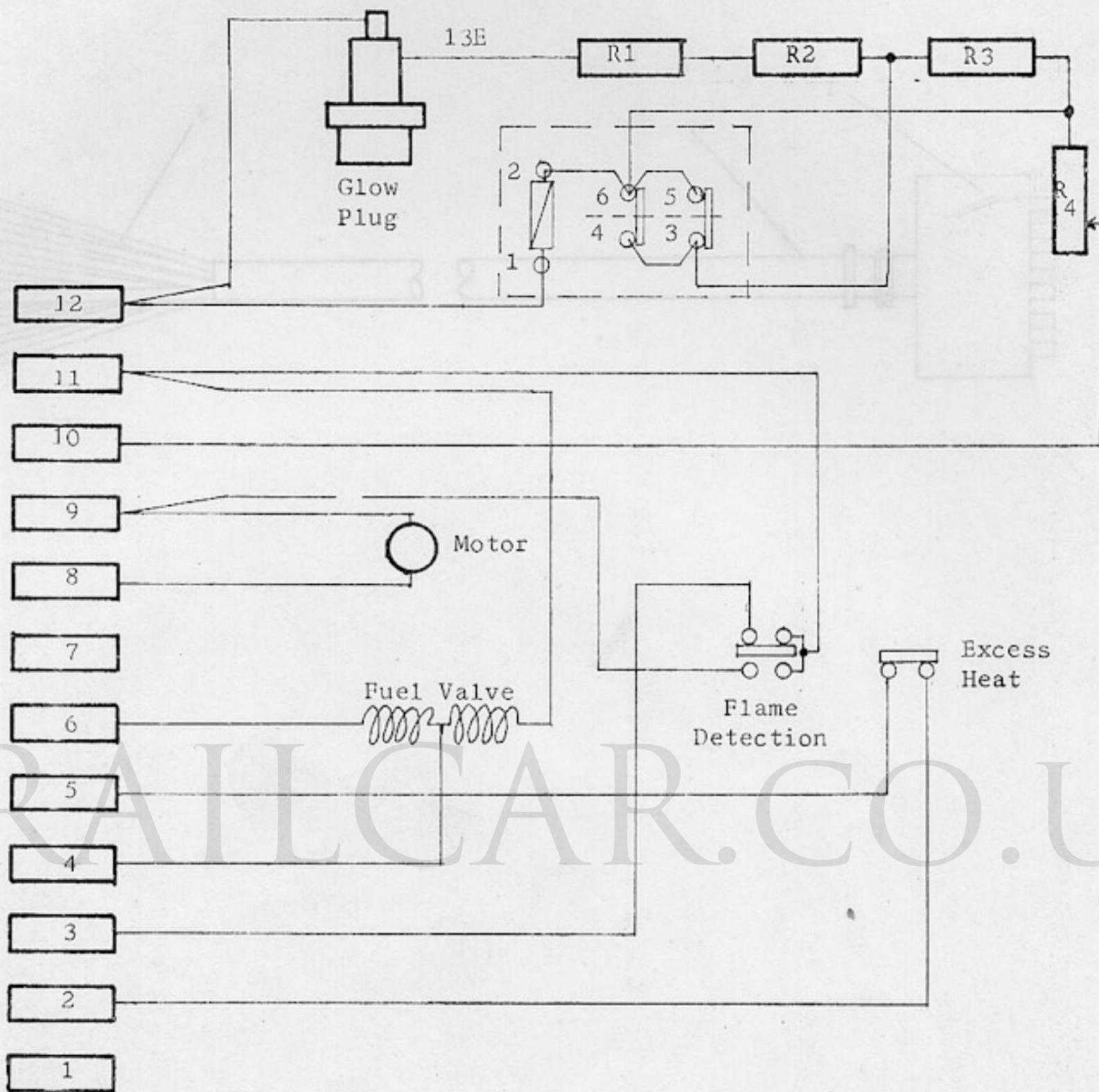


Figure 9 Connection Diagram

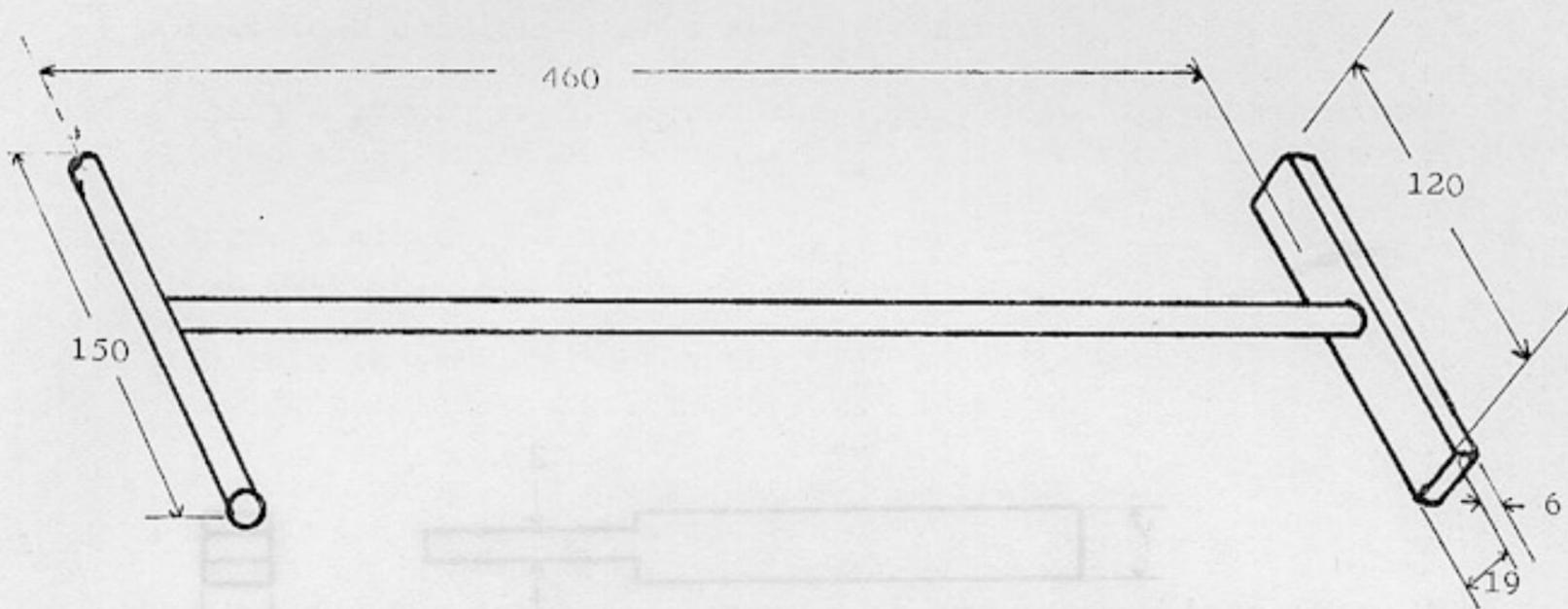


Figure 10 Flame Ring Extractor

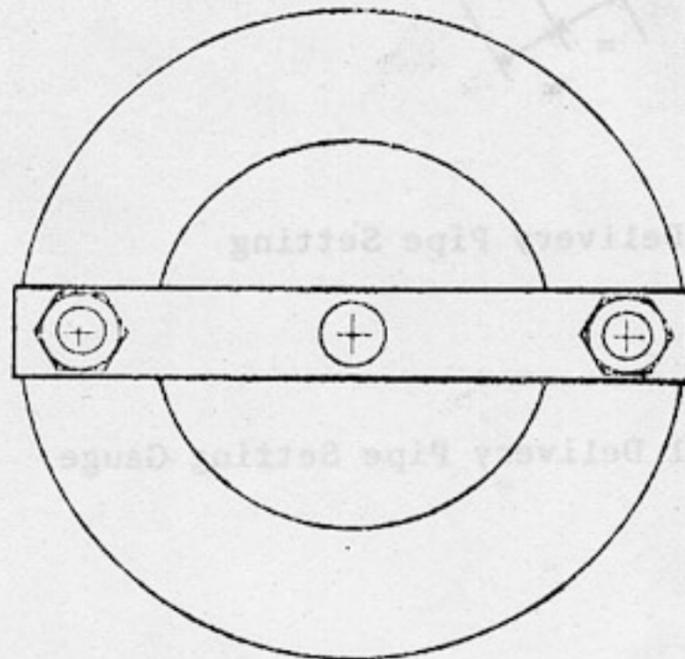
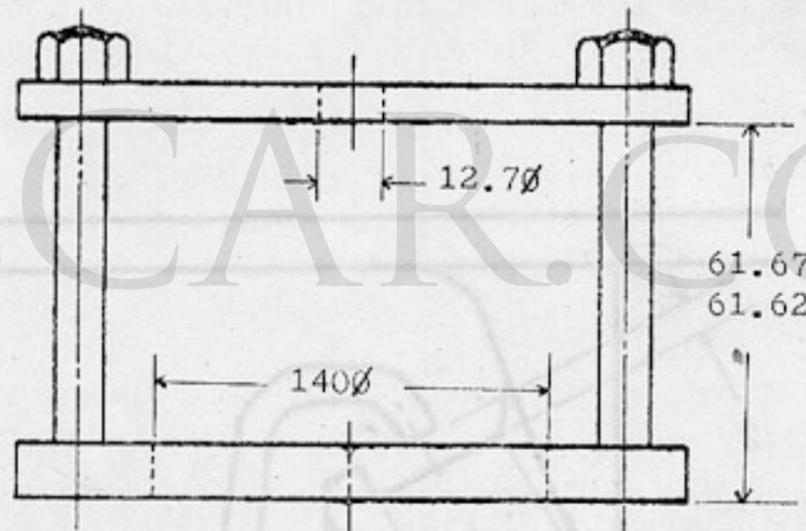
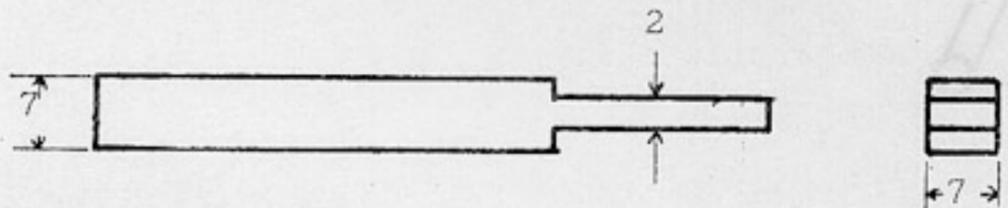
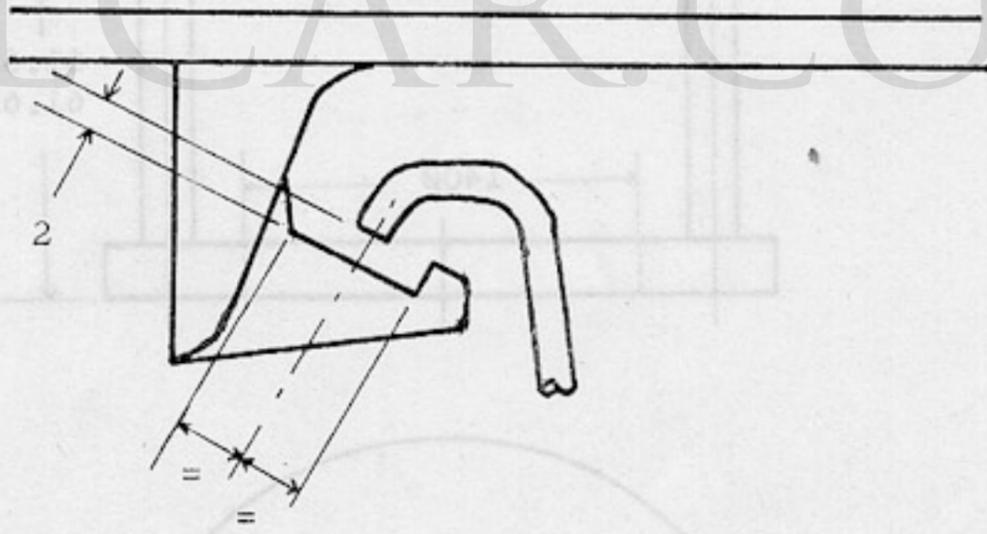


Figure 11 Atomiser Cup Setting Gauge



Setting Gauge



Fuel Delivery Pipe Setting

Figure 12 Fuel Delivery Pipe Setting Gauge

SECTION 2 TEST SPECIFICATION

Voltmeter 0-50 V d.c.
 Ammeter 0-10A d.c.
 Hand Stroboscope
 Stop clock
 'Fyrite' exhaust gas analyser or equipment
 Atomiser cup setting gauge (see Appendix B Fig. 1)
 Fuel delivery pipe setting gauge (see Appendix B Fig. 2 and 3)
 Dummy atomiser cup
 Master test fan A.T. 9181/F

Rigs are required to test the following components:-

Fuel solenoid valve
 Electric motor
 Fuel pump
 Complete heater

If any of the following tests do not give the indicated result, investigate and rectify the defect and repeat the test.

1 Fuel Solenoid:-

- 1.1 Connect the fuel solenoid valve to a slave fuel pump running at 3500 r/min. with a suction lift of 1220 mm. Check that the valve does not open.
- 1.2 Slowly increase the voltage to both coils and check that the valve operates between 16 and 18 V. If defective adjust the valve seat adjuster. If the correct setting still cannot be obtained renew the coils.
- 1.3 Open the valve by applying 18 V to both coils. Switch out one coil and reduce the voltage on the holding coil. Check that the valve closes when the voltage falls below 12 V. If defective adjust the valve seat adjuster. If the correct setting still cannot be obtained renew the coils.
- 1.4 Apply 31 V to each coil in turn. Check that the valve does not open with either coil energised.
- 1.5 Apply fuel oil pressure of 150 psi to the valve inlet and check that there is no leakage from the valve seat. Apply the same pressure to the valve outlet and check that there is no leakage from the valve body or valve seat.
- 1.6 Fit the locking plate (3.10) and repeat tests 1.1 - 1.3.
- 1.7 Seal the nut (3.6) using varnish.

2 Motor

- 2.1 Fit the master test fan AT.9181/F which is designed to reproduce full load conditions on a service heater.
- 2.2 Using a stroboscope, adjust the supply volts to obtain a motor speed of 3500 r/min. Run the motor for 5 minutes at this speed.
- 2.3 After 5 minutes measure the supply and check that the current is not more than 7.9 A at 24 V

If this is exceeded check that the motor is correctly assembled paying particular attention to the bearings.
- 2.4 Measure the insulation resistance to frame using a 500 V Megger. Minimum acceptable reading 50MΩ.
- 2.5 Fit the motor to reconditioned pump and test in accordance with para 3. Should the motor require changing, the pump must be re-tested as the combination is a matched set.

3 Pump

- 3.1 Connect the motor leads. Connect a fuel supply using clean filtered diesel oil to B.R. Cat. No. 27/12001. The delivery pipe from the pump is fitted to the orifice provided for the fuel delivery pipe (7.40).
- 3.2 Run the pump for 3 minutes with fuel wetted rubbing surfaces at a constant speed in the range of 3400 - 3500 r/min. The input current voltage to maintain this speed under these conditions must not exceed 3 Amps at 12 V.
- 3.3 Set the motor speed to 3500 r/min. and turn on the fuel supply to the pump. Check that the pump is self priming.
- 3.4 Check that the fuel delivery rates against a 1220 mm suction lift are as follows:-

Type	Time to Deliver 30cc (Secs.)
40ASM	old type 62.3 - 66.7
	CBH2082 66 - 72
50ASM	old type 54.5 - 58.1
	CBH2083 58 - 62

WOSS 830/4

In the suction lift condition there must be no evidence of air being delivered with the fuel. If the pump does not conform to the test figures, check that all unions are tight before dismantling the Pump. Also check for porous pump casting.

4 Complete Heater

Note: see Section 3 Table 2 for fault chart.

- 4.1 Connect the heater to a control panel with a supply of 24 V and a fuel supply of constant suction lift of 1220 mm or a gravity feed of 610 mm head as indicated.
- 4.2 Select Ventilating on control panel and check that the heater motor runs. Check that the over-heat relay contacts are closed.
- 4.3 With the supply to 24 V (measured at the heater) from a fuel supply of 610 mm suction lift from a cold, fully primed condition. Check that heat is detected within 75 seconds of the initiation of combustion.
- 4.4 Repeat test 4.3 with the supply at 20 V from a fuel supply of 1220 mm gravity head. Check that the time taken between the motor starting and combustion is within:

40 ASM heaters	20 seconds.
50 ASM heaters	15 seconds.
- 4.5 Repeat test 4.4 with the supply at 30 V.
- 4.6 Check that the fuel solenoid valve has closed, and that the motor continues to run for between 2 and 4 minutes.

Switch off.

4.7 Run the heater continuously for 30 minutes at full heat with the supply at 24 V and from a suction lift of 610 mm. Check that:

4.7.1 current input does not exceed 8.2 A.

4.7.2 motor speed is 3400 - 3500 r/min.

4.7.3 carbon dioxide content of the exhaust gas does not exceed:

40ASM	7.0%
50ASM	7.5%

4.7.4 the fuel delivery rate is as follows.

Shaft Speed (r/min.)	3400
40 ASM Pump (old type)	
Time (secs.) to pump 30cc	64.0 - 68.6
Delivery rate (cc/min.)	28.1 - 26.2
40 ASM Pump (new type)	
Time (secs.) to pump 30cc	68.7 - 74.0
Delivery rate (cc/min.)	24.3 - 26.2
50 ASM Pump (old type)	
Time (secs.) to pump 30cc	56.2 - 59.7
Delivery rate (cc/min.)	30.2 - 32.0
50 ASM Pump (new type)	
Time (secs.) to pump 30cc	59.9 - 63.7
Delivery rate (cc/min.)	28.2 - 30.1

4.8 Blank off the main circulating air inlet with the standard blanking plate WAT 1492 and check that:

4.8.1 the overheat protection relay RL2 de-energises in 2.5 - 4.5 minutes and the fuel valve closes. Remove WAT1492.

4.8.2 the fuel valve remains closed after relay RL2 re-energises.

4.8.3 the motor shuts down in 3-5 minutes.

- 4.9 Switch to the cold position and check that the motor operates and that the fuel valve remains closed.
- 4.10 Turn to the full heat position and reduce the supply to 20 V. Increase the supply and check that there is a drop in input current when the value of input voltage reaches that noted during voltage regulator test 18.7. This drop in voltage indicates the cutting in of the additional resistor.
- 4.11 Switch off and disconnect the heater from the test rig.
- 4.12 Measure the insulation of all terminals to frame using a 500 V megger. Minimum acceptable reading 10 MΩ.

RAILCAR.CO.UK

SECTION 3 TECHNICAL DATA

Table 1 Vehicle Classes and Heater Types

Class	Mk.	B Th.U/hr	Hand	Smith Pt No.	BR Cat. No.
101,104 110-128	2B/R	40	R	CBH2230	14/73237
			L	CBH2230/1	14/73240
107 108	2B	50	R	CBH2091A	14/2052

RAILCAR.CO.UK

Table 2 Fault Finding Chart for Heater Test

Symptom	Fault and Action
Motor fails to start in 'ventilating' position.	Check the motor supply.
Combustion is not initiated within specified time limit after motor has started.	Check the supply to the glow plug and voltage relay. Check the glow plug junction.
Fuel drips from the drain union.	Check that the fuel flow conforms to the fuel rate table in 4.11.4. If the fuel flow is outside the limits in section 4.11.4, check the fuel solenoid, supply pipes and pump for defects.
Combustion is not initiated within specified time limit after motor has started. No fuel drips from the drain union.	Check the electrical supply to the fuel valve solenoid and operation of solenoid valve.
Heater combusts but flame detector thermostat fails to detect heat within specified time limit of the motor starting.	Re-start and slowly rotate RP1 anti-clockwise after combustion has been established for 45 seconds. Relay RL1 should then energise. If not, check wiring and thermistor TH1
Heater motor runs for more than specified time after switching off the heater.	If heater has not shut-down in 4 minutes, slowly rotate RP1 clockwise until RL1 de-energises. If not, check associated thermistor TH1 wiring to ensure that it is not open circuit.

Table 2 (Contd)

Symptom	Fault and Action
Heater shuts down after running for a short period. On restarting it runs for the same period and shuts down again.	Overheat thermostat tripping due to lack of circulation air or component fault. Check relay RL2 and thermistor TH2.
Total input current exceeds 7.7A on continuous running.	<p>Check that there is no supply to the glow plug. If there is a supply, check circuit.</p> <p>Check motor current. If this is exceeded, check the main drive shaft to ensure that nothing is catching or binding on rotation.</p> <p>Check motor for incorrect overhaul, e.g. bearings.</p>
Carbon dioxide (CO ₂) content exceeds specification limit.	<p>Dismantle the heater and check for:</p> <ul style="list-style-type: none"> defective seal ring (7.6). dirty heat exchanger. heat exchanger leaking.

RAILCAR.CO.UK

SECTION 4 ADDITIONAL PROCEDURES

AP1 Armature Rewind.

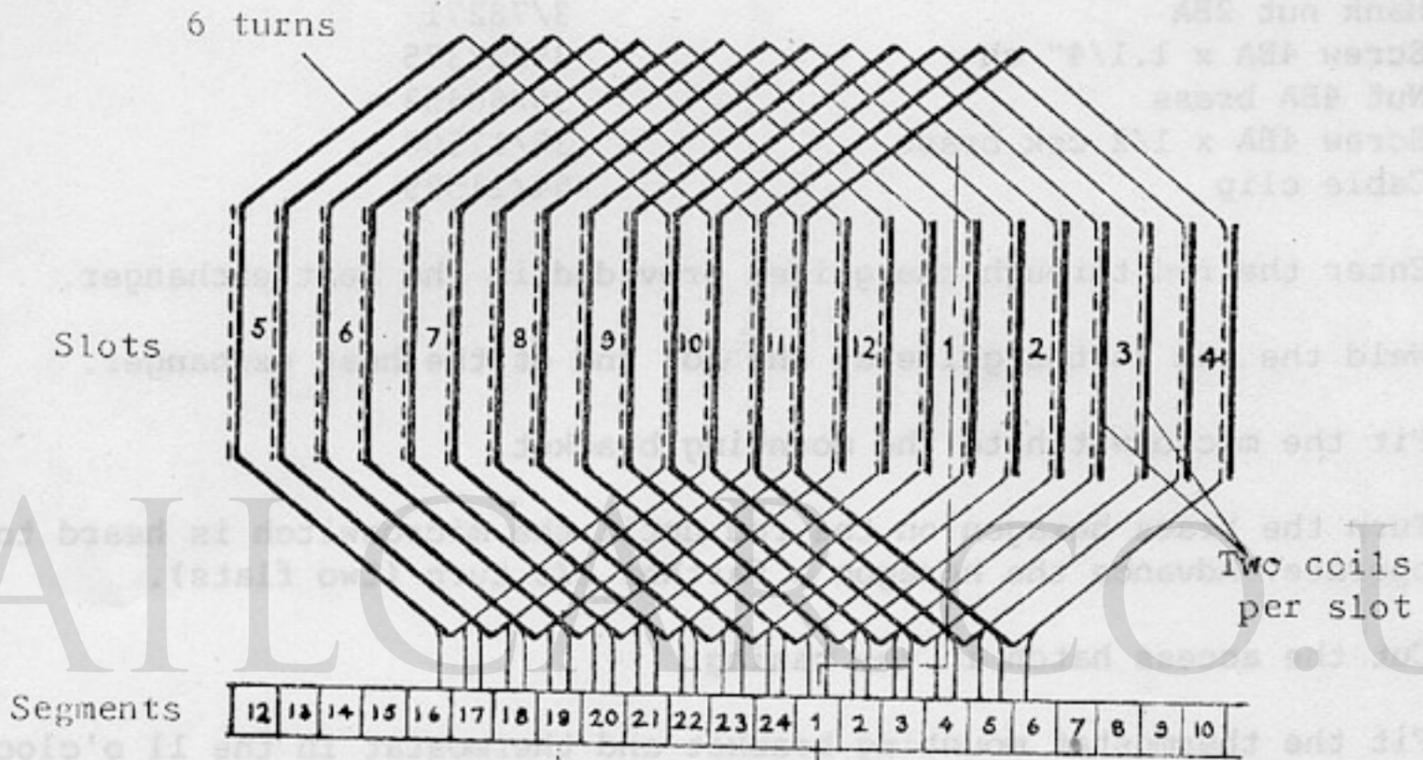
Materials	BR Cat. No.	WOSS 501/6 Approval No.
Moulded commutator	14/490	-
Woven glass tape 3/4" x 0.005"	55/24025	1.4.1
or 20mm x 0.13mm	55/12110	1.4.1
Air drying varnish clear	28/76035	3.1.3.1
Polyester fleece/film/fleece 0.15mm	55/17922	1.9.2
Solder	22/23695	-
Epoxy glass laminate 1/32"	55/12618	2.1.1.1
Solvented stoving varnish	28/76065	3.1.4
Thread, terylene black	30/30365	-
Fibre endwasher for core	-	-
Copper wire 0.71 insulated	6/168075	5.2.1

Data

Winding	See Figure 13
Coils per armature	12
Turns per coil	12
Conductor	0.71 ϕ Modified polyester BS4665-0.
Slot pitch	1 - 6
Core length	2.1/4"
Core diameter	1.3/4"
No. of commutator bars	24

1. Remove the windings.
2. Remove the commutator.
3. Clean the core and shaft and remove the endwinding support insulation.
4. Renew the core fibre endwashers if damaged.
5. Fit a new commutator and measure the insulation resistance between the segments and frame using a 250 V Megger. Minimum acceptable value 100M Ω .
6. Build up both endwinding supports with layers of 0.005" glass tape impregnated with air drying varnish until a diameter of 16 mm is reached.
7. Cut slotliners of 0.15mm polyester fleece/film/fleece. These are to be 65 mm long and of sufficient width to fold over the coils. Insert a liner into each slot.
8. Wind the coils manually into the slots. See Figure 13.
9. Fill the space between the commutator and the coils with layers of impregnated glass tape to provide a bed for the commutator connections just below the riser slots.

10. Identify the leads of the lower coils and lay them into position. Cut to length, strip the insulation and tin with solder. Fit the conductors to the slots and tamp lightly to hold.
11. Apply one layer of 0.005" woven glass tape over the leads.
12. Repeat 10 and 11 for the upper coil leads.
13. Solder the leads to the risers.
14. Fold over the edges of the slot liners and wedge with strips of 1/32" Permaglass 22 sheet. Pack under the wedges with strips of 0.15mm polyester fleece/film/fleece to form a tight winding.
15. Band the commutator-end endwindings with terylene thread.
16. Heat the armature to 40 - 60°C and immerse up to the back of the commutator in stoving varnish. Raise the armature above the varnish and allow to drain.
18. Stove the armature for 5 hours at 160°C.
19. Skim the commutator.
20. Carry out a voltage drop test.
21. Measure the insulation resistance the commutator and frame using a 250 V Megger. Minimum acceptable value 100M Ω .
22. Dynamically balance the armature to within 0.5 gm. cm. Use metal strips inserted into the core slots as weights.
23. Fit a protective ring of cardboard to the commutator.



NOTE: Winding shown symmetrical for clarity. In fact the centre line of segment no. 1 is on centre line of slot no. 1 at commutator end.

Figure 13 Winding Details

AP2 Fitting of Rod and Microswitch Assembly

Reference Document

BR Drg. C-A1-23153

Materials

BR Cat. No.

Kit of Parts (C-A1-23153 items 2,4,5,7)	14/2625
Cable	6/110960
Cable	6/110950
Thermostat Otter V51	14/2624
Bolt 2BA	35/24480
Hank nut 2BA	3/78271
Screw 4BA x 1.1/4" ch	35/27375
Nut 4BA brass	35/60453
Screw 4BA x 1/2 csk brass	35/17500
Cable clip	54/11585

1. Enter the rod through the guides provided in the heat exchanger.
2. Weld the rod to the guide at the hot end of the heat exchanger.
3. Fit the microswitch to the mounting bracket.
4. Turn the brass hexagon on the rod until the microswitch is heard to operate. Advance the hexagon a farther 1/3 turn (two flats).
5. Cut the access hatch in the casing.
6. Fit the thermostat mounting bracket and thermostat in the 11 o'clock position viewed from the hot end of the heater.
7. Wire the Microswitch using cable to 6/110960.
8. Wire the thermostat using cable to 6/110950.